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ABSTRACT

This curriculum guide contains six units with relevant problem areas for the central cluster of agricultural education. These problem areas have been selected as suggested areas of study to be included in a core curriculum for secondary students enrolled in an agricultural education program. The six units are as follows: (1) agricultural literacy; (2) generalizable skills in agricultural occupations; (3) basic principles of agricultural science; (4) basic agribusiness principles and skills; (5) developing leadership capabilities in agriculture and agribusiness; and (6) supervised experience in agriculture and horticulture. Each problem area includes some or all of the following components: related problem areas, prerequisite problem areas, occupational tasks addressed, learning assessment plan sheets, instructor's guide, information sheets, student worksheets or assignment sheets and keys, demonstrations, transparency masters, and a discussion guide for transparencies. Suggestions are made for use of the core materials, including specific suggestions for using the different components of a problem area. (KC)

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CORE

Agricultural Education Curriculum

- Central Cluster
  - Agricultural Business and Management Cluster
  - Horticulture Cluster
  - Agricultural Resources Cluster

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AN INTEGRATED CURRICULUM
FOR TECHNICAL PREPARATION
IN AGRICULTURE

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Central Core Materials for Agricultural Education Programs

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1989

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Acknowledgments

Appreciation is expressed to the many agricultural educators who shared their time, knowledge, and instructional aids for the preparation of this core curriculum. Without their cooperation and input, this printing would not have been possible.

Suggestions for Using Core Materials

It is recommended that teachers planning to use the attached curriculum guides and teaching aids refer to the **Illinois Plan for Agricultural Education: Secondary Core Curriculum Implementation Guide** for specific guidelines. This booklet includes ideas, suggestions and a step-by-step set of instructions for revising local programs and courses. These curriculum guides and teaching aids have been designed to improve instruction in agri-science and business management and to enhance student learning in these areas. Each problem area includes some or all of the following components:

1. Related problem areas
2. Prerequisite problem areas
3. Occupational tasks addressed
4. Learning assessment plan sheets
5. Instructor's guide
6. Information sheets
7. Student worksheets or assignment sheets and keys
8. Demonstrations
9. Transparencies
10. Discussion guide for transparencies

This curriculum guide should be utilized as a source unit. This means that teachers should selectively choose those components which they need to achieve their teaching objectives. The project staff does not recommend that teachers "teach" the core program as it is presented. Instead, the teacher should personalize and localize the materials for the particular group taught and, wherever possible, add other materials and teaching techniques to enrich the core program.

Teachers could teach everything included in the core curriculum but this would not be advisable considering the variations which exist in agriculture programs, students' needs and interests, and program objectives. Instead, teachers should select problem areas for a "local core" and supplement them with other problem areas important in the local area. Another suggestion is that an entire unit need not be taught to a given group during a given year. For example, teachers may want to teach part of the Food Science and Technology Unit to freshmen and teach the remaining part to an advanced class.

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Specific suggestions for using the different components of a problem area are presented in the following section.

1. **Related problem areas.** These problem areas are included to assist teachers in planning their programs and course outlines. Teachers should review these problem areas when scheduling their courses to get an overview of the subject matter included in the core which is related to selected agricultural topics.
2. **Prerequisite problem areas.** Many of the core problem areas may require a current knowledge of science, mathematics, communications, or basic agricultural concepts. This section will alert the teacher if this problem area requires any previous or specific instruction.
3. **Occupational tasks addressed.** Instructors in Education for Employment programs have identified the occupational tasks which are to be taught in their courses. This section identifies those tasks from the state developed task lists which can be addressed within the context of this problem area.
4. **Learning assessment plan sheets.** The recently amended School Code of Illinois requires that goals for learning be identified and taught. This section identifies those State Goals for Learning and Learning Objectives which can be addressed within the context of this problem area.
5. **Instructor's guide.** The instructor's guide is not a lesson plan. It is a source of teaching ideas which may be implemented by the agriculture teacher to conduct an effective instructional program. Each guide includes more material than most teachers would use. Teachers should select from the several interest approaches and teaching activities those suggestions which seem most appropriate for the local situation. The instructor's guide emphasizes a problem-solving method and a student-centered, activity approach. Lecture-presentation and rote memorization of facts should be kept to a minimum. The instructor's guides include suggestions for carrying learning to the "doing" level. Application of classroom learning to SAEPs and FFA activities is an important part of the teaching process.
6. **Information sheets.** These sheets have been prepared for those problem areas where technical information on the subject may be difficult to locate. If reference materials are not available, the teacher may want to duplicate copies of the information sheets for class use.

7. **Student worksheets or assignment sheets and keys.** These exercises are designed as classroom activities for student use. They may provide a change of pace for students when introducing, reinforcing or mastering certain agricultural concepts. Most exercises include a teacher's key with suggested answers.
8. **Demonstrations.** The teaching of certain problem areas often calls for demonstrations of manipulative skills or scientific principles. The demonstration outline may be used by the teacher or students to conduct demonstrations of science principles and manipulative skills. Teachers may want to change some of the student activities included in the instructor's guide into student demonstrations.
9. **Transparencies.** Some of the problem areas include transparency masters which can be used to prepare transparencies for the teachers to use when discussing certain concepts and subject matter.
10. **Discussion guide for transparencies.** Most of the transparencies included in the core materials do not include on the overlay any narration or explanation. The discussion guide provides teachers with some suggested points to bring out in the discussion of a transparency including explanations, descriptions, and discussion questions related to the transparency. The information sheets may also provide pertinent information useful in the discussions associated with the transparencies.

The core materials, if used properly, can improve the teaching process and save valuable teacher time. At the same time, misuse or overuse of these materials may lead to a lock-step approach to teaching and learning with the teacher adding little in the way of resourceful innovations and creative techniques. **The Illinois Plan for Agricultural Education: A Planning Guide** stresses the need to broaden local curricula in order to meet the needs of several audiences. It emphasizes the need to address several objectives at each level of a comprehensive program. It is recommended that this booklet be reviewed as you are evaluating your local program needs.

For best results when using the Core Curriculum materials, teachers should:

1. Use the curriculum but don't handle it like a teaching plan.
2. Localize the curriculum for their community.
3. Personalize the curriculum for their students.
4. Supplement the curriculum to achieve local objectives.

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Illinois State Board of Education

Department of Adult, Vocational and Technical Education
Program Improvement Section
Product Abstract

1. Title of material: Central Core Materials for Agricultural Education Programs
2. Date material was completed: June, 1989
3. Please check one: New material ____ Revised X
4. Originating agency: University of Illinois
   Address: Urbana, Illinois Zip Code: 61801
5. Name of developer: Dale A. Law
   Address: 1301 West Gregory, Urbana, IL Zip Code: 61801
6. Developed pursuant to Contract Number: OT-IO-688

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7. Subject Matter (Check only one according to USOE Code):
   USOE Code
   - X 01 Agricultural Education
   - ____ 03 Business and Office Education
   - ____ 04 Distributive Education
   - ____ 07 Health Occupations Education
   - ____ 09 Home Economics Education
   - ____ 10 Industrial Art Education
   - ____ 16 Technical Education
   - ____ 17 Trade and Industrial Education
   - ____ Career Education
   - Other (Specify)

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8. Education Level:
   - ____ Pre-K Thru 6
   - ____ 7-8
   - X 9-10
   - X 11-12
   - X Post-Secondary
   - ____ Adult
   - ____ Teacher (Pre-service)
   - ____ Administrator (Pre-Service)
   - ____ Other (Specify) ____

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9. Intended for Use By:
   - X Student
   - X Classroom Teacher
   - ____ Local Administrator
   - ____ Teacher Educator
   - ____ Guidance Staff
   - ____ State Personnel
   - ____ Other (Specify) ____

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10. Student Type:
    - X Regular
    - X Disadvantaged
    - X Handicapped
    - ____ Limited English Proficiency
    - ____ Other (Specify) ____

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11. Medium and Format of Materials:
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      - ____ No. of pages
      - ____ Paper bound
      - ____ Hard bound
      - X Loose-leaf
    - ____ Videotape
      - ____ Minutes
      - ____ B & W
      - ____ Color
      - ____ inches
    - ____ Film
      - ____ Minutes
      - ____ B & W
      - ____ Color
      - ____ mm
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    Photos: Yes ____ No X
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100 North First Street
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16. General Description:
This curriculum guide includes teaching units for the Central Core Cluster problem areas selected as suggested areas of study to be included in a core curriculum for secondary students enrolled in an agricultural education program.

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ILLINOIS AGRICULTURAL CORE CURRICULUM REVISION
UNITS AND PROBLEM AREAS

Central Core Cluster

Unit A: Agricultural Literacy

1. Identifying Careers in Agriculture/Horticulture
2. Recognizing the Role of Agriculture in Society
3. Understanding the Relationship Between Agriculture and the Environment
4. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information About Agriculture
5. Understanding the World Food and Fiber Chain
6. Recognizing the Role of Research and Development in Agriculture
7. Recognizing the Impact of Technology on Agriculture: Biotechnology
8. Recognizing the Impact of Technology on Agriculture: Electronics

Unit B: Generalizable Skills in Agricultural Occupations

1. Developing Communications Skills in Agriculture
2. Applying Mathematics Skills in Agriculture
3. Developing Human Relations Skills in Agriculture
4. Developing Problem Solving Skills in Agriculture
5. Developing Transition Skills in Agriculture
6. Identifying and Practicing Ethics in Agricultural Occupations
7. Gaining Employment in an Agricultural Occupation
8. Developing Safe Work Habits in Agricultural Occupations

Unit C: Basic Principles of Agricultural Science

1. Understanding Basic Soil Science Principles
2. Identifying and Using Agricultural Tools and Equipment
3. Understanding Basic Genetics and Reproduction
4. Using Energy Effectively
5. Identifying Basic Principles of Plant Science
6. Identifying Basic Principles of Animal Science
7. Identifying Basic Principles of Electricity
8. Understanding and Using Pesticides
9. Identifying Basic Agricultural Mechanics Principles
10. Conserving Agricultural Resources
11. Understanding Food Science Technology

Unit D: Basic Agribusiness Principles and Skills

1. Keeping and Using Records in Agricultural Occupations
2. Applying Basic Economic Principles in Agribusiness
3. Developing Basic Microcomputer Skills
4. Understanding Basic Business Organization
5. Managing Personal Finances

Unit E: Developing Leadership Capabilities in Agriculture/Agribusiness

1. Understanding the History and Organization of FFA
2. Recognizing Opportunities in FFA
3. Developing Leadership Skills Through Youth Organizations
4. Participating in Community and Government Leadership

Unit F: Supervised Experience in Agriculture/Horticulture

1. Understanding the Structure and Purposes of SAE
2. Planning and Developing SAE Programs
3. Expanding my SAE

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UNIT A: Agricultural Literacy

PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Recognizing the Role of Agriculture in the Society
3. Understanding the Relationship Between Agriculture and the Environment
4. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information About Agriculture
5. Understanding the World Food and Fiber Chain
6. Recognizing the Role of Research and Development in Agriculture
7. Recognizing the Impact of Technology on Agriculture: Biotechnology
8. Recognizing the Impact of Technology on Agriculture: Electronics

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CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying Careers in Agriculture/Horticulture

RELATED PROBLEM AREAS:

1. Gaining Employment in an Agricultural Occupation
2. Identifying Career Opportunities in Plant and Soil Science (Agricultural Business and Management Cluster)
3. Identifying Career Opportunities in Agribusiness Management (Agricultural Business and Management Cluster)
4. Identifying Career Opportunities in Food Science (Agricultural Business and Management Cluster)
5. Identifying Career Opportunities in Animal Science (Agricultural Business and Management Cluster)
6. Identifying Career Opportunities in Agricultural Engineering/Mechanization (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING

In planning the instructions for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum
Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply their skills and knowledge in the social sciences to decision making in life situations.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	**IV. ASSESSMENT**				**V. EXPECTATIONS**
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Distinguish between rights and responsibilities of employers and workers in the workplace.					
*2. Analyze the values of the individual in the world of work.					
*3. Understand the relationships between educational attainment and entry into the varied occupational fields.					
*4. Understand the knowledge and skills required for success in selected fields of work.					
*5. Distinguish between technical skills, and employability skills and abilities that increase the likelihood of success in a field.					
*6. Recognize that competence in a field of work entails the development of a wide range of skills.					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying Careers in Agriculture/Horticulture

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. List at least five criteria for selecting an occupation.
2. Determine the occupational category and specific job titles in each field of activity:
   a. Occupational categories
      1. Professional
      2. Technical
      3. Managerial
      4. Clerical
      5. Production
      6. Sales
      7. Service
   b. Specific job titles
      1. Production agriculture
      2. Agricultural service
      3. Food processing
      4. Other manufacturing and non-manufacturing
      5. Trade
      6. Forestry
      7. Transportation
3. Identify the different types of enterprises and jobs included in agriculture.
4. List the major educational requirements of a person employed in a given occupation.
5. List the major competencies needed by a person employed in a given occupation.
6. Describe, in writing or orally, the working conditions involved.
7. List the approximate earnings expected in a given occupation.
8. Cite at least one reference which provides information about occupations in agriculture.
9. Understand the opportunities available for agricultural employment in different parts of the nation.
10. Identify instructional units relating to each occupational area.
11. Place selected jobs in the appropriate occupational areas.
12. Become familiar with agricultural opportunities in the community through a survey of the agricultural businesses using survey forms, questionnaires, visitations, personal interviews, and other available data.
13. Complete written work sheets on each occupational area and define each occupational area.
14. Complete a written agriculture career interest research paper using Learning Resource Center Occupational Information.
15. Select the type of work in which they are most interested and do further research and study on that occupation.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying Careers in Agriculture/Horticulture

PROBLEMS AND QUESTIONS FOR STUDY

1. What are the eight major occupational categories in agriculture?
2. What jobs are available in each of the agricultural categories?
3. What competencies are necessary to get a job in an agricultural occupation?
4. How can one make use of the local high school agricultural education program to prepare for an agricultural occupation?
5. What does one need to know about an occupation to select it for exploration?
6. How does one begin to identify a career interest area?
7. What are the opportunities for entry level jobs in the agricultural occupations in a local community? In Illinois? In the United States?
8. What is the Food and Fiber System?
9. What agriculturally related industries make up the Food and Fiber System?
10. What agricultural industries are located in the local community?
11. What are occupational titles?
12. What reference materials are available for each area?
13. How are interests related to career choices?
14. What is the importance of studying careers?
15. What agriculture careers are available within a 25 mile radius of our area?
16. What is meant by educational requirements?
17. What is entry level?
18. Which areas of agriculture offer the most career opportunities?
19. What are seasonal occupations?
20. What areas of agriculture have limited employment in our local area?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying Careers in Agriculture/Horticulture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Involve students in identifying problems and concerns in selecting careers in agriculture.
2. Introduce the unit by discussing the contributions of the agriculture industry to the community, state, and nation.
3. Hold a class discussion on reasons for choosing a career in agriculture.
4. Invite a representative of a local agricultural industry to speak on agriculture's importance and trends.
5. Conduct a class discussion on advantages and disadvantages of private ownership and employment.
6. Distribute Student Worksheet #1. Allow students time to complete the handout, then call on one or two students to review with the class their answers. (Do not force this requirement.)
7. Administer the "Vocational Agriculture Interest Inventory."
8. Distribute Information Sheets on names of each of the occupational areas and review the Information Sheets.
9. Show transparencies on the eight agricultural occupation areas and discuss the scope and definition of each area. Use the Information Sheets to discuss each occupational area on the transparency.
10. Show a filmstrip or videotape on occupational areas in agriculture. Making slides of your own is beneficial, especially of past students in on-the-job-training stations.
11. Distribute Student Worksheet #4, along with a worksheet for studying the occupation. (The class can develop their own forms or use the example in the worksheet.)
12. Have students write to one or more agricultural companies requesting career information. Use the information from the list of references for career information in Agriculture Occupations.
13. Have students prepare a written or oral report on one or more occupations of interest to them.
14. Permit students to discuss how their selected jobs fit their personal qualifications and the results of their interest inventory.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying Careers in Agriculture/Horticulture

REFERENCES

1. *Employment Opportunities for College Graduates in the Food and Agricultural Sciences.* Coulter, K., Stanton, M., Goecker, A. (1986). Texas A & M University Publication EIS 86-174 7/86, U.S. Department of Agriculture, Washington, D.C.

2. *Standard Industrial Classification Manual.* Executive Office of the President, Office of Management and Budget. (1987). U.S. Government Printing Office, Washington, D.C.

3. *Standard Occupational Classification Manual.* Executive Office of the President, Office of Management and Budget. (1980). U.S. Government Printing Office, Washington, D.C.

4. *Illinois Handbook for Secondary Vocational Education Program Planning.* (1987). Illinois State Board of Education, Department of Adult, Vocational and Technical Education, Springfield, IL.

5. *Illinois Plan for Agricultural Education: A Planning Guide.* Law, D.A., Pepple, J.D. (Report OT-IO-688). (1989). University of Illinois, Department of Adult, Vocational and Technical Education, Vocational Education Program Improvement Section, Urbana, IL 61801.

6. *Statewide Occupational Employment Study in Agriculture: Agricultural Service Industries.* Pepple, J.D. (Report OT-IO-709). (1989). University of Illinois, Department of Adult, Vocational and Technical Education, Vocational Education Program Improvement Section, Urbana, IL 61801.

7. *Dictionary of Occupational Titles.* (1977). 4th edition. U.S. Department of Labor Employment and Training Administration, U.S. Government Printing Office, Washington, D.C.

*8. *Occupational Outlook Handbook.* (1988-89). U.S. Department of Labor Employment and Training Administration, U.S. Government Printing Office, Washington, D.C.

*9. *Opportunities in Agricultural Careers.* White, W.C., Collins, D.N. (1988). VGM Career Horizons, National Textbook Company, Lincolnwood, IL.

*10. *Career Opportunities in Agricultural Services.* VAS U6028. University of Illinois, Vocational Agriculture Services, 1401 South Maryland Drive, Urbana, IL 61801.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Forestry

INFORMATION SHEET #2 — Food Processing

INFORMATION SHEET #3 — Other Manufacturing and Non-Manufacturing

INFORMATION SHEET #4 — Wholesale and Retail Trade

INFORMATION SHEET #5 — Transportation

INFORMATION SHEET #6 — Rest of the Economy

TRANSPARENCY MASTER #1 — Food and Fiber System (with discussion guide)

TRANSPARENCY MASTER #2 — Illinois Employment Within Eight Sectors of the Food and Fiber System (with discussion guide)

TRANSPARENCY MASTER #3 — Total Employment Distribution Within the Food and Fiber System (with discussion guide)

TRANSPARENCY MASTER #4 — Illinois Employment Within Eight Sectors of the Food and Fiber System (with discussion guide)

TRANSPARENCY MASTER #5 — Employment Distribution in Food Processing (with discussion guide)

TRANSPARENCY MASTER #6 — Employment Distribution in Other Manufacturing and Non-Manufacturing (with discussion guide)

TRANSPARENCY MASTER #7 — Employment Distribution in Forestry (with discussion guide)

TRANSPARENCY MASTER #8 — Employment Distribution in Trade (with discussion guide)

TRANSPARENCY MASTER #9 — Employment Distribution in Transportation (with discussion guide)

TRANSPARENCY MASTER #10 — Employment Distribution in the Rest of the Economy (with discussion guide)

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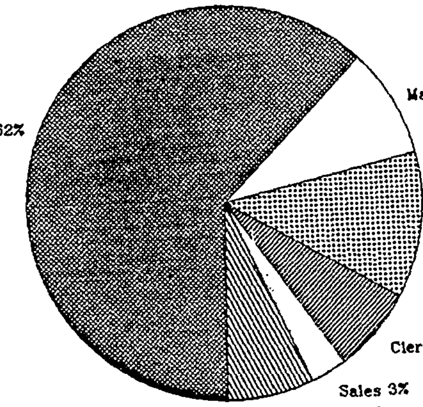
INFORMATION SHEET #1

Forestry



Total Sample Number: 3569

Definition

This major group includes establishments primarily engaged in the operation of timber tracts, tree farms, forest nurseries and related activities such as reforestation services and the gathering of gums, barks, balsam needles, maple sap, Spanish moss, and other forest products.

Relation to Agriculture

Forestry is closely associated with agriculture in the following ways:

1. Environmental Agriculture — climate, soil, types of vegetation.
2. Wildlife — preservation, reproduction.
3. Plant Sciences — growth patterns, growth needs, life cycles, dependent relationships, maple syrup collection, gum collection.
4. Animal Science — growth patterns, environmental requirements, life cycles.
5. Horticulture — cultivation, harvestation.
6. Forestry Services — fire protection, firefighting, management, pest control.

Sample Occupations

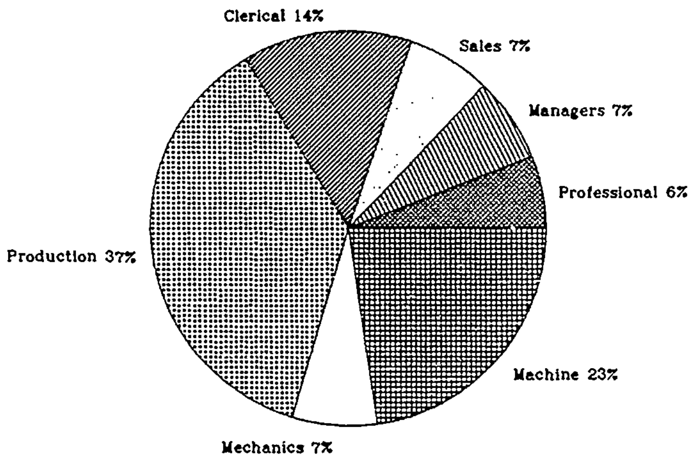
1. Forester — provides habitats for wildlife; manages, develops and protects natural resources; maps areas and estimates timber sales; protects from fire, disease, and insects.
2. Range Managers — manages, improves and protects rangelands without damaging the environment; determines type and number of wildlife/animals; determines grazing system and best season for that system.
3. Other Occupations — include firefighter, tree chopper, fire truck driver.

Additional Information

1. Illinois State Forester — Alan S. Mickelson, Division of Forest Resources, Springfield, IL 62706.
2. Societies and Associations — Society of American Foresters and American Forestry Association.
3. Publications — Directory of Forest Products Industries.

INFORMATION SHEET #2

Food Processing



Total Sample Number: 95578

Definitions

1. Meat Product Companies — These businesses are engaged in the slaughtering for trade of cattle, hogs, sheep, lambs, and calves for use on-site in canning, cooking, curing, and freezing. These businesses are also engaged in making sausages, as well as cured, smoked, canned, frozen, and prepared meats. Their activities also include the packing, dressing, and freezing of poultry, rabbit, and small game; also the drying, freezing, and breaking of eggs.

2. Dairy Product Companies — These businesses are engaged in:

   a. Manufacturing creamery butter; natural, processed, and imitation cheese; dry, condensed, and evaporated milk; ice cream and frozen dairy desserts; and special dairy products such as yogurt and malted milk.

   b. Processing fluid milk and cream for wholesale or retail distribution.

3. Canned and Frozen Product Companies — These businesses are engaged in canning, sun drying, and dehydrating fruits and vegetables; pickling and brining fruits and vegetables; and manufacturing salad dressings, relishes, sauces, and seasonings. They may also be engaged in freezing fruits, juices, and vegetables; producing fresh or dried citrus by-products; and manufacturing frozen food specialties such as frozen dinners or pizzas.

4. Grain Mill Product Companies — These businesses are engaged in milling flour or meal from grain; cleaning and polishing rice; and manufacturing rice, flour, or meal. They may also be engaged in manufacturing cereal breakfast foods; preparing flour mixes or doughs; milling corn or sorghum grains; producing starch, syrup, oil, sugar, and by-products; and manufacturing animal food from cereal, meat, and other products.

5. Fats and Oil Product Companies — These businesses are engaged in the manufacturing of cottonseed oil, cake, and meal; vegetable oil, cake, and meal; soybean cake and meal; soybean oils and concentrates; lentils; and protein isolates.

Relation to Agriculture

This is a crucial part of the transition of the Food and Fiber System which makes the connection between the producer and consumer. The food processors input raw products from the farm and output a processed product. Areas represented are:

1. Animal Science — edible or inedible livestock products, quality control.

2. Horticulture — acceptable versus nonacceptable fruits for processing.

3. Agricultural Technology — quality control, bacterial presence.

4. Crop Science — edible or inedible crop products, quality control.

ERIC

Sample Occupations

1. Slicing and Cutting Machine Operator — includes jobs involving the operation and tending of slicing and cutting machines.
2. Technician — contributes to biological experiments, tests and analyzes them to increase scientific knowledge and improve industrial and public health.
3. Cooling and Freezing Equipment Worker — operates and tends cooling and freezing equipment.
4. Grain Press Operator — sets up and operates extruding and forming machines.
5. Land Refiner — operates and tends stills, clarifiers and precipitators.
6. Scientist — studies application of scientific principles to problems related to food, fiber, and horticulture.
7. Other Occupations — include purification worker, blender, frozen pie maker, drive operator.

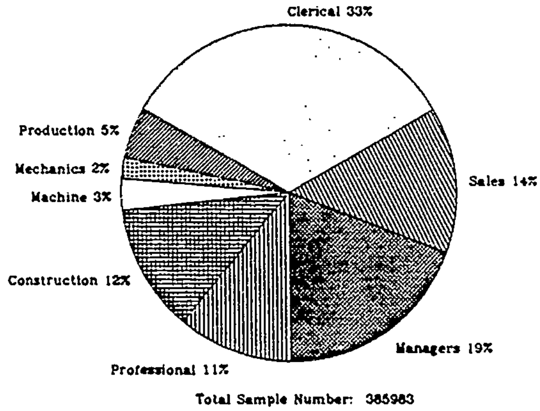
Additional Information

The following is an incomplete listing of corporations engaged in the food processing activities as defined above.

1. Meat Product Companies
   a. Hormel
   b. Swift
   c. Eckrich
2. Dairy Product Companies
   a. Kraft
   b. Viva
   c. Land o' Lakes
3. Canned and Frozen Product Companies
   a. Gerber
   b. Del Monte
   c. Sun Sweet
4. Grain Mill Product Companies
   a. Purina
   b. Pillsbury
   c. Kellogg's
   d. Archer, Daniels, Midland Co.
5. Fat and Oil Product Companies
   a. Staley
   b. Crisco
   c. Puritan

INFORMATION SHEET #3

Other Manufacturing and Non-Manufacturing



Definitions

1. General Building Contractors — This group is engaged in the construction (including new work, additions, alterations, remodeling, and repair) of industrial buildings and warehouses. This includes the construction of grain elevators. They also construct other nonresidential buildings such as farm buildings and silos.

2. Miscellaneous Repair and Related Services Shops — This group does miscellaneous repair not including repair to structures, computers, automobiles, clothing, or shoes. These industries are primarily engaged in specialized repair, including agricultural equipment repair, diesel engine repair, farm machinery repair, and tractor repair. Some industries are also engaged in horseshoeing.

3. Farm and Garden Machinery and Equipment Manufacturers — This group includes industries engaged in manufacturing farm machinery and equipment, including wheel tractors, for use in the preparation and maintenance of the soil, planting and harvesting of crops, preparing crops for market on the farm, or performing other farm operations and processes. Included in this category are establishments primarily engaged in manufacturing commercial mowing and other turf and grounds care equipment.

4. Federally Sponsored Credit Agencies — This group includes industries engaged in extending credit in the form of loans, but not in deposit banking. These establishments of the federal government and federally sponsored credit agencies are primarily engaged in guaranteeing, insuring, or making loans. Federally sponsored credit agencies are established under the authority of the federal legislature, but are not regarded as part of the government. They are often owned by their members or borrowers.

5. Business Credit Institutions — These establishments are engaged in furnishing intermediate or long-term general and industrial credit, including finance leasing of machinery and equipment. They include private establishments engaged in extending agricultural credit, such as agricultural loans, farm mortgages, and livestock loan companies.

6. Mortgage Bankers and Brokers — This group is primarily engaged in arranging loans for others. They operate mostly on a commission or fee basis and do not ordinarily have any continuing relationship with either borrower or lender.

7. Commodity Contracts/Brokers and Dealers — This group is primarily engaged in buying and selling of commodity contracts on either a spot or future basis for their own accounts or the accounts of others. They are members, or are associated with members, of recognized commodity exchanges.

8. Security and Commodity Exchanges — This group consists of establishments primarily engaged in furnishing space and other facilities to members for the purpose of buying, selling, or otherwise trading in stocks, stock options, bonds, or commodity contracts.

9. Fire, Marine and Casualty Insurance Carriers — These industries cover crop and livestock by underwriting fire, marine, and casualty insurance. These establishments are operated by enterprises that may be owned by stockholders, policy holders, or other carriers.

10. Real Estate Operators and Lessors — This group, which includes individuals and business establishments, leases agricultural and forest properties.

Relation to Agriculture

The majority of this main category consists of corporations that lease to, insure or lend to the industries that produce the "food" in the Food and Fiber System. Without these organizations, the farmer would not be able to farm, and thus produce at the level of efficiency which we currently enjoy.

Sample Occupations

1. Construction Manager — plans, organizes, directs, and coordinates, through subordinate personnel, activities concerned with erection, alteration, maintenance, and repair of structures, facilities, and systems such as roads, bridges, docks, dams, water supplies, and drainage and sewage systems.

2. Tractor Mechanic/Assembler — is concerned with the fabrication, assembly, and hand finishing of tractors. A high degree of precision in performing tasks to meet standards, and an ability to interpret detailed instructions and specifications, are often required.

3. Repairer — repairs the assembly defects of agricultural equipment; reads inspection reports and examines equipment to determine type and extent of defect.

4. Loan Investigator — investigates background and personal characteristics of individual or business establishments applying for credit or employment.

5. Security Sales Representative — buys and sells securities at customers' requests; advises and furnishes them with information regarding stocks, bonds, market conditions, and history, as well as prospects of organizations in which the investments are being considered.

6. Insurance Sales Agent and Broker — helps select policy fitted to a client's needs; provides financial backing against loss; and plans for the financial security of individuals, families, and businesses.

7. Real Estate Agent and Broker — sells real estate owned by others, rents and manages properties, makes appraisals, develops new projects, and arranges for title searches and for meetings between buyers and sellers.

Additional Information

The following is an incomplete listing of corporations engaged in the manufacturing and non-manufacturing activities as defined above.

1. General Building Contractors
   a. Wick Building Systems
   b. Morton Building Inc.
   c. Butler Building Systems
   d. Moore Building Systems

2. Miscellaneous Repair and Related Services Shops
   a. V & C Construction
   b. Brummer Welding and Manufacturing

3. Farm and Garden Machinery and Equipment Manufacturers
   a. Skil Corporation
   b. Pride of the Farm
   c. Navistar Corporation
   d. Fiat Allis
   e. Hyster
   f. Case-IH
   g. John Deere
   h. A.O. Smith

4. Federally Sponsored Credit Agencies
   a. Farm Credit Services
   b. Farmers Home Administration

5. Business Credit Institutions
   a. Bank of Illinois
   b. Busey Bank
   c. Equipment Company Financing

6. Mortgage Bankers and Brokers
   a. Dean Witter Reynolds, Inc.
   b. Smith-Barney

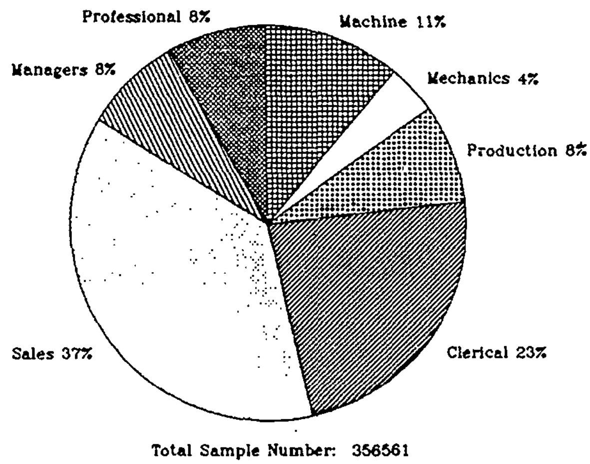
7. Commodity Contracts/Brokers and Dealers
   a. Edward D. Jones & Co.
   b. Archer, Daniels, Midland Co.
   c. The Andersons
   d. Dean Witter Reynolds, Inc.
   e. Shearson Lehman Hutton, Inc.
   f. Central Illinois Commodity Service, Inc.
   g. American Investment Services

8. Security and Commodity Exchanges
   a. Chicago Board of Trade
   b. Chicago Mercantile Exchange

9. Fire, Marine and Casualty Insurance Carriers
   a. Agri-Risk Services
   b. Country Companies
   c. Federal Crop Insurance
   d. Farmland Insurance
   e. Ansul Fire Protection
   f. Continental Insurance
   g. Franklin Life Insurance
   h. Old Republic Ins.
   i. State Farm Co.
   j. Kemper Insurance Co.
   k. Farmers Insurance Group
   l. Economy Fire and Casualty
   m. Real Estate Operators and Lessors
   n. Capital Agricultural Property Services, Inc.
   o. Bank of Illinois
   p. Busey Bank
   q. Champaign National Bank

INFORMATION SHEET #4

Wholesale and Retail Trade



Definitions

1. Machinery, Equipment and Supplies/Wholesale — This category includes establishments primarily engaged in the wholesale distribution of construction or mining cranes, excavating machinery and equipment, power shovels, road construction and maintenance machinery, tractor mounting equipment, and other specialized machinery and equipment. Some establishments are engaged in the distribution of farm and garden machinery for the use in the preparation and maintenance of the soil, the planting and harvesting of crops, and other processes pertaining to work on the farm or lawn and garden. Other establishments distribute equipment such as dairy machinery, and cans for fruits and vegetables.

2. Groceries and Related Products/Wholesale — This category includes establishments involved in the wholesale distribution of packaged frozen foods, dairy products, poultry and poultry products, confectionery and related products, fresh fruits and vegetables, etc. Most fall under the category of Groceries, General Line.

3. Farm Products/Raw Materials/Wholesale — This category includes establishments engaged in the buying and/or marketing of grain and field beans, livestock, and other farm product raw materials including chickens, feathers, hops, insecticides, etc.

4. Miscellaneous Nondurable Goods/Wholesale — This category includes establishments engaged in the wholesale distribution of animal feeds, fertilizers, agricultural chemicals, pesticides, seeds and other farm supplies.

5. Retail Nurseries, Lawn and Garden Supply Stores — These establishments are engaged in the selling to the general public of trees, shrubs, and other plants; seeds, bulbs, mulches, soil conditioners, fertilizers, pesticides, garden tools, and other garden supplies. They primarily sell products purchased from others, but may sell some plants which they grow themselves.

6. Retail Meat and Fish Markets — These establishments are engaged in the retail sale of fresh, frozen, or cured meats, fish, shellfish, and other seafoods. Some are primarily engaged in the retail sale, on a bulk basis, of meat for freezer storage and in providing home freezer plans.

7. Retail Fruit and Vegetable Markets — These establishments are engaged in the retail sale of fresh fruits and vegetables. They are frequently found in public or municipal markets or as roadside stands.

8. Miscellaneous Retail Stores — These establishments are engaged in the retail trade of products related to dairy, bakeries, tea, eggs, poultry, and coffee.

Relation to Agriculture

The trade industries provide a crucial step in the Food and Fiber System. It is here where:

1. Wholesalers sell equipment or food to distributors for retail distribution.

2. Retailers sell the food or equipment to the consumers.

This is the merchandising step for products that began on the farm, or at the manufacturer. Without the trade industries, there would be no efficient way of getting, for instance, corn to the consumer's table as canned creamed corn. Of course, all steps in the Food and Fiber System are equally important; without one we could not have the others.

Sample Occupations

1. Sales Representative/Farm and Garden Equipment and Supplies/Wholesale — sells farm and garden machinery, equipment, and supplies such as tractors, feed, fertilizer, seed, insecticide, and farm and garden supplies.

2. Commission Agent, Ag Produce/Wholesale — sells bulk shipments on a commission basis to buyers for growers or shippers; deducts expenses and commission from payment received from sale of produce.

3. Sales Representative/Livestock/Wholesale — sells cattle, hogs, horses, and other livestock on commission to packing houses, farmers or other purchasers; contacts prospective buyers to persuade them to purchase livestock; reviews current market information and inspects livestock to determine their value; informs buyer of market conditions, and the care and breeding of stock.

4. Sales Person/Flowers/Retail — sells natural and artificial flowers, potted plants, floral pieces, and accessories; advises customers regarding type of flowers, floral arrangements, and decorations desirable for specific occasions, utilizing knowledge of social and religious customs; arranges displays.

5. Sales Person/ Horticulture and Nursery/Retail — sells container-grown plants and garden supplies in nursery, greenhouse, or department store; advises customer on selection of plants and methods of planting and cultivation; suggests trees and shrubbery suitable to specified growing conditions.

Additional Information

The following is an incomplete listing of corporations engaged in the wholesale and retail trade activities as defined above.

1. Machinery, Equipment and Supplies/Wholesale
   a. Caterpillar
   b. Honda
   c. John Deere

2. Groceries and Related Products/Wholesale
   a. Southland Distribution Center
   b. IGA
   c. J.M. Jones Company

3. Farm Products/Raw Materials/Wholesale
   a. Prairie State Meats
   b. Schaper Poultry Division
   c. IPLA

4. Miscellaneous Nondurable Goods/Wholesale
   a. Purina
   b. Beecham
   c. Stauffer Chemical Co.
   d. Monsanto Co.
   e. National Oats Co.
   f. DeKalb-Pfizer Co.
   g. Dow Chemical Co.
   h. GROWMARK, Inc.
   i. International Multi Foods
   j. Wayne Feed

5. Retail Nurseries, Lawn and Garden Supply Stores
   a. Prairie Gardens
   b. True Value
   c. K-Mart Corporation

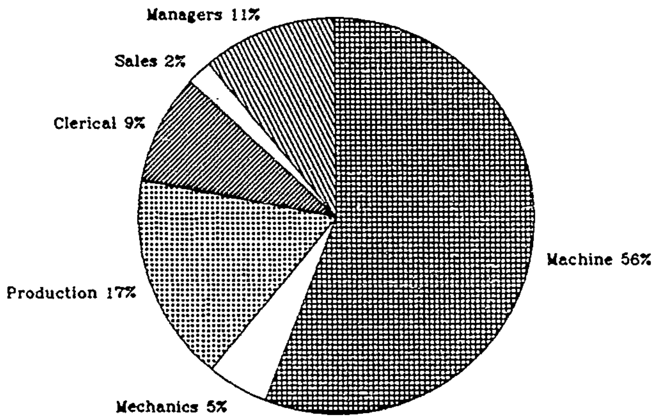
6. Retail Meat and Fish Markets
   a. Miller's Meat Company
   b. Allen's Farm Quality Meats
   c. Briney's Fish Market

7. Retail Fruit and Vegetable Markets
   a. Curtis Orchards
   b. Twin Silos Orchards

8. Miscellaneous Retail Stores
   a. Laesch Dairy Company
   b. Rick Orr Florist
   c. Sailfin Pet Shop

INFORMATION SHEET #5

Transportation



Total Sample Number: 35726

Definitions

1. Trucking and Courier Systems — This category consists of establishments primarily engaged in furnishing trucking or transfer services without storage for freight generally weighing more than 100 pounds, in a single municipality, contiguous municipalities, or a municipality and its suburban areas. These services include farm to market hauling, hauling live animals, and local trucking without storage.

2. Public Warehousing and Storage — This category includes establishments primarily engaged in the warehousing and storage of farm products including bean elevators, grain elevators, and establishments engaged in the storage of perishable produce, frozen, or refrigerated goods.

Relation to Agriculture

This stage in the Food and Fiber system is the transition stage between the farm and the consumer. This is an important stage in maintaining a strong economy for farm products. With quality transportation and warehousing, produce can be steadily controlled in terms of when it is available at the marketplace.

Sample Occupations

1. Warehouse Supervisor — supervises and coordinates activities of workers engaged in receiving, transporting, stacking, order filling, shipping, and maintaining of stock records in warehouse; may supervise labeling and casing or packing of materials or products.

2. Truck Driver — transports materials to and from specified destinations, and verifies load against shipping papers; may need to secure loads to protect cargo. This occupation requires significant training.

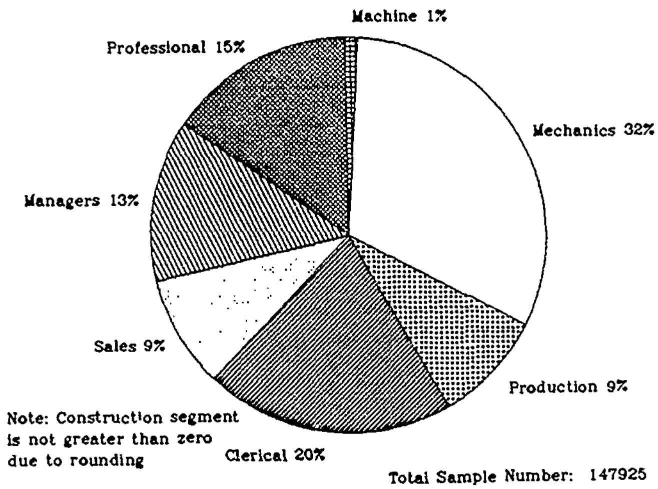
Additional Information

1. Trucking and Courier Systems
   a. Associated Transfer and Storage
   b. Consolidated Freightways
   c. Nussbaum Trucking
   d. Gilbert Brothers
   e. Yellow Freight System, Inc.
   f. Keith Morgan Trucking
   g. Independent truckers

2. Public Warehousing and Storage
   a. Rising Farmers Grain Co.
   b. The Andersons
   c. Savoy Grain Co.
   d. Cargill Grain Co.
   e. Pillsbury Grain Co.

INFORMATION SHEET #6

Rest of the Economy



The rest of the economy related to the Food and Fiber System contains a variety of different industries that all contribute in some way to the areas just discussed . . . forestry, food processing, manufacturing and non-manufacturing, trade, and transportation. Because these additional industries in the rest of the economy are so varied and vast (54 identified areas) an overview of some of these industries will give a general idea of how these seemingly unrelated industries are closely associated with agriculture. Refer to Student Worksheet #2 for a listing of these areas.

Textiles and Apparel is one category on the list. If one traces back the steps in the making of fabric, one finds once again that the process starts on the farm. Yarn and thread mills are responsible for taking a "ripe plant" or animal product and changing the product into thread, which is woven into cloth, which will eventually become apparel.

Another category that is significant to the Food and Fiber System is Chemical and Fertilizer Mineral Mining. Without this industry, farmers would not have access to soil enhancers such as fertilizers or other chemical compounds. This would lead to less efficient crop productions, with the risk of pest or weed infestation. Again, this is strongly tied to the Food and Fiber System, as an agriculture-related industry.

Industries that produce engine parts and distribute them to the wholesale manufacturers are also related to agriculture in that those parts are a necessary component of making tractors, lawn mowers, and so forth. The manufacturer of bolts, nuts, radiator belts, and so forth is yet another step in the Food and Fiber System.

In summary, it is obvious that agriculture influences and is influenced by much of today's economy. Society can no longer think the words agriculture and farm are synonymous. One now must include businesses that help make the transition from the farm to the consumer, a service that often begins far before the seeds are planted. The economi , of Illinois and America rely on an efficient and productive Food and Fiber system.

ERIC

TRANSPARENCY MASTER #1

Food and Fiber System

Equipment
Seed
Fertilizer
Pesticides
Financial Services

Farming

Food Processing
Marketing Services
Advertising
Food Distribution

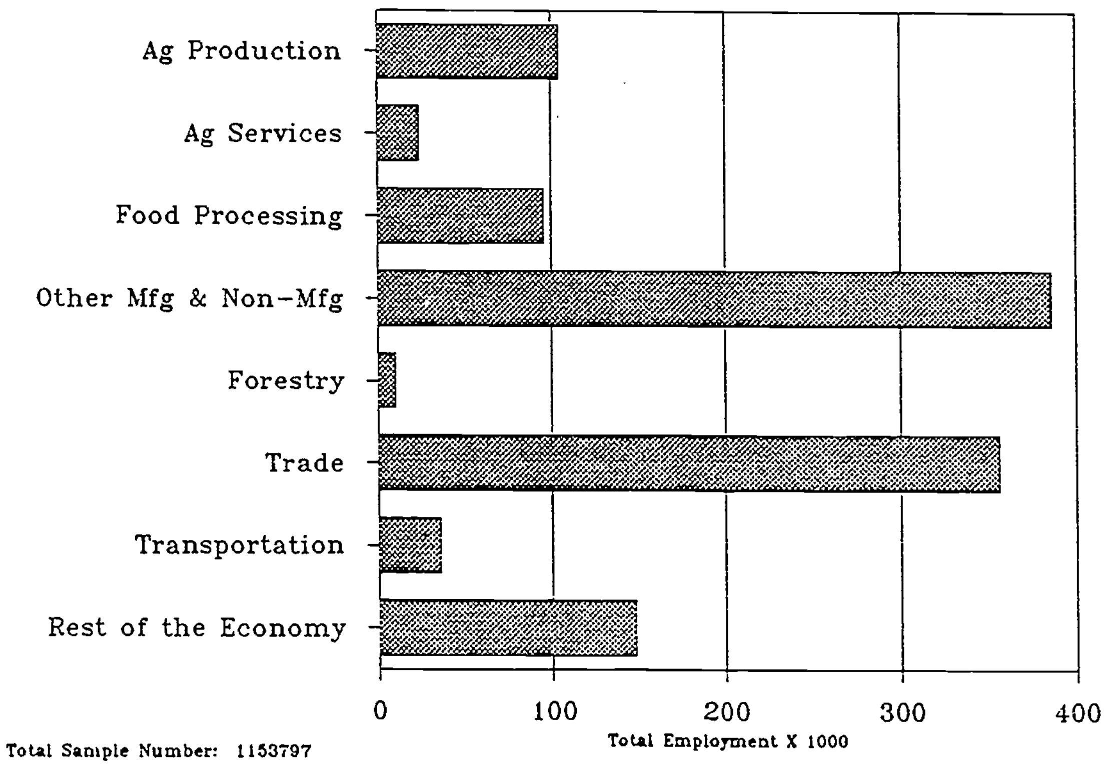
Input
Industries

Production
Agriculture

Output
Industries

TRANSPARENCY MASTER #2

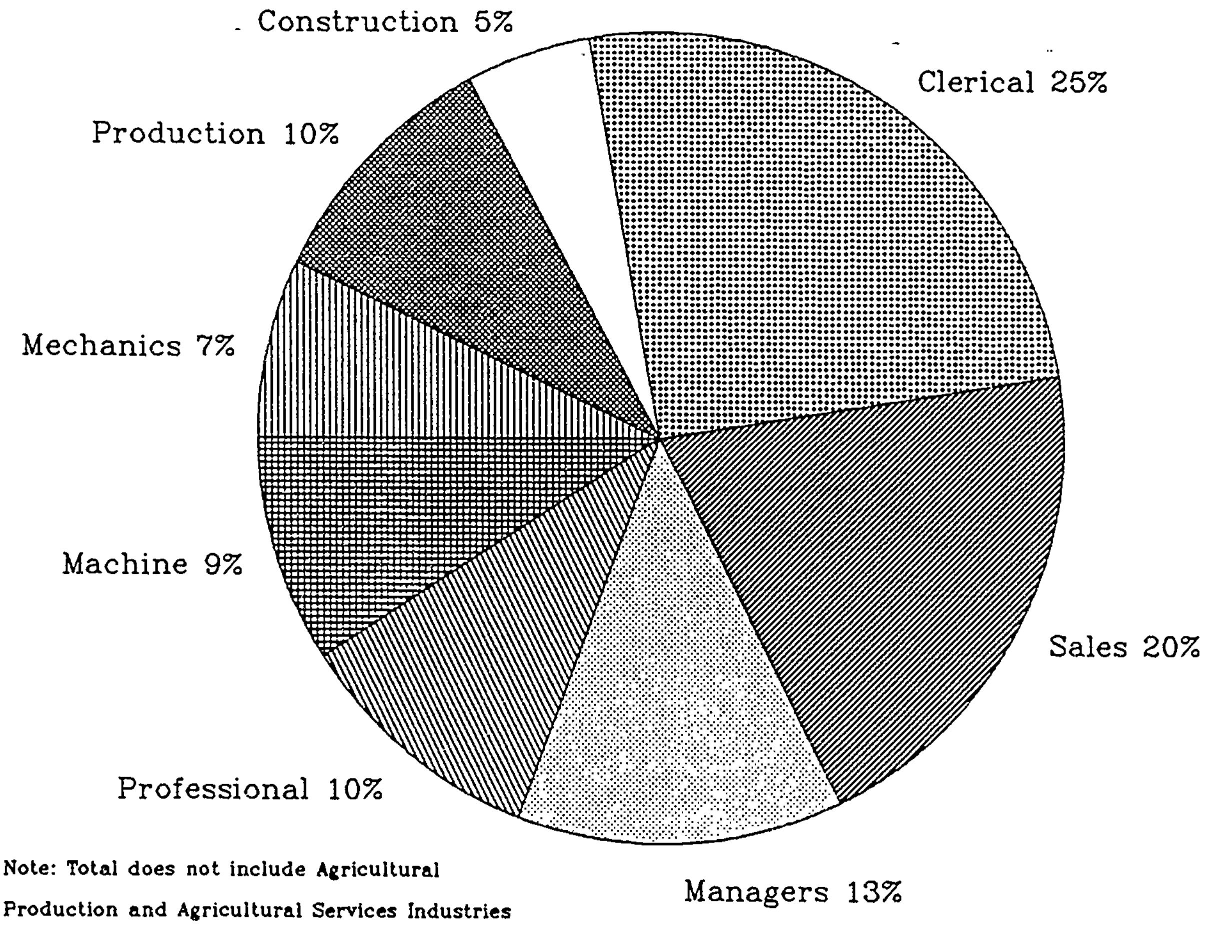
Illinois Employment Within Eight Sectors of the Food and Fiber System



31

TRANSPARENCY MASTER #3

Total Employment Distribution Within the Food and Fiber System

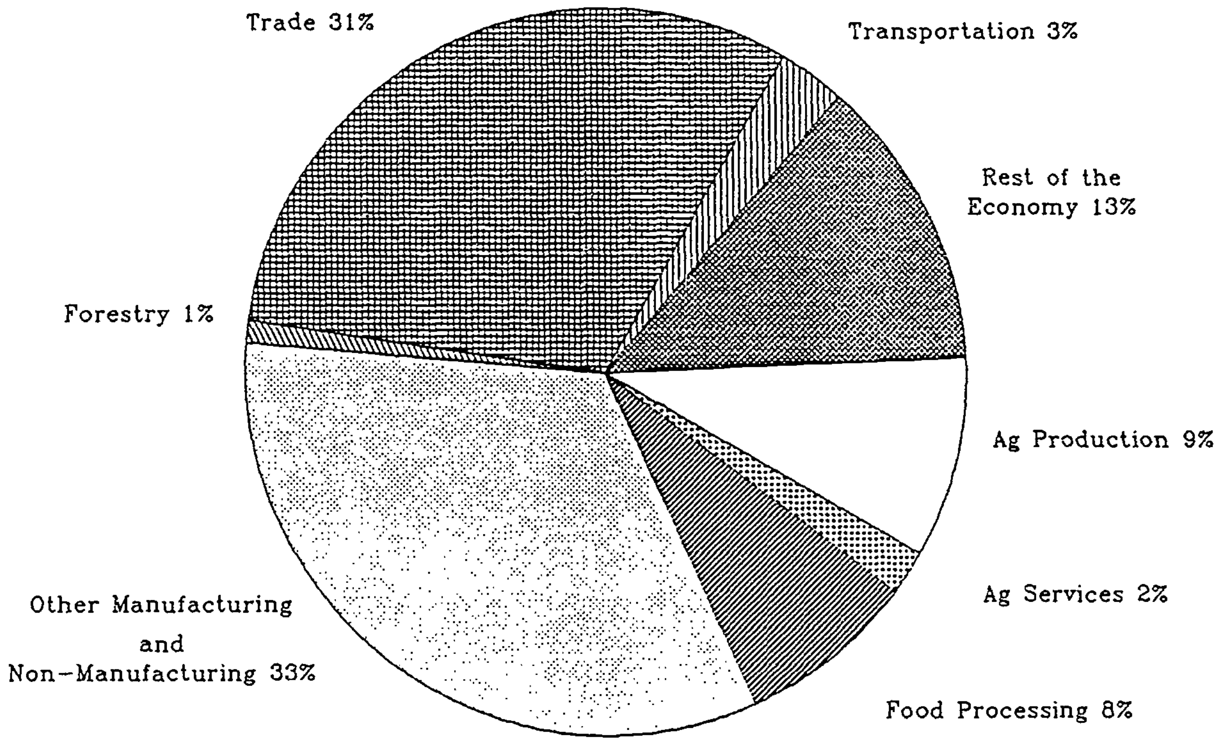


Note: Total does not include Agricultural Production and Agricultural Services Industries

Total Sample Number 1025343

TRANSPARENCY MASTER #4

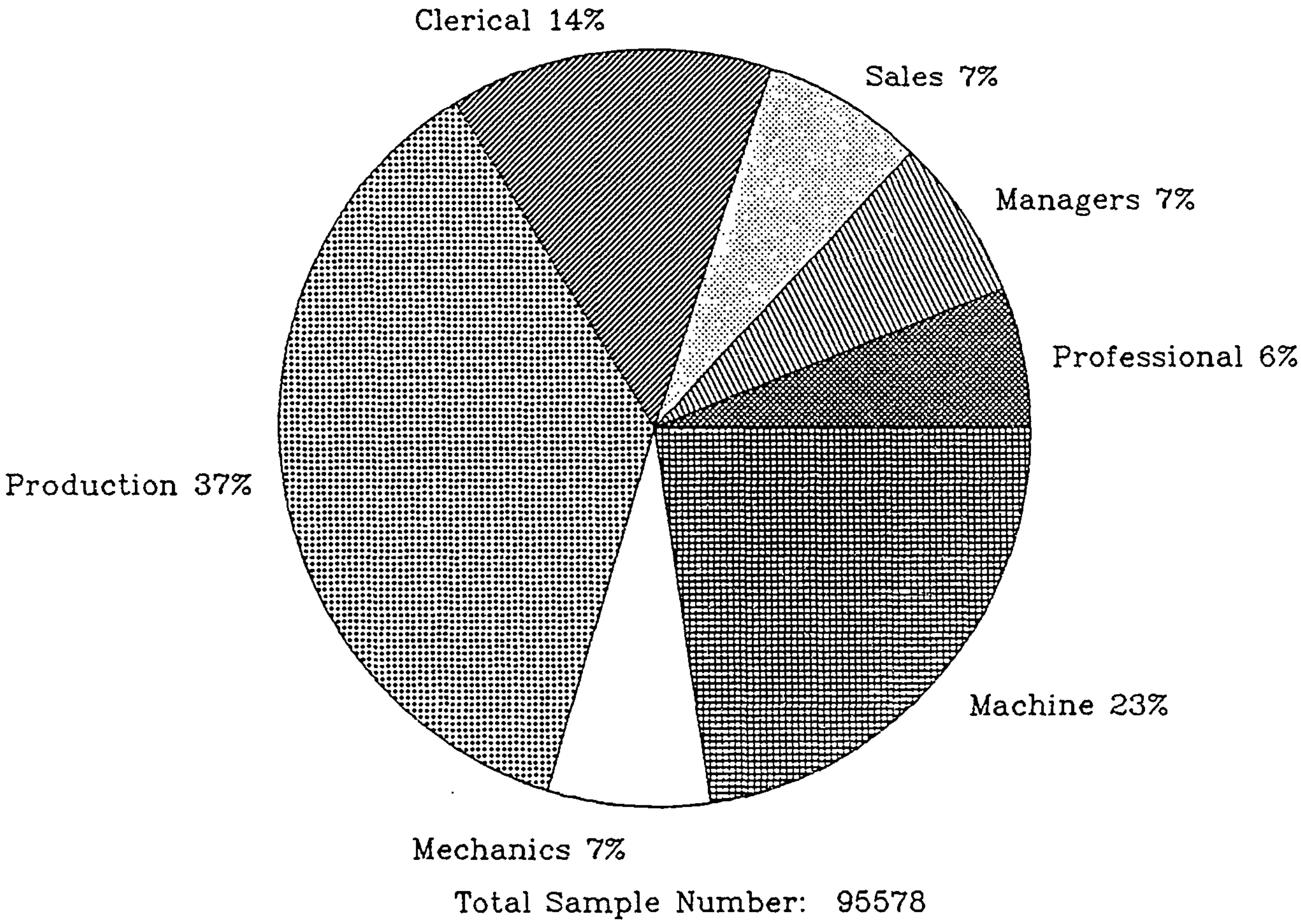
Illinois Employment Within Eight Sectors of the Food and Fiber System



Total Sample Number: 1153797

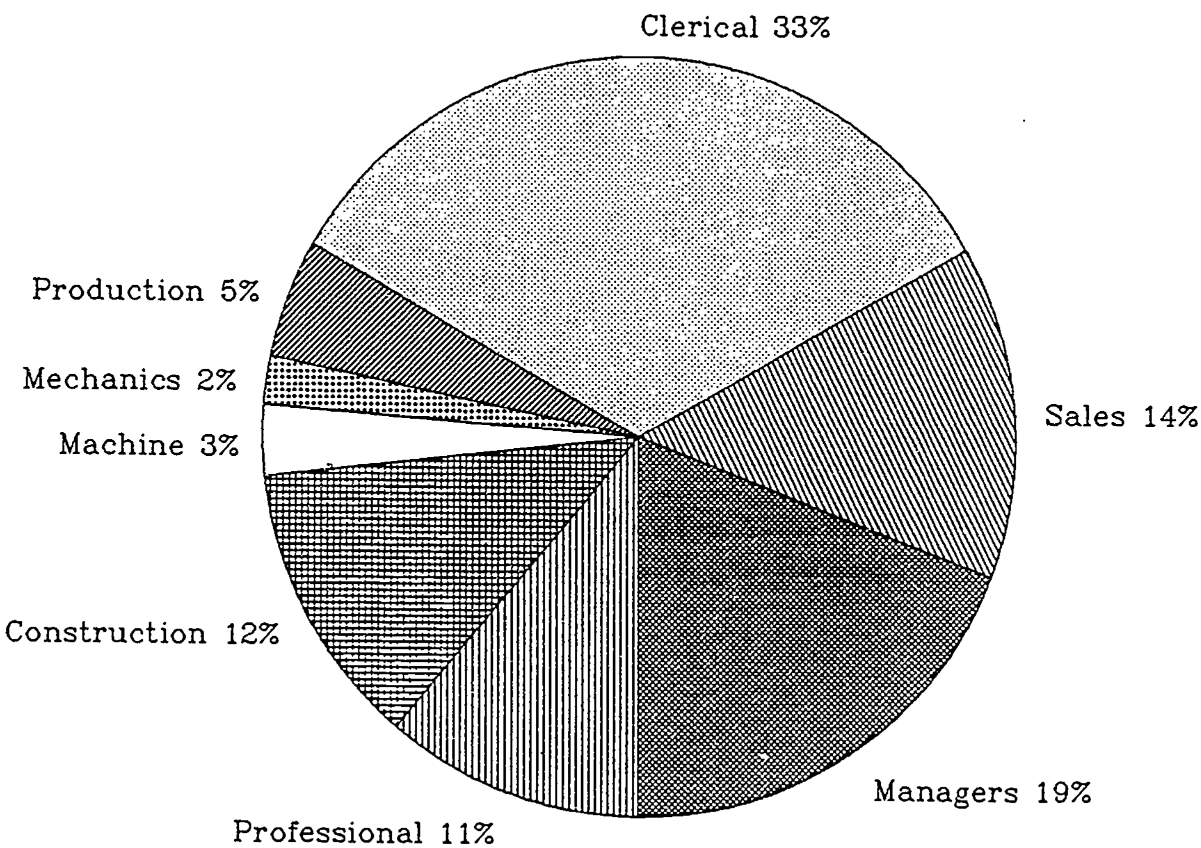
TRANSPARENCY MASTER #5

Employment Distribution in Food Processing



TRANSPARENCY MASTER #6

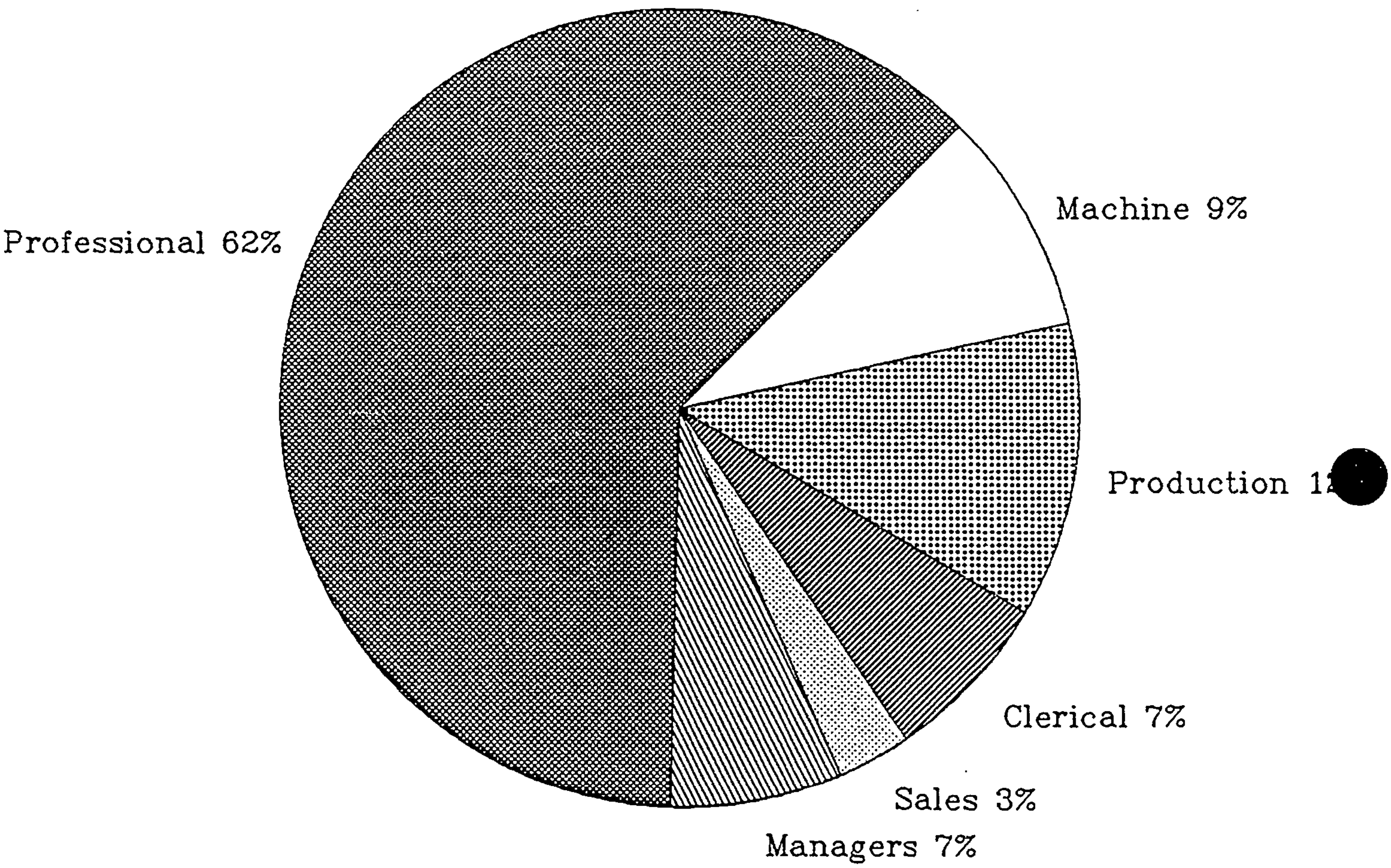
Employment Distribution in Other Manufacturing and Non-Manufacturing



Total Sample Number: 385983

TRANSPARENCY MASTER #7

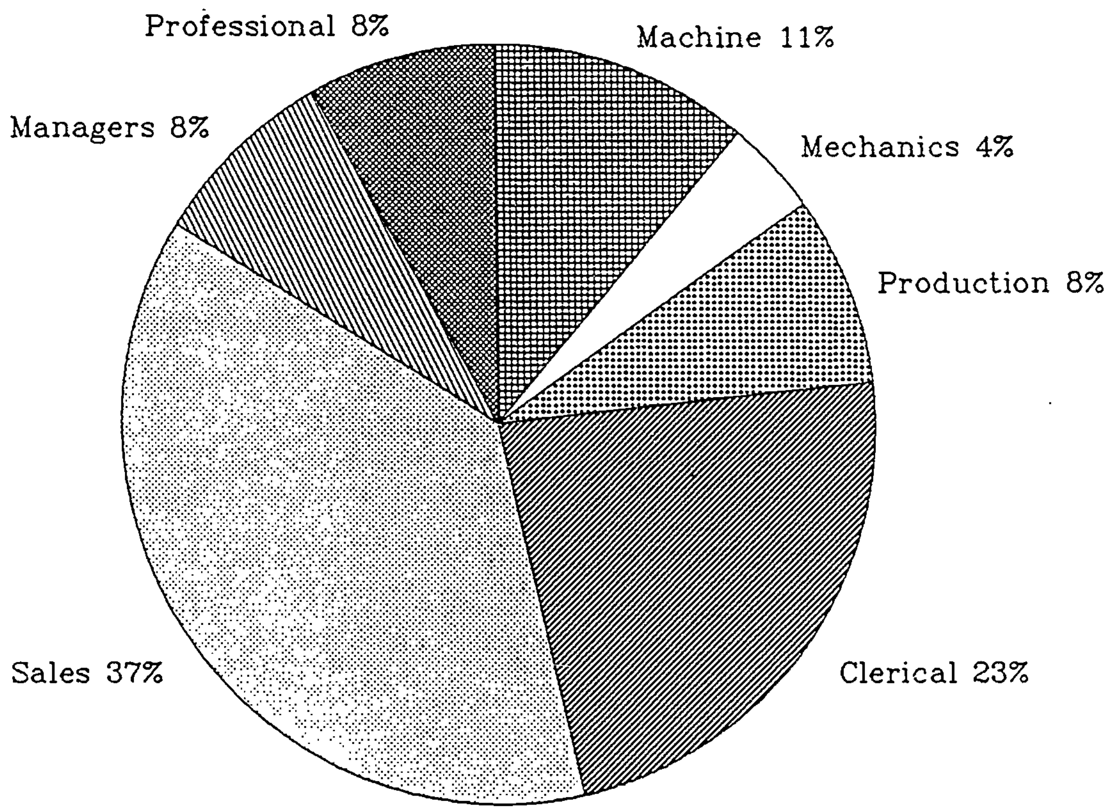
Employment Distribution in Forestry



Total Sample Number: 3569

TRANSPARENCY MASTER #8

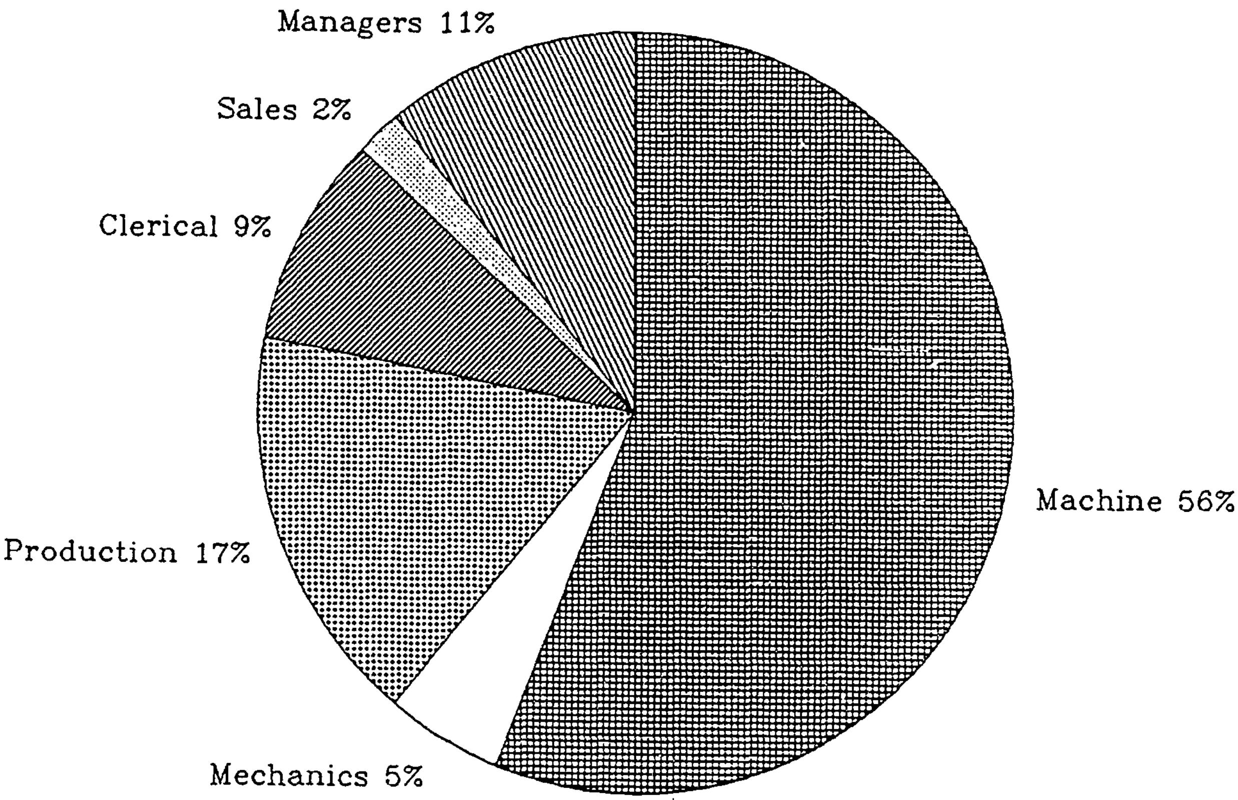
Employment Distribution in Trade



Total Sample Number: 356561

TRANSPARENCY MASTER #9

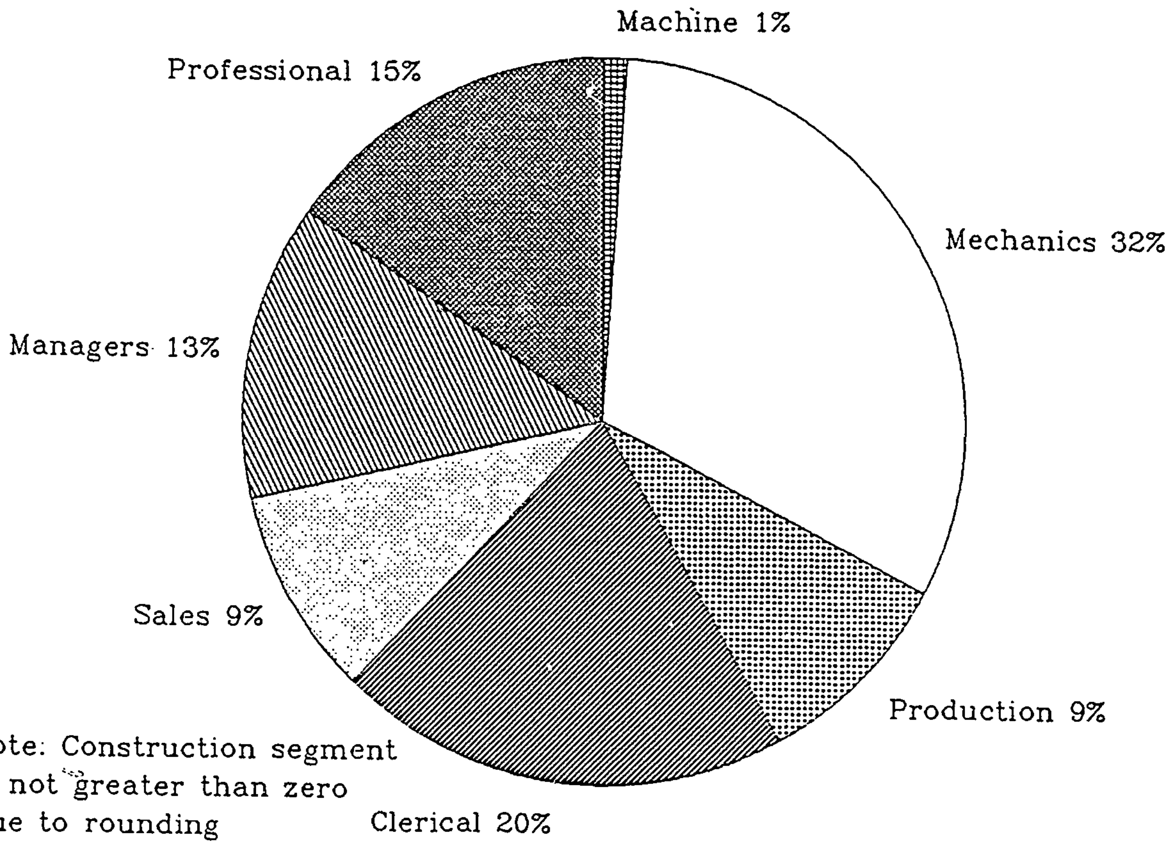
Employment Distribution in Transportation



Total Sample Number: 35726

TRANSPARENCY MASTER #10

Employment Distribution in the Rest of the Economy



Note: Construction segment is not greater than zero due to rounding

Total Sample Number: 147925

TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #1

The Food and Fiber System is best defined by this transparency. As noted, agricultural production is the centerpiece around which other agriculturally related industries form their services and products. These industries can be classified as either input or output in relation to production agriculture.

Therefore, the total size of the Food and Fiber System is determined by the types of industries which are considered to be necessary contributors as either an input or output industry.

Transparency Masters #2 — #4

These transparencies report the employment represented in each of the eight sectors of the Food and Fiber System. Agricultural Production has 104,273 employees (9%), Agricultural Services has 24,183 employees (2%), Food Processing has 95,578 employees (8%), Other Manufacturing and Non-Manufacturing has 385,982 employees (33%), Forestry has 3,569 employees (less than 1%), Trade has 356,561 employees (31%), Transportation has 35,726 employees (3%), and the Rest of the Economy has 147,925 employees (13%) of the total 1,153,797 employees compromising the Illinois Food and Fiber System as defined by this research study.

Transparency #4 represents the total employment within the Food and Fiber System, excluding the Agricultural Production and Agricultural Service Industries. The pie chart is divided into occupational categories represented in the survey sent to each business. It is importan .o note that this study identifies over one million people working in the Illinois Food and Fiber System.

Transparency Masters #5 — #10

These transparencies separate the Food and Fiber System into specific agriculture-related categories. The data identifies the general occupational areas of professional, managers, sales, clerical, construction, production, mechanics, and machine operator. These titles can be further identified through career exploration and research into industries fou :d in these categories.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Determining Your Interests

STUDENT WORKSHEET #2 — Occupational Titles

STUDENT WORKSHEET #3 — Identifying Local and State Career Opportunities in Agriculture

STUDENT WORKSHEET #4 — Agri-Career Investigation

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Determining Your Interests

Answer these questions with your first impression. Determine "your" interests and not what others expect you to answer.

1. List your first, second and third choice of all subjects.

   a. ____________ b. ____________ c. ____________

2. List three subjects you like least in school.

   a. ____________ b. ____________ c. ____________

3. List the three subjects where you made your highest grades.

   a. ____________ b. ____________ c. ____________

4. List the three subjects where you made your lowest grades.

   a. ____________ b. ____________ c. ____________

5. What school activities do you like the best?

   a. ____________ b. ____________ c. ____________

6. What work, outside of school, do you like to do?

   a. ____________ b. ____________ c. ____________

7. What do you like to do for entertainment? ____________

8. What are your hobbies? ____________

9. Are there any hobbies, interests, jobs, or classes that you have not had a chance to try that seem of particular interest to you? List them. ____________

10. Of all the things you do, what do you feel you do best? Why? ____________

11. Has anyone ever said that you were good at something,or that you had done a good job at something, or that you have a talent for something? What are these things? ____________

12. Do you think they were right? ____________

13. Have aptitude tests, grades or achievement tests indicated that you have an area in which you perform well? What is that area? ____________

14. Do you feel that you have any physical limitations that could limit your choice of occupations? ____________

15. Do you feel that you get along well with other people? ____________

16. Do you like to read and do math or do you like to work with your hands and tools? ____________

STUDENT WORKSHEET #2

Occupational Titles

Objective:

To familiarize the student with agri-occupational titles and begin the process of developing career interests by seeking more information about occupations of primary interest to each student.

Directions:

1. Handout the "Career Options."
2. Have students mark (✔) any title of interest.
3. Have students rank the marked occupations by listing them in order of "most interested" to "least interested."
4. Using buzz-groups or by brain-storming, develop a list of career questions which the students would need to ask about the first three careers on their list.
5. Develop a master list of career questions. (This can be used in Student Worksheet #4.)
6. Complete Student Worksheet #2 to help students determine local and state career opportunities in agriculture. Use general class discussion and small group or individual out-of-class assignments to determine the career opportunities which exist for their top choices on the "Career Options."
7. The Transparency Master Discussion Guide and Information Sheets can be used for additional information for state-wide (Illinois) career opportunities in the eight occupational areas.

Agricultural Occupations — 01.0000

Career Options

Agricultural Production — 01.0100

01.0101 Animal Science	01.0102 Plant Science	01.0102 Farm Mechanics	01.0104 Farm Business Management	01.0199 Agricultural Production, Other

Agricultural Services — 01.0200

01.0201 Agricultural Chemicals	01.0202 Feeds	01.0203 Seeds	01.0204 Fertilizers (Plant Food)	01.0299 Agricultural Supplies and Services, Other

Agricultural Mechanization/Technology — 01.0300

01.0301 Agricultural Power and Machinery	01.0302 Agricultural Structures and Conveniences	01.0303 Soil Management	01.0304 Water Management	01.0305 Agricultural Mechanics Skills	01.0306 Agricultural Construction and Maintenance	01.0307 Agricultural Electrification	01.0399 Agricultural Mechanics, Other

Agricultural Products, Processing and Marketing — 01.0400

01.0401 Food Products	01.0402 Non-Food Products	01.0499 Agricultural Products, Other

Horticulture — 01.0500

01.0501 Arboriculture	01.0502 Floriculture	01.0503 Greenhouse Operation and Management	01.0504 Landscaping	01.0505 Nursery Operation and Management	01.0506 Turf Management	01.0599 Ornamental Horticulture, Other

Renewable Natural Resources — 01.0600

01.0601 Forests	01.0602 Recreation	01.0603 Soil	01.0604 Wildlife	01.0605 Water	01.0606 Air	01.0607 Fish	01.0608 Range	01.0699 Agricultural Resources, Other

Forestry — 01.0700

01.0701 Forests	01.0702 Forest Protection	01.0703 Logging	01.0704 Wood Utilization	01.0705 Recreation	01.0706 Special Products	01.0799 Forestry, Other

Professional Agriculture — 01.9900

Teaching	Communications	Research	Community Service	Information Specialist

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ERIC

Agricultural Occupations

Opportunities for students with Careers in Agriculture are unlimited. Agriculture today includes production, processing, manufacturing, distribution, utilization and consumption. In fact there are more career opportunities off-the-farm than on. In Illinois more than 1.1 million (1,153,797) of the state's work force were engaged in occupations in the Food and Fiber System in 1988, and one-fifth (1/5) of those employed in agricultural occupations worked on farms in production agriculture in 1988.

The original concept of agriculture, production on land, is now only one segment of the entire industry. The careers in agriculture go far beyond the concern with production of food and fiber. The following expanded list of agricultural careers includes many of the agricultural jobs available to students who follow the appropriate sequential program in Agricultural Education.

01.0100 AGRICULTURAL PRODUCTION

01.0101 Animal Science
- Livestock producer, breeder beef, dairy, sheep, swine, poultry or horse
- Herdsman
- Poultryworker
- Stock-ranch supervisor
- Specialty animal raiser
- Farm hand
- Livestock trainer
- Veterinarian aide
- Farrier
- Artificial inseminator
- Milking machine operator
- Beekeeper
- Kennel manager
- Production manager

01.0102 Plant Science
- Cereal grain producer
- Fiber crop farmer
- Forage crop farmer
- Specialty crop grower
- Vegetable crop grower
- Fruit producer
- Ornamental crop grower
- Seed grower
- Production supervisor
- Farm hand
- Fruit harvester operator
- Seed harvester operator
- Plant disease specialist
- Plant insect specialist
- Oil crop producer

01.0102 Farm Mechanics
- Machine and equipment operator
- Machinery and equipment repairer
- Lubrication specialist
- Soil and water manager
- Construction maintenance person
- Agriculture structure user
- Electrification technician

01.0104 Farm Business Management
- Farm manager
- Tenant farmer
- Farm record analyst
- Farm organization specialist
- Farm loan specialist
- Farm real estate salesperson or broker
- Farm loan manager

01.0199 Agricultural Production, Other

01.0200 AGRICULTURAL SERVICES

01.0201 Agricultural Chemicals
- Plant manager
- Warehouse supervisor
- Pest exterminator
- Chemical applicator operator
- Product salesperson
- Weed inspector
- Fumigator
- Laboratory technician

01.0202 Feeds
- Feed inspector
- Salesperson
- Grain and feed processor
- Quality control technician
- Mill operator
- Elevator operator
- Feed deliveryperson

01.0203 Seeds
- Biotechnologist
- Seed analyst
- Agronomist
- Seed inspector
- Salesperson
- Seed hauler
- Quality control technician
- Plant superintendent

01.0204 Fertilizers
- Plant manager
- Buyer
- Machine operator
- Plant food salesperson
- Regional manager
- Transportation specialist (Deliveryperson)
- Quality controller

01.0299 Agricultural Supplies and Services, Other
- Laboratory technician
- County extension specialist
- Biological aide
- Quality control specialist
- Transportation specialist
- Distributor
- Jobber
- Buyer
- Farrier
- Veterinary hospital assistant
- Tree pruner
- Animal technician
- Artificial inseminator
- Blood tester

01.0300 AGRICULTURAL MECHANIZATION/ TECHNOLOGY

01.0301 Agricultural Power and Machinery
- Serviceperson
- Salesperson
- Farm equipment operator
- Equipment mechanic
- Machinery setup person
- Parts person
- Equipment deliveryperson
- Hydraulics technician
- Local dealer

01.0302 Agricultural Structures and Conveniences
- Agricultural structure designer
- Farmstead mechanization serviceperson
- Service supervisor
- Setup manager
- Structure salesperson
- Office manager
- Local dealer
- Crew member

01.0303 Soil Management
- Conservationist
- Agronomist
- Soil technician
- Manager
- Appraiser

01.0304 Water Management
Water control manager
Ecology technician
Conservation technician
Irrigator

01.0305 Agricultural Mechanics Skills
Machinery repairperson
General shop supervisor
Maintenance engineer

01.0306 Agricultural Construction and Maintenance
Agriculture structure erector
Maintenance supervisor
Maintenance person
Construction supervisor
Farmstead planner
Equipment setup person
Deliveryperson
Appraiser

01.0307 Agricultural Electrician
Electrician
Electrician assistant
Service company representative
Safety technician

01.0399 Agricultural Mechanics, Other
Agricultural technologist

01.0400 AGRICULTURAL PRODUCT, PROCESSING AND MARKETING
01.0401 Food Products
Livestock buyer
Produce buyer
Grain buyer
Meat inspector
Veterinary livestock inspector
Meat grader
Produce inspector
Honey processor
Butcher
Fruit buyer and grader
Egg handler
Milk sampler
Milk tester
Cheese maker
Ice cream freezer operator
Laboratory technician
Product salesperson
State inspector

01.0402 Non-Food Products
Tobacco buyer
Wool salesperson
Marketing specialist
Quality control manager
State inspector

01.0499 Agricultural Products, Other
Appraisers

01.0500 HORTICULTURE
01.0501 Arboriculture
Arborist
Tree trimming supervisor
Tree surgeon helper
Wood plant specialist
Arboretum superintendent
Line clearance supervisor

01.0502 Floriculture
Floral designer
Floral grower
Flower shop manager
Indoor plant manager
Retail florist
Wholesale florist
Deliveryperson
Rose consultant

01.0503 Greenhouse Operation and Management
Wholesale nurseryworker
Retail nurseryworker
Plant propagator
Shipping supervisor
Indoor plant installer
Greenhouse manager
Greenhouse assistant
Storage manager

01.0504 Landscaping
Landscape gardener
Groundskeeper
Landscape designer
Landscape consultant
Landscape contractor
Pest control specialist
Landscape supervisor
Parkway supervisor
Equipment operator
Laborer
Landscape salesperson

01.0505 Nursery Operation and Management
Nurseryworker
Groundsworker
Retail nurseryworker
Horticulturist
Maintenance person
Rare plant specialist
Fungus and pest specialist
Bagger and burlap worker
Nursery materials salesperson
Garden center manager
Nursery supervisor
Nursery propagator
Grower
Laborer

01.0506 TurfManagement
Groundskeeper
Greens superintendent
Turf supply salesperson
Turf consultant
Turf research technician
Commercial sod grower
Sod cutter
Greens designer
Irrigation controller

01.0599 Ornamental Horticulture, Other
Salesperson
Buyer

01.0600 RENEWABLE NATURAL RESOURCES
01.0601 Forests
Forest aide
Timber surveyor
Fire lookout
Forest consultant
Forest fire fighter
Logging inspector

01.0602 Recreation
Park ranger
Fish and game warden
Park caretaker
Campgrounds manager
Park worker
Hunting and fishing guide
Zoo manager
Campgrounds developer
Guide
Park naturalist

01.0603 Soil
Soil conservationist
Range manager
Soil test technician
Water control specialist
Industrial waste inspector
Sanitary landfill manager

01.0604 Wildlife
Trapper
Guide
Gamekeeper
Predatory animal hunter
Game farm manager
Fowl and fish hatchery operator
Fish farmer

01.0605 Water
Industrial waste inspector
Water control specialist
Water filtration plant superintendent
Well water inspector
Wastewater treatment plant technician

01.0606 Air
Industrial waste inspector
Sanitary landfill manager
Pollution control manager
Pollution control aide

01.0607 Fish
Fish culturist
Fish farmer
Hatcheryworker
Guide
Fisheries technician

01.0608 Range
Range manager
Range supervisor
Guide
Range scientist

01.0699 Agricultural Resources, Other
Planning aide
Urban planner

01.0700 FORESTRY
01.0701 Forests
Biologist
District manager
Timber surveyor
Forest consultant
Forestry aide
Logging inspector

01.0702 Forest Protection
Fire watcher
Fire patrolperson
Fire lighter
Fire lookout
Fire warden

01.0703 Logging
Fieldworker
Log buyer
Logging contractor
Chief cruiser
Crew manager
Timber buyer
Log scaler

01.0704 Wood utilization
Pulpwood buyer
Pulpwood contractor
Pulpwood grower
Forest chemist
Fieldworker
Yard person

01.0705 Recreation
Park caretaker
Hunting and fishing guide
Campgrounds developer
Guide
Park ranger
Park worker
Fish and game warden
Campgrounds manager
Zoo manager

01.0706 Special Products
Christmas tree grower
Forestry district manager
Woods boss
Debarker operator

01.0799 Forestry, Other

01.9900 PROFESSIONAL AGRICULTURE
Cooperative extension agent
General laboratory assistant
Biologist
Entomologist
Farm commodity market reporter
Product researcher
Radio-TV farm director
USDA specialist
State staff member
Agricultural education instructor

STUDENT WORKSHEET #3

Identifying Local and State Career Opportunities in Agriculture

This worksheet reviews agricultural employment in Illinois and attempts to identify current labor needs. The examination of employment trends in Illinois agriculture is carried out within the framework of the eight areas outlined by the Food and Fiber System. These taxonomic areas are: Agricultural Production, Agricultural Services, Food Processing, Other Manufacturing and Non-Manufacturing, Forestry, Trade, Transportation, and Rest of Economy.

The employment outlook in Illinois agriculture is generally good, especially in the areas of Agricultural Services and Horticulture. Agricultural occupations show considerable promise, but employment opportunities are not uniform throughout Illinois agriculture. For example, there is considerable competition for positions in forestry. Although many job openings can be found in the Agricultural Manufacturing area, there has been a general decline in the number of workers employed in this area over the last five years. An individual seeking a career in agriculture would be well advised to examine each career area carefully before preparing for any specialized field.

Below, summarize your findings and conclusions on the assigned careers.

	Careers	Local Opportunities	Statewide Opportunities
A.	______	______	______
B.	______	______	______
C.	______	______	______
D.	______	______	______
E.	______	______	______

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STUDENT WORKSHEET #4

Agri-Career Investigation

Objective:

1. To do further research on each of the top three occupational titles selected by the students.

Procedure:

1. Following the format developed in Student Worksheet #2 or using one of the two other examples, each student is to submit a report on his or her top three agri-career titles.

2. A session in the Learning Resource Center (library) with assistance from its personnel may be necessary in obtaining career information. Materials to become familiar with include: Occupational Outlook Handbook, Encyclopedia of Career and Vocational Guidance, National Ag. Occupation Competency Study, Dictionary of Occupational Titles, Computerized Vocational Information Service (if available at school), and any other career oriented texts.

3. Have students personally interview an individual employed in the student-selected occupational choices. The students could discuss their interviews in oral presentations before the class.

Student Worksheet for Agri-Career Investigation

1. Name of Occupation: ______________________________
2. The duties of the job: ______________________________

____

3. Job Requirements:

   Age: ____________

   What interests or skills will you need for the job? ______________________________

   ____

   What are the personality and physical requirements? ______________________________

   ____

4. Education Requirements: ______________________________

   ____

   ____

   ____

   ____

   What type of_high school classes should you take to prepare for this job? ______________________________

   ____

   What type of school or training past high school? ______________________________

   ____

5. Job Advantages and Disadvantages:

   What are the good points about the job? ______________________________

   ____

   What are the bad points about the job? ______________________________

   ____

6. Job's Demand and Future Outlook:

   What is the present need for workers? Great ________ Moderate ______ Slight ________

   What is the job's future outlook? Little change ______ Increasing need _____ Decreasing need _____

7. Entering the Job:

   Are there any special job entrance requirements? (an entrance test, a license, money, union dues): __________

   ____

   ____

8. Information Sources:

   Where else can you obtain more information on your job area? ______________________________

   ____

   ____

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Agriculture in Society

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Understanding the Relationship Between Agriculture and the Environment
3. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information About Agriculture
4. Understanding the World Food and Fiber Chain

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty B: Performing Sales Duties

1. Explain the legal responsibilities of businesses which deal with interstate commerce
2. Determine potential volume of grain produced in trade territory using crop reports

Duty D: Marketing Animals and Animal Products

1. Plan marketing schedule

Duty E: Performing Promotional Activities

1. Plan territory management
2. Analyze and interpret market information

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D. and Jerry D. Pepple, Ed.D.
Principal Investigator: Chris A. Roegge, Ph.D.

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ________
☐ **Original submission** ☐ **Revision** Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and analyze comparative political and economic systems, with an emphasis on the political and economic systems of the United States.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Relate the importance of agriculture to the world, United States, and Illinois economies. 2. Explain the interdependency of agriculture and society.					
*3. Analyze the factors involved in the change from an agriculturally based to an industrially based economy in the United States.					
*4. Understand how production decisions in our country are affected by conditions in other countries.					
*5. Identify the facts which affect supply and demand.					
*6. Decide the purposes and results of trade restrictions and trade promotions.					
*7. Explain the concept of comparative advantage.					
*8. Compare the effects of a trade surplus, a trade deficit, and tariff, and an embargo on the economy of the United States.					
*9. Analyze the economic interdependence among the Illinois, United States, and World Communities.					

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ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and analyze events, trends, personalities, and movements shaping the history of the world, the United States, and Illinois.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Relate the early history of agriculture.					
2. Cite important events in the development of agriculture in the United States.					
3. Relate important agricultural developments to contemporary events in United States history.					
4. Identify major recent trends in the production and consumption of agricultural products, and describe how the two are interrelated.					
*5. Describe the impact of scientific and technological achievements on the development of the United States.					
*6. Relate specific examples of the interdependence of the people of Illinois with people of the world.					
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ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Agriculture in Society

STUDENT LEARNING OBJECTIVES:

Upon completion of their study of this problem area, students will be able to:

1. Define agriculture, agribusiness, and related terms.
2. Relate the early history of agriculture.
3. Cite the important events in the development of agriculture in the United States.
4. Relate important agricultural developments to contemporary events in United States history.
5. Relate the importance of agriculture to the World, United States, and Illinois economies.
6. Explain how agriculture affects and is affected by government policy.
7. Explain the interdependence of agriculture and society.
8. Identify major recent trends in the production and consumption of agricultural products, and describe how the two are interrelated.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Agriculture in Society

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. What is agriculture? What is agribusiness?
2. What important agricultural developments occurred during early history?
3. What major technological developments occurred in agriculture in the 19th century? The 20th century?
4. What are the major agricultural commodities produced in Illinois?
5. What are the major nonproduction agricultural industries in the local community?
6. What are the major agricultural production regions in the United States?
7. How does agriculture affect the economy of Illinois?
8. How does agriculture affect the economy of the United States?
9. How does agriculture affect the economy of the world?
10. What is the current status of agriculture in the U.S.?
11. What current trends have the greatest effect on agriculture?
12. What does the future hold for U.S. agriculture?
13. What changes in the consuming public will have significant impact on U.S. agriculture?
14. What developments in international agriculture have had significant impact on U.S. agriculture?
15. What federal legislation has had significant effect on agriculture over the years?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Agriculture in Society

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have students compile a list of all local businesses which are based on or related to agriculture. Have the students divide the list into categories "production," "supply and service," "finance," "processing," "wholesale/retail," "marketing," "governmental," and "manufacturing."

2. Have students collect articles from newspapers and/or news magazines (other than "farm" magazines) which deal with agriculture. Students may write and present reports on the articles. Class discussions of the articles may follow.

3. Invite a local banker or commodity broker to speak to the class concerning the effect of agriculture on the local, state, or national economy.

4. Take a field trip to an agricultural museum. Conduct a class discussion of technological changes in agriculture.

5. Have students trace a local agricultural product from its production through all phases of marketing, storage, transportation, processing, wholesaling, and retailing.

6. Have students review Information Sheet #1 and discuss the effect these trends will have on agriculture.

7. Use the information sheets to develop and lead class discussions.

8. Have students complete Student Worksheet #1. Correct and discuss.

9. Show Transparency Master #1. Lead a discussion of the pros and cons of each item listed under "The Unheralded Accomplishments."

10. Assist students in completing Student Worksheet #3. This activity can be performed individually, in small groups, or as a class.

11. Lead students through Student Worksheet #4. This activity can also be performed individually, in small groups, or as a class.

12. Have students complete and discuss Student Worksheet #2. Discuss the meanings of the terms and give examples.

13. Use selected Modules from Applied Communications to enhance communication skills.

14. Use selected Modules from Applied Mathematics to enhance math skills.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Agriculture in Society

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Key Developments Shaping Modern World Agriculture*, Unit #8354; *Interdependency of Agriculture and Society*, Unit #8353; *The Impact of Agriculture on the World Economy*, Unit #8352; *Factors Affecting World Trade*, Unit #8356; *The Impact of Agriculture as a Political Tool*, Unit #8357; *Key Developments Shaping United States Agriculture*, Unit #8355; and *Supply and Demand of Food and Fiber*, Unit #8350. Instructional Materials Service, Texas A & M University, F.E. Box 2588, College Station, TX 77843.

2. *Agricultural Statistics, 1986*. United States Government Printing Office, Washington D.C. 20402.

3. *Technology in Agriculture: Today and Tomorrow* (Various Materials). (1988). Paterson, Bruce C. (Presented at the 1988 Illinois Vocational Association Convention, Itasca, Illinois). National Livestock & Meat Board, 444 N. Michigan Avenue, Chicago, IL 60611.

4. *Applied Communications*. Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

5. *Applied Mathematics*. Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — History and Development of U.S. Agriculture

INFORMATION SHEET #3 — Inventions and Events Impact History

INFORMATION SHEET #4 — Agricultural Facts

INFORMATION SHEET #5 — Changes in the Consuming Public: 1988-2000

INFORMATION SHEET #6 — Agriculture and the Economy

INFORMATION SHEET #7 — Supply and Demand of Agricultural Products

TRANSPARENCY MASTER #1 — Great Scientific Accomplishments

TRANSPARENCY MASTER #2 — Agriculture's Role in the Economy of the United States

TRANSPARENCY MASTER #3 — Percent of Americans Involved in Farming Over a 160 Year Period

TRANSPARENCY MASTER #4 — Consumption of Meat Products

INFORMATION SHEET #1

Terms to be Defined

Agriculture — the science and art of providing food and fiber products.

Agribusiness — a combination of the supply, service, production, and marketing aspects of a modern agricultural system.

Agrarian — relating to farmers or promoting agricultural interests.

Capital goods — material goods used to produce other goods.

Chemical technology — methods of exploiting the composition, structure, and properties of various substances for practical means.

Commodity — a product of agriculture.

Comparative advantage — placing emphasis in an area where the greatest returns will be realized.

Consumer — a person who uses economic goods.

Domestic — having to do with one's own country.

Domesticate — to adapt an animal or plant to the advantage of mankind.

Economic policy — an overall plan to coordinate activities related to the production, distribution, and consumption of goods and services.

Exchange rate — a ratio at which two currencies are traded.

Entrepreneur — one who organizes, manages, and assumes the risk of a business.

Export — the act of selling goods to foreign countries.

Extensive agriculture — the cultivation of crops and livestock using land as the major import.

Food and fiber — the products of agriculture; plants and animals used to produce food and clothing.

Free enterprise — a business climate free of government regulation other than that required to protect the public interest and keep the economy in balance.

Gross National Product (GNP) — the total value of the goods and services produced by the residents of a nation during a specified period of time.

Hybridization — the breeding of plants from two varieties or species.

Import control — any tactic to raise the price of imported goods.

Import quota — regulations that limit the amount of foreign goods brought into a country.

Innovation — a new idea, method, or device.

Intensive agriculture — the cultivation of crops and livestock using many inputs.

International trade — the exchange of goods between two or more nations.

Labor intensive — enterprises which require a large amount of hand labor.

Mechanization — to equip with machines. In agriculture, it refers to the replacing of animal and human power with machine power.

Price supports — the purchase of surplus farm commodities to maintain domestic farm prices.

Production agriculture — the segment of agriculture which actually raises crops and livestock.

Production subsidy — government program to maintain domestic farm prices.

Supply and service industries — a group of industries that provide farmers with inputs for production (feed companies, implement manufacturers, etc.).

Surplus — an excess over what is needed for local or domestic consumption.

Tariff — a charge imposed by a government on imported goods.

Third world — the underdeveloped or emerging countries of the world, especially of Africa or Asia.

INFORMATION SHEET #2

History and Development of U.S. Agriculture

The earliest problems faced by the colonists involved learning to farm in the new world. Most of the colonists were not farmers by trade, but survival dictated that virtually all of them become farmers. Furthermore, the crops and farming techniques used in Europe did not necessarily work in the new world. With the help of native Americans, the colonists learned to cultivate new crops such as corn. A major factor was clearing enough land upon which to grow crops. Farming was very labor intensive, that is to say that labor was the major input. Eventually, the colonists learned cultivation and management methods which enabled them to grow more crops and livestock and even to develop export markets for crops such as tobacco.

As the country expanded westward, transportation of agricultural products to markets became a major concern. Farmers who were relatively isolated from cities and towns had no efficient way to get their products to those who needed them. Rivers were the major early mode of transportation, and the construction of the Erie canal was the first attempt to join the farmers in the west with the cities on the coast. Eventually, the railroads linked the entire country together. Of course, a major issue at the time was the use of slaves for farm labor. In 1862, the Morrill Act was passed, which provided for the establishment of Land Grant Universities and Colleges to advance the science of agriculture. After the Civil War, the westward expansion continued. Government actions such as the Homestead Act were developed to help people get started in farming. Agriculture at the time was extensive, meaning that land was viewed as a limitless resource. A piece of land was farmed until it was no longer productive, then abandoned for fresh land elsewhere. Also at this time, farmers, dissatisfied with the prices they were receiving for their products and the cost of shipping, attempted to organize. Though it was never completely successful, the Grange was the first large-scale attempt to join the interests of farmers together.

The early 1900s are considered by many to be the "golden years" of agriculture in the United States. Prices were high, labor requirements were being lessened by mechanization, and there were more farms in existence than at any other time in history. The great depression, however, changed all of that. Farmers, like other segments of the population, fell upon hard times. Their problems were compounded by the dust bowl of the 1930s, when the poor soil management practices of the past caught up with them. The dust bowl did point out the need for better husbandry of the land and the Soil Conservation Service was formed as a result. Also, the United States Department of Agriculture was formed during this time. Education in agriculture took on added importance as well with the formation of the cooperative extension service and of agricultural education in the high schools.

The revolution in agriculture really occurred after World War II. In addition to advances in agricultural mechanization, new developments in plant and animal biology such as hybridization, the development of chemical fertilizers and pesticides, and the improvement of management practices contributed to fantastic increases in efficiency and production. These developments also contributed to the expansion of nonfarm agribusiness enterprises to the point that today they greatly outnumber the production enterprises.

The downside of increased production was and is surpluses of agricultural products. Government subsidy programs were developed to ensure a fair price for agricultural commodities, but have been only moderately successful. Today, the very small number of remaining farmers face extremely tough management decisions. The optimism and frantic expansion of the 1970s has given way to low commodity prices and farm failures in the 1980s. Increasing competition from other countries has made American commodities less competitive on the world market. In 1988, a severe drought across the country had the potential to drastically reduce crop yields. This caused government surpluses of crops to be diminished and commodity prices to rise.

Major Developments in American Agriculture

1607 — Indians show the Plymouth colonists how to grow crops such as corn, pumpkins, squash, and beans

1613 — First colonial export crop (tobacco) established

1770 — George Washington establishes an experimental farm at Mt. Vernon, Virginia

1793 — Cotton gin is invented by Eli Whitney

1797 — First cast iron, one-piece plow is patented

1825 — Erie canal opens, enabling agricultural products produced in the midwest to be transported to the East Coast

1834 — Cyrus McCormick invents the reaper

1837 — John Deere designs a one-piece wrought iron plow in Grand Detour, Illinois

1850 — Joseph Glidden develops barbed wire for use by cattle ranchers

1862 — Morrill Act creates land grant universities. United States Department of Agriculture is established

1869 — Transcontinental railroad completed

1876 — First experiment station established in Connecticut

1887 — Hatch Act establishes agricultural experiment stations at land grant colleges

1901 — Congress establishes the Bureau of Forestry (later the U.S. Forest Service)

1901 — First successful gasoline engine tractor is built

1914 — Smith-Lever Act establishes the Cooperative Extension Service

1917 — Smith-Hughes Act provides for agricultural education in the public schools

1933 — Agricultural Adjustment Act subsidizes crop producers who participate in soil conservation programs

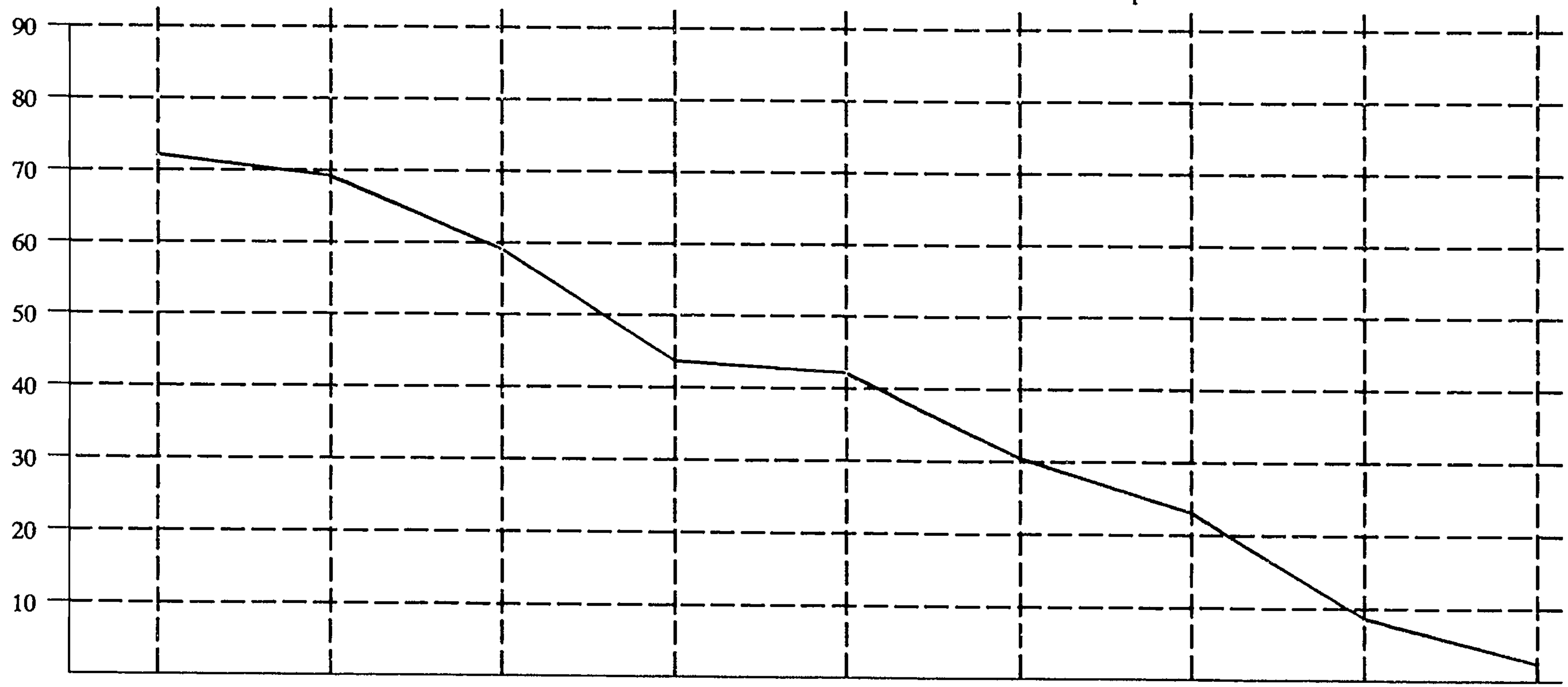
1947 — Antibiotics first used to treat animal diseases

1973 — Agriculture and Consumer Protection Act developed the "target price" concept for measuring the size of price support payments

Inventions and Events Impact History

(Suggestion: Have students identify and discuss the agriculturally related inventions and events.)

Before 1820	1820–1840	1840–1860	1860–1880	1880–1900	1900–1920	1920–1940	1940–1960	1960–1980
Windmill Canned Goods Electromagnet	McCormick Reaper Telegraph Corn Planter Steel Plow	Mechanical Refrigeration Safety Match Hypodermic Syringe	Refrigerated Railroad Car Barbed Wire Internal Combustion Engine Cream Separator Incandescent Light	Diesel Engine X-ray Machine Radio	Plastic Air Conditioning	Mechanical Cotton Picker Quick-frozen Foods Drought Hybrid Corn Modern Tractor Penicillin Great Depression	Nuclear Energy Electric Power Plant Individual Deep Freeze Unit	Micro-processor



Percent of Americans Involved in Farming Over a 160 Year Period

INFORMATION SHEET #4

Agricultural Facts

1. In 1986, there were 2.2 million farms in the United States, and over 1 billion acres of farmland. The average-sized farm is 455 acres.

2. In Illinois in 1986, there were 87,000 farms (down 3000 from the previous year), and 28.7 million acres of farmland. The average-sized farm is 330 acres.

3. Land use is broken down into acres as follows:

Use	U.S.	Illinois
Cropland	383 million	23,165
Pasture	597 million	1,773
Forest	655 million	3,551
Special Use*	544 million	1,497**

*Urban and transportation areas, federal and state lands, military areas, etc.
**Does not include urban areas.

4. Illinois Land Value Comparison:

1983	$1837/acre
1986	$1143/acre

5. Population trends:

Total Population	240 million
Farm Population	5.35 million
Farm as % of Total	2.2%

6. Per capita per year consumption of selected foods:

Meats		Dairy Products	
Beef	74 lbs.	Cheese	22 lbs.
Pork	42 lbs.	Milk	245 lbs.
		Ice Cream	18 lbs.
Poultry			
Chicken	57 lbs.	Fresh Fruits	88 lbs.
Turkey	12 lbs.	Processed Fruits	38 lbs.
Eggs	32 lbs.	Fresh Vegetables	81 lbs.
		Soda Pop	45 gal.
Fish	15 lbs.	Sugar	63 lbs.

7. Americans spend less than 17% of family income on food.

8. Agricultural commodities account for 20% of total U.S. exports.

9. The agriculture system employs 20% of the workforce.

10. The combined agriculture industry generates over $600 billion, or 20% of the GNP.

11. One farmer feeds 79 people and creates 6 agriculturally related jobs.

12. U.S. Share of World Food Production

Product	% of World Share
Soybeans	64
Corn	46
Oilseeds	42
Sorghum	31
Oranges	25
Poultry	24
Beef	23
Peas	23
Eggs	17
Wheat	17
Cotton	17
Milk	15
Pork	13

ERIC

INFORMATION SHEET #5

Changes in the Consuming Public: 1988 - 2000

1. There will be 24 million more U.S. mouths to feed by 2000.
2. The annual number of births will slide, but life expectancy will continue to rise.
3. The middle-aging of America is upon us. By the year 2000, just about 30% of the population will be in the 35-54 age group.
4. There are fewer toddlers. There will be a big decline in young adults, but more oldsters, those 65 and up. They now outnumber teenagers for the first time.
5. The median age is increasing. Today it is 32; by the year 2000 it will be 36+.
6. The traditional family is changing. More than half of today's mothers work. The number of single-parent families keeps on rising.
7. The fastest-growing living arrangement is the nonfamily category: young adults, newly divorced, widows, etc.
8. The number of households with two incomes will continue to increase.
9. The above factors mean that there will be an expansion among high-income groups.
10. More food shoppers will have the money to buy what they want!

INFORMATION SHEET #6

Agriculture and the Economy

Agricultural products are no longer traded primarily within national boundaries. Agriculture has become a vital part of the "world economy" in which all countries are interdependent. For many years, the United States dominated the world agricultural export market, but no longer. Countries such as Brazil, which were once heavy importers of U.S. commodities, now compete with us in the export market for such products as soybeans. The growth in world trade has made food and fiber available throughout the world, though widespread hunger continues to exist. Factors such as domestic farm policies have hampered U.S. agricultural exports by pricing our farm products out of the market. U.S. agricultural exports have fallen from 30% of overall production in 1980 to 17% in 1986.

Developed countries such as Japan, which have traditionally been major export markets, are not any more. Protectionist trade policies, a leveling off of population, and a greater degree of self-sufficiency have contributed to this decrease. On the other hand, Third World countries have growing populations and high food demand. Unfortunately, they cannot always afford to purchase the food that their people need. Agricultural development in these countries has enabled them to develop export markets, which in turn helps to raise the funds necessary to import U.S. agricultural products. This is an illustration of the Law of Comparative Advantage, which states that the greatest profit is realized when countries, areas, or individuals focus resources on enterprises which they produce most efficiently. A Third World country, then, may be able to produce a certain crop very efficiently, but not other crops. Therefore it is to that country's advantage to focus its resources on that particular crop. In so doing, the country could realize a greater profit, which would enable it to buy more of the products which it cannot produce efficiently.

Of course, for this system to work there must be free trade. This is not always the case, however. Many countries impose trade barriers to protect domestic industry. These barriers usually are of the following types:

1. Production Subsidies — factors which increase or maintain farm income.

2. Import Controls — measures taken to limit the amount of goods which a country can import.

3. Export Subsidies — the buying of surplus commodities at high domestic prices. Governments then "dump" the commodities on the world market often at a loss.

4. Export Embargoes — the prohibition of the export of certain commodities to certain countries.

INFORMATION SHEET #7

Supply and Demand of Agricultural Products

Factors Influencing Supply

- price
- units in production
- weather
- amount in storage
- government action
- time lags
- credit
- land
- water
- technology

Factors Influencing Demand

- consumer preference
- competition
- weather
- seasonality
- willingness and ability to purchase
- income level
- population

TRANSPARENCY MASTER #1

Great Scientific Accomplishments

The invention of the telephone and the subsequent communication and information industry that has evolved.

The advent of the automobile and the airplane and their impact on our society.

The discovery of the secrets of the atom and the changes it has brought to our lives.

The exploration of space — the thrill of watching men on the moon — and the realization of space as a rich and endless frontier.

The Unheralded Accomplishments

The founding of genetics — a scientific basis for breeding plants and animals.

The mechanization of agriculture.

The understanding of mineral nutrition and the use of fertilizers.

The development and widespread application of chemicals for the control of weeds and pests.

TRANSPARENCY MASTER #2

Agriculture's Role in the Economy of the United States

The value added to farm products as they flowed through the economic system amounted to 20 percent of GNP in 1987. The food and fiber system generated $700 billion of GNP!

American agriculture has assets > $1 trillion — nation's largest industry

Economic Activity in the food and fiber system requires the services of 20 percent of the labor force — over 22 million people!

Agricultural exports will total approximately $32 billion in 1988, and generate nearly $75 million of activity in the U.S. economy.

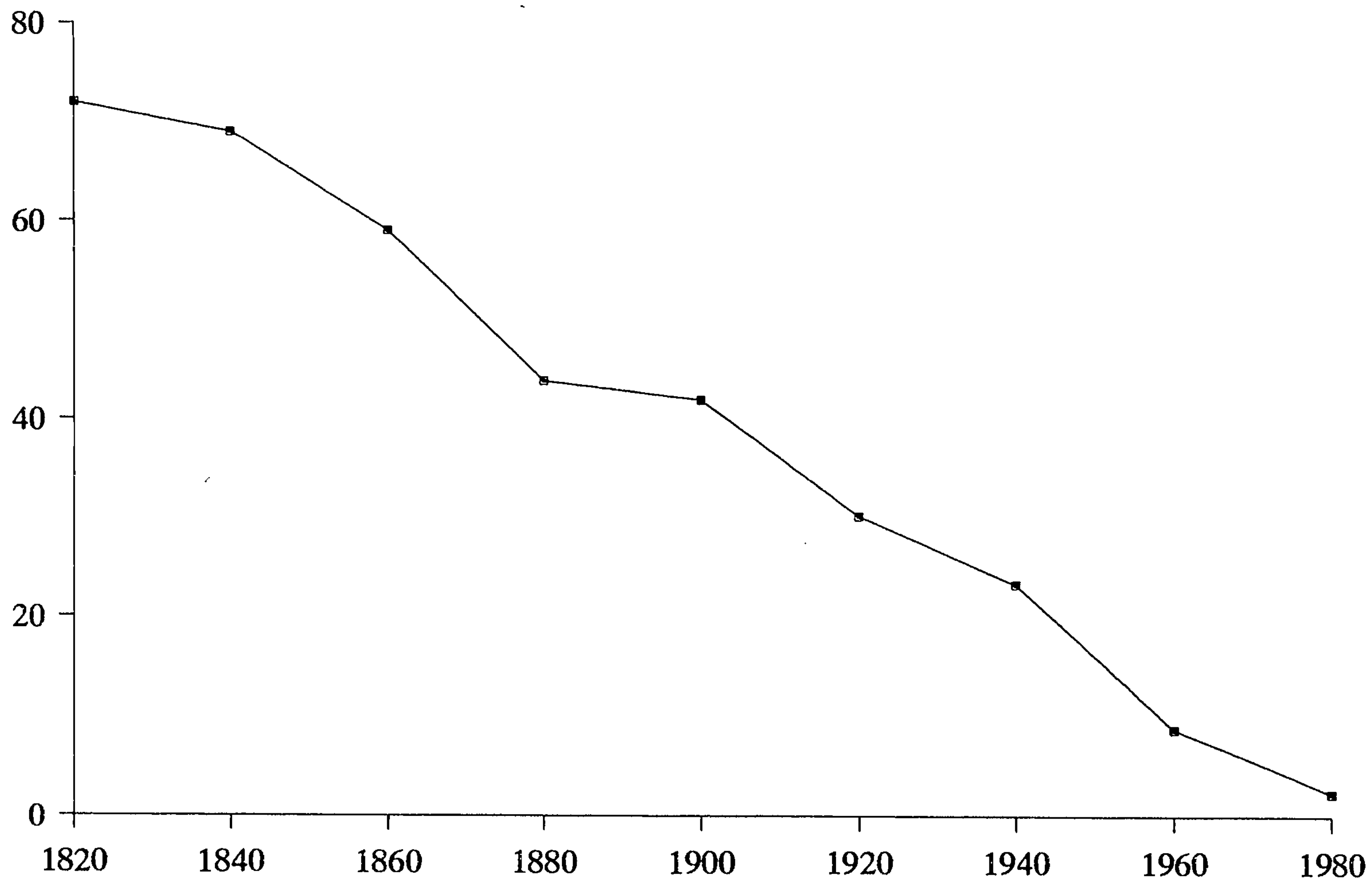
Agricultural exports give rise to at least 1 million jobs in the economy.

Each $1 billion in exports provides 30,000 additional jobs!

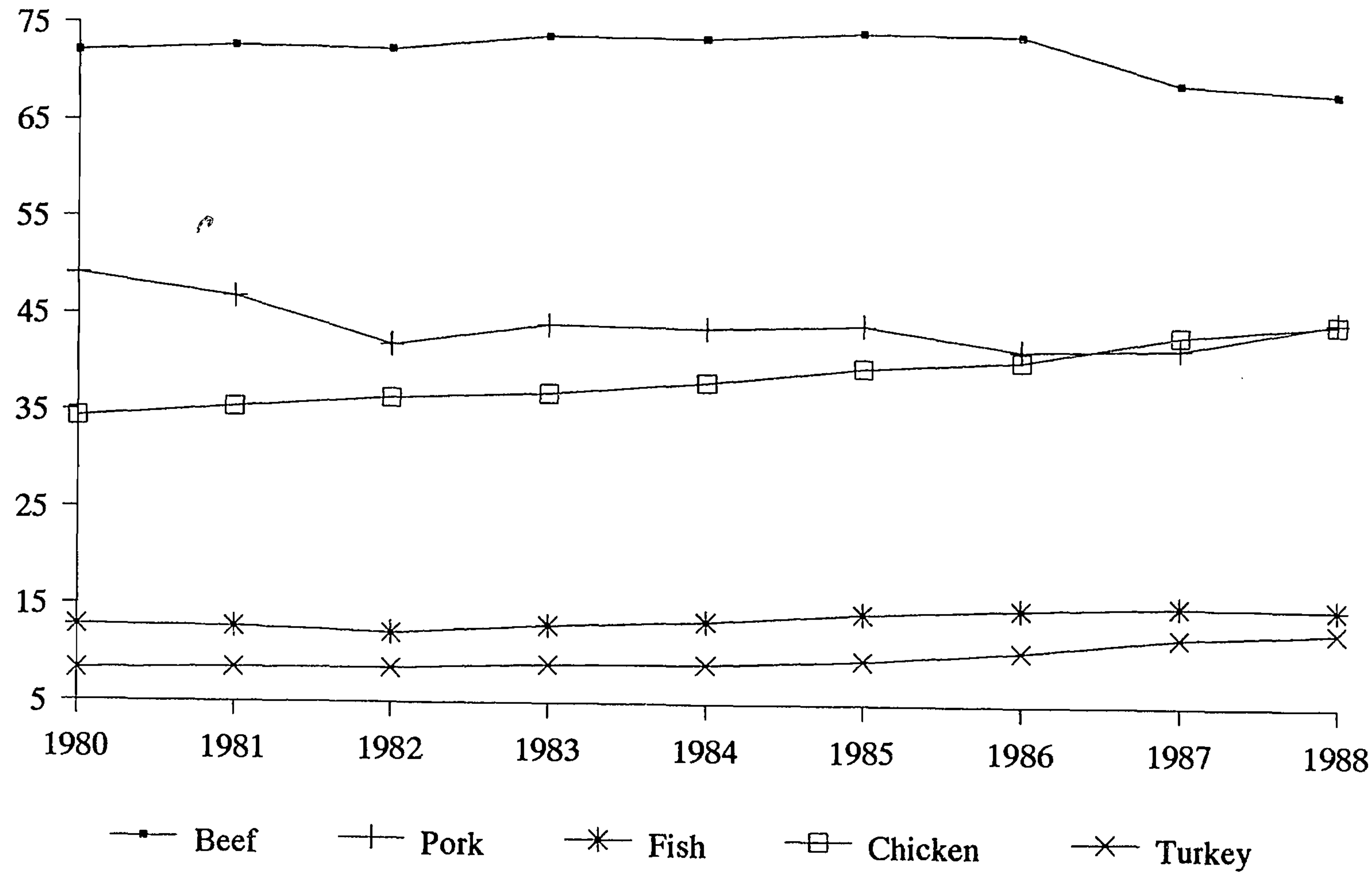
TRANSPARENCY MASTER #3

Percent of Americans Involved in Farming

Over a 160 Year Period



Consumption of Meat Products



Per Capita in Pounds

76

75

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Agriculture & Society Questions

STUDENT WORKSHEET #2 — Ag in the Society Word Search (with solution)

STUDENT WORKSHEET #3 — Agriculture and Political Issues

STUDENT WORKSHEET #4 — Agriculture and Agribusiness in the Community

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

ERIC

STUDENT WORKSHEET #1

Agriculture and Society Questions

I. Match the term to its definition by placing the correct letter in the space provided.

1. ____ Agribusiness
2. ____ Extensive Agriculture
3. ____ Import Control
4. ____ Price Supports
5. ____ Tariff
6. ____ Commodity
7. ____ Hybridization
8. ____ Mechanization
9. ____ Consumer
10. ____ Gross National Product

A. A product of agriculture
B. To equip with machines
C. A person who uses economic goods
D. A combination of the supply, service, production, and marketing aspects of a modern agricultural system
E. A charge imposed by a government on imported goods
F. Any tactic to raise the price of imported goods
G. The total value of goods and services produced
H. The cultivation of crops and livestock using land as the major import
I. The breeding of plants from two varieties or species
J. The purchase of surplus farm commodities to maintain domestic farm prices

II. Fill in the blank.

1. The first major export crop in the American colonies was ____________.
2. ______________________________ refined the mechanical reaper.
3. Agricultural commodities account for ______ % of total U.S. exports.
4. One farmer feeds ______ people and creates _____ ag-related jobs.
5. The average age of the U.S. consuming public is _______.
6. ____________ countries such as Japan are not the major export markets for U.S. commodities which they once were.
7. ____________ countries have growing populations and high demand for food.
8. The ____________________ of agriculture allowed farmers to greatly increase the amount of land in production.
9. The early 1900s were considered to be the "___________________" of agriculture in America.
10. The ___________ - ___________ Act established the Cooperative Extension Service to help bring the latest in science and technology to the farmer.

III. Short Answer

1. In what areas did major developments take place in the years following World War II to "revolutionize" agriculture?
2. What was Joseph Glidden's contribution to agriculture? Why was it important?
3. What was the purpose of the Smith-Hughes Act?
4. How can government subsidies harm agricultural prices?
5. List five factors which influence the demand for agricultural products.

STUDENT WORKSHEET #1 — Key

Agriculture and Society Questions

I. Match the term to its definition by placing the correct letter in the space provided.

1. _D_ Agribusiness
2. _H_ Extensive Agriculture
3. _F_ Import Control
4. _J_ Price Supports
5. _E_ Tariff
6. _A_ Commodity
7. _I_ Hybridization
8. _B_ Mechanization
9. _C_ Consumer
10. _G_ Gross National Product

A. A product of agriculture
B. To equip with machines
C. A person who uses economic goods
D. A combination of the supply, service, production, and marketing aspects of a modern agricultural system
E. A charge imposed by a government on imported goods
F. Any tactic to raise the price of imported goods
G. The total value of goods and services produced
H. The cultivation of crops and livestock using land as the major import
I. The breeding of plants from two varieties or species
J. The purchase of surplus farm commodities to maintain domestic farm prices

II. Fill in the blank.

1. The first major export crop in the American colonies was *tobacco*.
2. *Cyrus McCormick* refined the mechanical reaper.
3. Agricultural commodities account for *20* % of total U.S. exports.
4. One farmer feeds *79* people and creates *6* ag-related jobs.
5. The average age of the U.S. consuming public is *32*.
6. *Developed* countries such as Japan are not the major export markets for U.S. commodities which they once were.
7. *Third World* countries have growing populations and high demand for food.
8. The *mechanization* of agriculture allowed farmers to greatly increase the amount of land in production.
9. The early 1900s were considered to be the "*golden years*" of agriculture in America.
10. The *Smith - Lever* Act established the Cooperative Extension Service to help bring the latest in science and technology to the farmer.

III. Short Answer

1. In what areas did major developments take place in the years following World War II to "revolutionize" agriculture? *Biology, chemistry, and mechanization.*
2. What was Joseph Glidden's contribution to agriculture? Why was it important? *Barbed wire. Ended the era of the open range.*
3. What was the purpose of the Smith-Hughes Act? *To provide for agricultural education (among other things) in high schools.*
4. How can government subsidies harm agricultural prices? *By keeping domestic prices higher than world prices, decreasing world demand, creating more surpluses.*
5. List five factors which influence the demand for agricultural products. *Consumer preference, competition, weather, seasonality, willingness and ability to purchase, income, population.*

STUDENT WORKSHEET #2

Ag in the Society Word Search

F	C	I	D	O	Y	T	I	D	O	M	M	O	C	O	T	V	E	Y	D
L	E	O	T	S	U	R	P	L	U	S	I	N	A	E	E	W	Q	P	V
V	D	A	A	Z	O	X	H	U	D	N	F	A	T	N	H	F	K	V	L
F	O	G	A	D	N	A	O	O	G	O	D	G	T	I	Y	N	T	D	N
U	D	R	A	G	S	C	G	A	T	C	M	R	K	V	B	J	G	I	J
C	L	I	X	I	G	T	A	R	F	K	E	E	L	N	R	W	J	U	V
A	U	B	M	I	E	G	R	O	A	P	U	S	S	B	I	C	M	W	I
P	M	U	O	E	E	K	F	O	R	R	B	B	Z	T	D	Z	P	D	T
A	V	S	T	K	C	S	X	E	P	I	I	N	Z	I	I	L	G	C	U
C	F	I	K	H	L	H	N	A	V	X	N	A	J	Q	Z	C	D	N	U
C	Q	N	Q	Y	R	E	A	Q	G	N	E	L	N	F	A	X	A	X	O
L	I	E	M	K	U	E	M	N	U	Q	O	M	F	S	T	X	J	T	K
R	X	S	R	R	U	X	M	O	I	B	T	I	F	H	I	E	R	W	E
J	C	S	S	A	R	L	J	U	S	Z	R	I	T	R	O	P	L	Y	M
G	L	F	B	Q	L	I	W	C	S	A	A	T	L	A	N	M	R	Z	H
S	T	L	D	Y	D	G	V	P	T	N	I	T	P	G	V	A	Z	B	A
R	R	J	E	G	Z	J	N	M	T	E	O	Z	I	S	N	O	S	D	F
J	I	E	L	V	W	D	M	I	Q	B	B	C	P	O	D	X	N	N	J
Q	H	A	G	R	I	C	U	L	T	U	R	E	E	N	N	C	N	N	X
G	K	G	X	R	W	Y	Y	N	V	U	L	E	S	W	G	Z	E	N	I

The following words are hidden in the puzzle:

Agrarian
Agribusiness
Agriculture
Commodity
Consumer
Domesticate
Entrepreneurs
Export
Hybridization
Innovation
Mechanization
Surplus
Tariff

STUDENT WORKSHEET #2 — Key

Ag in the Society Word Search

.	.	.	.	.	Y	T	I	D	O	M	M	O	C	.	.	.	.	.	.
.	.	.	.	S	U	R	P	L	U	S	.	.	.	.	E	.	.	.	.
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.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I

The following words are hidden in the puzzle:

Agrarian
Agribusiness
Agriculture
Commodity
Consumer
Domesticate
Entrepreneurs

Export
Hybridization
Innovation
Mechanization
Surplus
Tariff

STUDENT WORKSHEET #3

Agriculture and Political Issues

1. Develop a list of the major agricultural problems or issues in your community (these are probably very similar to the major agricultural problems in the whole country). Discuss the effects of each issue on the well-being of the community.

2. Draft a letter to your state representative, state senator, congressional representative, or U.S. senator expressing your concerns regarding this (or these) issue(s). Ask the person to whom you write to express his or her position on the issue(s) and any recent or upcoming action which will have an effect on the issue(s).

82

STUDENT WORKSHEET #4

Agriculture and Agribusiness in the Community

1. List the types of agricultural production enterprises in your community. Discuss in class to be sure the list is complete.

2. For each type of enterprise listed in item 1, identify all of the agribusinesses in the community which support that enterprise. Discuss in class.

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the Relationship Between Agriculture and the Environment

RELATED PROBLEM AREAS:

1. Recognizing the Role of Agriculture in Society
2. Conserving Water Resources (Agricultural Resources Cluster)
3. Controlling Air Pollution (Agricultural Resources Cluster)
4. Understanding Government Regulations and Controls (Agricultural Resources Cluster)
5. Conserving Soil (Agricultural Resources Cluster)
6. Managing Freshwater Resources (Agricultural Resources Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D. and Jerry D. Pepple, Ed.D.
Principal Investigator: Chris A. Roegge, Ph.D.

ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the interactions among populations of plants, herbivores, and carnivores.					
*2. Recognize that the populations of plants and animals change as the environment changes.					
*3. Understand that an ecosystem consists of a community interacting with its physical environment.					
4. Determine the geographic distribution of natural resources.					
5. Identify and discuss methods of protecting the environment.					
98					87

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvem ,nt Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
By the end of grade *(circle one)* 3 6 8 11 students should be able to:					
*1. Identify the positive effects of establishing a balance of harvest and renewal in our environment.					
*2. Evaluate the ways in which natural resources have been allocated, utilized, and conserved in the nation.					
3. Identify renewable and nonrenewable natural resources which are closely associated with agriculture.					
4. Identify ways in which agriculture contributes to air and water pollution.					
5. Identify ways in which agriculture is affected by air and water pollution.					
6. Determine the economic impact of natural resources on the agricultural economy.					
7. Identify methods which can be used to control agricultural resources of air and water pollution.					
88					89

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY ___ DISTRICT ___ ESC ___
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize the differences in purpose between groups organized to seek popular changes and those organized to promote unpopular changes.					
*2. Compare the economic interdependence among agriculture, business, government, labor, and the consumer.					
*3. Understand how individuals and/or groups effect change.					
4. Determine the role of the federal and state agencies in formulating environmental policy which affects agriculture.					
5. Understand the influence of environmental groups and movements on public policy and opinion.					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the Relationship Between Agriculture and the Environment

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Identify renewable and nonrenewable natural resources which are closely associated with agriculture.

2. Identify ways in which agriculture contributes to air and water pollution.

3. Identify ways in which agriculture is affected by air and water pollution.

4. Determine the economic impact of natural resources on the agricultural economy.

5. Determine the geographic distribution of natural resources.

6. Identify and discuss methods of protecting the environment.

7. Identify methods which can be used to control agricultural sources of air and water pollution.

8. Determine the role of the federal and state agencies in formulating environmental policy which affects agriculture.

9. Understand the influence of environmental groups and movements on public policy and opinion.

INSTRUCTOR'S NOTES AND REFERENCES

ERIC

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the Relationship Between Agriculture and the Environment

PROBLEMS AND QUESTIONS FOR STUDY

1. What is ecology? What are ecosystems?
2. What natural resources are important to agriculture?
3. In what ways are natural resources important to agriculture?
4. Where are our natural and agricultural resources located?
5. What is a nonrenewable resource? A renewable resource?
6. What are nutrient cycles and why are they important to agriculture?
7. What is air pollution? Water pollution?
8. What are the major sources of air pollution? Water pollution?
9. What agricultural practices pollute the air? The water?
10. What agricultural practices have been developed to minimize air and water pollution?
11. How does pollution affect agricultural production? Processing? Marketing? Science and technology?
12. Why should persons in agriculture be concerned about the environment?
13. What is being done about agricultural pollution sources?
14. What is soil erosion? How does it contribute to pollution?
15. What is siltation? How can it be controlled?
16. What is the EPA? What does it do?
17. What other agencies are interested in the environment?
18. What environmental policies are helpful to agriculture?
19. What environmental policies are harmful to agriculture?
20. What are pesticides?
21. How does pesticide use affect the environment?
22. What can be done to prevent pesticide damage to the environment?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the Relationship Between Agriculture and the Environment

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have students perform a soil erosion demonstration.
2. Have students complete Student Worksheet #4.
3. Have students perform a community inventory to identify local sources of air and water pollution.
4. Have the students complete Student Worksheet #5.
5. Have students complete Student Worksheet #1.
6. Have students write to various environmental groups for information on current priority issues relating to agriculture and the environment.
7. Have students collect news articles about environmental issues.
8. Have students complete and discuss Student Worksheet #2.
9. Make arrangements with a general science or biology teacher to integrate information on agriculture and the environment into his or her class (perhaps some cross-teaching would be possible).
10. Have students identify ecosystems or subsystems existing in the community or area.
11. Have students complete and discuss Experiment #3 "Detergents and the Growth of Algae."
12. Show and discuss VAS slidefilm #F722 "Agriculture: Soil Erosion and Water Quality."
13. Have students read sections 1 and 2 of VAS unit U4083 "Managing the Environmental Impact of Pesticides."
14. Have students read and complete the worksheets in IMS units 8351, 8358, 8359, and 8360 (see ordering information in the reference list).
15. Have students read and discuss the pamphlet *Groundwater and You*, available from the local Extension Office.
16. Have students read and complete the study questions for chapter 1 of *Our Natural Resources*, by Kircher and Wallace.
17. Organize and conduct a community service project to enhance the quality of the local environment.
18. Use selected Modules from Applied Communications to enhance skills in workplace communications.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the Relationship Between Agriculture and the Environment

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Soil Erosion and Water Quality,* S722 or F722; *Managing the Environmental Impact of Pesticides,* U4083. Vocational Agriculture Service, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217)333-3871.

2. "Keeping our Environment Clean" (Chapter 24) in *Agriculture in Our Lives.* Krebs, Alfred. Interstate Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050. (217)446-0500.

3. *Our American Land: The 1987 Yearbook of Agriculture.* U. S. Government Printing Office, Washington, DC 20402.

*4. *Environmental Concerns in Agriculture* (Unit #8358), *Methods of Protecting the Environment* (Unit #8359), *Effects of the Environment on Agriculture* (Unit #8360), and *Renewable and Nonrenewable Agricultural Resources* (Unit #8351). Instructional Materials Service, Texas A & M University, F. E. Box 2588, College Station, TX 77843.

5. *Our Natural Resources.* Kircher, Harry B., Wallace, Donald L. Interstate Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050. (217)446-0500.

6. *Applied Communications.* Curriculum Publications Clearinghouse, Western Illinois Univeristy, Horrabin Hall 46, Macomb, IL 61455.

*Indicates highly recommended resources

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Exhaustible vs. Inexhaustible Resources

TRANSPARENCY MASTER #1 — The Hydrologic Cycle (with discussion guide)

TRANSPARENCY MASTER #2 — The Oxygen–Carbon Dioxide Cycle (with discussion guide)

TRANSPARENCY MASTER #3 — The Nitrogen Cycle (with discussion guide)

TRANSPARENCY MASTER #4 — Illinois Forest Lands (with discussion guide)

INFORMATION SHEET #1

Terms to be Defined

Acid rain — rain with a pH value below 5.6 resulting from other acid-forming constituents absorbed by the rain from the atmosphere.

Algae — simple plants capable of photosynthesis.

Algae blooms — an overrun of algae and other aquatic plants stimulated by the presence of excess phosphorus.

Autotrophic — an organism that produces food from inorganic substances.

Bacteria — single cell microorganisms. Some cause disease, but others are essential decomposers.

Biodegradable — any substance that decomposes quickly through the action of microorganisms.

Biomass — the total weight of all living matter in an area.

Biosphere — the portion of the earth and its atmosphere that can support life.

Biota — all living organisms that exist in an area.

Climate — the average course of the weather over a period of years.

Community — a group of animals or plants living together in the same environment.

Conservation — using in a wise or economical way; usually associated with natural resources.

DDT — an insecticide which was banned from use because it was highly persistent and accumulated in food chain.

Decomposition — the breakdown of matter by bacteria. It changes the chemical makeup and physical appearance of materials.

Ecological climax — a relatively stable community that maintains itself in the absence of disturbance.

Ecological succession — the changes, over time, in the structure and function of an ecosystem.

Ecology — the interrelationships of living things with their environment.

Ecoregions — large regions of related ecosystems.

Ecosystem — an interacting natural system including living organisms and non-living materials.

Environment — all external influences that affect the development and survival of an organism.

Eutrophication — the normally slow aging process by which a lake evolves into a marsh, becomes dry land, and finally disappears.

Food chain — the transfer of nutrients from one organism to another.

Fossil fuels — coal oil and natural gas; called fossil fuel because they are derived from the remains of ancient plants and animals.

Fungi — small, often microscopic plants not capable of photosynthesis.

Groundwater contamination — pollution which occurs when agricultural chemicals applied to the soil surface leach into subsurface water.

Herbicide — an agent used to destroy or slow plant growth.

Herbivore — an animal that feeds on plants.

Heterotrophic — organisms that cannot make food from inorganic chemicals.

Monoculture — the growing of a single species to the exclusion of others on a large area of land.

Natural resource — any of the earth's resources which is available for use by man.

Nitrogen cycle — the process by which nitrogen is continuously renewed by plant, animal, and soil activity.

Nonpoint source pollution — pollution which originates at a distant site. Generally caused by agricultural runoff.

Nonpersistent pesticide — pesticides which do not remain in the environment for a long time but which are often dangerous to handle.

Nonrenewable resource — resources which are not capable of being replaced by ecological cycles or sound management.

Nutrient — element or compound essential to growth and development of living things; carbon, oxygen, nitrogen, potassium, and phosphorus.

Organic — referring to or derived from living organisms.

Organism — any living thing.

Organochlorides — chemical group which decomposes slowly. Pesticides belonging to this group are classified as persistent pesticides.

Oxygen-carbon dioxide cycle — the process by which oxygen and carbon dioxide are manufactured and exchanged by plants and animals.

Persistent pesticides — pesticides which decompose slowly and therefore remain active in the environment long after they are used.

Pesticide — an agent used to destroy plants and animals that are unwanted by mankind.

Photosynthesis — the process by which plants combine carbon dioxide and water in the presence of light to form sugars.

Plankton — tiny plants and animals that live in water.

Pollution — a substance which makes another substance unclean, dirty, or impure.

Pyrethrum — a natural insecticide which breaks down very quickly into relatively harmless compounds.

Range land — land that is too dry, wet, cold, or elevated for intensive agriculture or forestry; supports wildlife and grazing by domestic livestock.

Renewable resources — resources which are capable of being replaced by natural ecological cycles or sound management.

Siltation — the formation or deposition of silty soil.

Synergism — a cooperative action of two substances that results in a greater effect than both of the substances could have had acting independently.

Soil erosion — the loss of topsoil by way of wind or water due to poor land management practices.

Thermal inversion — an atmospheric condition where a layer of cool area is trapped by an area of warm air. An inversion can magnify the effect of air pollution.

Watershed — an area drained by a stream.

Wetlands — an area where the water table is at or near the surface, or the land is covered with shallow water. Wetlands occur between dry land and deeper water.

Zooplankton — tiny aquatic animals that fish feed upon.

INFORMATION SHEET #2

Exhaustible vs. Inexhaustible Resources

Inexhaustible Natural Resources

1. Solar energy
2. The earth's atmosphere
3. Water

NOTE: The atmosphere and water, while technically inexhaustible, could also be considered "impaired" resources due to pollution by man.

Exhaustible Natural Resources

1. Irreplaceable (nonrenewable) resources
    a. mineral resources
        - oil
        - coal
        - phosphate
        - iron
        - copper
        - natural gas
        - potash
        - salt
        - sulfur

    b. soil — it takes 2000 years to develop one inch of soil from rock.

    c. wildlife

2. Replaceable resources
    a. forests

    b. grasslands

    c. some soil elements

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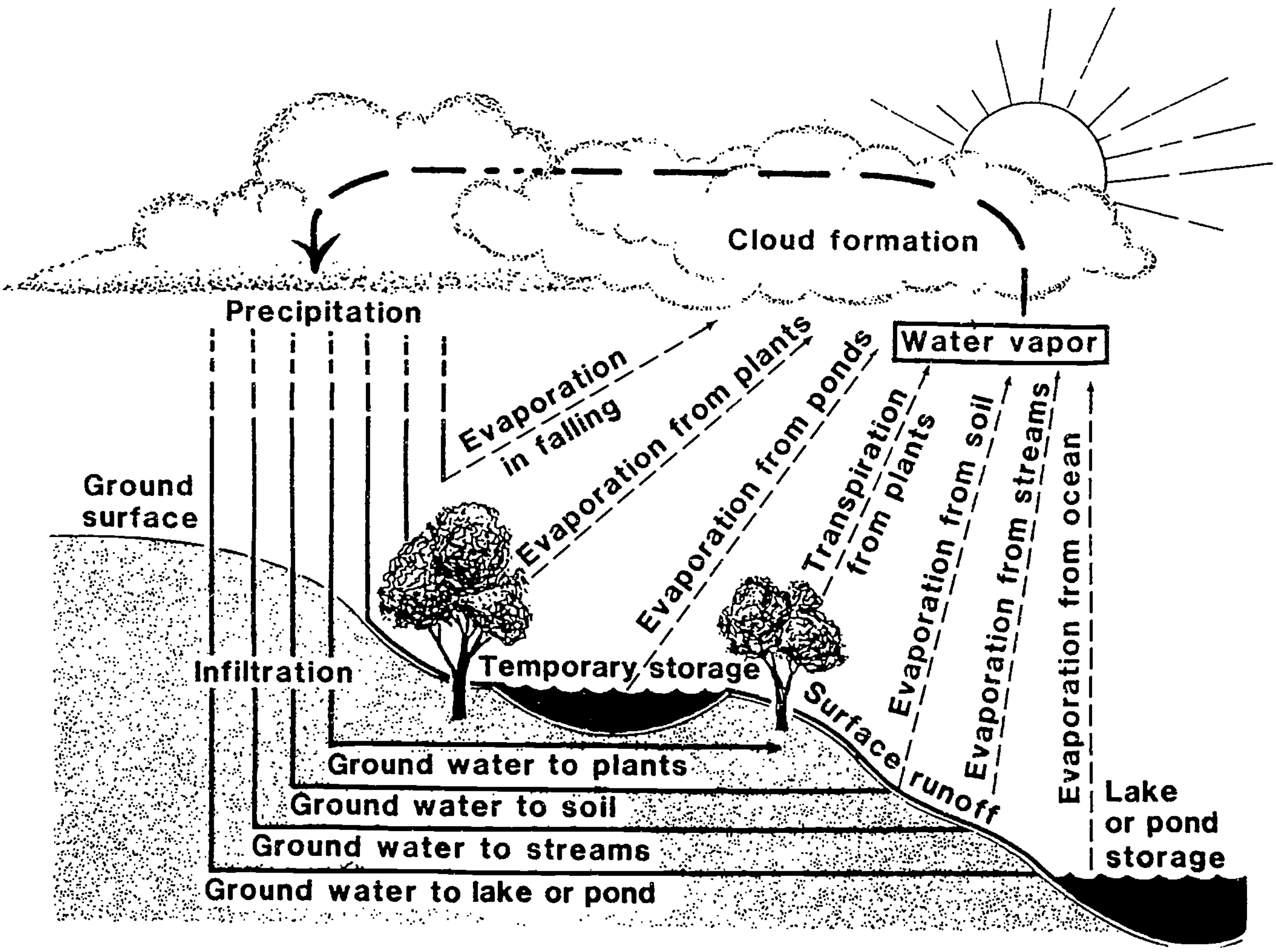
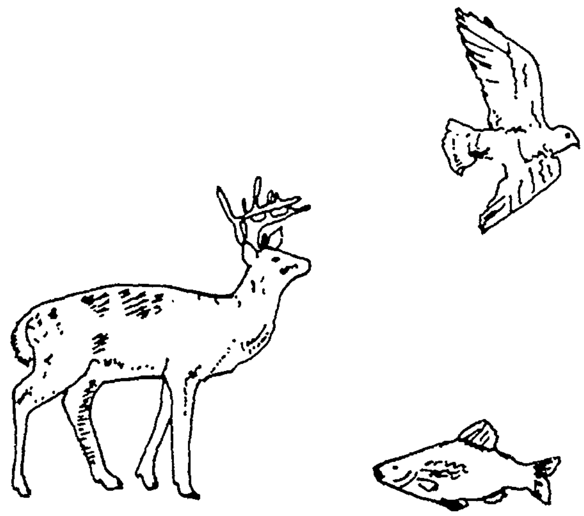
TRANSPARENCY MASTER #1

The Hydrologic Cycle



TRANSPARENCY MASTER #2

Oxygen — Carbon Dioxide Cycle



Plants	Animals
Use CO_2 to make food Give off excess O_2	Exhale CO_2 Inhale O_2

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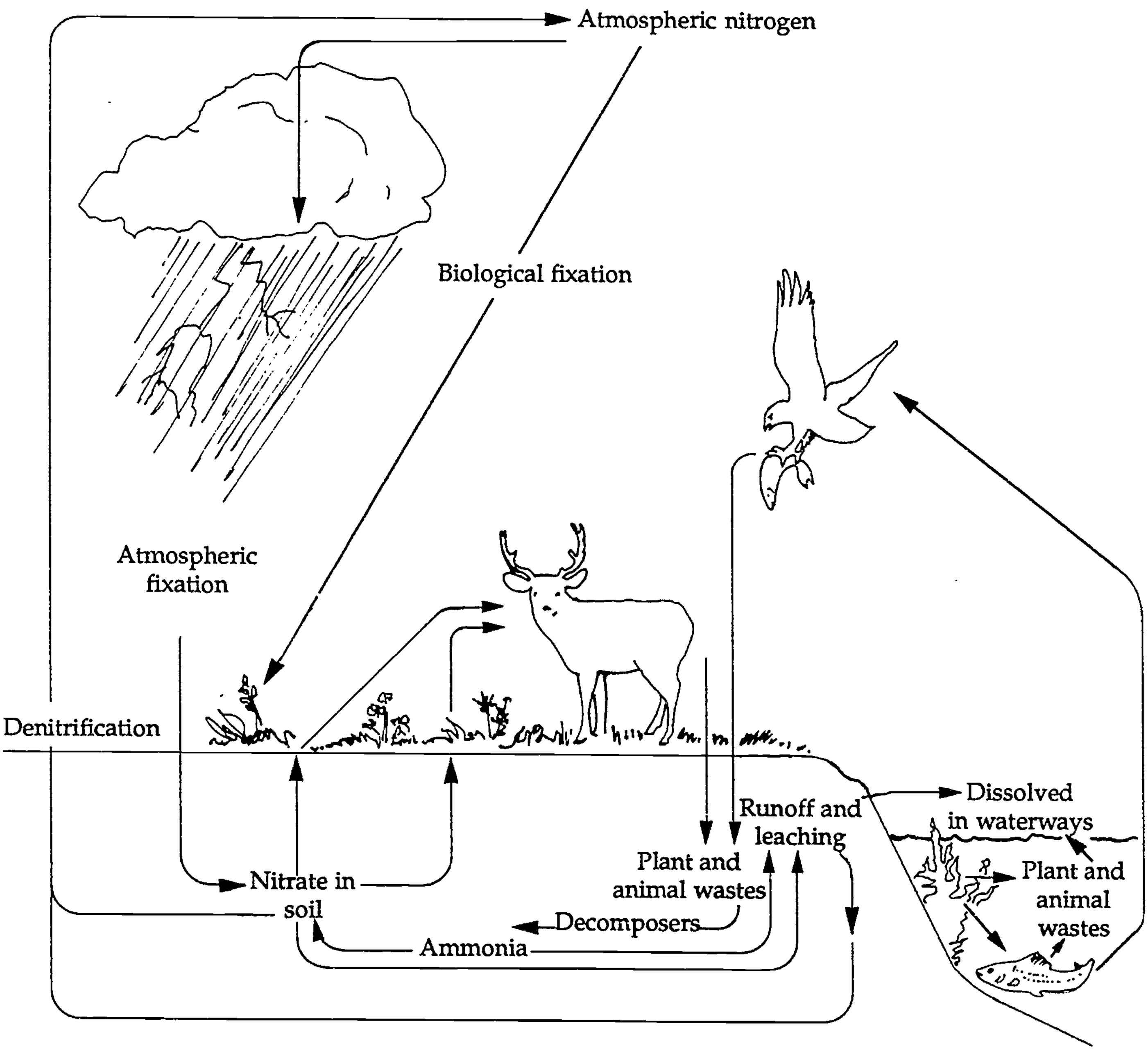
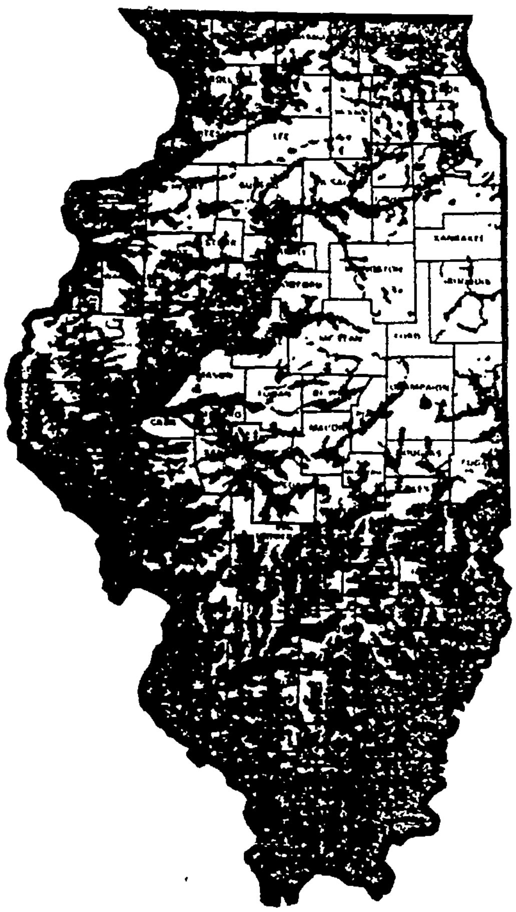
TRANSPARENCY MASTER #3

The Nitrogen Cycle



TRANSPARENCY MASTER #4

Illinois Forest Lands



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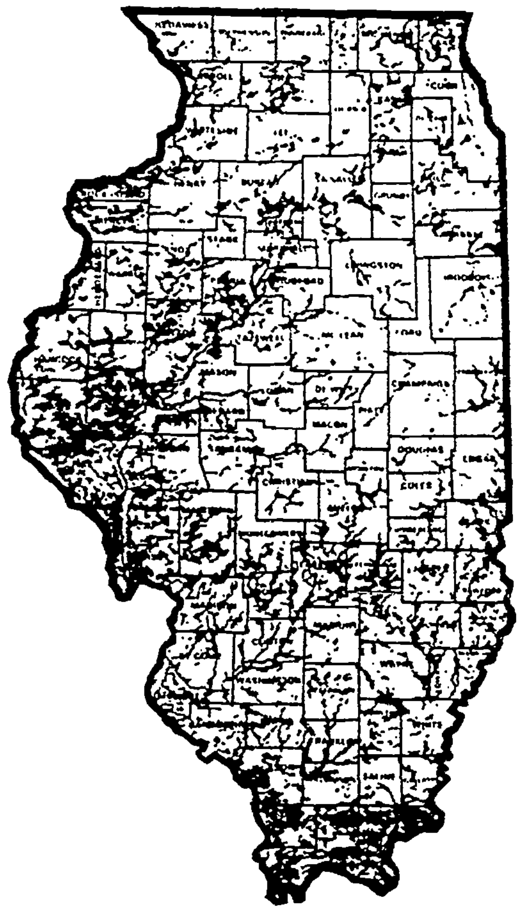

1980

Shaded areas show forest lands today and when Illinois was first settled.

TRANSPARENCY MASTER DISCUSSION GUIDE

TRANSPARENCY MASTER #1

1. Precipitation Phase
   a. forms of precipitation = rain, snow, sleet, hail
   b. a one-inch rain on 160 acres is approximately equal to 4,360,000 gallons

2. Infiltration Phase
   a. water is made available to plant roots
   b. water is stored in underground aquifers
   c. water moves underground to streams, rivers, and oceans

3. Surface Runoff Phase
   a. major cause of soil erosion
   b. moves to temporary storage in watersheds (lakes, ponds, etc.)

4. Evaporation Phase
   a. occurs from soil, plants, and water surfaces
   b. requires approximately 1 million horsepower of energy to evaporate enough water for a 1-inch rain on 160 acres

5. Condensation Phase
   a. change from vapor to mist to droplets
   b. takes the same amount of energy as evaporation

TRANSPARENCY MASTER #2

Plants and animals exchange oxygen and carbon dioxide. Plants utilize CO_2 in the photosynthetic process to make food, and give off excess O_2 which is used to purify the blood in the lungs of animals. In this purification process, CO_2 is exhaled. Neither plant nor animal could exist without the other. See Student Worksheet #2.

TRANSPARENCY MASTER #3

Nitrogen is essential for survival. Approximately 78% of the air we breathe is nitrogen. Nitrogen is also essential, in certain forms, for plant growth, for animal tissue growth and development, and for the production of proteins. Large amounts of N are removed from the atmosphere by plants, rainfall, and lightning. This N is incorporated into the soil, along with that contained in animal wastes. Soil N is fixed by certain plants (legumes) and returned to animals when consumed. Decaying organic material returns N from the soil to the atmosphere.

TRANSPARENCY MASTER #4

Forests:
- Prevent and control erosion.
- Make economic use of unproductive land.
- Provide windbreaks.
- Improve soil conditions and water quality.
- Provide cover and food for wildlife.
- Provide wood products.
- Provide recreational facilities.

Why have timber acreages declined?

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Ecosystem Concepts

STUDENT WORKSHEET #2 — Effect of Deficiency and Excessive Amount of Carbon Dioxide on Plant Growth

STUDENT WORKSHEET #3 — Detergents and the Growth of Algae

STUDENT WORKSHEET #4 — Questions for Discussion

STUDENT WORKSHEET #5 — Determining the Ethics of Chemical Pesticide Use

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Ecosystem Concepts

Materials:

Three or four aquatic ecosystems (microenvironments) will be required, depending upon the number of students in the class. Each ecosystem consists of a large jar or two-liter clear soda bottle with cap, sand, pebbles, sprigs of elodea or other aquatic plant, a few snails, and 3-4 guppies.

How Does the Ecosystem Work?

There is much more to an ecosystem than living things interacting with their environment. The whole is greater than the sum of the parts. Each link is related and intertwined with the others in very complicated ways. If you harm one member, you affect the whole system. This is known as a synergistic relationship.

Basic Rules of Ecosystems:

1. All ecosystems require three basic components: Producers, consumers, and decomposers. All ecosystems are not alike; however, all must have these basic components or they would not function for very long.

2. Energy flows in ecosystems in one way. Energy is lost at each level due to body processes and daily activity. Thus energy must be constantly replaced from the outside.

3. All ecosystems require the same nutrients. Nutrients are recycled through the system.

4. Ecosystems are highly interrelated. All components, both biotic and abiotic, are dependent on each other.

Niches:

The role an animal plays in an ecosystem is known as its "niche." Most organisms play more than one role and play different roles at different stages of development. For example, snakes prey on frogs, but baby snakes are prey for hawks and fish. The essential niches are listed in item 1 above, but there are several non-essential niches. Here are some examples of both.

Essential:

Producers — All green plants perform photosynthesis, the process by which plants take nutrients and water and, using the sun's energy, produce food and oxygen.

Consumers — All animals that eat plants or other animals are consumers. Animals that feed on plants are herbivores or first order consumers. Animals that feed on other animals are carnivores or second order consumers.

Decomposers — Bacteria, microorganisms, fungi, and scavengers assist in the transformation of tissue back into chemicals (nutrients). Most decomposition takes place in the soil or in the bottom of a lake or stream.

Non-Essential:

Scavengers — All animals that spend much time eating dead tissue are considered scavengers. Scavengers are a valuable link because they are the garbage disposers of the ecosystem.

Parasites — All organisms that live in or on others and use their host as a food source are parasites. They usually cause no harm, though some do.

Food Chains:

All ecosystems operate through "food chains," which consist of the transfer of energy through organisms by the process of eating and being eaten. In real life, food chains are connected with other food chains to form food webs. See figure 1.

Analysis of a Food Chain (see figure 1):

1. What is the top consumer?

2. Which is the first order consumer?

3. Which is the first carnivore?

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Analysis of an Ecosystem (see figure 2):

1. Name a: Producer

   Herbivore

   Carnivore

   Scavenger

   Decomposer

2. Draw arrows to show how the components are interrelated.

3. Label the diagram with these terms: precipitation, transpiration, evaporation, energy source.

Refer to the Aquatic Ecosystem (jar):

1. What is the one thing necessary for a self-sufficient environment that is not found inside the globe?

2. Which organisms in the system use the oxygen produced by the plants (autotrophs) during cellular respiration to produce energy?

3. What do the fish recycle back into the environment?

4. What would happen to the fish if the aquatic plants were removed? Explain.

5. What would happen to aquatic plants if the fish were removed?

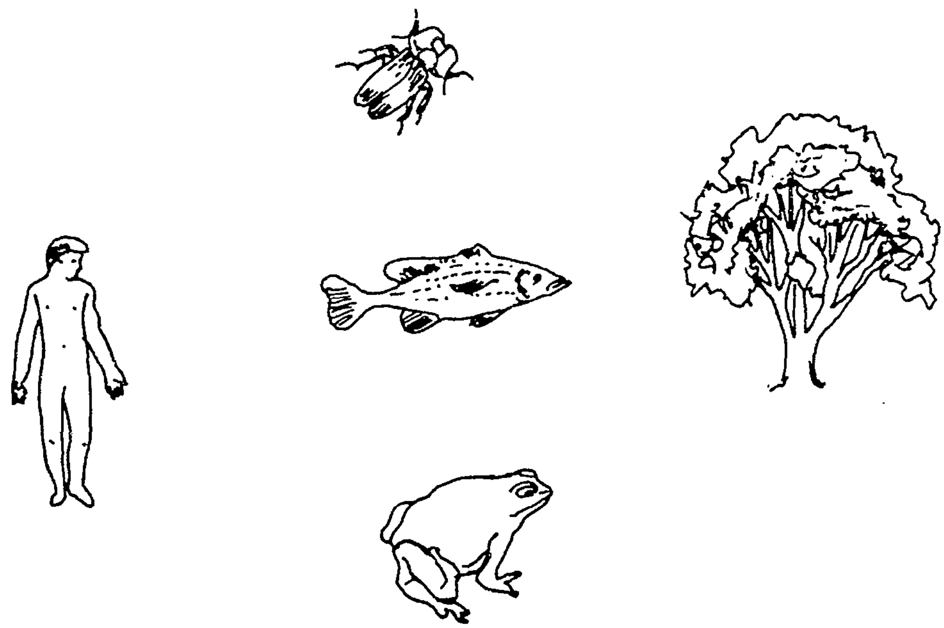

Figure 1

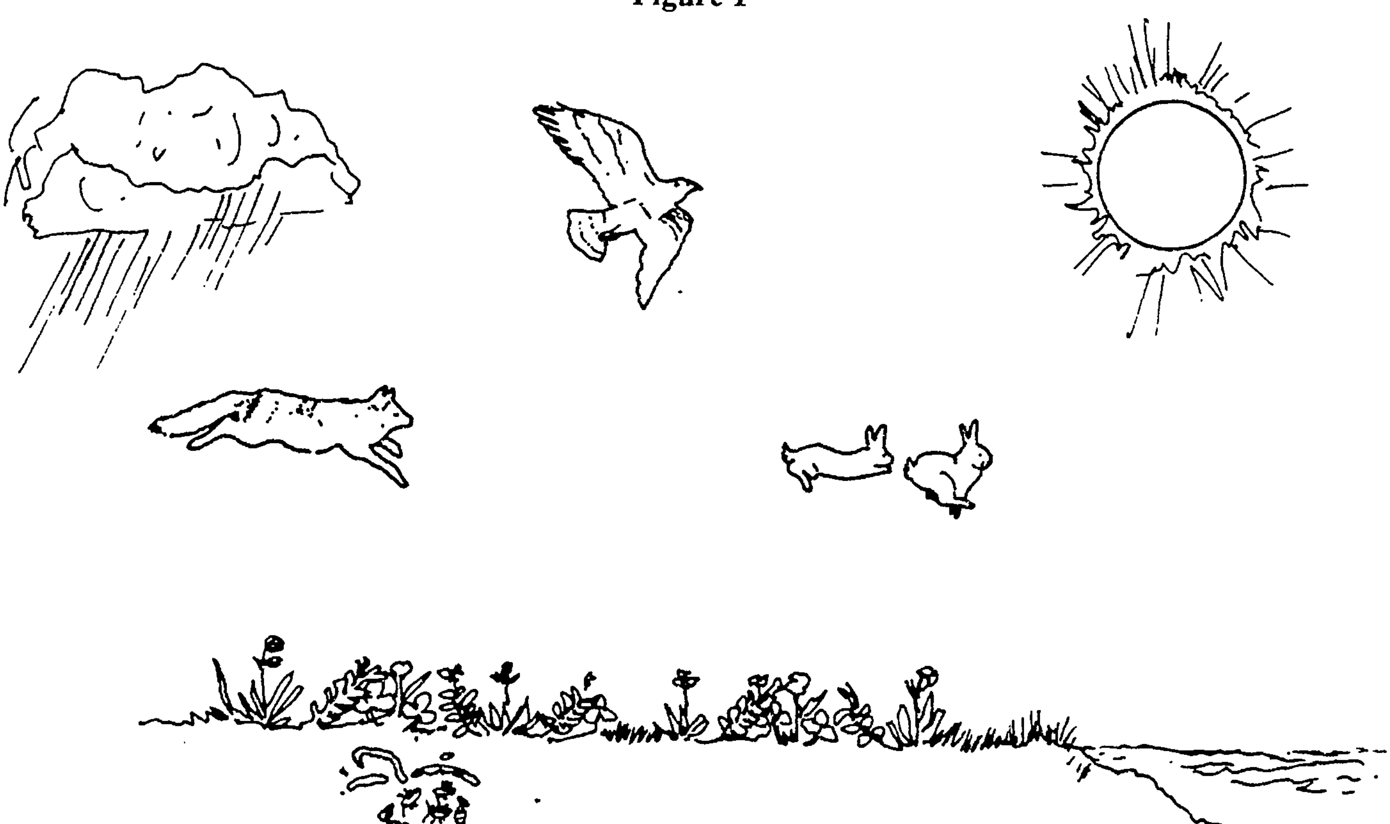

Figure 2

STUDENT WORKSHEET #2

Effect of a Deficiency and an Excessive Amount of Carbon Dioxide on Plant Growth

Purpose:

To show the effects of a lack of and an excessive amount of CO_2 on plant growth.

Materials:

1. Caustic soda or sodium hydroxide (this is the same compound commonly used to remove grease from drain pipes)
2. Two 1-gallon jugs
3. One small pill bottle or test tube
4. Small radish seedlings and soil
5. Cork or stopper
6. String

Procedures:

1. Secure two 1-gallon jugs.
2. Place soil and radish or squash seeds in jug. Insert a cork or stopper.
3. Water as often as needed by the use of a pipette or water dropper.
4. Allow the seeds to grow for a couple of weeks.
5. Remove the cork and transfer the caustic soda or sodium hydroxide very carefully to a small pill bottle or test tube.
6. Suspend the pill bottle or test tube with the caustic soda or sodium hydroxide inside a glass jug containing small seedlings. This will absorb CO_2 and thus decrease the level of CO_2 in the jug (See Figure 1).
7. With the apparatus shown in Figure 2, blow your breath several times into a jug containing small radish seedlings. Repeat this every day for a week or two. NOTE: This should keep the concentration above normal.
8. Observe the difference in the growth of the plants.

Questions:

1. Why was the caustic soda, which was enclosed in the pill bottle or test tube, suspended inside the glass jug?

2. Is the rate of growth of the seedlings affected by a deficiency of CO_2?

3. Is the rate of growth of the seedlings affected by an excessive amount of CO_2?

4. Why is it recommended in this experiment that you blow several times in the jug for an excessive amount of CO_2? What is another means of securing additional CO_2?

5. Why is carbon dioxide important to plant growth?

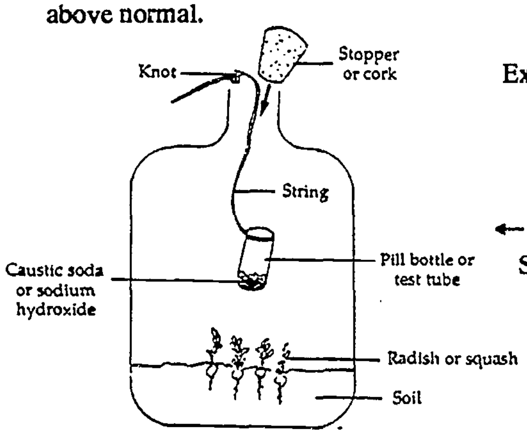

Figure 1

Exhale CO_2 here →

← Caustic Soda or Sodium Hydroxide

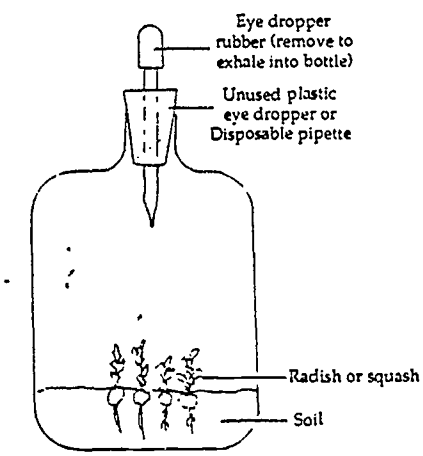

Figure 2

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STUDENT WORKSHEET #3

Detergents and the Growth of Algae

Objectives:

1. To demonstrate the effect of commonly used washing detergent on the growth of algae in fresh water.

2. To interpret the data from the lab and relate that data to man's effect on the ecosystem.

Materials:

1. 2 grams of detergent (phosphate free)
2. 2 one-gallon wide-mouth jars
3. Culture of fresh water algae
4. 1 balance
5. 4 liters of tap water (aged 24 hours)
6. 1 light source, such as a table lamp
7. 1 graduated cylinder

Procedure:

1. Add 2 liters of aged water to a gallon jar, and dissolve 2 grams of detergent in the water.

2. Add 20 ml of green algae culture to this jar. Label the jar "Experimental."

3. Without adding the detergent, repeat procedures 1 and 2 with another jar. Label this jar "Control."

Show your teacher that you have successfully completed these first three steps.

4. Cover the jar tops and allow them to stand, side by side, about one-half meter from a 100 watt lamp.

5. Observe the jars twice a week for two or more weeks.

6. Describe in writing the color and appearance of the contents of each jar, each week. Keep a record of your observations.

Discussion:

1. What are the differences, if any, between the experimental and the control jars?

2. What purpose did the light source serve in this experiment?

3. Which solution best compares to a polluted body of water?

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STUDENT WORKSHEET #4

Questions for Discussion

1. Place an "N" in the space if the item is a nonrenewable resource, and an "R" if it is a renewable resource.

   ________ Coal ______ Oil

   ________ Natural Gas ______ Soil

   ________ Wildlife ______ Forests

2. Name three agricultural sources of pollution:

   a.

   b.

   c.

3. Choose one of the three sources of pollution identified in question #2 and explain how it could be controlled.

4. What is acid rain? What causes it? Where is it a big problem?

5. What are the short-term benefits of conventional tillage as opposed to the long-term benefits of conservation tillage?

STUDENT WORKSHEET #2

Determining the Ethics of Chemical Pesticide Use

Consider yourself in the role of the producer, or farmer. As do virtually all farmers, you utilize chemical pesticides in your crop production system. Research and development is gradually making available alternative methods of pest management, though the alternatives have still not been shown to be as effective as the chemical controls. You are also aware of the potential effects of chemical pesticides on the environment. The question is, will you be willing to alter your tried and true method of pest control?

Use the following value assessment criteria to help make your decision. Respond to each question on a separate sheet of paper. Write a summary paragraph in which you explain your final course of action:

1. Reciprocity — Consider other points of view. How would the consumers of agricultural products, the general public, or future generations view this choice? How important are these points of view?

2. Consistency — How do you view the overall issue of environmental protection? How important do you feel your contribution is, related to that of industry, for example?

3. Coherence — How will your decision, and like decisions by farmers in general, affect the agricultural industry as a whole, or the general quality of life?

4. Comprehensiveness — Virtually all farmers now use chemical pesticides. What would be the result if all adopted an alternative plan of pest control?

5. Adequacy — Would the adoption of an alternative method of pest control adequately control the pests in order to achieve the desired yields? Would the continued use of the chemicals be tolerable to the environment?

6. Duration — What will the long-term effect of chemical pesticide usage be? Are the alternative methods (biological controls, for example) any safer?

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Understanding the Relationship between Agriculture and the Environment
3. Understanding the World Food and Fiber Chain
4. Recognizing the Role of Research and Development in Agriculture
5. Recognizing the Impact of Technology on Agriculture: Biotechnology
6. Recognizing the Impact of Technology in Agriculture: Electronics
7. Animal Science Unit (Agricultural Business and Management Cluster)
8. Plant and Soil Science Unit (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agriculture Business and Management Cluster

Duty A: Formulating Livestock Feeding Programs

1. Balance rations
2. Compute feed cost per pound of grain

Duty B: Performing Sales Duties

1. Developing basis chart for various commodities

Duty F: Financing the Agribusiness

1. Calculate net worth of machinery
2. Calculate net worth of animals
3. Calculate net worth of land
4. Calculate operating expenses
5. Prepare cash flow projections
6. Prepare financial statements
7. Interpret financial statements
8. Prepare budget

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Duty H: Managing the Business

1. Select computer software for records and reports
2. Select computer software for livestock management decisions
3. Select computer software for crop management decisions
4. Select computer software for machinery management decisions
5. Utilize a computerized network on agricultural marketing and management

Duty J: Applying Fertilizers and Chemicals

1. Calculate application rates
2. Formulate fertilizer

Duty P: Scouting Fields for Weed, Disease, Insect, or Other Damage

1. Make recommendations for fungus control
2. Make recommendations for insect control
3. Make recommendations for weed control
4. Make recommendations for disease control

Duty R: Applying Safety Practices

1. Comply with shop and equipment safety rules
2. Participate in safety training program

Horticulture Cluster

Duty D: Applying Fertilizer and Chemicals

1. Calculate fertilizer and chemical applications
2. Formulate fertilizer
3. Calibrate fertilizer application equipment

Duty N: Performing Sales Duties

1. Conduct sales meetings
2. Suggest procedures for fungus control
3. Suggest procedures for insect control
4. Suggest procedures for weed control
5. Suggest procedures for disease control

Agricultural Resources Cluster

Duty B: Applying Laws, Regulations and Policies

1. Interpret Environmental Protection Agency (EPA) regulations

Duty C: Performing Promotional Activities

1. Implement environmental education programs

Duty H: Applying Safety Practices

1. Comply with Occupational Safety and Health Administration (OSHA) safety standards

LEVEL: Orientation

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in the Language Arts, Social Sciences and the Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ___ of ___

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications of technological development.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Relate farming practices to soil conservation.					
*2. Recognize the variety of Illinois' natural areas and relate them to economics and recreation.					
*3. Recognize that controversy exists concerning controls versus non-controls over the application of technology.					
116					117

ISBE 41-78 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
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Page ____ of ____

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
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☐ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to listen critically and analytically.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11), students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Evaluate the content of an oral message of an appropriate length.					
*2. Respond effectively and appropriately to oral messages.					
3. Recognize characteristics required for communications to and leadership within organizations.					
118					119

ISBE 41-78 (1/88)

ERIC Full Text Provided by ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze the types of information sources needed to make effective consumer decisions.					
*2. Compare the economic interdependence among agriculture, business, government, labor, and the consumer.					
*3. Know how to use the various levels of government.					
4. Identify agencies of the United States Department of Agriculture and describe their services.					
5. Identify agencies of the Illinois Department of Agriculture and describe their services.					
6. Identify governmental regulatory agencies that supervise agribusiness activities and required procedures for contacting them.					
7. Identify private sector retail information and consulting sources that provide information to agribusinesses. 120					
8. Identify private sector information and consulting services that provide information about agriculture and agribusinesses to the public.					121

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ____ DISTRICT ____ ESC ____
District Name
City

I. LEARNING AREA (*check one*)
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to write standard English in a grammatical, well organized and coherent manner for a variety of purposes.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (*circle one*) 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know and understand the purposes of public and personal writing.					
*2. Use the correct form of public or personal writing appropriate to the audience.					
3. Recognize characteristics required for communication to and leadership within organizations.					
122					123

ISBE 41-78 (1/86)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Identify agencies of the United States Department of Agriculture and describe their services.

2. Identify agencies of the Illinois Department of Agriculture and describe their services.

3. Identify governmental regulatory agencies that supervise agribusiness activities and required procedures for contacting them.

4. Identify private sector, retail information and consulting services that provide information to agribusinesses.

5. Identify private sector retail information, and consulting services that provide information about agriculture and agribusiness to the public.

6. Recognize characteristics required for communication to and leadership within organizations.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture

PROBLEMS AND QUESTIONS FOR STUDY

1. What services are provided by the ASCS?
2. What services are provided by SCS?
3. How do ASCS and SCS work together?
4. What financial services are available from FmHA?
5. What financial services are available from Farm Credit Services?
6. What services are available to agricultural businesses from the Forest Service and the Department of the Interior?
7. What services are available from the local office of the Cooperative Extension Service?
8. What are the speciality areas that relate to agricultural businesses in the Cooperative Extension Service?
9. What diagnostic services are available to agricultural businesses through the Illinois Department of Agriculture and the universities?
10. Where is the index of publications from the CES found?
11. What news services and periodicals are available in the local library system?
12. What management services are available to agricultural businesses in the county?
13. What computer services are available to agricultural businesses in the county?
14. What consulting services are provided by agricultural suppliers in the county?
15. What agencies regulate the sale and application of pesticides?
16. What requirements are necessary to apply the chemicals used in agricultural businesses in the county?
17. What agencies control the transportation of agricultural products in Illinois?
18. What are the requirements for hiring people to work in the agricultural businesses in the county?
19. What information is provided by the Crop Reporting Service?
20. What information can be used by agriculture from the Census Bureau?
21. What market information is available to agricultural businesses in the county?
22. What cooperatives provide consulting services or member services to agricultural businesses in the county?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have students contact the local offices of the USDA to find a reference of client services performed by the ASCS, SCS and FmHA.

2. Have students develop a plan for a funded project for agricultural business development through USDA agencies (BOAC projects may qualify for actual grants from these agencies).

3. Have students meet with the county extension advisor to find out what services are available locally and what services are provided through the state.

4. Tour a state diagnostic or university research laboratory.

5. Assign a research report on an agricultural business topic to include sources of information form newspapers, magazines, public domain information, and computer network information.

6. Have students develop a fertilizer plan for a field or lawn.

7. Tour a local agricultural equipment or services supplier.

8. Have students meet with a local chemical applicator or pest control scout and find out where the applicator or scout gets answers to questions on pest or disease problems.

9. Have students develop posters or bulletin boards on the regulations that govern the transportation of agricultural products.

10. Set up a small business operated by the students that would hire, pay, and dismiss hourly and wage-earning employees.

11. Have students develop a marketing plan for an agricultural client.

12. Have students draw a map of the production of an agricultural product in Illinois.

13. Have students develop a feed ration for a customer.

14. Have students develop a pesticide program for a customer.

15. Have students use Student Worksheet #6 to develop a letter requesting information about an agency or an organization.

16. Lead students in a discussion of leadership styles and use Student Worksheet #5 as a self-assessment.

17. Have students attend a local meeting of an organization to collect information.

18. Use problem area "*Understanding the Animal Production Industry*" as a resource for breed organizations.

19. Use Student Worksheet #7 for practical experience in the problems of oral communication. Lead the class in a discussion following the activity.

20. Lead students in a discussion of information sources available in the local community. Some examples are:

    • Businesses
    • Newspapers
    • Agri-Industry publications
    • General news magazines
    • Television
    • Cooperatives
    • Field days—agency and private business
    • Short courses—agency and private business
    • Local offices of Government Agencies
    • Have students cite other examples

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES (con't.)

21. Lead students in a discussion concerning who are the intended recipients (producer, consumer, general public, etc.) of the information from a particular source.

22. Contact agencies for reference materials, films, and speakers to use in class.

23. Contact the Illinois Department of Agriculture for a current copy of the Illinois Agricultural Legislative Breakfast-Directory of Sponsoring Organizations for current addresses of agricultural organizations.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture

REFERENCES

1. Information provided by individual organizations.

*2. *Directory of Services*. Illinois Department of Agriculture.

3. *Handbook of Illinois Government.* Secretary of State, 213 State House, Springfield, IL 62756. (217) 782-2201.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Federal Agencies Concerned with Agriculture

INFORMATION SHEET #2 — Agricultural Stabilization and Conservation Service

INFORMATION SHEET #3 — Farmers Home Administration

INFORMATION SHEET #4 — Federal Crop Insurance Corporation

INFORMATION SHEET #5 — Soil Conservation Service

INFORMATION SHEET #6 — Cooperative Extension Service

INFORMATION SHEET #7 — Farm Credit Services

INFORMATION SHEET #8 — Illinois Department of Agriculture

INFORMATION SHEET #9 — Miscellaneous Governmental Agencies

INFORMATION SHEET #10 — Illinois Associations and Organizations

INFORMATION SHEET #1

Federal Agencies Concerned with Agriculture

Table 1: Agricultural Subcommittees of the U.S. Congress.

Senate	House of Representatives
1. Soil and Water Conservation	1. Cotton, Rice and Sugar
2. Agricultural Credit and Rural Electrification	2. Livestock, Dairy and Poultry
3. Agricultural Production, Marketing and Stabilization	3. Wheat, Soybeans and Feed Grains
4. Agricultural Research and General Legislation	4. Tobacco and Peanuts
5. Rural Development Oversight and Investigation	5. Conservation, Credit and Rural Development
6. Foreign Agricultural Policy	6. Department Operations, Research and Foreign Agriculture
7. Forestry, Water Resources and Environment	7. Domestic Marketing, Consumer Relations and Nutrition
	8. Forests, Family Farms and Energy

Table 2: Agencies of the Executive Office of the President that Influence Agricultural Policy.

1. The Office of Management and Budget (OMB)	5. The Office of the Trade Representative (STR)
2. The Council of Economic Advisors (CEA)	6. The Office of Science and Technology Policy (OSTP)
3. The National Security Council (NSC)	7. The Council on Environmental Quality (CEQ)
4. The Central Intelligence Agency (CIA)	

Table 3: Agencies of the United States Department of Agriculture (USDA)

Commodity and International Programs

1. The Agricultural Conservation and Stabilization Service (ASCS)
2. The Foreign Agriculture Service (FAS)
3. The Organization for International Cooperation and Development (OICD)

Marketing Programs

1. The Agricultural Marketing Service (AMA)
2. The Animal and Plant Health Inspection Service (APHIS)
3. The Federal Grain Inspection Service (FGIS)
4. The Agricultural Cooperative Service (ACS)
5. The Food Safety Inspection Service (FSIS)

Resources and Environmental Programs

1. The Forest Service (FS)
2. The Soil Conservation Service (SCS)

Rural Development Programs

1. The Farmers Home Administration (FmHA)
2. The Rural Electrification Administration (REA)
3. The Federal Crop Insurance Corporation (FCIC)

Consumer Services

1. The Food and Nutrition Service (FNS)

Research and Education

1. The Agricultural Research Service (ARS)
2. The Cooperative State Research Service (CSRS)
3. The Extension Service (ES)

Economic Intelligence Programs

1. The Economic Research Service (ERS)
2. The Statistical Reporting Service (SRS)
3. The World Agricultural Outlook Board (WAOB)

INFORMATION SHEET #2

Agricultural Stabilization and Conservation Service

Program Title:

Agricultural Stabilization and Conservation Service (ASCS), Department of Agriculture

Purposes:

1. To improve and stabilize farm income.
2. To assist in bringing about a better balance between supply and demand of commodities.
3. To assist farmers in the orderly marketing of their crops.

Description:

The ASCS administers specified commodity and related land-use programs designed for voluntary production adjustment, resource protection, and price, market, and farm income stabilization. Price support loans are offered to producers. If market prices fail to rise above support prices, producers can pay off the loan through forfeiture of collateral. If market prices rise above support, producers can pay off their loan and market their commodity. Eligible commodities are feed grains, wheat, rice, rye, soybeans, honey, upland cotton, extra-long staple cotton, dairy products, peanuts, and tobacco. Landlords, owners, tenants, or sharecroppers who meet program requirements are eligible to apply for support.

In addition to commodity loans and purchases, ASCS offers other assistance such as emergency conservation programs for farmlands and water, storage facilities and equipment loans, agricultural conservation programs (ACP), grain reserve programs, and rural clean water programs.

Information Contacts:

ASCS is a federal agency in the United States Department of Agriculture. An Illinois state office is located in Springfield and county offices are located in each county of the state.

INFORMATION SHEET #3

Farmers Home Administration

Program Title:

Farmers Home Administration (FmHA), Department of Agriculture

Purpose:

To provide credit for farm and nonfarm enterprises for those rural Americans who are unable to obtain credit from other sources at reasonable rates and terms.

Description:

Examples of federal loans or grants offered by the Farmers Home Administration include emergency loans to farm operators, housing loans and grants to provide low-rent housing to domestic farm laborers, loans to operators of not larger than family farms, farm ownership loans, and resource conservation and development loans. The Catalog of Federal Domestic Assistance lists 13 other areas or programs which are eligible for assistance from the Farmers Home Administration. In order to obtain FmHA loans, borrowers must submit a farm and home plan acceptable to the FmHA and agree to operate under the supervision of FmHA.

Information Contacts:

The FmHA is a federal agency located in the United States Department of Agriculture. State FmHA offices are located in each state and county offices are located in most counties. Consult the local telephone directory or contact the state office for location of county offices.

INFORMATION SHEET #4

Federal Crop Insurance Corporation

Program Title:

Federal Crop Insurance Corporation (FCIC), Department of Agriculture

Purpose:

To improve economic stability of agriculture through a sound system of crop insurance by providing all-risk insurance for individual farmers to assure a basic income against droughts, freezes, insects, and other natural causes of disastrous crop losses.

Description:

Insurance is available on crops in 3,000 agricultural counties in 49 states. The following Illinois crops may be covered: Apples, beans, combined crops, corn, forage crops, oats, soybeans, sweetcorn, and wheat. To encourage participation, the Federal Crop Insurance Corporation will pay up to 30% of each producer's premium.

Information Contacts:

The FCIC is a federal agency located in the United States Department of Agriculture. Regional offices are located in 18 states. One of the regional offices is located at 320 W. Washington Street, Springfield, IL. Interested persons may also contact a local sales representative.

INFORMATION SHEET #5

Soil Conservation Service

Program Title:

Soil Conservation Service (SCS), Department of Agriculture

Purposes:

1. To develop and carry out a national soil and water conservation program in cooperation with landowners, operators, and other land users and developers; community planning agencies and regional resource groups; and federal, state, and local government agencies.

2. To assist in agricultural pollution control, environmental improvement, and rural community development.

Description:

The Soil Conservation Service operates 11 programs in the conservation area. Technical assistance is provided to individuals and groups in planning and applying soil and water conservation practices and treatment. Technical soil and water conservation resource information is furnished to units of government. Other activities include soil surveys, watershed protection and flood prevention, river basin surveys, and rural abandoned mine programs.

Information Contacts:

In addition to the headquarters office in Washington, D.C., state offices are located in all states. The SCS state office for Illinois is located in Champaign, IL.

INFORMATION SHEET #6

Cooperative Extension Service

Program Title:

Cooperative Extension Service (CES), Department of Agriculture

Purposes:

1. To help people and communities identify and solve their farm, home, and community problems through the practical application of research findings of USDA and the Land-Grant Colleges and Universities.

2. To provide educational programs based upon local needs in the broad fields of:

   a. Agricultural production and marketing.
   b. Rural development.
   c. Home economics.
   d. Youth development.

Description:

Funding is provided for land-grant institutions which, through state and county extension service personnel, provide educational and technical assistance to:

1. Farmers, producers, and marketing firms on how to apply new technical developments derived from agricultural research.

2. Community organizations to develop natural, economic, and human resources.

3. Homemakers and youth in the areas of food and nutrition, home management, family economics, child development, and parent education.

4. 4-H youth in the areas of leadership development and career guidance through work projects, demonstration projects, camping, and achievement programs.

Information Contacts:

The Cooperative Extension Service is administered at the federal level in the Department of Agriculture. At the state level, it is administered through the land-grant university (University of Illinois). At the county level, the extension office and personnel are usually located in the county seat. County extension offices have a supply of extension circulars and leaflets which can be obtained for instructional purposes.

Agricultural Engineering
Agricultural Engineering and Sciences Building
1304 West Pennsylvania Avenue
Urbana, IL 61801
(217) 333-3570

Loren Bode, Pesticide Application
John Siemens, Tillage
Robert Wolf, Pesticide Applicator Training

Agronomy
Turner Hall
1102 South Goodwin Avenue
Urbana, IL 61801
(217) 333-4424

Diane Anderson, Pesticide Applicator Training/Weed Science
Bill Curran, Integrated Pest Management/Weed Science
Don Graffis, Alfalfa Production
Bob Hoeft, Fertility
Ellery Knake, Weed Science
Marshall McGlamery, Weed Science
Emerson Nafziger, Crop Production and Physiology
Ted Peck, Soils
Gary Pepper, Soybean Production

ERIC

Agronomy (con't.)
David Pike, Pesticide Impact Assessment/Weed Science
Bill Simmons, Soil and Water Management

Entomology
172 Natural Resources Building
607 East Peabody Drive
Champaign, IL 61801
(217) 333-6650, 333-6651, 333-6652, or 333-6653

Don Kuhlman, Field Crop Insect and Pesticides
Mike Gray, Integrated Pest Mgt/Field Crop Insects
Phil Nixon, Pesticide Applicator Training/Household and Ornamental Insects
Roscoe Randall, Turf, Ornamental, Veg., and Fruit Insects
Kevin Steffey, Field Crop Insects and 4-H Entomology
Rick Weinzierl, Stored Grain and Livestock Insects

Eugene Killion, Honey Bees
502 East Jasper Street
Paris, IL 61944
(217) 465-4944

Horticulture
Plant Sciences Lab
1201 South Dorner Drive
Urbana, IL 61801
(217) 333-0350

Tom Fermanian, Turfgrass
John Gerber, Vegetable Crops
John Masuinas, Vegetable Crops
Dan Meador, Fruit Crops
Tom Voigt, Turfgrass
Dave Williams, Woody Ornamentals

Plant Pathology
Turner Hall
1102 South Goodwin Avenue
Urbana, IL 61801
(217) 333-8414 or 333-7515

Darin Eastburn, Vegetable Crop Diseases
Walker Kirby, Field Crop Diseases
Mal Shurtleff, Turf and Ornamental Diseases

Veterinary Medicine
3505 VMBSB
2001 South Lincoln
Urbana, IL 61801
(217) 333-2760 - L.G Biehl

Food Science
352D Agricultural Engineering Science
1304 West Pennsylvania
Urbana, IL 61801
(217) 333-0130 — L.D. Witter, Head

Forestry
110 Mumford Hall
1301 West Gregory
Urbana, IL 61801
(217) 333-2770 — M.F. Bolin

Agricultural Economics Department
305 Mumford Hall
1301 West Gregory
Urbana, IL 61801
(217) 333-1810

C.A. Bock, Agricultural Law
D.E. Erickson, Farm Management
T.L. Frey, Agricultural Finance
D.L. Good, Agricultural Prices/Outlook
H.D. Guither, Public Policy
M.A. Hudson, Agri-Business/Management and Marketing

Animal Sciences Department
328 Mumford Hall
1301 West Gregory
Urbana, IL 61801
(217) 333-1045

T.R. Carr, Meats
D.B. Faulkner, Beef
G.R. Hollis, Swine
M.F. Hutjens, Dairy
K.H. Kline, Horses
K.W. Koelkebeck, Poultry
G.E. Ricketts, Sheep
L.H. Thompson, Reproductive Physiology

Office of Agricultural Communications and Education
69 Mumford Hall
1301 West Gregory
Urbana, IL 61801
(217) 333-4782

G.L. Beaumont, Media
R.L. Courson, Production and Distribution
P.C. Hixson, Design
V.M. Malone, Extension Education

Human Resources and Family Studies
260 Bevier
905 South Goodwin
Urbana, IL 61801
(217) 333-3791

B.J. Cude, Family Economics
J.W. Pankau, Health Education
R.J. Weber, Nutrition
M.E. Mead, Clothing
S.L. Grogan, EFNEP

INFORMATION SHEET #7

Farm Credit Services
Part A

Program Title:

Real Estate loans, handled under the internal program retaining the services formerly offered by Land Bank

Purpose:

To provide families with financing tailored to meet their unique credit needs at the best possible terms and the lowest cost consistent with sound business practices.

Description:

The Federal Land Bank System was established in 1917. Originally funded by the federal government, the Land Bank System, which is comprised of 12 district Federal Land Banks and segmented into associations within each state, has repaid all government monies and is not part of the federal government. It is a cooperative, entirely owned and controlled by those who borrow from it.

The Land Bank offers long-term credit to finance the purchase of land, construction and repair of buildings, improvement of farm property, or the purchase or construction of rural homes. Owners of farm-related businesses may also be eligible for loans to finance business sites or structures.

Land Bank loans are made for terms ranging from 5 to 40 years. The Land Bank obtains the money it loans through the sale of securities to investors in the nation's money market. Each farm loan requires a stock purchase in the association equal to 2% of the loan or $1,000, whichever is the lesser amount. This stock purchase provides membership in the association and voting rights in the election of the association's directors.

Other services offered include mortgage, life, and crop insurance.

Information Contacts:

The St. Louis Farm Credit District serves Arkansas, Illinois, and Missouri. Illinois is divided into 4 service areas. Central offices for these service centers are located in the following towns;

1. Bloomington, Illinois
2. Champaign, Illinois
3. Kaneville, Illinois
4. Mt. Vernon, Illinois

In addition branch offices and outlying offices are located in many counties which do not have a central office.

NOTE: Information has been furnished by the Champaign Office of Farm Credit Services.

INFORMATION SHEET #7

Farm Credit Services
Part B

Program Title:

Production loans, handled under the internal program, retaining services formerly offered by Production Credit Association

Purpose:

To provide short and intermediate-term credit for qualified farmers along with numerous related services.

Description:

Production Credit Associations were created by Congress in 1933. They are cooperative organizations designed to provide short-term or intermediate-term credit for qualified farmers. Farmers who borrow must purchase stock in the amount of 2% of the loan or $1,000, whichever is the lesser amount. Stockholders are entitled to vote on election of service center directors and other stockholder issues. Loan money is obtained from the Federal Intermediate Credit Bank through the sale of farmers' notes. The Federal Intermediate Credit Bank acts as a wholesaler of credit, using farmers' notes as collateral for debentures which are sold to investors in the money markets throughout the country. This enables farmers to obtain credit on reasonable terms. The service centers also provide ready cash (drafts) programs and insurance for credit life, crop, hail, and multi-peril.

Information Contacts:

Farm Credit Systems has both central and branch offices in Illinois in the following towns:

1. Bloomington, Illinois
2. Champaign, Illinois
3. Kaneville, Illinois
4. Mt. Vernon, Illinois

In addition, branch FCS offices are located in most, but not all, counties. Local telephone directories can be used to identify these branch offices.

INFORMATION SHEET #8

Illinois Department of Agriculture

The Illinois Department of Agriculture was established in 1855. Its responsibilities, functions, and services are in the areas of marketing, transportation, food quality, animal health, research, industry regulation, soil and water conservation, farm energy development, and information/education. The Department headquarters are located at the Illinois State Fairgrounds, P.O. Box 19281, Springfield, Illinois 62794. (217) 782-2172.

The Department is organized with the following divisions:

1. Division of Administrative Services
2. Division of Marketing
3. Division of Plant Industry and Consumer Services
4. Division of Natural Resources
5. Division of Animal Industry
6. Division of Fairs and Horse Racing

Services, responsibilities, and functions of the last five divisions listed above are outlined in this Information Sheet and taken from the *"Directory of Services"* printed by the Illinois Department of Agriculture.

Division of Marketing:

1. Bureau of Agricultural Statistics
   a. Responsible for the Agricultural Statistics Act, the Dairy Statistics Act, and U.S. laws relating to crop reporting and agricultural statistics.
   b. Provides services including disseminating information on crops, livestock, prices, and related agricultural items.

2. Bureau of Market Development and Information
   a. Responsible for, through its Market News Section, gathering and dissemination of grain and livestock market prices.
   b. Provides, through its Market Services Section, assistance in the areas of direct marketing, promotion, and research; also works with commodity and farm groups.
   c. Assists, through its International Trade Section, Illinois firms in developing international markets for Illinois agricultural products.
   d. Provides, through its Alternate Fuels Section, dissemination of information, assistance in development of research, and promotion of the development of alcohol and other alternate fuels.

Division of Plant Industry and Consumer Services:

1. Bureau of Warehouses
   a. Responsible for the Public Grain and Warehouse and Warehouse Stores for Food Act; Alcoholic Liquors, Drug and Cosmetics Act; Personal Property Warehouse Act; Agricultural Cooperative Act; and the Grain Dealer's Act
   b. Provides services including grain dealers' licensing, grain warehouse licensing, personal property warehouse licensing, and grain dealers and grain warehouses examination.

2. Bureau of Plant and Apiary Protection
   a. Responsible for Insect Pest and Plant Disease Act; Bees and Apiaries Act; Noxious Weed Law; Economic Poison Act, and Acts dealing with pesticide use and user licensing.
   b. Provides services including the registration and inspection of apiaries, certification and inspection of all nurseries and greenhouses, registration of nursery stock dealers, licensing of pesticide users, inspection and certification of plant material destined for markets outside of Illinois, response to pesticide incidents and complaints, and coordination of state responsibilities relative to Federal Insecticide, Fungicide and Rodenticide Act (FiFRA).

3. Bureau of Products Inspection and Standards
   a. Responsible for the Weights and Measures Act; Fair Package and Labeling Act; Commercial Feed Law; Commercial Fertilizer Act; Seed Law; Egg and Egg Products Act; and Rules and Regulations relating to the Storage and Handling of Anhydrous Ammonia.
   b. Provides services including testing all meters that dispense petroleum products, issuing seed permits, and granting egg licenses.

4. Bureau of Laboratories
   a. Provides analytical services in the administration of Weights and Measures Act; Commercial Feed Law; Commercial Fertilizer Act; State Economic Poison Law; and the Seed Law.

b. Provides chemical analysis of feeds, fertilizers, and some pesticides.
c. Performs seed purity and germination analysis.
d. Responsible for calibration of weights and measures.

Division of Animal Industry:

1. Bureau of Animal Health

a. Responsible for programs aimed at control or eradication of swine and bovine brucellosis, bovine tuberculosis, cattle scabies, scrapie in sheep, pseudorabies, equine viral encephalitides, various poultry diseases, etc.
b. Administers these Acts: Livestock Dealer and Feeder Swine Dealer Licensing, Diseased Animals, Bull Leasing, Livestock Auction Market, Bovine Tuberculosis Eradication, Swine Disease Control and Eradication, Bovine and Swine Brucellosis Eradication, Hatcheries, Poultry Flocks, Milk and Cream Testers, and Slaughter Livestock Buyers.
c. Provides services including registration of slaughter livestock buyers; licensing of bull lessors, feeder swine dealers, livestock dealers, and livestock auction markets; swine herd validation as brucellosis-free and qualification as pseudorabies negative; certification to bovine and goat herds as brucellosis-free; accreditation of various herds as tuberculosis-free; and technical advice on animal health problems.

2. Bureau of Animal Welfare

a. Administers these Acts: Animal Welfare, Humane Care for Animals, Dead Animal Disposal, Loading Platforms for Collection of Dead Animals, Law Relative to Slaughter and Use of Horse Meat, Brand Act, Domestic Animals Running at Large, Act to Prohibit the Keeping of Certain Animals and Reptiles, Refrigerated Warehouses, and Act to Prohibit the Feeding of Garbage to Swine, other Animals or Poultry.
b. Provides services including general supervision of the administration of the Animal Control Act and county animal programs; licensing of pet shop operators, dog dealers, kennel operators, cattery operators, pounds, animal shelters, and inedible rendering plants; supervision of the slaughtering of horses and sale or use of horse meat; issuance of permits for trucks which transport dead animals and/or inedible products, and permits to remove inedible meat products; and offering technical advice.

3. Bureau of Diagnostic Laboratories

a. Responsible for laboratory services in support of animal health and welfare, and meat and poultry inspection programs.
b. Serves to assist the animal owner, via his or her veterinarian, with disease diagnosis.
c. Monitors incidence of animal diseases.

4. Bureau of Meat and Poultry Inspection

a. Administers the Meat and Poultry Inspection Act and the Humane Slaughter of Livestock Act.
b. Provides services including inspection of meat and poultry slaughtered and/or processed in Illinois and sold to restaurants, hotels, retailers, and consumers; development of standards for new products; and laboratory analysis of meat and/or poultry products from licensed establishments.

Division of Natural Resources:

1. Bureau of Farmland Protection

a. Maintains responsibility for working with state agencies in implementing the Governor's Executive Order on Farmland Protection.
b. Provides technical assistance to local units of government in developing programs for farmland protection.
c. Reviews state development projects for compliance with the Governor's Executive Order on Farmland Protection.
d. Conducts a public information program on the importance of and the need for farmland protection.

2. Bureau of Mine Reclamation and Water Resources

a. Works with the U.S. Army Corps of Engineers and various state and federal agencies in developing and implementing effective land treatment programs to protect existing water resources.
b. Works with the Illinois Department of Mines and Minerals in developing the State's surface mine reclamation program.
c. Assists the IDMM in reviewing permit applications, permits, and mining operations to ensure that mined farmland is returned to its pre-mined level of productivity and to

minimize the impacts of mining on agricultural resources.

d. Develops revegetation standards and methodologies for assessing levels of productivity.

3. Bureau of Soil Conservation

a. Coordinates a State erosion and sediment control program.
b. Assists private and public organizations and agencies in the development of soil erosion and water quality programs.
c. Represents the State in all matters arising from the provisions of the Soil and Water Conservation Districts Act.
d. Assists the Soil and Water Conservation District Directors in carrying out their duties and programs.
e. Establishes rules and procedures for district referendums, hearings, and supervision of district director elections.
f. Evaluates Soil and Water Conservation District budget proposals and special project proposals.
g. Provides training sessions, information, and exchange of ideas between districts.

Division of Fairs and Horse Racing:

1. Illinois State Fair

a. Schedules and coordinates non-fair activities on the fairgrounds.
b. Schedules all space rental activity for fair and non-fair events.
c. Supervises all horse related activities on fairgrounds.
d. Responsible for all competitive events activity for the Illinois State Fair, including livestock, arts, crafts, produce, etc.
e. Responsible for premium payment and budgetary information related to all competitive events.
f. Responsible for all entertainment functions at the Illinois State Fair, including grandstand, free stages, and special events.
g. Responsible for supervising all publicity and promotion for the Illinois State Fair.
h. Responsible for all administrative rules pertaining to all fair and non-fair activity at the fairgrounds.
i. Responsible for preparing and supervising all contractual activity relating to the fair.

2. Bureau of County Fairs

a. Responsible for rules, regulations, and procedures governing state financial assistance to agricultural and industrial fairs.
b. Provides services including financial assistance to County Fairs, 4-H Clubs, Exposition Authorities, Mid-Continent Livestock Exposition, and Vocational Agricultural Section Fairs.

3. Bureau of Horse Racing

a. Responsible for administration of the Horse Racing Act, qualifying stallions for Illinois breeding, registering foals, and establishing conditions and minimum purses for State Fair Colt Stake races.
b. Provides services including breeders awards, state fair races, pari-mutual races, and county fair races for standardbreds; and breeder awards, purse supplements, stallion owner awards, stake races, and "race-a-day" for thoroughbreds.

INFORMATION SHEET #9

Miscellaneous Governmental Agencies

1. **Animal Damage Control**

   Ron Ogden, State Director
   USDA — APHIS
   Room 104, 600 East Monroe Street
   Springfield, IL 62701
   (217) 492-4308

2. **Emergency Services and Disaster Agency**

   Oran Robinson, Hazardous Materials Officer
   110 East Adams Street
   Springfield, IL 62706
   (217) 782-7860

   Emergency Reporting
   (800) 782-7860 (toll free within Illinois)

3. **Environmental Protection Agency, Illinois**

   A. G. Taylor, Agricultural Adviser
   2200 Churchill Road
   Springfield, IL 62706
   (217) 782-3960

   Emergency Response
   (217) 782-3637

4. **Hazardous Waste Research and Information Center**

   David L. Thomas, Director
   1808 Woodfield Drive
   Savoy, IL 61874
   (217) 333-8940

5. **Illinois Department of Labor**

   310 S. Michigan Avenue, 10th Floor
   Chicago, IL 60604
   (312) 793-2804

   1 West Old State Capitol Plaza, Room 300
   Springfield, IL 62701
   (217) 782-6206

   2209 W. Main Street
   Marion, IL 62959
   (618) 997-4371
   (800) 654-4620

6. **U. S. Department of Labor, Wage and Hour Division**

   Henry Rodriguez
   524 S. Second Street
   Springfield, IL 62701
   (217) 492-4060

7. **Illinois Department of Public Health**

   Harvey Dominick, Chief
   Section of Pesticides and Vector Control
   Division of Environmental Health
   Office of Health Protection
   525 West Jefferson Street
   Springfield, IL 62761
   (217) 782-5830

8. **University of Illinois Agricultural Research and Demonstration Centers**

   Brownstown:
   John Sawyer, Superintendent
   Route 2, Box 32A
   Brownstown, IL 62418
   (618) 427-5239

   Dixon Springs:
   Stephen Ebelhar, Superintendent
   Agronomy Division
   Route 1
   Simpson, IL 62985
   (618) 695-2790

   Illinois River Valley Sand Field:
   Standley Sipp, Superintendent
   Box 283
   Kilbourne, IL 62655
   (309) 538-4342

   Northern:
   Lyle Paul, Superintendent
   Route 1
   Shabbona, IL 60550
   (815) 824-2029

   Northwestern:
   Mike Mainz
   Route 3, Box 111
   Monmouth, IL 61462
   (309) 734-7459

Orr:
Glenn Raines, Superintendent
Box 212
Perry, IL 62362
(217) 236-4911

9. **Department of Conservation Division of Forest Resources and Natural Heritage**

605 Stratton Office Building
Springfield, IL 62706

U. S. Forest Service
South Building
12th and Independence Avenue, SW
P.O. Box 2417
Washington, D. C. 20013

U. S. Forest Service
Eastern Region
633 West Wisconsin Avenue
Milwaukee, WI 53203

INFORMATION SHEET #10

Illinois Associations and Organizations

Association of Illinois Soil and Water Conservation Districts
John Olson
3085 Stevenson Drive, Suite 305A
Springfield, IL 62703
(217) 529-7788

The Association of Illinois Soil and Water Conservation Districts is the representative voice of the ninety-eight (98) Soil and Water Conservation Districts in the state. The Association is responsible for advancing the conservation and orderly development, management, improvement, and multiple use of natural resources of the State of Illinois through the districts.

The Association services the Soil and Water Conservation Districts and the people of Illinois through a continuous dedication to the preservation and conservation of our soil and water resources. The Association of Illinois Soil and Water Conservation Districts services include education and information, public relations, and legislation.

State Office
3085 Stevenson Drive
3rd Floor
Springfield, IL 62703

Illinois Farm Bureau
1701 Towanda Avenue
Bloomington, IL 61701
(309) 557-3251

Farm Bureau in Illinois is a general farm organization which serves the agricultural community of the state. Financed by voluntary dues from its more than 295,000 member families, Farm Bureau works to improve farm income and farming as a way of life.

Farm Bureau serves its members through a wide range of marketing, legislation, education, public relations, and business services.

Basic to the strength of Farm Bureau in Illinois is an organizational network of County Farm Bureaus with staff, officers, and local programs serving members throughout the state.

Bill Allen
Executive Director of Information

Illinois Leadership Council for Agricultural Education in Conjunction with Illinois Committee on Ag Education

The Illinois Leadership Council for Agricultural Education is a statewide organization representing all segments of the agricultural industry and is mandated by its membership to provide statewide leadership to improve education in agriculture.

The objectives of the council are:

1. To serve as an advocate for agricultural educators at the local and state levels.

2. To involve the total agricultural industry in the assessment of vocational agriculture education and in developing quality instructional programs and processes to meet current and future needs.

3. To provide a forum to identify and address state issues and concerns relative to all aspects of agricultural education.

4. To facilitate planning for the future of agricultural education on a statewide basis.

5. To establish a state structure to search out resources necessary for expanding and strengthening agricultural education.

The Illinois Committee on Ag Education was appointed by Governor Thompson in April 1987. It is comprised of thirteen agricultural leaders charged with developing and overseeing the implementation of the plan for improving agricultural education in Illinois.

1989 Leadership Council Officers

ILCAE Chairperson
Dr. Barbera Valerions, Principal
Chicago High School of Sciences
Chicago, IL
(312) 881-5000

Past Chairman and ICAE Member
J. Gordan Bidner
Funks Seeds International
Route 51 South
Bloomington, IL 61701
(309) 829-7623

ICAE Chairman
Harold Reetz
R.R. 2, Box 13
Monticello, IL 61462
(217) 762-2074

Illinois Farm Union

The principal purpose of the Farmers Union is to see that rural people and farmers in particular get effective legislation.

The Illinois Farm Union is proud that it is the only general farm organization that takes the time to sponsor work programs for the underprivileged, such as Illinois Green Thumb Inc., in rural areas throughout counties in Illinois.

Harold Dodd, President
R. R. #1
Loami, IL 62661
(217) 624-3781

Illinois Hay Association

The Illinois Hay Association is a newly organized group of interested and concerned hay producers and dealers who are dedicated to improving and advancing nay production in Illinois.

The Association works very closely with the Agricultural Stabilization and Conservation Service, the Illinois Extension Service, the Illinois Department of Agriculture, the State Universities, as well as with other states in efforts not only to promote Illinois hay, but also to use hay and components of hay in crop rotations to help conserve irreplaceable topsoils in our state. Furthermore, the current net return from hay and forage crops has proven that hay production in Illinois is indeed very competitive with other major crops in the state.

Tass County Extension Advisor
Robert Walker
(217) 452-7255

Washington County Extension Advisor
Ruth Hamilton
(618) 327-8881

Illinois Leaders in Agriculture

Objectives: The purposes of this particular organization are:

1. To provide educational programs, designed to meet the specific needs of men and women who are engaged in agricultural employment.
2. To provide a structure for coordinating activities within the state.
3. To provide leadership training through educational programs and opportunities to exhibit competent and aggressive leadership skills in a variety of settings.
4. To provide agriculturists and their families an opportunity to participate in civic and community service work designed to improve rural and urban life in their community, state, and nation.
5. To provide a basis for solid decision making (personal and/or business).
6. To strengthen the confidence of members in themselves and their work.
7. To cooperate with other organizations and agricultural agencies in programs benefiting agriculture.
8. To provide organized social and recreational activities.
9. To provide a means for continuing education to assist members.
10. To serve as a support group for local and/or regional vocational agriculture teachers and their programs at the secondary and/or post secondary levels.

Don Smith
R. R. #1, Box 43
San Jose, IL 62682

Illinois FFA Alumni Association

The purpose of the state association is to serve as a communication link between local affiliates, to direct activities on the state level in support of FFA and vocational agriculture, to provide services to assist in the establishment and development of local affiliates, and to represent Illinois in matters of national interest.

The state association provides materials for the establishment and continued development of local Chapters including handbooks, membership kits, brochures, and slide tape orientation programs.

Richard Sanders
109 East John
Forrest, IL 61714
(815) 657-8815

American Agriculture of Illinois
Tom Curl
R.R. #4
Clinton, IL 61727
(217) 935-3771

American Agriculture of Illinois' policy has been from the beginning, and will continue to be in the future:

1. 100% parity for all agriculture products.
2. All food reserves at 100% parity.
3. Farmer board to make agriculture policy.
4. Imports would not enter the country below 100% parity.
5. Long range plan for agriculture.

Associated Milk Producers, Inc.

A complete dairy farmer cooperative, AMPI is organized, owned, operated and controlled by dairy farmers. Representing some 1,500 Illinois dairy farms, AMPI provides marketing and bargaining for its members along with numerous membership services, including the operation of plants, and surplus and standby handling of milk.

Formed in 1969 through the merger of more than 100 small predecessor cooperatives, AMPI now includes nearly 30,000 members in 20 states from northern Minnesota and Wisconsin to southern Texas and from western Ohio to New Mexico and Colorado. By working together, dairy farmers are able to provide volumes of milk at the times and places needed by milk handlers. It is the belief of AMPI members that dairy farms families should be given full opportunity to earn and receive a parity income with Americans in other walks of life.

Kenneth McPeek
13516 E. Willow Road
Stockton, IL 61085
(815) 947-2197

Illinois Association of Meat Packers

The purpose of the Association is to advance and improve the meat processing industry by encouraging and fostering high ethical standards of good business practices in the industry, and to facilitate the cooperation of all engaged in the industry by the interchange of ideas and business methods as a means of increasing efficiency and the usefulness of the industry to the consuming public.

Jeri Nieman
1177 N. Springfield Road
Freeport, IL 61032
(815) 232-1006

Illinois Beef Industry Council
and Illinois Beef Auxiliary

The Illinois Beef Industry Council (IBIC) and Illinois Beef Auxiliary (IBA) are nonprofit corporations dedicated to beef promotion, animal research, consumer education, and general development of the beef cattle industry in Illinois.

"Self-help" programs, such as those conducted by the Illinois Beef Industry Council, provide beef industry people with the opportunity to meet competition most effectively and to preserve and improve their products and their position in both economic and world markets.

Purposes and objectives of the IBIC and IBA are: to collect and receive monies from public and private sales of beef cattle through a "check-off" program; to provide organizations through which the beef industry can become an influence in the areas of product promotion, animal research, and consumer education; and to promote the development and expansion of the beef industry in Illinois.

Tim O'Conner, Executive Vice-President
993 Clocktower Drive
Springfield, IL 62704
(217) 793-3535

Illinois Apple and Peach Marketing Board
Ronald H. Meyer
R.R. #1, Box 26
Sidney, IL 61877
(217) 688-2590

ERIC

Illinois Corn Growers Association
P.O. Box 1623
Bloomington, IL 61701
(309) 557-3257

Illinois Corn Growers Association (ICGA) is a commodity organization serving corn producers in Illinois. ICGA is organized to promote and develop new and expanded markets for corn and corn products, and to sponsor research on corn production, utilization, and marketing, thus enhancing the livelihood of the Illinois corn producer. Financing comes from voluntary dues paid by members each year and a $0.025 per bushel check-off.

Scott Bidner, Executive Director

Illinois Draft Horse and Mule Association

The goal of this association is to promote and improve the breeding, growing, and fitting of the draft horse and mule in Illinois; and to meet in social gatherings to discuss experiences for the benefit of young breeders interested in the draft horse and mule.

Jack Hale, President
R.R. #2
Lovington, IL 61837

Land of Lincoln Soybean Association
2422 E. Washington
Bloomington, IL 61704-4490
(309) 557-3255

Land of Lincoln Soybean Association was organized in 1964 and is controlled by a 19-person Board of Directors made up of farmers around the state of Illinois. It is a membership organization primarily interested in developing foreign markets for soybeans and soybean products, providing funds for soybean production and utilization research, and supporting legislative activities pertaining to soybeans and soybean products which are favorable to soybean farmers.

Land of Lincoln Soybean Association is one of 24 state associations affiliated with the American Soybean Association which are actively involved in conducting a worldwide market development program for soybeans and soybean products and expanding soybean research using the funds from a $0.01 per bushel check-off.

William Tiberend, Manager

National Farmers Organization

For all agricultural producers, the organization desires only to receive the cost of production plus a reasonable profit, through collective bargaining.

Kenneth Stremlau
Illinois NFO
R.R. #2
Mendota, IL 61342
(815) 539-7573

Illinois Egg Market Development Council
c/o K.W. Koelkebeck
326 Mumford Hall
1301 W. Gregory Drive
Urbana, IL 61801
(217) 244-0195

The Illinois Egg Development Council is the first Illinois commodity check-off program to be authorized by an act of the legislature. Through this act and a product referendum, it was decided to assess all commercial producers with flocks of three thousand or more birds at a rate of one-sixth cent per dozen. The proceeds of this assessment are used to promote marketability and consumer acceptance of all eggs and egg products.

This is done on a state, regional, and national basis whereby the council may develop appropriate programming or support the marketing efforts of regional and national organizations established for this purpose. Placing of funds to obtain scientific research and consumer studies is also an activity of the council.

The governing council consists of nine elected producer representatives from three districts within the state. It has the benefit of advisory councilmen from the University of Illinois, the Department of Agriculture, and the Illinois Agricultural Association.

Illinois Exhibition Poultry, Bantam and Waterfowl Association

The Illinois Exhibition Poultry, Bantam and Waterfowl Association is a nonprofit organization dedicated to the preservation of the Exhibition Poultry System in Illinois and the breeds it represents. The Association serves as spokesman on all affairs pertaining to the exhibition poultry breeder of Illinois and is affiliated with the American Poultry Association, the nation's oldest livestock organization.

It is the organizer of the highly successful Champion Meat Trio Class at the Illinois State Fair and the sponsor of the Land of Lincoln Gathering Poultry Show.

The Illinois Poultry Association believes that the purebred is the cornerstone of our poultry culture.

Marion R. Nash
P.O. Box 102
Murphysboro, IL 62966
(618) 684-3811

Illinois Pork Producers Association

The Illinois Pork Producers Association represents over 10,000 members statewide. It has county organizations in over 90 counties in Illinois. Through this grass roots network, it can effectively communicate with its members throughout the state.

Through the introduction of new campaigns, "Pork . . . The Other White Meat" and "America's Cut," there has been generated a significant change in consumer attitudes toward pork. The association continues to work closely with state and national legislators.

Mike Sondag, Executive Vice President
6411 South Sixth Street
Springfield, IL 62707

Illinois Women's Pork Association
State Office
6411 South Sixth
Frontage Road East
Springfield, IL 62712

The Illinois Pork Association Women with its 1900 members stands strongly committed to the future of the pork industry. As an auxilliary of the Illinois Pork Producers Association, it too is very active in state and national affairs.

While the main emphasis of the association is the promotion of and consumer education about pork, it does become involved in legislative matters that affect the pork industry. The association strongly believes in the production of a lean, healthful, and safe product. Its hope is that consumers will continue to see the benefits of "The Other White Meat."

The association works closely with the Illinois Pork Producers Association and welcomes the opportunity to share ideas or assist in any way with legislative activity.

Pam Denby, President
R.R. #1, Box 180
Gerard, IL 62640

Illinois Poultry Industry Council

The two basic goals of the Illinois Poultry council are to foster, protect, and promote the poultry industry of the State of Illinois and to coordinate all segments of the Illinois poultry industry.

Rich Timmerman, President
Rural Route
Germantown, IL 62245
(618) 523-4797

Illinois Rabbit Breeders' Association, Inc.

The Illinois Rabbit Breeders' Association was organized in 1941. The first rabbit show was held in 1948.

At the present time there are 25 local clubs, with a membership of about 600. Thirty scheduled shows are held each year. The Illinois State Convention is held the latter part of September in Springfield, IL.

Richard Gehr, President
190 N. First Avenue
Coal City, IL 60416
(815) 634-4788

Illinois Lamb and Wool Producers, Inc.

The purpose of the Illinois Lamb and Wool Producers is to promote lamb and wool and all products from them in Illinois. The membership consists of purebred breeders, commercial breeders, lamb feeders, and lamb buyers. Members work in cooperation with the Extension Service of the University of Illinois.

Sharon Heitz, President
R.R.#1, Box 338
Mansfield, IL 61854
(217) 762-7012

Illinois Livestock Association

The voice of livestock interests in Illinois is the Illinois Livestock Association (ILA), which is dedicated to providing livestock feeders and producers with a trade association through which the members can combine their efforts in solving problems of the industry and improvement of the livestock economy.

The aims and purposes of the ILA are:

1. To provide livestock feeders and producers with a trade association representing their industry in all matters affecting the livestock business.
2. To have a strong, powerful voluntary group which can work toward solving problems in the livestock industry.
3. To promote the importance of the livestock industry in Illinois and to enlarge and encourage the demand for the products the industry produces.
4. To protect the livestock feeders and producers from any groups or individuals who may attempt to infringe upon their rights and privileges as businessmen.
5. To build and maintain the necessary goodwill that will cause the livestock industry to be held in the highest esteem, and bring both public and governmental recognition to its members.
6. To bring to its members as much information as possible that will be helpful to them in their business endeavors.
7. The Illinois Livestock Association serves its members and the livestock industry by offering industry protection and promotion, trade information, market analysis, performance testing, and organized representation.

Kan Koons, President
R.R. #1, Shirley, IL 61772
(309) 827-6680

Illinois State Nurseryman's Association

The Illinois State Nurseryman's Association (ISNA) has been active for the past 56 years. The membership includes most of the leading and progressive nurseries in the state, as well as growers, garden centers, and industry suppliers throughout the country.

The main objective of the ISNA is to promote horticulture in a broad sense, that is, to promote increased knowledge and use of nursery products by the public, and to provide safeguards to the planting public.

The Association maintains close liaison with state governmental agencies and institutions of learning. It sponsors trade shows, provides educational services for its members, supports research, and issues scholarships.

The nursery industry in Illinois represents thousands of acres and millions of dollars of plant goods and services. This represents a significant factor in the state's economy.

Randy Vogel
Springfield Hilton, Suite 1702
Springfield, IL 62701
(217) 525-6222

Illinois State Horticultural Society

The Illinois State Horticultural Society was organized in 1957. The Society's objective is the advancement of the science of Pomology and the arts of horticulture. It is a non-profit organization comprised of fruit producers and other interested individuals.

Ronald Mayer
R.R. #1, Box 26
Sidney, IL 61877
(217) 688-2590

Illinois State Turkey Association

The state association coordinates the work of the National Turkey Federation with the state activities for information and promotion. Directors of the state association meet quarterly to keep the industry informed on current events and projects. A fall meeting and tour of some local turkey farms is held for turkey producers and industry representatives. An annual meeting and program is held each January.

The state association is affiliated with the National Turkey Federation whose headquarters is in Reston, Virginia. The national association has a publicity development and turkey information service for turkey and turkey products at Salt Lake City, Utah. Complete publicity, TV film, scripts, and other promotion materials are served by the Salt Lake City office.

Merle Gaulratt
Rural Route
Tampico, IL 61283

Illinois Vegetable Growers Association

The Illinois Vegetable Growers Association is the Voice of the Vegetable Industry in Illinois. Its goal is to serve the state of Illinois with the finest produce available.

The association is designed to speak to consumers on the benefits of Illinois-grown produce, to legislators on the special needs of the vegetable industry, and to growers on discovering their common interests. It asks the growers to suggest areas for cooperative efforts, to keep the association informed of special problems, and to support the association with its membership.

Henry Boi
17510 Garden Valley Road
Woodstock, IL 60098
(815) 568-7023

Illinois Women for Agriculture

The objectives of the organization are to be informed, to open lines of communication between farmer and nonfarmer, and to seek ways and means of creating a better understanding of farming.

Illinois Women for Agriculture is a nonprofit, nonpartisan, public interest group of people concerned about the future of the agriculture industry.

The organization is concerned about rising costs, depressed prices, a disorganized market structure, and unwanted harassment from overlapping social and governmental agencies.

Rosanna Voss
3120 N. 12th Street
Quincy, IL 62301

Land of Lincoln Purebred Livestock Breeders Association

The Land of Lincoln Purebred Livestock Breeders Association is a breeder's organization of all purebred breeds of livestock in Illinois.

The objectives of this association are to stimulate and encourage better breeding of livestock in the state of Illinois, to study and encourage the adoption of the best methods for marketing purebred livestock, to foster social interest among breeders and breed associations, to assist colleges of agriculture and the College of Veterinary Medicine at the University of Illinois, and to support the management of the Illinois State Fair.

Paul Hawkins, Secretary-Treasurer
Oakland, IL 61943
(217) 346-2820

Illinois State Beekeepers Association

The Illinois State Beekeepers Association originated in 1891 as a nonprofit organization with membership open to anyone interested in honey bees and beekeeping.

The purposes of the organization are to promote good apiary management, to encourage legislation that will help in improving beekeeping practices, to further the beneficial use of honey bees for pollination of many Illinois food and farm crops, and to support the Rules and Regulations of the Illinois Department of Agriculture as administered by the Bureau of Apiary Protection.

At the association's bi-annual meetings, problems of the industry are discussed and educational programs are presented. In addition, the Association publishes the bi-monthly Illinois State Beekeepers Association Bulletin, which is sent to all active members.

Recognizing the need for additional bee forage plants, the association has recently cooperated with the Department of Conservation and the Natural History Survey, in a project to seed roadsides in selected areas. Favorable reports on the results of this effort have been encouraging to beekeepers, conservationists, and ecologists, bringing hopes of an expanded program in Illinois, and a possible innovation that other states may adopt. This is typical of the challenging and worthwhile activities promoted by this relatively small but powerful organization.

Lloyd Lindenfelser, President
P.O. Box 436
Tremont, IL 01568
(309) 925-2221

Illinois State Grange

The Illinois State Grange has served agriculture and the rural community since 1871. The nation's oldest farm and rural family organization is dedicated to a better quality of life for those engaged in agriculture and their rural neighbors, through legislation and community service action.

Russell Stauffer
P.O. Box 1502
Springfield, IL 62705
(217) 498-9533

Illinois Fruit and Vegetable Growers Foundation
Dan Hinkle
Box 218
Cissna Park, IL 60924

Illinois Fruit Growers Exchange
T. Jay Boyd
P.O. Box 438
Cobden, IL 62920
(618) 893-2194

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Illinois Irrigation Association
Tim Fanter
R.R. #1, Box 43A
Kilbourne, IL 62655
(309) 543-2307

Illinois Fertilizer and Chemical Association

Lloyd Burling, President
P.O. Box 186
St. Anne, IL 60964
(815) 427-6644

Dwight Dunbar, Vice President/Legislative Affairs
P.O. Box 357
Spring ld, IL 62705
(217) 522-3734

Victor Thompson, Containment Regulations and Systems
P.O. Box 357
Springfield, IL 62705
(217) 522-3734

Mink Breeder's Association of Illinois
38614 N. Fairfield Road
Lake Villa, IL 60046

Charles C. Ide, Jr, President
8250 Edgewood
Downers Grove, IL 60516
(309) 985-0843

Illinois Agricultural Aviation Association

Mark Idoe, President
M-T Helicopter Service
R.R. #1, Box 41
Seymour, IL 61875
(217) 687-5800

Illinois Aquaculture Industry Association
P.O. Box 291
1701 Towanda Avenue
Bloomington, IL 61701
(309) 557-2105

Illinois Fox Association

Lyle Read, President
17828 W. Eagle Point Road
Polo, IL 61064
(815) 946-3702

Illinois Association of Resource
Conservation and Development Areas
110 E. Fayette
Pittsfield, IL 62363

Illinois Fertilizer and Chemical Association, Inc.
Box 186
St. Anne, IL 60964
(800) 892-7122

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — What's My Name

STUDENT WORKSHEET #2 — Agency Report

STUDENT WORKSHEET #3 — Federal Agencies — Rules and Regulations

STUDENT WORKSHEET #4 — Sources of Help

STUDENT WORKSHEET #5 — Selecting your Leadership Style

STUDENT WORKSHEET #6 — Questions for Organizations

STUDENT WORKSHEET #7 — Leadership Development Activity

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

What's My Name

Agricultural agencies and legislation are commonly referred to by an abbreviation of their correct title. List the name of the following:

SCS ______________________

ASCS ______________________

FmHA ______________________

OSHA ______________________

FDA ______________________

USDA ______________________

EPA ______________________

FCC ______________________

ICC ______________________

FTC ______________________

CES ______________________

FCS ______________________

REA ______________________

CCC ______________________

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STUDENT WORKSHEET #1 — Key

What's My Name

SCS	*Soil Conservation Services*
ASCS	*Agricultural Stabilization and Conservation Service*
FmHA	*Farmers Home Administration*
OSHA	*Occupational Safety Health Act*
FDA	*Food and Drug Administration*
USDA	*United States Department of Agriculture*
EPA	*Environmental Protection Agency*
FCC	*Federal Communications Commission*
ICC	*Interstate Commerce Commission*
FTC	*Federal Trade Commission*
CES	*Cooperative Extension Service*
FCS	*Farm Credit Services*
REA	*Rural Electrification Administration*
CCC	*Commodity Credit Corporation*

STUDENT WORKSHEET #2

Agency Report

Each student should select an agency or resource which affects agriculture or provides services to agriculture and do an in-depth study of that agency or resource. Visit the agency or write for information if necessary. Answer the following questions:

1. Name of agency ______________________________

2. Does agency operate at national, state, or local level? ______________________________

3. Does it function as a regulatory agency, a service agency, or an educational agency? ______________________________

4. What does the agency do? ______________________________

5. What groups or individuals are affected or benefited by this agency? ______________________________

STUDENT WORKSHEET #2 — Key

Agency Report

Each student should select an agency or resource which affects agriculture or provides services to agriculture and do an in-depth study of that agency or resource. Visit the agency or write for information if necessary. Answer the following questions:

1. Name of agency? *Cooperative Extension Service*

2. Does agency operate at national, state, or local level? *All three levels*

3. Does it function as a regulatory agency, a service agency, or an educational agency? *Educational agency*

4. What does the agency do? *Helps people and communities identify and solve their farm, home, and community problems. Helps people apply and implement research findings from land grant university research stations and experimental farms. Provides educational programs and services to youth and adults in agriculture, home economics, youth development, and rural living. Sponsors 4-H programs.*

5. What groups or individuals are affected or benefited by this agency? *All persons could benefit. Farmers are often the main group of clients. However, city people can use these services too. Both youth and adults are served.*

STUDENT WORKSHEET #3

Federal Agencies — Rules and Regulations

Government agencies enforce rules and regulations which affect farmers and agribusiness firms. Through library research and/or class discussions, identify and record three rules and regulations which each of the following agencies enforce.

Agency	Rules and Regulations
Food and Drug Administration	1. ____________
	2. ____________
	3. ____________
Environmental Protection Agency	1. ____________
	2. ____________
	3. ____________
National Labor Relations Board	1. ____________
	2. ____________
	3. ____________
Federal Communications Commission	1. ____________
	2. ____________
	3. ____________
Interstate Commerce Commission	1. ____________
	2. ____________
	3. ____________
Bureau of Animal Welfare in Illinois, Department of Agriculture	1. ____________
	2. ____________
	3. ____________
Division of Agricultural Industry, Regulation in Illinois Department of Agriculture	1. ____________
	2. ____________
	3. ____________

STUDENT WORKSHEET #3 — Key

Federal Agencies — Rules and Regulations

Government agencies enforce rules and regulations which affect farmers and agribusiness firms. Through library research and/or class discussions, identify and record three rules and regulations which each of the following agencies enforce.

Agency	Rules and Regulations
Food and Drug Administration	1. *Labeling of animal drug products*
	2. *Correct mixing of drugs in feed*
	3. *License to sell certain drugs*
Environmental Protection Agency	1. *Disposal of chemical containers*
	2. *Record of sales of chemicals*
	3. *Runoff control*
National Labor Relations Board	1. *Compliance with minimum wage*
	2. *Workmans Compensation insurance*
	3. *Grievance procedures—employees*
Federal Communications Commission	1. *Use of two-way radios*
	2. *Clearance to use channels*
	3. *Licensing of employees for two-way radio use*
Interstate Commerce Commission	1. *Permits to haul through states*
	2. *Licensing of grain-hailing units*
	3. *Bonded to protect shippers*
Bureau of Animal Welfare in Illinois, Department of Agriculture	1. *Licensing of pet shop operators*
	2. *Supervising of slaughter of horses*
	3. *Issue permits for truckers hauling dead animals*
Division of Agricultural Industry, Regulation in Illinois Department of Agriculture	1. *Test all meters that dispense petroleum products*
	2. *Seed purity and germination analysis*
	3. *Certification of nurseries*

STUDENT WORKSHEET #4

Sources of Help

Problem or Need	Agency to Contact
1. Farmer needs a short-term loan to finance a feeding operation.	
2. Member of adult class wants more information on price support loans.	
3. Vocational agriculture student wants a free bulletin or circular on grain marketing.	
4. Credit is needed to build housing for domestic farm workers.	
5. Students want information about organizing a 4-H club.	
6. Farm operator needs crop insurance.	
7. Young farmer needs help in implementing soil conserving practices.	
8. Ag business person needs information on using two-way radios in business.	
9. Livestock feeder suspects contamination in feed he has purchased.	
10. Pesticide applicator needs more information on regulations regarding disposal of chemical containers.	
11. Elevator operator needs someone to check grain scales.	
12. Union suspects violation of federal minimum wage laws.	
13. Local citizen wants to contact agency responsible for Noxious Weed Law.	
14. Citizen needs information on conduct of county fairs.	
15. Citizen wants to know agency in charge of horse racing.	

STUDENT WORKSHEET #4 — Key

Sources of Help

Problem or Need	Agency to Contact
1. Farmer needs a short-term loan to finance a feeding operation.	*Farm Credit Services*
2. Member of adult class wants more information on price support loans.	*ASCS*
3. Vocational agriculture student wants a free bulletin or circular on grain marketing.	*Cooperative Extension Service*
4. Credit is needed to build housing for domestic farm workers.	*Farmers Home Administration*
5. Students want information about organizing a 4-H club.	*Cooperative Extension Service*
6. Farm operator needs crop insurance.	*Federal Crop Insurance Corp.*
7. Young farmer needs help in implementing soil conserving practices.	*Soil Conservation Service*
8. Ag business person needs information on using two-way radios in business.	*Illinois Department of Agriculture*
9. Livestock feeder suspects contamination in feed he has purchased.	*Illinois Department of Agriculture*
10. Pesticide applicator needs more information on regulations regarding disposal of chemical containers.	*Environmental Protection Agency*
11. Elevator operator needs someone to check grain scales.	*Illinois Department of Agriculture*
12. Union suspects violation of federal minimum wage laws.	*National Labor Relations Board*
13. Local citizen wants to contact agency responsible for Noxious Weed Law.	*Illinois Department of Agriculture*
14. Citizen needs information on conduct of county fairs.	*Illinois Department of Agriculture*
15. Citizen wants to know agency in charge of horse racing.	*Illinois Department of Agriculture*

STUDENT WORKSHEET #5

Selecting your Leadership Style

Directions: Mark a cross over the letter that best describes you.

Dominance:

A. I belong to several groups but only attend when something especially interests me.

B. I like to work on committees but do not like to chair them.

C. I lose interest in groups when they go along in the same old rut and don't listen to my suggestions.

D. I consciously seek, and obtain, leadership in many of my groups' activities.

E. I am often selected as leader of groups without seeking it.

Tact:

A. People frequently misunderstand my comments.

B. My acquaintances tell me that I am noted for handling many difficult situations without arousing ill will.

C. People seldom resent it when I must correct what they are doing or must criticize them.

D. I consciously study how to handle people tactfully.

E. Before I try to get others to accept my point of view, I first try to find out how they feel so I can adapt my ideas to theirs.

Communication:

A. I always assume the other person will be friendly and take the initiative in meeting me more than halfway.

B. People tell me they come to me with problems they wouldn't even discuss with their own families.

C. I always try to give the other person some incentive or some reason for doing what I want done.

D. When a conversation lags at a party of strangers, I try to fill in the break by finding a topic of general interest.

E. I have some definite ideas about the failings and follies of the younger generation and don't hesitate to express them.

Maturity:

A. I want what I want when I want it, regardless of consequences to myself or others.

B. I frequently let others have the last word.

C. I have been told that I can take well-meant, constructive criticism graciously.

D. I believe in telling others the truth if it is for their own good.

E. I take a stand on issues in which I believe even if they are unpopular, after looking into the pros and cons.

Attitudes:

A. I get annoyed when people don't do things my way. Sometimes my temper gets the best of me.

B. I try to show the attitude toward other persons that I want them to show toward me.

C. I believe I should make every effort to accept change and try to keep changing with the times.

D. I patiently listen to people with whom I disagree.

E. I vacillate when it comes to making a decision; sometimes I wait so long circumstances force a decision upon me.

Cooperation:

A. When people have a misunderstanding, I try to intervene and reconcile them.

B. In dealing with co-workers, I try to put myself in their shoes and act toward them the way I'd like them to act toward me.

C. I am willing to accept the help of others, provided it does not interfere with their work.

D. When I want information from others, I feel I have a right to demand it because I am acting on behalf of my boss.

E. If my boss says to me, "Tell So-and-So I want this right away," I change both his message and voice tone to, "The boss would appreciate this as soon as possible."

STUDENT WORKSHEET #6

Questions for Organizations

Students may use any or all of the questions listed below as a guide for an interview, or for writing to an organization to gather information. The teacher may use the questions to gather background information or to see if the organization has any educational materials.

1. What is the history of the organization?

2. What are the purposes or objectives of the organization?

3. What are the membership qualifications?

4. How much are the dues for the organization?

5. What is the organizational structure?

6. What does the organization do in the local community?

7. Who are the officers?

8. Who are the state officers?

9. What role does the individual member play in the local organization?

10. How does the organization benefit the individual?

11. Does your organization provide informative materials that could be of benefit to a high school teacher? If so, please describe the types of material available.

STUDENT WORKSHEET #7

Leadership Development Activity

Objectives:

1. To identify some problems in oral communication.
2. To develop some probable solutions to the problems.

Materials:

1. A diagram of a combination of squares, rectangles, and circles.
2. Pencils and paper to be used by the participating students.

Procedures:

1. Select a student and give to him or her the diagram. Make sure other students do not see the diagram.

2. Face the presenter in front of the group.

3. The presenter will describe the diagram on the paper, through oral means only. Presenters should not use their hands.

4. All students will draw the diagram as they understand the presenter to describe it.

5. A second presenter will then be selected. The second presenter will use the diagram he or she drew from the first description. Have the students draw another diagram from the second presenter's description.

6. Have students compare their drawings.

7. Compare their drawings to the original.

Questions:

1. Was your drawing the same as the original?

2. Is there a difference between your first drawing and second drawing? ________ Why?______________________

____

3. Why are the drawings not the same as the original? ______________________________________

____

4. Does everyone perceive what is said the same way? ______________________________________

____

5. How could the drawings have been improved, if the presenter had not been restricted? ______________

____

Observations:

Describe how problems in communication arise, and how some of these can be avoided. How does communication affect an organization.

Application:

Relate how this activity could benefit your student organization meetings.

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the World Food and Fiber Chain

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Recognizing the Role of Agriculture in Society
3. Understanding the Relationship Between Agriculture and the Environment
4. Recognizing the Role of Research and Development in Agriculture
5. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information About Agriculture
6. Conserving Agricultural Resources

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to demonstrate a knowledge of world geography with emphasis on the United States

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know the reasons for different kinds of land use.					
*2. Understand how decisions affecting the use of the natural environment can have both positive and negative results.					
*3. Understand the economic and social factors that contribute to conditions of interdependence between and among nations.					
*4. Identify the major regions of the world. *5. Identify some of the environmental problems existing within the regional structure of the world.					
6. Recognize that a food and fiber chain exists.					
7. Describe the interdependence among nations for food.					
8. Describe the current pattern of population growth and explain this pattern's affect on food availability.					
9. Distinguish between useable and non-useable land resources.					

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the World Food and Fiber Chain

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Recognize that a food and fiber chain exists.
2. Describe the interdependence among nations for food and fiber products.
3. Describe the current pattern of population growth and explain this pattern's affect on food availability.
4. Distinguish between useable and non-useable land resources.
5. Describe environmental effects on land use and food and fiber production.
6. List valuable agricultural inputs lacking in various parts of the world.
7. Describe current trends in world agricultural production.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the World Food and Fiber Chain

PROBLEMS AND QUESTIONS FOR STUDY

INSTRUCTOR'S NOTES AND REFERENCES

1. What is the food and fiber chain?
2. How is one affected by the food and fiber chain?
3. Why should one be concerned with events in other parts of the U.S.? The world?
4. What is the current pattern of population growth?
5. How does population growth affect the supply of food?
6. What is arable land?
7. How does the amount of arable land affect imports and exports?
8. How does the environment affect land use?
9. What are some results of land use?
10. How does the way land is used affect food and fiber production?
11. What are the various regions of the world?
12. What agricultural products are grown in the various regions of the world?
13. Why can't the same agricultural products be produced in all areas of the world?
14. Why aren't all the inputs which are necessary for agricultural products available in all areas?
15. What is the current trend in agricultural production?
16. What is the interdependence among nations for food and fiber?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the World Food and Fiber Chain

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have students search current agricultural publications for articles on import and export concerns and the impact of foreign production on domestic prices and production. Have students write a brief summary of their findings.

2. Use the problem area *Identifying and Using Agricultural Organizations, Agencies, and Sources of Information About Agriculture* as a resource for addresses of specific organizations. Have students write these organizations requesting information on their dealings with foreign organizations. The problem area *Understanding the Animal Production Industry* could be used as a resource for animal specific registry organizations.

3. Have students identify everyday agriculturally related products that they use which are imported. Lead a discussion of why these products are used instead of domestic products.

4. Invite a guest speaker from the Cooperative Extension Service or an organization like the soybean growers, corn growers, or the pork and beef producers to make a presentation on the impact of foreign trade to the economy of Illinois in general or to their members in particular.

5. Ask students to conduct a survey of local grocery stores, clothing stores, agriculture equipment dealers, or agricultural and horticultural supply dealers to make a list of commonly used items and whether these items are foreign or domestic in origin. Examples: At the grocery store, out of fifteen canned items how many are produced domestically? At the clothing store, out of five items how many are domestically produced? At the clothing store, out of ten items how many are made of natural fibers and how many are made of synthetic fibers?

6. Assign students a specific country or region to research. Have the students report to the class what agricultural products are produced, imported, and exported; the population growth pattern; what governmental policies affect agricultural imports and exports; how much agricultural trade is done with the U.S.; and how much agricultural trade is done with Illinois.

7. Obtain copies of Instructional Materials Service Unit #8361 "The World Food Chain — From Production to Consumption" for student use as a resource and for completing the enclosed study guide.

8. Obtain copies of the text "Food and Fiber for a Changing World" for use as a resource for reading assignments and as a reference for student use.

9. Use Student Worksheet #1 as a study guide for note taking during lectures or as a study guide for independent assignments.

10. Use Student Worksheet #2 an outside assignment for student research into the origin of products that are available for consumption.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding the World Food and Fiber Chain

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Food and Fiber for a Changing World.* Thomas, G.W., Curl, S.E., Bennett, W.F., Sr. (1982). Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

2. *U.S. Agriculture in a Global Economy: The Yearbook of Agriculture.* (1985). U.S. Government Printing Office, Washington, DC 20250.

3. *The World Food Chain —From Production to Consumption.* (Subject Matter Unit #8361). (1987). Instructional Material Service. Texas A & M University, College Station, TX 77843.

4. *1988 Fact Book of U.S. Agriculture.* United States Department of Agriculture, Office of Governmental and Public Affairs, Washington, DC 20250.

5. *Summary of 1987 Food Production.* Food and Agriculture Organization, United Nations, New York, NY.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Introduction to the Food and Fiber Chain

INFORMATION SHEET #2 — United States and Canada

INFORMATION SHEET #3 — Western Europe

INFORMATION SHEET #4 — Eastern Europe and Russia

INFORMATION SHEET #5 — Asia and the Pacific

INFORMATION SHEET #6 — Latin America

INFORMATION SHEET #7 — Africa and the Middle East

INFORMATION SHEET #8 — Seafood

TRANSPARENCY MASTER #1 — Food Deficit Countries (with discussion guide)

TRANSPARENCY MASTER #2 — Population Growth (with discussion guide)

TRANSPARENCY MASTER #3 — Trends on Fiber Consumption (with discussion guide)

TRANSPARENCY MASTER #4 — Land Use Patterns by Region (with discussion guide)

TRANSPARENCY MASTER #5 — World Harvested Area of Principal Crops (with discussion guide)

TRANSPARENCY MASTER #6 — Grain Requirements Ladder (with discussion guide)

TRANSPARENCY MASTER #7 — Comparative Food Consumption (with discussion guide)

TRANSPARENCY MASTER #8 — Meat Consumption (with discussion guide)

TRANSPARENCY MASTER #9 — Major Importers and Exporters (with discussion guide)

TRANSPARENCY MASTER #10 — Oilseed Production and Export (with discussion guide)

TRANSPARENCY MASTER #11 — Sugar Imports and Exports (with discussion guide)

TRANSPARENCY MASTER #12 — Major Feed Grain Importers and Exporters (with discussion guide)

TRANSPARENCY MASTER #13 — Global Beef Production and Exports (with discussion guide)

TRANSPARENCY MASTER #14 — Global Pork Production and Exports (with discussion guide)

TRANSPARENCY MASTER #15 — Global Poultry Production and Exports (with discussion guide)

TRANSPARENCY MASTER #16 — U.S. Agricultural Exports and Imports (with discussion guide)

INFORMATION SHEET #1

Introduction to the Food and Fiber Chain

The food and fiber chain is that system in which plant and animal products are converted to food and clothing. The chain encompasses not only what is produced and where a particular item can be produced but also what can be made from a particular item and where that product is consumed. The continuing challenge is to provide adequate, quality food and fiber for the world's inhabitants.

Compounding this challenge is the continuing rise in population. Even though certain areas of the world have experienced dramatic increases (up to 65%) in food and fiber production, the rise in population has left only a small increase (7%) in the per capita amount of food available. The developing areas of Africa, Asia, and Latin America account for 85% of the world's births with annual percentage increases two to three times that of developed countries (2.6 - 2.9% vs. 0.4 - 0.7%). These areas can be classified as diet deficient and contain two-thirds of the population of the world. It has been estimated that 25% of the world's population is undernourished and that one child in three dies of malnutrition before age five.

The amount of diet deficiency is normally defined in terms of grain, as cereal grains are the most important component of most diets. North Americans consume 1600 pounds of grain each year, whereas many Asians consume only 400 pounds. The cereal grains are an incomplete source of essential amino acids and this, among other reasons, accounts for the fact that as economic conditions improve the amount of meat consumed goes up. It is calculated that 80% of the population of the world can not afford to purchase meat even if it is available. Another factor of meat availability is that grain must be in sufficient quantites to allow it to be fed to animals in addition to people. The average person needs 2800 calories per day for energy requirements but in many countries 1000 calories or less are not uncommon.

The ability of the world to feed its inhabitants seems technically possible but the many resources required all play a role. Though the earth contains 37 billion acres of land only 7.7 billion is potentially arable and only 45% of this 7.7 billion can possibly be used for food production. Though water is available in many areas, only 39% of that available water can be consumed. Fourteen percent of the world's cultivated lands require irrigation. It has been estimated that 25-35% of the food produced is lost to the inadequate control of pests, and even when controls are available not all are affordable. Even though fertilizer use is up 65% in the last decade not all areas that need this input have it available nor can all afford the transportation costs required when it is available. The continued availability of energy, especially fossil fuels, is of concern to all countries, especially the major food producers that use the most fuel. All needed resources play a role in what is produced and where a particular product can be produced. Many other resources such as transportation systems, and not least, governmental policy, play a role in the food and fiber chain in getting the supplies of food and clothing to where they are needed.

Food Production

A. 2/3 of cultivated lands are planted in cereal grains.
B. Wheat, rice, and corn are the major grains grown. Leading producers:
   1. Corn — USA
   2. Wheat — USSR
   3. Rice — China
C. Other grains grown, in order of quantity produced, are: sorghum, barley, sugar cane, sugar beets, cassava, potatoes, sweet potatoes, beans (pulses), soybeans, peanuts, coconuts, bananas.
D. Highest yields:
   1. Rice
      a. Japan — 6.4 metric tons/hectare
      b. Jamaica — 6.25 metric tons/hectare
   2. Wheat
      a. Netherlands — 5.70 metric tons/hectare
      b. Denmark — 5.69 metric tons/hectare
      c. USA — 2.13 metric tons/hectare
   3. Corn
      a. New Zealand — 7.90 metric tons/hectare
      b. Australia — 6.60 metric tons/hectare
      c. USA — 6.40 metric tons/hectare

NOTE: (1 metric ton = 1.1 ton)(1 hectare = 2.47 acres)

E. Protein is the food nutrient most deficient.
F. Soybeans and other beans (pulses) are the major suppliers of protein.
G. 2/3 of the soybeans in the world come from the USA, Brazil, and China.
H. Poultry production is easily adaptable to most areas to provide animal protein.

As can be seen, no one area is self-sufficient in products desired. All regions require products from some other area to satisfy demand. This interdependence points out that decisions and events in one place have an effect in other places, whether it be a governmental policy or a flood or a drought. For the challenge of feeding the world to be met, a recognition is necessary of the finite resources available and the seemingly infinite pressure that these resources are under to provide adequate and quality food and fiber for all the world's inhabitants, not to just those that can afford them.

INFORMATION SHEET #2

Unites States and Canada

United States

A. Exports

- Deliveries to 170 countries
- Top 5: Japan, Netherlands, Canada, South Korea, Taiwan
- Top regions: Asia, Western Europe, Latin America, Canada, Africa, USSR
- Agriculture total — 27.9 billion dollars
- Leading exporter of agricultural products in the world

B. Imports

- Deliveries from 155 countries
- 54% of imports from 10 countries: Canada, Mexico, Brazil, Australia, Columbia, New Zealand, France, Indonesia, Netherlands, Denmark
- Among the largest agriculture importers in the world
- 2/3 of agricultural imports were meats, fruits, vegetables, and sugar

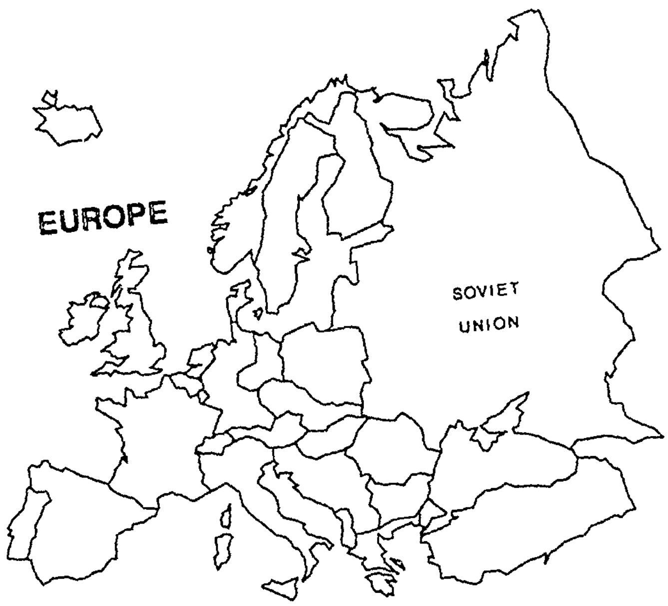
See relevant problem areas for additional information

Canada

- Only 4% of the total land area in cultivation
- Major crop production in the west
- Major crops: wheat, barley, oats, rye, oilseeds (rapeseed [canola] and flaxseed)
- 70% of cattle production in west
- 60% of hog production in east
- Most dairy and poultry production in east
- Agriculture accounts for 10% of total exports
- Largest supplier of agricultural products to U.S.
- #2 exporter of wheat after U.S.
- Major customers after U.S.: USSR, China, Japan, Europe, Brazil
- Fruits and vegetables account for 1/3 of total imports
- Main supplier of imports is U.S.

INFORMATION SHEET #3

Western Europe



A. Wide variation in agricultural importance to countries
   - 2% of gross value in United Kingdom
   - 16% of gross value in Greece

B. Common Market: Common agriculture policy, highly protected agriculture sector, common pricing of products

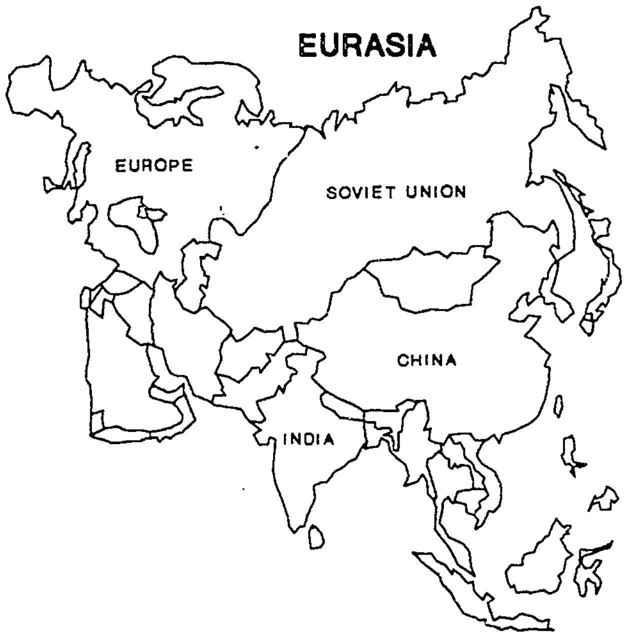
C. Wide variation in farm size with an average of 40 acres
   - 170 acres in U.K.
   - 20 acres in Italy and Greece

D. Major surplus products: Dairy products, soft wheat, barley, sugar, beef, veal

E. Major shortage products: Rice, corn, high-protein foodstuffs, sheep and goat meat, fresh deciduous fruit, citrus, vegetable fats and oils

INFORMATION SHEET #4

Eastern Europe and Russia



A. Socialized farming: Prices for products and managerial decisions set by central bureacracy

B. Farm sizes range from an average 25,000 acres in Russia to 8,000 acres in eastern Europe.

C. Private plots of up to 1 acre allowed; these plots provide 25% of crop production and 30% of animal production in USSR

D. USSR leading producer of rye, barley, oats, potatoes, sunflower seed, sugar beets, and milk; #3 in meat production

E. Most food quality poor and shortages are common

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INFORMATION SHEET #5

Asia and Pacific

A. Contains 60% of the people in the world

B. Diversified crops but rice still dominant

C. Australia and New Zealand: possess a modern agriculture industry which provide 50% of the beef and veal, 20% of the sheep, and 15% of the wheat exported in the world.

D. China: Until 1978 collective and socialistic production; this system was dismantled and land given to individuals that may sell for cash that amount which is produced above what is contracted to the government.

E. Japan
- America's largest foreign market
- Imports feed grain and soybeans
- Little arable land
- Recent agreements to open markets to more foreign agricultural products

F. Southeast Asia
- Net exporter of farm products
- Malaysia provides 70% of the world's palm oil

G. India
- Self-sufficient in grain except for periodic weather induced shortfall
- Leading importer of edible oils (soybean and palm)

INFORMATION SHEET #6

Latin America

A. Contains 15% of the total land area (equal to the U.S. and Canada).

B. 70% of the population is urban and dependent on rural farmers for food products.

C. Production increases equaled by population increases, subject to malnutrition but usually not famine.

D. Cereal grains comprise 1/4 of agricultural output.

E. Argentina is a major corn exporter.

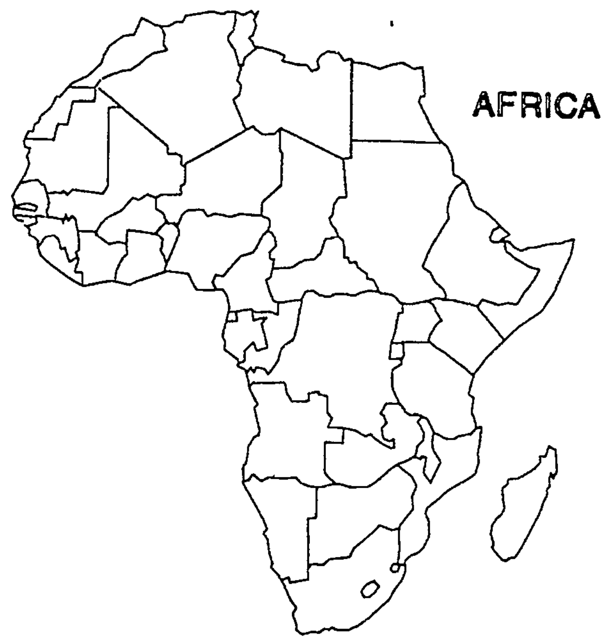
F. Other region exports: Coffee, sugar, cocoa, bananas, soybeans.

G. U.S. imports 1/3 of the coffee produced and 1/4 of the sugar and bananas produced.

H. Mexico imports 1/3 of the U.S. exports to the region.

INFORMATION SHEET #7

Africa and the Middle East



A. A wide range of economies from rich developing (oil exporters) to the poorest underdeveloped (Sub-Saharan Africa).

B. Of lands that are cultivated, irrigation is provided to almost 100% in Egypt, 30-40% in Saudi Arabia and Iran and only 10% in North Africa.

C. Farms are small and operated in a traditional manner utilizing family labor and hand tools.

D. The oil exporters are major importers of wheat, wheat flour, poultry, dairy products, oils, tea, and coffee.

E. Region Exports

- Livestock from Turkey
- Horticultural products from Egypt
- Citrus from Israel

F. Sub-Saharan Africa

- Prone to famine
- High percent population increase
- 80% of the population employed in agriculture
- High percent of the population is urban
- Government policies subsidize consumers with low producer prices
- Food imports increased by four times but diets deteriorated due to population increases and the lack of income to purchase inputs and products beyond that provided by aid
- Civil wars and graft impede distribution of those foodstuffs available
- Area has little irrigation, low inputs of fertilizer, and continues to practice deforestation, which subjects fragile land to cultivation and erosion

INFORMATION SHEET #8

Seafood

Seafood is becoming more important as a red meat substitute due to health-related factors. Research indicates that most seafood is low in fat, cholesterol, and calories. The #1 harvester of seafood is Japan with 15% of the catch, followed by the USSR (12%), China (6%), and USA (5%). Japan is also the #1 importer of seafood, followed by the USA which imports 60% of its seafood supply.

Aquaculture is becoming more important as a means of supplying seafood. In America, 95% of the catfish and nearly all of the Rainbow Trout consumed have been farmed. For further information see the problem area *Identifying Alternative Animal Production Systems: Aquaculture.*

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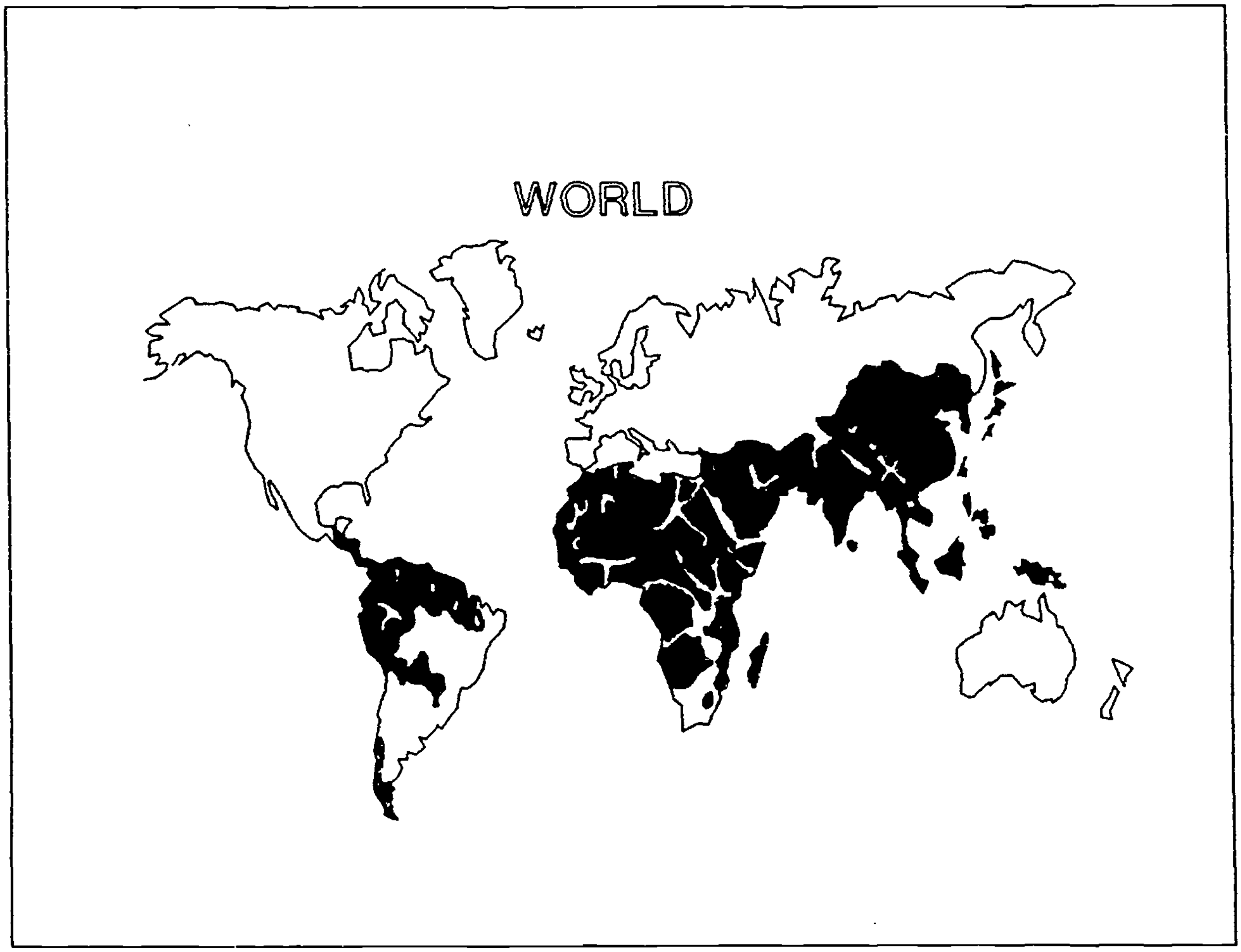
TRANSPARENCY MASTER #1

Food Deficit Counties



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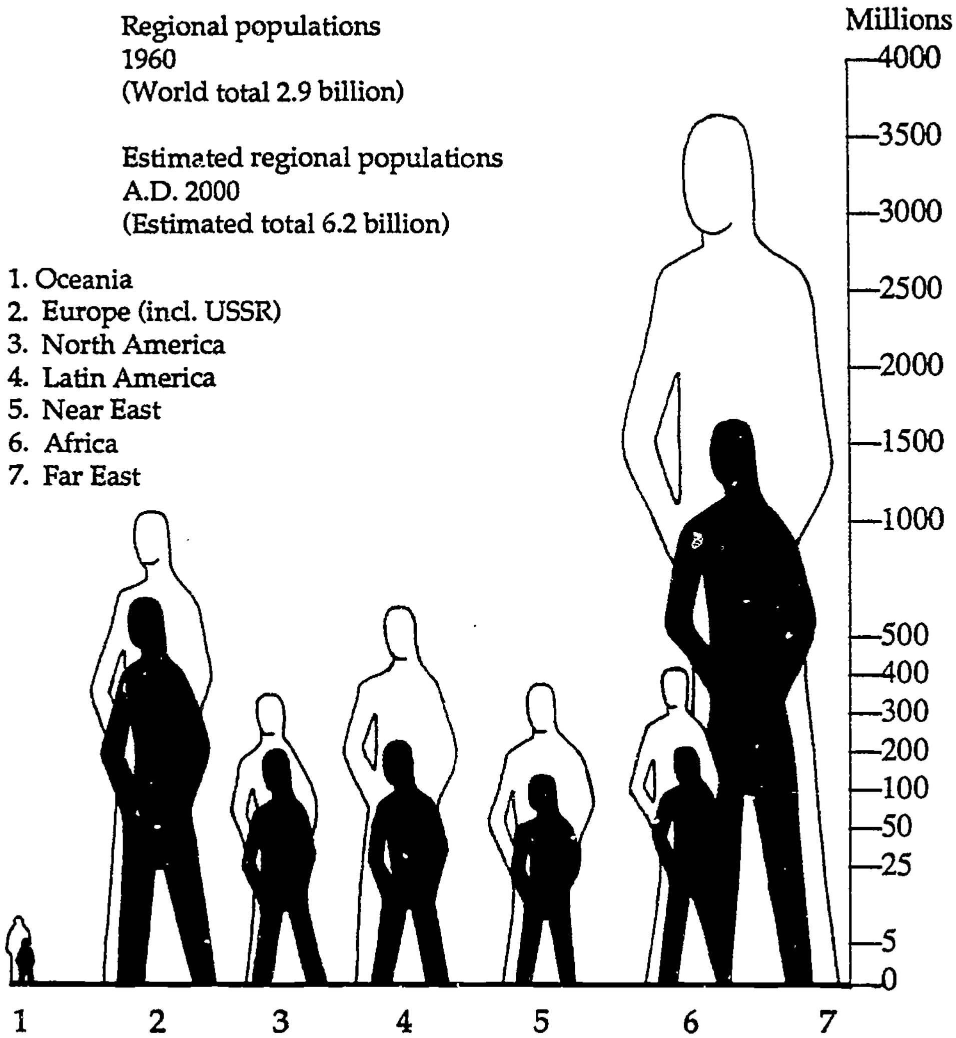
TRANSPARENCY MASTER #2

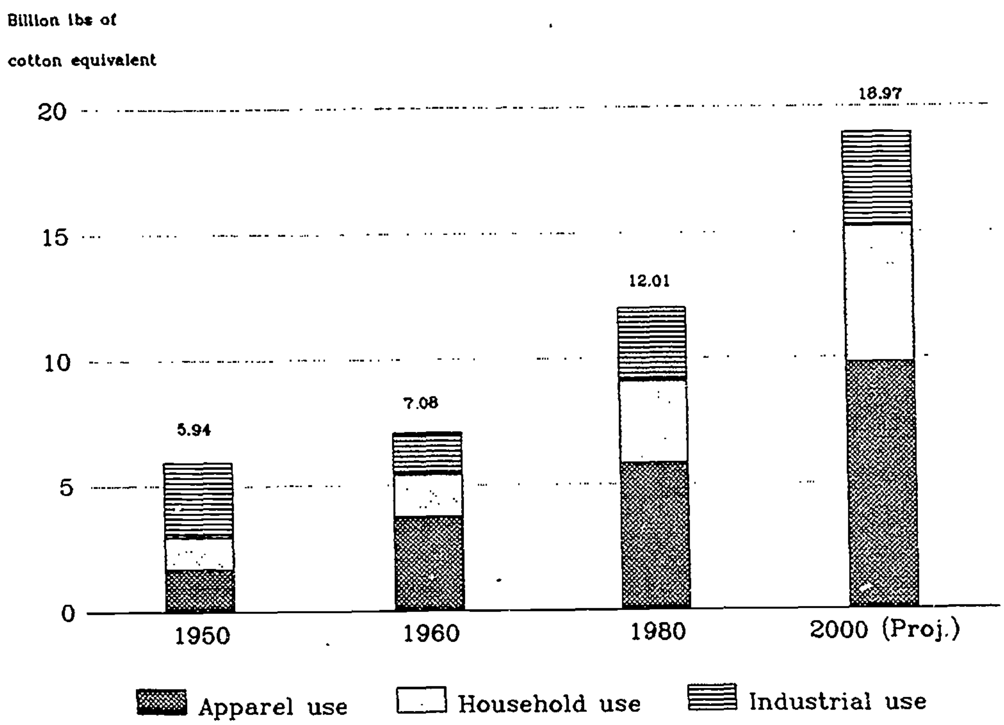
Population Growth

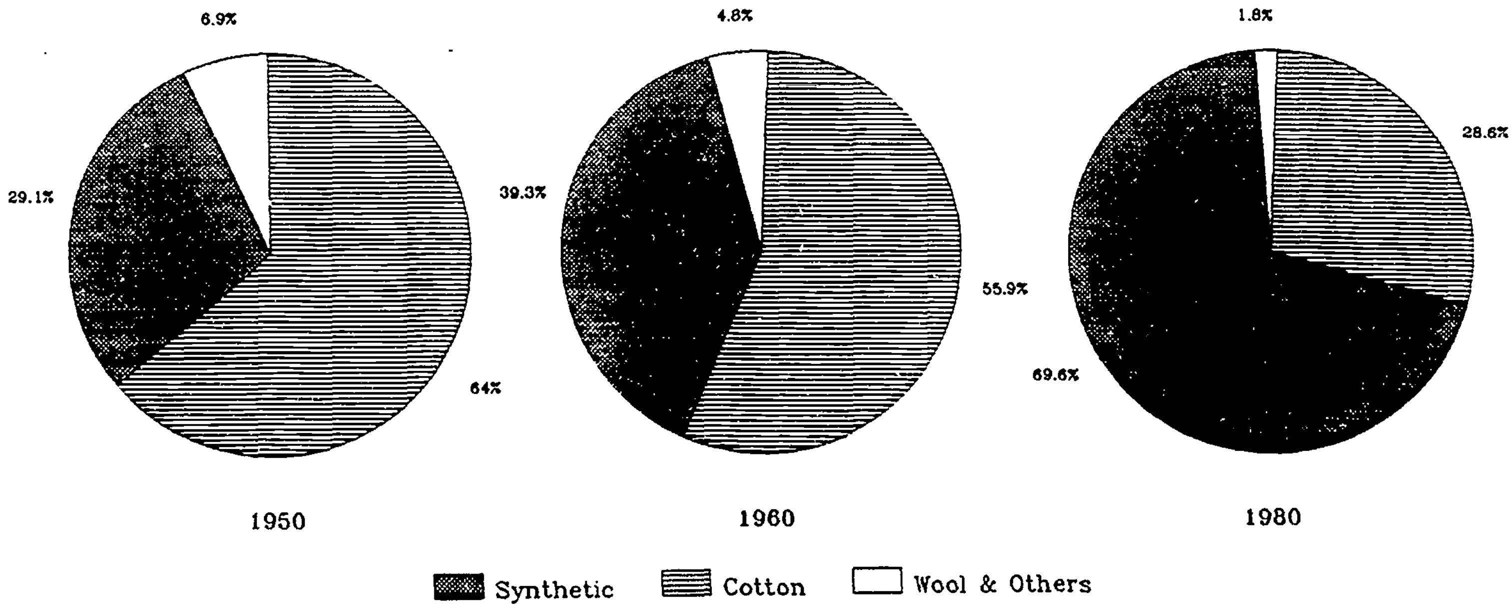


Expected population by the year 2000. (Adapted from the report of the National Advisory Commision on Food and Fiber, Washington, D.C.)

TRANSPARENCY MASTER #3

Trends in Fiber Consumption



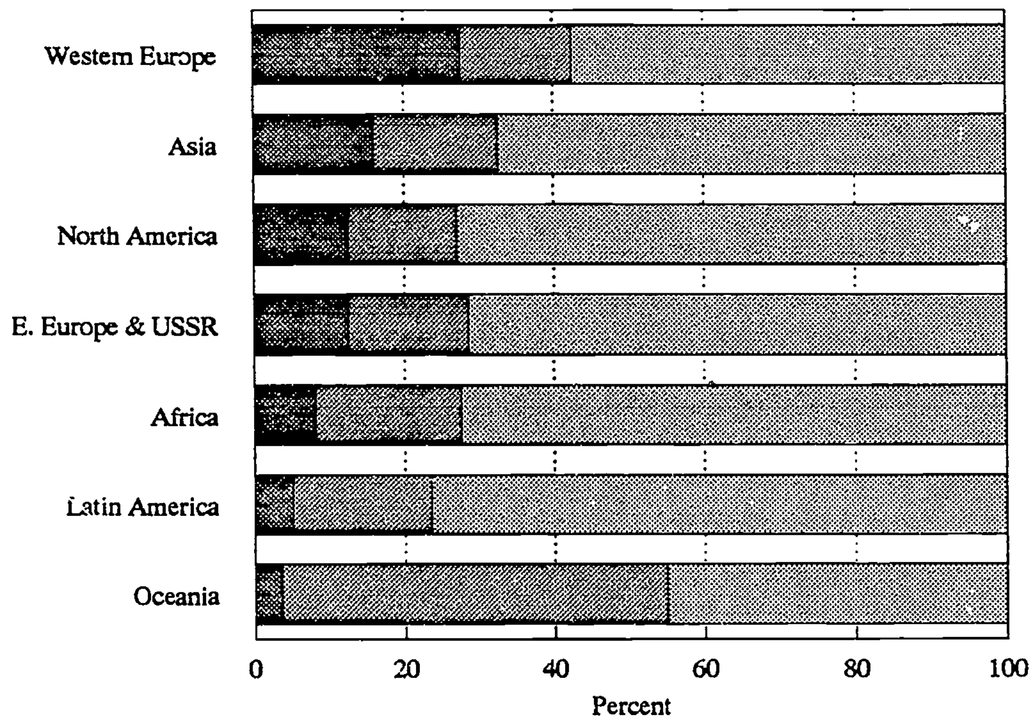


Some trends in fiber consumption, showing what the principal uses are and how natural and synthetic types share the total market. Adapted from Landsberg & Thomas.

TRANSPARENCY MASTER #4

Land Use Pattern by Region

Each region is made up of arable land & land in tree crops, permanent meadows & pastures, and all other land.



U.S. Department of Agriculture

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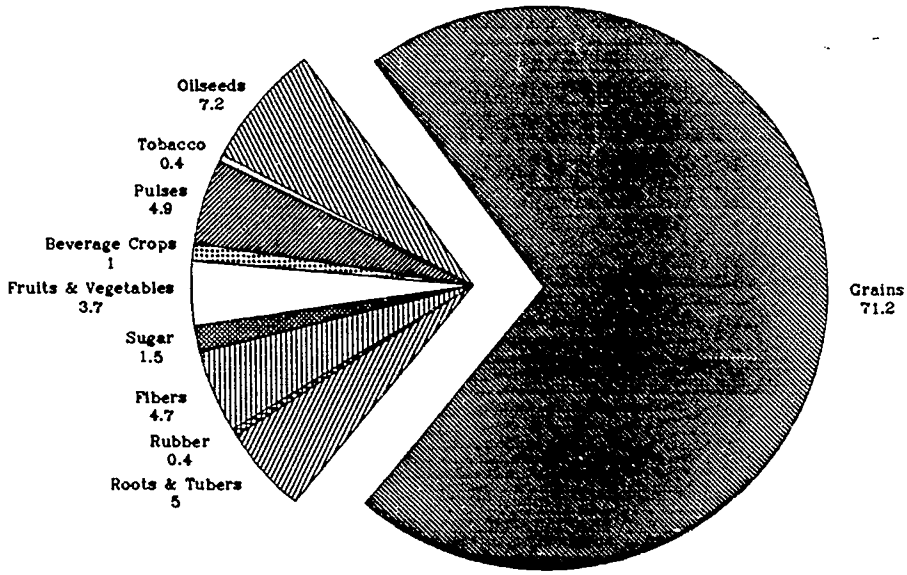
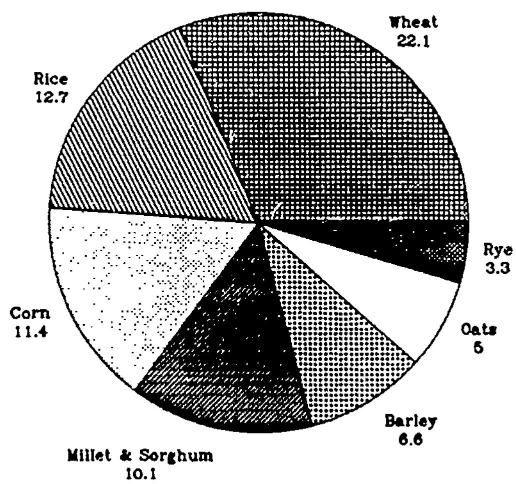
TRANSPARENCY MASTER #5

World Harvested Area of Principal Crops



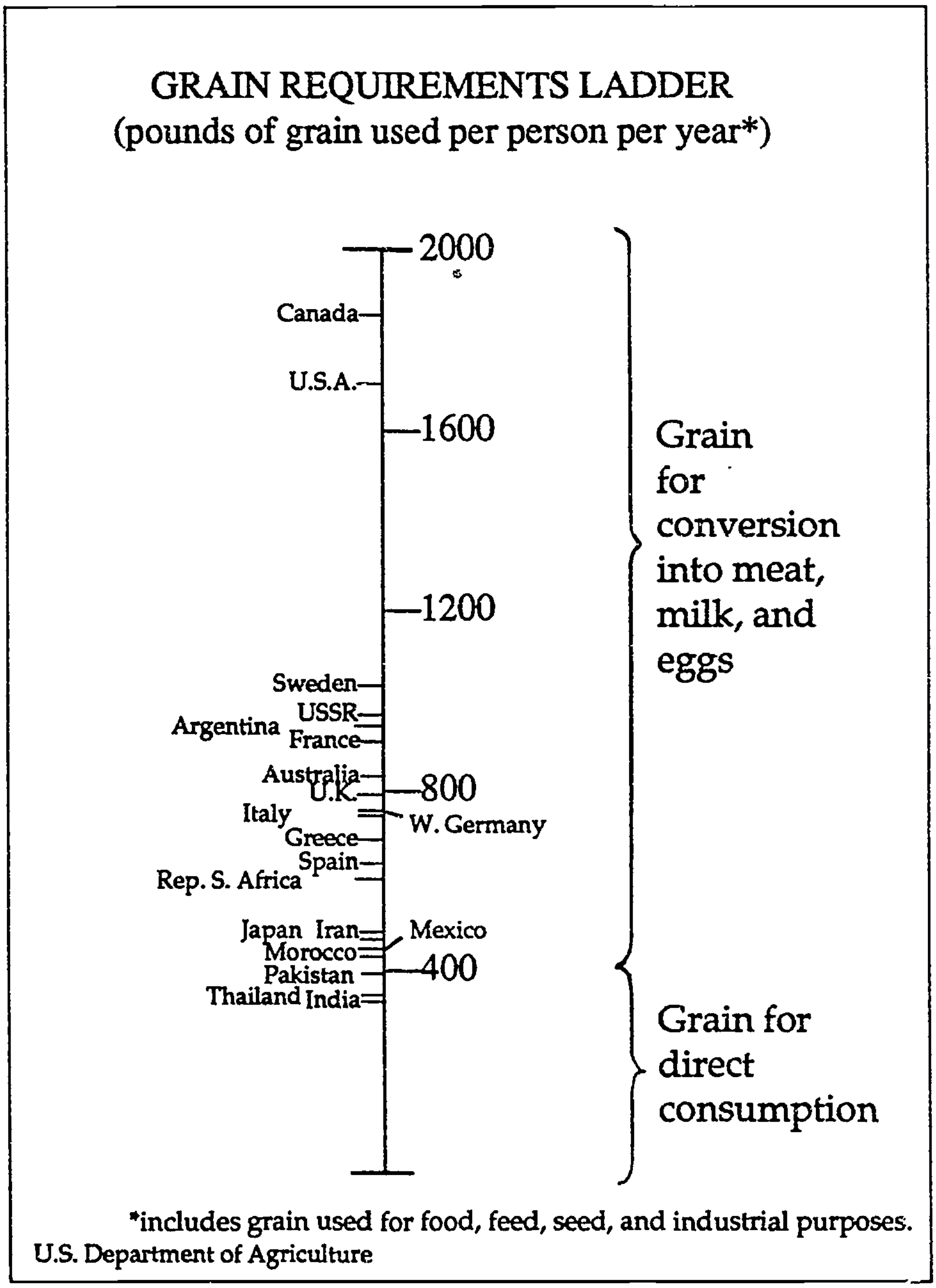
Grains



U.S. Department of Agriculture

TRANSPARENCY MASTER #6

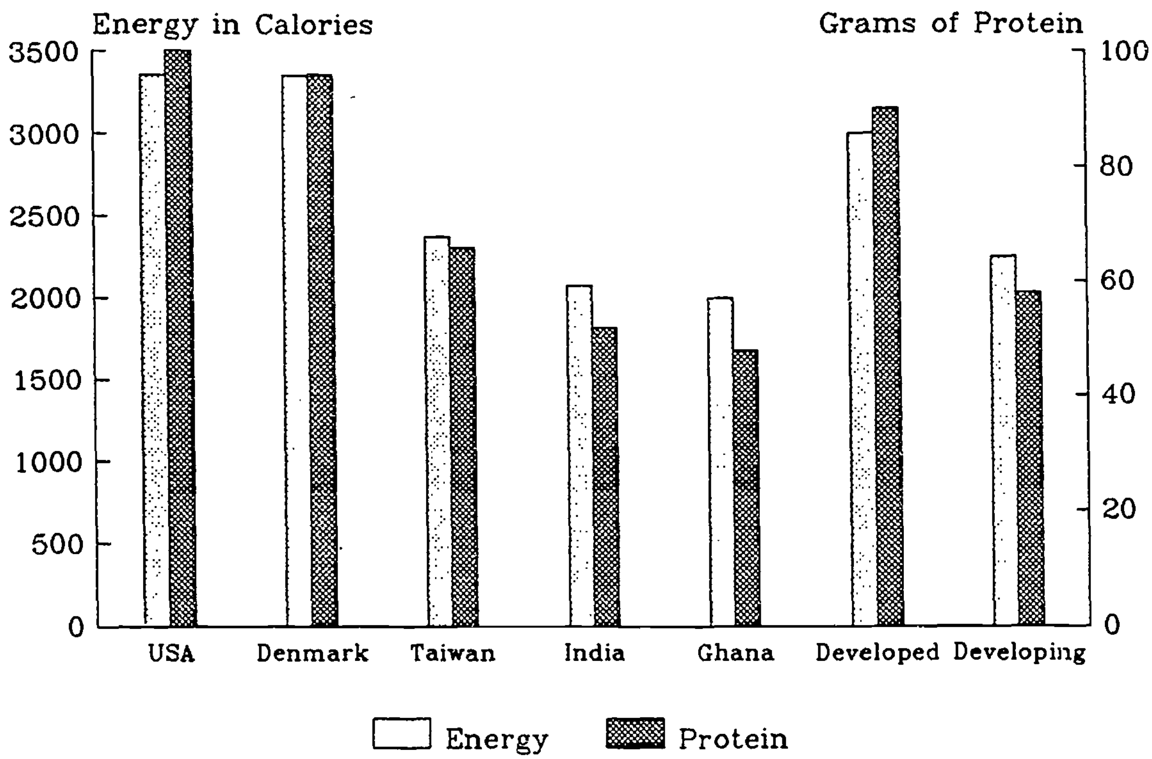
Grain Requirements Ladder



Canada and the United States utilize four times as much grain per person as do developing countries, such as Pakistan, Thailand, and India.

TRANSPARENCY MASTER #7

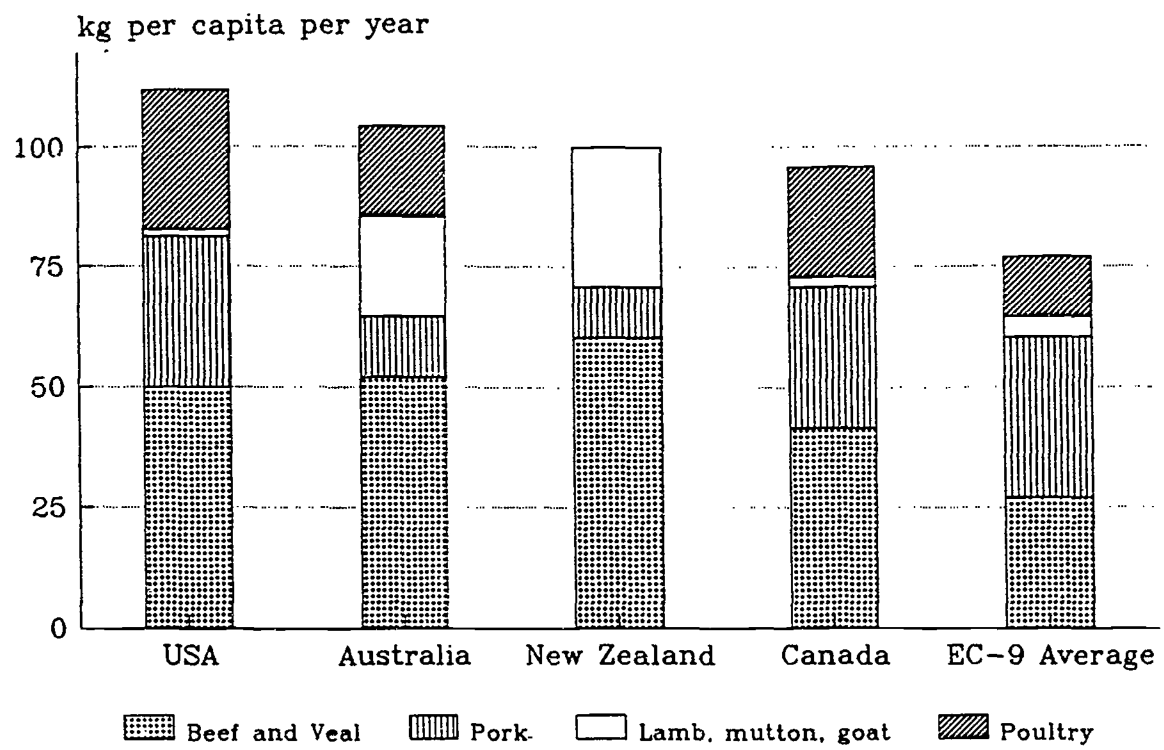
Comparative Food Consumption



Approximate levels of energy and protein for selected coutries. (From United Naitons data)

TRANSPARENCY MASTER #8

Meat Consumption



A comparison of meat consumption among selected countries.

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TRANSPARENCY MASTER #9

Major Importers and Exporters

Major Importers of Basic Commodities Traded in the World

Wheat	Feed Grains	Soybeans & Products	Beef	Pork
U.S.S.R.	Japan	European Community	United States	United States
China	U.S.S.R.	Japan	U.S.S.R.	Japan
Japan	European Community	Spain	Japan	U.S.S.R.
Egypt	Mexico	Taiwan	European Community	European Community
Eastern Europe	Taiwan	Mexico	Egypt	Hong Kong
European Community	South Korea	Eastern Europe	Canada	
Brazil	Eastern Europe	U.S.S.R.	Saudi Arabia	
	Saudi Arabia	India		

Major Exporters of Basic Commodities Traded in the World

Wheat	Feed Grains	Soybeans & Products	Beef	Pork
United States	United States	United States	European Community	European Community
Canada	Argentina	Brazil	Australia	Eastern Europe
Australia	Canada	Argentina	Argentina	
France	South Africa	European Community	New Zealand	
Argentina	Thailand		Brazil	
	Australia		Canada	
	France			

TRANSPARENCY MASTER #10

Oilseed Production and Export

World Production of Oilseeds and Related Products, 1984/85

	Seed	Oil	Protein Meal
		Million metric tons	
Soybeans	90.7	13.4	59.2
Cottonseed	34.3	4.2	12.6
Peanuts	19.7[1]	3.3	4.6
Sunflower seed	17.7	6.3	7.0
Rapeseed	16.5	5.6	9.2
Flaxseed	2.2	.6	1.2
Palm Kernel	2.2	.9	1.1
Palm Oil	-	7.0	-
Coconut	4.4[2]	2.7	1.4
Olive Oil	-	1.7	-
Fish Products	-	1.4	5.5
Total	187.7	47.1	100.4[3]

[1]In-shell basis [2]Copra basis [3]Total does not add up because of rounding

World Exports of Oilseeds and Related Products, 1984/85

	Seed	Oil	Protein Meal
		Million metric tons	
Soybeans	25.7	3.6	21.8
Cottonseed	.3	.4	1.0
Peanuts	.9	.3	.5
Sunflower seed	2.0	1.8	1.8
Rapeseed	2.9	1.0	1.2
Flaxseed	.5	.2	.5
Palm Kernel	.2	.6	.7
Palm Oil	-	4.2	-
Coconut	.3	1.1	.7
Olive Oil	-	.4	-
Fish Products	-	.8	2.6
Total	32.8	14.4	30.8

TRANSPARENCY MASTER #11

Sugar Imports and Exports

Sugar Imports by Region

Region	1981/82	1982/83	1983/84	1984/85
		1,000 metric tons		
North America	4,893	4,428	4,179	3,114
Caribbean	385	136	195	160
Central America	20	23	-	-
South America	823	988	706	386
European Community	2,402	2,111	2,734	2,726
Other Western Europe	1,009	1,015	871	883
Eastern Europe	1,115	1,038	1,365	938
U.S.S.R.	6,883	5,926	5,600	5,400
North Africa	2,095	2,194	2,150	2,200
Other Africa	1,032	984	1,253	1,195
Middle East	2,593	2,715	2,825	2,845
Far East	5,826	6,369	5,520	6,060
Oceania	157	299	220	214
World total	29,233	28,226	27,618	25,901

Sugar Exports by Region

Region	1981/82	1982/83	1983/84	1984/85
		1,000 metric tons		
North America	327	254	375	309
Caribbean	8,919	8,004	8,265	8,370
Central America	679	1,084	828	771
South America	4,335	4,284	4,070	3,745
European Community	6,855	6,776	5,988	5,475
Eastern Europe	479	838	751	760
Other Western Europe	240	316	194	207
U.S.S.R.	268	165	250	300
Africa	2,567	2,635	2,211	2,578
Middle East	150	195	525	550
Far East	5,106	3,912	3,649	3,337
Oceania	3,052	3,127	2,890	3,136
World total	32,977	31,590	29,996	29,538

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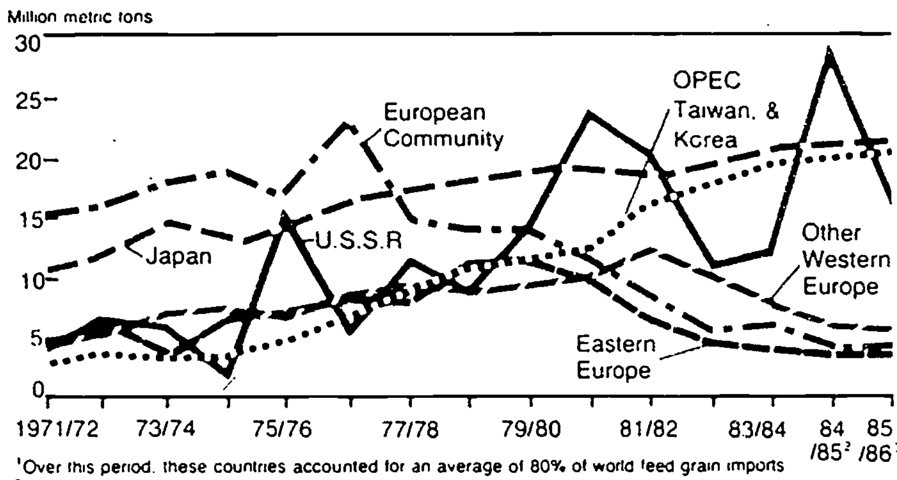
TRANSPARENCY MASTER #12

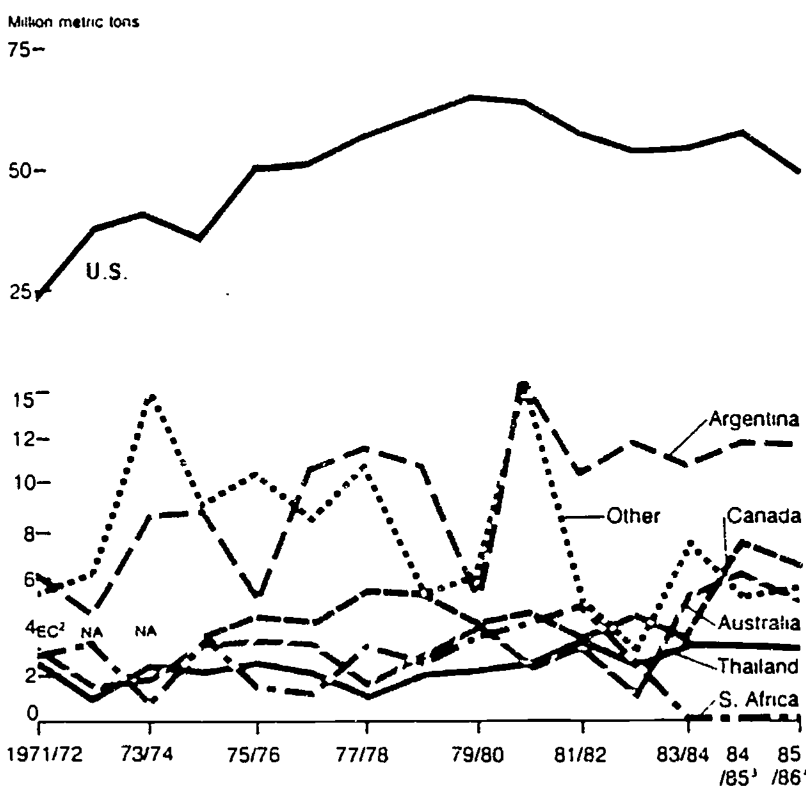
Major Feed Grain Importers and Exporters

Major Feed Grain Importers, 1971/72-1985/86[1]



[1]Over this period, these countries accounted for an average of 80% of world feed grain imports
[2]Preliminary
[3]Forecast

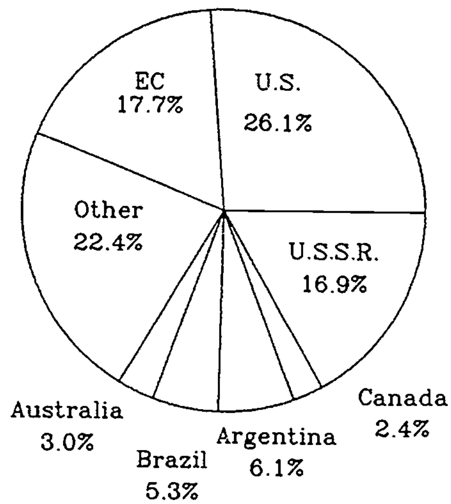
Major Competitor Exports, 1971/72-1985/86[1]

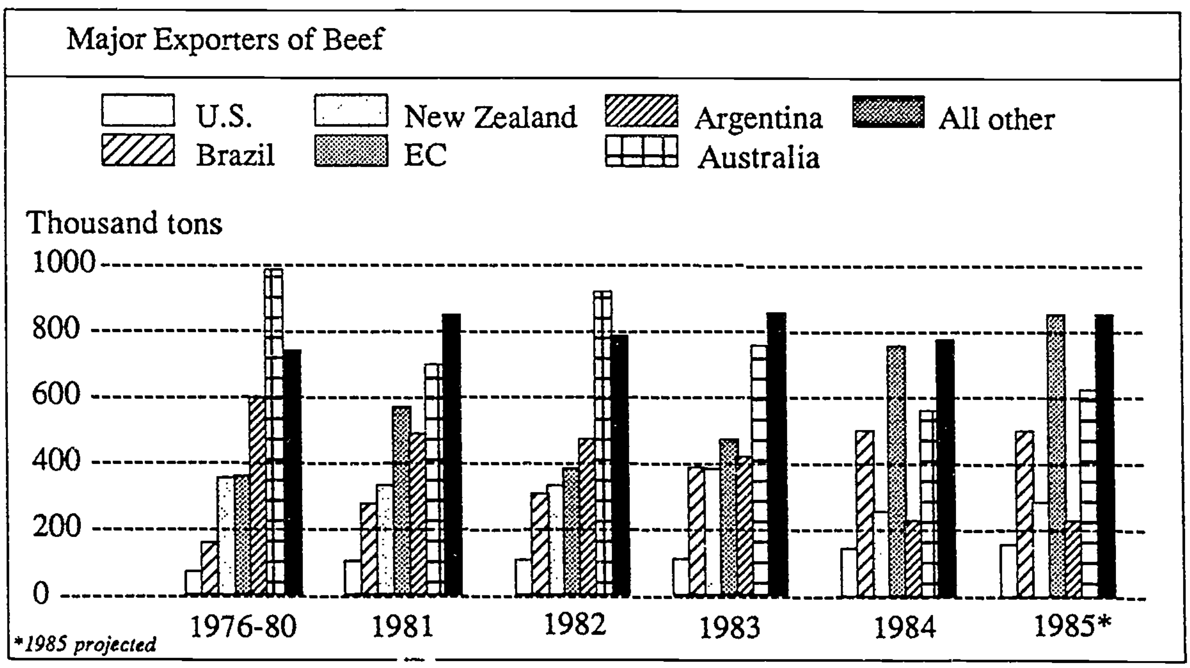


NA = Not Available
[1]Based on Oct./Sept. Marketing Year
[2]Excludes Intra-EC Trade
[3]Preliminary
[4]Forecast

TRANSPARENCY MASTER #13

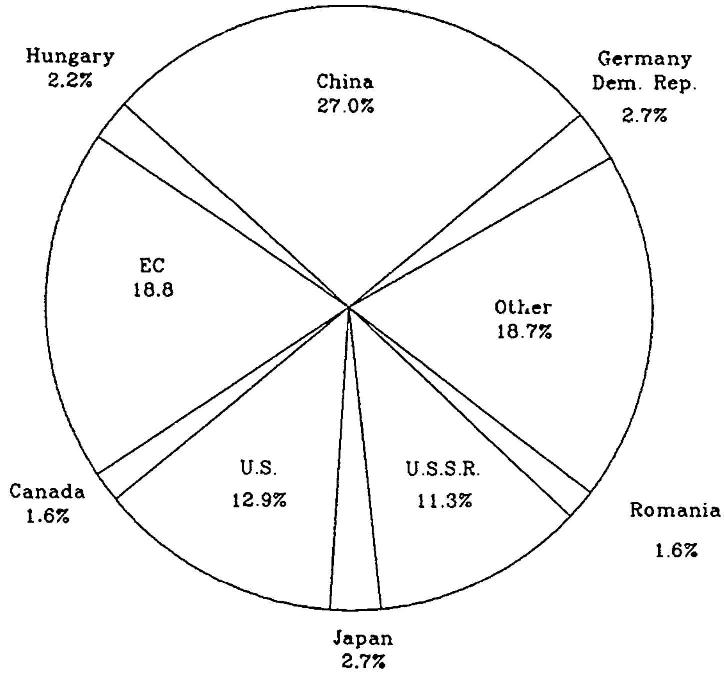
Global Beef Production and Exports



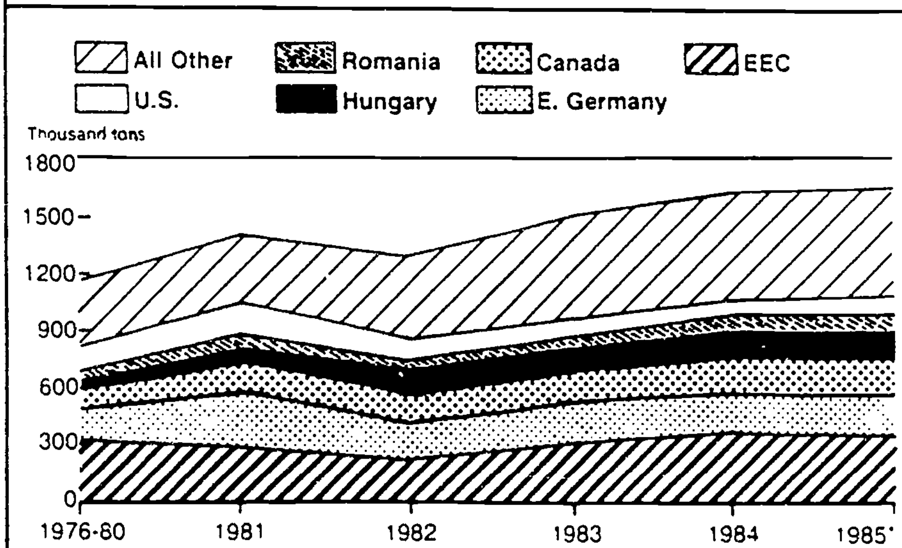


TRANSPARENCY MASTER #14

Global Pork Production and Exports



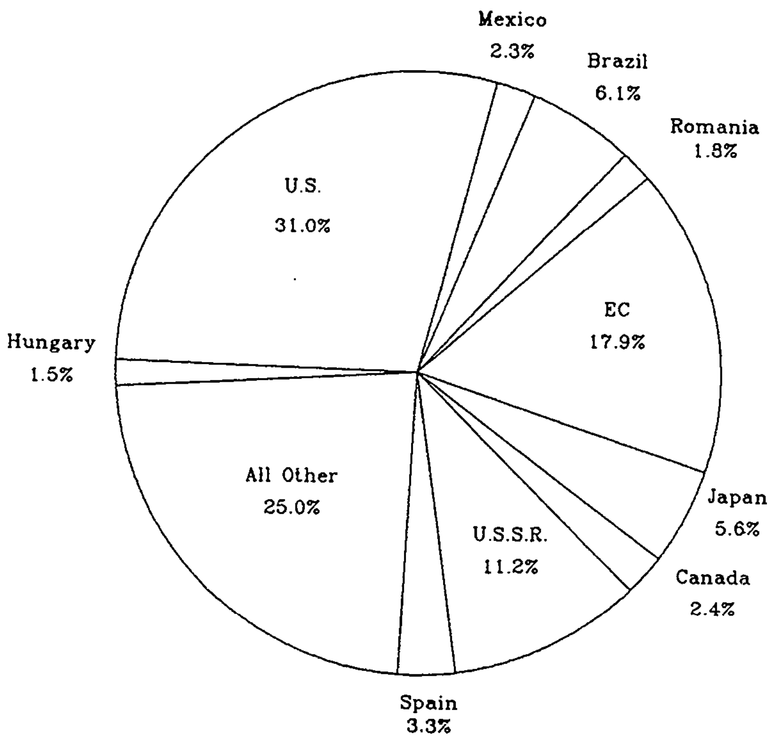
Global Exports of Pork, 1976-80 and 1981-85

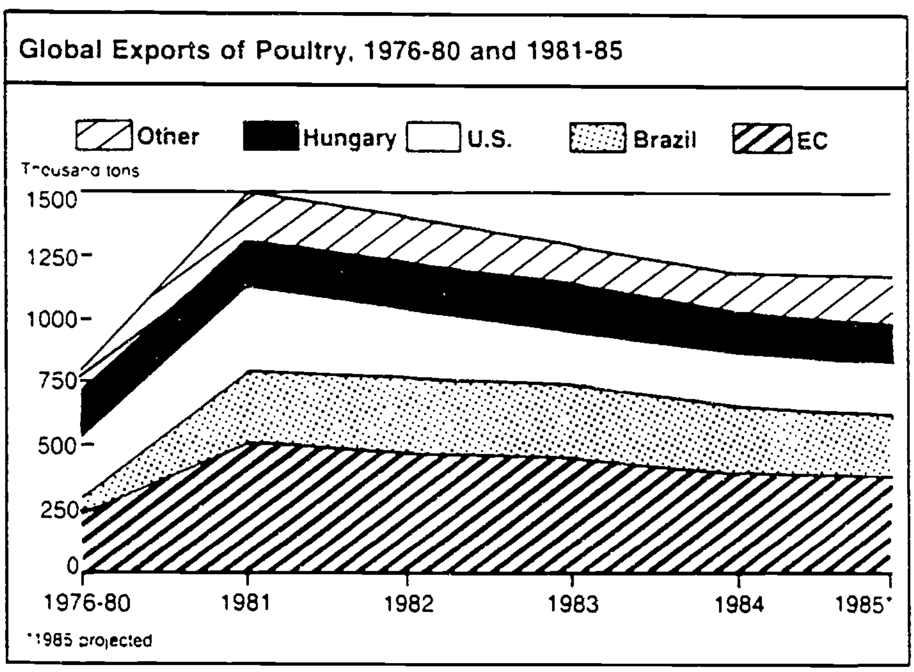


*1985 projected

TRANSPARENCY MASTER #15

Global Poultry Production and Exports

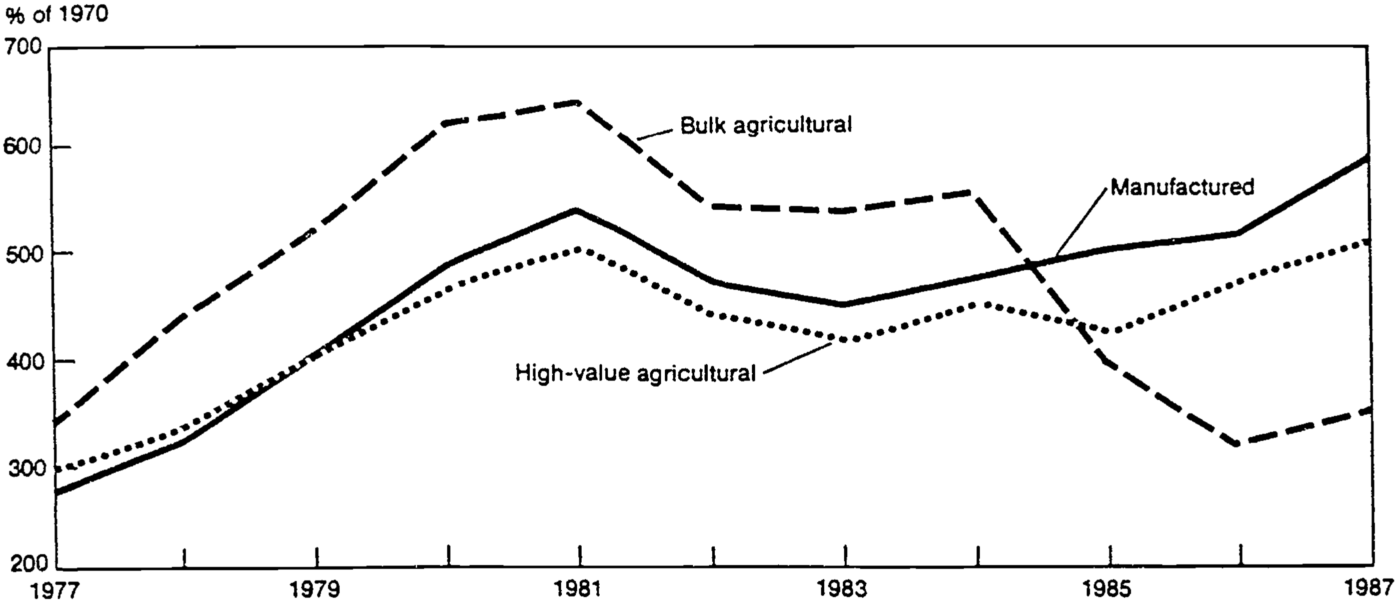




TRANSPARENCY MASTER #16

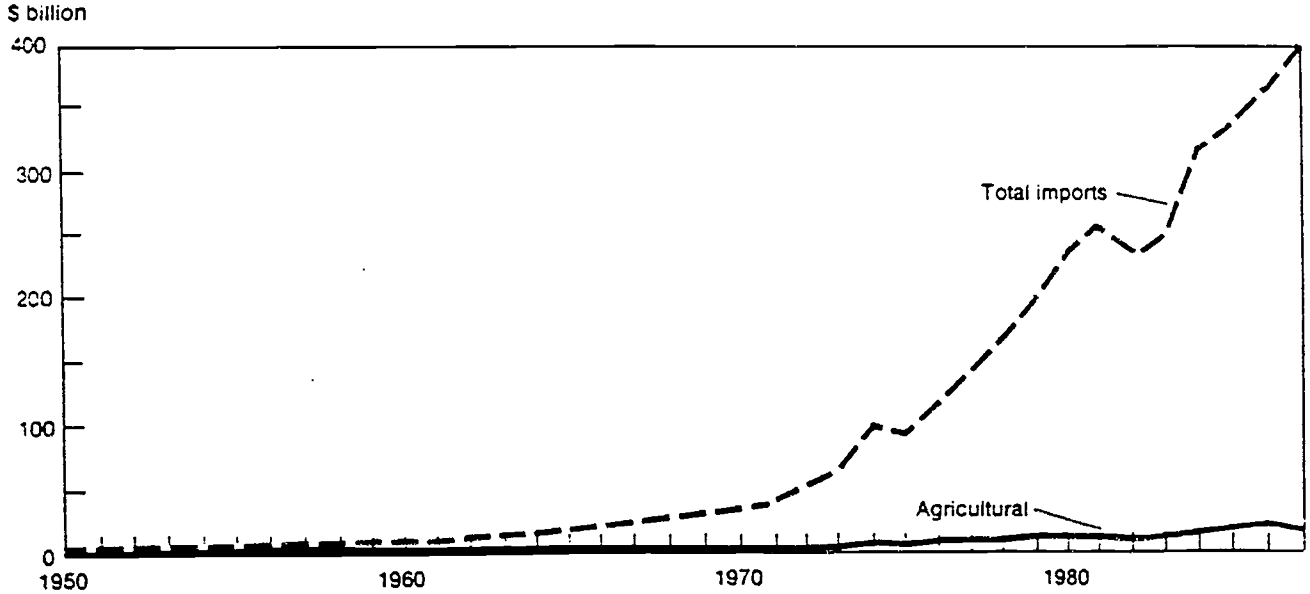
U.S. Agricultural Exports and Imports

High-value and bulk exports reverse roles in the 1980's[1]



[1]Agricultural export indices are derived from value data from the United Nations' Food and Agriculture Organization (FAO). Manufactured export data are derived from U.S. Department of Commerce value data.

U.S. imports, 1950-87[1]



[1]Calendar years.

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #1

Use this transparency in conjunction with discussions on why certain areas have a food deficit while others do not.

Transparency Master #2

Lead students in a discussion of why certain areas have larger population growths than other areas.

Transparency Master #3

Lead students in a discussion of why natural fibers make up less and less of the total cloth used.

Transparency Master #4

A. Lead students in a discussion of reasons for differences in land uses.
B. Use a relief globe to facilitate understanding the different regions.

Transparency Master #5

Lead students in a discussion of possible reasons why wheat occupies more acreage than all others. Ask students why the other crops are in the order they are.

Transparency Master #6

A. Lead students in a discussion of reasons for different consumption levels of grain in different areas.
B. Point out the categories of direct consumption and grain for conversion.

Transparency Masters #7 and #8

A. Lead students in a discussion of why different areas have different levels of not only total food consumption but also meat consumption.
B. Refer back to Transparency Masters #1 - #6 for reemphasis.

Transparency Master #9

A. Lead students through a discussion of reasons why certain areas are importers or exporters of a particular commodity.
B. Emphasize the difference between a country being a major producer of a commodity and an importer or exporter of a commodity. Point out that Russia is a major producer of wheat as well as a major importer.

Transparency Masters #10 — #16

Use these transparencies to supplement discussion of Transparency Master #9 and also to further amplify the information sheets.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Study Guide

STUDENT WORKSHEET #2 — Survey of Products

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Study Guide

1. What is the food and fiber chain?
2. What factors are encompassed in the chain?
3. What problem compounds the challenge to feed the world?
4. How does this problem affect food consumption?
5. What areas have the highest percent increase in population?
6. How much of the world's population is considered undernourished?
7. How is diet deficiency defined?
8. What amounts of grain are consumed in the U.S. vs. Japan or Mexico.
9. How much of the population of the world can't afford to purchase meat?
10. What are some natural resources that affect food and fiber availability?
11. What are the most commonly grown crops in the world?
12. Does the U.S. lead the world in grain production?
13. Does the U.S. lead in producing all grains grown?
14. Does the U.S. have the highest yields of rice, wheat, and corn?
15. What food nutrient is most lacking?
16. What products provide protein in most areas of the world?
17. What country provides most of the world's soybeans?
18. What governmental policies affect agricultural producers in some developing countries?

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STUDENT WORKSHEET #1 — Key

Study Guide

1. What is the food and fiber chain? *The system in which plant and animal products are converted to food and fiber products.*

2. What factors are encompassed in the chain?
   a. *What commodity is produced?*
   b. *Where is a particular commodity produced?*
   c. *What can be produced from the commodity?*
   d. *Where is the commodity or product consumed?*

3. What problem compounds the challenge to feed the world? *The continuing rise in population.*

4. How does this problem affect food consumption? *Even though food production has increased significantly (up to 65%) in some areas, per capita food available has only gone up a small amount (7%).*

5. What areas have the highest percent increase in population?
   a. *Africa (2.9%)*
   b. *Latin America (2.6%)*
   c. *Asia (1.8%)*
   d. *compared to Europe (.4%)*
   e. *USA (.7%)*

6. How much of the world's population is considered undernourished? *Up to 25%.*

7. How is diet deficiency defined? *In terms of grain consumption.*

8. What amounts of grain are consumed in the U.S. vs. Japan or Mexico. *1600 pounds vs 400 pounds.*

9. How much of the population of the world can't afford to purchase meat? *80%.*

10. What are some natural resources that affect food and fiber availability?
    a. *Amount of land that can be cultivated (45% of 7 billion acres)*
    b. *Availability of water (39% of water available can be consumed; irrigation required)*
    c. *Other environmental effects (temperature, pests, etc.)*
    d. *Energy consumed in production*
    e. *Availability of inputs (fertilizer, chemicals, technology, seed types)*

11. What are the most commonly grown crops in the world? *Cereal grains, wheat, and rice are most used around the world.*

12. Does the U.S. lead the world in grain production? *Yes.*

13. Does the U.S. lead in producing all grains grown? *No, corn (U.S.), rice (China), wheat (U.S.S.R.).*

14. Does the U.S. have the highest yields of rice, wheat, and corn? *No, rice (Japan), wheat (Netherlands), corn (New Zealand).*

15. What food nutrient is most lacking? *Protein.*

16. What products provide protein in most areas of the world? *Soybeans, other beans (pulses).*

17. What country provides most of the world's soybeans? *USA, approximately 66% of total.*

18. What governmental policies affect agricultural producers in some developing countries?
    a. Subsidizing the cost of food for large urban populations by maintaining low producer prices.
    b. Low producer prices prevent cash availability for inputs such as fertilizer, chemicals, and seed when these inputs are available.

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STUDENT WORKSHEET #2

Survey of Products

Availability of item ________________________________

Business name ________________________________

Address ________________________________

Business type ________________________________

Name of item ________________________________

Brand name sold under ________________________________

Company making item ________________________________

Imported or domestic ________________________________

If domestic, state where made ________________________________

If imported, country where made ________________________________

If imported, is there a domestic substitute ________________________________

Name of substitute ________________________________

Components found in item ________________________________

Item's uses ________________________________

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Research and Development in Agriculture

RELATED PROBLEM AREAS:

1. Understanding Food Science Technology
2. Recognizing the Impact of Technology on Agriculture: Biotechnology
3. Recognizing the Impact of Technology on Agriculture: Electronics
4. Identifying Alternative Crop Production Systems (Agricultural Business Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences and Language Arts. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

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CORE

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:					
*1. Evaluate data collected by scientists and others to demonstrate changes in the atmosphere. *2. Identify future vocations in science.					
*3. Recognize contributions to science and technology of men and women of various ethnic groups. *4. Compare and contrast the quality of life 100 years ago with our current lifestyle.					
*5. Understand the use of the scientific method in consumer decision making. *6. Use the scientific method to formulate an opinion on an environmental issue.					
*7. Predict the consequences of technological change.					
*8. Identify situations in which moral and ethical beliefs have affected the application of science.					
*9. Analyze the impact of the accumulation of scientific and technological knowledge.					
*10. Defend a position based upon research focused on a societal problem.					

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ISBE 41-78 (1/86)

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Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)
COUNTY ____ DISTRICT ____ ESC ____
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the process, techniques, methods, equipment, and available technology of science.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Replicate the results of an experiment.					
*2. Recognize that their experimental results must be open to the scouting of others.					
*3. Recognize the differences between methods used by scientists and the process by which myths and superstitions develop.					
*4. Relate data that reflects the accuracy of measuring devices.					
*5. Demonstrate the ability to draw conclusions from collected data.					
*6. Demonstrate various ways to display the same data.					
207					208

ISBE 41-76 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ____ DISTRICT ____ ESC ____
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the process, technologies, methods, equipment, and available technology of science.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Apply quantitative observational methods to accumulate and process data.					
*2. Evaluate and revise an inference based upon additional data.					
*3. Revise a prediction on the basis of additional information.					
*4. Analyze the results of an experiment.					
*5. Evaluate the interpretation of data collected during an experiment.					
209					210

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______

☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to write standard English in a grammatical, well-organized and coherent manner for a variety of purposes.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:					
*1. Focus clearly upon one central idea or event when writing.					
*2. Use information from other sources when writing.					
*3. Use descriptive details, reasons for an opinion, concrete examples of solutions to a problem, and/or an authority's viewpoint to support the main idea.					
*4. Revise, edit, and proofread documents.					
211					212

ISBE 41-78 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________
☐ Original submission ☐ Revision   Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Expand or limit a topic for an oral presentation to meet time, setting, and audience needs.					
*2. Phrase a problem and follow an agenda for a discussion.					
*3. Recognize fallacies in an argument.					
*4. Use and credit sources appropriately.					
*5. Organize a persuasive oral message.					
					214
213					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Research and Development in Agriculture

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Describe how agricultural research benefits society.
2. Develop an understanding of the scientific method.
3. Develop an understanding of research being conducted in plant and soil sciences.
4. Develop an understanding of research being conducted in animal and veterinary sciences.
5. Develop an understanding of research being conducted in the social sciences.
6. Develop an understanding of research being conducted in the engineering sciences.
7. Select and conduct a research project using the scientific method.
8. Prepare a research paper which reports the results of a research project.
9. Analyze existing agricultural research for decision making.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Research and Development in Agriculture

PROBLEMS AND QUESTIONS FOR STUDY

1. What is research?
2. What are some basic areas where research is being conducted?
3. Who benefits from agricultural research?
4. What is/are some of the method(s) of research?
5. What research is being conducted in plant and soil science?
6. What research is being conducted in animal and veterinary sciences?
7. What research is being conducted in the social sciences?
8. What research is being conducted in the engineering sciences?
9. How can one use existing research?
10. How can one conduct my own research project?
11. How does one prepare a research report?
12. Where can one find and read about existing research studies?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Research and Development in Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES	INSTRUCTOR'S NOTES AND REFERENCES

1. Define research.

2. Discuss basic techniques of research with the class. Develop the techniques or steps on the chalkboard.

3. Explain to the class different types of research being conducted in agriculture.

4. Ask students "What is the scientific method?" Discuss the steps of scientific method.

5. Have students read and discuss the information presented in VES 8354.

6. Discuss with students some recent research results which have affected their lives.

7. Discuss the principles and methods of research which can be conducted by the local agricultural program.

8. Have students read and discuss the information in VES 8355.

9. Take a class trip to an agribusiness which is involved in research. Have an employee discuss the processes used and products that they are researching.

10. Have students conduct a science laboratory experiment on an approved topic. Refer to Student Worksheet #1 and prepare research paper. Refer to Information Sheet #6 as a guide.

11. Discuss with students the results and conclusions of their experiment.

12. Discuss with students the application of possible future research which needs to be conducted in agriculture.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Role of Research and Development in Agriculture

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *The Science Workbook of Student Research Projects in Food-Agriculture-Natural Resources.* (1985). College of Agriculture, The Ohio State University, 2120 Fyffe Road, Columbus, OH 43210. (614) 422-1734.

*2. *Experiments in Food Science.* The Institute of Food Technologists, 221 N. LaSalle Street, Chicago, IL 60601. (312) 782-8424.

3. *Illinois Research,* Office of Agricultural Communications and Education, Agricultural Experiment Station, College of Agriculture, University of Illinois, 47 Mumford Hall, 1301 West Gregory Drive, Urbana, IL 61801. (217) 333-2548.

*4. *Key Developments Shaping Modern World Agriculture (8354); Key Developments Shaping United States Agriculture (8355).* Instructional Materials Service, Texas A & M University, F.E. 2588, College Station, TX 77843.

*5. *1986 Yearbook of Agriculture, Research for Tomorrow.* United States Department of Agriculture, Washington, D.C. 20250.

6. *1988 Fact Book of Agriculture,* Office of Governmental and Public Affairs, USDA, Washington, D.C. 20250.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Plant and Soil Sciences

INFORMATION SHEET #2 — Animal and Veterinary Sciences

INFORMATION SHEET #3 — The Social Sciences

INFORMATION SHEET #4 — The Engineering Sciences

INFORMATION SHEET #5 — Research Priorities

INFORMATION SHEET #6 — Sample Research Paper

TRANSPARENCY MASTER #1 — Plant and Soil Science

TRANSPARENCY MASTER #2 — Animal and Veterinary Sciences

TRANSPARENCY MASTER #3 — The Social Sciences

TRANSPARENCY MASTER #4 — The Engineering Sciences

TRANSPARENCY MASTER #5 — Scientific Method of Research

TRANSPARENCY MASTER #6 — Some Benefits of Agricultural Research

TRANSPARENCY MASTER #7 — Agricultural Research Service Priorities

TRANSPARENCY MASTER #8 — Some Methods Used to Disseminate Research Findings

TRANSPARENCY MASTER #9 — Some Sources of Research Results

TRANSPARENCY MASTER #10 — A Quality Science Project

TRANSPARENCY MASTER #11 — Science Project Activities

TRANSPARENCY MASTER #12 — Research Paper

ERIC

INFORMATION SHEET #1

Plant and Soil Sciences

Robert W. Howell and Russel T. Odell

Plant and soil sciences have been a part of the agricultural program since the earliest days of the University of Illinois. Research has focused on the characteristics and fertility of the soil and on the important crops of Illinois — corn, soybeans, small grains, forages, fruits, ornamentals, vegetables, and trees — and on the weeds, diseases, pests, and environmental hazards that confront them.

Manly Miles, a physician who had left medicine to join the faculty of Michigan Agricultural College, served as a non-resident professor of agriculture at the University of Illinois in the early 1870s. In 1875, he was appointed professor of agriculture. During his one-year stay, he established a series of plots to study the effects of different cropping systems on yields. These plots were later named the "Morrow Plots" in honor of George E. Morrow, a lawyer by training and a well-known writer and speaker on agricultural subjects who was employed as a professor of agriculture after Miles left. Morrow was the first to hold the title of Dean of Agriculture. In 1879, he expanded Mile's cropping system experiment. In 1904, 1955, and 1967, different soil treatments were added to study the interactions between cropping systems and soil treatments. The Morrow Plots, a National Historical Landmark, continue in operation just north of Mumford Hall.

Tree Adaptation and Woodland Management

Tree species adaptation and woodland management have been important areas of research at field locations throughout Illinois. Over 700 windbreak demonstrations have been developed by Extension foresters in cooperation with farmers on private land.

Emphasis has also been given to methods of treating wood fence posts and crossties with preservative chemicals. Tests were conducted in cooperation with the College of Veterinary Medicine and private industry to determine the effects of wood preservatives on farm animals.

Corn and Soybean Breeding

In the 1880s, McCluer and Hunt observed that self-pollinating reduced vigor, probably influencing corn breeders for many years. In 1896, an experiment on selection for oil and protein in Burr White open-pollinated corn was initiated by Cyril G. Hopkins. The 88th cycle was grown in 1987. Protein has increased by selection to 32 percent, and oil to 21 percent. Conversely, selection for low protein and oil has decreased these components to 5 and 0.5 percent, illustrating the extensive variability in corn. Nondestructive analysis for corn content in seeds by nuclear magnetic resonance was pioneered in the Illinois Station.

The Crop Evolution Laboratory, established in 1967, has been the principal group studying the evolution of crop plants, especially cereals, and concomitant development of the relationship between cultivated crops and civilization.

Soil Testing

In 1937, Roger H. Bray and colleagues established the identification, composition, and structure of Illite, one of the most common potassium-bearing clay minerals. Further research determined the different forms of potassium in soils and led to the development of a quick test for the amount of soil potassium that is readily available to plants. Bray and his associates also developed methods for determining total, organic, and available forms of phosphorous in soils. One of these methods, the Bray P-1 test for adsorbed phosphorus, has gained general acceptance as the guide for the use of phosphate fertilizer on acid and neutral soils in humid areas of the United States and many other countries. Testing for soil acidity and for available phosphorus and potassium became widespread after 1940, when soil-testing laboratories were established throughout Illinois.

Soil Surveys

When Hopkins became head of the Department of Agronomy in 1900, he initiated a statewide program that included a comprehensive survey of Illinois soils, chemical analysis of different kinds of soils, and experiment fields strategically located throughout the state. Gradually, the Soil Conservation Service (SCS) assumed major responsibility for soil mapping and the publication of soil survey reports. Classic research has been done on nitric soils and soils developed in loess and till, which are the most extensive soil parent materials in Illinois. Studies of soil productivity and the rooting pattern of crops are widely used in appraising and managing soils.

Russell S. Stauffer and associates measured the infiltration capacity of different kinds of soil in the field and the disposition of natural precipitation on eight important soils. They also measured the effects of contour farming on soil loss, runoff, and crop yields for sloping soils in Urbana and Dixon Springs to help develop effective erosion-control practices.

Soil Nitrogen

Nitrogen is important for plant growth, but it creates environmental problems when it occurs in excess amounts or at improper places. During the last 30 years, it has been demonstrated that soil organic matter is composed of compounds with chemically acceptable structures having recognizable groupings, bonds, and predictable properties and reactions. This knowledge of soil organic matter helps to understand the fate of residual fertilizer nitrogen and its reactions with herbicides. It has also been found that much of the nitrogen in sediments and sedimentary rock occurs as ammonium held within the lattice structure of silicate minerals. Sedimentary rock, not the atmosphere as previously assumed, is the largest reservoir of nitrogen in the universe.

Solving Insect Problems

Work in agricultural entomology has focused on finding practical solutions to numerous insect problems, such as the coding moth, Colorado potato beetle, army worms, grasshoppers, and chinch bugs. Except for limited biological and cultural methods, most insect infestations were controlled by arsenicals, Paris green, and other chemicals during the early years. DDT, aldrin, dieldrin, and other chlorinated hydrocarbons — followed by organophosphate and carbamate insecticides — began to be widely used in the late 1940's. DDT residues in soils, plants, animal tissues, and milk and their effects on non-target species soon alarmed scientists in the Illinois Nautral History Survey (NHS) and other groups. The Illinois NHS was among the earliest to conduct research on the hazards of DDT and the new chemical insecticides. In the 1950s, Illinois entomologists began recommending that chlorinated hydrocarbons not be used on livestock and some feed and food crops. The U.S. Environmental Protection Agency later banned these insecticides.

Since the 1970s, a comprehensive system of integrated pest management has been developed that includes careful monitoring of the density of injurious insects and the judicious use of pesticides when necessary.

Plant Physiology Programs

The Illinois Agricultural Experiment Station (AES) was a leader in the development of strong plant physiology programs in several departments. Research on physiological developments of work in biotechnology/ genetic engineering began in the Illinois Station at least two decades ago but was greatly stimulated by funding from venture capital and traditional sources beginning about 1980.

Environmental concerns have been an important part of our research program for many years. For example, nitrogen losses and soil and water losses from sloping land have been studied for 50 years to develop better soil management practices. During recent years, many exotic materials have been introduced into plant and soil systems to control weeds, insects, and diseases. Although the effects of these materials on target species are usually known, their effects on non-target species and their rates of degradation in soil are often less well known.

Adapted from Illinois Research, Agricultural Experiment Station, College of Agriculture, University of Illinois at Urbana-Champaign, Vol 29, No# 4 and Vol 30, No# 1.

INFORMATION SHEET #2

Animal and Veterinary Sciences

Richard M. Forbes and W. Reginald Gomes

Research in Livestock Management

Early work dealt with problems important for the state: animal power, milk production, and quality of meat production. Because horses were the major source of power on Illinois farms, the Department provided information to make the best use of four-, six-, and eight-horse teams, using horse-pulling contests to demonstrate their effectiveness. Similarly, demonstrations of increased income from increased milk production per cow were conducted.

Early AES work described market classes and grades of cattle to facilitate the economical production of beef of high quality. Subsequently, classes and grades of swine, horses and mules, sheep, and meat were described.

Studies of deaths among young pigs led to improved management methods and to the development of the McLean County System of Swine Sanitation. Experiments in drylot feeding were successful in reducing labor costs and in providing more effective disease control. Confinement raising of swine, which later became the norm of the industry, was made possible by research at the University with pigs kept on slotted floors and maintained by various procedures for limiting feed consumption.

Over the years, the influence of Illinois research on dairy management has been extensive, from the introduction in 1905 of the round barn — some are still standing today — to the Dairy Automation Unit, which is the most highly automated, computer-oriented dairy farm in the nation. Also developed at Illinois were computer-driven electronic feeders and in-line automated detectors for mastitis.

Nutrition and Feeding

Early research reports on the marketing of grain and forage through livestock and animal products emphasized improving carcass quality and the rate of meat and milk production to maximize rates of return to the farmers. The concept of fat-corrected milk (FCM) was developed to recognize that fat content is the major variable influencing the energy value of milk.

Early feeding studies involved tests of feeds and mixtures of feeds and determined the economic value of carrying market animals to different degrees of finish.

Understanding the results of these feeding trials required more knowledge of the chemical nature of the feeds and of the amounts required by livestock. The lengthy series of studies on protein requirements of cattle, sheep, swine, and poultry conducted on the University of Illinois campus have now made it possible to devise rations of optimum nutritional quality. Application of these principles has been of immense value, for example, in designing the supplements needed to maximize the efficiency with which swine and poultry can grow and reproduce when fed corn-soy rations. These basic principles of animal nutrition have enabled researchers to understand, detect, and correct nutrient deficiencies.

Two other important contributions to feeding research made by Illinois researchers are the use of antibiotics in farm animal rations to increase the weight gain of growing animals and the implantation of hormones for the same purpose. These techniques have been of great economic value to both the grower and consumer.

Rumen Microbiology

Cattle and sheep depend on a very complex mixture of microbes in the rumen to digest their feed. New species of bacteria have been isolated that attack specific rumen constituents, such as fatty acids or benzoate and phenol derivatives. Other species produce acetate and butyrate from methane, hydrogen-carbon dioxide, carbon monoxide, or other simple compounds.

Nutritional Biochemistry

Basic studies in the chemistry of nutrients included research on the products of metabolism of vitamins and the effects of vitamin and mineral deficiencies on the pathways of fat, protein, and carbohydrate metabolism. Characterization of pathways and sites of lipid metabolism peculiar to the lactating ruminant has been an important contribution.

Animal Breeding and Genetics

In the early years of animal research at the Illinois AES, great emphasis was placed on animal evaluation and judging. Although subjective analyses of animal form is still practiced, research workers have consistently sought objective measures of animal performance for selecting superior seedstock. The first demonstration of the equal importance of sires, compared with dams resulted in the 1924 equal parent index, which subsequently became the basis for sire selection everywhere.

Illinois scientists were at the forefront of studies on the heterosis (hybrid vigor) gained by crossbreeding cattle and on the inheritance of milk yield, milk composition, and other traits. More recent studies have been initiated to investigate the genetic selection on the response of animals to exogenous hormones.

For many years, Illinois scientists have studied blood group antigens and their relationship to economically important traits. By evaluating genetic patterns of these groups, accurate predictions can be made of the susceptibility of animals to porcine stress syndrome, bovine leucosis, and other conditions. With the advent of improved computer technology to study the large amount of information involved, blood typing may be a useful tool in early selection of breeding stock.

Animal Physiology

Reproductive Physiology:

Classic work by AES animal scientists has been conducted on the morphology, physiology, and biochemistry of spermatozoa, on the preservation of sperm, and on artificial insemination of cattle. Recent work involves the mechanisms of fertilization and the culture, manipulation, and transfer of embryos. In the endocrinology of reproductive processes in birds and mammals, Illinois researchers have been instrumental in understanding the control of ovulation, corpus luteum formation, and the onset and termination of pregnancy; the control of the laying process in chickens and the factors influencing molt; and processes for the improvement of reproduction in farm animals.

Environmental Physiology:

The relationships between animals and their environment, so important to animal health and welfare and to livestock production, have been extensively studied in Illinois. Along with the influences of management practices that might stress animal performance, the effects on animals of temperature, photoperiod, and air quality (airborne dust, ammonia, and bacteria) have been analyzed. High temperatures have been shown to influence the number and vitality of lambs, pregnancy rate in cattle, and eggshell thickness and broiler weight gain in chickens. Novel approaches to minimizing the deleterious effects of heat on animal performance have included adding carbon dioxide to the drinking water of sheep and chickens and cooling the roosts where birds sleep.

Animal Behavior:

Studies on animal behavior have improved our understanding of animals and their ability to adapt to changing environments. Recent studies have investigated visual, auditory, and social influences on the feeding behavior of pigs and the effects of the environment on social dominance in pregnant animals and on social conflict in growing pigs. Research has aided our understanding of mothering behavior in sheep and its influence on cross-fostering. In studies of temperature preferences in growing animals, researchers have found that young pigs can learn to adjust their environmental temperature by operating a switch to activate room heaters.

Horses and Companion Animals

With the onset of machine power, the role of horses changed dramatically. Horses, dogs, and cats now serve humanity as sources of companionship and pleasure. The need for research on animal health and performance, however, remains.

Recent studies in horse nutrition and physiology have included estimating the energy requirement for lactation and energy cost of exercise. One study has revealed that the accumulation of lactic acid in the blood after exercise lessens as conditioning increases. The speed of galloping in quarter horses has been shown to be altered by changing the velocity of stride, not the length of stride, as in thoroughbreds.

Nutrition of dogs and cats has been a relatively recent subject of research, emphasizing requirements for protein, amino acid, and mineral elements. This work has been valuable in demonstrating interspecies variation as a part of a broad interest in the animal sciences in comparative nutrition.

Meat Science and Muscle Biology

More recent research has involved studies of muscle biochemistry, of growth models, focusing on endocrine factors and other agents that repartition nutrients from fat tissues to muscle, and of the molecular biology of muscle and adipose tissues. Meat science research has involved the preparation of new products and new processing methods.

Veterinary Research

Research in veterinary medicine has traditionally focused on diseases of major economic importance to the livestock and poultry industries. Initially, special emphasis was on preventative medicine programs for dairy cattle and swine and on studies of absorption, tissue distribution, and excretion of drugs used in these species. Later studies have emphasized identifying cause of disease, studying pathogenesis, and formulating and evaluating control measures.

The growing need for enlarging interdisciplinary studies to include biotechnological exploration with relevance to recognition, diagnosis, prevention, and control of disease has been recognized. In the future, metabolic processes, genetic engineering, immunology, and herd health improvement will also be studied.

Adapted from Illinois Research, Agricultural Experiment Station, College of Agriculture, University of Illinois at Urbana-Champaign, Vol 29, No# 4 and Vol 30, No# 1.

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INFORMATION SHEET #3

The Social Sciences

Harvey J. Schweitzer and Chester B. Baker

Marketing and Farm Management

The first economic studies by faculty were done in marketing and in farm management. Both remain significant areas of research today. Research in marketing has aimed to improve decision making by farmers, marketing firms, and public policymakers.

The Research and Marketing Act of 1964 gave impetus to research by providing federal funding for several years for both research and service work on all aspects of marketing, processing, and distribution of agricultural products. Whereas research on some farm commodities has declined, mirroring the decline in the number of these enterprises in the state, grain marketing — particularly the quality aspects of grain in the marketplace — has received increased emphasis. Major contributions have been made to the design of grades and standards that improve marketing efficiency and quality management of farm commodities after harvest.

Rural development

From the earliest days of the Department, rural sociologists gathered demographic and other social data to help rural people improve their community institutions and organizations.

The Rural Development Act of 1972 provided modest allocations for both research and extension work in rural development. Rural sociologists and agricultural economists became involved in studies on rural transportation, local government, and leadership development. These special funds were later folded into regular Hatch and Smith-Lever (Extension) appropriations, but research continues on many socio-economic aspects of farming and rural communities.

Financial Management

Problems in financial management have received much attention in the Department of Agricultural Economics. Studies on investment and capital accumulation and credit in the 1950s and 1960s reflected unprecedented economic growth for farm firms in these decades. In the 1970s and early 1980s, the emphasis of research shifted to cash, credit, and debt aspects of risk management. Financial management has been integrated with production, marketing, and household management. Farmers and financial institutions have benefited from research and extension programs in agricultural finance. International and capital markets are becoming increasingly important for agriculture, and the macro-economic aspects of agriculture are increasingly emphasized.

The Economics of Natural Resources

Another growing area of research is the economics of natural resources. Studies of our valuable land base have been dominant; and land tenure, markets, and taxation have been stressed for many years in the Department. Recent policies on control of soil erosion, water quality, fertilizer use, and other environmental concerns involving agricultural practices and policies are subjects of study and analysis.

Agricultural and Food Policy

Research on agricultural and food policy has come to rely heavily on the development of models for predicting the effects of policy alternatives on the farm sector. Values, goals, and politics, as well as economic factors, are parts of this analysis. These studies and models are expanding to include international developments and trade. Studies of farmer's views on agricultural and food policy have been undertaken both here and abroad. Rural sociologists and agricultural economists have studied new technologies in developing countries, providing technical assistance in studies of production systems and of commodity and financial markets.

New Tools and Techniques

In the past quarter century, departmental social scientists have developed and adapted new and improved research tools and techniques, including econometric and sociometric methods for estimating production and cost and demand relationships; for identifying the incidences and effects of structural changes in the farm and rural nonfarm sector; and for price forecasting. Policies have contributed significantly to the development and understanding of current farm legislation. Increasingly emphasized is the public finance sector. Studies on property taxes and the ability of local governments to provide needed services are changing Illinois policies for assessing property.

Agricultural Law

Early work in agricultural law focused on teaching and public service. By the 1970s, however, it became apparent that research must become a significant part of the program. Extension work in water and drainage law led to major revisions of the Illinois Drainage Code. Animal and veterinary law and the legal bases for rural universities in developing countries have been researched. Recently land use, environmental issues, protection of farmland, and taxation have been studied in greater depth.

International Agriculture

Closely linked to developments in international agriculture has been the involvement, by College and Department social scientists, in institutional development and the research topics of graduates allied with Extension programs. Although the major divisions of work have remained essentially the same, research priorities have changed, specialization among staff has occurred, and new research tools and techniques have been used. Areas of socio-economic research are highly complementary. For example, research in commercial agriculture contributes to models that improve public as well as private policy decisions. Research on the problems of rural communities and on natural resources improves the environment not only of commercial agriculture, but also of the general public.

Adapted from Illinois Research, Agricultural Experiment Station, College of Agriculture, University of Illinois at Urbana-Champaign, Vol 29, No# 4 and Vol 30, No# 1.

INFORMATION SHEET #4

The Engineering Sciences
Benjamin A. Jones, Jr., and Joseph Tobias

Food Sciences

Whether foods are natural or fabricated, their flow from producer to consumer must be safeguarded against deterioration in quality, safety, and nutritional properties. To provide these safeguards, we must understand the changes that occur during storage and processing. Storage applies both to raw materials, such as corn or animal carcasses, and to the processed products made from them, such as corn syrup and ham. Relatively simple in concept, processing usually becomes complex in execution.

Dairy Husbandry

Topics for early research on dairy products in Dairy Husbandry included: the bacteriology of paper milk containers, the source of bacteria in milk, use of paper containers for homogenized milk, oxidation and other off-flavors in milk, factors that influence the quality of ice cream, whipping cream by aeration, the structure of cheese by X-ray diffraction, and milk composition.

Animal Husbandry

The emphasis of current research in the Meats Division is on adapting new meat product technology; evaluating new repartitioning agents to produce leaner, more efficient meat animals; and basic studies on meat animal growth, especially muscle and fat tissue.

Household Science

More recent research in the Foods and Nutrition division of the School of Human Resources and Family Studies is on human milk and infant nutrition, the relation of iron nutriture to immunity, the interaction of exercise and diet in diabetes, the anticarcinogenic components of plants, and the interrelation of exercise and nutrition in muscle development.

Nutrition research continues to be conducted in Food Science, Animal Sciences, the Medical Sciences, and several other administrative units. An interdepartmental Division of Nutritional Sciences has been created for teaching graduate nutrition courses and providing a unified base for nutritionists from diverse disciplines.

Food Manufactures

Significant work is this field has included studies on the survival of pathogenic bacteria in freezing, spoilage bacteria of the psychrophillic (cold-loving) type, time and temperature requirements for continuous pasteurization of ice cream, types of wrapping films used to protect meat quality, and food-poisoning staphylococci. Important research was also conducted on the bacterial injury caused by heat, hydrogen peroxide, freezing, low water activity, and the biochemistry of the "healing" process.

Biotechnology offers opportunities for developing new markets for commodities and agricultural by-products. Microbiologists have developed a continuous system for the fermentation of 2,3-butuleme glycol by *Bacillus polymyxa* from whey. Production of butyl alcohol from corn may become an economic reality. Genetic manipulation to incorporate a functional amylase (starch-hydrolyzing enzyme) and the culturing of the fermenting microorganism under butanol "pressure" to maximize butanol tolerance are being studied to solve this problem.

Food Chemistry

Knowledge of the chemistry and functionality of proteins is essential in product development and in understanding processing technology. Combined with current research, extensive past studies of milk, vegetable, and animal proteins should yield information leading to additional applications and improved quality, including "value-added" improvements in foods. Most recently, NMR techniques have enhanced our knowledge of the properties of proteins, starch, and bound water.

Fats, oils and other lipids — from either animal or vegetable sources — greatly influence flavor, texture, and consistency, as well as consumer acceptability of foods. These substances may be the origin of both desirable flavors and off-flavors in a great variety of foods. Studies involving the stability of oils in the presence of heat, oxygen, and enzyme attack have improved the quality and extended storage life of foods.

Significant contributions have been made in the analytical aspects of food chemistry: quantitative tests for the macroconstituents and microconstituents of foods and for drugs, pesticides, and other contaminants; procedures for separating subclasses and components of nutrients; and the identification of isolated components from foods.

Human Nutrition

Some findings in food chemistry raise nutritional questions: What are the nutritional properties of heated oils? What are the nutritional properties of proteins from processed foods? To answer these and other questions, nutritional studies in the Food Science Department have been concerned with the effect of processing on nutritional properties; dietary components and cancer; the bioavailability of some nutrients; dietary components and immunity; the behavior and metabolism of some nutrients including vitamins and minerals; and the relations of diet to heart disease. Chemists and technologists in the department have also addressed measures for negating the effect of antinutritional factors, such as the trypsin inhibitor and phytic acid in soybeans, peanuts, and other oilseeds.

Food Processing

Food technologists at Illinois have led in several developments. Their research on high-temperature processing of milk, cream, and ice cream laid the groundwork for aseptic processing of sterile or ultra-pasteurized fluid milk products and provided basic information on the binding of water and on heat-induced interactions among the constituents of milk. Another pioneering effort was the development and testing of a concept for thermally processed foods in plastic film packages. This work preceded commercial introduction of the process by some 15 years.

Studies of the technology for manufacturing or preserving a number of commodities were major efforts that helped some investigators become known as specific commodity experts. Research on cheese, ice cream, market milk, sweet corn, green lima beans, peanuts, and soybeans yielded both practical answers to questions and new insights into these complex food systems. Current research on the engineering and physical chemistry of food extrusion, on membrane technology in food and by-product processing, on bioreactors for utilizing agricultural by-products, and on the development of shelf-stable foods in the intermediate moisture range will be referred to as significant early contributions.

Agricultural Engineering

The easy problems have been solved. The future will require more than just more scientific expertise. It will require the efforts of research teams addressing complicated problems - like the current joint work of agricultural engineers and food scientists on food processing, agricultural waste management, and reducing harvesting and other damage to crops. Educated as interdisciplinarians, agricultural engineers and food scientists expect to make major contributions to the engineering and food sciences in the next century.

Adapted from Illinois Research, Agricultural Experiment Station, College of Agriculture, University of Illinois at Urbana-Champaign, Vol 29, No# 4 and Vol 30, No# 1.

INFORMATION SHEET #5

Research Priorities

Developing new and improved plant varieties. Scientists are identifying growth processes through the use of cell culture and are trying to improve plants and animals by genetic engineering. They are also using more conventional plant breeding and genetic techniques, and are developing new hormonal or regulator control of plant and animal growth.

Improving animal reproductive efficiency. Progress is being made toward improved reproductive efficiency of meat and dairy animals, including twinning and multiple births in cattle. Reproductive rates could increase 100 percent.

Increasing animal production efficiency. Scientists are investigating ways to make maximum use of livestock feedstuffs such as forages and concentrates. In addition, research to exploit gene transfer through the use of recombinant DNA molecules may increase the value of animals as food. Research on methods to prevent, control, or eliminate infectious diseases, internal parasites, and external parasites such as insects, ticks, and mites can significantly increase the efficiency of livestock production.

Plant germplasm use and preservation. Unique collections and repositories of information and materials, developed and maintained by ARS, are essential in meeting national research needs, and are heavily used by other public and private research organizations. They include facilities for plant germplasm introduction and preservation, clonal repositories, disease-free seed stock, the ARS Culture Collection, and taxonomic collections of plants, microbes, and insects. Germplasm variability is imperative if breeders are to develop new, unique, and productive crops for ensuring a stable, plentiful supply of food, feed, and fiber with desirable quality.

Removing barriers to crop productivity. Barriers to increased production of major domestic and export crops are being removed through the development of stress-tolerant varieties. Crop and soil management systems and weather data systems have been improved to facilitate agricultural decision making, and to use plant nutrients from fertilizers and organic materials more efficiently.

Conserving soil, water, and air. The goals of this research are to use water more efficiently in plants, control erosion, restore productivity to eroded soils, and prevent water pollution, ultimately resulting in better utilization and conservation of our natural resources.

Reducing effects of soil erosion on soil productivity. Wind and water are slowly eroding our fertile topsoil. As the topsoil is depleted, the ability of the remaining soil to grow crops is reduced. Scientists are working to determine the impact that soil erosion has on crop production in this country, and to develop ways to control erosion and restore productivity to eroded soils.

Controlling water quality. Agricultural practices may have an adverse effect on downstream water quality. To prevent this, scientists across the country are developing and testing economical farm management practices to control water pollution from agriculture.

Using energy efficiently. Scientists are developing systems to reduce the amount of energy used in agriculture. In addition to doing research on photosynthesis and nitrogen fixation, they are trying to increase fertilizer efficiency and find better methods for frying grain and curing peanuts and tobacco. Minimum tillage, irrigation efficiency, increased forage production, production of biomass for energy, and new uses for solar energy are all being studied.

Increasing plant and animal resistance to pests and environmental stresses. Both plants and animals are subject to severe losses in productivity through stresses imposed by pests and adverse environmental factors. Losses can be markedly decreased by using improved cultural and management systems and genetically superior, stress-tolerant varieties and breeds.

Developing new pest control technology. Even with today's sophisticated pest control technologies, more research is needed to reduce crop losses from insects and other pests. The role of insect migration in insect outbreaks is being studied along with the chemistry of host plant resistance to attack, animal host immunity to pests and diseases, insect pathogens for control of major insect pests, the fate of fungicides in plants and animals, the regulation of insect hormone systems, the use of behavioral chemicals to increase effectiveness of beneficial insects, the development of new technology to control weeds, and the incorporation of all these components into a system of integrated pest management.

Controlling animal losses from diseases, parasites, and toxicants. Diseases, internal and external parasites, and toxicants cause major losses of animals and are major contributors to low animal productivity. Research is needed to find new and improved methods of identifying losses, rapidly diagnosing recognized diseases, detecting unapparent carriers, and identifying new diseases. Recombinant DNA technology is expected to revolutionize the production of biological materials that are needed to prevent diseases or promote growth.

Increasing photosynthesis. Scientists estimate that an increase of only 1 percent in photosynthesis efficiency would be of great importance in meeting food production goals.

Improving the ability of plants to capture or "fix" nitrogen. Because all-out food production could result in a shortage of nitrogen fertilizer, scientists are working to find the best ways to use every pound of fertilizer and to improve the ability of certain plants to capture nitrogen from the air.

Improving nutritional quality in certain crops. High-yielding cereals, legumes, and vegetables are sometimes deficient in nutritional content — protein, vitamins, minerals, and fiber. Improved quality in feed grains would come close to eliminating the need for high protein supplements in animal feed rations, thus releasing protein for other uses. To provide a greater availability of vitamins and protein for the future, research will be valuable in increasing the nutritive content and improved blending of proteins of foods.

Reducing food losses. Food losses occur at every level of the food chain, from production to home preparation to export. Scientists are developing biological methods to prevent and control such losses without harm to the quality and safety of the products. Additionally, by lessening the perils of transportation and distribution to perishable commodities, research expands the marketing window for exports.

Producing more and better forage. Research on forage could lead to improving livestock production capabilities on more than 900 million acres of marginal lands. If vegetation can be increased by only threefold, this land will support more than twice the number of cattle needed for the entire country.

Areas to be given special emphasis. Some of these areas include conserving, reclaiming, and efficiently using natural resources needed to sustain agricultural production; increasing the efficiency of animal and crop production systems; increasing the efficiency of processing, distribution, and marketing food and agricultural products to users and consumers; maintaining and improving systems to provide people with safe, nutritious, and esthetically pleasing food; and developing the means for integrating scientific knowledge into systems that optimize resource management and facilitates transfer of technology to users.

INFORMATION SHEET #6

Sample Research Paper

An Experimental Study of Four Soil Types on the Germination of Corn and Beans

By

-student's name-

Supervisor

-instructor's name-

Date

-date paper is completed or submitted-

Table of Contents

An Experimental Study of Four Soil Types on the Germination of Corn and Beans

Purpose

Survival and growth of plant seedlings are affected by different types of soils. Some soils promote growth. Other soils retard plant growth. Scientists in agriculture work to identify how soils promote or control plant growth.

Different plants may vary considerably in the way they respond to various soils. A good supply of soil moisture during the germination period is very important. Some soils provide more moisture to the seed than other soil types.

My study will compare the germination of corn and beans when planted in sand, clay, silt loam (top soil), and potting soil. My null hypotheses were:

1. There is no difference in the germination of corn when planted in sand, clay, silt loam, and potting soil.
2. There is no difference in the germination of beans when planted in sand, clay, silt loam, and potting soil.

This study is important because it costs money to prepare soil and plant the seeds, and if they don't grow there will not be any plants to harvest, eat, or sell. If scientists can discover ways to help plants germinate and grow better, we can have more food to feed our population.

Review of Literature

The solid portion of a soil is made up of mineral matter and organic matter. The mineral portion is formed from rock-like materials which have been broken down into particles of various sizes. Organic ma ɔr from plants and other organisms is added to the mineral matter in the soil-forming process. The mineral particles in the soil determine texture. Soil texture is the fineness or coarseness of the mineral particles. We say that a clay soil has a fine texture and a sandy soil has a coarse texture (Oschwald and Courson, 1984).

The mineral particles of soil are separated into four groups on the basis of size. They are gravel, sand, silt, and clay. Gravel is removed by screening before a texture analysis is made and does not help to determine texture. Sand, silt, and clay are the most common particles in soils and are called soil separates. Clay is the finest and sand is the coarsest.

Sand particles are small pieces of ground-up rock. They are the coarsest and heaviest of the mineral particles. They do not stick together when wet; and although they allow air and water to enter and pass th ough the soil easily, they do not hold water very well. Sand and gravel particles supply few nutrients to crops since they cannot hold or store nutrients very well.

Silt particles are smaller than sand but larger than clay. They can barely be seen with the naked eye. They are very small mineral particles and hold nutrients better than sandy soils, and allow air and water to enter the soil readily. However, silty soils low in organic matter are likely to form surface crusts easily after a rain.

Clay particles are the smallest of the soil particles. They are so small that they cannot be seen with the unaided eye and many of them are too small to be seen even under an ordinary microscope. They hold most of the plant nutrients and are important in the chemical reactions which take place in a soil. Clay has a high water-holding capacity but if a soil has too much clay, it is not very permeable to air, water, and plant roots; it is sticky when wet, dries out slowly, is hard to work, and may become cloddy when cultivated (Oschwald and Courson, 1959).

Potting soil is a soil which contains a high percentage of matter called a muck or peat. In a peat soil the plant material making up the organic matter is usually only partially decayed and some plant remains can still be recognized, while in muck soil the organic matter is well decayed and no plant parts can be recognized. Muck and peat soils contain some mineral matter—sand, silt, and clay, but the large amount of organic matter is responsible for most of the soil properties. You can usually recognize peat and muck by the dark color and high organic-matter content (Tyznik, 1981).

Methodology

For demonstration purposes, I selected plants which are relatively fast germinating: corn and beans.

March 4 I got soil samples for planting: clay, sand, potting soil, and top soil. I put the samples in the classroom/laboratory to warm up. The soils were wet from the night's rain.

I got growing flats at Prairie Gardens in Champaign-Urbana. The name of the flats were Care Free Gro-Cell Greenhouse: 162• x 2• in. deep cells, 11 x 11 in. plant tray, and 11 x 11 in. plastic dome

The seeds we bought were Jubilee Hybrid Sweet Corn and Stringless Green Pod Bushbeans. Both varieties had a recommended planting depth of 1 to 1 1/2 inches, and the days to germinate were 7-10 days. I planted the seeds on April 8. They were planted about 1 inch deep as shown in Chart 1 and Chart 2.

Chart I

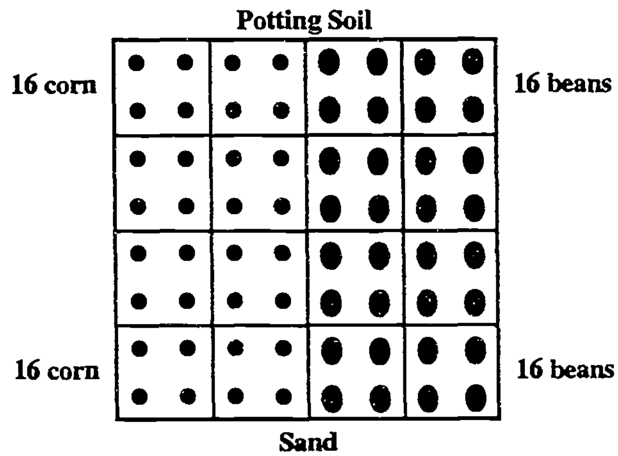
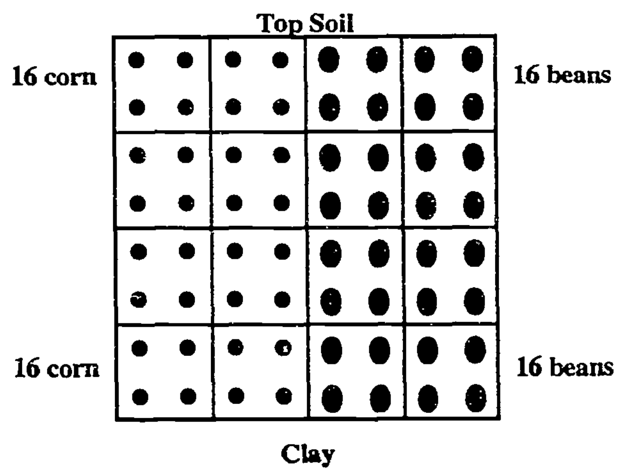


Chart II



Results

The results of my study are shown below in Table 1 and Table 2.

Table 1

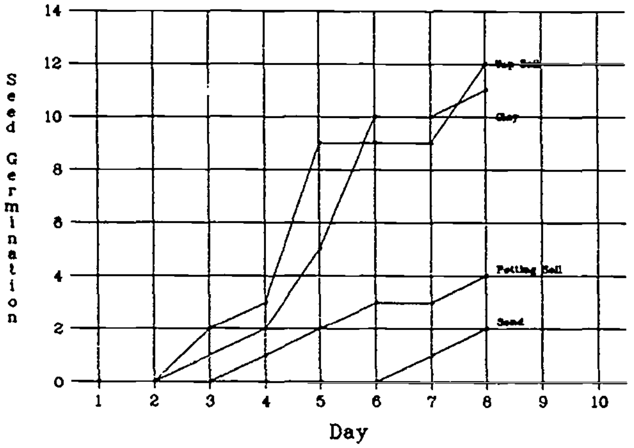
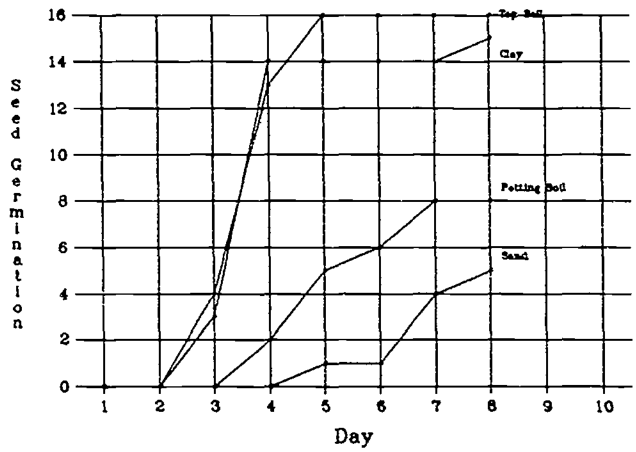


Table 2



Conclusions

Hypothesis 1: There is no difference in the germination of corn when planted in sand, clay, silt loam (top soil), and potting soil.

This hypothesis was False. In my experiment I found that corn germinated best in top soil, then clay, potting soil, and sand. Top soil and clay were very close in their germination time.

Hypothesis 2: There is no difference in the germination of beans when planted in sand, clay, silt loam (top soil), and potting soil.

This hypothesis was False. In my experiment I found that beans germinated best in top soil, then clay, potting soil, and sand. Top soil and clay were very close in their germination time.

In my experiment, corn germinated faster than beans when planted in the same soil types.

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Oschwald, W.R., and Courson, R.L. (1959). *Soil Texture.* Vocational Agriculture Service, University of Illinois, Urbana, IL (pp.1-2, 5-6)

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ERIC

TRANSPARENCY MASTER #1

Plant and Soil Science

- Tree Adaptation and Woodland Management
- Corn and Soybean Breeding
- Soil Testing
- Soil Surveys
- Soil Nitrogen
- Solving Insect Problems
- Plant Physiology

TRANSPARENCY MASTER #2

Animal and Veterinary Sciences

- Livestock Management
- Nutrition and Feeding
- Animal Breeding and Genetics
- Animal Physiology
- Horses and Companion Animals
- Meat Sciences and Muscle Biology
- Veterinary Research

TRANSPARENCY MASTER #3

The Social Sciences

- Rural Development
- Financial Management
- Economics of Natural Resources
- Agriculture and Food Policy
- Agriculture Law
- International Agriculture

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TRANSPARENCY MASTER #4

The Engineering Sciences

- Food Sciences
- Dairy Husbandry
- Animal Husbandry
- Household Science
- Food Manufactures
- Food Chemistry
- Human Nutrition
- Food Processing
- Agricultural Engineering

TRANSPARENCY MASTER #5

Scientific Method of Research

- Identifying a Problem
- Defining the Problem
- Developing Hypotheses
- Testing the Hypotheses
- Forming Conclusions

TRANSPARENCY MASTER #6

Some Benefits of Agricultural Research

- Genetically improved high-quality pest-resistant varieties of crops.
- Maintenance of an efficient and competitive agriculture in world trade, and improvement in U.S. capability for export of agricultural commodities.
- Development of new crops and of new uses for crops.
- Improved methods for conserving natural resources.
- Genetically improved livestock with higher reproduction rates.
- Efficient control of diseases, insects, nematodes, weeds, parasites, and other pests, including control of insects affecting humans and stored products.
- Control of livestock diseases and prevention of introduction of exotic diseases.
- Improved control of insects, ticks, and mites that affect livestock.
- Better plant and animal nutrition.
- Better nutritional quality in foods and added food safety.
- Improved irrigation equipment, principles, and practices.
- Improved farm equipment and mechanization practices.
- More efficient processing, transporting, and marketing of food.
- New and better fibers and fabrics.
- Improved levels of rural living.
- Support for programs of action and regulatory agencies.

TRANSPARENCY MASTER #7

Agricultural Research Service Priorities

- Developing New Plant Varieties
- Improving Animal Reproductive Efficiency
- Plant Germplasm Use
- Crop Productivity
- Conserving Soil, Water, and Air
- Controlling Water Quality
- Energy Efficiency
- Increase Plant and Animal Pest Resistance
- Pest Control Technology
- Increasing Photosynthesis
- Nitrogen Use by Plants
- Nutritional Quality of Crops
- Reducing Food Losses

TRANSPARENCY MASTER #8

Some Methods Used to Disseminate Research Findings

- Publications
- Tours
- Seminars
- Workshops
- Credit and Noncredit Courses
- Media Programs

TRANSPARENCY MASTER #9

Some Sources of Research Results

I. Economic Research Reports. Economic Research Service, Box 1608, Rockville, MD 20850. Phone (301) 953-2515.

- Agricultural Outlook
- Farm Line
- National Food Review
- Economic Indicators of the Farm Sector
- Rural Development Prospectives
- Foreign Agricultural Trade of the United States
- The Journal of Agricultural Economics Research
- Situation and Outlook
- Agricultural Statistics

II. State Research Colleges and Universities

III. Private Agricultural Businesses and Industries

TRANSPARENCY MASTER #10

A Quality Science Project

1. Represents your work — not that of an expert, your parents, or your instructor.
2. Indicates an understanding of the science area chosen.
3. Shows careful planning that would eliminate a "rush" project.
4. Has a notebook showing a complete record of all your work.
5. Has a simple, well-stated title and neat lettering.
6. Includes photographs, charts, pictures, graphs, etc., that might be necessary to explain your work.
7. Has accurate, valid, and correct observations.
8. Tells a complete story — Problem and Solution.
9. Is original in approach and presentation.
10. Is self-explanatory.
11. Is attractive and organized.
12. Does not have to cost much money.
13. Is best if it is an experiment, but it doesn't have to be.
14. Is one that gives credit to those who gave help.

TRANSPARENCY MASTER #11

Science Project Activities

1. Select a topic and discuss it with your instructor.
2. Conduct a review of relevant literature to find out as much as possible about the topic.
3. Keep a project notebook. Record all of your thoughts, preparations, readings, and observations.
4. Set up a laboratory work area at home or school where the project will not be disturbed by others.
5. Start the project early and work on it a little each day; don't wait until the last minute.
6. Identify a source and collect any materials needed for the project.
7. Check with your instructor or other resource people for suggestions and materials.
8. Construct an exhibit or display of your project.
9. Prepare a project report or research paper.

TRANSPARENCY MASTER #12

Research Paper

I. Title Page
name, school, course name, date

II. Table of Contents
major sections and sub-headings

III. Purpose
This section should be no more than one-half page or one paragraph in length. The hypotheses should be included here.

IV. Review of Literature
This section is a summary of background information which you read or located by other means. It should be written in your own words with proper credit given to any authors or researchers when their work or reports were referenced.

V. Methodology
This section is a summary of materials used, methods, and procedures.

VI. Results
This section reports the data gathered and is summarized with the use of tables, graphs, pictures, etc.

VII. Conclusion
This section reports, in your own words, what you have learned or discovered as a result of your experiment. It can include recommendations for further research.

VIII. Bibliography
This section lists your sources of information. It is complete enough so others can locate your references.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Student Research Project

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

Student Research Activity

1. Identify problem. Write a brief paragraph which explains and discusses the problem you wish to investigate.

2. Define the problem. Write the research question(s) you will be answering.

3. Develop hypotheses. State the type of results you expect to observe from your experiment.

4. Test hypotheses. State the methods of research you plan to follow. Record your measurements, observations, etc. Use Charts, graphs, tables, etc.

5. Form conclusions. Write a brief paragraph on your findings and recommendations for further needed research.

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CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Biotechnology

RELATED PROBLEM AREAS:

1. Recognizing the Impact of Technology on Agriculture: Electronics
2. Recognizing the Role of Agriculture in Society
3. Understanding the Relationship Between Agriculture and the Environment

PREREQUISITE PROBLEM AREA(S):

1. Understanding Basic Genetics and Reproduction

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

CORE

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D. and Jerry D. Pepple, Ed.D.
Principal Investigator: Chris A. Roegge, Ph.D.

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ____ DISTRICT ____ ESC ____
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:					
1. Identify environmental concerns brought about by biotechnology research.					
2. Predict future effects of biotechnology.					
3. Identify future careers in biotechnology.					
*4. Predict the consequences of technological change.					
*5. Recognize the implications of modern genetic technology.					
*6. Evaluate the economic, political, and social implications of scientific and technological developments.					

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ISBE 41-78 (1/88)

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Define biotechnology and related terms.					
2. Understand the basic processes of biotechnology.					
3. Recognize the latest applications resulting from biotechnology research in (a) animal science, (b) plant and soil science, (c) food science.					
*4. Identify the components of a DNA molecule.					
*5. Understand that the basic unit of inheritance is DNA.					
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Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY ____ DISTRICT ____ ESC ____
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes, techniques, methods, equipment, and available technology of science.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Understand the basic processes and procedures of biotechnology research.					
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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Biotechnology

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define biotechnology and related terms.
2. Understand the basic processes of biotechnology research.
3. Recognize the degree of progress made in biotechnology research up to this point.
4. Recognize the latest developments or applications resulting from biotechnology research in: (a) animal science, (b) plant and soil science, and (c) food science and technology.
5. Predict future impacts of biotechnology research.
6. Discuss concerns brought about by biotechnology research in the areas of environment, ethics, control of research, and conflict of interest.
7. Identify career opportunities in biotechnology, and the related job requirements, educational requirements, and biotechnology career trends.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Biotechnology

PROBLEMS AND QUESTIONS FOR STUDY

1. What is biotechnology?
2. How did it come about?
3. What types of biotechnology research are currently being performed?
4. What applications does biotechnology hold for farmers? For agribusiness persons? For consumers?
5. Where is biotechnology research taking place?
6. What processes are involved in biotechnology research?
7. How will agriculture change as a result of biotechnology?
8. What types of careers are available in biotechnology?
9. What is genetic engineering?
10. Is biotechnology research safe for the environment?
11. What will be the benefits of biotechnology?
12. What will be the costs of biotechnology?
13. What impact will biotechnology have on plant science?
14. What impact will biotechnology have on animal science?
15. Who should control biotechnology research?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Biotechnology

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have students search current agricultural magazines for articles on biotechnology. Have each student write a brief summary of an article.
2. Have students debate the pros and cons of biotechnology research.
3. Have the class observe an embryo transplant.
4. Have students identify everyday products of biotechnology research.
5. Tour a food processing plant (such as a cheese factory) which utilizes biotechnology.
6. Tour a research facility and discuss the processes and impacts of the biotechnology research.
7. Have students observe and evaluate a tissue culture experiment.
8. Demonstrate a biological pesticide.
9. Have students write a position paper on the use of biotechnology in agriculture.
10. Divide students into small groups and have them research and report on the questions posed on Information Sheet #3.
11. Have the students complete Student Worksheet #1.
12. Split the list of terms (Information Sheet #2) into groups. Split the students into teams and have them search out definitions.
13. Discuss each item on Information Sheet #3. Determine potential benefits and/or drawbacks of each from the point of view of (a) farmers, (b) agribusiness persons (ag supply and service), and (c) the general public.
14. Discuss Transparency Masters #1 — #3.
15. Have students complete and discuss Student Worksheet #2.
16. Invite a local veternarian to discuss the applications of biotechnology in animal science.
17. Have students complete Worksheet #4. Discuss with class.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Biotechnology

REFERENCES

1. *Agricultural Biotechnology News*. (Periodical). Freiburg Publications, Box 7, Cedar Falls, IA 50613.

*2. *Science of Food and Agriculture*. (Periodical). Council for Agricultural Science and Technology (CAST), 137 Lynn Avenue, Ames, IA 50010-7120.

3. *Research for Tomorrow: The 1986 Yearbook of agriculture*. (1987). Crowley, John J., ed. U.S. Government Printing Office, Washington, DC 20402.

4. *Impact of Research and Development and Current Developments in Agricultural Science and Technology*. (Subject Matter Unit #8363). (1987). Instructional Materials Service. Texas A & M University, College Station, TX 77843.

5. *Technology in Agriculture: Today and Tomorrow*. (Various materials). (1988). Paterson, Bruce C. (Presented at the 1988 Illinois Vocational Association Convention, Itasca, Illinois). National Livestock & Meat Board, 444 N. Michigan Avenue, Chicago, IL 60611.

6. *Plant Genetics Activities*. (Subject Matter Unit). (1988). Williams, Sonja L. Vocational Agriculture Service, 1401 S. Maryland Drive, Urbana, IL 61801.

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9. *Of the Earth: Agriculture and the New Biology*. (Videotape). Venard Films, Ltd., Box 1332, Peoria, IL 61654-1332.

*10. *Biotechnology: The Challenge*. (1987). United States Department of Agriculture, Washington, DC 20250-1300.

*11. *Biotechnology Strategies for Life*. (1986). MIT Press, Cambridge, MA 02142.

12. *Applied Communications*. Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322-3905.

*Indicates highly recommended references

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — An Overview of Biotechnology

INFORMATION SHEET #2 — Terms to be Defined

INFORMATION SHEET #3 — The Future of Agriculture, A Look Beyond 1988

INFORMATION SHEET #4 — Impact of Biotechnology

INFORMATION SHEET #5 — Microorganism Technology

INFORMATION SHEET #6 — Biotechnology Products for the Food Industry

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TRANSPARENCY MASTER #1 — Agricultural Power

TRANSPARENCY MASTER #2 — Biotechnology Applications for Plant Agriculture (with discussion guide)

TRANSPARENCY MASTER #3 — Biotechnology Applications for Animal Agriculture (with discussion guide)

TRANSPARENCY MASTER #4 — Biotechnology Applications in Food Processing (with discussion guide)

TRANSPARENCY MASTER #5 — Gender Preselection (with discussion guide)

TRANSPARENCY MASTER #6 — rDNA Technology (with discussion guide)

TRANSPARENCY MASTER #7 — Summary

INFORMATION SHEET #1

An Overview of Biotechnology

Biotechnology in its broadest sense (the application of living organisms to improve, modify, or produce industrial products or processes) has been around for some time. The use of microorganisms to produce fermented food substances and antibiotics, selection of animals to produce desired traits in offspring, hybridization in plants, and artificial insemination are all examples of biotechnological contributions to agricultural science. Only recently, however, have techniques been developed to manipulate organisms at the molecular and even cellular levels. These methods, such as recombinant DNA technology (often referred to as genetic engineering) hold the greatest potential impact and also cause the greatest amount of concern among the general population.

Genetic engineering involves the division and recombination of cell DNA, the material which controls the passing of specific characteristics from one generation to the next. The DNA can be divided and restructured in combinations which would never occur in nature. Scientists can also construct totally synthetic genes to cause organisms to perform desired functions or exhibit desired traits.

Some applications of biotechnology which are occurring in agriculture today include the use of simple organisms as "biological factories" to produce useful substances such as human insulin for diabetes treatment and bovine growth hormone used to increase milk production in dairy cattle. Biotechnology is being used to produce desirable characteristics in plants, such as high drought stress tolerance, disease and pest resistance, herbicide stress resistance, improved nutritional quality, and improved physical structure. Animal scientists are identifying specific genes which control disease resistance, and genetic techniques are greatly accelerating the improvement of productive performance in animals.

On the other side of the coin, concerns exist among the public about the safety, ethics, and control over biotechnology research applications. Terminology such as "cloning," used by the scientist to mean gene cloning, carries the connotation of cloning whole human beings to the lay public. Many feel that mankind is "playing god" and has no right to dabble in hereditary materials of animals and humans. Some worry that techniques such as genetic engineering, in the hands of unscrupulous individuals, could be turned into a weapon, or that accidental misapplication of this technology could have disastrous sociological and environmental effects on the entire planet.

Agriculture is the field which stands to be impacted most dramatically by biotechnology. It remains up to all segments of the agricultural industry to weigh the costs vs. the benefits of biotechnology, and to make responsible decisions concerning its application.

History of Genetic Engineering

1944 — DNA identified as genetic material
1953 — Double strand DNA structure identified
1973 — First transgenic bacteria prepared
1976 — First genetic engineering company (Genetech) established
1980 — First patent for genetically engineered microbe
1982 — Approval of first genetically engineered drug
1986 — First field test of genetically engineered plant
1987 — Genetic engineering patent extended to higher life forms

INFORMATION SHEET #2

Terms to be Defined

Amino acid — an organic acid containing an amino group (-NH2) and a caroboyxl or acid group (-COOH). Some amino acids contain sulfur.

Antigen — a substance (usually a protein or carbohydrate) that stimulates the production of an antibody when introduced into the body of animals.

Biotechnology — technology concerning the application of biological and engineering techniques to microorganisms, plants, and animals; sometimes used in the narrower sense of genetic engineering.

— the application of scientific and engineering principles to the processing of materials by biological agents to provide goods and services. The three major techniques are genetic engineering, monoclonal antibody technology, and bio-processing.

Chloroplast — a self-replicating organelle or organized cellular body that contains chlorophyll and is the site of photosynthesis and starch formation. Chlorophyll is responsible for the green color of plants.

Chromosome — a small, normally linear body containing DNA and found in the cell nucleus in higher organisms. Bacterial chromosomes are circular, highly folded, and free in the cell cytoplasm. Chromosomes maintain the genetic template and replicate through fission when a parent cell divides into two identical daughter cells.

Cloning — in molecular biology, the process of producing many copies of a single ancestral gene or sequence of DNA by incorporating that DNA into a replicating microorganism. In plants and animals, the replication of cell lines, tissues, or organisms from somatic (nonreproductive) tissues.

Cytoplasm — the cell contents other than the nucleus.

Deoxyribonucleic acid (DNA) — a compound of deoxyribose (a 5-carbon sugar), phosphoric acid, and nitrogen bases.

Embryo rescue — the use of tissue culture techniques to propagate an embryo that otherwise would not develop into an individual. It allows crosses to be made between sexually incompatible species.

Enzyme — a protein that catalyzes a specific chemical change without being used up in the reaction.

Gene — an element of the genetic material that controls the expression of an inherited character by specifying the structure of a particular RNA molecule or protein or by controlling the function of other genetic material. Genes usually consist of specific sequences of purine and pyrimidine bases, usually in DNA. Genes are also called genetic fac ›rs.

Genetic engineering — alteration of the genetic components of organisms by human intervention.

Germplasm — the hereditary material transmitted to the offspring through the germ cells. For plants, the term is used to include pollen, the female germinal cells, seeds, vegetative parts used for reproduction, or a total collection of plant material. For animals, the term is used to include sperm cells, egg cells, and entire animals.

Mitochondria — bodies in the cell cytoplasm that are rich in fats, proteins, and enzymes and that produce energy for the cell through respiration.

Nucleus — a membrane-bounded cellular body that contains the principal hereditary material.

Organelles — any of the various small specialized bodies other than the nucleus in a cell.

Parthenogenesis — reproduction by development of a female germ cell without fertilization.

Pathogen — a disease-causing organism, as a bacterium, fungus, or virus.

rDNA — modified DNA produced by enzymatic breaking of the molecular chain and rejoining it after removing, modifying, or adding genes. The term recombinant DNA refers also to molecules resulting from the multiplication of such DNA, or to the technique by which recombinant DNA is produced.

Regeneration — the process of inducing single cells or groups of cells to produce an embryo, organ, or entire plant.

Superovulation — production of an increased number of eggs in mammals at one time as a result of injection of a hormone.

Tissue culture — the process or technique of making plant or animal tissue grow in a culture medium outside the organism.

INFORMATION SHEET #3

The Future of Agriculture

A Look Beyond 1988

- Growers will be using genetically altered seeds that will produce crops that do not need pesticides.
- Growers will be growing products for industry such as plants that will yield pharmaceuticals and plastics.
- The control of crop characteristics such as size, weight, color, and shape will result in more and better agricultural products and increased per unit profits.
- Spraying crops with genetically altered bacteria will extend growing seasons by preventing frost damage.
- Plant genetics will be altered to produce new strains of crops that can grow in areas where the old strains were unable to grow because of too dry or too wet conditions.
- Genetic engineering will be used to produce hybrids unlike anything available to growers today.
- Lasers will be used for grading land to improve drainage.
- Growers will have sensors in the field to detect and report humidity, air and soil temperatures, soil pH, and fertility levels, via computer.
- Many genetic diseases in both plants and animals will be eliminated.
- Hormones and delivery systems will be developed to significantly increase milk production, lean meat produced per animal, and number of live animals produced per breeding animal per year.
- Cloning will make it possible to make multiple, identical copies of the champion bull or prize steer.
- Embryo transplants will produce multiple births of improved animals and the embryos will be sexed to suit the purchaser's needs.

INFORMATION SHEET #4

Impact of Biotechnology

Four Broad Applications of Biotechnology

New technologies have been applied in four general areas, including:

1. Plant and animal production.
2. Food processing and manufacturing.
3. Environmentally secure animal waste disposal.
4. Conversion of agricultural residues to new products.

Four Areas

Four areas of agriculture are likely to be affected by these new technologies including:

1. Plant productivity.
2. Animal care products.
3. Animal productivity.
4. Reproductive biology.

Questions to Keep in Mind

1. Should biotechnology be used to increase production at a time when stockpiles of some agricultural commodities are high?

2. What can we do to change public perceptions of the risks surrounding products created by these new technologies?

3. Biotechnology companies are going overseas where regulations are less stringent. How can U.S. agriculture compete if the U.S. fails to allow biotechnology breakthroughs?

4. How can we direct biotechnology into areas which will lower our costs of agricultural production and make us more competitive?

5. Can biotechnology help us develop new uses for our basic agricultural commodities?

CHANGE!!

INFORMATION SHEET #5

Microorganism Technology

Some Potential Uses of Genetically Engineered Microorganisms in Plant Agriculture

Process	Goal
Nitrogen fixation	Supply a greater proportion of the nitrogen needs of plants by improving the free living nitrogen-fixing bacteria in the soil and the plant-associated (symbiotic) nitrogen-fixing bacteria that act in legume root nodules.
Insect control	Control insect pests by improving existing microbial insecticides and by developing new ones.
Disease control	Control plant diseases by improving the microorganisms currently used and developing the potential of others that limit the incidence of plant diseases by competing with the disease-producing (pathogenic) microorganisms or by producing a substance that inhibits the disease-producing microorganisms.
Weed control	Control weeds by spraying them with microorganisms that cause diseases of weeds or selectively inhibit weed growth in other ways.
Environmental stress alleviations	Develop the capability of bacteria to protect higher plants against unfavorable environmental conditions, such as low temperatures leading to damage by frost.
Deterioration of seeds or tubers and other parts during storage	Reduce the deterioration by developing the potential of microorganisms to limit by competition the growth of microorganisms that cause rotting or other undesirable changes in stored products, or to inhibit the growth of the undesired microorganisms by production of protective compounds.
Plant composition change	Production of desired nutrients, flavoring substances, medicinal ingredients, pesticides, or other substances.
Production of volatile compounds	Production of aromatic gases to protect or enhance food quality.
Plant growth regulation	Promote or change the expression of normal functions, including differentiation, texture, ripening, and senescence, to improve the yield, quality, and longevity of the products.
Silage production	Develop and improve microbial inoculants to improve the quality of forages stored as silage.
Pesticide decomposition	Develop the capability of microorganisms to decompose specific pesticides for disposal purposes.
Soil structure improvement	Develop the capability of microorganisms to convert organic residues to soil-stabilizing products.
Cloud seeding	Develop bacteria with potential as nuclei for ice formation as a substitute for and improvement on the silver halide currently used.

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INFORMATION SHEET #6

Biotechnology Products for the Food Industry

Product	**Use**
ENZYMES	
amylase	high fructose corn syrup
isomerase	
rennet	cheesemaking
proteases	meat tenderizers
pullulanase	"lite" beer
ORGANIC ACIDS	
citric acid	acidulant
propionic acid	food preservative
AMINO ACIDS	
methione, lysine, tryptophan	nutritional supplement
aspartic acid, phenylalanine	aspartame production
VITAMINS	nutritional supplement
LOW CALORIE PRODUCTS	
aspartame	non-nutritive sweetener
modified fatty acids	food additives/cooking oils
SINGLE CELL PROTEIN	animal and human food supplement

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INFORMATION SHEET #7

Career Opportunities in Biotechnology

Scientists and Engineers	— These careers are involved in many aspects of Biotechnology.
Business and Finance	— New business opportunities are being created by biotechnology.
Producers	— Biotechnology will have the largest impact on these.
Communication Specialists	— These careers are involved in interpreting and transferring information.
Natural Resources	— Environmental concerns regarding biotechnology point out the importance of careers in this area.

TRANSPARENCY MASTER #1

Agricultural Power

Four Types of Power Have Characterized Agricultural Progress:

- Hand Power (1775 — Civil War)
- Horse Power (1860 — World War I)
- Mechanical Power (1915 — World War II)
- Science Power (1945 — 1980)

Fifth Type of Agricultural Power:

- Science Power/Exponential Phase (1980 — ?)

TRANSPARENCY MASTER #2

Biotechnology Applications for Plant Agriculture

- Photosynthesis
- Nitrogen Fixation in Non-leguminous Plants
- Herbicide Resistance
- Disease Resistance
- Pest Resistance
- Stress Tolerance
- Product Quality
- Unique Hybrids

TRANSPARENCY MASTER #3

Biotechnology Applications for Animal Agriculture

- Reproduction
- Animal Health
- Animal Nutrition
- By-Product Utilization
- Growth/Lean Meat Production/Milk Production

TRANSPARENCY MASTER #4

Biotechnology Applications in Food Processing

- Food Additives

- Fermentation Processes

- Production of Enzymes

- Product Transformation

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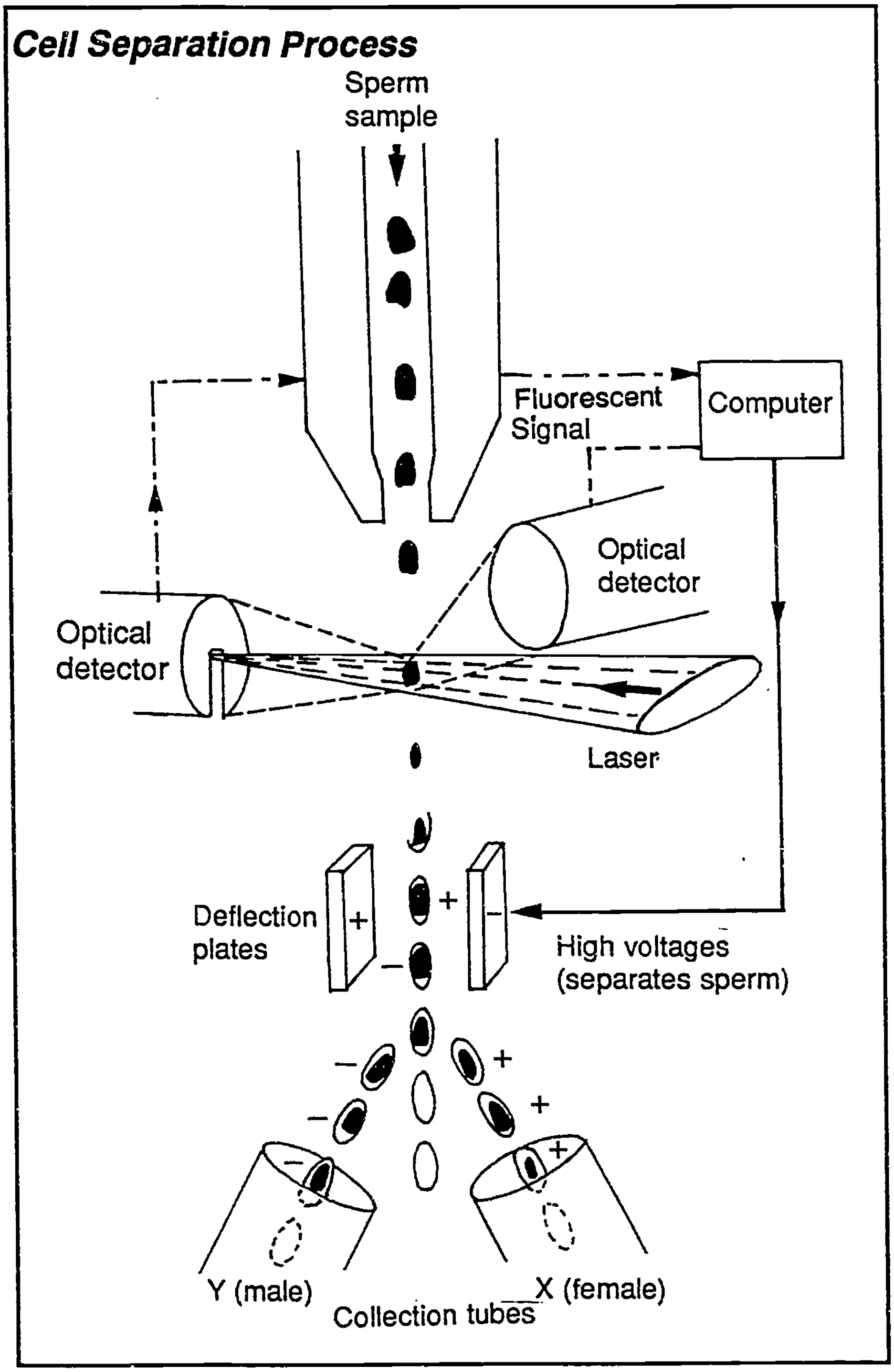
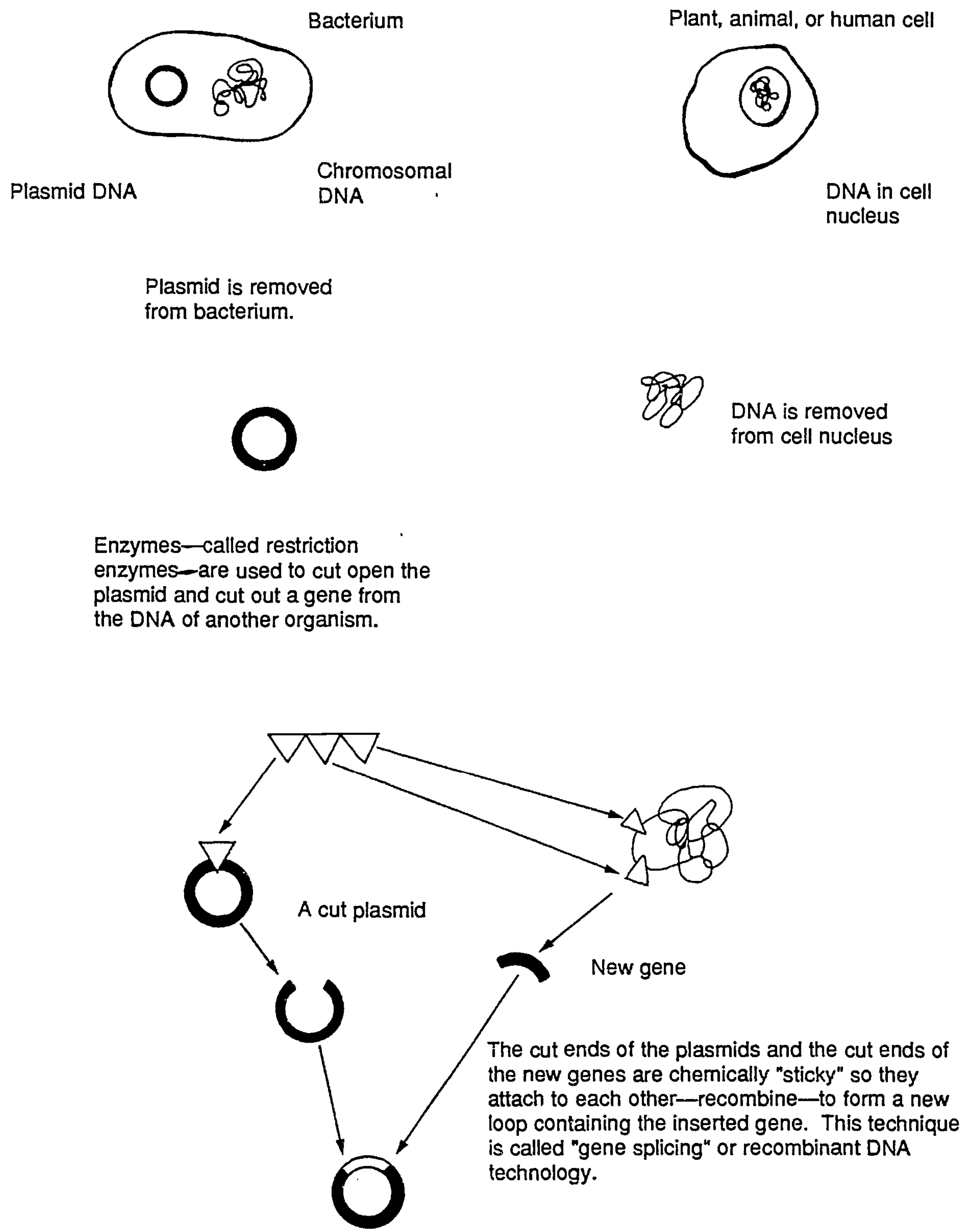
TRANSPARENCY MASTER #5

Gender Preselection



TRANSPARENCY MASTER #6

rDNA TECHNOLOGY



TRANSPARENCY MASTER #7

Summary

- Food demand will outpace food supply.
- 85% of increased productivity will result from technology.
- U.S. must take advantage of technological advances; others certainly will!
- U.S. farmers and agribusinesses need the best technology to compete in the world's marketplace.
- Today's students → tomorrow's technologists.
- Management, marketing, sales, regulation, finance, and law experts will also be needed for the new industries created by biotechnology.
- Demand → supply!!
- Opportunities are limited only by the ability to <u>create</u> them!!!

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TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #2

Photosynthesis

a. Genetically change photosynthetic enzymes to be more efficient
b. Plant makeup genetically altered to cause it to put more photosynthetic energy into grain, fruit, or vegetable production

Nitrogen Fixation in Non-Leguminous Plants

a. 79% of the earth's atmosphere is nitrogen
b. Transfer of nitrogen-fixing genes to non-leguminous plants such as corn
c. Reduced need for supplemental nitrogen

Herbicide Resistance

a. Decrease plant stress from herbicide use or carryover
b. Build in a resistance in plant seeds

Disease Resistance

a. Alter plant makeup so specific diseases have no effect
b. Cause plants to produce their own resistant chemicals

Pest Resistance

a. Transfer resistance which is controlled by one gene
b. Cause plant to stop producing whatever attracts the pest
c. Reduced need for chemical pesticides

Stress Tolerance

Genetically alter the plant so that it will automatically adjust to any weather

Product Quality

Eliminate negative side effects of product processing

Unique Hybrids

Perennial grain or vegetable crops

Transparency Master #3

Reproduction

a. Saving and storing of valuable embryos
b. Sexing of animals
c. Cloning of valuable animals (reproducing genetically identical copies)

Animal Health

a. Build in disease resistance
b. Eliminate harmful side effects of vaccines

Animal Nutrition

a. Implant bacteria for non-ruminants to fully utilize cellulose (allow monogastric animals such as hogs to use more roughages)
b. Improve nutritional value of feeds

By-Product Utilization

Transfer livestock waste through bioprocessing into useful and beneficial products such as vitamins

Growth/Lean Meat Production/Milk Production

a. Growth hormones to speed weight gain and feeding efficiency
b. Develop vaccines to suppress growth-inhibiting hormones
c. Make animal products more nutritionally desirable (red meat, for example)

Transparency Master #4

Food Additive

a. Amino acids (see information sheet #5)
b. Natural forms of vitamins

Fermentation Process

a. Add bacteria to meat to "outcompete" pathogens which may speed spoilage
b. This technology already exists in the cheesemaking industry

Production of Enzymes

(see information sheet #5)

Product Transformation

a. Low calorie foods
b. Altered fatty acid structure (no-calorie ice cream!)

Transparency Master #5

The only measurable difference between X (female) and Y (male) sperm is their DNA content. The X chromosome is larger and contains slightly more DNA than the Y chromosome. Instruments called "flow cytometers" can identify X and Y sperm cells after they have been treated with fluorescent dye, which stains the DNA after the sperm is passed through a laser beam. The amount of fluorescent light given off is measured by computer. Because the X chromosome is larger and contains more DNA, the female sperm gives off more light. From this analysis, the ratio of

X to Y sperm in a semen sample can be determined. Also, the X and Y sperm can be separated after identification. The sperm cells can be encased in a droplet of liquid, given a positive or negative charge, and passed between two high-voltage steel deflection plates. Each plate will attract the sperm of the opposite charge, separating them into collection tables. At present, the separated sperm cannot fertilize eggs because the tails have been removed. Researchers are seeking to separate intact sperm.

Transparency Master #6

It was discovered in the early 1970's that the bacterium *E.Coli* had circular pieces of DNA called plasmids floating free in its cell liquid. This is different from plant and animal DNA, which is tangled in a large mass inside all chromosomes, making it difficult to work with. Plasmids have turned out to be the ideal "vehicle" for gene transfer. Specialized enzymes, called "restriction enzymes" are used to cut DNA molecules at specific locations. The desired genes are cut out of a complex DNA molecule. The same restriction enzymes are then used to cut the plasmid. The cut ends of the gene and the plasmid attract one another and attach, or "recombine" to form a new plasmid containing the new gene. This plasmid now carries a new genetic instruction which may be used for a variety of purposes such as introducing resistance to a disease or pest into crop plants.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Biotechnology Questions

STUDENT WORKSHEET #2 — Determining the Ethics of Biotechnology

STUDENT WORKSHEET #3 — Biotechnology Word Search (with solution)

STUDENT WORKSHEET #4 — What is Your Opinion on Biotechnology?

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Biotechnology Questions

1. Name four types of biotechnology operations or techniques:

   a.

   b.

   c.

   d.

2. What is "genetic engineering?"

3. What would be the primary benefit of biological pest control?

4. Why do many farmers oppose the use of some biotechnology products, such as bovine growth hormone, which are proven to increase productivity?

5. Define "tissue culture."

6. List and discuss three areas of concern of the general public about biotechnology:

   a.

   b.

   c.

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7. Name three food products processed using forms of biotechnology:

   a.

   b.

   c.

8. What would be the advantage of nitrogen fixation in non-leguminous plants?

9. Is artificial insemination a form of biotechnology? Explain.

STUDENT WORKSHEET #1 — Key

Biotechnology Questions

1. Name four types of biotechnology operations or techniques:

   a. *tissue culture*

   b. *genetic engineering or rDNA technology*

   c. *gender preselection*

   d. *superovulation*

2. What is "genetic engineering?"

   The changing of the genetic makeup of an organism as the result of deliberate human intervention.

3. What would be the primary benefit of biological pest control?

   The environmental benefit of decreased use of chemical pesticides.

4. Why do many farmers oppose the use of some biotechnology products, such as bovine growth hormone, which are proven to increase productivity?

   Because they see these technologies contributing to ag surpluses and only benefiting larger operators.

5. Define "tissue culture."

   The process of regrowing a part of or an entire plant from a piece of an existing plant under lab conditions.

6. List and discuss three areas of concern of the general public about biotechnology:

   a. *cloning — not understood. Whole people cannot be cloned.*

   b. *"playing god" — Are we responsible enough to use this technology without abusing it?*

   c. *environment — Do we know or can we predict the long-term effects of biotechnology on the enrironment?*

7. Name three food products processed using forms of biotechnology:

   a. *cheese*

   b. *bread*

   c. *wine*

8. What would be the advantage of nitrogen fixation in non-leguminous plants?

   less need for supplemental nitrogen

9. Is artificial insemination a form of biotechnology? Explain.

   Yes. It involves humans applying technology to change a natural biological process.

2.1

STUDENT WORKSHEET #2

Determining the Ethics of Biotechnology

Question: Should biotechnology research be actively pursued? Applied?

Activity: Class discussion/debate/position paper

Value Assessment Criteria:

1. Reciprocity — What choice would you support if you were a: (1) farmer, (2) seed dealer, (3) chemical dealer, or (4) consumer.

2. Consistency — Would your choice be different if addressing a group of: (1) farmers, (2) environmentalists, or (3) consumers.

3. Coherence — How will the choice affect the relationship between farmers and agribusinessmen? Farmers and non-farmers? U.S. and foreign agriculture? How will biotechnology applications affect government agricultural policy?

4. Comprehensiveness — Where will biotechnology research lead? Will all farmers adopt the technology? What will happen if they do?

5. Adequacy — Will biotechnolgy solve the farm economy problems? The grain surpluses? Will it lead to further problems? How will it affect food prices?

6. Duration — Will biotechnology solve world hunger? What will the long-term effects be? Will biotechnology benefit or hurt the environment? Why must the research be carefully controlled?

STUDENT WORKSHEET #3

Biotechnology Word Search

U	T	F	O	N	S	U	E	L	C	U	N	F	C	I	D	G	O
O	T	V	A	N	T	I	G	E	N	E	Y	D	B	L	N	E	O
T	I	G	N	A	O	E	W	Q	P	V	V	I	D	I	A	Z	O
X	H	E	U	N	F	I	A	T	F	K	O	G	N	V	L	F	O
A	D	R	N	O	O	G	T	D	G	T	I	O	E	N	T	N	D
N	U	M	D	A	G	S	C	A	E	A	L	T	C	N	O	K	V
J	G	P	I	J	C	L	X	C	L	C	E	I	G	I	E	A	F
K	L	L	N	W	J	U	H	V	A	U	U	N	T	I	E	G	S
O	U	A	S	B	C	N	M	W	I	M	V	A	Z	P	M	E	O
E	K	S	F	B	O	B	Z	Z	S	P	R	O	D	Y	M	T	A
V	T	M	P	L	K	S	X	A	I	E	N	Z	R	O	M	I	L
G	C	U	O	A	C	F	L	K	N	A	H	L	S	E	A	E	V
N	J	G	Q	D	T	P	N	E	U	C	N	O	Q	Q	P	Y	Q
G	Y	L	X	X	O	H	G	O	L	I	M	D	M	K	M	U	U
Q	M	S	X	T	J	E	O	K	R	O	X	R	U	X	O	B	S
T	F	H	Y	E	R	R	W	G	R	J	C	A	R	L	J	S	I
R	P	C	L	Y	M	G	L	H	E	F	B	Q	L	I	W	C	T
L	M	R	Z	H	S	T	C	L	D	N	Y	D	G	V	P	I	P

The following words are hidden in the puzzle:

Antigen
Biotechnology
Chromosomes
Cloning
Cytoplasm
DNA
Enzyme
Gene
Germplasm
Nucleus
Pathogen
Regeneration
Superovulation

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STUDENT WORKSHEET #3 — Key

Biotechnology Word Search

•	•	•	•	•	S	U	E	L	C	U	N	•	•	•	•	G	•
•	•	•	A	N	T	I	G	E	N	•	•	•	B	•	N	•	•
•	•	G	•	•	O	•	•	•	•	•	•	I	•	I	•	•	•
•	•	E	•	•	•	I	•	•	•	•	O	G	N	•	•	•	•
•	•	R	•	•	•	•	T	•	•	T	•	O	E	•	•	N	•
•	•	M	•	•	•	•	•	A	E	•	L	•	•	N	O	•	•
•	•	P	•	•	•	•	•	C	L	C	E	•	•	I	E	•	•
•	•	L	•	•	•	•	H	•	•	U	•	N	T	•	•	•	S
•	•	A	•	•	•	N	•	•	•	M	V	A	Z	•	•	E	•
•	•	S	•	•	O	•	•	•	S	•	R	O	•	Y	M	•	•
•	•	M	P	L	•	•	•	A	•	E	•	•	R	O	M	•	•
•	•	•	O	A	•	•	L	•	N	A	•	•	S	E	•	E	•
•	•	G	•	•	T	P	•	E	•	•	N	O	•	•	P	•	•
•	Y	•	•	•	O	H	G	•	•	•	M	D	•	•	•	U	•
•	•	•	•	T	•	E	O	•	•	O	•	•	•	•	•	•	S
•	•	•	Y	•	R	•	•	G	R	•	•	•	•	•	•	•	•
•	•	C	•	•	•	•	•	H	E	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	C	•	•	N	•	•	•	•	•	•	•

The following words are hidden in the puzzle:

Antigen
Biotechnology
Chromosomes
Cloning
Cytoplasm
DNA
Enzyme
Gene
Germplasm
Nucleus
Pathogen
Regeneration
Superovulation

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STUDENT WORKSHEET #4

What is Your Opinion on Biotechnology?

Indicate if you agree or disagree with the following statements about the use of biotechnology. Circle "A" for agree and "D" for disagree. If undecided, circle "U". There are no right or wrong answers.

The Use of Biotechnology . . .

is always bad	A	U	D
can protect our environment	A	U	D
can reduce world hunger	A	U	D
will provide better food	A	U	D
can reduce human health care problems	A	U	D
can eliminate hazardous chemicals	A	U	D
will make farming more profitable	A	U	D
should be favored by public policy	A	U	D
will result in new job opportunities	A	U	D
will make food cost less.	A	U	D

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Electronics

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Recognizing the Role of Agriculture in the Society
3. Recognizing the Role of Research and Development in Agriculture
4. Developing Basic Microcomputer Skills
5. Using Microcomputers in Agribusiness Management (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S):

1. Identifying Basic Principles of Electricity

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instructions for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences, Social Sciences, and Fine Arts. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D
Research Assistant: Robert E. Petrea

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☒ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to listen critically and analytically.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Evaluate the content of an oral message of an appropriate length.					
*2. Respond effectively and appropriately to oral messages.					
265					269

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify variables that affect the size of electric and magnetic fields.					
2. Define terms integral to electronics.					
3. Distinguish between electronics and electronic devices.					
4. Match specific electronic devices with their appropriate function.					
5. Give examples of electronic applications in specific agricultural settings.					
290					291

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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COUNTY | DISTRICT | ESC
District Name
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I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the knowledge and skills required for selected fields of work.					
2. Distinguish between electronics and electronic devices.					
3. Give examples of electronic applications in specific agricultural settings.					
					293
292					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Electronics

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define terms integral to electronics.
2. Distinguish between electronics and electronic devices.
3. Match specific electronic devices with their appropriate function.
4. Give examples of electronic applications in specific agricultural settings.
5. Predict future applications of electronics in agriculture.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Electronics

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. What is electronics?
2. What are electronic devices?
3. What are some specific uses of electronic devices?
4. What are some electronic components?
5. What is a rectifier?
6. What is a semiconductor?
7. What is a transistor?
8. What is a diode?
9. How are electronic components used?
10. What is an integrated circuit?
11. How are integrated circuits used?
12. Why are electronic components necessary?
13. How is one affected by electronics?
14. Why should one recognize uses of electronic devices?
15. How are electronics used in agriculture?
16. What are some future uses of electronics?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Electronics

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have students search current agricultural publications for articles on electronic devices available. Have each student write a summary of a selected article.

2. Use Information Sheet #1 as a reference for review of specific electronic components.

3. Use Information Sheet #2 as a reference for specific terms applicable to electronics.

4. Have students conduct a survey and identify everyday items that do not use electronic devices.

5. Invite guest speakers to address the class on various aspects of electronics. Industry representatives, salespeople, repair workers, and local managers and producers could give presentations on how electronics have affected them.

6. Conduct field trips to agribusinesses such as grain elevators, feed stores, production facilities, financial institutions, equipment dealers, horticultural suppliers, fertilizer dealers, greenhouses, veterinary offices, nurseries, and others where students can observe the everyday application of electronics in agriculture.

7. Lead students in a discussion of future applications of electronics in agriculture such as totally automated production, harvesting, and processing facilities; totally controlled environments in animal production and plant greenhouse facilities; the use of space-grown crystals for exact control of frequency for guidance systems; the applications of robotics in equipment assembly and in harvesting equipment; and other topics taken from current news articles.

8. Use the transparency discussion guides for background information about the transparencies.

9. Use Information Sheet #3 as a starting list to lead students in a discussion of common uses of electronics in agriculture. Ask students to relate personal experiences with these items and add items to the list.

10. Use problem areas such as "Identifying Careers in Agriculture/Horticulture" and "Using Microcomputers in Agribusiness Management" for specific information related to those areas.

11. Arrange for the use of Vocational Agriculture Service's Electrical Control Kit during this problem area. The materials, equipment, and activities can be incorporated as demonstrations of electron behavior and control.

12. Consult with the instructor of electronics for ideas, material, and equipment to be used in conjunction with this problem area.

13. Consider using commercial material available on robotics as an ethics problem. Computer programs on robotics are available from AAVIM as well as others. Videotapes and robotics kits are available from HOBAR. Ethics questions that could be considered are: The pros and cons of robotics; the effect of robotics on job availability; and the application of "artificial intelligence" in robots.

14. Use Student Worksheet #1 as an assignment for individual research into one particular electronic device's effect on a selected business. The purpose is to acquire information on what the device is, how the device works, what manual functions the device replaced, and why the device is used. It may be necessary for students to consult various references to determine how the device functions.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Recognizing the Impact of Technology on Agriculture: Electronics

REFERENCES | **INSTRUCTOR'S NOTES AND REFERENCES**

1. *Fundamentals of Machine Operation; Fundamentals of Service*. (Series). John Deere Distribution Service Center, Service Publications, Dept. 150, 1400-13th St., East Moline, IL 61244. (309)765-2967.

2. Various materials. Dickey-John Corp., P.O. Box 10 , Auburn, IL 62615. (217)438-3371.

3. *Microelectronics in Agriculture and Horticulture*. Cox, S.W.R. (1982). Granada Publishing Limited, 866 United Nations Plaza, New York, NY 10017.

*4. *Farm Electronics*. Cox, S.W.R. (1988). BSP Professional Books, Division of Blackwell Scientific Publications Ltd., 52 Beacon St., Boston, MA 02108.

5. *Agricultural Electrification*. Surbrook, T.C., Mullin, R.C. (1985). South-Western Publishing Co., 355 Conde Street, West Chicago, IL 60185. (800)323-1530.

*6. *Electronics the Easy Way*. Miller, Rex (1988). Barron's Educational Series, Inc., 250 Wireless Blvd., Hauppauge, NY 11788.

7. AAVIM, 120 Driftmier Engineering Center, Athens, GA. 30602. (404)542-2586.

8. Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112. (612)633-3170.

*Indicates highly recommended reference

ERIC

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — An Overview of Electronics

INFORMATION SHEET #2 — Terms to be Defined

INFORMATION SHEET #3 — Common Uses of Electronics in Agriculture

TRANSPARENCY MASTER #1 — Electronics in Vehicle Gauges (with discussion guide)

TRANSPARENCY MASTER #2 — Building Environmental Control (with discussion guide)

TRANSPARENCY MASTER #3 — Animal Feed Management (with discussion guide)

TRANSPARENCY MASTER #4 — Dairy Monitoring (with discussion guide)

TRANSPARENCY MASTER #5 — Complete Feeding (with discussion guide)

TRANSPARENCY MASTER #6 — Commodity Handling (with discussion guide)

TRANSPARENCY MASTER #7 — Commodity Storage Monitoring (with discussion guide)

TRANSPARENCY MASTER #8 — Spray Control System (with discussion guide)

TRANSPARENCY MASTER #9 — Electronic Scale (with discussion guide)

TRANSPARENCY MASTER #10 — Control of Carbon Dioxide Enrichment (with discussion guide)

TRANSPARENCY MASTER #11 — X-Ray Potato Sorting (with discussion guide)

TRANSPARENCY MASTER #12 — Flow Control of Nutrient Solution in Greenhouses and Hydroponics (with discussion guide)

TRANSPARENCY MASTER #13 — Water Evaporation Pan (with discussion guide)

TRANSPARENCY MASTER #14 — Trickle Irrigation (with discussion guide)

TRANSPARENCY MASTER #15 — Vehicle Guidance System (with discussion guide)

ERIC

INFORMATION SHEET #1

An Overview of Electronics

Electronics can be defined as the science that deals with the behavior and control of electrons. This science led first to the ability to provide the medium that we call electricity and next to provide devices that can use that electricity to produce actions or results. These electronic devices, something that uses electrons, can be everyday items such as light bulbs, clocks, electric motors, and sparkplugs. Electronic devices also encompasses diodes, transistors, semiconductors, and integrated circuits that make possible today's microwave ovens, computers, videocassette machines, televisions, and fiber optic communications.

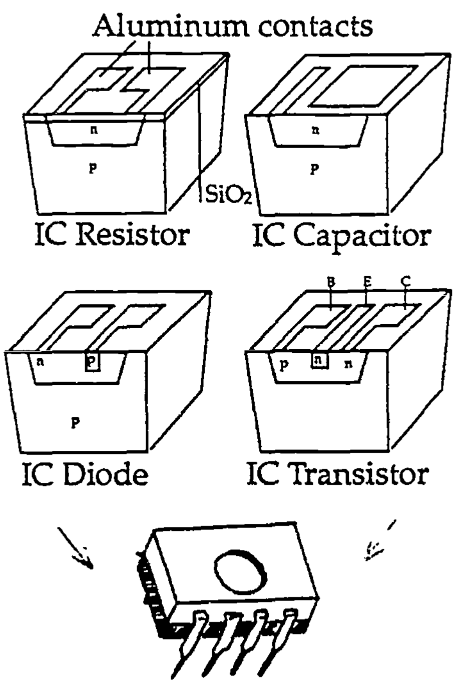
The majority of us are accustomed to alternating current (AC) electricity that we use in our homes everyday. This form of electricity is much easier to transport inexpensively across long distances and many electronic devices use this form. Direct current (DC) electricity has certain intrinsic advantages and is extensively used in many of the circuits within the more sophisticated devices that we are accustomed to. The necessity for a supply of DC power led to one of the basic electronic components which is the rectifier. The rectifier changes AC to DC by its construction. The copper component allows easy current flow in one direction but the copper oxide component is highly resistent to flow in the alternate direction, thus providing current in only one direction. A drawback to this DC current is that it pulsates. This feature is lessened by the use of capacitors which can not only reduce the pulsation but also increase voltages to the level needed.

Another of today's major components is the semiconductor. The word semiconductor comes from the fact that the base materials, germanium and silicon, can perform somewhere between a conductor or an insulator depending on the purity provided. Substances such as arsenic, antimony, bismuth, and phosphorus are added as donor impurities because they give up electrons. Aluminum, indium, galium, and boron are added as acceptor impurities because they accept electrons. By controlling the amount of donor or acceptor material added the amount of conductivity can be controlled. Semiconductors are referred to as solid state because the materials are solid as compared to the vacuum used in vacuum tubes. A diode is a semiconductor with two terminals that is used in the circuit to allow current to flow only in one direction. The word transistor comes from the words transfer and resistor. A transistor is a semiconductor that has more resistance in the input than the output, or the reverse, and can be used as a switch or an amplifier depending on the need.

The science that produced the semiconductor has now provided the integrated circuit (IC). The IC is made of semiconductor material and is often referred to as a chip. Transistors, diodes, capacitors, and resistors can all be deposited on a single chip providing a complete circuit on a small flat surface that is easily packaged. A single chip can hold more than a thousand transistors in a space that once held only one. ICs are found in control circuits, television sets, radio receivers, and many toys. Great numbers of ICs are in today's computers and many of the same ICs are found in guided missiles. Thus an individual IC can have many different applications.

Electronics and electronic devices will continue to have an increasing influence on our lives and the applications seem to be limited only by the imagination of engineers and designers.

An example of chips packaged together with external terminals. The N material accepts electrons in a negative toward positive fashion (similar to a copper conductor). The P material accepts electrons in a positive toward negative fashion. The SiO_2 (silicon oxide) serves as an insulator. The N and P material may be made from either silicon or germanium depending on the situation.



ERIC

INFORMATION SHEET #2

Terms to be Defined

Adaptive control — a control system which responds to external stimuli by automatically adjusting its control action.

Algorithm (control) — the operation by which the input controls the derivation of the output.

Amplification — the process in which a large current is controlled by a small current.

Analogue — the use of a physical quantity (i.e. voltage) to represent a variable and which is made proportional to the variable.

Analogue to digital(A/D) converter — a device which converts an analogue signal to a digital signal at short intervals.

Chip — common name for an integrated circuit.

Data acquisition — the collection of data from any possible source.

Data processing — the extraction of information from data by performing a systematic sequence of operations (such as merging, sorting, computing, etc.) on that data.

Diode — a device that has two terminals and allows current to flow in only one direction.

Error — within a control system, the difference between the set point and the measured value of the controlled entity.

Feedback — information that cycles from the output of a system to become input on the system's status.

Field effect transistor (FET) — a transistor with a high input total resistance and low current needs.

Frequency modulation (FM) — an analogue system in which the frequency transmitted varies in proportion to the value of the variable.

Frequency to voltage (f/V) converter — a device that converts the frequency transmitted to a proportional voltage.

Impedance — an electrical system's total effective resistance: the sum of the inductance, capacitance, and ohmic resistance.

Integrated circuit — a single chip of semiconductor material that contains all of the circuit's components.

Interface — the area common to all units of a system, containing all the required mechanisms that allow the units to transfer data.

Off-line working — using equipment not connected to a system to process data.

On-line working — automatically collecting and processing data from a system as soon as it is available.

Printed circuit — a phenolic or fiberglass board onto which copper lines have been etched. These copper lines are then etched away to allow components to be connected as needed.

Real time — refers to the simultaneous processing of data as it is generated by an event.

Rectifier — a device that converts alternating current to direct current.

Semiconductor — a device constructed of materials which conduct electrical currents somewhere between a conductor and an insulator. Germanium and silicon are such materials, and the amount of conductivity depends upon purity of the material.

Set point — within a control system, the desired value of the controlled variable.

Transducer (electrical) — a device which responds to a physical quantity, condition, or property by producing an electrical output.

Transistor — a semiconductor with three electrodes which can act as an amplifier or as a switch depending on need.

Voltage to frequency (V/f) converter — a device which converts an analogue signal to a pulse that is proportional to the magnitude of the signal.

INFORMATION SHEET #3

Common Uses of Electronics in Agriculture

1. Machinery

   a. Lights and Controls
   b. Air Restriction (Sensor and Indicator)
   c. Engine Oil Pressure (Sensor and Indicator)
   d. Engine Exhaust Temperature (Sensor and Indicator)
   e. Transmission Oil Pressure (Sensor and Indicator)
   f. Transmission Oil Temperature (Sensor and Indicator)
   g. Voltmeter
   h. Fuel Gauge (Sensor and Indicator)
   i. Hourmeter
   j. Ground Speed (Sensor and Indicator)
   k. Engine RPM (Sensor and Indicator)
   l. PTO RPM (Sensor and Indicator)
   m. Wheel Slip Percentage (Sensor and Indicator)

2. Other Machinery Uses

   a. Combines

      1) Reel Speed
      2) Cylinder Speed
      3) Grain Loss Monitors
      4) Straw Walker Sensor
      5) Cleaning Shoe Sensor
      6) Ground Speed Radar

   b. Independent Tractor Monitors

      1) Wheel Slip Percentage
      2) Engine RPM
      3) Field Area
      4) Total Area
      5) Area/Hour
      6) Average Area/Hour
      7) Ground Speed Radar

   c. Planters and Drills

      1) Fertilizer and Seed Shaft Sensors
      2) Fertilizer and Seed Bin Level Sensors
      3) Photoelectric Seed Drop Detection

   d. Equipment

      1) Ridge Till Steering Indicators
      2) Electric Motor Controllers
      3) Auger Flow Sensors
      4) Sparkless Electric Motor Contacts
      5) Feeding Equipment
      6) Grain Drying Equipment
      7) Irrigation Equipment
      8) Moisture Testing Equipment
      9) Machinery Testing and Engine Analyzing

1. Equipment

   a. Surveying Equipment
   b. Tile Laying Equipment

2. Management

   a. Telephones
   b. Radios
   c. Commercial AM and FM
   d. Private VHF and UHF
   e. Data Processing Equipment
   f. Satellite Transmission Reception Equipment
   g. Audio
   h. Video
   i. Data
   j. Videotape Recording and Playing Equipment

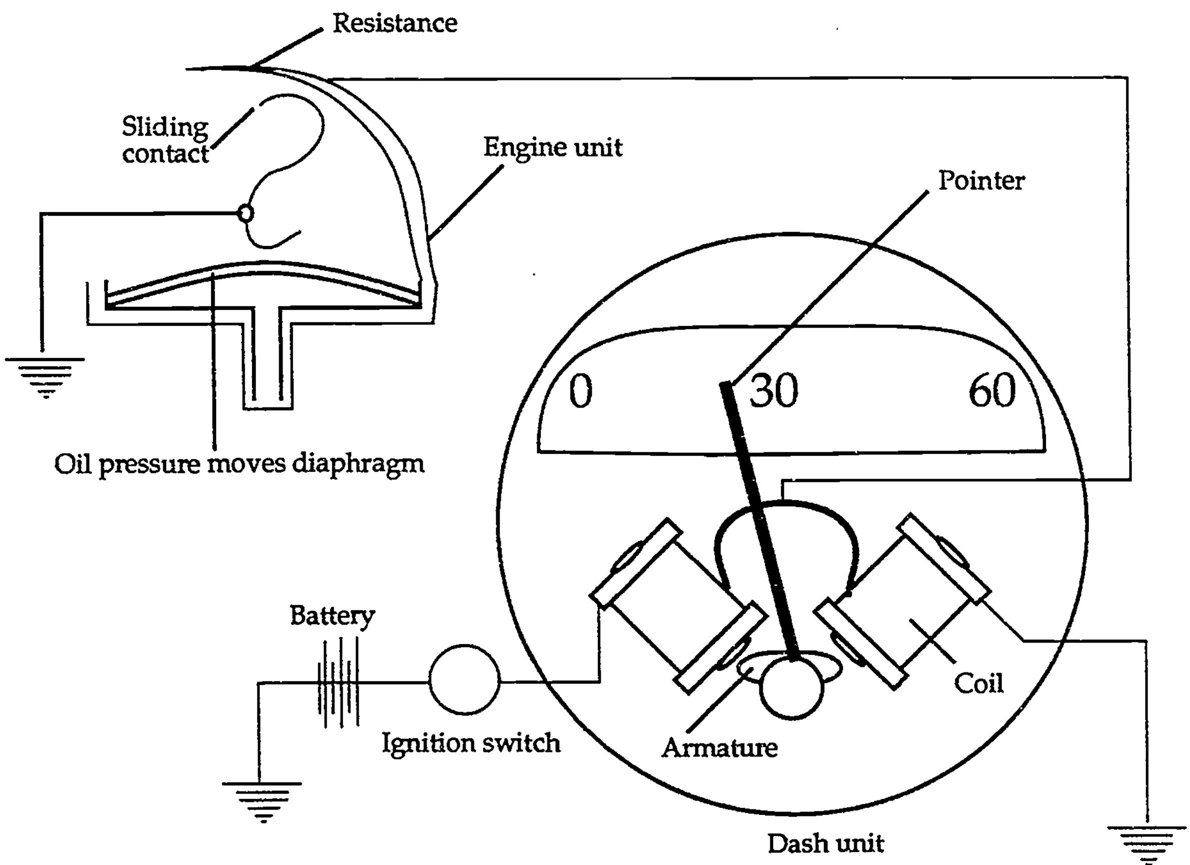
3. Structures

   a. Thermostats
   b. Ventilation Control
   c. Humidity Control
   d. Digital Electronic Control Panels
   e. Lights and Lighting Control
   f. Alarms
   g. Security
   h. Environmental
   i. Electronic Timers
   j. Electronic Ignition of Appliances

This list is not inclusive and serves only as an example of uses available.

TRANSPARENCY MASTER #1

Electronics in Vehicle Gauges

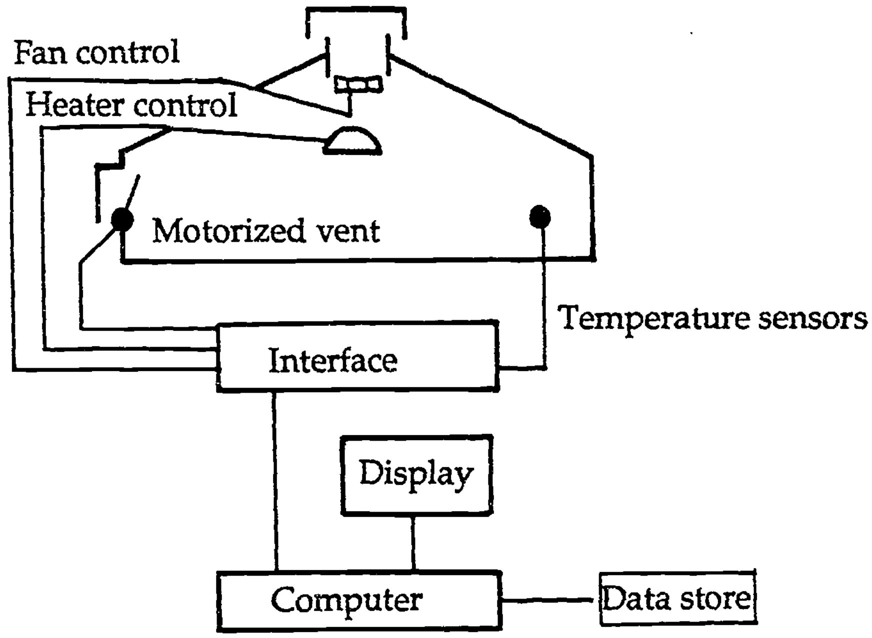


Oil Pressure Gauge

302

TRANSPARENCY MASTER #2

Building Environmental Control

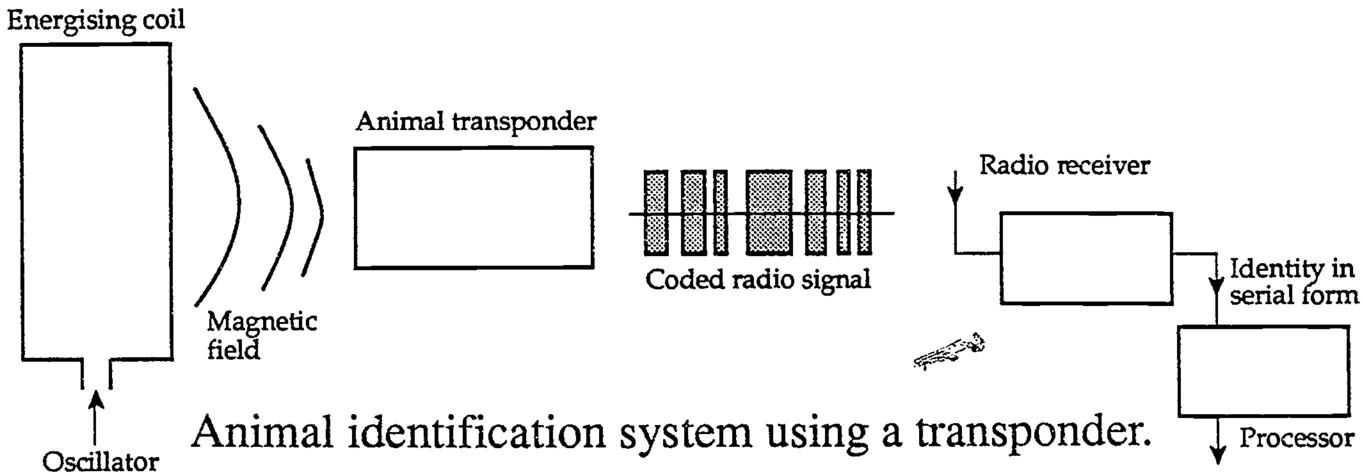


303

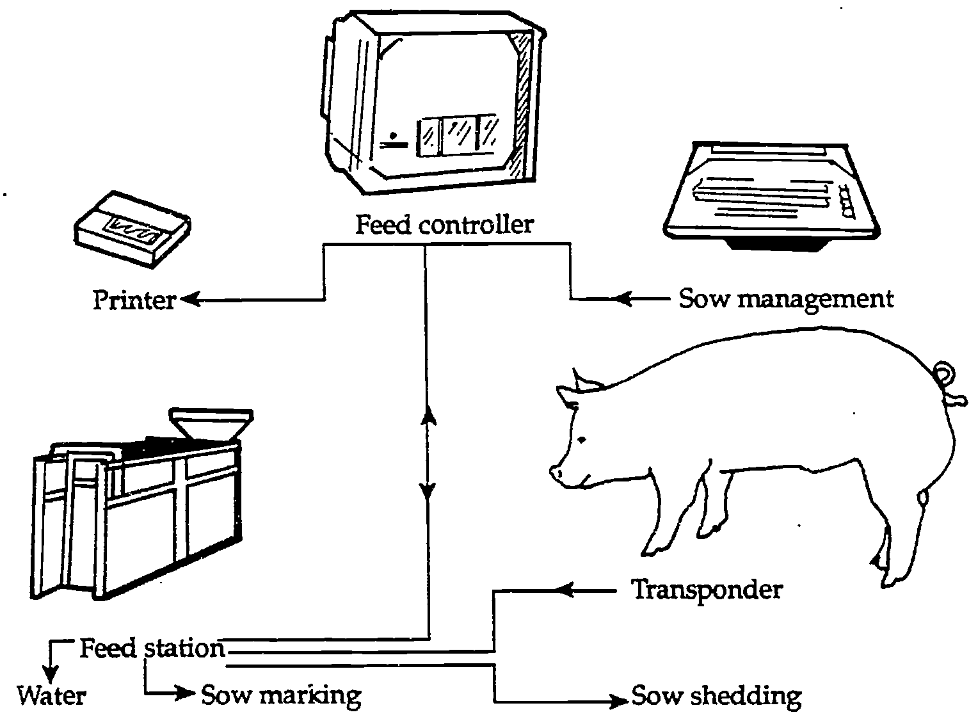
Adapted from *Farm Electronics*

TRANSPARENCY MASTER #3

Animal Feed Management



Animal identification system using a transponder.

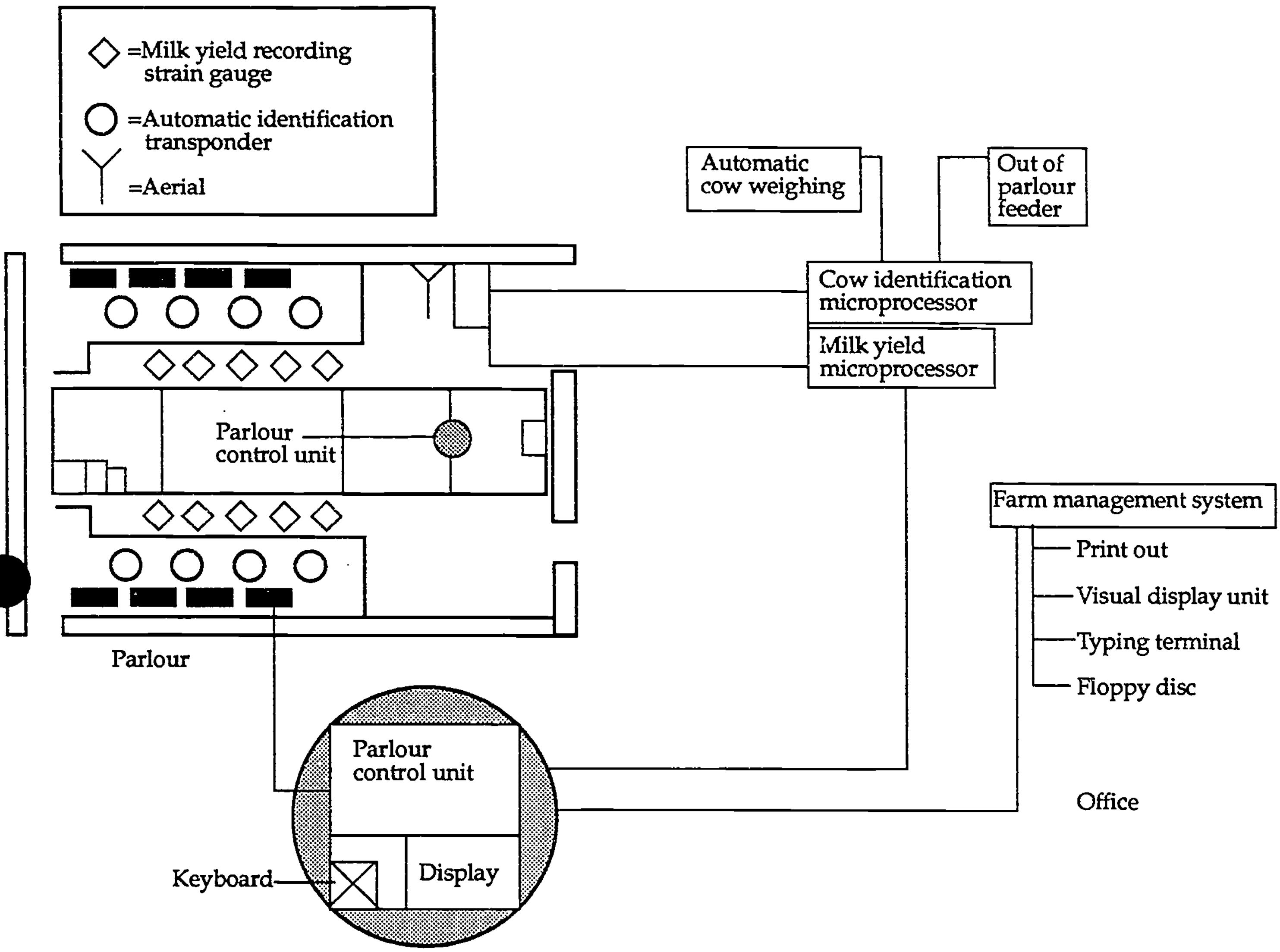


304

Adapted from *Farm Electronics*

TRANSPARENCY MASTER #4

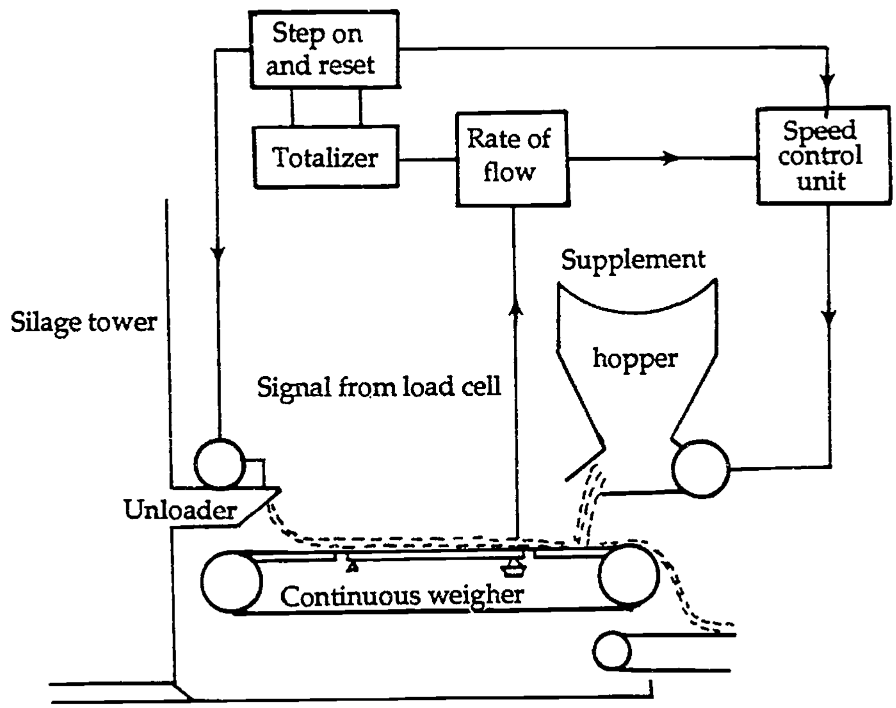
Dairy Monitoring



305 Adapted from *Farm Electronics*

TRANSPARENCY MASTER #5

Complete Feeding



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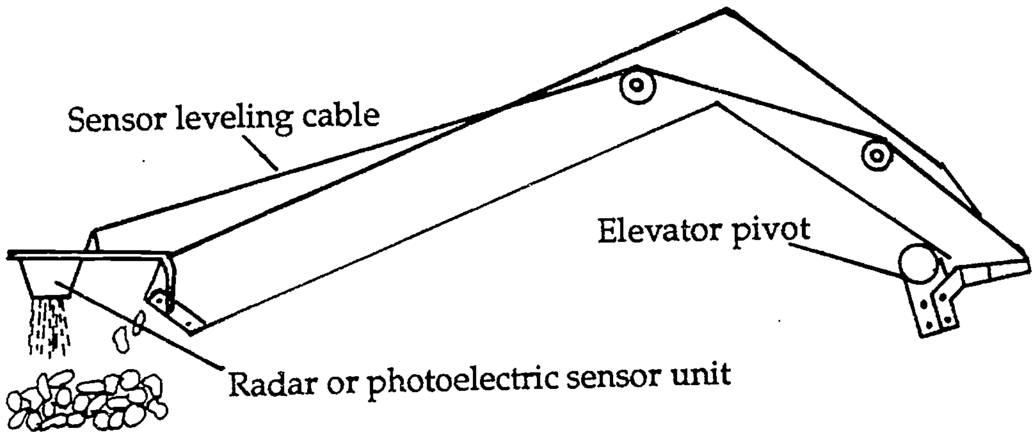
Adapted from *Farm Electronics*

TRANSPARENCY MASTER #6

Commodity Handling



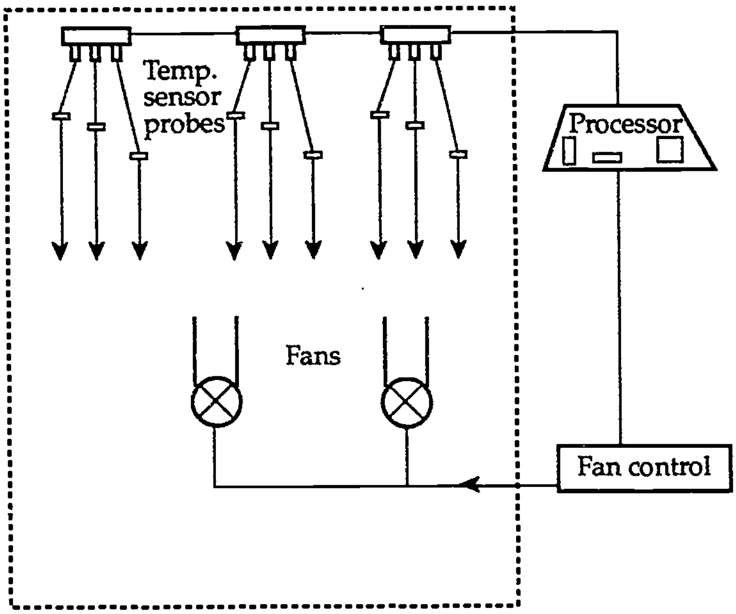
307

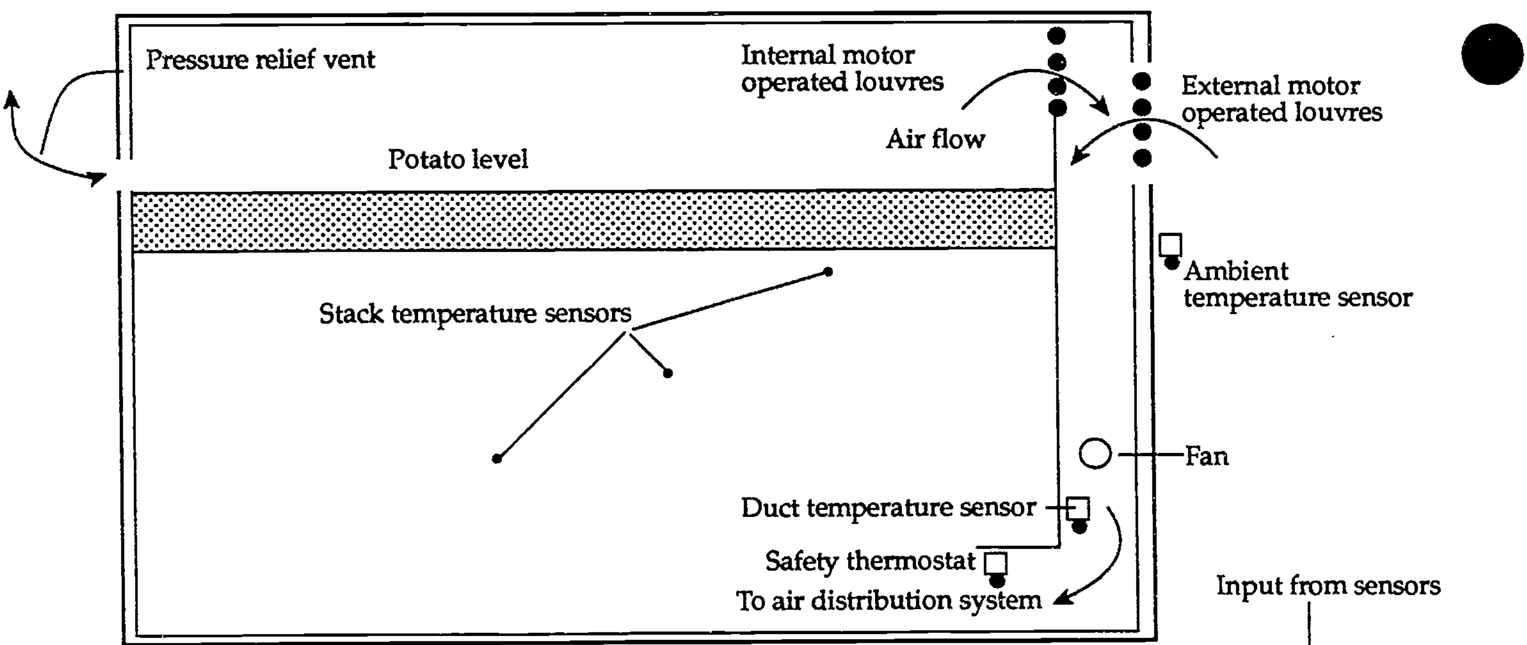
Adapted from *Microelectronics in Agriculture and Horticulture*

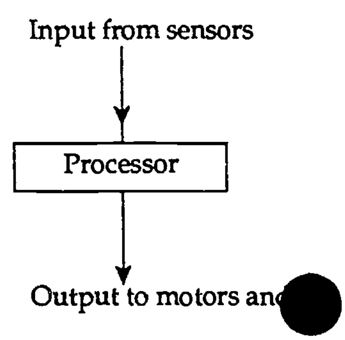
TRANSPARENCY MASTER #7

Commodity Storage Monitoring

Grain





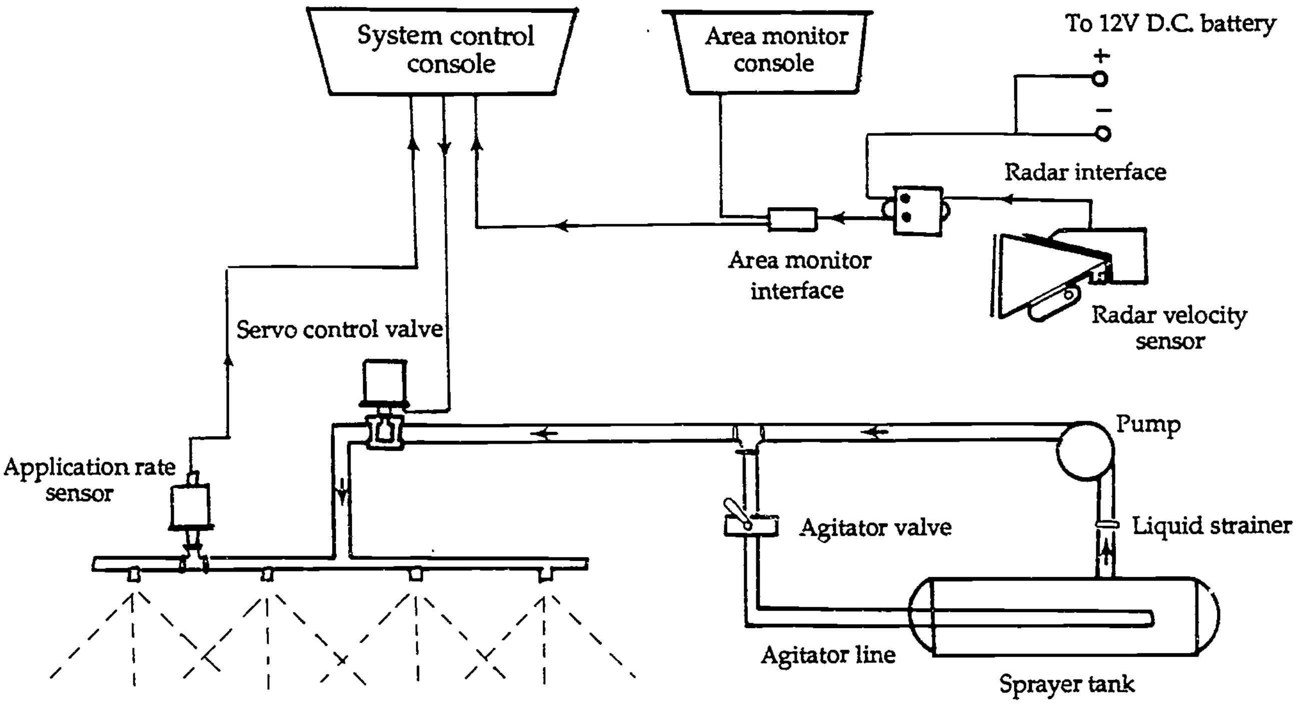


Potato

Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER #8

Spray Control System



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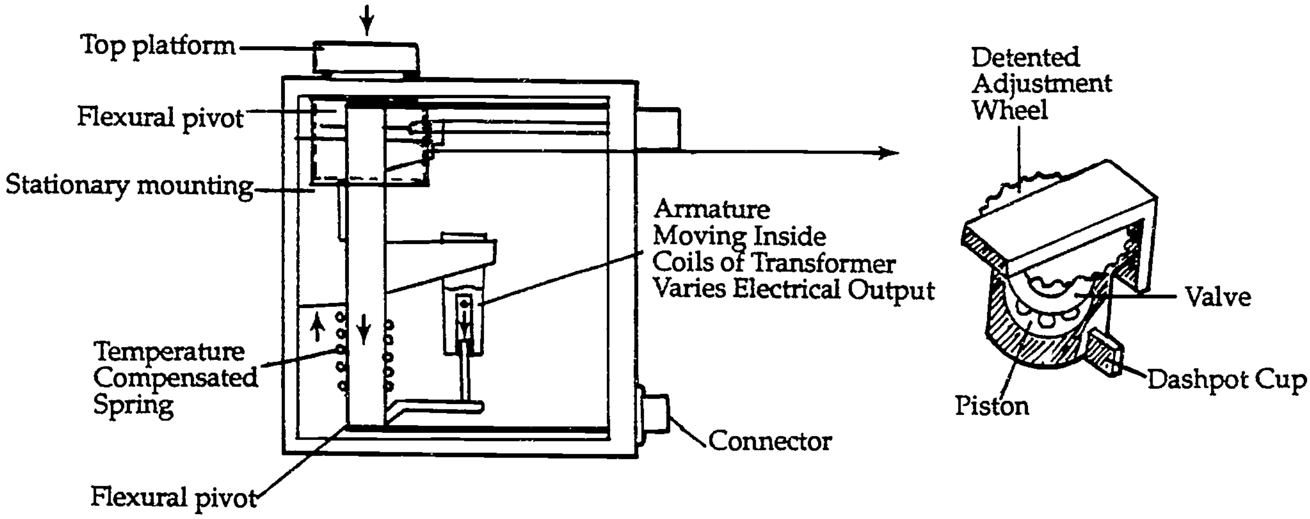
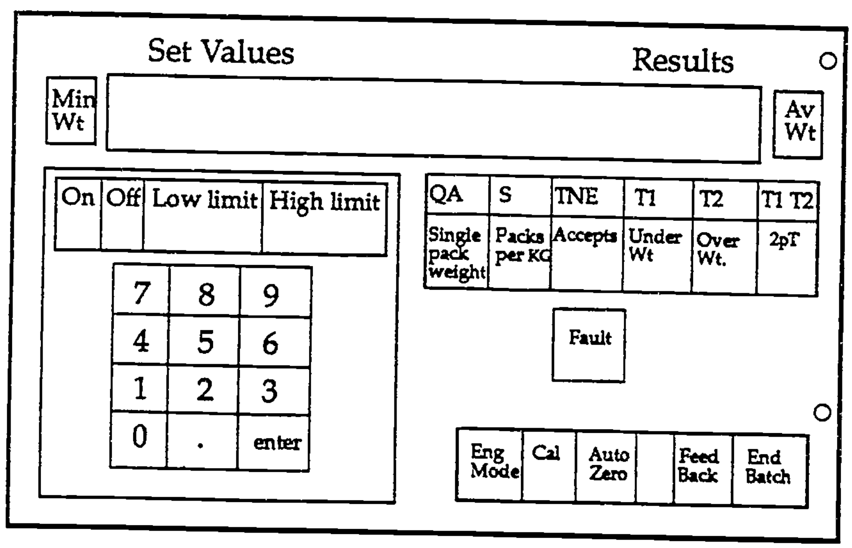
Adapted from *Farm Electronics*

TRANSPARENCY MASTER #9

Electronic Scale

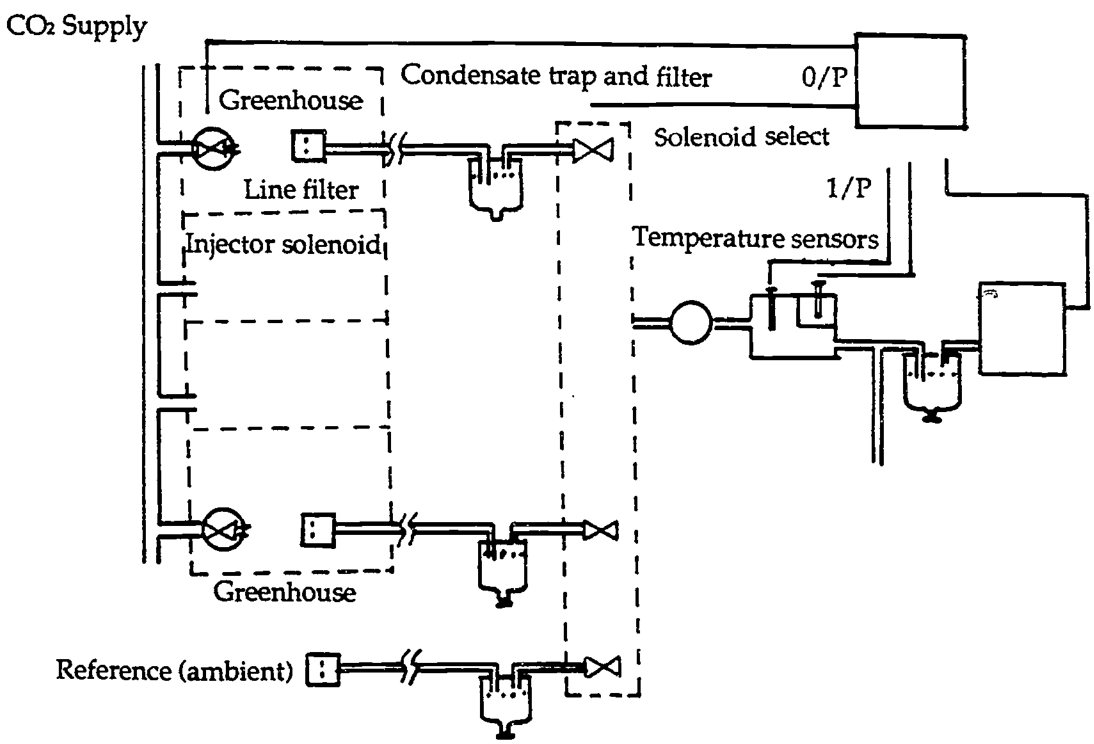




Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER #10

Control of Carbon Dioxide Enrichment



Adapted from *Microelectronics in Agriculture and Horticulture*

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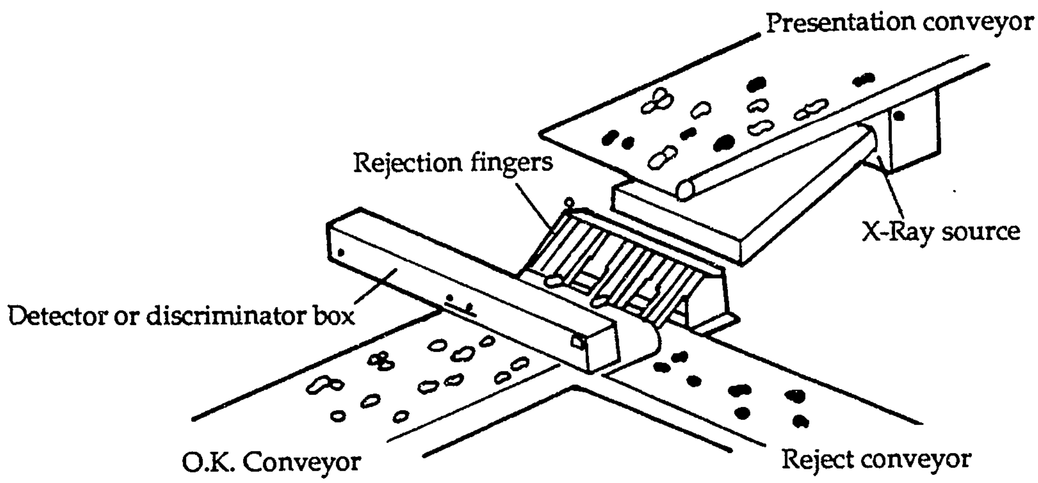
TRANSPARENCY MASTER #11

X-Ray Potato Sorting



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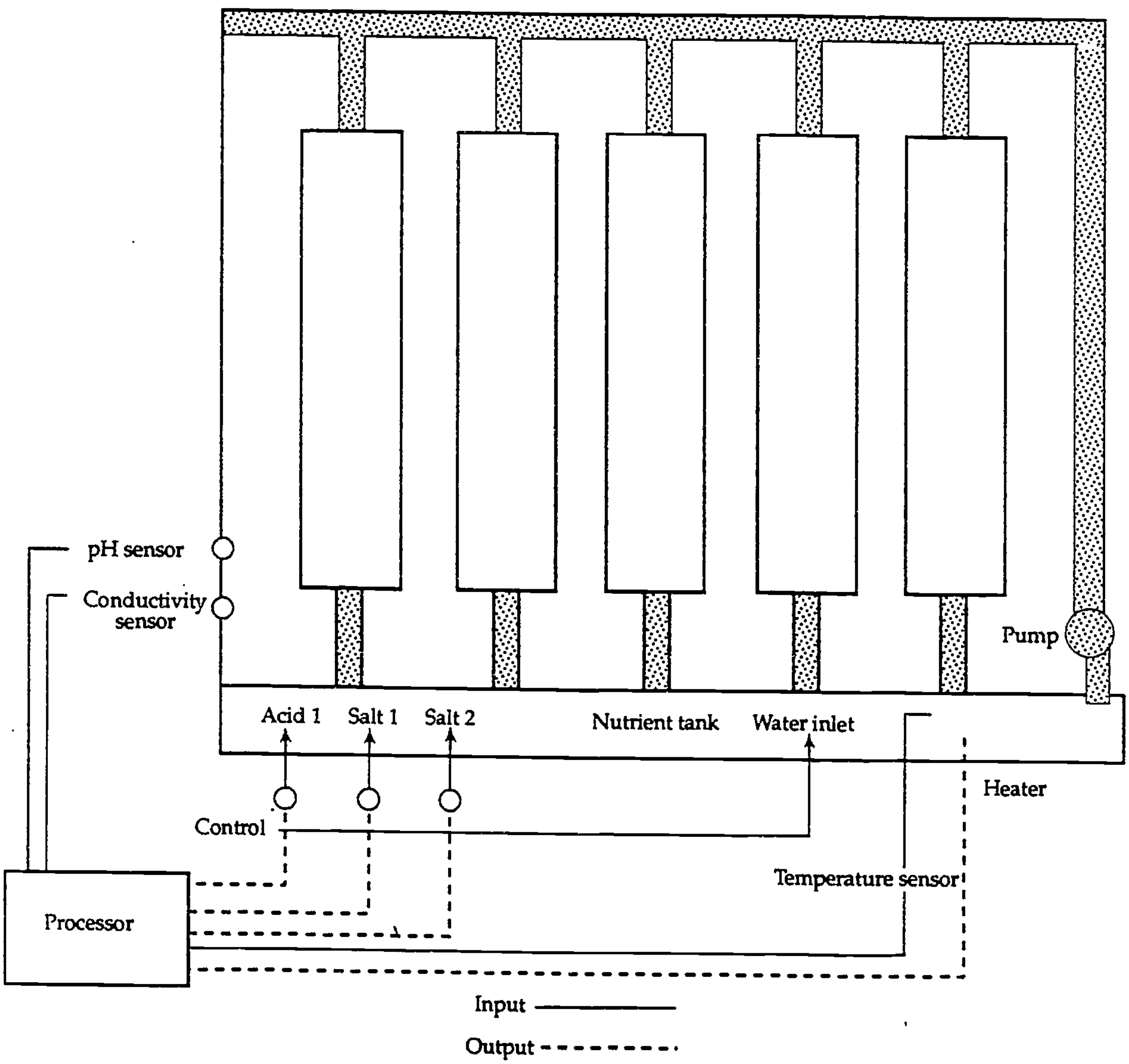
Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER #12

Flow Control of Nutrient Solution in Greenhouses and Hydroponics



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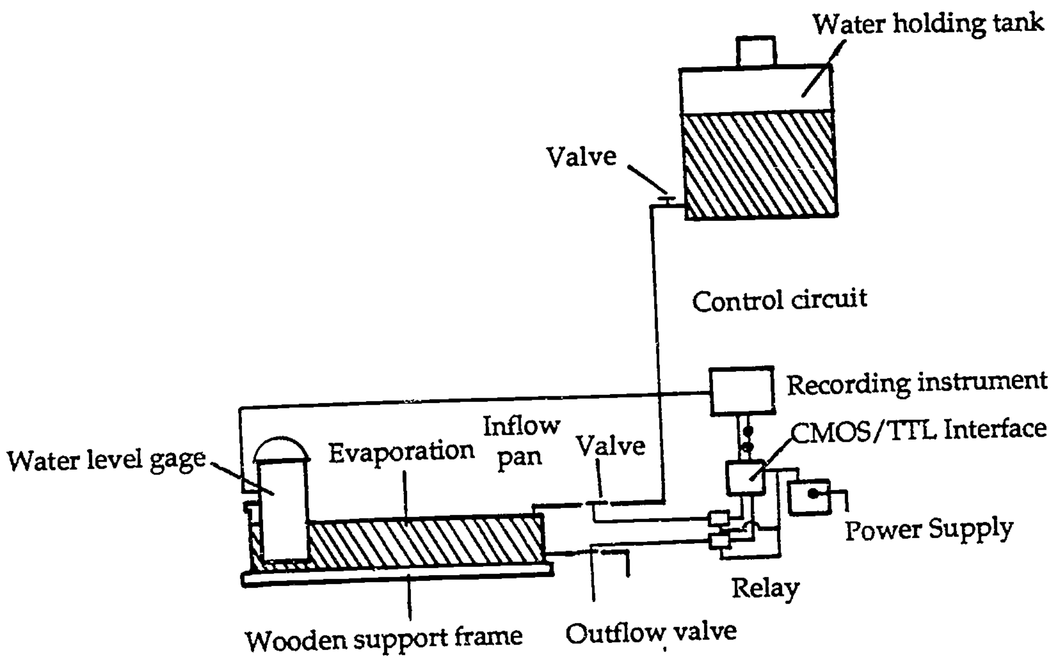
Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER #13

Water Evaporation Pan



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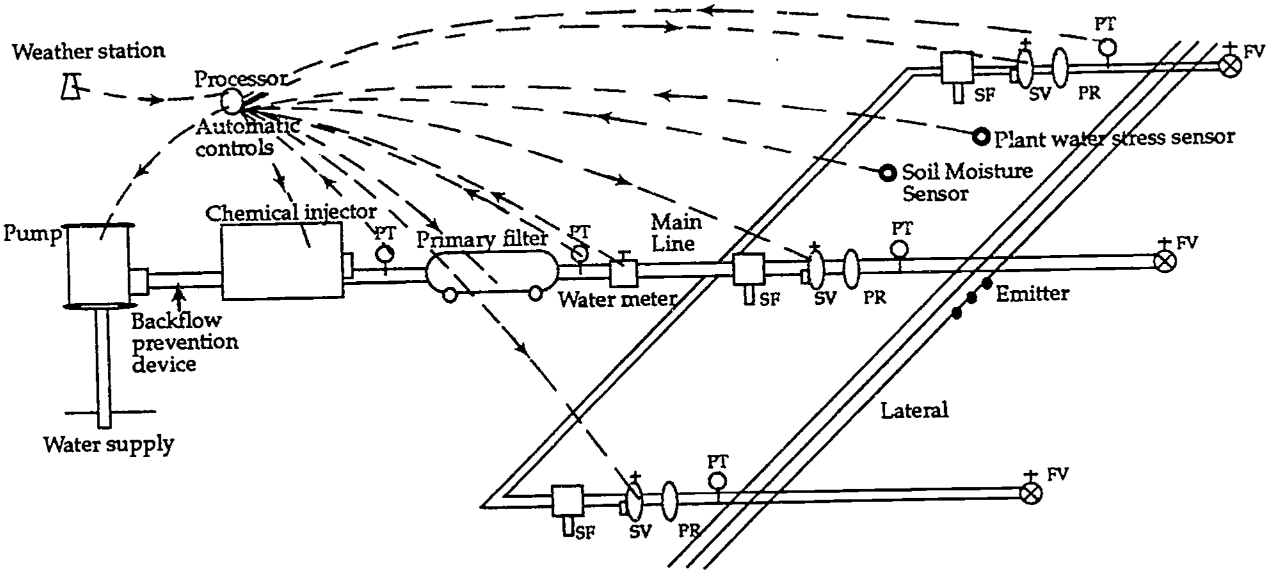
Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER #14

Trickle Irrigation

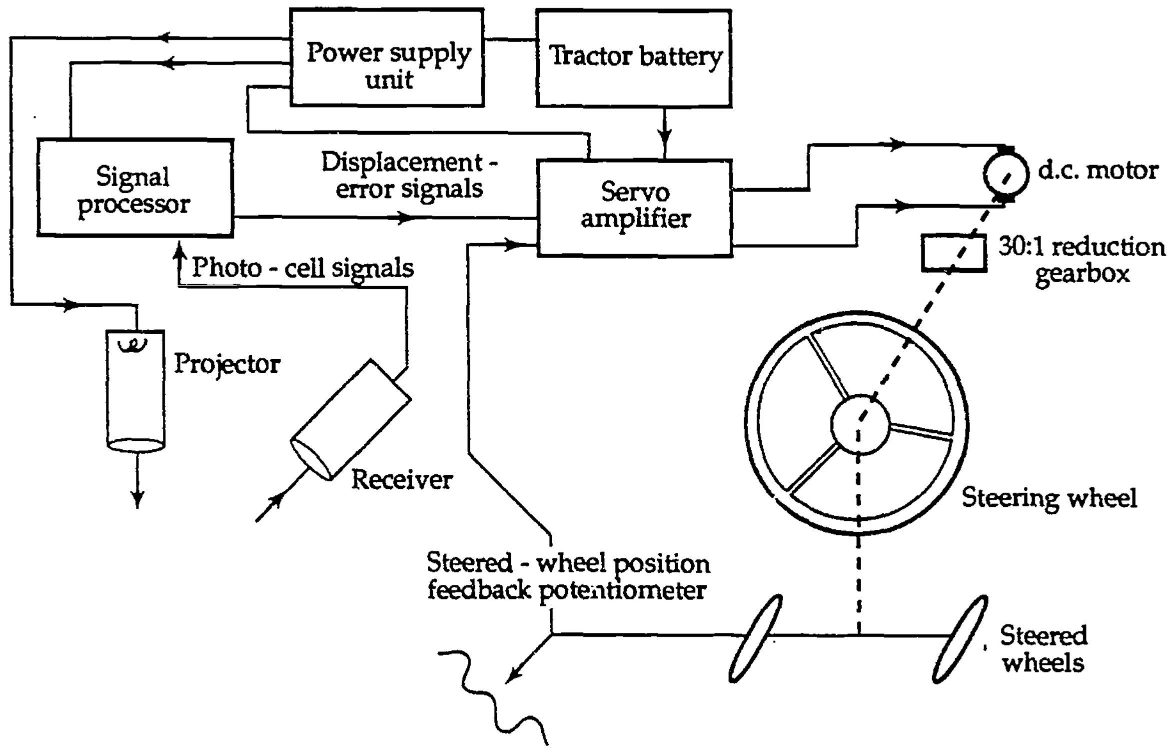


Flush valve = FV
Solenoid valve = SV
Secondary filters = SF
Pressure transducer PT
Pressure regulator = PR
Flow control valve = PR

Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER #15

Vehicle Guidance System



316

Adapted from *Microelectronics in Agriculture and Horticulture*

TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #1

A. Use the diagrams of the gauges as a reference point for electronics use in every day life.

B. Use Information Sheet #3 as an additional list for leading students in a discussion of everyday uses of electronics in agriculture.

Transparency Master #2

Use the diagram as an example of computer use in controlling building environment. This generic example can be adapted for specific uses.

Transparency Master #3

A. Lead the students through a discussion of the process of how the information is collected and sent to the feed controller and computer for processing and storage.

B. Use the simplified diagram to show how a transponder relays the information to the computer via radio signals that are transcribed by the receiver.

Transparency Master #4

A. Use the diagram in relating to students the amount of information that can be gathered, processed, and stored using such a system.

B. Ask students to identify the information that can be gathered. Refer to Transparency Master #3 for information on how the transponder functions.

Transparency Master #5

A. Use the diagram as an example of electronics use in a production facility.

B. Ask students to relate personal experience with such a system. If students have had experience, ask them to relate problems associated with the system.

Transparency Master #6

A. Use the diagram as an example of electronics use in commodity handling.

B. The sensor may contain a radar unit, which emits and receives microwaves, that measures the distance from the chute to the top of the stored commodity. The sensitivity of the reception can be varied to position the chute at the desired height. The microwaves are emitted and the frequency change radiated back is measured.

C. Photoelectric sensors can also be used by providing a projection source and a receiver to measure either absorption or reflection of light.

Transparency Master #7

A. The diagrams can be used as examples of the use of electronics in grain and potato storage.

B. The temperature sensor probes in grain relay the information to the processor, which determines if the temperature is within limits and controls fan operation.

C. The potato sensors are similar in that they relay information. Here, however, the processor not only controls the fan but also the louvre motors.

Transparency Master #8

A. The diagram illustrates an available type of spray monitoring and control system.

B. The radar measurement of ground speed and area covered is relayed to the system control. This information is combined with the application rate sensor information to determine the adjustments necessary on the servo valve.

C. Ask students to relate personal experience with this type of system.

Transparency Master #9

A. This diagram represents an electronic scale used at grain elevators, on portable animal scales, and on portable scales used by law enforcement agencies.

B. The flexural pivot senses pressure put on the piston and valve and the processor converts that pressure reading into a weight.

Transparency Master #10

A. Use this diagram as an example of a controlled environment in a greenhouse.

B. The temperature sensors, flow sensors, CO_2 sensors, and ambient reference sensors relay information to the computer which controls the injector solenoid to control the amount of CO_2 in the greenhouse.

C. Lead students in a discussion of how this method is used. Refer to problem areas on plant growth and development for more information.

Transparency Master #11

A. This diagram is an example of electronics use in food processing.

B. The discriminatory box is adjusted to recognize the normal absorption range of x-rays by potatoes. The discriminatory box controls the rejection fingers and rejects all items that absorb either more or less of the x-rays than that programmed as "normal" for a potato.

Transparency Master #12

A. Use this diagram as an example of electronics use in horticulture.

B. The sensors of pH, conductivity, and temperature provide information to the processor. The processor determines if the readings are within limits and controls the addition of acid, salt 1 and 2, and heat as needed to the nutrient solution. The pH measures the level of H^+ ions, and the conductivity measures the relationship of acids and bases within the solution.

Transparency Master #13

A. This diagram illustrates a water evaporation pan used to measure evaporation rates. This design also includes an automatic water valve to maintain a constant daily starting level.

B. The evaporation pan has applications to measure the evaporation from reservoirs for water level control and quantity available, to predict evapotranspiration rates for plant irrigation, to facilitate maintaining water levels in artificial or man-made aquaculture environments, and to predict forage crop drying rates.

Transparency Master #14

A. This diagram illustrates a proposed fully automatic trickle irrigation system.

B. The various input transducers and sensors would provide the computerized feedback processor and control with the information needed to adjust the valves and regulators to maintain an optimal water supply.

Transparency Master #15

A. This diagram illustrates a vehicle guidance system for driverless applications for following a furrow in primary cultivations.

B. The projector emits a beam of light onto the furrow; the receiver views the light distortion caused by the furrow through photocells and images the furrow. Associated electronics determines the position of the tractor in relation to the furrow and steers the tractor.

C. Turning the tractor at the headlands requires a horizontally scanning light that is reflected by boundary posts. The reflected light is focused onto a photocell that defines the range by the light's intensity. At a predetermined distance from the boundary the computer actuates a speed change, implement lift, a 90 degree turn, and after a lateral displacement another 90 degree turn, lowers the implement, and resumes speed after the furrow is located.

D. Other guidance systems employ mechanical feelers on furrow walls (ridge till) or crop material, radio or optical beacons that require fixed repeaters for location determination, and leader cables buried in a grid of parallel wires that are tracked by search coils on the vehicle, which measure the phase sensitivity to guide the vehicle.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Electronic Device Research

STUDENT WORKSHEET #2 — Study Guide

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Student Name ______________________________

Date ______________________________

Electronic Device Research

Electronic devices now perform many functions that were previously performed in some other manner. Select a local agribusiness and conduct an interview with someone who uses an electronic device to perform a job that was previously performed by some other means.

Name of business ______________________________

Address ______________________________

Type of business ______________________________

Contact person ______________________________

Name of electronic device ______________________________

What company makes this device? ______________________________

What function does this device perform? ______________________________

How does this device perform this function? ______________________________

How was this job performed before this device became available? ______________________________

What problems have been encountered using this device? ______________________________

How often does this device need maintenance? ______________________________

What maintenance procedures are performed on this device? ______________________________

How satisfied is the user with this device? ______________________________

What recommendations for improvement would the user suggest for this device? ______________________________

ERIC Full Text Provided by ERIC

STUDENT WORKSHEET #2

Student Name ______________________________

Date ______________________________

Study Guide

1. What is electronics? ______________________________
2. What is an electronic device? ______________________________
3. Name three current uses of electronic devices in agriculture. ______________________________
4. Name two basic electronic components. ______________________________
5. What is a semiconductor? ______________________________
6. What is an integrated circuit? ______________________________
7. Why are integrated circuits used? ______________________________
8. Name a specific electronic device and the function it performs. ______________________________
9. Using your answer to #8: How was the function performed before the electronic device became available?

   ____

32[illegible]

STUDENT WORKSHEET #2 — Key

Study Guide

1. What is electronics? *The science that deals with the behavior and control of electrons.*

2. What is an electronic device? *Something that uses electrons (electricity).*

3. Name three current uses of electronic devices in agriculture. *Refer to Information Sheet #3 and the Transparency Masters.*

4. Name two basic electronic components. *Refer to Information Sheet #1.*

5. What is a semiconductor? *Refer to Information Sheet #1.*

6. What is an integrated circuit? *Refer to Information Sheet #1.*

7. Why are integrated circuits used? *Because of their size and the ability to perform many functions.*

8. Name a specific electronic device and the function it performs. *Answers will vary.*

9. Using your answer to #8: How was the function performed before the electronic device became available? *Answers will be dependent on #8.*

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UNIT B: Generalizable Skills in Agricultural Occupations

PROBLEM AREAS:

1. Developing Communications Skills in Agriculture
2. Applying Mathematics Skills in Agriculture
3. Developing Human Relations Skills in Agriculture
4. Developing Problem Solving Skills in Agriculture
5. Developing Transition Skills in Agriculture
6. Identifying and Practicing Ethics in Agricultural Occupations
7. Gaining Employment in an Agricultural Occupation
8. Developing Safe Work Habits in Agricultural Occupations

ERIC

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Communications Skills in Agriculture

RELATED PROBLEM AREAS:

All problem areas require some form of communication whether it be listening, speaking, reading, writing, visual, nonverbal, or some combination of these forms.

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Language Arts. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illincis Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to read, comprehend, interpret, evaluate, and use written material.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Locate information that is explicitly stated in the text.					
*2. Summarize the important ideas of the text and the important supporting details.					
*3. Ask questions after reading that take into account the entire text read and are used to clarify and to review information.					
4. Identify and define components of the communication process.					
5. Identify and use techniques for effective listening, speaking, writing, and reading.					
6. Apply effective communications appropriate to a variety of situations.					

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ISBE 41-76

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LEARNING ASSESSMENT PLAN

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Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA (*check one*)
☒ Language Arts
☐ Mathematics
☐ Sciences
☐ Fine Arts
☐ Social Sciences
☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand how and why language functions and evolves.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (*circle one*) 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the purposes being met by a specific message.					
*2. Draw inferences from all forms of communication.					
3. Plan, organize, support, present, and evaluate persuasive messages.					
4. Apply effective communications appropriate to a variety of situations.					

ISBE 41-78 (1/88)

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LEARNING ASSESSMENT PLAN

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Submission Date ____________
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA (check one)
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (circle one) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Prepare a detailed outline for an oral presentation. *2. Distinguish among propositions of fact, policy, and value.					
*3. Organize information in an oral message.					
*4. Organize a persuasive oral message.					
5. Identify and use techniques for effective listening, speaking, writing, and reading.					
6. Identify characteristics of effective directions and use a systematic approach to following and giving directions.					
7. Analyze requests to identify needs and problems.					
8. Use appropriate communications methods in making and responding to requests.					
9. Plan, organize, support, present, and evaluate persuasive messages.					

ISBE 41-78

ILLINOIS STATE BOARD OF EDUCATION
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LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY	DISTRICT	ESC

District Name

City

Submission Date ____

☐ Original submission ☐ Revision

Page ____ of ____

I. LEARNING AREA *(check one)*

☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to write standard english in a grammatical, well organized, and coherent manner for a variety of purposes

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know and understand the purposes of public and personal writing.					
*2. Use the correct form of public or personal writing appropriate to the audience.					
*3. Revise, edit, and proofread.					
4. Identify and use techniques for effective listening, speaking, writing, and reading.					
5. Use appropriate communication methods in making and responding to requests.					
6. Plan, organize, support, present, and evaluate persuasive messages.					
7. Apply effective communications appropriate to a variety of situations.					
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ISBE 41-78

Submission Date ______
☐ Original submission ☐ Revision | Page ____ of ____

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

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Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to listen critically and analytically.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze accurately the content of an oral message of an appropriate length. *2. Follow multistep oral directions in the order given.					
*3. Demonstrate interaction skills in a variety of contexts.					
*4. Respond effectively and appropriately to oral messages.					
5. Describe barriers to effective communication.					
6. Identify and use techniques for effective listening, speaking, writing, and reading.					
7. Identify characteristics of effective directions and use a systematic approach to following and giving directions.					
8. Analyze requests to identify needs and problems.					335
9. Use appropriate communication methods in making and responding to requests.					

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ISBE 41-78

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Communications Skills in Agriculture

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Identify and define components of the communication process.
2. Describe barriers to effective communication.
3. Identify and use techniques for effective listening, speaking, writing, and reading.
4. Identify the characteristics of effective directions and use a systematic approach to following and giving directions.
5. Analyze requests to identify needs and problems.
6. Use appropriate communication methods in making and responding to requests.
7. Plan, organize, support, present, and evaluate persuasive messages.
8. Apply effective communications appropriate to a variety of situations.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Communications Skills in Agriculture

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. What is communication?
2. Why is communication necessary?
3. What are the components of communication?
4. What are some of the barriers to communication?
5. Why is it necessary for one to overcome barriers to communication?
6. How can one overcome barriers to communication?
7. What techniques can one use to become a more effective listener? Speaker? Writer? Reader?
8. Why is it necessary that one understands directions?
9. What is an approach one can use to following and giving directions?
10. How can one analyze requests in order to understand what is needed?
11. What are the various methods of responding to requests? Of making requests?
12. Why is it important to use methods appropriate to the given situation?
13. What is a persuasive message?
14. What is the content of a persuasive content?
15. Why is it important that one be able to plan, use, and evaluate persuasive messages?
16. What are situations in which one would use persuasive messages?
17. What are the differences between communicating with a co-worker and a supervisor?
18. How should one present a problem to a supervisor?
19. How should I request information from a supervisor?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Communications Skills in Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use specific discipline personnel, such as English and speech instructors, as resource persons for ideas, methods, techniques, and materials.

2. Stress to students the applicability of communication to all situations. Home, school, sports, leisure, and work all require communication that may be unique to the given situation but all require the same basic foundations.

3. Use the arrangement of the problem area to acquaint students with one model of communication (Transparency Master #1). Follow the introduction with the barriers to communication and techniques for effective listening, speaking, writing, and reading. Student Worksheets #1 - #6 can be used in conjunction with Information Sheets #1 - #5.

4. Use Transparency Master #2 as an example of a company memo. Information Sheet #6 can be used to acquaint students with different categories of requests. Follow these with Student Worksheets #7 - #11 for practice in the practical use of communication in the workplace. Emphasis has been given to following directions and making and responding to requests.

5. Transparency Masters #3 - #5 and Student Worksheet #12 deal with persuasive messages. Emphasize the planning, organization, supporting information, and elements of presentation necessary to make a persuasive message successful. An evaluation checklist is provided to help the student begin to be systematic in constructing these messages. The checklist can also be used to help students analyze messages presented by others.

6. Lead students in a discussion of the uses of persuasive messages in everyday communication. Have students give personal examples.

7. Use Information Sheets #8 and #9 and Student Worksheets #13 and #14 for work in dealing with requests from and providing information to supervisors. Stress to students the importance of their position in the work structure and the attitudes necessary to be successful in an entry level position.

8. Lead students in a discussion of the applicability of Student Worksheets #1 - #10 not only in dealing with supervisors, but also in dealing with co-workers, clients, and customers, and in performing those jobs necessary to be successful in the work environment.

9. Invite guest speakers to address the class on the necessity of effective communication in the work environment. One approach would be to have an owner, manager, secretary, supervisor, and worker from an agribusiness give examples of everyday communications that are necessary, and the methods and procedures followed to maintain open communication. Of interest would be examples of problems encountered and how those problems are resolved.

10. Have students relate the presented concepts to SAE programs and record books.

11. Use FFA activities such as public speaking and parliamentary procedure contests, committee work, public relations, and Building Our American Communities (BOAC) projects as areas for reinforcing the need for effective communications skills.

12. Use specific problem area activities as an additional source of relevant communications activities.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Communications Skills in Agriculture

REFERENCES

1. *Applied Communication.* (1988). Agency for Instructional Technology. Available from Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322-3906.

*2. *Understanding the Importance of Effective Communication through the Spoken Word.* (Subject Matter Unit #8369); *Understanding the Importance of Effective Communication through the Written Word.* (Subject Matter Unit #8370); *Improving Communication Skills through Organized Activities.* (Subject Matter Unit #8371); *Utilizing the Media for Effective Communication —Public Relations.* (Subject Matter Unit #8372). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843.

3. *Speaking and Listening in Vocational Education; Writing in Vocational Education.* (1984). Oregon Career Development Consortium, 651 High St. N.E., Suite 4, Salem, OR 97301.

4. *Generalizable Communications Skills Assessment.* (1984). Illinois State Board of Education, Department of Adult, Vocational, and Technical Education.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Barriers that Affect Communication

INFORMATION SHEET #2 — Techniques for Effective Listening

INFORMATION SHEET #3 — Techniques for Effective Speaking

INFORMATION SHEET #4 — Techniques for Effective Writing

INFORMATION SHEET #5 — Techniques for Effective Reading

INFORMATION SHEET #6 — Types of Requests

INFORMATION SHEET #7 — Written and Oral Persuasive Messages

INFORMATION SHEET #8 — Requesting Information from Supervisors

INFORMATION SHEET #9 — Presenting Problems to Supervisors

TRANSPARENCY MASTER #1 — Basic Components of the Communications Process

TRANSPARENCY MASTER #2 — Sample Memo

TRANSPARENCY MASTER #3 — Content of Persuasive Messages

TRANSPARENCY MASTER #4 — Guidelines for Preparing a Persuasive Report or Presentation

TRANSPARENCY MASTER #5 — Steps for Preparing a Persuasive Message

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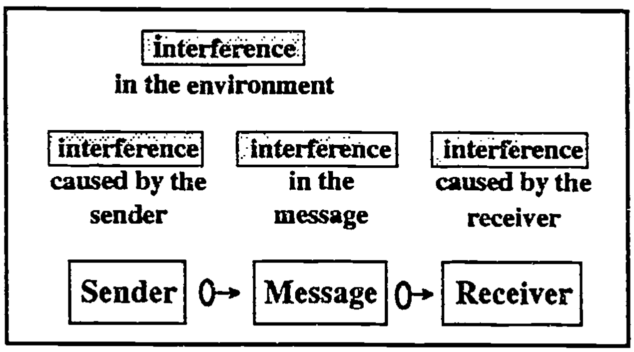
INFORMATION SHEET #1

Barriers that Affect Communication

The major components of the communication process (sender, message, and receiver) are present whenever there is communication — at school, at home, at play, and at work. Two factors may affect the success of communication: deadlines and interferences. These factors can affect all types of communication: listening, speaking, reading, writing, visual, and nonverbal.

Many situations have **deadlines**, so the time you have to communicate about a problem or gather information may be limited. These deadlines can work to your advantage or disadvantage. Deadlines affect how much you can communicate and how well. If the deadline is pressing, you may feel pressured and maybe even anxious or threatened. To communicate effectively, you need to identify how much time you have and decide how to use time to your advantage.

Interferences, on the other hand, are almost always a disadvantage. They are also referred to as "noise" or barriers to communication. Interferences may come from the environment or from the communication process itself. The figure below shows interferences that affect communication.



From the Environment

Interference from the environment can make sending or receiving a message difficult. Interference can be described as "static," similar to the static you hear on the radio or see on television. For example, if you're trying to carry on a conversation when a lot of people are talking loudly in the next room, you may be distracted or have a hard time hearing. If you're talking on the telephone, static might result from actual interference caused by a bad connection. Interference also happens when people hold a microphone too close, thus distorting the sound. Interference in the communication channel for reading and writing occurs when handwriting is sloppy, typewriting is carelessly done, or when a page is torn or has something spilled on it.

From the Sender

Interference may occur because the sender provides inaccurate information in the message or includes personal prejudices or biases. Presenting an opinion as a fact can be a form of interference. Interference can also occur when the sender ignores or misinterprets the receiver's feedback, such as comments and nonverbal signals (facial expressions, tone of voice, etc.). For example, the receiver may indicate through comments and a puzzled look that he or she does not understand the message. Or the sender may assume that the receiver knows more or less than the receiver actually knows about the subject, thus giving the receiver too much or too little information. The sender might also organize the information poorly, making it difficult for the receiver to understand. For example, the sender may fail to state facts in the order they happen, thus making the message hard to follow.

In the Message

Interference in the message is usually the result of the sender using inappropriate words, signals, or images. Sometimes this is because the sender hasn't carefully selected the best words; at other times, it is because the sender doesn't know the correct words or information. For example, calling a specific electronic component "one of those things" could cause confusion. Message errors can also result from words or other important information (such as a date or address) being omitted, so the message is incomplete. Interference in a written message can be caused by too many words or too much technical jargon. Interference can also be the result of inattention to page design such as using a type size that is too large or too small, having too little white space, or providing insufficient margins.

From the Receiver

Interference in the receiver is usually the result of the receiver's personal opinions that keep him or her from listening or reading with an open mind. If the receiver already has an opinion and is unwilling to consider other ideas, the sender may have difficulty communicating with the receiver. The receiver may also frequently interrupt and challenge the sender's ideas.

INFORMATION SHEET #2

Techniques for Effective Listening

Concentrate on the message rather than the speaker. Colorful personalities draw listener attention, which is good. But their unusual presentation style (clothes, gestures, voice) may eventually distract listeners, to the extent that the message may not be communicated.

Daydream selectively. Normal people spend a surprising percentage of their everyday lives daydreaming. It's acceptable to daydream if you're able to recognize when you are doing it and know how to stop when you need to.

Take notes. Notes help you remember and are useful records of what you listened to. However, if you try to write down too much of what is said (beyond important words and phrases), you'll spend more time writing than listening and thinking.

Ask questions. Most speakers (senders) appreciate questions because they show the receiver's interest. But questions asked in mid-message can interrupt the sender's flow of ideas. Ask questions only when the sender indicates a willingness to answer them.

Sit in the right place. Sometimes you can't control where you are in relation to the sender; often you must sit or stand wherever a space is available or assigned. If you can choose, pick a location that helps you listen. For example, if you're easily distracted, sit or stand far enough away and positioned so that you can see both the sender and the other receivers.

Listen with a purpose or interest. Know why you're listening and what you're listening for.

Identify listening cues. The following are words or phrases that tell you what to expect:

1. **Introduction** — let me begin
2. **Main idea** — one main point, a central idea
3. **Examples** — for instance, for example, like, such as
4. **Details** — specifically, an important part of
5. **Conclusion** — in summary, finally

Recognize common patterns of organizing information.

1. **Chronological order** — first, next, then
2. **Order of importance** — most important, least significant, priority
3. **Comparison and contrast** — similar, like; different, in contrast
4. **Cause and effect** — because, so, therefore

Notice nonverbal signals. Try to determine what they mean.

Be open to new ideas. Consider other ideas even when you don't agree with them.

Know your own listening habits. Learn to make them work for you and improve them when necessary.

INFORMATION SHEET #3

Techniques for Effective Speaking

1. **Selecting the message**
   a. Decide what you want to say.
   b. Match the message to the receiver.

2. **Organizing the message**
   a. Put the information in a pattern that the receiver will recognize (chronological, priority, comparison and contrast, cause and effect).
   b. Use appropriate phrases to make the pattern clear to the listener (next, most important, similarly, because).
   c. Use visuals to clarify and illustrate your message when appropriate.
   d. Prepare by thinking through what you want to say.

3. **Presenting the message**
   a. Use natural facial expressions, gestures, and appropriate posture.
   b. Deliver your message with enthusiasm and sincerity.
   c. Maintain eye contact with the receiver(s).
   d. Speak loudly enough for receiver(s) to hear you and slowly enough to be understood.
   e. Avoid slang and such fillers as "um," "ya know," and "like."

INFORMATION SHEET #4

Techniques for Effective Writing

Remember to plan your writing by asking yourself the following:

1. Who is my audience?
2. What is the purpose?
3. What do I want to say?
4. How should I organize the information?
5. What examples and details will help my audience understand and remember my main points?
6. What is the most effective format?

Once you decide what to write and the best order in which to present the information, you can begin drafting. When you prepare a draft, just concentrate on getting the ideas down on paper. You can always go back and change things later.

While drafting, ask yourself the following:

1. Have I included all the information the reader will need?
2. Have I explained my ideas?

When you revise, reread the entire document to make sure it says what you want. Look for better ways of expressing your ideas (reorganizing the paragraphs, changing sentences or words, etc.). Business documents usually follow specific ways of presenting information. The content must be accurate, with main ideas and amount of detail appropriate for the reader. You must check sentence structure as well as punctuation, capitalization, and spelling. Your layout and design should follow the standard forms used in your occupational area. The revised draft should be neat, complete, and on time. Ask yourself the following:

1. Will the reader understand what I mean?
2. Is the order of information and ideas logical and easy to follow?
3. Are the examples and details useful?
4. Have I included enough information?
5. Have I included too much information?
6. Do my sentences make sense?
7. Have I double-checked the mechanics and grammar?
8. Does it look professional?

INFORMATION SHEET #5

Techniques for Effective Reading

You scan to locate specific detail that is mixed in with many other details. When you scan you:

1. Read down the page (rather than across).
2. Read section and column headings.
3. Use a reading aid such as a bookmark to help keep your place if you need it.

You skim to determine the main idea. When you skim you:

1. Note the title and subtitles.
2. Read the introduction and conclusion.
3. Read boldface type and italics.
4. Look at illustrations.

Another useful on-the-job reading or listening technique is summarizing. However, summarizing is not a quick technique but one that requires a reasonable amount of time and effort to complete. In a summary you put all the writer's important ideas into your own words. Summaries can be done in sentence or chart form, or presented orally. To summarize:

1. Read the material carefully.
2. Identify the topics covered.
3. Put the material aside and write your summary (or put it in the form of a chart or summarize it orally).
4. Do not include unnecessary words in your summary.
5. Check your summary against the original material.

INFORMATION SHEET #6

Types of Requests

The chart below summarizes the three types of requests and gives examples of each type. After reading each section of the chart, fill in the blank spaces by writing an example of a request from your occupational area.

Information	Action	Permission
Who Co-workers, supervisors, clients, and customers	**Who** Co-workers, supervisors, clients, and customers	**Who** Co-workers, supervisors, clients, and customers
What Questions about products, service, equipment	**What** Workers orders, purchase orders for products or equipment, appointments for service	**What** To change, alter, or ignore standard practice, procedure, or policy
Example "Will these cut heavier sheet metal?" "How does the new equipment compare in performance to the old?"	**Example** "Please send 20 #747 printer ribbons." "I'd like an appointment for Friday at 2:00 P.M." "May I have Friday off?"	**Example** "May I have Friday off?" "May I use your tools?" "May I charge this purchase to the office account?"
Personal Example __________ __________ __________ __________ __________	**Personal Example** __________ __________ __________ __________ __________	**Personal Example** __________ __________ __________ __________ __________
What Questions about policies and procedures	**What** Requests to carry out policies or procedures	**What** To adjust policies or procedures
Example "How do we close up at night?" "Can I return the merchandise if it is the wrong color?"	**Example** "Can you make an appointment for me?"	**Example** "Is it OK if we share this workbench?" "May I use the printer in your office?"
Personal Example __________ __________ __________ __________ __________	**Personal Example** __________ __________ __________ __________ __________	**Personal Example** __________ __________ __________ __________ __________

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Information	Action	Permission
What Questions about schedules, orders, or the status of a work task **Example** "Can the heating plant be installed by the 10th?" "Does the order for Redfeather Plumbing include 15 shutoff valves?" **Personal Example** __________	**What** Claims and adjustments **Example** Enclosed in the package you will find the broken valve. Please credit our account #7124." **Personal Example** __________	**Not Applicable** __________
What How-to questions **Example** "How can I adjust the fuel level?" "What must I do to print five more copies?" **Personal Example** __________	**What** Demonstrations **Example** "Will you show me how to change the dip switch?" **Personal Example** __________	**What** To demonstrate **Example** "May I show you how to cut that metal?" **Personal Example** __________
When A response may be needed immediately, or by a future date. **Example** "When do you need it?" **Personal Example** __________	**When** A response may be needed immediately, or by a future date. **Example** "When do you need it?" **Personal Example** __________	**When** A response may be needed immediately, or by a future date. **Example** "When do you need it?" **Personal Example** __________

INFORMATION SHEET #7

Written and Oral Persuasive Messages

Written Persuasive Messages

A written message is useful both for company records and as a source of public information. A persuasive message can be written as a memo or a more formal report. A persuasive report might range in length anywhere from one to ten pages and must include detailed explanations of the list in Information Sheet #4. The contents should reflect careful research that is supported with facts and figures.

Oral Persuasive Messages

When speaking you should pay attention to the following:

1. **Voice**

   a. Pleasant pitch of voice (high, average, low)
   b. Proper rate of speed (fast, medium, slow)
   c. Volume of voice (loud, normal, soft) appropriate for audience/room size

2. **Physical Presence**

   a. Maintaining eye contact with audience
   b. Good posture (not stiff but natural, loose, and relaxed)
   c. Appropriate gestures and expressions
   d. Use of visuals
   e. Appropriate dress

3. **Language**

   a. Proper pronunciation of words
   b. Correct grammar
   c. Appropriate vocabulary

An outline for a short oral, persuasive presentation should include the following:

1. The subject and purpose of the presentation.

2. Your point of view.

3. Your first argument and supporting evidence.

4. Your second argument and supporting evidence.

5. Your third argument and supporting evidence.

6. A call for action.

INFORMATION SHEET #8

Requesting Information from Supervisors

All

1. **Plan your request.** Think about your audience, the purpose, and again, most important of all, what you want to say.

2. **State your request clearly.** Start with an introductory statement of the problem or situation. Then describe, as best you can, the information you are requesting.

3. **Explain the reasons.** Provide appropriate information.

4. **Keep the request simple, short, and courteous.** Remember, you are requesting information, not demanding it. Your language and tone should probably be more formal with a supervisor than with a co-worker.

If Written

1. **Use visuals if they are appropriate.** When you communicate in writing, you have your words, visual illustrations, and the format to make your point. If you fail to express yourself clearly, your reader may become confused.

2. **Review your draft.** Check for spelling, grammar, and punctuation mistakes.

If Oral

1. **Listen actively.** Maintain eye contact with the receiver. Try not to interrupt any response to your request. Use pauses to consider what was said or to ask more questions to check your understanding.

2. **Use facial expressions and gestures.** These help to communicate understanding, acceptance, or confusion.

INFORMATION SHEET #9

Presenting Problems to Supervisors

We can all agree that the best way to handle a problem is to catch it before it develops. But sooner or later everyone encounters problems at work. A work-related problem is anything that interferes with getting a job done properly and on time. When a problem occurs, what should you do about it? How should you tell your supervisor?

Before you talk to your supervisor:

1. Make sure you understand the problem.

2. Decide if and when you should present the problem. Can it be handled by yourself or a co-worker in the normal course of work? Major problems need immediate attention; minor problems can wait until your supervisor's work load lightens.

3. Think about what your supervisor needs to know. What is your goal in the presentation of the problem to your supervisor? What are the basic facts that he or she needs to know to handle the problem?

4. Think of a possible solution.

When you talk (or write) to your supervisor:

1. Explain the problem clearly. Get to the point. Concentrate on the facts. Give opinions only if your supervisor requests them.

2. Concentrate on what the problem is, not who caused it. Focus on the solution to the problem.

After you talk with (or write to) your supervisor:

1. Be modest. Avoid taking too much credit for bringing up the problem or for your suggestions.

2. Respect confidentiality. Don't gossip about another worker's mistakes. Job-related problems are best handled in an atmosphere of trust.

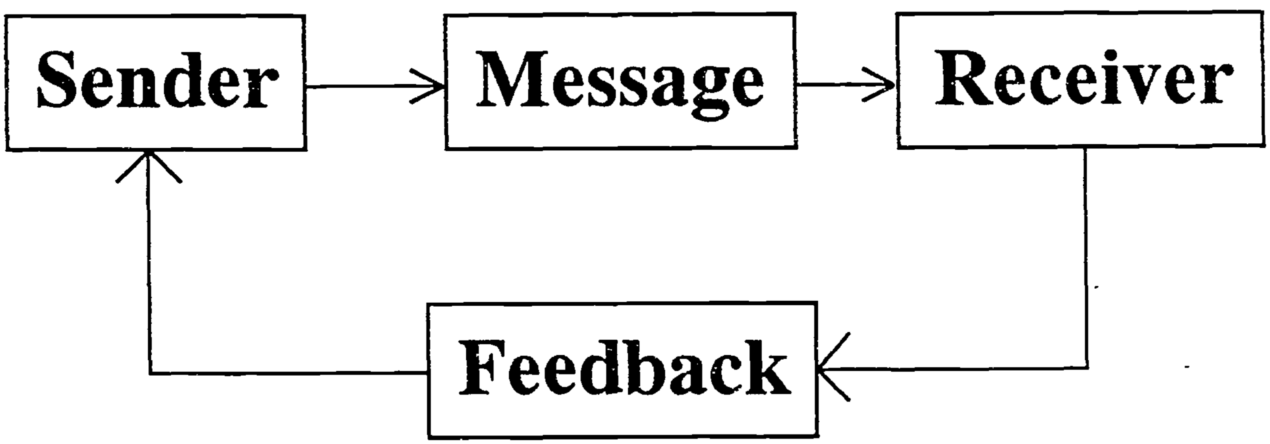
3. Don't be angry or resentful if all your suggestions are not used. Your supervisor may not be able to use your idea for some reason. The problem has been addressed in a positive way, and that's important.

TRANSPARENCY MASTER #1

Basic Components of the Communications Process

The sender wants to communicate something and decides to speak, write, send nonverbal signals, or produce visual message.

The receiver wants to understand sender's meaning and therefore listens, reads, or observes nonverbal signals of visual information



TRANSPARENCY MASTER #2

Sample Memo

Paradise Gardens
Lawn and Garden Center

To: XXXX

From: Lotus Ling, Manager

Date: January 15, 1989

Subject: Spring and Summer Merchandise

It is time to get ready for the spring and summer gardening merchandise. Get Molly from sales, Sean from the warehouse, and Gene from receiving to help you take care of the following tasks. I'll be out of town until the 25th but I'd like these things completed by the time I get back.

- Move the birdseed and birdfeeder display to the area near the back door.
- Move the garden seed display along with the summer bulbs to the area next to the cash register.
- Get the shovels and rakes from the warehouse (last year's stock), and put them along the front wall of the store. Sean can probably help move the merchandise around.
- Have Gene notify our suppliers of lawn and garden equipment that we will need additional advertisements and promotional flyers for the spring display.

TRANSPARENCY MASTER #3

Content of Persuasive Messages

Oral and written persuasive messages should contain the following information, usually in this order:

1. An explanation of why the message is important.

2. A clear statement of your point of view, your purpose for stating it (the proposal), and the benefits of supporting it.

3. The arguments (with evidence) supporting your point of view.

4. A restatement of the proposal.

5. A call for action on the proposal.

TRANSPARENCY MASTER #4

Guidelines for Preparing a Persuasive Report or Presentation

- Identify the subject and purpose of the presentation.
- State your point of view.
- Present your first argument and supporting evidence.
- Present your second argument and supporting evidence.
- Present your third argument and supporting evidence.
- Call for action.

TRANSPARENCY MASTER #5

Steps for Preparing a Persuasive Message

The steps necessary for the sender (writer or speaker) to complete an effective persuasive message are:

- Thoroughly understand the issue or situation.
- Determine the message.
- Focus on the audience and delivery (time, place, style).
- Select the best argument(s).
- Identify the supporting evidence.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Describing a Communication Problem

STUDENT WORKSHEET #2 — Communication Skills Inventory

STUDENT WORKSHEET #3 — Writing Activity

STUDENT WORKSHEET #4 — Reading Activity

STUDENT WORKSHEET #5 — Speaking Activity

STUDENT WORKSHEET #6 — Listening Activity

STUDENT WORKSHEET #7 — Written Directions

STUDENT WORKSHEET #8 — Oral Directions

STUDENT WORKSHEET #9 — Oral Responses

STUDENT WORKSHEET #10 — Making Oral Requests

STUDENT WORKSHEET #11 — Written Responses

STUDENT WORKSHEET #12 — Presenting a Point of View

STUDENT WORKSHEET #13 — Requesting Information from Supervisors

STUDENT WORKSHEET #14 — Presenting Problems to Supervisors

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Describing a Communication Problem

Describe a recent communication problem you believe was the result of poor listening skills — yours or someone else's. Who was the sender? What was the message? Who was the receiver? What were the specific barriers to effective listening? How could the communication problem be solved? Use the following form.

Sender: ______________________________

Receiver: ______________________________

Message: ______________________________

Barriers to effective listening:

____

____

____

Problems resulting from barriers:

____

____

____

Possible solutions:

____

____

____

STUDENT WORKSHEET #2

Communication Skills Inventory

	Always	Sometimes	Rarely	Never	Unsure
1. I use natural facial expressions and gestures to convey ideas and feelings.					
2. I am aware of the barriers that affect communication (deadlines and interferences).					
3. I try to reduce factors that negatively affect communication (prejudices, environmental noise, message errors).					
4. I am able to switch easily from sender to receiver when I communicate.					
5. I am able to select the best mode (speaking, writing, visual, or nonverbal signals) for communicating.					
6. I use standard patterns of organization (chronological order, comparison and contrast, cause and effect) to present information orally or in writing.					
7. I listen with a purpose so I can concentrate on the message.					
8. I adjust my spoken or written message to the needs of the people listening to or reading the message.					
9. I use reading techniques like scanning, skimming, and summarizing to assist me in my work.					
10. I write with attention to conventions—accurate content, grammatical and mechanical correctness, and proper layout and design.					

STUDENT WORKSHEET #3

Writing Activity

Writing is an important mode of communication in the field of agriculture. If you do not write clearly, you may fail to communicate your meaning. Failure to communicate often has serious consequences. In this activity you will practice writing a memo in which you respond to a request for information.

You work as a farm manager. Cindy Cooper, another farm manager, has received an inquiry from a landowner who wants to use 20 acres to graze livestock. Cindy has asked for your advice. Using the facts presented below, write a memo to Cindy.

A. A saddle horse will eat 30 to 40 pounds of forage per day.

B. Average nonirrigated pasture will produce between 500 to 1000 pounds of usable forage per acre per year.

C. Beef cows should have at least 2 acres of pasture per head.

D. Pasture-carrying capacities can be increased by irrigation, rotation grazing, balanced fertilization program, superior grass species.

E. Overgrazed pastures can become barren or weed infested and can erode more easily.

F. Landowners typically overestimate the carrying capacity of land for livestock.

G. The landowner has 20 acres available for pasture land.

(Design your own logo here.)

To:
From:
Subject:
Date:

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STUDENT WORKSHEET #3 — Key

Writing Activity

To: *Cindy Cooper, Farm Manager*
From: *(Student's name)*
Subject: *Pasture Improvement and Use*
Date:

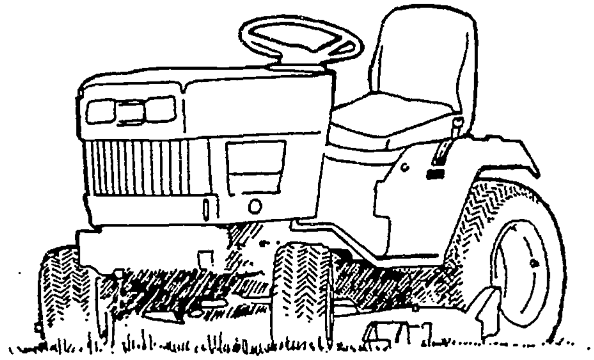
In response to your request for information, the following guidelines should help you respond to the landowner who wants to use 20 acres as pasture land.

A common mistake of new landowners is overestimating the carrying capacity of pasture. When this occurs, the pasture can become barren or weed infested and reduce the land's value. A safe estimate would be to graze no more than 10 beef cows or one horse, if no supplemental feed is provided.

The grazing capacity of a pasture can be increased through irrigation, rotation grazing, fertilization, seeding superior forage grasses, and by providing supplemental feed to the livestock.

STUDENT WORKSHEET #4

Reading Activity



100 Series Lawn Tractors

Features

Eight sleek models — the 9 hp 130 with gear drive and high-performance 30 inch mower; the 12 1/2 hp 160 and 165 with 38 inch mower and gear and hydrostatic drive, respectively; the 14 hp 175 with hydrostatic drive and 38 inch mower; and the 17 hp 180 and 185 with gear and hydrostatic drive respectively, each available with 38 or 46 inch mower

Aluminum engine block with cast-iron cylinder liner for lightweight strength. Overhead valves on 130, 175, 180, and 185 engines provide more torque, better fuel economy and greater productivity

Full-pressure lubrication on the 160, 165, 175, 180, and 185 delivers oil to bearings and other vital engine parts

Rustproof fiberglass hood fully encloses engine for quieter operation

Fully regulated electrical system and 13 or 15 amp charging system for quick, reliable starts

Hinged seat tilts forward to protect it against the elements, allows easier refueling when rear bagger is attached

Black dash with low-fuel indicator on 160, 165, 175, 180 and 185, in-tank fuel gauge on 130; battery and oil indicators on 175, 180 and 185

Full-length steel frame for durability

Replaceable dry-type air filter with foam precleaner

Color-coded controls, sturdy footrests and beadlock rims for comfort and convenience

Sector and pinion steering and tight turning radius for superb handling and maneuverability

Triple-safety starting — shift lever must be in neutral (gear drive models) or brake pedal depressed (hydrostatic models), PTO disengaged, and ignition key used before tractor will start

Seat switch automatically shuts off engine if you inadvertently leave seat with PTO engaged

Mechanical lift lever lowers mower to any of seven preset cutting heights, 1 to 4 inches

Optional 6 1/2 bushel rear bagger for tractors with 30 or 38 inch mower; optional 6 1/2 bushel Power Flow system for tractors with 46 inch mower. All can be lined with trash bags for added convenience

Built-in headlights on 175, 180 and 185

Add versatility with

42 inch front blade
38 inch snow thrower
30 or 50 Dumpcart
31T or 38T Lawn Sweeper
5-B Sprayer
Thatcher
Spiker

Adapted from *Grounds Care Equipment Purchasing Guide* (Moline, IL: John Deere, 1987), p. 76

1. **Skim:** What is the purpose of this selection?
2. **Scan:** What accessories are available?
3. **Scan:** Do all of the mowers have gauges to indicate oil pressure and battery charge?
4. **Scan:** Why have they started using overhead valve engines?
5. Write a brief summary of the advantages of these lawn tractors.

STUDENT WORKSHEET #4 — Key

Reading Activity

Possible answers

1. *Page provides a description of the features of John Deere 100 series lawn tractors.*

2. *Optional rear bagger, bushel Power Flow system, 42" front blade, 38" snow thrower, 30 or 50 Dumpcart, 31T or 38T Lawn Sweeper, 5-B Sprayer, Thatcher, Spiker.*

3. *No, only models 175, 180 185.*

4. *Use overhead valve engines to provide more torque, better fuel economy, and greater productivity.*

5. *The 100 series of lawn mowers offers 8 models to choose from. They are both lightweight and durable with fully regulated electrical systems. Other features include triple safety starting and sector and pinion steering. Several types baggers are provided as optional equipment.*

STUDENT WORKSHEET #5

Speaking Activity

Take turns listening to one another as the following lists or sentences are read aloud. Note on a sheet of paper any words or sentences the reader does not speak correctly.

Be careful not to put any unnecessary sounds in:

1. credit	6. résumé	11. accumulate	16. Washington
2. assets	7. sad	12. card	17. debt
3. across	8. contra	13. facsimile	18. alphanumeric
4. wash	9. elm	14. discount	19. customer
5. receipt	10. deferred	15. country	20. daughter

Be careful not to omit any necessary vowel or consonant sounds in:

1. equation	7. numeric	13. cycle	19. friendly
2. accounting	8. accrued	14. products	20. width
3. didn't	9. debit	15. promptly	21. revenue
4. length	10. liabilities	16. calculating	22. running
5. creditors	11. recognize	17. capital	23. fifths
6. library	12. quantity	18. claims	24. integral

Read each of the following sentences aloud twice — first in a monotone and then changing the pitch to emphasize the words you think deserve emphasis.

1. Would you believe the boss asked me for advice?
2. Only five more minutes until quitting time.
3. Mr. Johnson has insisted that we greet the public with a smile both on and off the telephone.
4. With today's sales we are over our month's goal with three days yet to go.
5. I just can't believe you could forget to run the payroll on payday.

Check your pronunciation of the simple, everyday words listed below. Practice your problem words every day until you have mastered the correct pronunciation

Word	Right Rhyme	Wrong Rhyme	Word	Right Rhyme	Wrong Rhyme
again	men	tin	figure	your	err
any	penny	tinny	for	core	fur
attract	act	tack	get	set	sit
because	clause	buzz	guess	less	miss
beg	keg	vague	if	tiff	clef
bury	berry	hurry	instead	head	hid
can	ban	bin	just	must	mist
catch	latch	ketch	leg	keg	vague
chair	wear	cheer	library	prairie	berry
corp	core	corpse	maybe	baby	webby

STUDENT WORKSHEET #6

Listening Activity

Instructions: Try this listening game to see how well your students understand directions and how quickly they can follow them. Some of the questions are nonsense, but they are a good test of listening ability. Have your students number their papers from 1-9. Read each direction *once* only, pausing briefly for them to answer. This is a *listening* test.

1. Write *yes* no matter with what letter your name begins.
2. Of the words *hammer* and *nail*, write the shorter.
3. Write *no* even if you think cement is heavier than feathers.
4. Write the numbers, 2, 7, 9, 5, 8, and circle the largest.
5. If you circled 7, make a square; if not, make a cross.
6. If screwdrivers screw screws, complete this sentence correctly: Hammers pound ________________.
7. If 3 x 2 = 8, make a circle; if not, make two dots.
8. Give the wrong answer to this question: "Does wood come from trees?"
9. If Washington was not the first President of the United States, write the shorter of the words *red* and *green*; if he was, sign your name.
10. Have students give oral directions for locating a certain unnamed business house in the vicinity. The other students should be able to place the business if the directions are clear.

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STUDENT WORKSHEET #7

Written Directions

Small Engine Tune-Up

Imagine that you are a mechanic in a small engine repair business and you have completed the tasks identified on the work order. Read the following work order from the shop supervisor and use the work order to check off the tasks performed.

Sven Johnson and Sons, Engine Repair and Maintenance

We'll put the Go back in your engine

I've put a white service tag on a tiller that needs our standard, preseason tune-up. Mr. Cordero will pick it up at 5 PM.

Be sure to remove and replace the air cleaner, change the oil, and inspect the starter assembly for wear. When you clean the cooling fins wear safety glasses. The tiller needs a compression check; and you should inspect the cross-over tube, intake elbow, and governor blade and linkage for wear. We now replace the points and plugs as part of the tune-up. Check the flywheel and key. When you finish, adjust the remote control linkage and the fuel mixture. **Run the engines with the door open; the exhaust gases are deadly. Don't fill the engine or spill gasoline while the engine is hot from running; these could cause an explosion.**

Indicate the tasks performed by writing in the correct column on the work order form or a copy of the form. (See Air filter, for example.)

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Sven Johnson and Sons, Engine Repair and Maintenance

We'll put the Go back in your engine

Work Order Form

Item ID	Brand/Model/Year	Date
4579T	Dear John/4DP/86	5/1

Name: Mr. Seth Cordero
Address: 1616 Beacon Lane
City/State: Iuka, IL 62849 Telephone: 999-0000

Instructions:	Maint Service Check/Clean/Repair/Replace	
standard preseason tune-	Air filter	**replace**
up: change oil, air cleaner,	Oil, belts, seals	
check points and plugs,	Starter assembly	
inspect flywheel, linkages	Flywheel & key	
	Fuel filter	
	Carburetor	
	Cooling fins	
	Governor blade	
	Intake elbow	
	Points, Plugs	
	Condenser	
	Engine Compression	
	Muffler	
	Linkages	
	Fuel-air mixture	
	Other (specify)	

Labor	
Parts & Accessories	
Oil, Grease	
Tax	
Total	

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STUDENT WORKSHEET #7 — Key

Sven Johnson and Sons, Engine Repair and Maintenance

We'll put the Go back in your engine

Work Order Form

Item ID	Brand/Model/Year	Date
4579T	Dear John/4DP/86	5/1

Name: Mr. Seth Cordero
Address: 1616 Beacon Lane
City/State: Iuka, IL 62849 Telephone: 999-0000

Instructions:	Maint Service Check/Clean/Repair/Replace	
standard preseason tune-	Air filter	*replace*
up: change oil, air cleaner,	Oil, belts, seals	*replaced oil*
check points and plugs,	Starter assembly	*checked*
inspect flywheel, linkages	Flywheel & key	*checked*
	Fuel filter	
	Carburetor	
	Cooling fins	*cleaned*
	Governor blade	*checked*
	Intake elbow	*checked*
	Points, Plugs	*replaced*
	Condenser	
	Engine Compression	*checked*
	Muffler	
	Linkages	*adjusted*
	Fuel-air mixture	*adjusted*
	Other (specify)	*inspected cross-over tube*

Labor	
Parts & Accessories	
Oil, Grease	
Tax	
Total	

Have students share observations about following written directions in this activity. Discuss and summarize techniques for following written directions:

- First, skim directions.
- Read for details.
- Summarize what to do.
- Reread critical steps.
- Act step by step.

STUDENT WORKSHEET #8

Oral Directions

A. Laying Landscaping Brick

Imagine that you are an employee at Spellings Landscaping Company. Your employer has phoned and instructed you to go to the Wiles residence and finish a landscaping job that is complete except for the laying of the brick walk.

Listen to the directions for laying landscaping brick. Make a list of what you must do and how to do it. Check your understanding and, if necessary, ask the person giving the directions to clarify what you are to do.

(This section is for the giver of directions.) Read these directions for laying landscaping brick. Then read them aloud to your partner as though you were a supervisor giving instructions to an employee. Use your finger to mark your place in case someone interrupts you or asks a question.

> I want you to go to the Wiles residence and finish the landscaping job. We're all done except for laying the brick walk. The bricks are at the site. The owners said they wanted the bricks laid in the basket-weave pattern. Recheck the forms and footing for proper grade and placement. It may have been tampered with since we left it a couple of days ago. Use the tile-setters' method for laying the brick. Remember this mixture is one part cement to two parts sand. Prepare enough mixture to fill the forms to within 1 1/2 inches of the top. You may have to make a screeding board; cut it so it is 1/4 inch narrower than the basket-weave pattern. Sweep more mixture into the cracks of the brick. Get a large piece of plywood, and lay it on top of the brick. Tamp the bricks with a sledge or post until they're flush with the top of the forms. Fill in the cracks with more mixture, and water the finished walk lightly. Tell the owners that we'll be back in a couple of days to clean the surface of the walk, and tell them they should stay off the walk until then. Pick up all your tools and clean up any scrap material. Put the material in the truck, and we'll dispose of it properly at the dump. Record your time in the log book, and report back the office when you're finished.

B. Winter Planting Schedule

Your boss has just phoned in with instructions for the winter planting schedule. Listen to the directions and fill out the form below. Check your understanding and, if necessary, ask the person giving the directions to clarify what you are to do.

(This section is for the giver of directions.) Read these directions for the winter planting schedule. Then read them aloud to your partner as though you were a supervisor giving instructions to an employee. Use your finger to mark your place in case someone interrupts you or asks a question.

> I've got the schedule for three greenhouses worked out. Let me tell you what we're going to do. You must fill out the schedule and post it in the office. Then, when we start sowing the seeds on Monday, we'll have a plan for doing it.
>
> Greenhouse A will be used for those plants that will take a bit longer to get started. From January 15 to January 22 you'll sow the onions, pansies, and start the geranium cuttings. Those should be ready to transplant by February 2 to 10. From February 13 to 20, sow the petunias there, also.
>
> We'll use Greenhouse B for the cole crops, Sow the cabbage, cauliflower, and broccoli from March 2 to 14. They can be transplanted about a week later, March 10 to 20.
>
> I want the tender plants in Greenhouse C. We're supposed to have an early spring so let's start sowing tomato, pepper, and eggplant, March 9 to 20. Some will be ready to transplant by March 16 to 20. Let's sow the herbs (dill, parsley, and basil) in there the same week that you're transplanting. We'll be able to transplant the herbs about a week later; so schedule it.
>
> On April 1, begin to get the outdoor sheds ready for the plant sale that will be about April 10.

Winter Planting Schedule

Greenhouse	Seeds	Sowing Date	Transplanting Date
A.			
A.			
B.			
B.			
C.			
C.			
Sheds			

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STUDENT WORKSHEET #8 — Key

Oral Directions

A. Laying Landscaping Brick

1. *Check forms for proper grade of slope.*
2. *Check excavating of footing for proper depth.*
3. *Prepare mixture of 2 parts sand and 1 part cement, and fill walk area to within 1 1/2 inches (4 cm.) of the surface of the forms.*
4. *Tamp lightly and screed (level) off using a screeding board cut 1/4 inch (.65 cm.) narrower than the brick being used.*
5. *Sprinkle light film of raw cement over the surface.*
6. *Lay brick in place in the basket-weave pattern.*
7. *Sweep the mixture of sand and concrete into the cracks of the brick.*
8. *Tamp the surface until the brick is flush with the top of the forms.*
9. *Fill cracks again where settling has occurred.*
10. *Water lightly the entire surface of the finished work.*

B. Winter Planting Schedule

Greenhouse	Seeds	Sowing Date	Transplanting Date
A.	*onion, pansy, geranium*	*1/15 - 1/22*	*2/2 - 2/10*
A.	*petunias*	*2/13 - 2/20*	*2/20 - 2/27*
B.	*broccoli, cabbage*	*3/2 - 3/14*	*3/10 - 3/20*
B.	*cauliflower*	*3/2 3/14*	*3/10 - 3/20*
C.	*tomato, pepper, eggplant*	*3/9 - 3/20*	*3/16 - 3/27*
C.	*dill, parsley, basil*	*3/16 - 3/27*	*3/23 - 4/5*
Sheds	*April 1: prepare sheds for April 10th plant sale*		

STUDENT WORKSHEET #9

Oral Responses

When you receive an oral request, it is especially important to think about the request and decide how you will respond. Listen actively. As you decide on an appropriate response, make sure to clarify the request in order to get all the needed information. Then, plan how you will make your response clearly and tactfully.

On a separate sheet of paper, list what you need to do and outline what you would say to respond to the requests in the following situations. Be prepared to present your responses orally.

A. **You take telephone orders for a feed and seed store that closes at 5:30 PM. A customer from a town about 20 miles away calls at 4:30 PM, saying, "I would like 200 pounds of Top Grow alfalfa seed, one mineral block, two nylon cattle halters, and 20 quarts of Noble 10W-40 motor oil. How much would that be all together? I'll be right over to pick them up."**

   Top Grow alfalfa seed costs $0.38 per pound. Mineral salt blocks cost $17.00 per block. Standard nylon cattle halters cost $9.95 per halter. Each case (24 quarts per case) of Noble 10W-40 motor oil is $18.96.

   It is clear that the customer will arrive just as the store is closing and the employees in the warehouse do not like to work late.

B. **You work in a retail florist shop. A customer calls, saying, "I would like to purchase a birthday floral arrangement for my aunt who lives in Calgary, Alberta. She'll be 31 tomorrow. Can the flowers be sent by telephone or wire delivery? I don't have a specific arrangement in mind, but I do not want to spend over $30.00. Oh yes, I want to send a card with the flowers."**

   Your telephone delivery offers three special occasion floral arrangements in this price range: the Memory Maker (a bouquet of daisies and roses), the Celebrator (an arrangement of iris, mums, and tulips), and the Over-the-Hill (a bouquet of lilies and roses).

   To send flowers you will need the aunt's name, an exact address and telephone number, and either an established credit account with the florist or a charge card number.

STUDENT WORKSHEET #9 — Key

Oral Responses

A. An appropriate response should include the following:

- Closing time and an alternative pick-up time.
- A restatement of the order.
- Price quotes.
- Verification as to whether the customer will charge or pay cash for the order.

B. An appropriate response should include the following:

- Quote prices for flower arrangements in customer's price range.
- Names and all information written legibly and correctly.
- Complete delivery instructions'.
- Enclosure card message, if appropriate.
- Verification of customer's charge account.
- Complete name and address of the recipient.
- Repetition of completed order to the caller.

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STUDENT WORKSHEET #10

Making Oral Requests

Using the telephone is highly important when making requests. At work you may need to ask information from a co-worker in another department. Sometimes you may need to order something or get more information to complete a task. Because the telephone is one of the most frequently used communication tools in the office, it is important to acquire effective telephone skills.

Working together in pairs, discuss an appropriate telephone request for each of the following situations. On a separate sheet of paper, outline what you would say. Be prepared to present your request orally to your classmates.

A. You are the office manager of the Bloomington Farm Co-op. Call and place an order for 25 gallons of a new corn pesticide (Weed-Rid) and 10 Sure-Cut chain saws. You must receive the order within 10 days. Your company may make orders over telephone by supplying their account number. Bloomington Farm Co-op's account number is #7102-410.

B. As office manger of the Bloomington Farm Co-op, you want to register a complaint about the service your company received from a tractor company's regional representative. The representative has not returned your calls, has misplaced two orders for replacement parts, and incorrectly billed you for equipment you did not order.

ERIC

STUDENT WORKSHEET #10 — Key

Making Oral Requests

A. Students' requests should include the following:

- Student's name.
- Company name.
- Merchandise ordered.
- Account number.
- Special instructions, delivery date.

B. Students' requests should include the following:

- Student's name.
- Company name.
- Buffer statement.
- Statement of problem.
- Supporting details.
- Action requested.
- Courteous ending.

ERIC

STUDENT WORKSHEET #11

Written Responses

When requests are written rather than oral, planning is even more important to ensure clear communication. In the following activity you will practice writing a response to a written request for a refund.

Read the written request. Analyze by identifying what was requested. Plan your response; and then, on a separate sheet of paper draft your response to the request, After you have written the response, check it for clarity. It should address all points of the request. If your response is unclear or not complete, revise it.

You have been employed at the Universal Chemical Company, a manufacturer of herbicides, as one of their customer relations specialists. At this time you have been assigned to handle customer letters which are concerned with product problems. The general policy on handling customer problems with products is to provide a refund for the purchase price.

You have received the following letter from a customer. Prepare a written response.

853 West Crescent Street
Cimarron, CO 81220
June 21, 1989

Universal Chemical Company
Customer Service Department
3455 South Street
Jackson, MS 39956-1112

Dear Sir or Madam:

On May 23, 1989, I paid $17.95 for a 25-pound bag of Feed and Weed Kill, a product made by your company. I bought it at Mighty Green Lawn Company, which is located in this town. A copy of the sales slip is enclosed.

Although I followed the application instructions on the label, I still have a problem with weeds which the product is advertised to control. There was almost no effect on these weeds.

Roger Thomas, manager of Mighty Green Lawn Company, refused to return my money saying it was their policy not to give refunds on herbicides. Your advertisements say that customer satisfaction is completely guaranteed. Since the product didn't work, I feel you should refund my money.

Thank you and I hope to hear from you in the near future.

Sincerely,

Marcus Kildare

STUDENT WORKSHEET #11 — Key

Written Responses

Students' written responses will differ but should include the following.

- Student's name and position.
- Name of company.
- Reference to the request.
- Response.
- Supporting detail or explanation.
- Suggested action.
- Friendly ending.

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STUDENT WORKSHEET #12

Presenting a Point of View

Because most occupations involve dealing with people, there are many current issues that do not have one specific answer. Some of these issues relate to efficiency on the job, the high cost of technology, service, and work benefits and safety.

Choose one of the topics listed or another work-related topic that interests you, and prepare a three-minute persuasive presentation. Discuss the topic with classmates. If possible, discuss the topic with a worker in your area of interest. Use the library to do research on your topic. It is important that you know the facts and understand the issue before you form an opinion.

Once your purpose and audience are clearly defined, you must search for evidence to support your point of view through:

- Observation.
- Personal experience.
- Experts' opinions.
- Research that includes facts and statistics.

These four kinds of supporting information fit into three broad categories of evidence: **facts, opinions, and feelings.**

- Observation -- → **Facts, Opinions**
- Personal experience -------------------------------- → **Opinions, Feelings**
- Experts' opinions ------------------------------------ → **Opinions, Feelings**
- Organized research --------------------------------- → **Facts**

Facts are the most acceptable kind of support because they can be proven. An **opinion** is a belief about an issue that is stronger than a feeling but less authoritative than a provable fact. A **feeling** is an emotional reaction to an issue.

Your report should persuade management in your occupational area to accept and act on your proposal. Use the following guidelines to prepare your report for presentation.

- Study the problem.
- Identify options for resolving the problem.
- Choose the strongest supporting evidence.
- Based on the supporting evidence, decide what should be done to solve the problem.
- Prepare a brief report for presentation. (Your instructor will let you know whether this report should be oral or written, or both.)

Sample Topics

- Should chemicals be used to control pests?
- Should the government subsidize programs for agricultural products?
- Should wildlife habitats be established for endangered species?
- How should you plan an energy-efficient home?
- How should you introduce a new product into a retail agribusiness?
- Compare two agricultural products and recommend one to a client.
- Should breeding stock be improved through artificial insemination?
- How should farmers obtain credit from banks?
- How should you select breeds of beef cattle?

Checklist

Elements of Persuasive Communication

Check the Goal(s) of your Persuasive Message, Does the message

- ☐ persuade the receiver to be open to an opinion?
- ☐ stimulate the receiver's feelings about an opinion?
- ☐ persuade the receiver to adopt an opinion?
- ☐ persuade the receiver to change an opinion?
- ☐ translate an opinion into action?

Identify the Audience of your Persuasive Message

- ☐ individual ____________________ ☐ group ________________________
- ☐ attitudes identified (circle one): enthusiastic, interested, neutral, disinterested, aggressive

Decide upon the delivery

- ☐ time of delivery: ____
- ☐ place of delivery: ____
- ☐ style of delivery: ____

Present your Proposal

- ☐ state your point of view (position): ______________________________
- ☐ explain your position: ______________________________________

Identify Arguments and Evidence

- ☐ first argument for point of view with supporting evidence:

  ____

- ☐ second argument for point of view with supporting evidence:

  ____

- ☐ third argument for point of view with supporting evidence:

  ____

Check Kind of Supporting Evidence Used

- ☐ observation
- ☐ informed opinion
- ☐ personal experience
- ☐ organized research (facts and statistics)

STUDENT WORKSHEET #13

Requesting Information from Supervisors

You are employed as a chemical applicator for a local fertilizer/chemical company. The State University is conducting a Chemical Applicator Workshop on campus. The registration fee for the workshop, which runs for five days, is $125.00. This includes a manual and all the handouts. The State Applicator Test which is now required for all chemical applicators (and which you have not taken), will be given at the workshop.

Memo

To:
From:
Date:
Subject:

Prepare a written request, using memo format, to attend this workshop. Ask your company to pay the costs for travel, meals, and the registration fee. The request should explain how your company would benefit from this activity. Estimate what your expenses would be. Specify the days you would be gone and who would cover your normal assignments during your absence.

STUDENT WORKSHEET #14

Presenting Problems to Supervisors

Assume that you are a driver for a local florist shop. Your delivery truck was purchased about three months ago and is considered "state-of-the-art." You loaded the truck for the afternoon deliveries and were slightly behind schedule. There were more deliveries than usual and you had to bring the truck back by 5:00 PM.

Because the day was very warm and traffic was heavy, the truck started to overheat and steam was coming out from under the hood. You saw a service station ahead and pulled in. The attendants were busy, so you picked up a water hose and put cold water into the radiator. The truck would not restart.

After the mechanic at the station came out and inspected the engine, she told you the engine block had cracked when the cold water was put in. The estimated cost to repair the damage is $1600.00.

Report this problem to your employer.

(Your teacher will tell you whether this report will be delivered orally or in memo form.)

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Applying Mathematics Skills in Agriculture

RELATED PROBLEM AREAS:

1. Developing Problem Solving Skills in Agriculture

2. All problem areas that use numbers and mathematics in recognizing, reading, analyzing, and solving problems.

PREREQUISITE PROBLEM AREA(S) None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Mathematics. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and use methods of data collection and analysis, including tables, charts, and comparisons.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
By the end of grade *(circle one)* 3 6 8 11 students should be able to:					
*1. Analyze tables, charts, arrays, schedules, experiments and surveys reported in media sources.					
*2. Draw a line to fit data on a coordinate graph.					
*3. Understand what type of graphical display best illustrates a given set of data.					
4. Recognize, understand, and use charts, tables, and graphs to convey information.					
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ISBE 41-78 (1/88)

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LEARNING ASSESSMENT PLAN

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(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and apply geometric concepts and relations in a variety of forms.

Contact Person: ____
Title: ____
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Relate the numbers of sides and the sums of angle measures in polygons.					
*2. Sketch spheres, cylinders, cones, pyramids, and prisms.					
*3. Identify perpendicular and parallel lines and planes in space.					
*4. Understand simple geometric figures and patterns of relationships in two and three dimensions.					
5. Understand and apply geometric concepts in both two and three dimensions.					

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ISBE 41-76 (1/86)

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LEARNING ASSESSMENT PLAN

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Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to identify, analyze, and solve problems using algebraic equations, inequalities, functions, and their graphs.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
By the end of grade *(circle one)* 3 6 8 11 students should be able to:					
*1. Solve equations and inequalities found in every day life.					
*2. Write an equation for a line when given its graph.					
*3. Solve linear equations.					
*4. Know equivalent forms of a formula.					
5. Identify, apply, and solve problems using equations and formulas.					
356					357

ISBE 41-78 (1/86)

Submission Date ______

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Page ____ of ____

ILLINOIS STATE BOARD OF EDUCATION
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LEARNING ASSESSMENT PLAN

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(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to make and use measurements, including those of area and volume.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Estimate unknown lengths in a figure (two or three dimensional) using geometric relationships and principles.					
*2. Apply given formulas to find surface areas and volumes in cylinders, prisms, and spheres.					
*3. Find areas and volumes of figures resulting from common geometric figures.					
*4. Measure in a variety of contexts using appropriate units.					
5. Understand and apply mathematical concepts such as renaming, converting, estimating, measuring, and proportions.					
6. Understand and apply geometric concepts in both two and three dimensions.					
388					389

ISBE 41-78 (1/86)

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Department of School Improvement Services
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Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and use ratios and percentages.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Write proportions equivalent to a given proportion.					
*2. Solve problems leading to proportions involving area in similar figures.					
*3. Apply ratios and proportions in real-life situations.					
4. Understand and apply mathematical concepts such as renaming, converting, estimating, measuring, and proportions.					
390					391

ISBE 41-78 (1/88)

Submission Date ______
☐ Original submission ☐ Revision Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

ILLINOIS STATE BOARD OF EDUCATION
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LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to perform the computations of addition, subtraction, multiplication, and division using whole numbers, fractions, and decimals.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Translate word problem situations to mathematical expressions from sentences.					
*2. Express a repeating decimal as a simple fraction.					
*3. Order numbers.					
4. Perform common arithmetic computations.					
5. Understand and apply mathematical concepts such as renaming, converting, estimating, measuring, and proportions.					
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ISBE 41-78 (1/86)

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(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use mathematics skills to estimate, approximate, and predict outcomes and to judge reasonableness of results.

Contact Person: ____________
Title: ____________
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize an appropriate equation, given a graph of values over time, describing the relationship over time and use that equation to estimate values not given.					
*2. Know appropriate operation to use to arrive at the answer to a given question.					
*3. Use successive approximations to come closer to the answer to a question.					
*4. Estimate present and future values from graphs of numerical information.					
*5. Use mental arithmetic to estimate results of computations.					
6. Understand and apply mathematical concepts such as renaming, converting, estimating, measuring, and proportions.					
7. Identify, apply, and solve problems using equations and formulas.					
301					395

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Applying Mathematics Skills in Agriculture

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Perform common arithmetic computations.
2. Understand and apply mathematical concepts such as renaming, converting, estimating, measuring, and proportions.
3. Understand and apply geometric concepts in both two and three dimensions.
4. Identify, apply, and solve problems using equations and formulas.
5. Recognize, understand, and use charts, tables, and graphs to convey informations.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Applying Mathematics Skills in Agriculture

PROBLEMS AND QUESTIONS FOR STUDY

1. What are some uses of mathematics in agriculture?
2. How are mathematics principles applied in agriculture?
3. What mathematics computations are used in agriculture?
4. What is estimating?
5. How does one use estimating?
6. What is renaming?
7. Why does one need to know how to rename numbers?
8. What is meant by converting numbers?
9. When will one need to convert English factors to metric factors?
10. What is the difference between accuracy and precision?
11. Why is it necessary to understand ratios and proportions?
12. What is meant by scale drawings?
13. When would one use scale drawings?
14. When are formulas used in agriculture?
15. How is a formula different than an equation?
16. What is the difference between a linear equation and a nonlinear equation?
17. Why are equations used?
18. How are right triangles used in agriculture?
19. What shapes in agriculture are two dimensional?
20. What shapes in agriculture are three dimensional?
21. What are the mathematical formulas used with two and three dimensional figures?
22. What is trigonometry?
23. How is trigonometry used in agriculture?
24. How do charts, tables, and graphs differ?
25. What is the appropriate use of a chart? A table? A graph?
26. Why are charts, tables and graphs used?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Applying Mathematics Skills in Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use the practice problems enclosed as practical examples of how mathematics is used to solve problems encountered in agriculture.

2. Use the categories in the terms to be defined as an example of how mathematical concepts may be divided for delivery to students.

3. Use this problem area as a resource for sample problems that may be included in material on a specific subject matter area.

4. Use the terms to be defined as a reference for specific definitions that are appropriate for a given area of focus. These terms may be used by the instructor in developing individual lesson plans or as a general outline of concerns to be addressed.

5. Have students complete relevant problems and use the keys as guides to the problems' solutions.

6. Invite agribusiness owners, operators, or managers to address the class on how mathematics are used in their operations.

7. Lead students in a discussion of why word problems are more practical examples of problems that are encountered than are problems in which formulas and equations are already set up.

8. Have students make a list of all mathematics used outside of school. Be sure to include gas money, dates, purchases, and decisions made for which mathematics was necessary.

9. Have students relate mathematics concepts to entries necessary in SAE record books.

10. Use specific problem areas within agribusiness operation and management, agricultural engineering/mechanization, animal science, plant and soil science, basic agribusiness principles, or horticulture as a source of additional practical problems encountered within those areas.

11. Encourage your vocational department to obtain the entire *Applied Mathematics* curriculum. The curriculum contains videos which show mathematics being used in a variety of settings. In addition, student texts provide explanations of relevant procedures, problems for each vocational area, and a glossary. This problem area is similar in structure to *Applied Mathematics* and the *Applied Mathematics* videos would be useful as interest approaches.

12. Have students relate mathematics concepts to those used in FFA activities and contests.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Applying Mathematics Skills in Agriculture

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Applied Mathematics.* (1989). Curriculum Publications Clearinghouse, Western Illinois Univeristy, Horrabin Hall 46, Macomb, IL 61455.

*2. *Using Arithmetic in Agriculture.* (VAS Unit #6015); Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*3. *Learning Mathematics in Vocational Agriculture: Prescriptive Math Modules.* (A Supplement for: The Basic Program of Vocational Agriculture in Louisiana). (1989). Louisiana Department of Education, Office of Vocational Education, P.O. Box 94064, Baton Rouge, LA 70804.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Conversion Tables

INFORMATION SHEET #2 — Terms to be Defined (By Category)

ERIC
Full Text Provided by ERIC

INFORMATION SHEET #1

Conversion Tables

Angle

	'	°	rad	rev
1 minute	1	0.01667	2.909×10^{-4}	4.630×10^{-5}
1 degree	60	1	0.01745	2.778×10^{-3}
1 radian	3438	57.30	1	0.1592
1 revolution	2.16×10^{4}	360	6.283	1

Time

	sec	min	h	d*	y*
1 second	1	0.01667	2.778×10^{-4}	1.157×10^{-5}	3.169×10^{-8}
1 minute	60	1	0.01667	6.944×10^{-4}	1.901×10^{-6}
1 hour	3600	60	1	0.04167	1.141×10^{-6}
1 day	8.640×10^{4}	1440	24	1	2.738×10^{-3}
1 year	3.156×10^{7}	5.259×10^{5}	8766	365.3	1

*Note: The number 3.281×10^{-2} is equivalent to 0.03281, and the number 3.937×10^{4} is equivalent to 39,370. If you have difficulty understanding this, please consult your teacher.

Volume(Capacity)

	cm^3	m^3	in^3	ft^3	l	oz	gal
1 cubic centimeter	1	10^{-6}	0.06102	3.531×10^{-5}	1.000×10^{-3}	0.03381	2.642×10^{-4}
1 cubic meter	10^{6}	1	6.102×10^{4}	35.31	1000.	3.381×10^{4}	264.2
1 cubic inch	16.39	1.639×10^{-5}	1	5.787×10^{-4}	0.01639	0.5541	4.329×10^{-3}
1 cubic foot	2.832×10^{4}	0.2832	1728	1	28.32	957.5	7.480
1 liter	1000.	1.000×10^{-3}	61.03	0.03532	1	33.81	0.2642
1 ounce	29.57	2.957×10^{-5}	1.805	1.044×10^{-3}	0.02957	1	7.813×10^{-3}
1 gallon	3785	3.785×10^{-3}	231	0.1337	3.785	128	1

1 gallon = 4 quarts = 8 pints = 16 cups
1 cup = 8 ounces = 16 tablespoons = 48 teaspoons

ERIC

Mass/Weight

	g	kg	oz	lb	ton
1 gram	1	10^{-3}	0.03527	2.205×10^{-3}	1.102×10^{-6}
1 kilogram	10^{3}	1	35.27	2.205	1.102×10^{-3}
1 ounce	28.35	0.02835	1	0.0625	3.125×10^{-5}
1 pound	453.6	0.4536	16	1	0.0005
1 ton	9.072×10^{5}	907.2	3.2×10^{4}	2000	1

Length

	cm	m	km	in	ft	yd	mi
1 centimeter	1	0.01	10^{-5}	0.3937	3.281×10^{-2}	1.094×10^{-2}	6.214×10^{-6}
1 meter	100	1	10^{-3}	39.37	3.281	1.094	6.214×10^{-4}
1 kilometer	10^{5}	1000	1	3.937×10^{4}	3281	1094	0.6214
1 inch	2.54	0.0254	2.54×10^{-5}	1	0.0833	0.0278	1.578×10^{-5}
1 foot	30.48	0.3048	3.048×10^{-4}	12	1	0.3333	1.894×10^{-4}
1 yard	91.44	0.9144	9.144×10^{-4}	36	3	1	5.682×10^{-4}
1 mile	1.6093×10^{5}	1609.3	1.6093	6.336×10^{4}	5280	1760	1

Area

	cm^2	m^2	in^2	ft^2	A	mi^2
1 square centimeter	1	10^{-4}	0.1550	1.076×10^{-3}	2.471×10^{-8}	3.861^{-11}
1 square meter	10^{4}	1	1550	10.76	2.471×10^{-4}	3.861×10^{-7}
1 square inch	6.452	6.452×10^{-4}	1	6.944×10^{-3}	1.594×10^{-7}	2.491×10^{-10}
1 square foot	929.0	0.09290	144	1	2.296×10^{-5}	3.587×10^{-8}
1 acre	4.047×10^{7}	4407	6.273×10^{6}	43560	1	1.563×10^{-3}
1 square mile	2.590×10^{10}	2.590×10^{6}	4.007×10^{9}	2.788×10^{7}	640	1

INFORMATION SHEET #2

Terms to be Defined

Estimating

Approximate value — a value that is nearly correct or true. For example, a person who gives the temperature as 90° F, when it is actually 92.7° F, is giving an approximate value for the temperature.

Approximation — the process of approaching, or coming near to, a true or exact value, answer, quantity, etc. For example, the approximation to the true width of a human hair becomes better and better as a more accurate instrument — such as a micrometer — is used to make the measurement.

Digit — any of the numerals 0,1,2,3,4,5,6,7,8, and 9. In our number system, all numbers, whether decimals, fractions, or whole numbers are written using these ten digits.

Estimate — when used as a verb, "estimate" means to assign or calculate an approximate value for the cost, size, weight, etc., of something. When used as a noun, an "estimate" is the approximate value of the answer given in place of the true or exact value.

Exact value (true value) — that one value which the approximation answer approaches, as the approximation of measurement technique gets better and better. For example, when dealing with a measurement of size, weight, or temperature, etc., a measuring instrument provides only an approximate value at best, even though a true (exact) value may exist. In other instances, involving numerical operations, the operation 15 + 2 has the exact answer of 7.5.

Reasonable answer — an answer, obtained as a result of a calculation, that makes sense in the context of the problem. A calculated answer is said to be "reasonable" when it agrees more or less closely with an answer to the problem obtained by an estimate or approximate calculation. For example, if the answer to the calculation of the area of a triangle came out to be 115.27 square inches, and a correct estimate for the same calculation gave 110 square inches, you would conclude that the answer of 115.27 square inches is a "reasonable" answer. If, however, the calculated answer came out to be 1152.7 square inches — and the correct estimate gave 110 square inches — you would conclude that 1152.7 square inches is not a "reasonable" answer. You would then recheck your calculation to find where an error had been made.

Rounding — a process of changing numerical digits according to the following rules.

a. Identify the position of the last digit to be saved.
b. The digit to be saved is increased by 1 if the digit to the right is 5 or greater.
c. The digit to be saved remains unchanged if the digit to the right is 4 or less.
d. All digits to the right of the decimal point that are to be rounded are dropped. All digits to the left of the decimal point that are to be rounded are replaced with 0s to keep the decimal point in the proper place. For example, 17.324, rounded to the nearest tenth, is 17.3. The digits 2 and 4 are dropped. Similarly, 186,872, rounded to the nearest thousand, is 187,000. The digits 8, 7, and 2 are replaced by zeros.

Units place (ones place) — the first place to the left of the decimal point. For example, the decimal number 84.7 has the digit 8 written in the "tens" place, the digit 4 written in the "ones" place, and the digit 7 written in the "tenths" place.

Whole numbers — any one of the "counting" numbers, such as 0,1,2,3,4,5,6,7,8,9,10,11,12, and so on. A whole number has no fractional part or no digits to the right of the decimal point, Thus, the numbers 1/2, 10.2, and 2 1/5 are not whole numbers.

Renaming

Decimal fraction — a proper or improper fraction written in a form that includes a decimal point, and numbers to the right and (sometimes) left of the decimal point. For example, the proper fraction 3/8 is equal to 0.375 when written as a decimal fraction. The improper fraction 10/8 is equal to 1.25.

Denominator — the number below (or to the right of) the fraction line for any proper or improper fraction. For example, the number "8" is the denominator for the fractions 3/8 and 10/8.

Digit — any of the whole numbers 0 through 9 inclusive.

Equivalent — means "equal to" but not necessarily "identical to." For example, the fraction 1/4 is equivalent to the decimal fraction 0.25, and each is equivalent to 25 percent.

Fraction — a number such as 1/3, 3/5, or 20/9 written as one whole number over another. The number on the top is called the numerator. The number on the bottom is called the denominator. The fraction line indicates a division operation.

Improper fraction — any fraction, such as 9/8, 5/3, or 10/10, whose value is equal to or larger than one, The numerator of an improper fraction always is equal to or larger than the denominator.

Mixed number — a mixed number is a combination of a whole number and a fraction. For example, 9 7/16 is a mixed number. It is made up of the whole number 9 and the fraction 7/16.

Numerator — the number above (or to the left of) the fraction line for any proper or improper fraction. For example, the number 3 is the numerator for the fractions 3/10 and 3/2.

Percent — the word "percent" means parts per hundred. One percent of something means the same as one-hundredth of something. The word "percent" often is represented by the symbol %. So 25 percent and 25% mean the same — twenty-five hundredths of something.

Proper fraction — any fraction, such as 3/8, 1/5, or 8/9, whose value is less than one. The numerator of a proper fraction is always less than the denominator.

Reduced fraction — a fraction in its basic or simplest form, whose numerator and denominator contain no common factors other than 1. For example, the fraction 15/20 is not a reduced fraction because both the numerator "15" and the denominator "20" contain the common factor 5. The fraction 15/20 can be "reduced" by dividing both the numerator and denominator by 5, as follows:

$$\frac{15}{20} = \frac{15 + 5}{20 + 5} = \frac{3}{4}$$

The fraction 3/4 now has no common factors in the numerator "3" and the denominator "4" other than 1. The fraction 3/4 is therefore a reduced fraction, in its simplest form.

Unending repeating decimal — those fractions, such as 1/3 and 2/3, that result in unending repeating numbers when changed to decimal fractions. For example, 1/3 becomes 0.3333333 . . ., with no end to the string of threes. That's because 3 does not divide evenly into 1. Likewise the fraction 2/3 becomes 0.6666666 . . ., another string of unending sixes.

English and Metric

Caliper — a tool used for precision-length measurements. It has a fixed jaw, a sliding jaw, and a calibrated scale.

Celsius — the scale of temperature measurement used in the metric system. On a Celsius scale — formerly known as the Centigrade scale — water freezes at 0° and boils at 100°. The Celsius scale is related to the Fahrenheit scale of temperature measurement by the formula

$$°C = 5/9\ (°F - 32)$$

Centi- — a prefix indicating "a hundredth part." For example, a centimeter is one hundredth (0.01) of a meter.

Fahrenheit — the scale of temperature measurement used in the English system. On the Fahrenheit scale, water freezes at 32° and boils at 212°. The Fahrenheit scale is related to the Celsius scale of temperature measurement by the formula

$$°F = 9/5\ °C + 32°$$

Gram — the basic unit of mass ("weight") in the metric system of measurement, equal to about 1/28 of an ounce. (It is the mass of one milliliter of distilled water a 4°C.)

Kilo- — a prefix indication "a thousand." For example, a kilogram is 1000 grams, or a kilowatt is 1000 watts.

Liter — the basic unit of volume in the metric system of measurement, equal to 1.0567 liquid quarts. (It is officially defined as the volume of 1 kilogram of distilled water at 4°C.)

Meter — the basic unit of length in the metric system of measurement, equal to 39.37 inches. (It is officially defined on the basis of the wavelength of krypton light).

Milli- — a prefix indicating "a thousandth part." For example, a millimeter is one thousandth of a meter (0.001m), or a milliliter is one thousandth of a liter (0.001*l*).

Unit conversion ratio — a fraction, or ratio, with a numerator (or denominator) equal to one but with a unit of measurement different from that used in the denominator (or numerator). This ratio is used to convert between units. For example, a unit ratio for converting inches to centimeters is 1 inch/2.54 centimeters or 0.3937 inches/1 centimeter.

Vernier — a short scale that slides along a longer scale. It permits a more accurate reading of fractional parts of divisions on the longer scale.

Measuring Accuracy

Accuracy of measure — an indication of how close the result of a measurement comes to the *true value.* The measurement is not exact because neither the *measuring process* nor the *instruments used* is exact.

Approximate number — any number that results from a *measurement.*

Error of measurement — the largest possible difference between the actual dimension of quantity and the measured dimension of quantity. It is one-half of the smallest fraction of a unit on the measuring device. It is not a mistake, but a way recognizing the limits of the measuring device. Recording the error of measurement is another way of showing the precision of the measurement.

Exact number — any number that results from *counting.*

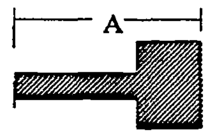
Lower limit — the *smallest* acceptable dimension in a tolerance specification. For example, in a specification of 10 cm ± 0.1 cm, the lower limit is 9.9 cm. (The *upper limit* is 10.1 cm.)

Precision — a measure of how identically a measurement is repeated, without reference to a "true" or "real" value. In a measuring instrument, precision is defined as the smallest fraction or decimal division on the instrument.

Precision of instruments — the degree of precision available with a measuring instrument. All measuring instruments give approximate values for a measurement. As an example of the precision of an instrument, a micrometer whose scale permits measurements to be made to 0.001 inch is said to have a precision of 0.001 inch.

Significant digit — those digits in a measured number — or digits in numbers obtained by arithmetic operations involving measured numbers — that we can be certain are correct. Often, the last significant digit in a number is shown with a line under the number. For example, in the measurement $2.4\underline{3}$ cm, the line under the 3 indicates that it is the last significant digit — and the measurement is accurate to the nearest 0.01 cm.

Tolerance — the greatest range or variation that can be allowed in the dimension of a manufactured part for it to be acceptable and fit together with other parts. A drawing with tolerance specifications might appear as follows:



+0.005"
A=2.050"
-0.002"

Tolerance interval — the range from the lower limit of a dimension to the upper limit of a dimension. For example, if the tolerance is given as 3.24" ± 0.003", the range of tolerance interval is 0.006". If the tolerance is given as

+0.005"
5.812"
-0.003"

the range, or tolerance interval, is 0.008".

Uncertainty in measurement — the differences in the values of repeated measurements, caused either by the measuring device or by the person doing the measurement, or both.

Upper limit — the *largest* acceptable dimension in a tolerance specification. For example, in a tolerance specification of 10 cm ± 0.1 cm, the upper limit is 10.1 cm. (The *lower limit* is 9.9 cm).

Variation — the difference between two measurements. For example, if two measurement of the width of a doorway are made and one is 35 14/16 inches while the other is 35 15/16 inches, the variation in the two measurements is 1/16 inch.

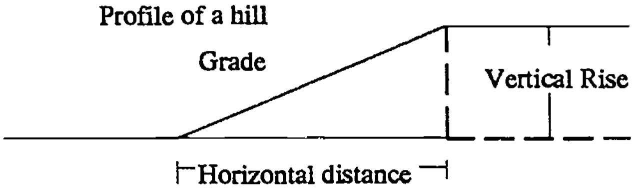
Using Proportions

Constant ratio — a constant ratio is a ratio like circumference/diameter that has the same value (Π) in all cases. The density of elements, such as 11.34 gm/cm^3 for lead, and the speed of light, 186,000 miles/sec, are examples of constant ratios.

Direct proportional relationship — a relationship between variables like voltage, current, and resistance where V = I x R. The current (I) increases as voltage(V) increases if the resistance (R) remains constant.

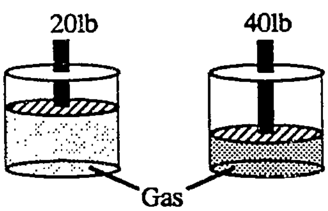
Equal ratios — Equivalent fractions are equal ratios. A fraction like 6/8 can be simplified to 3/4. The two fractions, 3/4 and 6/8, are equal ratios. Equal ratios are proportions.

Grade — the slope of an incline, or the ratio of vertical rise to horizontal distance covered.



Other similar grade situations are encountered in building roofs, in surveying, and in plumbing.

Inverse proportional relationship — a relationship between variables like pressure and volume of a gas (P x V = Constant) where one variable increases when the other variable decreases.



Increased pressure results in decreased volume.

Proportion — a proportion is an expression of equality between two ratios. If a proportion equates equivalent fractions, the fractions can be simplified as shown below.

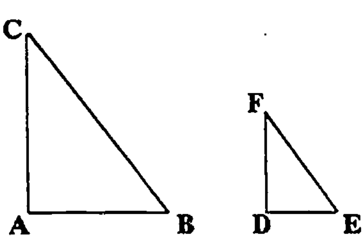
$$\frac{6}{9} = \frac{4}{6}; \qquad \frac{6+3}{9+3} = \frac{4+2}{6+2} \text{ or } \frac{2}{3} = \frac{2}{3}$$

Proportions are seldom simplified except to prove that the two ratios are indeed equal to each other.

Rate — a rate is a ratio that usually involves the units of time in the denominator. Examples are 20 miles/hour, 16 feet/second, and 500 gallons/minute.

Ratio — a comparison of two quantities — either pure numbers or numbers with units. Comparisons of quantities with similar units are often called proper ratios. The quantities that are compared need not have similar units.

Similar figures — figures are similar if their corresponding sides are proportional and their corresponding angles are equal. In a general sense, similar figures are overall reductions or enlargements of one another. In the two similar figures shown below, the corresponding pairs of sides are AB and DE, AC and DF, BC and EF.



The corresponding angles are CAB and FDE, ABC and DEF, and ACB and DFE.

Proportions can be written between corresponding sides as follows:

$$\frac{AB}{DE} = \frac{AC}{DF} \text{ or } \frac{AB}{DE} = \frac{BC}{EF}$$

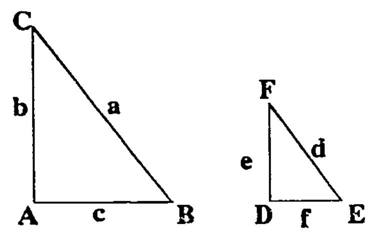
Scale Drawings

Actual-size model — a full-sized replica or congruent figure. The model and the modeled quantity are identical in every respect. Corresponding dimensions are in the ratio of 1:1.

Blueprint — a photographic copy of drawings generally used in the building trades by architects, building contractors, building supervisors, and subcontractors.

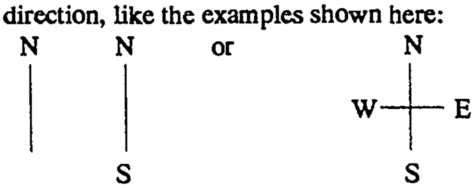
Congruent figures — figures that are one-to-one copies of each other. They have the same size and shape and are identical in every respect.

Corresponding measurements — measurements of matching parts of similar figures. For example, the triangle ABC and the triangle DEF are similar. Angles A and D are corresponding angles, as are angles C and F and angles B and E. Sides a and d are corresponding sides, as are sides b and e, and sides c and f.



Dimension — a measure that denotes the length, width, height, depth, diameter, etc., of a figure. Figures are said to be two-dimensional to describe area and three-dimensional to describe volume.

Keys to scale drawings — the keys refer to two features of maps and some scale drawings. One key is the scale that tells you how far apart locations are. The other key is usually a diagram giving at least one direction, like the examples shown here:



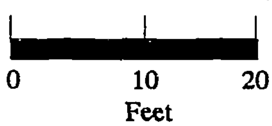
The distance key and the direction key are both needed to locate a given site, plot or position.

Ratio — a comparison of two quantities — either pure numbers or numbers with units. Comparisons of quantities with *identical* units — like 1 ft/20 ft — are often called *proper ratios.* Many important ratios — like 80 heartbeats per minute, 30 miles per gallon, and 60 miles per hour — do not have identical units. Sometimes, ratios that involve time, such as 60 miles per hour, are called rates.

Reduced model — any *scaled-down* model or drawing that is smaller than the original object. Examples include maps, model planes, scale drawings whose scale is a ratio less than one, reduced photographs, and aerial photographs of land areas. Many reduced models are used in business and industry.

Scale of a drawing — the scale is a key that indicates the relationship of a model or drawing to the real object or quantity. Scales may be represented in any of the following ways:

1 inch represents 10 feet (sentence)
1:120 (ratio)
Scale = 1/120 (fraction)



(graphical scale)

Scaled-up model — models are *scaled up* when they are very small — like microscopic organisms, cells, and other small quantities. The scale of these models of drawings is a number greater than one. A scale of 1000 : 1 indicates that a microscope would magnify something 1000 times. An enlargement of a picture scales up the original photograph.

Using Formulas

Coefficient — the numerical or constant part found in an algebraic expression. For example, in the algebraic expression $4/3\pi r^3$, $4/3\pi$ is the coefficient of the variable r.

Constant — specific number used as a coefficient in algebraic expressions and as a number in formulas or equations. For example, in the equation $V_{Total} = (4/3\pi r^3) + 16$, the V and r are variables, while the coefficient $4/3\pi$ and the number 16 are the constants.

Equation — a statement of equality written in terms of variables and constants. For example, $A = \pi r^2$, $V = 4/3\pi r^3$, $i=prt$, and $y = mx + b$ are some of the many equations you have studied.

Formula — a shorthand way of writing a mathematical relationship between quantities. A formula — also referred to as an equation — shows how quantities relate to each other. Variables (quantities) in the formula are represented by letters. Constants are represented by numbers or letters.

Hypotenuse — the longest side of a right triangle. It is opposite the right angle in the triangle.

Literal Numbers — expressions using letters to indicate variables in formulas and equations. For example, in the formula for the volume of a sphere, $V = 4/3\pi r^3$, the variables V and r are *literal numbers.*

Mathematical expression — a group of numbers, letters, and symbols that represent a numerical value in a formula or equation. The volume represented can be a *constant* or a *variable.* For example, $V = 4/3\pi r^3$, is an expression used in the formula for the volume of a sphere. The value of this expression is variable, depending on the value of r.

Mathematical sentence — a transformation of words to mathematical expressions that includes constants and variables. A mathematical sentence may be true or false.

Perpendicular lines — lines, rays, of line segments that intersect to form 90° angles.

Pythagorean formula — the relationship between the length of the hypotenuse of a right triangle and the length of the other two sides. It is usually written as $c^2 = a^2 + b^2$, where c represents the length of the hypotenuse, a represents the length of one side, and b represents the length of the other side.

Right triangle — any triangle that has a 90° angle.

Rule-of-thumb — a formula that gives a quick *estimate* for an answer.

Unknown — the variable in a formula or equation that you wish to isolate to find its value.

Variables — literal numbers used to indicate the quantities in an equation that are dependent on the values of other quantities in the same equation. Variables may be dependent or independent when expressed in an equation. For example, in the equation for the volume of a sphere, $V = 4/3\pi r^3$, V and r are both variables.

Linear Equations

Conditional equation — a statement of equality in two variables that is satisfied by *certain pairs* of values for the two variables.

False equation — a statement of equality that is NOT true. No values for the variables can satisfy the statement.

Identity — an equation that is satisfied for all values of the variable.

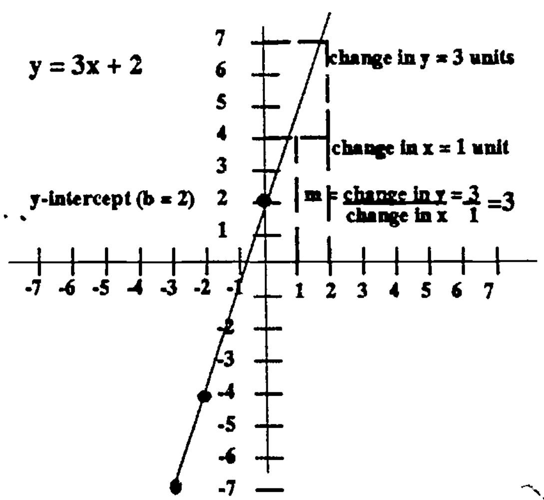
Linear equation — a statement of equality, involving one or two variables to the first power, that does not contain products of the variables. The slope-intercept form of a linear equation is $y = mx + b$.

Numerical coefficient — the numerical value that multiplies a variable in a mathematical term. For example, in the term 3y, 3 is a numerical coefficient, multiplying the variable y.

Nonlinear equation — an equation that involves powers, roots, or products of variables.

Satisfy an equation — to substitute values for variables that make the equation true.

Slope-intercept form of a linear equation — the form $y = mx + b$. In this equation, y is a dependent variable, x is an independent variable, and m and b are constants. If the equation $y = mx + b$ is graphed, m is the slope of the graphed line and b is the y intercept. For example, in the equation $y = 3x + 2$ graphed below, m is the slope equal to *change in y value + change in x value* and b is the y-intercept value for $x = 0$. For the particular graph shown here, the slope m is 3 and the y-intercept b is 2.



Solve an equation — to find a value for a variable — or a pair of values for two variables — that satisfies the equation.

Unknown — the variables you isolate in an equation to find its value (or values).

Variables — literal numbers — letters that represent numbers — used to indicate the possible values of a quantity in a mathematical expression.

Non-Linear Equations

Cartesian coordinate system — a coordinate system that uses two perpendicular number lines as axes, The axes are commonly called the x-axis and the y-axis

Coordinate — either of the two numbers in an ordered pair that is used to locate a point on a coordinate plane.

Dependent variable — the variable that has been isolated. For example, in the slope-intercept form of an equation, $y = mx + b$, the variable y is the **dependent variable** because it has been isolated. Values are chosen for x and the values of y are evaluated. The value of y **depends** on the value chosen for x. The dependent variable is also described as the "respondent" variable since its value depends on the value assigned to the independent, or control variable.

Exponent — the number in an exponential term that indicates how many times the base is used as an equal factor. For example, in the exponential term 2^3, 2 is the base and 3 is the exponent.

Graphs — diagrams that "picture" data of information in a way that makes it easier to understand. Common graphs are bar graphs, circle graphs, and line graphs.

Horizontal axis — the horizontal number line — a line generally running from left to right on a sheet of paper — that is used to locate the position of the first number in an ordered pair.

Independent variable — the variable that has **not** been isolated. For example, in the slope-intercept form of an equation, $y = mx + b$, x is the **independent variable** because it has not been isolated. The independent variable is also described as the "control" variable since values assigned to it control the values that the dependent variable assumes.

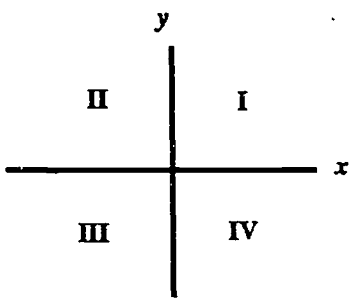
Linear equation — a statement of equality that involves one or two variables raised only to the first power and that does not contain products of variables. The slope-intercept form of a linear equation is $y = mx + b$. When linear equations are graphed on Cartesian coordinate systems, they appear as straight lines.

Nonlinear equation — an equation that involves powers, roots, or products of variables. When nonlinear equations are graphed on the Cartesian coordinate system, they appear as curved lines.

Origin — a unique point on a graph determined by the intersection of the horizontal and vertical axes of the graph. Usually the numbers labeled along the two axes begin with a zero value at the origin. In that case, the origin is sometimes referred to as the "zero point."

Plotting points — locating the positions of ordered pairs of numbers on Cartesian coordinate systems.

Quadrant — one of the four quarters of a Cartesian coordinate plane. The boundaries of each quadrant are the x-axis and the y-axis. The quadrants are numbered I, II, III, and IV as shown below.

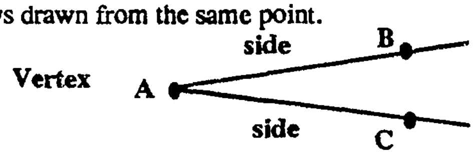


Reciprocal — the reciprocal of a number is *one divided by that number.* For example, the reciprocal of 2 is 1/2, the reciprocal of 1/25 is 25, and the reciprocal of n is 1/n. The product of a number and its reciprocal is always one.

Vertical axis — the vertical number line — a line generally running from top to bottom on a sheet of paper — that is used to locate the position of the second number in an ordered pair.

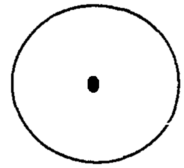
Lines and Angles

Angle — the figure formed by two rays drawn from the same point — or the *amount of opening* between two rays drawn from the same point.



Center of circle — a point inside a circle that is the same distance from all points on the circle.

Circle — a closed curve in two dimensions with all points on the curve at equal distance from a single, enclosed center point.

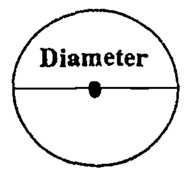


Circumference — the distance all the way around a circle — the *perimeter* of a circle.

Compass — an instrument used to draw circles.

Degree — a unit of measurement for angles. A circle is divided into 360 parts or degrees. One degree equals 1/360 of a complete revolution.

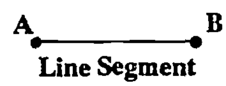
Diameter — a line segment beginning on one side of a circle, passing through the center, and ending on the other side of the circle. The length of a diameter is twice the length of a radius.



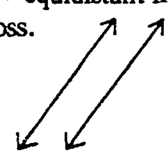
Line — has the following traits:

A. It has no width.
B. It extends infinitely in both directions.
C. It is identified by labeling two points and attaching arrows at the points to indicate extension in both directions.

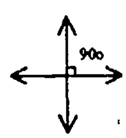
Line segment — the part of a line that extends between two points. The two points are called the end points of the line segment.



Parallel lines — equidistant lines in the same plane that never cross.



Perpendicular lines — lines that form 90-degree angles where they cross.



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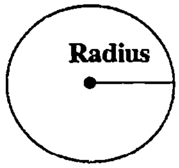
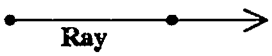
Point — has the following traits:
A. It has no width.
B. It has no length.
C. It identifies a position in space.

Protractor — an instrument used to measure angles.

Radius — a line segment from the center of a circle to any point on the circle. The length of a radius is one-half the length of a diameter.

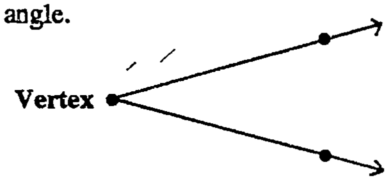


Ray — a line with a fixed point at one end, extending to infinity in the other direction.



Rotate — a movement about a fixed line called an axis of rotation. A movement from a starting point all the way around to the same starting point is a complete revolution.

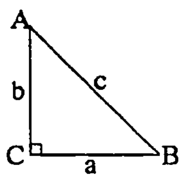
Vertex of angle — the point where two rays come together to form an angle.



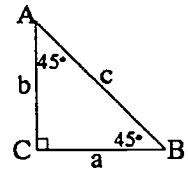
Right Triangles

Acute angle — any angle whose measure is greater than 0° and less than 90°. A right triangle always has acute angles and one right angle.

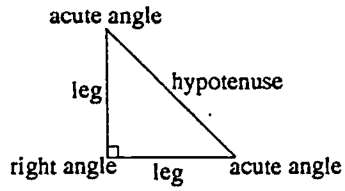
Cosine of an angle — for a specified acute angle of a right triangle, the *cosine* of the angle is equal to the ratio of the length of the adjacent leg to the length of the hypotenuse. For the triangle shown below, cos A = *b/c*



45° - 45° right triangle — a right triangle with two 45° angles; two legs have equal lengths and the length of the hypotenuse is equal to 2 times the length of either leg. A drawing of a 45° - 45° right triangle is shown below.

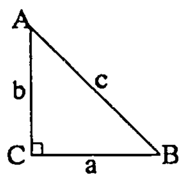


Hypotenuse — the longest side of a right triangle. It is the side located opposite the right angle. See drawing below.



Leg — either of the two sides of a right triangle that are opposite the two acute angles. See drawing above.

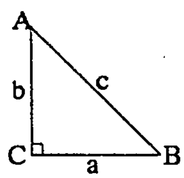
Pythagorean formula — a mathematics equation indicating that the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs. For triangle ABC below, this equation becomes, $c^2 = a^2 + b^2$.



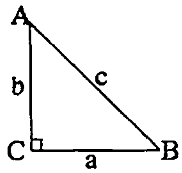
Ratios of a right triangle — any of the six possible ratios of the lengths of the sides of a right triangle. In triangle ABC shown above, these ratios are a/b, b/a, a/c, c/a, b/c, and c/b.

Right triangle — a triangle that has 90° for one of its three angles.

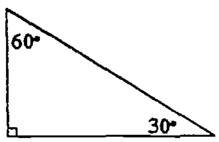
Sine of an angle — for a specified angle of a right triangle, the sine of the angle is equal to the ratio of the length of the opposite leg to the length of the hypotenuse. For the triangle shown below, sin A = a/c.



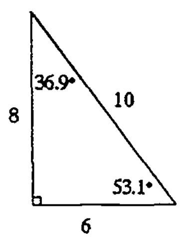
Tangent of an angle — for a specified acute angle of a right triangle, the tangent of the angle is equal to the ratio of the length of the opposite side to the length of the adjacent side. For the triangle shown below, tan A = a/b.



30° - 60° right triangle — a right triangle whose two acute angles are 30° and 60°. The length of the leg opposite the 30° is always one half the length of the hypotenuse. The length of the leg opposite the 60° angle is always 3 times the length of the shorter leg. A drawing of a 30° - 60° right triangle is shown below.

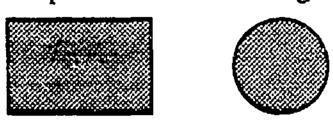


3 : 4 : 5 right triangle — a right triangle whose three sides have length ratios of 3 : 4 : 5. The triangle shown below is such a triangle, since the ratio 6 : 8 : 10 is equivalent to 3 : 4 : 5.

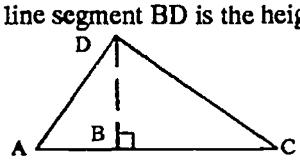


Two Dimensions

Area — a measure of the amount of surface. The area enclosed by a rectangle and a circle is indicated by the shaded portion shown in the figures below.



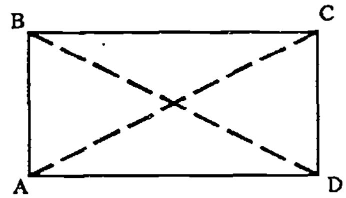
Base — one of the dimensions used to describe the shape of an object. For example, any side of a triangle may be chosen as the base. Once the base is identified, the height can be determined. For the triangle shown, if the line segment AC is the base, then the line segment BD is the height.



Circle — a closed curve in two dimensions with all points on the curve at equal distances from a single, enclosed center point.

Circumference — the distance all the way around a circle — the perimeter of a circle.

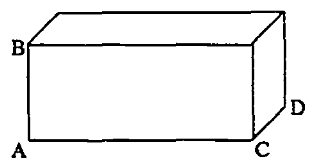
Diagonal — a line segment that extends between opposite corners of a closed, four-sided figure. The measure of this line segment is also called a diagonal. In the rectangle shown below, the line segments AC and BD are the diagonals.



Diameter — the line segment beginning on one side of a circle, passing through the center, and ending on the other side of the circle. The length of a diameter is twice the length of a radius.

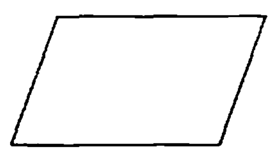
Dimension — a linear measure along a single direction of a line segment. Length, width, and height are all examples of dimensions used to describe the shape of an object like a box.

Height — one of the dimensions used to describe the shape of an object. The height is a measure of the line segment perpendicular to the base, extending up to the highest point of the object. For instance, in the drawing shown, line segment AB is used to indicate the height of the object.



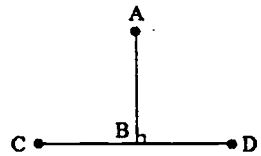
Length — a dimension that refers to one of the linear measures used to describe the shape of an object. For instance, in the drawing shown, the length of line segment AC is generally used to indicate the length of the object.

Parallelogram — a two-dimensional, four-sided, closed figure whose opposite sides are parallel and equal. A parallelogram has the general shape shown below.



Perimeter — The distance around the outside boundary of a closed figure such as a rectangle, triangle, trapezoid, or circle.

Perpendicular — in the drawing below, line segment AB is perpendicular — or at an angle of 90° — to line segment DC, and vice versa. Right angles formed by perpendicular lines are usually noted with a small square at the vertex, as shown below.



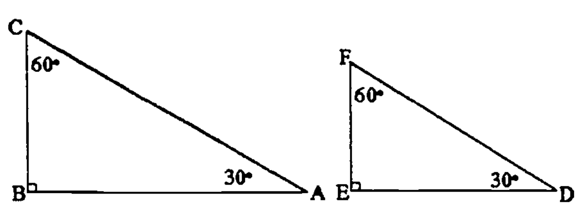
Perpendicular distance — the distance measured along a line segment that is oriented at 90 degrees to another line segment. In the drawing above, the perpendicular distance of point A from line segment DC is the length of the line segment AB.

Pi (∏) — an unending, nonrepeating number equal in value to the *circumference* of any circle divided by its *diameter*. Common approximations for the number pi (∏) are 3.14, 3.142, 3.1416, and 22/7.

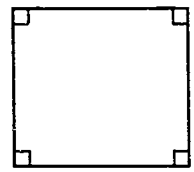
Radius — the line segment from the center of a circle to any point of the circle. The length of a radius is one-half the length of a diameter.

Rectangle — a two-dimensional, four-sided, closed figure with four right angles. The opposite sides of a rectangle are parallel and of equal length. The general shape of a rectangle is shown below.

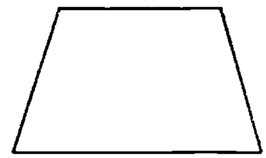
Similar triangles — two triangles whose corresponding angles are equal. For example, triangles ABC and DEF, shown below, are similar, since pairs of corresponding angles are equal. The corresponding angles are ∠ CAB = ∠ FDE = 30°, ∠ ACB = ∠ DFE = 60°, and ∠ ABC = ∠ DEF = 90°.



Square — a two-dimensional, closed figure with four right angles and four sides of equal length. A square is pictured as shown.



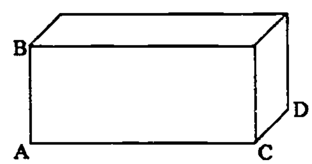
Trapezoid — a two-dimensional, four-sided, closed figure with two opposite sides parallel to each other. A trapezoid has the general shape shown here.



Two-dimensional figure — a figure extending in two dimensions on a plane. Common shapes such as rectangles, squares, parallelograms, triangles, trapezoids and circles are all two-dimensional figures.

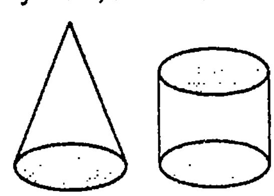
Vertex of an angle — the point where two lines come together to form angles.

Width — a dimension that refers to one of the linear measures used to describe the shape of an object. For instance, in the drawing shown below, the length of line segment DC is used generally to indicate the width of the object.



Three Dimensions

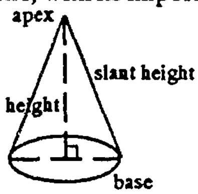
Base — the bottom, or foundation, that usually supports a three-dimensional figure. The base is generally a two-dimensional figure, such as a circle, as shown. Some figures, such as a cylinder, have two bases.



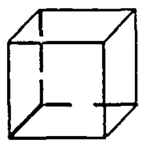
Capacity — the amount of space that a container encloses. It is measured as volume — by formula or displacement. Measurement units include both dry and liquid.

Circumference — a measure of the distance around a circle. It is the length obtained by multiplying the diameter times the constant Π. It is given by the formula C = Π x d.

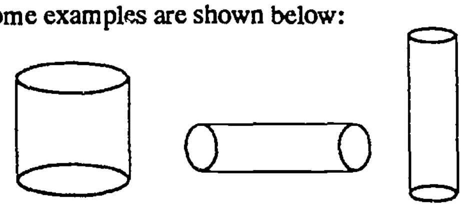
Cone — a three-dimensional figure with a circular base and a pointed top. A cone, with its important parts, is shown below:



Cube — a geometric figure with six equal faces. Each face is a square. All edges are equal.

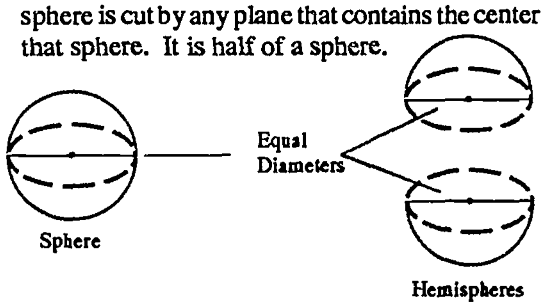


Cylinder — a three-dimensional figure with a circular base. Examples include cans, silos, and straws. Some examples are shown below:

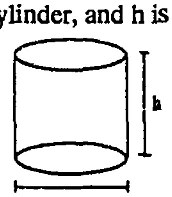


Exponent — a number or symbol placed above and to the right of another number or symbol to show how many times the first number or symbol is used as a factor. For example, $4^3 = 4 \times 4 \times 4$. In this example, the exponent 3 indicates that 4 is a factor 3 times, or 4 is multiplied by itself twice.

Hemisphere — a three-dimensional figure formed when a sphere is cut by any plane that contains the center of that sphere. It is half of a sphere.



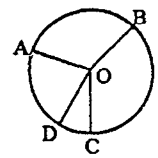
Lateral area — the outside surface area of the sides of three-dimensional figures. The lateral area does not include the area of the base(s). For example, the lateral area of a cylinder is Π x d x h, where Π is 3.14, d is the diameter of the cylinder, and h is the height of the cylinder.



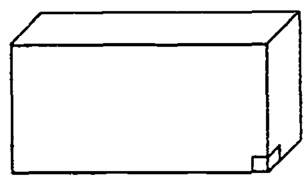
Pi (Π) — a constant-valued number obtained when the circumference of any circle is divided by its diamter. Values commonly used to approximate Π include 3.14 or 22/7.

r^3 — the radius cubed means *radius x radius x radius.* If a sphere has a radius of 6 cm, the radius cubed would be 6 cm x 6 cm x 6 cm = 216 cm^3.

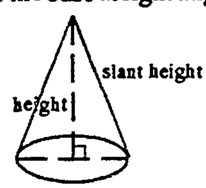
Radius — any line segment from the center of a circle to any point on the circumference of the circle. It is equal to one-half of the diameter of the same circle. Any one of the segments shown below is a radius of the circle:



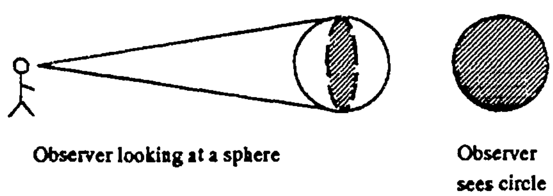
Rectangular solid — a three-dimensional figure whose six faces are rectangularly shaped. Other frequently used names include rectangular prism and rectangular parallelepiped. Cubes are included as a special rectangular solid whose six fades are all squares. The corners of any rectangular solid include only right angles as shown below:



Slant height — the distance from a point on the outside of the base to the top of a cone as shown. The slant height is always longer than the true height, a line drawn from the apex to the base at right angles to the base.



Sphere — a three-dimensional figure formed when all points of the surface are at an equal distance from a given location in space - the center of the sphere. It can be generated by rotating a circle around its diameter as a circle when viewed from any position, as shown in the drawing below.

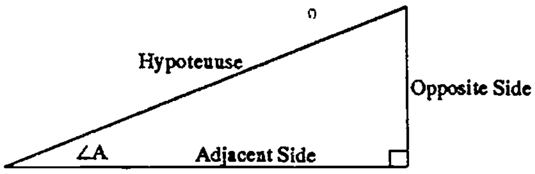


Total surface area — the area of the total outside surface of a three-dimensional figure. It is equal to the sum of the area of the six faces for rectangular solids. For a cylinder, it is equal to the lateral area plus the area of the two bases.

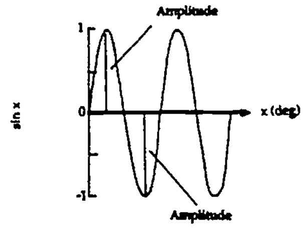
Volume — the amount of space enclosed by a three-dimensional figure. Volume is measured in cubic units.

Trigonometry

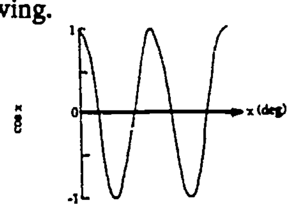
Adjacent side of an angle — one of the sides that forms an acute angle in a right triangle. The hypotenuse is not considered the adjacent side.



Amplitude of a wave — the maximum rise or fall above the zero position or horizontal line of symmetry. See drawing.

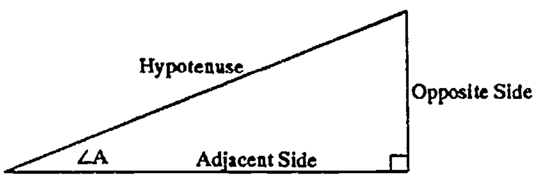


Cosine curve — the graph of the cosine of an angle versus the angle. See drawing.



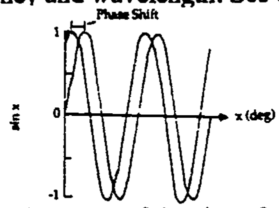
Frequency of a wave — the number of complete wave cycles that pass a given point each second. Wave frequency is measured in cycles per second, or hertz.

Opposite side of an angle — the side opposite an acute angle in a right triangle. See drawing.

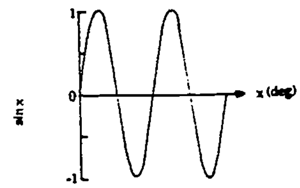


Period of a wave — the time it takes for one complete wave cycle to pass by a fixed point.

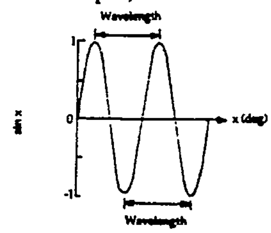
Phase shift — the relative separation (in degrees) between the crests of two waves that have the same frequency and wavelength. See drawing.



Sine curve — the graph of the sine of an angle versus the angle. See drawing.



Wavelength — the length of a complete wave cycle, measured, for example, from crest to crest. See drawing.



Wave motion — disturbances, rising and falling motions, that transfer energy from one place to another. Physical phenomena that can be described in terms of wave motion include ocean waves, sound waves, alternating current or voltage signals, light waves, and ground waves generated by earthquakes.

Graphs, Charts, and Tables

Ampere — a name for the unit of current that flows in an electrical circuit. Electrical current is measured with an instrument known as an ammeter.

Axis — a reference line used in making graphs. Generally, one of the axes is a horizontal line, sometimes called the x-axis, and the other is a vertical line, sometimes called the y-axis. The horizontal and vertical axes are perpendicular to one another. They start at a common point, usually the lower left corner of the graph. The common point is referred to as the origin of the graph.

Bar graph — a type of graph that uses side-by-side horizontal bars or vertical bars of different lengths to compare different items of information.

Circle graph — a type of graph that is circular in shape. The circle graph compares different information by assigning "pie sections" of different sizes to the various categories of information.

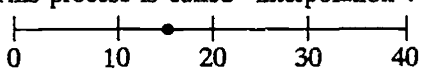
Extrapolate — extending a graph to find values beyond the known range. For example, in making a graph of Celsius and Fahrenheit temperatures, the boiling point of water(100°C, 212°F) and the freezing point of water (0°C, 32°F) can be graphed. A straight line can be drawn between these points. Then the desired Celsius temperature can be extrapolated by extending the line and reading the value that is equal to 300°F

Graph — a diagram that "pictures" data of information in a way that makes it easier to understand. Common graphs are bar graphs, circle graphs, and line graphs.

Graph units — the particular values assigned to represent the information displayed on a graph. For example, the graph units for "time" labeled along a horizontal axis may be chosen as seconds, hours, days, months, or years, depending on the length of time to be represented. Similarly, if "cost" is labeled along a vertical axis, the graph units may be chosen as cents, dollars, thousands of dollars, millions of dollars and so on, depending on the range of cost to be shown.

Grid lines — the horizontal and vertical lines drawn parallel to the horizontal and vertical axes of a graph. Taken together these intersecting lines form a grid. Each horizontal line represents a specific value of the information labeled along the vertical axis. Each vertical line represents a specific value of the information labeled along the horizontal axis.

Interpolate — estimating a value from a graph or table that is between known or labeled values. For example, on the number line below, the point is halfway between 10 and 20 so the value of 15 is estimated. This process is called "interpolation".



Line graph — a series of points, plotted between the horizontal and vertical axes of a graph, that form a line when connected to one another. Each point on the line represents specific values of the quantities labeled along the horizontal and vertical axes of the graph.

Origin — a unique point on a graph determined by the intersection of the horizontal and vertical axes of the graph. Numbers labeled along the horizontal and vertical axes of the graph generally have their lowest values at the origin. In some cases, the numbers labeled along the two axes begin with zero values at the origin. In that case the origin is also referred to as the "zero point".

Resistance — a term used to indicate the opposition to current flow in electrical circuits. The higher the resistance of a circuit element, the more voltage is needed to produce a given value of current.

Table — an organized array of information — usually numbers — arranged in appropriately labeled rows and columns.

Trend — a tendency to follow a particular "direction" or a particular sequence of values. For example, consider a graph that shows the cost of living for the past 24 months. It indicates that the cost of living has increased steadily each month. This steady increase is seen as a trend that may continue unless other economic factors come into play.

Vertical — a direction perpendicular to the horizon or perpendicular to the level ground. On a graph drawn from top to bottom, it is the direction parallel to a side of the page.

Volt — a name for the unit of voltage in electrical circuits. Electrical voltage is measured with an instrument known as a voltmeter.

Zero point — the origin or point on a graph where the horizontal and vertical axes intersect. The origin is referred to as the "zero point" whenever the numbers labeled along the horizontal and vertical axes begin with zero values at this point. The zero point is located generally at the lower left corner of the graph.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Estimating

STUDENT WORKSHEET #2 — Renaming Numbers

STUDENT WORKSHEET #3 — English and Metric

STUDENT WORKSHEET #4 — Measuring Accuracy

STUDENT WORKSHEET #5 — Using Proportions

STUDENT WORKSHEET #6 — Scale Drawings

STUDENT WORKSHEET #7 — Using Formulas

STUDENT WORKSHEET #8 — Linear Equations

STUDENT WORKSHEET #9 — Nonlinear equations

STUDENT WORKSHEET #10 — Lines and Angles

STUDENT WORKSHEET #11 — Right Triangles

STUDENT WORKSHEET #12 — Two Dimensions

STUDENT WORKSHEET #13 — Three Dimensions

STUDENT WORKSHEET #14 — Trigonometry

STUDENT WORKSHEET #15 — Graphs, Charts, and Tables

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Estimating

1. Peas are seeded at 1 pound per 100 feet.
   a. Estimate how many pounds of peas would be seeded in 6 rcws each 90 feet long.

   b. If there are about 2,000 seeds in each pound of peas, estimate the number of peas planted in each row.

2. The cost of transporting goods limits how for a farmer is willing to move his goods to market. The Baileys look over their records for the past several trips to a distant market. The labor and fuel expenses were $62, $55, $58, $70, and $61. On the above trips they delivered 98 bushels, 102 bushels, 95 bushels, 107 bushels, and 90 bushels, respectively.
   a. About how much does it cost in labor and fuel for each trip to this distant market?

   b. About how many bushels are the Baileys able to deliver on each trip?

   c. Using these estimated averages, about how much does it cost in labor and fuel per bushel to deliver the produce to market?

3. You work in an industry that uses tape measures marked off in tenths of inches. A specification calls for a measurement between 16 3/16" and 16 5/16". What lengths — when rounded to the nearest tenth of an inch — can you measure with your tape that will fall within the specified lengths?

4. You install solar heating systems. The number of panels needed depends on the amount or living area and the climate. For mild climates, you take 10% of the living area to find the total area of solar panels needed. Each solar panel is 3 ft x 7 ft, or 21 ft^2.
   a. What is the total surface area of solar panels needed for a single story house with 1,360 ft^2 of living area?

   b. Because of the design of the panels, you need to always have pairs of panels together. How many 21 ft^2 sola panels should you recommend to obtain this surface area and have an even number of panels?

STUDENT WORKSHEET #1 — Key

Estimating

1. a. Estimated pounds needed = Number of rows x Length of rows x Pounds per row
   Estimated pounds needed = 6 rows x ~100 ft per row x 1 lb per 100 ft
   Estimated pounds needed = 6 lb

   b. Estimated number of peas = Number of pounds per row x Number peas per pound
   Estimated number of peas = ~1 lb x 2000 peas per lb
   Estimated number of peas = 2000 peas

2. a. Fuel and labor expenses appear to be about $60.

   b. Deliveries appear to be about 100 bushels.

   c. Estimated cost per bushel = Total cost ÷ Number of bushels
   Estimated cost per bushel = ~$60 ÷ ~100 bushels
   Estimated cost per bushel = $0.60 per bushel

3. Convert the mixed numbers (with fractions) to decimal fractions.
   Minimum: 16 3/16" = 16.1875"
   Maximum: 16 5/16" = 16.3125"
   So measurements of 16.2" and 16.3" will fall within the range specified by the minimum and maximum values. This is equivalent to rounding the minimum up to 16.2" and the maximum down to 16.3"

4. a. Total area needed = 10% of living area
   Total area needed = 0.10 x 1360 ft^2
   Total area needed = 136 ft^2

   b. Number of panels needed = Total area needed ÷ Area por panel
   Number of panels needed = 136 ft^2 ÷ 21 ft^2 per panel
   Number of panels needed = 6.4762 panels

   Since you need to recommend an even number of panels, you would probably recommend 6 panels (rounding down to 6) rather than 8 panels (rounding up to 8).

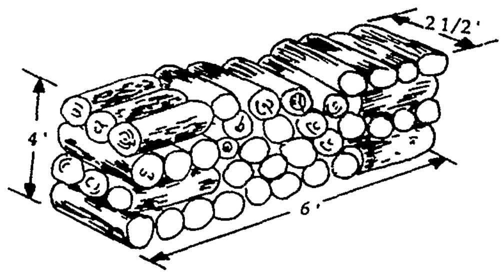
ERIC

STUDENT WORKSHEET #2

Renaming Numbers

1. A common guideline for triangle flower arrangement requires that the height be about 1 1/2 to 2 times the width. If the width of a flower spray is 14 inches, to what height should the greenery be trimmed? (Give the smallest and largest suitable heights.)

2. A cord of wood is equal to 128 cubic feet of stacked logs. A customer has ordered a half cord of firewood. You deliver a load of wood and make a pile of 2 1/2 foot logs that measures 4 feet high by 6 feet long.



   a. How many cubic feet of firewood has the customer ordered?

   b. Multiply the length by the height, and also by the length of the logs, to find how many cubic feet of firewood you have delivered.

   c. Do you need to bring more wood to the customer to make a half cord? If so, how much more (cubic feet)?

3. A sample of milk contains 4% fat, 5% carbohydrate, and 3.5% protein.
   a. Express the percent fat in milk as a decimal.

   b. How many grams of fat are found in an 8-ounce serving of milk that weighs 250 grams?

   c. If each gram of fat has 9 calories in it, how many calories does the fat in this serving contain?

4. The pure live seed percentage (PLS%) is the best index of seed quality. It is calculated by multiplying the germination percentage by the purity percentage.
   a. A lot of Kentucky bluegrass seed has a germination percentage of 60% and a purity percentage of 90%. Express each of these percentages as a decimal.

   b. Multiply the two decimals, and convert the product back to a percentage to find the PLS% for this seed.

5. The Moores have a bumper crop of 1,000 bushels of apples this year. They can have the apples picked by a labor crew for $2.50 per bushel, and then market the apples for $5.00 per bushel. Or they can let the public pick the apples at $4.00 per bushel. When the public picks their own apples, the Moores have about 20% loss of the apple crop from waste. The Moores want to choose the method that provides more income.
   a. What would be the Moores' income if a labor crew harvests the apples and they sell the apples at market?

   b. If they permit the public to pick the apples, how many apples will be left after allowing for the 20% loss?

   c. After deducting the loss for waste, how much income can the Moores expect from allowing the public to pick the apples?

   d. Should the Moores sell the apples to the public, or hire a labor crew to pick them for market?

STUDENT WORKSHEET #2 — Key

Renaming Numbers

1. Smallest suitable height = 1 1/2 x 14" = 21"

   Largest suitable height = 2 x 14" = 28"

2. a. Customer order = 1/2 cord of wood
   Customer order = 1/2 x 128 cubic feet = 64 cubic feet

   b. Amount delivered = Length x Width x Height
   Amount delivered = 2 1/2 feet x 4 feet x 6 feet = 60 cubic feet

   c. Difference = 64 cubic feet - 60 cubic feet = 4 cubic feet
   You need to bring 4 cubic feet more wood to make a half cord.

3. a. Percent fat = 4% = 0.04

   b. Grams of fat = 4% of 250-gram serving
   Grams of fat = 0.04 x 250 grams = 10 grams

   c. Calories in 10 grams fat = 9 cal/gram x 10 grams
   Calories in 10 grams fat = 90 cal

4. a. Germination = 60% = 0.60
   Purity = 90% = 0.90

   b. PLS% = 0.60 x 0.90
   PLS% = 0.54 = 54%

5. a. Income using labor crew = Sale income from market - labor cost
   Income using labor crew = (1000 bushels x $5.00/bushel) - (1000 bushels x 2.50/bushels) = $2500.00

   b. Apples lost = 20% of 1000 bushels
   Apples lost = 0.20 x 1000 bushels = 200 bushels
   Apples remaining = 1000 bushels - 200 bushels = 800 bushels
   Or, alternatively, the students may realize that if 20% are lost, 80% will remain.
   Apples remaining = 80% of 1000 bushels = 800 bushels

   c. Income using public = 800 bushels x $4.00/bushel = $3200.00

   d. The Moores should sell their apples to the public because they will have $700.00 more income from their crop.
   Difference = $3200.00 - $2500.00 = $700.00

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STUDENT WORKSHEET #3

English and Metric

1. You are landscaping the outside of a new business establishment. You set up 3 planter boxes that hold about 10 cubic feet of dirt each. A truck has delivered 6 cubic yards of topsoil.
   a. How many cubic feet of topsoil do you need to fill the planter boxes?

   b. How many cubic feet of dirt did the truck deliver?

   c. Will you have enough dirt to fill the planter boxes?

2. You estimate that your cotton crop can be harvested in 1 week and 4 days if you schedule three tractors to work 12 hours a day, 6 days a week.
   a. How many hours do all three tractors combined have to work to harvest the cotton?

   b. You can only get two tractors at harvest time. Your workers are willing to work 7 days a week to try to harvest the cotton within 2 weeks. Since they still need the same amount of tractor time, how many hours will each of the two tractors have to work to meet the goal?

   c. How many hours a day will each tractor have to work to get the job done in 2 weeks, working 7 days a week?

3. The cylinder displacement in automobiles was expressed in cubic inches in the past, but now is being reported in liters.
   a. About how many liters displacement would a 400-cubic-inch engine have?

   b. About how many cubic inches of piston displacement would a 2.2-liter engine have?

4. A measurement of the coolant in an automobile radiator indicates that it should protect down to -30°C and that it has a boiling point of 106°C. This means that the coolant will freeze at -30°C, and boil at 106°C.
   a. At what temperature in degrees Fahrenheit will the coolant freeze?

   b. How hot (in degrees Fahrenheit) will the coolant be when it starts to boil?

5. A bolt must pass through the materials shown in the drawing. What is the total thickness that is to be bolted?

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STUDENT WORKSHEET #3 — Key

English and Metric

1. a. Soil needed to fill boxes = Number of boxes x Cubic feet of soil per box
Soil needed to fill boxes = 3 boxes x 10 ft^3/box = 30 ft^3 soil

   b. Cubic feet of soil delivered = Cubic yards x Unit ratio
Cubic feet of soil delivered = 6 yd^3 x 27 ft^3/yd^3 = 162 ft^3

   c. The truck delivered 162 ft^3 of topsoil. You need 30 ft^3 of soil to fill all three planters. You will have 132 ft^3 of topsoil left over. 162 ft^3 - 30 ft^3 = 132 ft^3

2. a. First calculate days worked by each tractor.
Days worked by each tractor = Days worked per week x Weeks + Remaining days
Days worked by each tractor = 6 days /1 week x 1 week + 4 days
Days worked by each tractor = 6 days + 4 days = 10 days
Then find the number of hours worked by each tractor.
Hours worked by each tractor = Days x Hours per day
Hours worked by each tractor = 10 days x 12 hours/day = 120 hours
Working days available = Weeks x Working days per week
Working days available = 2 week x 7 days /week = 14 days
Hours worked per day = Hours + Days
Hours worked per day = 180hr/14 days = 12.85 Hours per day

3. a. Liters = Cubic inches x Unit ratio
Liters = 400 in^3· x 1 liter/61.02545 in^3.
Liters = 400 liter + 61.02545 = 7 liters (rounded)

   b. Cubic inches = Liter x Unit ratio
Cubic inches = 2.2 liter x 61.02545 in^3/1 liter = 134 in^3 (rounded)

4. a. The coolant will freeze at about -23°F

   b. The coolant will boil at about 223°F

5. Total thickness to be bolted = $T_{washer} + T_{foot} + T_{shock} + T_{base} + T_{washer}$
Total thickness to be bolted = 2.0 mm + 3.5 mm + 3.0 cm x 10 mm/ cm +2.8 cm x 10 mm / cm + 2.0 mm
Total thickness to be bolted = 2.0 mm + 3.5 mm + 30 mm + 28 mm + 2.0 mm = 65.5 mm

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STUDENT WORKSHEET #4

Measuring Accuracy

1. Seeds are normally purchased and sown by weight. Suppose you sample carrot seeds for a seed company and count out 1000 seeds that weigh 1.23 grams.

   a. What is the precision of your seed count? of your sample weight?

   b. What number of seeds per gram can you report? What number of seeds per ounce can you report? (Report your answer with the correct number of significant digits.)

2. A coring aerator can cover 5000 ft^2 per hour. How long would it take to cover the greens on an 18 hole golf course, if each green averages 8000 ft^2. (Report your answer with the proper precision.)

3. To estimate the volume of lumber in a standing tree requires a measure of the diameter of the tree at breast height (dbh). To obtain this, you measure the circumference of the tree with a steel tape measure and divide by Π to get a diameter. Suppose you measure several tree circumferences, as listed below. Compute the diameter of each tree, and report it with the correct number of significant digits.

Tree	Circumference
A	58"
B	107"
C	42"
D	28"

4. As an entomologist, you examine fields for the cotton boll worm. If more than 6000 worms per acre are found, an insecticide treatment is needed. To estimate the number of worms per acre, all the plants on several short lengths of row will be examined. For 38-inch rows, there are a total of 13,756 row-feet per acre. Suppose you examine four 72-inch sections of rows and count a total of 9 worms.

   a. Set up a proportion equating the ratio of worms counted to the number of row-feet examined and the ratio of worms per acre to the number of row-feet per acre. Solve for the unknown number of worms per acre. (Report your answer with the correct number of significant digits.)

   b. Does this finding warrant an insecticide treatment?

   c. Suppose you found 10 worms. Repeat the calculations to find whether a treatment is needed.

STUDENT WORKSHEET #4 — Key

Measuring Accuracy

1. a. The seed count is exact, since it is a count. The weight is apparently precise to 0.01 gram.
   b. Since the measurement of seed weight has three significant digits, the reported answer can have no more than three digits.
   Seeds per gram = Number of seeds + Weight in grams
   Seeds per gram = 1000 seeds + 1.23g = 813 seeds per gram (rounded to 3 digits)
   Seeds per ounce = Seeds per gram x Grams per ounce
   Seeds per ounce = 813 seeds / grams x 28.35 gram / ounce = 23,048.55 seeds per oz, or 23,000 (rounded)

2. Two measurements are involved. The rate of coverage has two significant digits, and the area per green has one significant digit. The count of 18 holes is exact. Hence, the answer can only report one significant digit.
   Time to aerate = Total area to aerate + Area per hour
   Time to aerate = (18 holes x 8000 ft per hole) + 5000 ft per hour
   Time to aerate = 28.8 hour, or 30 hour (rounded to one digit)

3. Diameter = Circumference / Π
   Rounded to 2 or 3 significant digits

Tree	Circumference	Diameter
A	58"	18"
B	107"	34.1
C	42"	13"
D	28"	8.9"

4. a. The total number of row-feet examined is 4 x 6 row-feet, or 24 row-feet. Since the rows are measured as 72 inches, a measurement with two significant digits, the result should be rounded to two significant digits. The count of 9 is considered exact.
   Worms counted + Row-feet = Worms per acre + Row-feet per acre
   9 worms + 24 row-feet = Worms per acre + 13,756 row-feet
   Worms per acre = (9 worms x 13,756 row-feet per acre) + 24 row-ft = 5091 worms / acre, or 5100

   b. Since this count does not exceed the 6000 worms per acre limit, a treatment is NOT needed.

   c. Worms per acre = (10 worms x 13,756 row-feet per acre) + 24 row-feet
   Worms per acre = 5656.67 worms per acre, or 5700
   A treatment is still not needed. If 11 worms were found, however, the solution becomes 6200 and a treatment is needed.

STUDENT WORKSHEET #5

Using Proportions

1. For good maintenance of lawns, a fertilizer analysis ratio of 3 : 1 : 2 is commonly used. This is the ratio of the fertilizer's content of nitrogen to phosphate to potassium. The strengths of each component are reported similarly on fertilizer bags in terms of percentages by weight. Several different mixes are available: 28-4-4, 21-0-0, 15-5-14, 12-4-8, 13-13-13, and 12-24-12. Which fertilizer mix (or mixes) has the desired ratio of 3 : 1 : 2?

2. Several ratios have been developed to analyze the financial strength and growth of farm businesses. One of these is the current ratio, a ratio that indicates the extent to which current liabilities could be liquidated, if necessary. Most businesses are expected to maintain a current ratio of at least 2 to 1.

   Current ratio = Total current assets + Total current liabilities

   a. An analysis of the Browns' farm business shows their current assets total $47,206. Their total liabilities $9498. Compute the Browns' current ratio.

   b. The previous year's balance sheet for the Browns showed assets totaling $38,314 and liabilities totaling $7908. Compute the current ratio for the previous year.

   c. Has the Browns' financial position strengthened this year (a higher current ratio) or weakened (a lower current ratio) when compared to the previous year?

3. A tractor has a belt pulley diameter of 10 inches that operates at a speed of 1100 revolutions per minute (rpm). The pulley is to be connected to a forage blower that needs to operate at a speed of about 650 rpm. What size pulley should be used in the forage blower?

4. The container of lawn herbicide instructs you to prepare a solution of 1 part full-strength herbicide to 10 parts water when using a hose-end sprayer.

   a. What is the ratio of full-strength herbicide to water?

   b. Your hose-end sprayer holds up to 16 oz of mix. If you fill the sprayer with 14 oz water, how many ounces of full-strength herbicide should you add to obtain the proper concentration?

   c. Suppose for direct application, the instructions are to mix 1 oz full-strength herbicide to each gallon of water. What is the ratio of full-strength herbicide to water in this instance?

   d. How does this compare to the strength of solution prepared in the hose-end sprayer?

STUDENT WORKSHEET #5 — Key

Using Proportions

1. Use the middle number, the phosphate content, to compare. The desired mix will have a nitrogen content that is 3 times the phosphate (3:1) and a potassium content that is 2 times the phosphate (2:1). If both of these ratios exist, then the mix will be in the desired ratio of 3:1:2.

Mix	Nitrogen Content = 3 x Phosphate content	Potassium content = 2 x Phosphate content
28-4-4	28 = 3 x 4 28 ≠ 12	
21-0-0	21 = 3 x 0 21 ≠ 0	
15-5-14	15 = 3 x 5 15 = 15	14 = 2 x 5 14 ≠ 10
12-4-8	12 = 3 x 4 12 = 12	8 = 2 x 4 8 = 8
13-13-13	13 = 3 x 13 13 ≠ 39	
12-24-12	12 = 3 x 24 12 ≠ 72	

So, only 12-4-8 has the three components in the proper ratio of 3 : 1 : 2.

2. a. Current ratio for this year = $47,206 / $9498 = 4.97 : 1 (rounded)

   b. Current ratio for previous year = $38,314 / $7908 = 4.84 : 1 (rounded)

   c. The Browns' financial position has *strengthened* this year, since their current ratio has increased.

3. The ratio of the pulley speeds should be indirectly proportional to the ratio of the pulley diameters.
Speed of drive pulley ÷ Speed of blower pulley = Diameter of blower pulley ÷ diameter of drive pulley
1100 rpm ÷ 650 rpm = y ÷ 10"
y = (1100 rpm x 10") ÷ 650 rpm = 16.9" (rounded)
A 16.9" pulley should be used on the forage blower or, more realistically, a 17" pulley.

4. a. The ratio of full-strength herbicide to water is 1 : 10.

   b. The proportion of the desired ratio and the specified ratio is:
   Specified parts of herbicide ÷ Specified parts of water = Desired measured of herbicide ÷ Desired measure of water
   1 part ÷ 10 parts = y ÷ 14 oz
   y = (1 part x 14 oz.) ÷ 10 parts = 1.4 oz
   So, you should add 1.4 oz full-strength herbicide to the 14 oz of water.

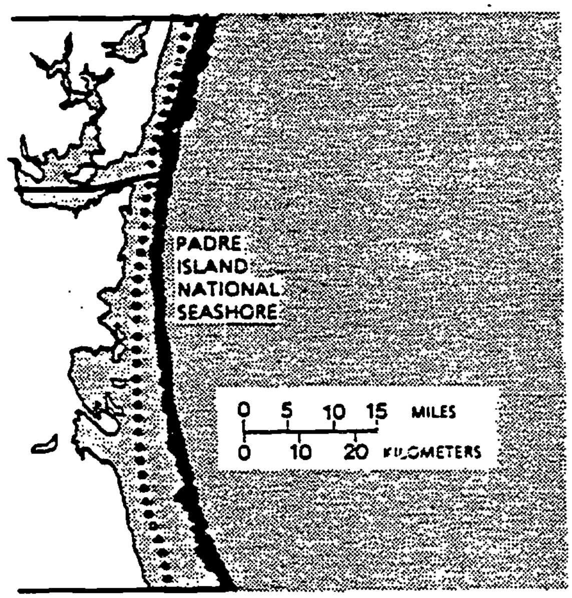
   c. The ratio of full-strength herbicide to water is 1 oz to 1 gallon. A better way to report this is without units. Converting 1 gallon to 128 ounces yields a ratio of 1 oz herbicide to 128 oz water, or 1 : 128.

   d. The strength of the solution for use in the hose-end sprayer is much greater than that used for direct application.

STUDENT WORKSHEET #6

Scale Drawings

1. Along the Gulf Coast in Texas, a long stretch of Padre Island is declared a national seashore. Use the section of the map shown here to determine approximately how many miles of seashore are protected (darkened part of the island on the map) by this status.

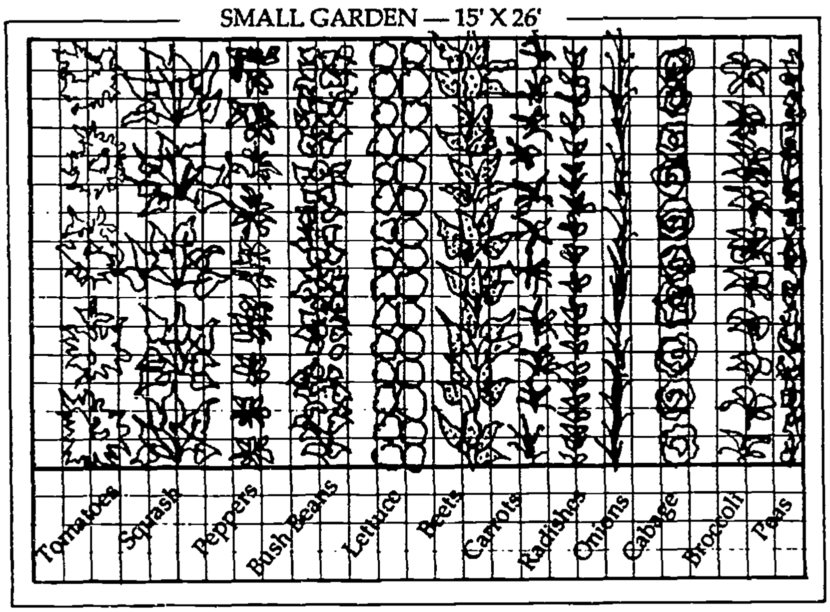


2. You work at a nursery where customers frequently ask for advice on home vegetable gardening. A reference book shows a sample layout for a small garden, shown below.

   a. What is the size of the garden shown in the drawing?

   b. What is the scale of the drawing? In other words, the width of 1 small square equals what unit of measure on the garden?

   c. Based on the drawing, how far apart should your customer plant the row of squash from the row of peppers?



   d. How far apart is each head of cabbage planted, as shown in the drawing?

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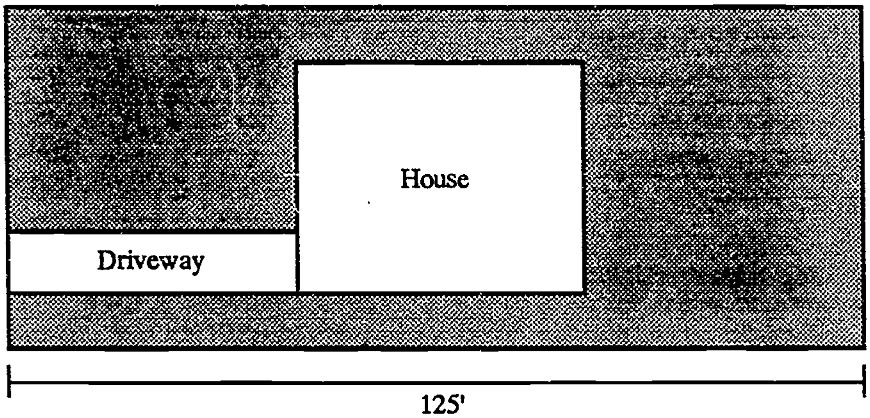
3. You work for a lawn treatment company. A scale drawing of the lot plan for a customer's house is shown below. Notice that the lawn area is shaded.



a. Use a scale to find the dimensions of the entire rectangular-shaped lot. What are the dimensions of the house? of the driveway?

b. How many square feet are occupied by the house? by the driveway?

c. How many square feet are occupied by the lawn?

d. If a bag of fertilizer is advertised to treat 5000 square feet of lawn, how many bags are needed to treat this lawn?

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STUDENT WORKSHEET #6 — Key

Scale Drawings

1. From the key, the scale of the map is
   Scale = Measurement in drawing + Actual distance
   Scale = 1.75 cm + 15mi
   This ratio is then equated to the measurement on the map of the length of seashore (7.6 cm), and solved for the actual distance.
   1.75 cm + 15 mi = 7.6 cm + Actual distance
   Actual distance = (7.6 x 15 mi) + 1.75 cm = 65.1 mi (rounded)
   Note: The distance used here was simply the straight-line distance from one end of the island to the other. The actual seashore distance would be better approximated by the length of the curved seashore.

2. a. The garden is 15' x 26', based on the title.

   b. Since the garden width is 15' and there are fifteen squares spanning this width, the width of each square is 1 foot. Hence the scale of the drawing is the width of 1 square represents 1 foot.

   c. The row of squash is shown 2 1/2 squares from the row of peppers. Hence the row of squash should be planted 2.5' from the row of peppers.

   d. The spacing between cabbage plants is roughly 1.5', since there is roughly a distance of 1 1/2 squares between each plant.

3. a. Scale = Measurement on drawing + Actual length
   Scale = 11.3 cm + 125ft
   Use this scale to solve the proportions for the remaining dimensions, using the ratio of the measurement on the drawing to the actual distance.
   Lot width (top to bottom):
   11.3 cm + 125 ft = 4.6 cm + Actual width
   Actual width = (4.6 cm x 125 ft) + 11.3 cm = 50.9 ft (rounded)
   House depth (left to right):
   11.3 cm + 125 ft = 3.7 + Actual depth
   Actual depth = (3.7 cm x 125 ft) + 11.3 cm = 40.9 ft (rounded)
   House width (top to bottom):
   11.3 cm + 125 ft = 3.1 cm + Actual width
   Actual width = (3.1 cm x 125 ft) + 11.3 cm = 34.3 ft (rounded)
   Driveway depth (left to right):
   11.3 cm + 125 = 0.8 cm + Actual depth
   Actual depth = (3.9 cm x 125 ft) + 11.3 cm = 43.1 ft (rounded)
   Driveway width (top to bottom):
   11.3 cm + 125 ft = 0.8 cm + Actual width
   Actual width = (0.8 cm x 125 ft) + 11.3 cm = 8.8 ft (rounded)

   b. Area of house = Width x Depth
   Area of house = 34.3 ft x 40.9 ft = 1402.9 ft^2
   Area of driveway = Width x Depth
   Area of driveway = 8.8 ft x 43.1 ft = 379.3 ft^2

   c. The lawn area will be the area of the whole lot less the area occupied by the house and driveway.
   Area of lot = Width x Depth
   Area of lot = 50.9 ft x 125 ft = 6362.5 ft^2
   Lawn area = Area of lot - Area of house - Area of driveway
   Lawn area = 6362.5 ft^2 - 1402.9 ft^2 - 379.3 ft^2 = 4580.3 ft^2

   d. If a bag of fertilizer will treat 5000 ft^2 of lawn, you will need only one bag.

STUDENT WORKSHEET #7

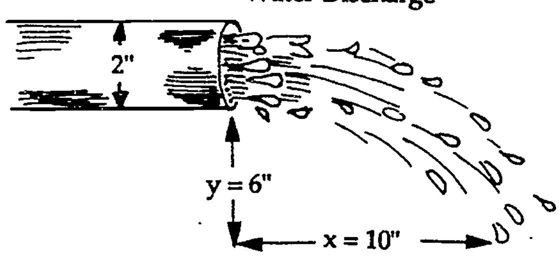
Using Formulas

1. Forestry surveys are often done using aerial photography. The diameter at breast height of ponderosa pines can be estimated from aerial photography by the following formula:
   $D = 3.7600 + (1.3480 \times 10^{-2})\,H\,V - (2.4459 \times 10^{-6})\,H\,V^2 + (2.4382 \times 10^{-10})\,H\,V^3$
   Where: D is the diameter at breast height in inches.
   H is the height of the tree in feet.
   V is the visible crown diameter from the photograph in feet.
   Use the formula to determine the diameter at breast height of 108-foot trees that have, from an aerial photograph, a visible crown diameter of 22 feet.

2. When determining the usable log volume, deductions are made for slab, edging, and saw kerf. To estimate the number of board feet that can be obtained from a log, the following formula may be used.
   $V = 0.0655\,L\,(1 - A)\,(D - S)^2$
   Where: V is the usable volume of a log in board feet.
   L is the length of the log in feet.
   A is the decimal percent deduction for saw kerf.
   D is the log diameter in inches.
   S is the slab and edging deduction in inches.
   Use the formula to estimate the usable volume of a 32-foot log having a diameter of 30 inches, allowing for 10% saw kerf and 3 inches of slab and edging deductions.

3. A fresh-water spring is discharging water through a 2-inch overflow pipe, as shown below. You would like to use this spring for irrigation and want to estimate how much water it can supply.

   Water Discharge

   A formula that describes the discharge from a pipe is
   $Q = 2.83\,d\,x + \sqrt{y}$
   Where: Q is the discharge from a pipe in gallons per minute.
   d is the inside diameter of the pipe in inches.
   x and y are the horizontal and vertical distances of the discharge in inches, as shown in the drawing.
   For the distances shown in the drawing, use the formula above to estimate the amount of water being discharged from the pipe. How many gallons a day could this spring provide?

4. A commercial cherry grower estimates that when 30 trees are planted per acre, each tree can produce about 50 pounds of cherries per season. For each additional tree planted (per acre), the yield per tree is reduced by 1 pound.
   a. Make a table of the yield per tree for several different planting densities: 30 per acre, 31 per acre, 32 per acre, and so on, up to 35 per acre.

   b. Add a column to your table that shows how many pounds of cherries would be produced per acre for each of the densities.

c. Someone proposes that this data can be described by the formula
$Y = 50 - (D - 30)$
Where: Y is the yield per tree in pounds.
D is the density of the planting in trees per acre.
Does this formula agree with the data in your table?

d. How can the formula above be modified to describe the pounds of cherries produced per acre? Write out this modified formula, and compare it to the values in your table.

5. The capacity of a cylindrical tank can be determined by using the formula shown below.
$C = 0.0034\,D^2L$
Where: C is the capacity of the tank in gallons.
D is the diameter of the tank in inches.
L is the length of the tank in inches.

a. How many gallons could a cylindrical spraying tank hold that has a diameter of 30 inches and a length of 66 inches?

b. Suppose you want to mount a tank with a capacity of 100 gallons on a trailer that can hold a tank no longer than 48 inches. Isolate the variable for the diameter and determine the diameter necessary for a tank to have the desired capacity.

STUDENT WORKSHEET #7 — Key

Using Formulas

1. Substituting into the formula H = 108 and V = 22
   $D = 3.7600 + (1.3480 \text{ X } 10^{-2})\, H\, V - (2.4459 \times 10^{-6})\, H\, V^2 + (2.4382 \times 10^{-10})\, H\, V^3$
   $D = 3.7600 + (1.3480 \times 10^{-2})\,(108)\,(22) - (2.4459 \times 10^{-6})\,(108)\,(22)^2 + (2.4382 \times 10^{-10})\,(108)\,(22)^3 = 35.7$
   So, the diameter at breast height of these trees is about 35.7 feet.

2. Substitute into the formula $L = 32, A = 0.10, D = 30$, and $S = 3$
   $V = 0.0655\, L\, (1 - A)\, (D - S)^2$
   $V = 0.0655\, (32)\, (1 - 0.10)\, (30 - 3)^2 = 1375$ (rounded)
   So, about 1375 board feet are usable in this log.

3. Substituting into the formula $d = 2, x = 10$, and $y = 6$
   $Q = 2.83\, d\, x + \sqrt{y}$
   $Q = (2.83)\,(2)\,(10) + \sqrt{6}$
   $Q = 138.6$ gal per min
   And over a day, which is 1440 minutes (24 hours x 60 min per hour)
   $Q_{day} = 138.6$ gal per min x 1440 min per day
   $Q_{day} = 199{,}584$ gal per day

4. a. & b.

Planting density(per A)	Yield(lb) per tree	Production (lb per A)
30	50	1500
31	49	1519
32	48	1536
33	47	1551
34	46	1564
35	45	1575

   c. Yes, the formula is able to generate the data in the table. For example, when trees are planted at a density of 34 trees per acre:
   $Y = 50 - (D - 30)$
   $Y = 50 - (34 - 30) = 46$ lb
   which agrees with the table's data.

   d. The production per acre is computed by multiplying yield by the number of trees per acre (the density D). Thus, the formula for the yield can be multiplied by the density D to obtain a formula for the production per acre.
   $P = D \times Y$
   $P = D \times [50-(D - 30)]$
   or, for the more advanced student, the above formula can be simplified to
   $P = 80\, D - D^2$
   For $D = 35$,
   $P = (80 \times 35) - 35^2 = 1575$ lb per A
   which agrees with the entry in the table above for a density of 35 trees per acre.

5. a. Substitute into the formula $D = 30$ and $L = 66$.
   $C = 0.0034\, D^2 L$
   $C = 0.0034(30)^2\, 66 = 202$ gal (rounded)

   b. Substitute into the formula $C = 100$ and $L = 48$.
   $C = .0034\, D^2 L$
   $100 = .0034\, D^2\, 48$
   $D^2 = 100 + (48 \times .0034) = 25$ in (rounded)

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STUDENT WORKSHEET #8

Linear Equations

1. A plant's water requirement is defined as the pounds of water that must pass from the roots and out the leaves to produce a pound of dry plant matter. The water requirement for corn is 368 pounds of water per pound of dry plant matter produced.

   a. Write an equation in slope-intercept form that expresses the relationship between the yield of plant matter and the water required.

   b. Use your equation to calculate the water required to produce 8000 pounds of dry corn plant matter. (Be sure to check your work.)

   c. An acre-inch of water is equal to 226,512 pounds of water. Use your equation to calculate the yield of dry corn plant matter that consumes one acre-inch of water. (Be sure to check your work.)

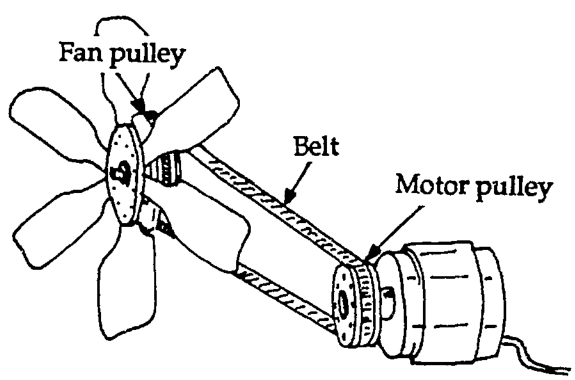
2. You make a variable wire-wound resistor and need to calibrate it. You find that when the contact is at the minimum position, your resistor has a resistance of 4 ohms. Then for every centimeter of travel away from this minimum position, the resistance increases by 2.5 ohms. This relationship continues up to a maximum of 29 ohms. At this resistance, the contact is at the farthest position — 10 cm from the minimum.

   a. Write a formula to compute the resistance of the resistor based on the distance from the minimum position. Is this a linear equation? If so, put it in slope-intercept form.

   b. How can you be sure of the validity of your formula?

   c. Isolate the variable for the distance of the contact from the minimum. Where should you place the contact to obtain a resistance of 22 ohms?

3. You have a standard assembly used to construct large exhaust fans for industrial warehouse facilities. The assembly is designed so the motor pulley and the fan pulley are 28 inches apart. There is a small adjustment available for belt tension. The motor pulley has a diameter of 3 inches. Based on the required fan speed and fan size, you can vary the size of the fan pulley. To help you determine the belt sizes, you know the formula:
   $B = 2L + (D + d)$
   Where: B is the length of the belt needed.
   L is the distance between the two pulley centers.
   D is the diameter of one of the pulleys.
   d is the diameter of the other pulley.



   a. Substitute the known values given above into the formula, and rewrite the formula as a linear equation in slope-intercept form. Identify the variables, the coefficient, and the constant.

   b. Try out your equation for fan-pulley diameters of 6 inches and 10 inches. Check your results with the original formula.

STUDENT WORKSHEET #8 — Key

Linear Equations

1. a. *Water required* = (368 lb water per lb plant matter) (*Yield*) + 0

   b. *Water required* = (368 lb water per lb plant matter) (8000lb plant matter) = 2,944,000 lb water

   c. Substitute for the *Water* and solve for *Yield*
   226,512 lb water = (368 lb water per lb plant matter) (*Yield*)
   Divide both sides of the equation by the coefficient of *Yield*, and reverse it.
   226,512 lb water ÷ 368 lb water per lb plant matter = Yield = 615.5 lb plant matter

2. a. Since the resistance increases (linearly) 2.5 ohms for every centimeter, then it can be defined by a linear equation. When the variable position is zero (the minimum) the resistance is 4 ohms, hence the constant must be 4 ohms. So,
   $R = 2.5\,D + 4$
   Where: R is the resistance of the resistor in ohms.
   D is the distance of the contact from the minimum position, in centimeters.

   b. This formula can be checked by comparing its results to the given data. At the minimum position, $D = 0$:
   $R = 2.5\,(0) + 4$
   $R = 4$ or 4 ohms
   which agrees with the given information. Also, at the maximum, when $D = 10$:
   $R = 2.5\,(10) + 4$
   $R = 29$ or 29 ohms
   which agrees with the given information also.

3. a. Substitute the known values: $L = 28$ in. and $d = 3$ in., and simplify to get an equation in standard form.
   $B = 2\,(28) + 1.625\,(D + 3)$
   $B = 56 + 1.625D + 1.625\,(3)$
   $B = 1.625D + 60.875$
   where B and D are the variables, 1.625 is the coefficient, and 60.875 is the constant. Since measurements in inches have been substituted, values for D and B must now be in inches.

   b. For a diameter of 6 inches, substitute D = 6.
   $B = 1.625\,(6) + 60.875$
   $B = 70.625$, or 70.6 in. (rounded)
   Checking the result with the original equation, substitute the values.
   $B = 2L + 1.625\,(D + d)$
   $70.6 \;\; 2(28) + 1.625\,(6 + 3)$
   $70.6 = 70.625$ or 70.6 (rounded)
   Yes, it checks.
   For a diameter of 10 inches, substitute $D = 10$ in.
   $B = 1.625\,(10) + 60.875$
   $B = 77.125$, or 77.1 in. (rounded)
   Checking the result with the original equation, substitute the values.
   $77.1 \;\; 2\,(28) + 1.625\,(10 + 3)$
   Yes, it checks.

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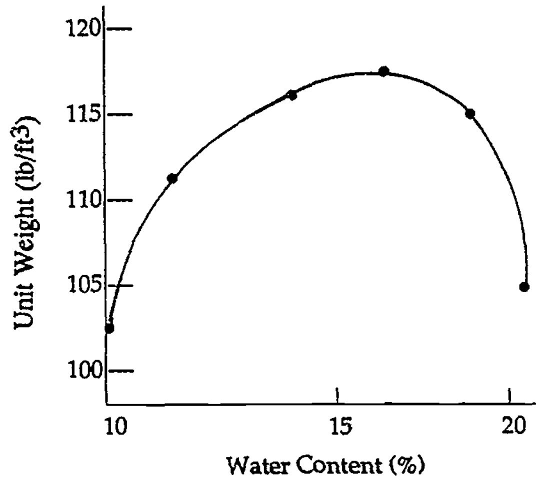
STUDENT WORKSHEET #9

Nonlinear equations

1. The water content of soil affects its weight. The results of certain soil tests produce the results shown below as a graph (called a compaction curve).



a. Examine the curve that is drawn through the test data. Does the trend it illustrates appear linear, or nonlinear?

b. The most important feature of the curve is the maximum, that is, the high point of the peak. The maximum weight shown on the graph is called the *maximum dry density*, of the M.D.D. The percent water content at which this maximum occurs is called the *optimum moisture*, or the O.M. of the soil. Approximately what are the M.D.D. and O.M. of this soil sample?

2. One of the basic tests performed on soils is the sieve test. The soil sample is allowed to settle through a stack of sieves that are of progressively finer and finer mesh. The amount of soil that remains in each sieve is measured. The percent of the soil sample that passes through each sieve is computed. The results from a typical soil sample are tabulated below.

Sieve size	Soil particle size (mm)	%Finer
3 in.	76.2	92%
2 in.	50.8	90%
1 in.	25.4	89%
1/2 in.	12.7	82%
No. 4	4.76	73%
No.10	2.00	66%
No.20	0.84	56%
No.40	0.42	41%
No.60	0.25	25%
No.100	0.15	12%
No.200	0.074	4%

a. Draw a graph of the percentages versus the soil particle size, for percentages less than 75%. Sketch in a curve that seems to fit the points on your graph.

b. Does the graph seem to be linear, or nonlinear?

c. Using your sketched curve, estimate the particle sizes that correspond to percentages of 10% and 60%. (The particle size corresponding to 10% is called the *effective size.*)

d. Compute the ratio of the two particle sizes determined above: the size for 60% to the size for 10%. (This ratio is called the ***uniformity coefficient.***)

3. The Usable log volume can be estimated from the formula below that allows for saw kerf, slab, and edging deductions.
$V = 0.0655\,L\,(1 - A)\,(D - S)^2$
Where: V is the usable volume of a log in board feet.
L is the length of the log in feet.
A is the decimal percent deduction for saw kerf.
D is the log diameter in inches.
S is the slab and edging deduction in inches.

a. Rewrite the above equation for logs that are 32 feet long and cut with a 10% saw kerf and 3 inches of slab and edging deductions.

b. Make a table of the usable board feet of lumber that can be obtained under these conditions for logs with diameters of 10 in., 15 in., 20 in., 30 in., and 40 in. (Round your answers to the nearest ten board feet.)

c. Draw a graph of the data.

d. What is the meaning of the graph as it approaches the x-axis? At what diameter does the usable number of board feet equal zero, based on this equation?

4. Often forestry surveys are done using aerial photography. The diameter at breast height of ponderosa pines can be estimated from the photographs with the following formula.
$D = 3.7600 + (1.3480 \times 10^{-2})\,H\,V - (2.4459 \times 10^{-6})\,H\,V^2 + (2.4382 \times 10^{-10})\,H\,V^3$
Where: D is the diameter at breast height in inches.
H is the height of the tree in feet.
V is the visible crown diameter from the photograph in feet.

a. The trees in one area average between 50 and 100 feet tall. Rewrite the equation for trees that are 50 feet tall, and again for trees that are 100 feet tall.

b. Are these equations linear, or nonlinear?

c. Make a table of values of D for values of V such as 10 ft, 20 ft, 30 ft, and 40 ft, for each of the equations. Draw a graph of these two equations. Does your graph support your answer in Part B above? Explain.

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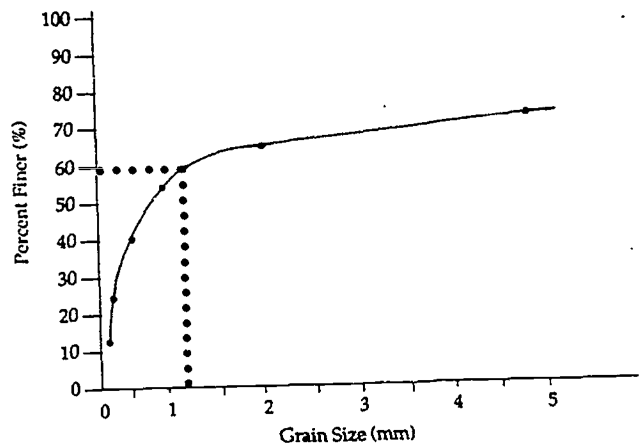
STUDENT WORKSHEET #9 — Key

Nonlinear equations

1. a. The curve definitely appears nonlinear.
   b. The students must estimate values from the graph. Therefore, answers between 118 and 119 lb/ft^3 for the M.D.D. and between 16 and 17% for the O.M. should be considered acceptable.

2. a. The students' graphs should appear generally as shown below. Only the percentages below 75% were plotted to make the scale of the graph more manageable.

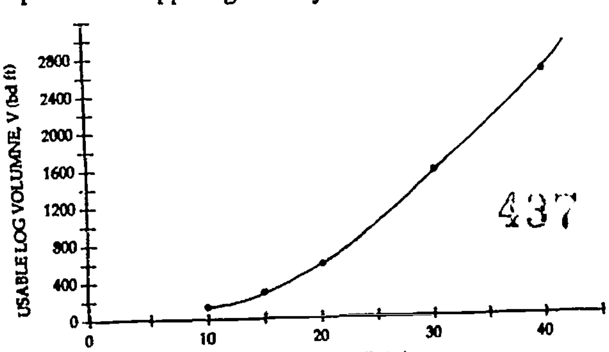


   b. The graph is definitely nonlinear.
   c. The students' answers may vary depending on how they have sketched the curve and how they read their graphs. The grain size corresponding to 10% finer is about 0.15 mm. A grain size of about 1.15 mm corresponding to 60% finer.
   d. The students' answers will vary, depending on how they read the graph in Part C.
   Uniformity coefficient = 1.15 mm + 0.15 mm = 7.7

3. a. Substitute $L = 32, A = 0.10$, and $S = 3$ and simplify
   $V = 0.0655\ (32)\ (1 - 0.10)\ (D - 3)^2$
   $V = 1.8864\ (D - 3)^2$
   b. Substitute for the values of D. For example, for $D = 10$:
   $V = 1.8864\ (10 - 3)^2$
   $V = 92.4$, or 90 board feet (rounded to nearest 10)
   Similarly for the other values of D

Diameter D (in.)	Usable volume V (bd ft)
10	90
15	270
20	550
30	1380
40	2580

   c. The students' graphs should appear generally as shown below.



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d. As the graph approaches the x-axis, the usable log volume decreases. This is understandable, since the smaller diameters will yield less usable lumber. Based on the equation, the students should be able to see that when the diameter equals 3 inches, the equation will predict a usable log volume of 0 board feet. This is due to the 3-inch slab and edging deductions that were assumed at the beginning of the exercise.

4. a. Substitute $H = 50$

$D = 3.7600 + (1.3480 \times 10^{-2})(50)V - (2.4459 \times 10^{-6})(50)V^2 + (2.4382 \times 10^{-10})(50)V^3$

$D = 3.7600 + (6.7400 \times 10^{-1})V - (1.2230 \times 10^{-4})V^2 + (1.2191 \times 10^{-8})V^3$

And then $H = 100$

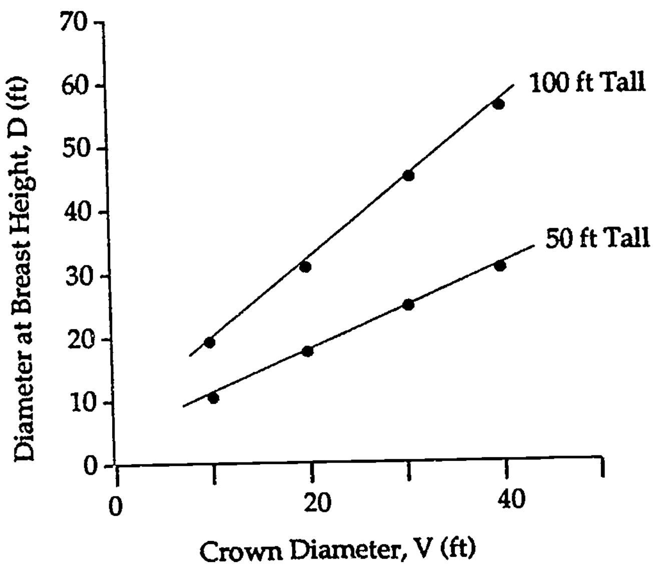
$D = 3.7600 + (1.3480 \times 10^{-2})(100)V - (2.4459 \times 10^{-6})(100)V^2 + (2.4382 \times 10^{-10})(100)V^3$

$D = 3.7600 + 1.3480\,V - (2.4459 \times 10^{-4})V^2 + (2.4382 \times 10^{-8})V^3$

b. The equations are nonlinear, since they involve the variable V raised to a power.

c. The students' tables and graphs should appear generally as shown below.

Crown diameter	Diameter at breast height	
V (ft)	when $H = 50$ ft	when $H = 100$ ft
10	10.49	17.22
20	17.19	30.62
30	23.87	43.98
40	30.52	57.29



The students should observe from the graph that the equations appear linear. This is primarily due to the very small coefficients on the higher powers.

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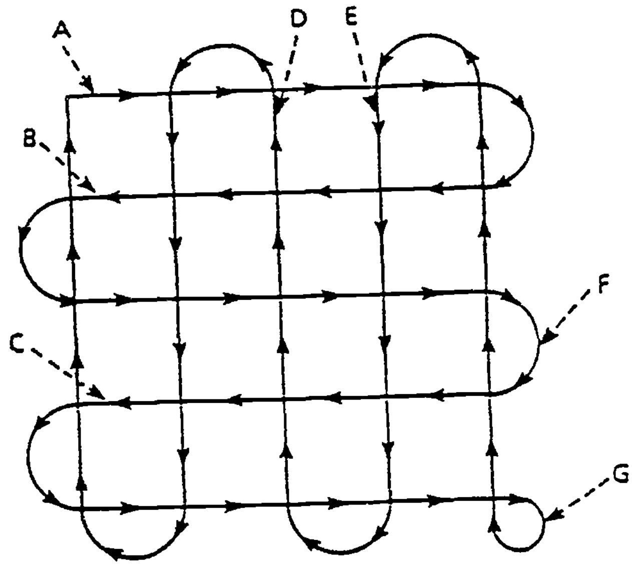
STUDENT WORKSHEET #10

Lines and Angles

1. To obtain uniform planting, a recommended path to follow when sowing turfgrass seed is shown. Observe that several portions of the paths are labeled. Answer the following questions about the labeled paths.



a. Path A is__________to Path B.
   1. parallel
   2. perpendicular
   3. at an angle of 30°
   4. at an angle of 45°

b. Path B is__________to Path C.
   1. parallel
   2. perpendicular
   3. at an angle of 30°
   4. at an angle of 45°

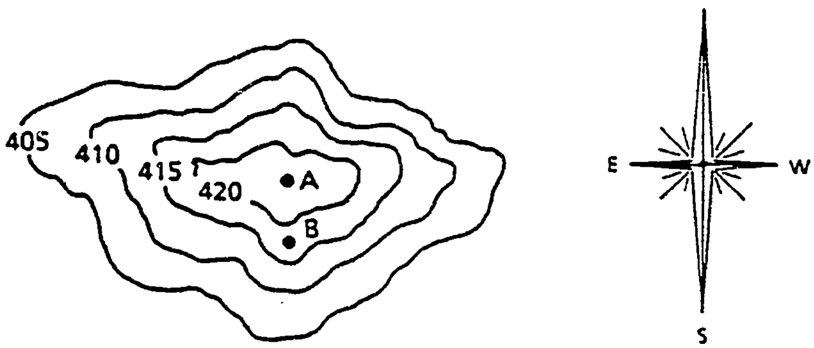
c. Path A is __________to Path D.
   1. parallel
   2. perpendicular
   3. at an angle of 30°
   4. at an angle of 45°

d. When you make Turn F, you turn through __________to change your direction.
   1. 90°
   2. 180°
   3. 270°
   4. 360°

e. When you make turn G, you turn through __________to change your direction.
   1. 90°
   2. 180°
   3. 270°
   4. 360°

2. Topographic maps show contour lines that indicate the elevation of the land. Each line corresponds to a level of elevation. *Parallel* lines indicate a smooth slope, with each line representing 10 feet of elevation change, for example. A line drawn *perpendicular* to these lines indicates the direction of the slope. You can draw a dimple topographic map as directed below.

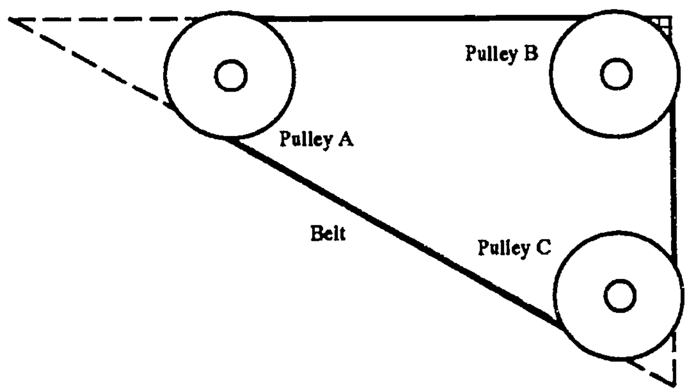
a. On your paper draw 5 parallel line segments that are about 2 cm apart from each other. Label the first segment 0', the segment 1', the third 2', etc.
b. Draw a dashed segment that is *perpendicular* to these line segments, and crosses all of them. Put an arrow on the end of the dashed segment closest to the 0' elevation. This indicates the downward sloping of the land (the direction a ball would tend to roll). What sort of surface might be shown by this map?
c. Examine the sketch below that represents a topographic map of a small hill. Notice that each ring is labeled with a number indicating its elevation, or distance above sea level. What is the "meaning" of the labeled A?



d. What direction would a ball roll, if released at point B: north, south, east, or west? (Notice the arrows indicating these compass directions on the map.)

3. A chemical sprayer nozzle has a spray pattern that makes an angle of about 70°. The nozzle rides about 7 inches above the ground.
   a. Turn your paper sideways. Draw a horizontal segment on the bottom of your paper, and a vertical segment perpendicular to it that is 7" tall. This 7" segment will represent how far the nozzle is positioned away from the soil.
   b. At the top of the 7" segment draw two angles, one on each side of the segment, that have a measure of 35° each. The top of your 7" segment will be the vertex of each angle. Extend the angle lines down to the "soil". (Your sketch should look like a triangle with a vertical line that evenly divides it in two.)
   c. What is the width of the bottom of the whole triangle, that is, the width of soil that is sprayed by the nozzle?
   d. What are two ways to change your sprayer so that you could spray a wider path.

4. A three-pulley arrangement with a belt that makes firm contact with all three pulleys is shown below.



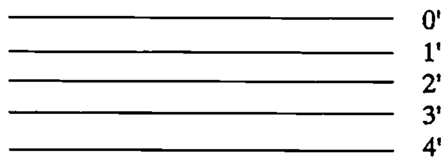
   a. Notice that the "line" of each belt has been extended to form a triangle. What angle inside the triangle is made by the belt as it rounds pulley A? pulley B? pulley C?
   b. What portion of pulley B is in contact with the belt? (Give your answer in degrees.) What portion of pulley B? What portion of pulley C?
   c. What relationship do you observe between these angles measured in Part A and Part B? (Hint: Take each pair of angles, and try addition, subtraction, or some other operation upon them.)

STUDENT WORKSHEET #10 — Key

Lines and Angles

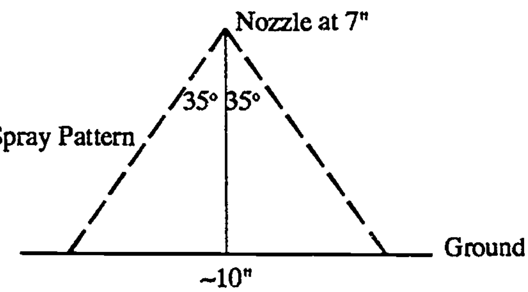
1. a. 1 (Path A is parallel to Path B.)
   b. 1 (Path B is parallel to Path C.)
   c. 2 (Path A is perpendicular to Path D.)
   d. 2 (When you make Turn F, you turn through 180° to change.)
   e. 3(When you make Turn G, you trun through 270° to change.)

2. a. & b. The students are using the vocabulary of this unit to construct a simple representation of a topographic map. Their complete "map" should resemble the illustration shown. This represents a sloping surface, such as a driveway, or sidewalk. (Not knowing the distance represented between each contour line, you cannot say whether this is a steep slope, or a gentle slope.)



   c. The point labeled A represents the top of the hill, the point of highest elevation.
   d. A ball released at point B would roll to a lower elevation, which would be in a southerly direction, perpendicular to the "lines" at that point.

3. a. & b. The students are instructed to make a scale drawing of the sprayer, similar to that shown below (not to scale), to obtain the width of the spray pattern.



   c. The width of the bottom of the whole triangle is about 10" (or exactly 9.8").
   d. Two ways you would spray a wider path would be to raise the nozzles or increase the angle of the spray pattern.

4. a. The angle inside the triangle at pulley A is 30°, at pulley B is 90°, and at pulley C is 60°.
   b. The angle of contact made by the belt at pulley A is 150°, at pulley B is 90°, and at pulley C is 120°.
   c. The sum of the two angles is 180°.

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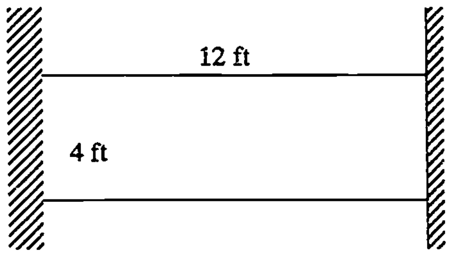
STUDENT WORKSHEET #11

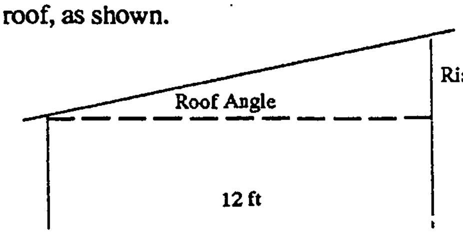
Right Triangles

1. You are constructing some forms for a short concrete sidewalk. They must make a 90° angle with the existing curb. You have tried to keep the forms parallel. But when you measure their length and width, you aren't sure they are "square" (that is, if they form 90° angles at the corners). The forms are 12 feet long and 4 feet wide, as illustrated.



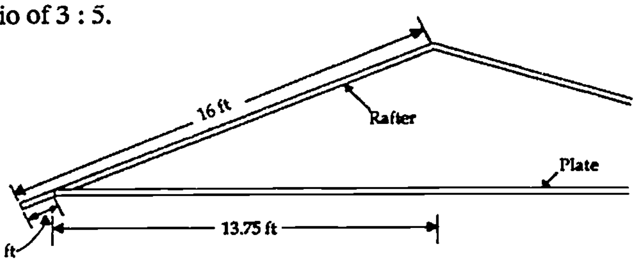
Describe a procedure, using the pythagorean formula with your tape measure and calculator, that you could use to verify whether your forms are "square" or not.

2. You are designing a small tool shed with a sloped roof, as shown.



   a. Write a formula that relates the tangent of the roof angle to the ratio of the rise to the run for a roof like this.
   b. Substitute a run of 12 feet into your formula and isolate the variable for the rise in your formula. Use this formula to make a table of the rise for roof angles of 5°, 10°, 15°, 20°, 25°, and 30°.
   c. For each angle, compute the length of roof decking needed to span the distance between the wall and the peak. (Hint: This will be the hypotenuse of the right triangle.) Add these values to your table.
   d. What are some of the consequences of using too large an angle for the roof, limiting your selection of roof angle? (Hint: Consider the rise and the hypotenuse values.)

3. A contractor is asked to change the design of the roof of a house. The current plans call for the roof to have a rise to run ratio of 1 : 3, using 16-foot rafters with an 18" overhang (see sketch below). The house's buyer is asking for the slope to change to a ratio of 3 : 5.



   a. What is the value of the tangent of the angle formed by the rafter and the plate for each roof slope discussed above?
   b. When the value of the tangent of angle A is known, then the inverse tangent function (on your calculator) will give the value of angle A. Simply enter the value of tan A into your calculator, and press the INV key followed by the tan key — the angle will be in the display. Do this for the two roof slopes. For each slope, what is the angle that the rafters make with the plate?
   c. Is the new slope steeper or flatter than the original slope?
   d. The builder will still use 16-foot rafters, and keep the same floor plan. Then the distance along the plate from the outer wall to the point below the roof peak (that is, the run) will be the same. With the new roof slope, will the amount of overhang be more or less than the original overhang?

STUDENT WORKSHEET #11 — Key

Right Triangles

1. You can use the Pythagorean formula to predict the correct length of the diagonal, or the hypotenuse, and measure it with your tape measure.
   $c^2 = a^2 + b^2$
   $c = \sqrt{(12\text{ ft}^2 + 4\text{ ft}^2)}$
   $c = \sqrt{(160\text{ ft}^2)}$, or 12.65 ft, or 12' 7 3/4" (rounded)
   Thus, the right triangle that has the 4-ft and 12-ft sides should have a diagonal (hypotenuse) equal to 12' 7 3/4". If your measurement doesn't bear this out, then the triangle must NOT be a right triangle, meaning that the corners are NOT square.
   Some students may also recall a method encountered, where you measure both diagonals and check to see if they are equal. This is an interesting consequence of the Pythagorean formula. In this case, the students are dealing with two triangles. If the triangles are indeed right triangles, then each diagonal is also a hypotenuse. Since they both should have the same leg lengths, then they should also have the same measure for the hypotenuse.

2. a. The tangent of the angle is equal to the ratio of the rise to the run. If we let R represent the roof angle, then tan R = Rise ÷ Run.
   b. Substitute a run of 12 feet and isolate the rise.
      tan R = Rise ÷ 12 ft
      Rise = 12 ft x tan R
      For an angle of 5°, for example,
      Rise = 12 x tan 5° = 1.05 ft (rounded)
      Similarly for the other angles, so that students' tables of rounded values for the rises should appear as below.
   c. The length of decking (excluding the overhangs) is the hypotenuse of the right triangle formed by the 12-foot run and the rise. The Pythagorean formula is used to determine its value. Thus the students' completed tables should appear as shown below.

Angle	Rise (ft)	Hypotenuse (ft)
5°	1.05	12.05
10°	2.12	12.18
15°	3.22	12.42
20°	4.37	12.77
25°	5.60	13.24
30°	6.93	13.86

   d. Probably the biggest consequence is the growing value of the rise. For a 30° slope, the back-side wall would need to be higher than the front side by almost 7 feet! This would require a lot of additional lumber for the tall side of the shed, or a very, very short side.

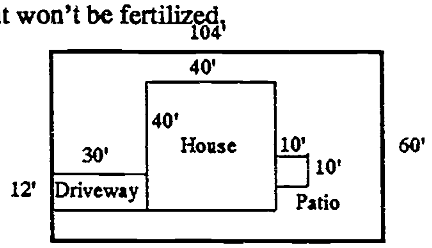
3. a. The value of the tangent is equal to the rise to run ratio (the slope) for each roof design. Thus, in the first case, with a slope of 1 : 3, the tangent of the roof angle equals 1/3, or 0.333(rounded). For the new slope of 3 : 5, the tangent of the roof angle equals 3/5, or 0.6.
   b. As instructed in the exercise, the students need simply use the inverse tangent function on their calculators.
      Rafter angle = INV TAN (Tangent of angle)
      Rafter angle = INV TAN (0.333) = 18.4° (rounded)
      For the second slope
      Rafter angle = INV TAN (0.6) = 31.0°
   c. The new slope is steeper by 12.6° — not a great difference.
   d. This question will test the students' understanding of how right triangles react to changes in leg lengths. Since the base leg (the run) remains the same (13.75), the rise must increase to yield a steeper angle, Consequently, the Pythagorean formula tells us that the hypotenuse must also increase. If the builder still uses 16-foot rafters, then the overhang will have to be less that the original plan, since more of the 16-foot length will be needed for the hypotenuse of the right triangle.

STUDENT WORKSHEET #12

Two Dimensions

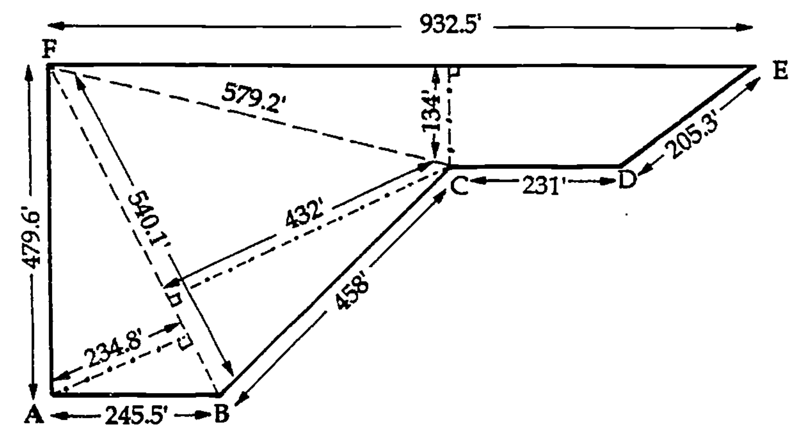
1. A certain firm produces vegetables grown in greenhouses. They use ten rectangular-shaped greenhouses, each one measuring 30' x 200' inside.
   a. How many square feet does *each* greenhouses have under one roof?
   b. If one acre is 43,560 square feet, how many acres are within *all* the greenhouses? (Round to 2 decimal places.)

2. It's time to fertilize your lawn with your new fertilizer spreader. The bag of fertilizer you've bought says it will cover 5000 square feet. Below is a sketch of your house lot, showing the house, driveway, and patio — areas that won't be fertilized.



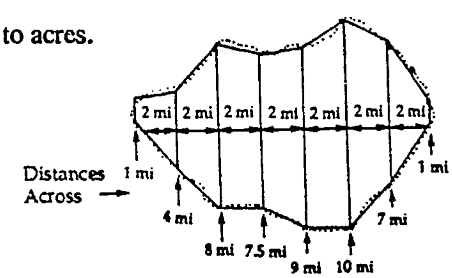
   a. What is the total area of the lot?
   b. What is the area of your lot that won't be fertilized?
   c. Use the results of the above calculations to find the area of your lot to be fertilized. Do you have enough fertilizer to apply to your lot at the recommended rate?

3. A diagram of an irregular field is shown below. Determine the amount of single-strand fencing needed to enclose this area. If each roll of wire has 1320 feet on it , how many rolls of wire will you need to fence the field?



4. The irregular field from Problem #3 can be divided into recognizable figures to determine the total area of the field. Use the diagram above of an irregular field broken up into two triangles and a trapezoid to find the acreage of the field.
   a. Identify the two triangles and trapezoid by the letters of their corners.
   b. Identify from the diagram the dimensions needed for the calculation of area for each of the three figures.
   c. Calculate the area for each figure, and the total area for the field.
   d. Since 43,560 square feet is one acre, convert the total area of the field to acres.

5. The surface area of a lake can be approximated by breaking up the area into trapezoids. A map of a lake is shown to the right, with trapezoids sketched in. Determine the area of the lake.



STUDENT WORKSHEET #12 — Key

Two Dimensions

1. a. Area of greenhouse = Length x Width
   Area of greenhouse = 200' x 30' = 6000 ft^2

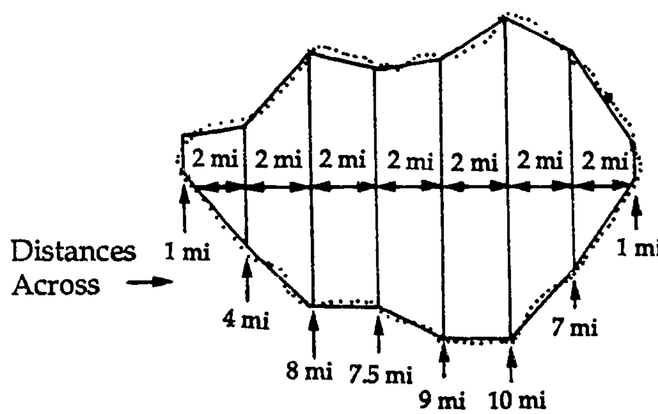
   b. Area of 10 greenhouses = 10 x Area of one greenhouse
   Area of 10 greenhouses = 60,000 ft^2
   Acres = Square feet ÷ 43,560 ft^2 per A
   Acres = 60,000 ft^2 ÷ 43,560 ft^2 per A = 1.38 A (rounded)

2. a. Total area = 104' x 60' = 6240 ft^2
   b. Area not fertilized = Driveway area + House area + Patio area
   Area not fertilized = 30' x 12' + 40' x 40' + 10' x 10' = 2060 ft^2
   c. Area to be fertilized = Total area - Area not fertilized
   Area to be fertilized = 6240 ft^2 - 2060 ft^2 = 4180 ft^2
   The bag will cover 5000 ft^2, so it is enough to cover your lot.

3. The fencing required to enclose the irregular- shape field is the sum of the sides of the perimeter of the field.
   Perimeter = 932.5' + 205.3' + 231' + 458' + 245.5' + 479.6' = 2551.9'
   Rolls needed = Perimeter ÷ Feet per roll
   Rolls needed = 2551.9' ÷ 1320 per roll = 1.9 rolls = 2 rolls (rounded)

4. a. The two triangles are FAB and FBC; the trapezoid is FCDE.
   b. To calculate the area of triangle FAB you need the base which is 540.1' and the height 234.8'. For triangle FBC you need the base 540.1' and the height 432'. For the trapezoid FCDE you need the height 134', $base_1$ which is 231', and $base_2$ which is 932.5'.
   c. Area of a triangle = 1/2 x Base x Height
   Area of a triangle FAB = 1/2 x 540.1' x 234.8' = 63,407.74 ft^2
   Area of a triangle FBC = 1/2 x 540.1' x 432' = 116,661.60 ft^2
   Area of a trapezoid = 1/2 x ($base_1$ + $base_2$) x Height
   Area of a trapezoid FCDE = 1/2 x (231' + 932.5') x 134' = 77,954.50 ft^2
   Total area of field = 63,407.74 ft^2 + 116,661.60 ft^2 + 77,954.50 ft^2 = 258,023.84 ft^2
   d. Acres = Square feet ÷ 43,560 square feet per acre
   Acres = 258,023.84 ft^2 ÷ 43,560 ft^2 per A = 5.92 A (rounded)

5. The surface are of a lake can be approximated by the area of the individual trapezoids. For ease in working the problem, number the trapezoids from left to right.
   Area of a trapezoid = 1/2 x ($base_1$ + $base_2$) x Height
   $Area_1$ = 1/2 x (1 mi + 4 mi) x 2 mi = 5 mi^2
   $Area_2$ = 1/2 x (4 mi + 8 mi) x 2 mi = 12 mi^2
   $Area_3$ = 1/2 x (8 mi + 7.5 mi) x 2 mi = 15.5 mi^2
   $Area_4$ = 1/2 x (7.5 mi + 9 mi) x 2 mi = 16.5 mi^2
   $Area_5$ = 1/2 x (9 mi + 10 mi) x 2 mi = 19 mi^2
   $Area_6$ = 1/2 x (10 mi + 7 mi) x 2 mi = 17 mi^2
   $Area_7$ = 1/2 x (7 mi + 1 mi) x 2 mi = 8 mi^2
   Total Area = 5 mi^2 + 12 mi^2 + 15.5 mi^2 + 16.5 mi^2 + 19 mi^2 + 17 mi^2 + 8 mi^2 = 93 mi^2



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STUDENT WORKSHEET #13

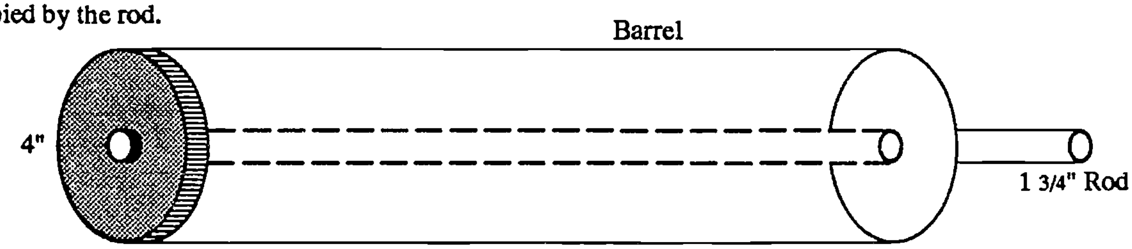
Three Dimensions

1. Suppose that an area receives 12" of rainfall during a season. This means the amount of rain is equivalent to water that is 12" deep over the entire area.
   a. How many cubic feet of rain have fallen on one acre of land that has an area of 43,560 square feet?
   b. Each cubic foot is equivalent to about 7.48 gallons. If you had to provide irrigation water of the same amount, how many gallons of water would you have to pump? (Round to the nearest gallon.)

2. The amount of timber on a logging truck is commonly reported in cords, where each cord is 129 cubic feet of wood. The volume of wood is estimated by assuming the trees are shaped approximately like a cylinder. However, the diameter at one end is larger than the diameter at the other end of the log. So a common approximation of the volume is found by using the average of the two diameters to compute the volume.
   a. The logs on a certain logging truck are all about the same. Each has a diameter of 25 inches at the large end and 14 inches at the small end. Determine the average of the two diameters of these logs. (Hint: The average is computed by adding up the numbers and dividing by how many numbers you've added.)
   b. The logs on this truck are 36 feet long. Using the average diameter computed above, compute the volume of each log. (Round to the nearest 0.01 cubic foot.)
   c. There are 17 logs on this logging truck. What is the total volume of wood on the truck? (Round to the nearest cubic foot.)
   d. How many cords of wood are on the truck? (Round to the nearest 0.1 cord.)

3. A 90' straight concrete sidewalk is to be constructed. It will be 3' wide and 4" deep.
   a. Since concrete is normally ordered in "yards" (that is, cubic yards), convert the measurements from inches and feet to yards.
   b. Identify the geometric figure in the construction that you can use to compute its volume. Compute the total volume of the construction, in cubic yards. (A sketch might be helpful.)
   c. Allow 10% for spillage. How many cubic yards should you add to your needs for spillage? What will your total needs be, ***rounded up*** to the nearest cubic yard?

4. A double-acting cylinder has a 4" diameter barrel, a 1 3/4" diameter rod, and a 24 1/2" stroke. When the cylinder is retracted, as shown, the amount of hydraulic fluid in the barrel is the volume of the barrel less the volume occupied by the rod.



   a. Compute the volume of the barrel.
   b. Compute the volume of the rod (the portion within the barrel).
   c. Compute the amount of fluid needed to fill the barrel when the rod is retracted, as shown. Convert this amount to gallons of hydraulic fluid. You know that each gallon of fluid occupies 231 cubic inches.

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STUDENT WORKSHEET #13 — Key

Three Dimensions

1. a. Use 1 foot instead of 12 inches.
   Volume of rain = Area x Height
   Volume of rain = 43,560 ft^2 x 1 ft = 43,560 ft^3

   b. Gallons of rain = Cubic feet x Gallons per cubic foot.
   Gallons of rain = 43,560 ft^3 x 7.48 gal per ft^3 = 325,829 gal (rounded)

2. a. Average diameter = (Large diameter + Small diameter) ÷ 2
   Average diameter = (25" + 14") ÷ 2 = 19.5"
   This must be converted to feet to calculate the volume in Part B.
   Average diameter = 19.5" x 1 foot / 12 inches = 1.625 ft

   b. Volume per log = $\Pi r^2 h$, r = 1/2 d
   Volume per log = 3.14 x $(1.625' \div 2)^2$ x 36' = 74.62 ft^3 (rounded)

   c. Total volume = Volume per log x Number of logs
   Total volume = 74.62 ft^3 per log x 17 logs = 1269 ft^3 (rounded)

   d. Number of cords = Volume of wood ÷ 128 ft^3 per cord
   Number of cords = 1269 ft^3 ÷ 128 ft^3 per cord = 9.9 cords

3. a. Length = 90' x 1 yd/ 3 ft = 30 yd
   Width = 3' x 1 yd/ 3 ft = 1 yd
   Depth = 4" x 1 yd/ 36" = 0.11 yd (rounded)

   b. The shape is a rectangular solid
   Volume of sidewalk = Length x Width x Height
   Volume of sidewalk = 30yd x 1 yd x 0.11 yd = 3.30 yd^3

   c. Spillage allowance = 3.30 yd^3 x 10% = 0.33 yd^3
   Total volume needed = Volume of sidewalk + Spillage allowance
   Total volume needed = 3.30 yd^3 + 0.33 yd^3 = 3.63 yd^3, or 4 yd^3 (rounded to nearest yd^3)

4. a. Barrel volume = $\Pi r^2 h$, r = 1/2 d
   Barrel volume = 3.14 x $(4" \div 2)^2$ x 24 1/2" = 307.72 in^3

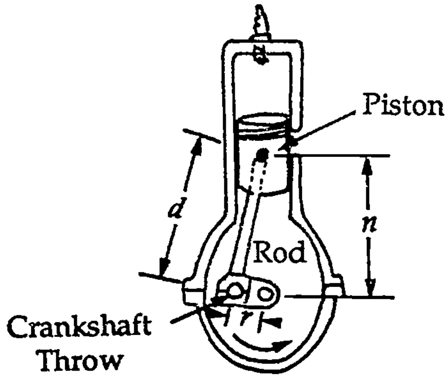
   b. Rod volume = 3.14 x $(1\ 3/4" \div 2)^2$ x 24 1/2" = 58.90 in^3 (rounded)

   c. Hydraulic fluid = Barrel volume - Rod volume
   Hydraulic fluid = 307.72 in^3 - 58.90 in^3 = 248.82 in^3
   Converting to gallons of fluid.
   Hydraulic fluid = 248.82 in^3 ÷ 231 in^3 per 1 gal = 1.08 gal (rounded)

STUDENT WORKSHEET #14

Trigonometry

1. During the stroke of a piston, the connecting rod pushes the crankshaft around 360°, as illustrated here.



As the crankshaft turns, the radius of the "throw" makes an angle T with a line between the shaft and the end of the rod (as shown in the drawing). The changing distance between the end of the rod and the crankshaft center can be computed using the formula below. (This changing distance can be used to determine the volume of gas/air mixture ahead of the piston as the crankshaft rotates.)

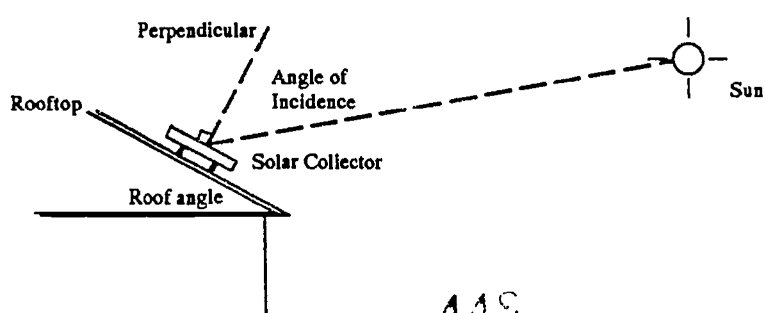
$$h = r \cos T + \sqrt{[d^2 + r^2 (\sin T)^2]}$$

where: h is the distance between the end of the rod and the crankshaft center.
r is the radius from the crankshaft center to the throw.
d is the length of the rod.
T is the angle made by the radius r and a line between the crankshaft center and the end of the rod

a. Using a value of $r = 2.5$ inches and $d = 6.0$ inches, make a table of values for d for angles of T equal to 0°, 30°, 60°, and so on, up to 360°.
b. Draw a graph of these values for d, and connect the plotted points with a smooth curve.
c. Referring to the drawing, you should be able to predict the value for d when T = 0° and T = 180°. Check the results from the formula with your expectations.
d. Examine the shape of the curve on your graph. Which curve does it most resemble — a sine curve or a cosine curve?

2. Standard household electricity supplied to houses alternates as a sine wave with a frequency of 60 Hz. A voltmeter indicates a voltage of about 120 volts.
   a. How long does it take this household voltage to oscillate from a positive polarity to a negative polarity and back to a positive polarity again?
   b. Voltmeters actually indicate the *rms* (the *root mean square*) voltage of an alternating current. This is equal to the amplitude of the ac voltage curve divided by the square root of two. Determine the amplitude of the ac voltage curve when a voltmeter indicates 120 volts.

3. Stationary solar collectors are often placed on roof tops to take advantage of available solar energy. However, when the rays from the sun do not strike the collector at a 90° angle, the efficiency of the collector is reduced.



The efficiency with respect to the solar angle is given by the formula below.

$$P = \sin(90° - \mathbf{A} + \mathbf{R}) \times \sin(15°/\text{hr}\, H - 90°)$$

where: P is the decimal percent efficiency
A is the minimum angle for the sun away from vertical (when the sun is highest in the sky)
R is the roof angle, as shown in the drawing
H is the hour of the day (assuming the sun is visible from the 6th hour to the 18th hour).

a. A certain house has a roof angle of 18°. At one time of the year, the minimum sun angle is 48°. Make a table of efficiencies from the 6th hour (that is, 6 AM) to the 18th hour (that is, 6 PM).
b. Draw a graph of the efficiencies computed in Part A.
c. What would be the effect of a different sun angle? (Hint: Try some different angles to find the angle that would result in the most efficient setup.)

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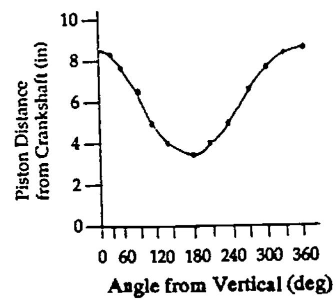
STUDENT WORKSHEET #14 — Key

Trigonometry

1. a. The students' tables should appear generally as shown below.

Angle (deg)	h
0	8.500
30	8.294
60	7.629
90	6.500
120	5.129
150	3.964
180	3.500
210	3.964
240	5.129
270	6.500
300	7.629
330	8.294
360	8.500

b. The students' graphs should appear generally as shown below.



c. At an angle of 0°, the distance should be equal to the sum of *d* and *r*, or 8.5 inches (that is, 6.0 in + 2.5 in). When the crankshaft is rotated 180°, the distance should be the value for *d* less the value for *r*, or 3.5 inches (that is, 6.0 in - 2.5 in). Both of these agree with the results from the formula shown in the table.

d. It most resembles a cosine curve, having a maximum at 0° and 360°, and a minimum at 180°

2. a. The question is asking for the period of the ac voltage. The period is the reciprocal of the frequency: 1/ 60 cycle per second, or 0.017 second (rounded).

b. As stated in the exercise, the voltmeter is reading the amplitude divided by $\sqrt{2}$. Thus, solving for the amplitude yields:
Amplitude = $\sqrt{2}$ x Voltmeter reading
Amplitude = $\sqrt{2}$ x 120 V = 170 V (rounded)

3. a. The students should use the equation given in the exercise, substituting the values of A = 48, R = 18, and H ranging from 6 to 18.
For example, for the 8th hour (8 AM), H = 8 hr.
$P = \sin(90° - 48 + 18) \times \sin(15°/\text{hr}\ [8\ \text{hr}] - 90°) = 0.433$, or 43.3% (rounded)
The students' tables should appear generally as shown below.

Hour	Percentage
6	0
8	43.3
10	75.0
12	86.6
14	75.0
16	43.3
18	0

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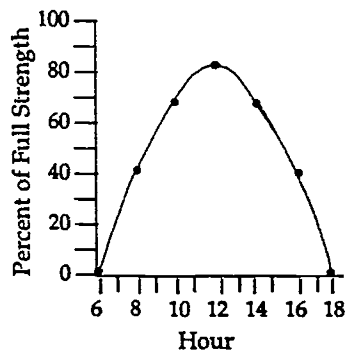
b. The students' graphs should appear generally as shown below.



c. In making the table, the students should discover that the first sine term remains the same for all hours, and is dependent on the roof and sun angles. To maximize the efficiency for all hours of the day, this term must be maximized. That would occur for the sine of 90° — when the roof angle and the sun angle cancel each other out. This makes sense, because then the sun's rays would strike the solar collector at a perpendicular angle. Thus, a sun angle closer to 18° would increase the efficiency. A sun angle *equal* to 18° would yield the most efficient condition.

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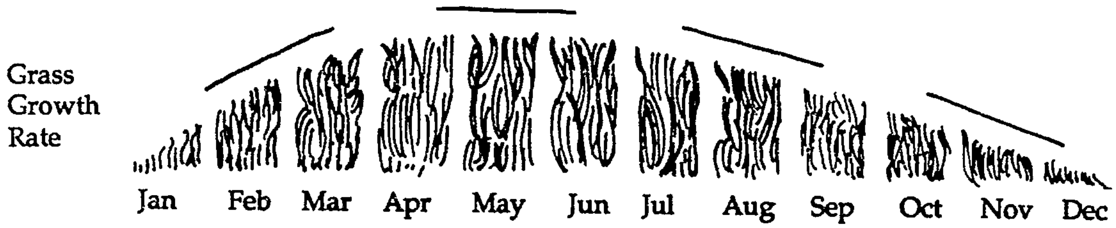
STUDENT WORKSHEET #15

Graphs, Charts, and Tables

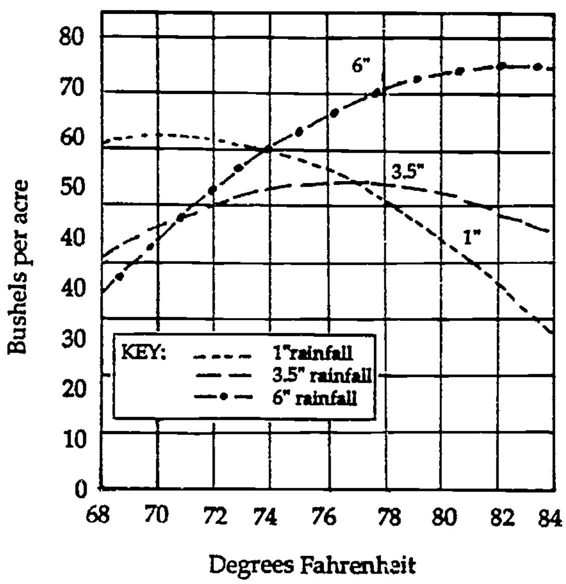
1. You work at Green's Nursery. You are frequently asked by customers when they should fertilize their lawns. You refer to the chart below to help answer their questions. The chart shows the growth rate and optimum times for fertilizing warm-season grasses.



a. Based on the graph, when do warm-season grasses grow the most? (What one or two months?)
b. When do they grow the least? (What one or two months?)
c. Which of the following statements would agree most closely with the information presented in the graph? (Choose the correct number.)
   1. Fertilizer should be applied every week.
   2. Fertilizer should be applied only during the summer months.
   3. Fertilizer should be applied during February, May, August, and November.
   4. Fertilizer should be applied during January, late June, and late September.

2. There are many relationships between weather and crop performance. One such relationship is pictured below for corn yields in a certain region. It compares crop yield with average temperature for the month of July, for various rainfalls.

Crop yeild compared to average temperature and rainfall



a. What are the units being used for (1) crop yields, (2) average temperature, and (3) rainfall?
b. How is the graph drawn so that you can identify the lines for the three different rainfalls?
c. For an average temperature of 82, what crop yields can be expected for a 6" monthly rainfall? for a 1" monthly rainfall?
d. Which is better for a cool average temperature of 70 — heavy rainfall or light rainfall?

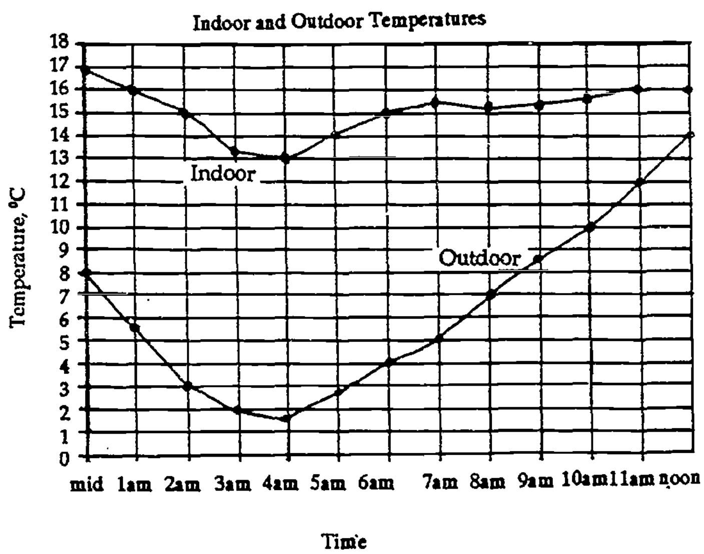
3. A test of twenty 30-amp fuses shows that not all the fuses are "breaking" at the rated amperage. The table of data is shown below.

Breaking point for sampled 30-A fuses

Breaking point range (amperes)	Number of fuses
24-25	1
26-27	3
28-29	5
30-31	8
32-33	2
34-35	1

a. Construct a bar graph of the data. Label the ranges of breaking points on one axis, and the number of fuses "breaking" in those ranges on other axis.
b. Is the most frequently occurring "breakpoint" near the rated amperage of the fuses? If not, where is it?
c. On your graph, shade in the test results that indicate "breakpoint" outside a tolerance range of 26 amps to 33 amps.

4. The graph below shows both the indoor and outdoor temperature for a twelve-hour period.



a. What are the units used to indicate the temperatures?
b. What twelve-hour period is depicted?
c. Do the indoor and outdoor temperatures seem to be related? How?
d. When is the greatest difference in temperature observed? What is the temperature difference at this time?
e. Sketch what you think the graph would look like if the next twelve hours were shown.

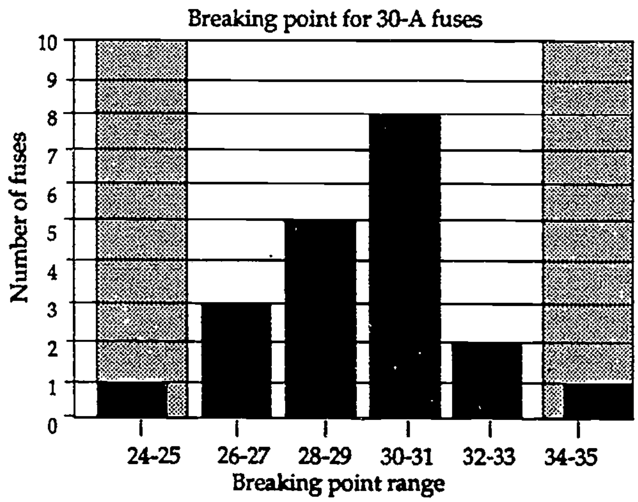
STUDENT WORKSHEET #15 — Key

Graphs, Charts, and Tables

1. a. Based on the graph, warm-season grasses grow the most in May and June.
   b. Warm-season grasses grow the least in December and January.
   c. Statement 3, "Fertilizer should be applied during February, May, August, and November", most closely agrees with the information presented in the graph.

2. a. The units used in the graph are:
      1. crop yields — bushels per acre
      2. Average temperature — degrees Fahrenheit
      3. rainfall — inches
   b. Each of the rainfall amounts is represented by a different type; one inch by a dotted line, three and one-half inches by a dashed line, and six inches by an alternating dot and dashed line.
   c. For an average temperature of 82°, a crop yield of 75 bushels per acre can be expected if you have a 6" monthly rainfall. A crop yield of only about 35 bushels per acre is predicted for a 1" rainfall.
   d. For a cool average temperature of 70°F, a light rainfall will produce better crop yield.

3. a. A bar graph depicting the breaking point for thirty-amp fuses follows.



   b. The most frequently occurring breakpoint is near the rated amperage of the fuses.
   c. The graph in Part A has been shaded to show those values outside of the tolerance range of 26 amps to 33 amps.

4. a. The units used to indicate the temperature are degrees Celsius.
   b. The twelve-hour period from midnight to noon is depicted by the graph.
   c. The indoor and outdoor temperatures seem to be related. When the outdoor temperature drops, so does the indoor temperature. When the outdoor temperature begins to rise so does the indoor temperature, until it reaches about 15° to 16°C, where it levels out. The leveling out is most likely due to a heating/ air conditioning system being turned on when people get up and start the day.
   d. The greatest temperature difference is observed at about 2:00 am. The temperature difference at this time is about 12°C.
   e. You should accept any student graph that shows the outdoor temperature reaching some maximum temperature and then dropping back off to somewhere in the neighborhood of 8°C at midnight. The indoor temperature should remain fairly level throughout the day, slowly increasing to around 17°C in the evening.

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agriculture

PROBLEM AREA: Developing Human Relations Skills in Agribusiness

RELATED PROBLEM AREAS:

1. Gaining Employment in an Agricultural Occupation
2. Developing Communication Skills in Agriculture
3. Identifying and Practicing Ethics in Agricultural Occupations

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Physical Development/Health and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following pages. Those learning objectives marked with an asterisk (*) are taken from sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Associate: Paul E. Hemp, Ed.D.

ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the knowledge and skills required for success in selected fields of work.					
*2. Understand how employers, labor unions, managers, and workers interact with one another to achieve a common goal.					
*3. Recognize that competence in a field of work entails the development of a wide range of skills.					
4. Understand their own work ethic and enumerate and explain the reasons why people work.					
5. List and describe the expectations employers have for their employees and the working conditions which promote high worker morale and satisfaction.					
6. Recognize different leadership styles and how to deal with these styles.					
7. Identify probelms workers have in getting along with each other.					
457					458

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
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LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

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(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☒ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will be able to understand principles of nutrition, exercise, efficient management of emotional stress, positive self-concept development, drug use and abuse, and the prevention and treatment of illness.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize the relationship between self-esteem and personality development.					
*2. Recognize behaviors which promote self-esteem without being destructive to self or others.					
*3. Understand behaviors which positively affect the self-concepts of others.					
4. Understand the factors which affect self-image and how self-image affects productivity and job satisfaction.					
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					460

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agriculture

PROBLEM AREA: Developing Human Relations Skills in Agribusiness

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Understand the factors which affect self-image and how self-image affects productivity and job satisfaction.
2. Understand their own work ethic and enumerate and explain the reasons why people work.
3. List and describe the expectations employers have for their employees and the working conditions which promote high worker morale and satisfaction.
4. Recognize different leadership styles and how to deal with these styles.
5. Identify problems workers have in getting along with each other.
6. Understand the types of behavior which help employees get along well with co-workers.
7. Apply basic principles of human relations in dealing with customers, co-workers, and clients.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agriculture

PROBLEM AREA: Developing Human Relations Skills in Agribusiness

PROBLEMS AND QUESTIONS FOR STUDY

Self-Understanding and Assessment

1. What is meant by the term "self-image"?
2. What is your image?
3. How do others see you?
4. Why do some people have a poor self-image?
5. How can you develop a positive self-image?
6. What are values and how are they developed?
7. What values do you have?
8. What is meant by priority setting?
9. What are your priorities?
10. What is an introvert? an extrovert?
11. What is the difference between closed-minded and open-minded?
12. What is the difference between an optimist and a pessimist?
13. Do you tend to be an optimist or a pessimist?
14. What are some human needs that people have?
15. What needs do you have?
16. What are the three major reasons why most people work?
17. Why do you work?
18. What is your work ethic?
19. How does self-concept or self-image influence interpersonal relationships?
20. How can the self-concept of one person be affected by the behaviors of others? Give examples which cause both positive and negative effects.

Getting Along with Employers

1. How do employers measure success in their businesses?
2. What should employees expect from employers?
3. What is seniority and how is it used to determine pay raises or promotions or to provide job security?
4. What is meant by the "grapevine"? How can it be used by employers or employees?
5. What do employers expect from employees?
6. How can an employee show loyalty to employers?
7. What is the "chain of command"? How is it important to an employee?
8. Name 10-12 occupational skills that employers want employees to have.
9. What are some causes of absenteeism?
10. Name three management styles. Compare and contrast these styles.
11. What is "participatory management"? What are the advantages and disadvantages of this concept?
12. How is productivity measured? How can it be increased?
13. How is profit sharing used to affect productivity?
14. What is the difference between technical skills, human relations skills, organization skills and coping skills?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

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PROBLEM AREA: Developing Human Relations Skills in Agribusiness

PROBLEMS AND QUESTIONS FOR STUDY (con't.)

15. What are "fringe benefits"? How do they affect employee morale, attitude, and satisfaction?

16. Distinguish between rights and responsibilities of employers and workers in the work place.

Getting Along with Co-Workers

1. Why is it important for employees to get along well with co-workers?

2. What is the major reason why people leave jobs?

3. What techniques can be used to gain acceptance from co-workers?

4. Distinguish between written rules and unwritten rules. What do rules have to do with getting along with others?

5. What is meant by "carrying your own weight"?

6. What are some of your habits or mannerisms which may irritate others?

7. Define the following words:

a.	peer	f.	employability skills
b.	ostracism	g.	self-concept
c.	nonverbal communication	h.	empathy
d.	morale	i.	company image
e.	technical skills	j.	credibility

Getting Along with Customers and Clients

1. What is the difference between a customers and a client?

2. What keeps customers coming back?

3. What is meant by the slogan, "The customer is always right"?

4. How should a sales clerk approach a customer?

5. How should one handle a customer who is angry or upset?

6. How can one recognize customers and remember their names?

7. How should one handle a dishonest customer?

8. How can a business minimize or reduce complaints?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agriculture

PROBLEM AREA: Developing Human Relations Skills in Agribusiness

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Organize learning activities and class discussion around the four basic sections of this problem area:

   a. Self-understanding and assessment.
   b. Getting along with employers.
   c. Getting along with co-workers.
   d. Getting along with customers and clients.

2. After defining the problem area and identifying objectives and problems, the students could be engaged in an exercise of self-assessment and analysis. This can be accomplished by using Student Worksheet #1. Discussion of the form can be conducted after students have completed it, and/or the teacher can summarize student responses and report back to the class those items which need the most attention.

3. Use Transparency Masters #2 and #3 to conduct a discussion of human needs and why people work.

4. Return to the list of problems and questions developed and listed for the section on Self-Understanding and Assessment. Conduct supervised study to provide students with the necessary knowledge background to answer and/or discuss the questions and problems.

5. Use Student Worksheet #2 to help students analyze their own personal characteristics and traits.

6. Proceed to the next area of study "Getting Along with Employers."

7. Refer class to list of problems and questions developed for this area. Select the problems which can be addressed by transparencies and other materials included with this problem area and handle them first, or choose the problems and questions which will require research and study using suggested references.

8. Use Transparency Masters #4, #5, #6, and #7 to distinguish between the types of skills needed by workers and to identify essential personality traits for job success, expectations of employees, and occupational skills employers want.

9. After students have studied management or leadership styles, use Student Worksheet #3 to provide practice in distinguishing between these styles.

10. Proceed to next area of study "Getting Along with Co-Workers."

11. Refer back to list of problems and questions identified for this area and conduct supervised study and class discussion to solve or answer them.

12. Review with class the laws which are designed to reduce and prevent discrimination in the workplace. Use Information Sheet #1 for a brief overview of terms and federal legislation.

13. Use Transparency Master #8 to discuss undesirable worker traits.

14. Have class role play some of the worker traits identified on Transparency Master #8.

15. Proceed to next area of study "Getting Along with Customers and Clients." Conduct a supervised study period to search out solutions and answers to the problems and questions previously identified.

16. Conduct class discussion to share information and develop appropriate conclusions. Use Transparency Master #9 to cover proper methods of handshaking.

17. Use Information Sheet #2 to help summarize the problem area. Use Student Worksheet #1 as an optional exercise for students who like to work on word puzzles.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agriculture

PROBLEM AREA: Developing Human Relations Skills in Agribusiness

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Human Relations in Agricultural Business*, (VAS Unit #6003); *Motivating Workers in an Agricultural Business*, (VAS Unit 6016); *Human Relations in Agricultural Business*, (F392). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*2. *Human Relations in Agribusiness*. Hillison, Crunkilton, Lee. (1980). McGraw-Hill Publishing Company, 1220 Avenue of the Americas, New York, NY 10124-0025.

*3. *Human Relations at Work*. (1987). Eggland and Williams. (3rd Edition). South-Western Publishing Company.

4. *Leadership for Agricultural Industry*. Stewart and Amberson. (1978). McGraw-Hill Publishing Company, 1221 Avenue of the Americas, New York, NY 10124-0025.

5. *Human Relations*. State Department of Education, Division of Vocational Education Services, Agribusiness Education Services, Montgomery, AL.

6. *Introduction to the World of Work*. State Department of Education, Division of Vocational Education Services, Agribusiness Education Services, Montgomery, AL.

*Indicates highly recommended references.

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Discrimination in the Workplace

INFORMATION SHEET #2 — How to Keep Your Future Job

INFORMATION SHEET #3 — Terms to be Defined

TRANSPARENCY MASTER #1 — Out of Every 10 Workers Who Lose their Jobs

TRANSPARENCY MASTER #2 — People Work to Fulfill Human Needs

TRANSPARENCY MASTER #3 — Work is Done When You Consciously Try to Satisfy Your Own Needs and the Needs of Others

TRANSPARENCY MASTER #4 — Skills Needed by Workers (with discussion guide)

TRANSPARENCY MASTER #5 — Essential Personality Traits for Job Success

TRANSPARENCY MASTER #6 — Expectations of Employee

TRANSPARENCY MASTER #7 — Basic Occupational Skills Employers Want

TRANSPARENCY MASTER #8 — Undesirable Worker Traits

TRANSPARENCY MASTER #9 — Handshaking

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INFORMATION SHEET #1

Discrimination in the Workplace

Prejudice — A judgment or opinion formed before the facts are known; preconceived idea; prejudging people before you know them.

Discriminate — To divide or distinguish; to constitute a difference between; to differentiate. (Note: Prejudice is sometimes used as the basis for discrimination or unfair treatment.)

Stereotype — A fixed or conventional notion of a person, group, or idea held by a number of people and allowing for no individuality; blanket judgments about classes of people.

Sexual Harassment — Troubling, worrying, or tormenting persons of the opposite sex.

Equal Employment Opportunities

An equal opportunity employer is one who conducts personnel activities without prejudicial discrimination. These activities include recruitment, hiring, terminations, promotion, training, salary benefits and privileges, and working conditions. Discrimination between employees cannot be made on the basis of race, color, religion, national origin, sex, age, or physical or mental handicaps.

Federal laws which support employment opportunities include the following:

1. Equal Pay Act (1963). Requires employers to give employees equal pay for equal work.
2. Civil Rights Act, Title VII (1964). Prohibits discrimination based on race, sex, religion, or national origin.
3. Age Discrimination in Employment Act (1967). Prohibits discrimination because of age.

INFORMATION SHEET #2

How to Keep Your Future Job

1. Rest at night so that you will be able to do your job well and cheerfully.
2. Try to be early to arrive at work and late to leave work.
3. Work while you are on the job; you are being paid, so stay busy.
4. Try hard to do what you know how to do, and then do your best to learn how you can to do your job better.
5. Give a little more than is expected for the salary you get.
6. Learn the names of your supervisors and your fellow employees.
7. Give yourself a chance to learn your work; don't give up; be patient.
8. Learn to do the job you were hired for before you seek the job your supervisor has.
9. Be agreeable and try to get along with your co-workers.
10. Ask questions when you do not understand; your boss would rather you ask than do a job wrong all day.
11. Listen to all directions carefully.
12. Watch your fellow employees' methods of doing things and ask them for suggestions and help when needed.
13. Maintain a good personal appearance.
14. Return from lunch and breaks promptly.
15. Stay cool on the job site; control your temper.
16. Be courteous and tactful on the job.
17. Develop a positive attitude toward all your business contracts.
18. Report to your immediate supervisor regarding your current duties.
19. Have a plan for what you have to do before you get to the job site. Make your plans on the way to work.
20. Learn the rules and regulations which relate to your job. Ask for a copy of the company's policies if there is one available.
21. Report mistakes you have made and try to learn from them.
22. It is best to keep business and personal relationships separate.
23. Try not to be a chronic complainer or one who quickly finds fault with others. Don't criticize your boss or co-workers.
24. Smile and try to contribute to a good work environment.
25. Let your co-workers do their job; the work site is not a place to visit or gossip.
26. When you become successful, keep following the rules; they are what helped make you successful.
27. Check company policy before you eat, drink, smoke, or chew gum on the job.
28. Make yourself aware of the overall goals of the company and support those goals in your everyday working. If the employees of a company do not care how well they do their work, the company will suffer and you may be out of a job.
29. Welcome constructive criticism.
30. Don't make excuses about the work you should have done.
31. Do your personal business at home on your own time.
32. Be loyal to the firm and people that employ you and pay your salary.
33. Use the established line of authority. Don't go over your supervisor's head.
34. Share the credit for accomplishments with co-workers.
35. Discuss problems with your supervisor when they occur. Don't complain to others.
36. Keep confidential business matters to yourself.
37. Don't step on others to get where you are going.
38. Don't ask for favors or exceptions unless it's a real emergency.
39. Continue to show interest in your job and maintain quality performance even after the excitement and newness wears off.

Remember, if you later wish to seek different employment, your supervisors will be contacted concerning your job performance!

Reprinted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

INFORMATION SHEET #3

Terms to be Defined

Authoritarian — a leadership or management style which favors blind submission to authority; a concentration of power.

Chain of command — a series of executive positions in order of authority.

Coping skills — skills which help one to handle and/or solve problem situations.

Democratic — a leadership or management style which favors democracy; social equality.

Empathy — the capacity for participation in another's feelings or ideas; sympathy.

Employability skills — job-keeping skills which enable a worker to maintain employment and move ahead in the job.

Extrovert — one whose attention and interests are directed toward what is outside the self.

Generalizable skills — skills which can be used or applied in a variety of work situations.

Grapevine — an informal person-to-person means of circulating information or gossip.

Human relations skills — skills which involve working with or getting along with other people.

Introvert — one who turns inward or is concerned with one's own mental self.

Laissez faire — lack of direction or interferences; to let people do as they choose.

Nonverbal communications — not verbal; communications carried out by means other than verbal skills; body language.

Organizational skills — skills needed to organize groups or activities; an example is organizing one's time.

Ostracism — to exclude from a group by common consent; rejection of persons from social groups.

Participatory management — providing workers with the opportunity to participate in the management of a business.

Peer — belonging to the same group or age, grade, or social status.

Self-image — one's conceptions of his or her self; self-concept.

Work ethic — how individuals view work; most persons in the U.S. view work as honorable, necessary, and desirable.

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TRANSPARENCY MASTER #1

Out of Every 10 Workers Who Lose Their Jobs

Do you like this arrangement of roses?

ONLY 1 LACKS TECHNICAL KNOWLEDGE AND SKILLS

BUT 9 DO NOT KNOW HOW TO GET ALONG WITH PEOPLE

TRANSPARENCY MASTER #2

People Work to Fulfill Human Needs

5. Self-realization Needs

Learning
Achieving goals
Developing talents
Personal growth
Improving skills

4. Self-respect and Self-esteem Needs

Recognition
Service
Responsibility
Independence
Self-confidence

3. Social Needs

Love
Acceptance
Belonging
Friendship
Family

2. Security Needs

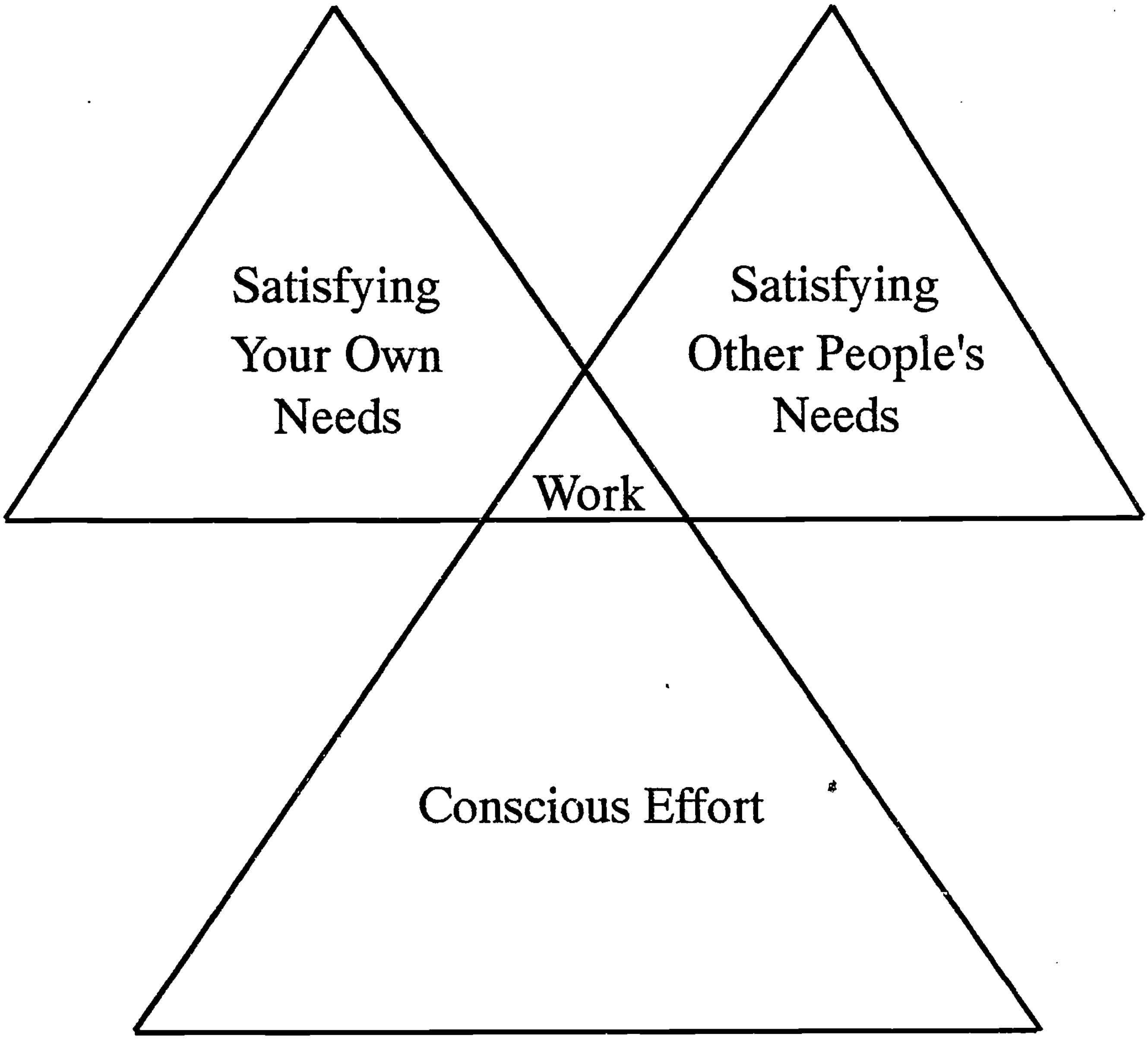
Economic certainty
Prevention of Injury
Safety

1. Physical Needs

Food
Water
Air
Shelter

TRANSPARENCY MASTER #3

Work is Done When You Consciously Try to Satisfy Your Own Needs and the Needs of Others



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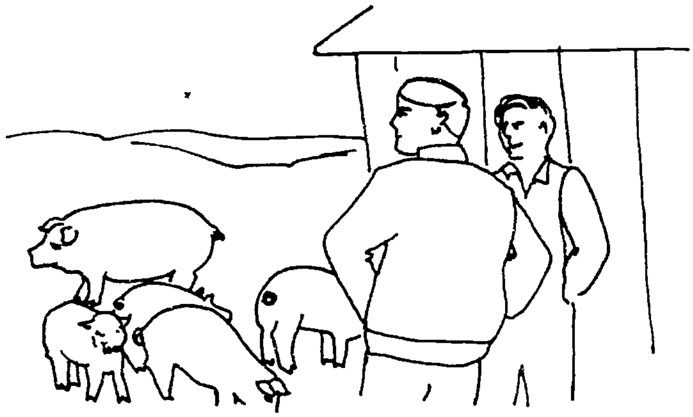
TRANSPARENCY MASTER #4

Skills Needed By Workers



Human Relations Skills

Organizational Skills

Coping Skills

TRANSPARENCY MASTER #5

Essential Personality Traits for Job Success

1. Cooperativeness
2. Dependability
3. Courtesy/Tact
4. Enthusiasm
5. Initiative
6. Honesty
7. Loyalty
8. Adaptability
9. Patience
10. Self-control

Human Relationships Means You

—Know yourself
—Work with people instead of against them
—React correctly in given situations

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TRANSPARENCY MASTER #6

Expectations of Employee

1. Respect for authority
2. Personal authority
3. Adherence to business rules and policies
4. Regular attendance
5. Proper personal characteristics (appearance and personality)
6. Acceptance and use of constructive criticism
7. Loyalty, high morale
8. Punctuality and commitment

TRANSPARENCY MASTER #7

Basic Occupational Skills Employers Want

Competencies	Activites which will develop these areas
1. Punctuality	1.
2. Dependability	2.
3. Getting along with others	3.
4. Working as a team member	4.
5. Organizing the work activities of others	5.
6. Understanding written information	6.
7. Basic writing skills	7.
8. Basic speaking skills	8.
9. Being neat and clean in appearance	9.
10 Maintaining good health	10.
11. Knowing your strengths and weaknesses	11.
12. Giving an honest day's work	12
13. Loyalty to your organization	13.
14. Making independent decisions	14.

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Competencies	Activites which will develop these areas
15. Using initiative and imagination	15.
16. Knowing what is expected	16.
17. Basic arithmetic skills	17.
18. Knowing how to use materials and equipment	18.
19. Locating information	19.
20. Having specialized training	20.
21. Knowledge of operating procedures	21.
22. Following instructions	22.
23. Working without close supervision	23.
24. Working under pressure	24.
25. Adjusting to work situations	25.
26. Managing time and materials effectively	26.
27. Following safety regulations	27.

TRANSPARENCY MASTER #8

Undesirable Worker Traits

1. Complaining to everyone about everything
2. Being jealous of others
3. Gossiping
4. Being inconsiderate of others
5. Being an "apple-polisher"
6. Acting like a supervisor
7. Taking credit for the work and ideas of others
8. Using other people for personal gains
9. Using sick leave inappropriately
10. Being consistently late

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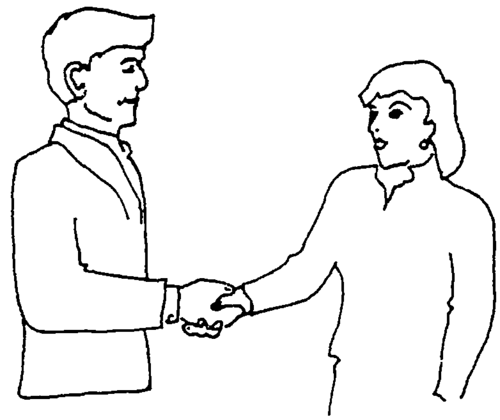
TRANSPARENCY MASTER #9

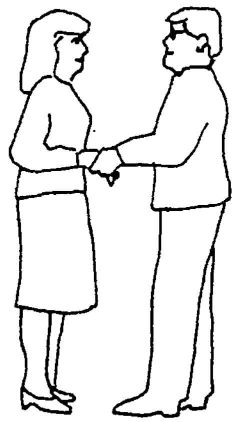
Handshaking

Correct

1. Look the person in the eye
2. Firm grip
3. Two short up-down shakes

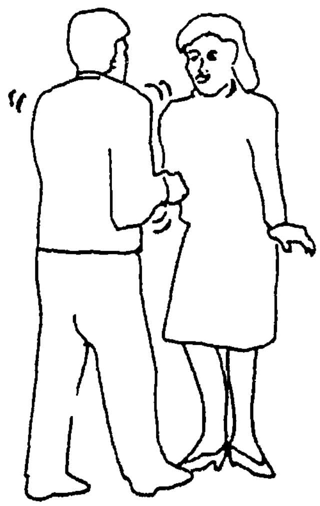


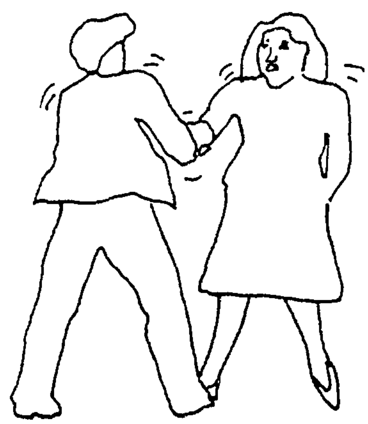
Incorrect



The Ring-squeezer, Bone-crusher

Limp, Dead-fish hand





Won't-let-go glued shake

Hand pump and jerker

TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #4 - Skills Needed by Workers

Human Relations Skills

1. What are some examples of human relations skills?

    a. Praising a job well done.
    b. Keeping your promises.
    c. Starting a conversation.

2. What is the difference between technical knowledge and "people knowledge" (human relations skills)?

3. What groups do we need to relate to in the work place?

4. Poor human relations are —

    a. Most frequent cause of job conflict and dissatisfaction.
    b. Cause of low productivity.
    c. Related to self-concept.

Organizational Skills

1. What is meant by organizational skills? Give example.

2. How do organizational skills help one to become a strong leader?

3. Discuss meaning of "being organized," time management, and motivating others.

Coping Skills

1. Coping means dealing with problems, handling trouble successfully.

2. Life is full of problem situations which must be handled or solved. These problem situations must be "coped with" if one is to survive on-the-job. They are sometimes referred to as job survival skills.

3. Ask students to name a difficult problem they have faced recently and to explain how they handled it. Call for input or alternatives from other class members.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Evaluating my Personal Appearance, Feelings, and Habits

STUDENT WORKSHEET #2 — How I See Myself

STUDENT WORKSHEET #3 — Three Management Styles of Employers

STUDENT WORKSHEET #4 — Employability Word Search (with key)

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Evaluating My Personal Appearance, Feelings, and Habits

Directions: Answer the following questions by circling "A" for Always, "U" for Usually, "S" for Sometimes, or "N" for Never. Review your answers to determine which areas you need to improve.

Part I: Personal Appearance

1. Are you aware that personal cleanliness and neatness have effect on those around you?	A	U	S	N
2. Do you shower or bathe at least once daily and after strenuous exercise?	A	U	S	N
3. Do you use an effective deodorant daily?	A	U	S	N
4. Do you brush your teeth at least twice daily?	A	U	S	N
5. Do you keep your hair clean and well-groomed?	A	U	S	N
6. Do you wear clothes that are becoming to you and appropriate to the occasion?	A	U	S	N
7. Are your clothes neat and clean?	A	U	S	N
8. Do you keep your weight at the pound recommendation for your height and body frame?	A	U	S	N
9. Do you eat a well-balanced diet each day?	A	U	S	N
10. Do you exercise regularly?	A	U	S	N
11. Do you get enough sleep each night?	A	U	S	N
12. Do you maintain straight, correct posture when sitting, standing and walking?	A	U	S	N

Part II: Working With Others

1. If someone asks you for help, do you give it cheerfully?	A	U	S	N
2. Do you laugh at the mistakes of others?	A	U	S	N
3. Is it easy for you to praise and compliment other people?	A	U	S	N
4. Do you enjoy gossip?	A	U	S	N
5. Do you feel awkward around strangers?	A	U	S	N
6. Are you able to ask others for help when you need it?	A	U	S	N
7. Do you try to see the other person's point of view?	A	U	S	N
8. Do others enjoy being around you?	A	U	S	N
9. Do you take a sincere interest in those around you?	A	U	S	N
10. Can you offer constructive criticism in a polite manner?	A	U	S	N
11. Do you congratulate your friends upon their achievements?	A	U	S	N
12. Do you enjoy being part of a group?	A	U	S	N
13. Do you make friends easily?	A	U	S	N
14. Are you thoughtful of the feelings of others?	A	U	S	N
15. Do you get along well with others?	A	U	S	N
16. Do people ask for your advice?	A	U	S	N
17. Does conversation stop when you join a group?	A	U	S	N
18. Do you sense that others feel uncomfortable around you?	A	U	S	N
19. Do you keep the promises you make to others?	A	U	S	N
20. Do you become jealous of others?	A	U	S	N

Part III: Communication Skills

1. Do you organize your thoughts and ideas before you speak?	A	U	S	N
2. Do you concentrate on the meaning you are trying to convey?	A	U	S	N
3. Do you make grammatical and spelling errors when speaking or writing?	A	U	S	N
4. When you are listening to someone, are you easily distracted by outside sights and sounds?	A	U	S	N
5. Do you use clear, distinct speech?	A	U	S	N
6. Do you have a pleasant speaking voice?	A	U	S	N

Part IV: Personal Feelings and Attitudes

1. Do you try to have a positive attitude?	A	U	S	N
2. Do you approach your work confidently?	A	U	S	N
3. Are you willing to accept responsibility?	A	U	S	N
4. Are you able to act naturally under all circumstances?	A	U	S	N
5. Do you worry about past mistakes and failures?	A	U	S	N
6. Do you control your temper?	A	U	S	N
7. Are you able to make decisions about everyday things easily?	A	U	S	N
8. Are you able to keep your personal troubles to yourself?	A	U	S	N
9. Do you react constructively to criticism?	A	U	S	N
10. Do you accept blame for things that are your fault?	A	U	S	N
11. Do you tell the truth and are you honest?	A	U	S	N
12. Are you easily discouraged?	A	U	S	N
13. Can you adapt to all situations?	A	U	S	N
14. Do you persevere until you achieve success?	A	U	S	N
15. Can you make decisions quickly and accurately?	A	U	S	N
16. Are you afraid to express your opinions and ideas?	A	U	S	N
17. Are you ambitious?	A	U	S	N
18. Do you complain when things don't go the way you would like?	A	U	S	N
19. Do you become impatient with yourself and others?	A	U	S	N
20. Do you feel you are a unique and valuable person?	A	U	S	N

Part V: Plans for Improvement

1. What do you feel are you strengths regarding personal appearance, feelings, and habits?

2. What do you feel are your weaknesses regarding personal appearance, feelings, and habits?

3. In what ways do you want to change or improve your personal appearance, feelings, and habits?

4. Now that you have decided what to improve about yourself, you must decide how you can make the improvements. One way is to develop a self-improvement plan of action with a reward/penalty system. For example, you may decide you need to spend more time studying. Your plan of action may be to study two hours each day after school. If you study for two hours, reward yourself with a pleasurable activity such as watching TV, playing a game of basketball, eating a piece of cake, etc. If you do not study you must give up one of the pleasurable activities you had planned to do.

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STUDENT WORKSHEET #2

How I See Myself

What kind of person are you? What personal characteristics and traits do you have? How do you describe yourself?

Read the list of characteristics and traits listed below. Check the 15 words or phrases that best describe you

_____ Aloof	_____ Loud
_____ Shy	_____ Agreeable
_____ Clever	_____ Cooperative
_____ Friendly	_____ Courteous
_____ Stubborn	_____ Dependable
_____ Helpful	_____ Moody
_____ Fun-loving	_____ Sarcastic
_____ Serious	_____ Argumentative
_____ Sincere	_____ Domineering
_____ Unselfish	_____ Mature
_____ Modest	_____ Optimistic
_____ Strong-willed	_____ Practical
_____ Tactful	_____ Punctual
_____ Patient	_____ Self-controlled
_____ Loyal	_____ Militant
_____ Enthusiastic	_____ Broad-minded
_____ Tolerant	_____ Resourceful
_____ Conceited	_____ Shrewd
_____ Rude	_____ Vicious
_____ Jealous	

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STUDENT WORKSHEET #3

Three Management Styles of Employers

Management styles are usually classified into three categories. These are (1) authoritarian, (2) democratic, and (3) laissez-faire (means hands-off).

Read the statements listed below and decide which leadership style is represented. Place an A, D, or L in the blanks to indicate an authoritarian, democratic, or laissez-faire leader.

1. ______ Uses a suggestion box to obtain advise from employees.
2. ______ Makes most of the decisions for employees.
3. ______ Uses advisory committees to make suggestions.
4. ______ Is rarely seen — avoids employees.
5. ______ Is a good listener — asks employees for their opinions.
6. ______ Requires employees to obtain his/her permission before making changes.
7. ______ Encourages independent work.
8. ______ Expects employees to solve their own problems.
9. ______ Often issues orders, rules and regulations.
10. ______ Usually defers to judgment of board of directors or stockholders.

Discussion Questions:

1. Which type of leader or employer would you like to have? Why?
2. Which leadership management style best describes your personal traits and characteristics?
3. Do you need to change your leadership style? Why?

STUDENT WORKSHEET #4

Employability Word Search

B	A	C	T	C	O	P	J	I	S	S	T	I	V	E	[illegible]	O	K	C	O	R	V
H	O	T	E	L	R	S	U	N	D	U	L	U	E	M	R	O	H	E	E	R	K
A	C	C	U	R	A	T	E	N	Z	O	L	V	D	A	E	K	U	G	R	O	P
T	T	L	I	P	H	O	S	C	C	I	I	T	N	E	D	I	F	N	O	C	A
K	I	A	D	G	O	B	E	I	R	T	Q	U	O	B	R	E	L	O	G	A	G
S	O	N	O	E	U	O	R	T	I	I	U	Q	S	H	A	E	E	B	O	D	Z
G	D	O	R	R	S	D	N	S	R	B	D	A	D	E	T	A	V	I	T	O	M
T	R	I	G	L	E	E	O	A	L	M	H	C	L	A	K	B	I	T	A	R	T
O	B	S	A	O	I	P	S	I	X	A	U	O	E	C	L	W	T	W	L	A	B
L	I	S	N	C	A	E	T	S	O	K	M	U	T	B	H	T	A	O	D	O	O
U	K	E	I	D	T	N	L	U	F	E	C	R	U	O	S	E	R	G	R	O	R
N	B	F	Z	I	E	D	J	H	B	L	T	T	L	E	T	I	E	A	B	L	G
D	F	O	E	A	D	A	P	T	A	B	L	E	N	U	D	O	P	R	A	I	D
E	L	R	D	E	G	B	R	N	U	A	T	O	E	P	F	L	O	Y	F	L	A
R	E	P	D	Z	N	L	R	E	N	I	H	U	O	U	E	T	O	E	Q	U	F
S	M	A	T	U	R	E	T	F	H	L	M	S	T	A	B	L	C	E	B	O	L
T	A	T	R	O	B	Q	R	T	N	E	A	T	S	G	R	B	E	A	F	L	U
A	N	F	E	U	T	I	E	G	I	R	P	A	T	I	E	N	T	D	T	U	D
N	T	O	J	M	E	T	L	K	E	L	N	O	O	S	R	U	T	T	R	J	R
D	R	S	U	N	K	R	A	C	I	T	E	H	T	A	P	M	E	D	E	L	S
I	E	M	D	I	R	O	O	H	S	A	I	I	J	M	A	E	T	O	R	S	B
N	Z	L	O	E	A	H	R	J	A	T	P	C	E	T	O	L	G	U	E	N	R
G	Y	E	K	N	O	W	L	E	D	G	E	A	B	L	E	R	Q	L	T	B	A

The following words are hidden in the puzzle:

Accurate	Adaptable	Alert	Ambitious	Cheerful
Confidence	Cooperative	Courteous	Dependable	Efficient
Empathetic	Energetic	Enthusiastic	Friendly	Honest
Knowledgable	Loyal	Neat	Mature	Motivated
Organized	Patient	Pleasant	Positive	Professional
Punctual	Reliable	Resourceful	Tactful	Understanding

STUDENT WORKSHEET #4 — Key

Employability Word Search

•	•	•	•	•	•	P	•	•	•	S	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	U	•	•	U	•	•	E	•	•	•	•	•	•	•	•
A	C	C	U	R	A	T	E	N	•	O	•	V	•	•	•	•	•	•	•	•	•
•	•	L	•	•	•	•	•	C	C	I	I	T	N	E	D	I	F	N	O	C	•
•	•	A	•	•	•	•	•	I	•	T	•	•	•	•	•	•	•	•	•	•	•
•	•	N	O	•	•	•	•	T	I	I	U	•	•	•	•	•	E	•	•	•	•
•	•	O	R	•	•	D	N	S	•	B	•	A	D	E	T	A	V	I	T	O	M
•	•	I	G	•	•	E	O	A	•	M	•	C	L	•	•	•	I	•	•	•	•
•	•	S	A	•	I	P	•	I	•	A	•	O	•	C	•	•	T	•	•	•	•
•	•	S	N	C	•	E	•	S	•	•	•	U	•	•	H	T	A	•	•	•	•
U	•	E	I	•	•	N	L	U	F	E	C	R	U	O	S	E	R	•	•	•	•
N	•	F	Z	•	•	D	•	H	•	L	•	T	L	E	•	•	E	•	•	L	•
D	F	O	E	A	D	A	P	T	A	B	L	E	N	U	•	•	P	R	A	•	•
E	•	R	D	E	•	B	•	N	•	A	•	O	•	•	F	L	O	Y	F	•	•
R	•	P	•	•	N	L	•	E	•	I	H	U	•	•	E	T	O	•	•	U	•
S	M	A	T	U	R	E	T	F	•	L	•	S	•	A	•	L	C	•	•	•	L
T	•	•	•	•	•	•	R	•	N	E	A	T	S	•	•	•	•	A	•	•	•
A	•	•	•	•	•	I	E	G	•	R	P	A	T	I	E	N	T	•	T	•	•
N	•	•	•	•	E	•	L	•	E	•	N	•	•	•	•	•	•	•	•	•	•
D	•	•	•	N	•	•	A	C	I	T	E	H	T	A	P	M	E	•	•	•	•
I	•	•	D	•	•	•	•	•	•	•	I	•	•	•	•	•	•	•	•	•	•
N	•	L	•	•	•	•	•	•	•	•	•	C	•	•	•	•	•	•	•	•	•
G	Y	•	K	N	O	W	L	E	D	G	E	A	B	L	E	•	•	•	•	•	•

The following words are hidden in the puzzle:

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Confident	Cooperative	Courteous	Dependable	Efficient
Empathetic	Energetic	Enthusiastic	Friendly	Honest
Knowledgable	Loyal	Neat	Mature	Motivated
Organized	Patient	Pleasant	Positive	Professional
Punctual	Reliable	Resourceful	Tactful	Understanding

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Problem Solving Skills in Agriculture

RELATED PROBLEM AREAS :

1. Developing Transition Skills in Agriculture

PREREQUISITE PROBLEM AREA: None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Science and Language Arts. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Associate: Edward W Osborne, Ph.D.

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Submission Date ______

☐ Original submission ☐ Revision

Page ____ of ____

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Serv[ic]es
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Understand the steps involved in the decision making process.					
2. Compare anticipated and unanticipated outcomes which result from a plan of action.					
3. Evaluate the costs and benefits of a particular course of action.					
490					491

ISBE 41-78 (1/88)

Submission Date ______

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Page ____ of ____

I. LEARNING AREA *(check one)*

☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Phrase a problem and follow an agenda for discussion.					
2. Distinguish among propositions of fact, policy, and value.					
492					
					496

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to read, comprehend, interpret, and use written material.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Use, synthesize, and analyze information from a variety of sources to enhance understanding, e.g., to form opinions based upon a variety of information, to compare, contrast, and verify information, and to expand knowledge.					
494					495

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Problem Solving Skills in Agriculture

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define "problem solving."
2. Describe the steps in the problem solving process.
3. Distinguish between problems and symptoms (correctly identify problems).
4. Discuss the similarities between problem solving and the scientific method.
5. Use problem solving for making management decisions in agriculture.
6. Use problem solving for personal decision making.
7. Gather information and data needed to support alternative solutions.
8. Effectively evaluate alternative solutions to a problem.
9. Determine the success or failure of a chosen solution after implementation.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Problem Solving Skills in Agriculture

PROBLEMS AND QUESTIONS FOR STUDY

1. What is problem solving?
2. How does one use problem solving?
3. How is problem solving similar to decision making?
4. When should problem solving be used?
5. Why should one use problem solving?
6. How does one identify problems?
7. How does one identify possible problem solutions?
8. How does one select the most appropriate (best) problem solution(s)?
9. How does one evaluate the results of the solution?
10. How is problem solving used as a teaching strategy?
11. How does one participate in problem solving as a student?
12. Why is a problem solving teaching strategy used to teach agriculture?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Problem Solving Skills in Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin this problem area with a provocative interest approach — one that forces students to confront a problem real to them and decide how to resolve it. The problem selected needs to be one that personally affects every student. For example, have students pretend they are driving alone in their car (ask a few students what type of car they would really like to have) in the late afternoon one Sunday. They are about 15 miles from home when their car dies. They pull over to the side of the road. The car will crank but won't start. They are due at their boyfriend's (girlfriend's) house in 30 minutes for dinner. What should they do?

   Have students think individually about this situation, and lead a discussion of their proposed actions. Challenge their solutions and raise other (possibly better) solutions. Take them to a point in the discussion where they feel a need to learn more about how to solve problems such as this.

2. Discuss Transparency Masters #1 - #3 contained in this problem area. Use the problem contained in the interest approach in item 1 to illustrate the steps in problem solving.

3. Have students brainstorm a list of other agricultural and nonagricultural problems. For each identified problem have them describe the symptoms or evidence of the problem.

4. Use a small group discussion to have students identify possible solutions to several problems of interest. Each group should focus on different problems; use a mixture of personal/daily living and agricultural problems. For each problem students should develop several (4-6) possible solutions and predict the consequences of each.

5. To give students practice at independently investigating a problem and gathering relevant information to aid in problem solving, assign individual students a problem for them to investigate, and prepare a list of recommended solutions.

6. After posing problem situations to students, have them describe verbally their thoughts and processes for defining the problem, identifying possible solutions, selecting a solution, and evaluating the results.

7. Experiments are an excellent means of "couching" a problem in a worthwhile learning activity. Select several agricultural problems that lend themselves well to experimentation in the class or lab. Help students discover the value of an experiment for testing possible solutions. Divide the class into pairs or small groups and have students design the experiment, identify equipment and materials needed, determine how to collect data, and predict outcomes. Then have students actually conduct the planned experiments. The experiments should be novel, fun, and provide results in a few days or sooner.

   The number of appropriate experiments in agriculture is practically unlimited. Some ideas include the effects of (1) insecticides on selected insect pests, (2) watering practices on plant growth, (3) temperature on plant growth, (4) soil texture on drainage, (5) cultivation practices on weed control, (6) welding procedures on weld strength, (7) fertilization on plant growth, (8) fastening methods on joint strength in woods.

8. Present a demonstration of problem solving as a teaching process to illustrate its similarities to day-to-day problem solving. Include interest approach, group objectives, problems and concerns, problem solutions, application and summary.

9. Use a problem solving/discovery learning teaching procedure on a regular basis in all agricultural classes. Have students consider the problem solving process, as well as the agricultural subject matter.

10. For each application of problem solving have students develop a set of 2-4 criteria to be used in evaluating possible problem solutions.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Problem Solving Skills in Agriculture

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES (con't.)

11. Conduct a role play depicting how students go about solving problems. Select a student and describe a specific problem situation. Identify 3-5 other students that will serve as resource people (information sources) for the problem solver. Instruct the problem solver to specify the roles that the other students are to play. Then have the problem solving student act out how he or she would attempt to solve the problem, with the help of other designated students.

    For example, tell the class that Kerry received a letter in the mail from the bank stating that she had overdrawn her checking account and two checks had been returned due to insufficient funds.

    An agricultural example could be a projected loss in an agribusiness partnership (firewood business) or a fruit tree that is losing its leaves.

12. Have students work in small groups to respond to the Problem Solving Case Studies included in this problem area.

13. Have students work in groups to respond to the Decision Making Case Studies contained in this problem area.

14. Have each student read a self-help, paperback book, magazine article, or similar reference on personal problem solving. Have each student turn in a two page synopsis of the reading and present a brief oral report to the class.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Problem Solving Skills in Agriculture

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Handbook on Agricultural Education in Public Schools*. Phipps, L.J., Osborne, E.W. (1988). Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

2. *Methods of Teaching Agriculture*. Newcomb, L.H., McCracken, J.D., Warmbrod, J.R. (1986). Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0500. (217) 446-0500.

*Indicates highly recommended references

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INSTRUCTIONAL MATERIALS

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

TRANSPARENCY MASTER #1 — What is a Problem?, What is Problem Solving?

TRANSPARENCY MASTER #2 — Steps in the Problem Solving Process

TRANSPARENCY MASTER #3 — Steps in the Decision Making Process

TRANSPARENCY MASTER #4 — Problem Solving or Decision Making?

TRANSPARENCY MASTER #5 — Comparison of Problem Solving Teaching and the Scientific Method

TRANSPARENCY MASTER #6 — Advantages of Problem Solving Teaching in Agriculture

TRANSPARENCY MASTER #7 — The Student's Role in Problem Solving Teaching

TRANSPARENCY MASTER #1

What is a Problem?

A problem is a life situation in which a person wants or needs to do something, but does not know how to proceed.

What is Problem Solving?

Problem solving is the process of attempting to deal with (solve) problems.

TRANSPARENCY MASTER #2

Steps in the Problem Solving Process

1. Defining the problem
2. Seeking data and information
3. Formulating and considering possible solutions
4. Choosing and testing of optimal solutions
5. Evaluating the results

TRANSPARENCY MASTER #3

Steps in the Decision Making Process

1. Stating the desired goal or condition
2. Identifying the obstacles to realizing this goal or condition
3. Examining alternatives available for overcoming each obstacle
4. Ranking these alternatives in terms of their probable consequences
5. Choosing the best alternative

TRANSPARENCY MASTER #4

Problem Solving or Decision Making?

1. Problem solving focuses on problems and their solutions; decision making focuses on desired goals or conditions.

2. Decision making involves problem solving to a large degree.

3. Problem solving usually occurs in response to a specific provocative situation; decision making is usually initiated to create a desired condition.

4. Problem solving usually focuses on recently occurring events; decision making usually deals with future, planned events.

5. Both problem solving and decision making involve the examination of alternative actions, choosing the optimal action, and evaluating the results.

TRANSPARENCY MASTER #5

Comparison of Problem Solving Teaching and the Scientific Method

Scientific Method	Problem Solving Teaching
1. define the problem	1. interest approach 2. group objectives 3. problems and questions
2. gather data	4. problem solution
3. test hypotheses	5. test solutions through application
4. evaluate the results	6. evaluate solutions

TRANSPARENCY MASTER #6

Advantages of Problem Solving Teaching in Agriculture

1. Life situations are the basis of study.

2. Knowledge and skills learned may be readily applied.

3. Students are more active in the learning process.

4. Students learn to "solve problems" themselves.

5. Students learn more and retain more of what they learn.

6. Students are better problem solvers as adults.

TRANSPARENCY MASTER #7

The Student's Role in Problem Solving Teaching

1. Help identify agricultural problems for class discussion.

2. Participate in clarifying the problem — help identify questions to answer.

3. Consult a variety of information sources.

4. Draw conclusions based upon the data you have gathered.

5. Think!

6. Practice problem solving in everyday life.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Sample Report Form for Conducting Experiments

STUDENT WORKSHEET #2 — Case Study #1 - Problem Solving (with solution guide)

STUDENT WORKSHEET #3 — Case Study #2 - Problem Solving (with solution guide)

STUDENT WORKSHEET #4 — Case Study #1 - Decision Making (with solution guide)

STUDENT WORKSHEET #5 — Case Study #2 - Decision Making (with solution guide)

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

ERIC

STUDENT WORKSHEET #1

Sample Report Form for Conducting Experiments

Short Title of the Experiment: ______________________________

____

Purpose: ______________________________

____

Procedures: ______________________________

____

____

____

____

____

____

____

____

____

Findings: ______________________________

____

____

____

____

Conclusions:

1. ______________________________
2. ______________________________
3. ______________________________

Student ______________
Date ______________
Class ______________

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STUDENT WORKSHEET #2

Case Study #1 — Problem Solving

Jimmy Sellers

Situation: Jimmy has established a small, diversified business growing and selling vegetables and small fruits. He has a rototiller that he purchased last year that he uses to cultivate between the rows of some vegetables. Jimmy has been tilling his tomatoes for about five minutes when suddenly his rototiller stops running. He tries to restart it without success.

Questions:

1. What provocative situation did Jimmy experience?
2. What problem is he now confronted with that he needs to solve?
3. What information should Jimmy gather to help define and describe the problem?
4. What possible solutions are there to this problem?
5. Which solution seems most valuable? (most likely to solve the problem)?
6. What results would you expect if the "best" solution were implemented?

STUDENT WORKSHEET #2

Case Study #1 — Problem Solving

Jimmy Sellers — Solution Guide

1. Conduct a brief class discussion to make sure everyone is familiar with the situation and can identify the problem (the vegetables need to be cultivated and the rototiller won't run).

2. Work with the entire class or have students work in small groups or pairs to identify a list of questions to guide their data-gathering efforts.

3. Have students develop a list of possible solutions and discuss how each could be tested.

4. Have students select the most promising solution and discuss their rationale.

Note: This same situation could be set up as a real problem in the lab, where a rototiller or other small engine has been planted with a defect. Students could then proceed through the problem solving process using the engine to gather information, identify and test solutions, and evaluate the results.

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STUDENT WORKSHEET #3

Case Study #2 — Problem Solving

Andy and Jeannie

Situation: Andy and Jeannie were out for a country drive one Sunday afternoon in Jeannie's new red sports car. The car became difficult to steer and handle, so they stopped to check the tires. Sure enough, the left front tire was flat. They were due back at home in an hour to meet some friends. Neither Andy nor Jeannie had ever changed a tire on this car. They weren't even sure where the jack was stored or how it worked.

Questions:

1. What problem did Andy and Jeannie need to solve?
2. What information do they need to solve this problem?
3. What solutions should be considered and tested?
4. Which possible solution should be implemented?

STUDENT WORKSHEET #3

Case Study #2 — Problem Solving

Andy and Jeannie — Solution Guide

1. Have students work in small groups or as a whole class to answer the questions.
2. As the students list possible solutions, add other mini-problems to the story for them to deal with (i.e., the lug wrench was missing, no houses in sight, etc.).
3. Have each group present a summary of their problem solving outcomes.
4. Ask individuals to think out loud about how they would react to this situation.
5. Conduct a discussion of the possible solutions. Be sure to address the key areas including:

   A. Safety — stopping, changing the tire, seeking help, etc.

   B. Obtaining help (when, where, how).

   C. Calling home if the delay is too long.

   D. Knowing your car and its features.

STUDENT WORKSHEET #4

Case Study #1 — Decision Making

Jeff Moore

Situation: Jeff has just graduated from a two year college, majoring in agricultural business. He has taken a job with a farm supply and garden center. After three months, Jeff learns of an opportunity to buy into a smaller similar business in a nearby town. Jeff has always dreamed of owning his own business. He feels he can obtain a loan to cover startup and purchase costs, as a single owner. He also has a good friend from college who may be interested in a partnership agreement. What should he do?

Questions:

1. What is the desired goal or condition?

2. What are the obstacles to achieving this goal?

3. Should Jeff leave his current job and start his own business?

4. If he leaves his current job, should Jeff try to buy the business alone or enter into a partnership with his friend?

STUDENT WORKSHEET #4

Case Study #1 — Decision Making

Jeff Moore — Solution Guide

1. Give copies of this case study to the class for them to read and digest. Some open discussion may be needed to clarify the case.

2. Divide students into small groups and assign the questions to each group. Help the discussion in each group develop.

3. Have each group (or individual students) prepare a written response to the questions.

4. Conduct a class discussion to bring out the various perspectives.

5. Attempt to draw closure to the discussion by presenting some key points, such as:

   A. The importance of Jeff's background to potential success.

   B. The risks of owning your own business.

   C. The advantages and disadvantages of a partnership.

   D. The potential for overcoming obstacles in owning a business.

STUDENT WORKSHEET #5

Case Study #2 — Decision Making

Anne Miller

Situation: Anne is a student at your school who is fast approaching the fun age of 16. To celebrate her big day Anne would like to buy herself a car. She might be able to borrow some money from her parents, if she agrees to do the dishes after dinner for the next three years. There are three used car dealers in town that Anne could visit. Anne thinks that she wants a small, sporty car, but she is not sure. She will start working at Jan's Nursery in three weeks, so she could possibly take out a small loan, if she needs to.

Questions:

1. What is the desired goal or condition that Anne is seeking?
2. What are the obstacles that stand in the way of Anne reaching this goal or condition?
3. Where should Anne go to buy her car?
4. What type of car should Anne buy?
5. How much money should Anne spend on her car?

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STUDENT WORKSHEET #5

Case Study #2 — Decision Making

Anne Miller — Solution Guide

1. Give each student a copy of this case study and have him or her read and study the situation.
2. Divide students into groups and have each group discuss the questions.
3. Have students write their decisions and reasons to hand in for your review.
4. Conduct a class discussion after the small groups have finished their work. Be sure to bring out the following key points:
    a. Buying a car costs a lot of money in maintenance, as well as purchase cost.
    b. Anne should buy her car from a reputable dealer/person.
    c. She may not want to spend all of her savings to buy the car, especially since she will need some money for operating expenses.
    d. Anne should develop a monthly expense budget to make sure she can cover the costs of buying and operating her new car.

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Transition Skills in Agricultural Occupations

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture
3. Developing Communications Skills in Agriculture
4. Applying Mathematics Skills in Agriculture
5. Developing Human Relations Skills in Agriculture
6. Developing Problem Solving Skills in Agriculture
7. Identifying and Practicing Ethics in Agriculture Occupations
8. Gaining Employment in an Agricultural Occupation
9. Developing Safe Work Habits in Agricultural Occupations
10. Understanding Basic Business Organizations
11. Managing Personal Finances
12. Keeping and Using Records in Agricultural Occupations
13. Developing Basic Microcomputer Skills
14. Developing Leadership Skills in Youth Organizations

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparation

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

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Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ________
Title: ________
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize that significant technological changes often relate to significant social changes.					
*2. Understand that planned changes involved different efforts for implementation than unplanned changes.					
*3. Recognize that change is an integral part of life and work.					
4. Describe their own attitudes towards change and explain how positive attitudes facilitate coping with change.					
5. Explain the consequences of accepting or rejecting change.					
6. Describe techniques to use in deciding how to respond to change.					
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ISBE 41-78 (1/88)

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Transition Skills in Agricultural Occupations

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Recognize that change is an integral part of life and work.
2. Describe their own attitudes towards change and explain how positive attitudes facilitate coping with change.
3. Explain the consequences of accepting or rejecting change.
4. Describe techniques to use in deciding how to respond to change.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Transition Skills in Agricultural Occupations

PROBLEMS AND QUESTIONS FOR STUDY

1. What is change?
2. How is one affected by change?
3. What types of decisions can one make about change?
4. Are there different ways for one to respond to change?
5. What kinds of attitudes are there towards change?
6. How does one discover one's attitude to change?
7. What are the ways that one can accept or reject change?
8. Is there a way that one can learn to accept change?
9. How can one understand a change situation?
10. How does one define a problem?
11. How can one find the alternatives to responding to a problem?
12. How does one select among the alternatives to responding to a problem involving change?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Transition Skills in Agricultural Occupations

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use local newspapers or news magazines as sources of articles about change and its effect on people.

2. Assign specific topics to students to find articles about changes that occurred to individuals and how those individuals dealt with those changes. Topics could include:

   a. Recent legislation.
   b. Advances in science.
   c. Recent occurrences concerning pesticides.
   d. Economic changes in agribusiness.
   e. The family farm situation.
   f. The environmental impact of various production methods.

3. Use local agribusiness managers as guest speakers on changes that are occurring in their particular businesses, how those changes affect employees, and how employees can respond to those changes.

4. Have students complete Student Worksheet #1 to assess personal attitudes towards change.

5. Use the student worksheet discussion guides as references for the use of the student worksheets.

6. Use Transparency Master #2 as a guide through the various levels of attitude that one can have in accepting or rejecting change.

7. Use Transparency Master #3 and its discussion guide as a problem-solving approach to analyze a particular change that is occurring. This is done in order to discover the alternatives available and the implications of those alternatives in order to make a decision. Use Student Worksheet #6 in conjunction with this transparency.

8. Use Student Worksheet #2 to help students understand there are good and bad points to any change.

9. Use Student Worksheets #3 and #4 together as outlined in the instructions.

10. Use Transparency Master #5 in conjunction with Student Worksheet #5 to help the students analyze the results of the alternative decision selected.

11. Have students give examples of changes that they have experienced and how they coped with those changes. Ask each student "Would you respond in the same way to that change now?"

12. Use any of the related problem areas for specific information on a particular area of concern.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Transition Skills in Agricultural Occupations

REFERENCES

1. *Working: Today and Tomorrow.* Campbell, R., Thompson, M.J. (1987). The Changing Times Education Service Division, EMC Publishing, 300 York Avenue, St. Paul, MN 55101.

*2. *Methods and Materials for Teaching Occupational Survival Skills.* (1978). Department of Adult, Vocational and Technical Education, Illinois State Board of Education, 100 North First Street, Springfield, IL 62777.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Transition

TRANSPARENCY MASTER #1 — Attitudes That Favor Change (with discussion guide)

TRANSPARENCY MASTER #2 — Scale of Acceptance and Rejection

TRANSPARENCY MASTER #3 — Decision Making Steps (with discussion guide)

TRANSPARENCY MASTER #4 — Finding Alternatives (with discussion guide)

TRANSPARENCY MASTER #5 — Making a Selection (with discussion guide)

INFORMATION SHEET #1

Transition

Transition is defined in dictionaries as the passage from one state, stage, or place to another. One of the important outcomes of public education is to prepare learners to make the transitions of life successfully. The many changes that must be accommodated during life's continuous process include adolescence, the first date, the first job, marriage, parenthood, and death. In the secondary setting, transition can be narrowed to those activities of high school, graduation, further education, and the initial years of employment.

As students leave the protective and controlled environment of the secondary school and embark on the ever-changing path of life, it is necessary that they have the basic skills and attitudes necessary to adapt. Because people face changes daily in their lives, not only the ability to find specific information is needed but also a means to evaluate the alternatives and consequences of decisions is needed.

Specific information on the various areas of concern in a student's transition from the secondary school to that which comes after can be found in the related problem areas listed earlier. In addition to the other generalizable skills needed in all occupations, there are areas such as identifying careers, obtaining information about agriculture, how businesses operate, and personal skills of managing finances and using microcomputers. All these areas play a role in one's ability to change as life requires it.

This problem area deals with the attitudes and skills needed to understand that changes will occur and how one can respond to those changes.

TRANSPARENCY MASTER #1

Attitudes That Favor Change

Optimism

Self-Confidence

Flexibility

Enthusiasm for Life

Willingness to Accept Uncertainty

Self-Control

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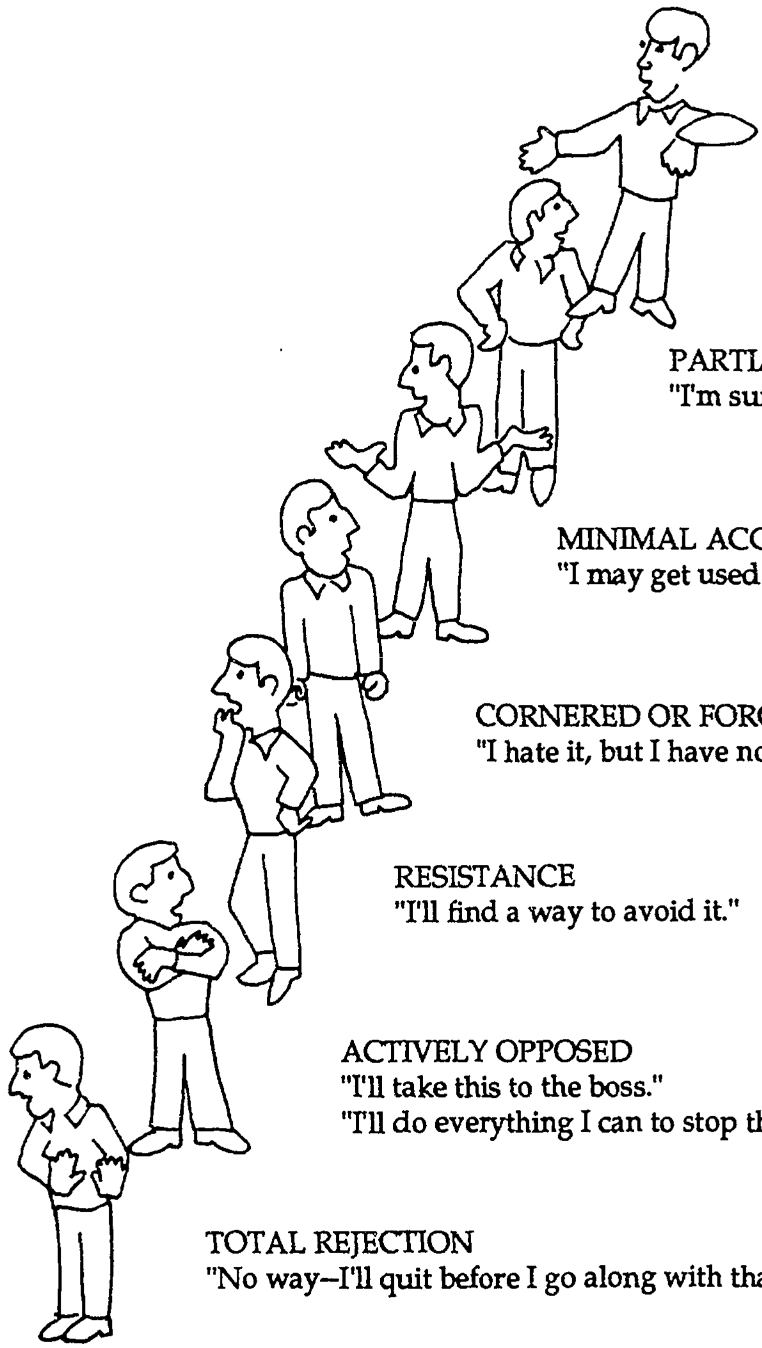
Adapted from Occupational Survival Skills, DAVTE / ISBE

TRANSPARENCY MASTER #2

Scale of Acceptance and Rejection



TOTAL ACCEPTANCE
"Frankly, I welcome the change."

PARTIAL ACCEPTANCE
"I'm sure it will be worth it in the long run."

MINIMAL ACCEPTANCE
"I may get used to it eventually."

CORNERED OR FORCED ACCEPTANCE
"I hate it, but I have no choice."

RESISTANCE
"I'll find a way to avoid it."

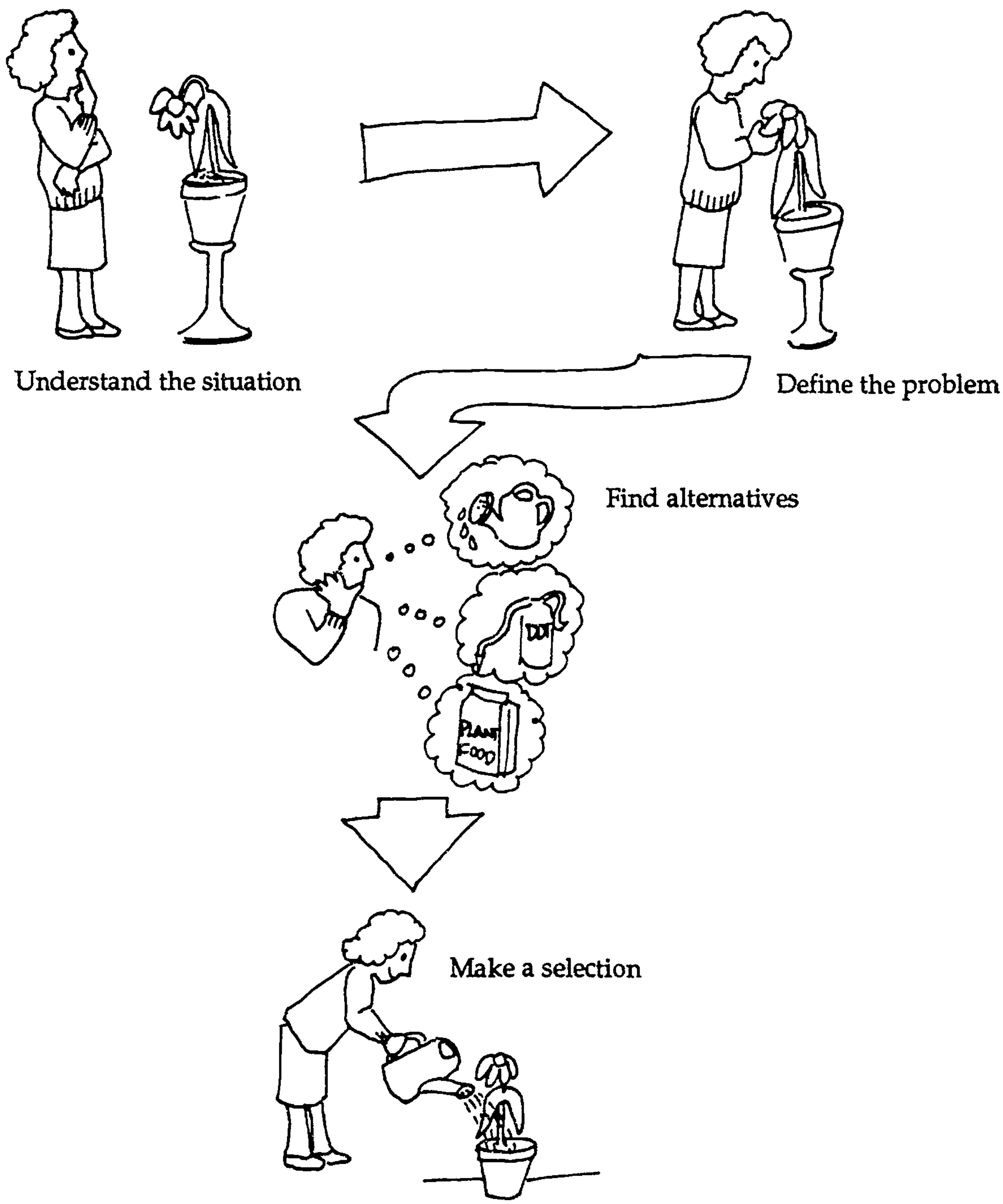
ACTIVELY OPPOSED
"I'll take this to the boss."
"I'll do everything I can to stop this."

TOTAL REJECTION
"No way–I'll quit before I go along with that."

Adapted from Occupational Survival Skills, DAVTE / ISBE

TRANSPARENCY MASTER #3

Decision Making Steps

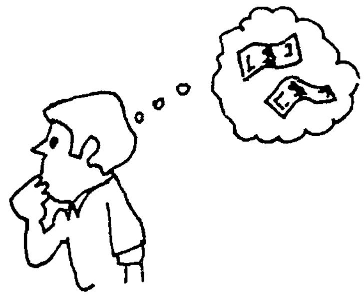


Adapted from Occupational Survival Skills, DAVTE / ISBE

TRANSPARENCY MASTER #4

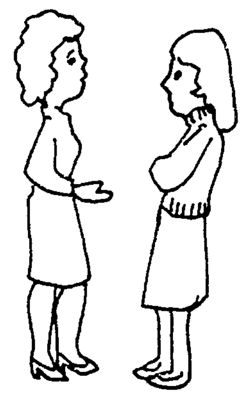
Finding Alternatives

1. **Accept the change** by being aware of its good points and minimizing its bad points. For example: "The required overtime will be an inconvenience for me, but I can use the extra money. I will just have to plan my time more carefully."

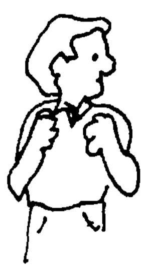


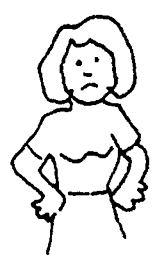
2. **Compromise or substitute.** For example: "The required overtime work interferes with a course I am taking at the community college. I would be willing to work late on the evenings when I don't have class."

3. **Request not to comply.** For example: "My workload is light as it is. I have been using my extra time to reorganize the records. I don't think it would be productive for me to work overtime, so I request that an exception be made in my case."



4. **Fight the change.** For example: "The required overtime is not outlined in our contract. I am taking this to the union."





5. **Refuse** (and take the consequences). For example: "I will not work overtime."

TRANSPARENCY MASTER #5

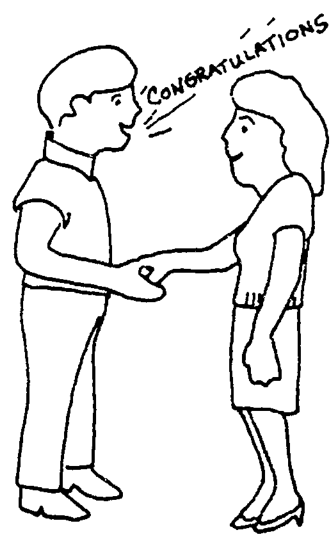
Making a Selection

What is the **Worst** Thing That Could Happen as a Result of Your Decision?

How can you avoid the worst result?

What is the **Best** Thing That Could Happen as a Result of Your Decision?

How can you increase the chances of getting the best results?



Can you combine or improve any of your alternatives?

Adapted from Occupational Survival Skills, DAVTE / ISBE

TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #1

1. Optimism — By looking at the positive aspects, we can accept change more readily.

2. Self-Confidence — Confidence in our ability to handle change will make it more acceptable to us.

3. Flexibility — Accepting and responding to change, instead of being set in out ways will help us make our actions realistic.

4. Enthusiasm for Life — A high level of energy and willingness to act helps us keep up with changes.

5. Willingness to Accept Uncertainty — Confusion and uncertainty often accompany change, especially in its early stages.

6. Self-Control — A person who can control anger, resentment, fear, dissatisfaction, etc. can analyze more clearly and act more sensibly in coping with change.

Transparency Master #3

1. Explain the first two steps of the decision making process.

   A. Understanding the situation means asking questions:

      1) What is happening?
      2) When is it happening?
      3) Why is it happening?
      4) How is it happening?
      5) Who is involved?

   B. Defining the problem means taking the information you have gathered and determining exactly what the problem is.

2. Introduce Student Worksheet #6 by explaining that its purpose is to illustrate and examine these first two steps in the decision-making process.

Transparency Master #4

Use in conjunction with Student Worksheet #4.

Transparency Master #5

Use in conjunction with Student Worksheet #5.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Attitudes Towards Change (with discussion guide)

STUDENT WORKSHEET #2 — Learning to Accept Change (with discussion guide)

STUDENT WORKSHEET #3 — Coping with a New Boss

STUDENT WORKSHEET #4 — Finding Alternatives

STUDENT WORKSHEET #5 — Making a Selection

STUDENT WORKSHEET #6 — Role-Playing Situations and Worksheet (with discussion guide)

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Attitudes Towards Change

DIRECTIONS: Use the following scale to express your opinion on the following statements — be honest with yourself!

5 = Strongly agree
4 = Agree
3 = Partly agree
2 = Partly disagree
1 = Disagree
0 = Strongly disagree

____ 1. In these days of rapid progress all around us we cannot afford to be slow to learn new ways of doing things.

____ 2. I must be certain that doing something differently is worthwhile before I try it.

____ 3. As soon as I hear something new, I like to try it.

____ 4. Too much time and energy is wasted on experimenting with new ideas before enough is known about them.

____ 5. I always try to keep myself up to date.

____ 6. When it comes to using new methods of doing things, I prefer to be a follower rather than a leader.

____ 7. I am always eager to learn about new developments.

____ 8. If I like things the way they are, I see no reason for making changes.

____ 9. If I hear about something new, I feel restless until I try it.

____ 10. Making changes creates too many problems and pressures. I'd rather relax and enjoy what I have.

____ 11. I'm always looking for new ways of doing things faster and better.

____ 12. Years of experience have made things the way they are — they're dependable.

Adapted from Occupational Survival Skills, DAVTE / ISBE

STUDENT WORKSHEET #1 — Discussion Guide

1. Remind students that the odd-numbered statements favor change. The even-numbered statements oppose change.

2. The higher the total score on the odd-numbered statements, the more the student favors change. Maximum possible score is 30.

3. The higher the total score on the even-numbered statements, the more the student favors change. Maximum score is 30.

4. Do scores show a consistency for or against change?

STUDENT WORKSHEET #2

Learning to Accept Change

Your instructor will give you an example of a change you might experience on a job. Examine the change, list the good and bad points of the change, and develop ways of minimizing the bad points.

Describe the Change:

Good Points:

1.
2.
3.
4.
5.
6.

Bad Points:

1.
2.
3.
4.
5.
6.

Ways of Minimizing Bad Points

Adapted from Occupational Survival Skills, DAVTE / Illinois

STUDENT WORKSHEET #2 — Discussion Guide

1. Use examples of situation that can occur on the job:

   A. Moved from day to night shift.

   B. Required overtime.

   C. Indefinite layoff.

   D. Passed over for promotion.

   E. Personality clash with new co-worker.

   F. Hours cut in half.

   G. Fired for too many absences.

   H. Promoted to supervisor.

2. Outline good and bad points, and ways to minimize the bad points of being promoted to supervisor:

   A. Good

      1. Higher pay
      2. More interesting work

   B. Bad

      1. Learning new job requires time and effort
      2. More pressure
      3. More responsibility

   C. Ways of decreasing bad points

      1. Plan ahead and ask for help
      2. Regard responsibilities as a challenge
      3. Organize time to do best job

3. Divide students into small groups and assign each a different situation; have students complete the worksheet.

STUDENT WORKSHEET #3

Coping with a New Boss

You work in a very busy office. You enjoy your work, even though the pace is often hectic. You have managed to organize your work so that you usually have time to finish everything, even with many interruptions during each day.

Mrs. Elkins, your boss, retired a month ago. Your new boss, Mr. Faulkner, seems pleasant and agreeable. He has appreciated your efforts to help him find things in the office and to help him get used to his new job.

There is just one problem. Mr. Faulkner's wife has stopped by the office several times to ask you to type her secretary's report for her service club. You don't mind doing the typing for her, since the reports are short. However, she always brings them to you on Thursday afternoons, your busiest time, and she wants them typed right away. You are lucky to get all your usual work done on Thursdays.

Understand the Situation: Summarize the facts.

Defining the Problem: State it simply.

Adapted from Occupational Survival Skills, DAVTE / ISBE

STUDENT WORKSHEET #4

Finding Alternatives

Assume that you are the person described in the situation on Student Worksheet #3. Write down at least one alternative way you could use to cope with the change described in each of the five ways listed below.

1. Accept the Change

2. Compromise or Substitute

3. Request not to comply

4. Fight the change

5. Refuse (and take the consequences)

Adapted from Occupational Survival Skills, DAVTE / ISBE

STUDENT WORKSHEET #5

Making a Selection

1. What is the *worst* thing that could happen as a result of your decision?

2. How can you avoid the worst result?

3. What is the best thing that could happen as a result of your decision?

4. How can you increase the chances of getting the best result?

5. Can you combine or improve any of your alternatives?

Adapted from Occupational Survival Skills, DAVTE / ISBE

STUDENT WORKSHEET #6

Role-Playing Situations and Worksheet

SITUATION #1

Brian Gunderson has been with the company for seven years and is in his late twenties. He heard about an opening for a supervisory position in another department and told his supervisor he would like to apply for it. His supervisor felt he had a good chance for the position and recommended him highly. Word has just come down that someone else got the job, and Brian's supervisor is on the way to inform him of the decision.

Role — Brian Gunderson

You have really been counting on this promotion. You like your job somewhat, but you feel like you're getting nowhere. This promotion is your chance to show how capable you are. You know you've been there longer than anyone else applying, and your supervisor gave his full support.

Role — Supervisor

You're really sorry that Brian didn't get the promotion, and you hate having to tell him. He's your most valuable worker, but his talents are being wasted in his present position. He's not going to be too happy to learn that the job went to Anne Perry, a young woman who's only worked here a year. Of course, she's worked in that department all that time and is familiar with its workings. And she is very bright and efficient.

SITUATION #2

Margaret Turner has been working in the factory for over a year now on the day shift. She just received notice that starting next week she will be moved to night shift. She's on her way to talk to her supervisor.

Role — Margaret Turner

You are really opposed to working the night shift. You're in a bowling league Thursday nights, and you're taking a course at a local junior college Monday and Wednesday nights. It's really going to disrupt your social life and home life too — your husband won't like it at all. How can they do that to you?

Role — Supervisor

Work orders are down, and 25% of the work force is being laid off. Another 10% are being switched to night shift to fill the vacancies left by those laid off. Everyone's upset and complaining to you — what a mess.

SITUATION #3

Jennifer Hanes has been working part-time in the billing office of a major department store for fifteen years. One of the other workers just came out of her supervisor's office very upset, and now the supervisor has sent for Jennifer.

Role — Jennifer Hanes

This job is just perfect for you. It's only half-time, so keeping up with your household chores is no problem. You love your work and the people with whom you work. The extra money has also been helpful over the years.

Role — Supervisor

Word just came down from upper management that as an economy move all part-time help was to be let go and their duties assumed by the full-time employees. Most of the part-time workers in this department have been here a long time and it's really tough for you to break the news to them. The only hope you can offer is that you will welcome them back if you start rehiring.

Adapted from Occupational Service Skills, Illinois DAVTE

Observer's Worksheet

UNDERSTANDING THE SITUATION	Brian Gunderson	Margaret Turner	Jennifer Hanes
What's happening?			
Why is it happening?			
How is it happening?			
Who is involved?			
DEFINE THE PROBLEM			
How effective was the worker in finding out about the situation?			
What problems did he/she have in getting the information? What other problems could have developed?			
How else might this situation be handled? What other questions would you have asked?			

STUDENT WORKSHEET #6 — Discussion Guide

1. Six students are needed for the role-playing — two for each situation outlined. Emphasize that the purpose of the role-playing is to understand the situation, *not* to make a decision.

2. While the six students are preparing for the role-playing, distribute Student Worksheet #6. Instruct the class in their duties as observers.

3. Set the scene by introducing the participants and reading the situation to the class.

4. Begin the action, and serve as a sympathetic prompter if difficulties arise. Cut the action when the situation has developed sufficiently.

5. Using the Observer's Worksheet as a guide, have the class comment on the effectiveness of the worker in the role-playing exercise.

6. Proceed with the second and third role-playing examples as time permits.

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Identifying and Practicing Ethics in Agricultural Occupations

RELATED PROBLEM AREAS:

1. Developing Human Relations Skills in Agriculture (Central Core Cluster)
2. Understanding Agricultural Law Applications (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S) None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum
Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D
Research Assistant: James K. Shinn

ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*
- ☐ Language Arts
- ☐ Mathematics
- ☐ Sciences
- ☐ Fine Arts
- ☒ Social Sciences
- ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to demonstrate a knowledge of the basic concepts of the social sciences and how these help to interpret human behavior.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Know the relationship between childhood experiences and adult personality.					
2. Understand the importance of one's own values in developing a healthy, mature, and realistic concept of self.					
3. Analyze the causes of antisocial behavior.					
4. Understand how customs, traditions, and followings shape human behavior.					
548					549

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Recognize that relationships between individuals are supported by a variety of forms of communication. 2. Recognize that relationships between individuals and groups are maintained through a variety of support systems.					
3. Analyze the complex relationships existing among individual consumers, business, industry, and government entities.					
4. Identify the attitudinal skills which affect worker performance.					
5. Understand that a society's values tend to grow out of its traditions.					
6. Understand that all relationships entail rule-guided duties, responsibilities and obligations.					
7. Distinguish between rights and responsibilities of employers and workers in the work place.					
8. Analyze the roles of the individual in the world of work.					
550 9. Analyze the relationship between individual and societal value systems.					551

ISBE 41-76 (1/86)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Identifying and Practicing Ethics in Agricultural Occupations

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Identify who sets the standards of conduct or behavior of people.
2. Explain the meaning of ethics.
3. Explain how one becomes an ethical person.
4. Explain how different situations call for different sets of ethical standards or behaviors.
5. Define ethics in the workplace.
6. Explain how ethical behavior in the workplace can carry over into activities outside of work.
7. Explain how ethical behavior on the part of middle managers or supervisors influences others.
8. Discuss the difference between ethical behavior and legal requirements.
9. Analyze the difference in ethical behavior among different societies and explain why these differences exist.
10. Demonstrate their understanding of the mentoring process in agribusiness by citing personal examples.
11. Demonstrate ethical behavior in school and on the job through FFA and SAE programs.
12. Demonstrate their understanding of individual rights by explaining orally a logical solution to conflicts resulting from individual rights being abused.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Identifying and Practicing Ethics in Agricultural Occupations

PROBLEMS AND QUESTIONS FOR STUDY	INSTRUCTOR'S NOTES AND REFERENCES

1. What are ethics?
2. Who decides what is ethical and what is not?
3. Do ethics change? If so, when and how?
4. How do ethical issues differ from legal issues?
5. Can a person be ethical and not legal?
6. Can a person be legal and not ethical?
7. How are ethics determined in the workplace?
8. How do ethics of work carry over into the rest of one's life?
9. Do ethics differ in different societies? Why? Why not?
10. Must individuals have different ethical standards for different situations?
11. Do ethical requirements differ with various levels of management in business? If so, how?
12. What ethical concerns are there with regard to:
    a. Agribusiness competitors?
    b. Agribusiness customers?
    c. Agribusiness suppliers?
    d. Agribusiness employers, their families and friends?
    e. Agribusiness employees and the community?
13. What do you owe your employer, ethically?
14. What does your employer owe you, ethically?
15. What is and how does the mentoring process in agribusiness work?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Identifying and Practicing Ethics in Agricultural Occupations

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area by citing a situation which has raised some ethical questions. The situation could be from local, state, or national news, or a school related issue. Ask students to explain why the situation has become an issue of concern. Use the opportunity to give an overview of the problem area.

2. An alternative way to introduce the problem area is to project Transparency Master #2 and reveal the questions for consideration (one at a time). Through guided class discussions of questions, develop an overview of the problem area.

3. Involve students in a discussion on how ethics in society are determined and ask for examples of how they have changed over time.

4. Ask students to distinguish between ethical and legal concerns. Draw from this discussion the point that someone can be legally right but ethically wrong.

5. Have the class identify how ethical standards differ in different societies and discuss why this is so.

6. Develop a list of ethical standards students would expect to find in the workplace.

7. From the list developed in item 6 (above), ask students which ethical standards apply only to the workplace and which carry over into life situations outside of work.

8. Have class identify those ethical standards they are familiar with which they feel are unfair and discuss the reasons for their existence.

9. Discuss with the class how ethical standards are seen from the employer's side and how they change as an employee moves up in the company.

10. Have students complete one or more case studies which require application of ethical standards the students already possess.

11. Utilize opportunities to point out the need for ethics when discussing individual standards, FFA or SAE programs.

INSTRUCTOR'S NOTES AND REFERENCES

ERIC

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agi.cultural Occupations

PROBLEM AREA: Identifying and Practicing Ethics in Agricultural Occupations

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Human Relations in Agribusiness.* Hillison, J., Crunkilton, J., Lee, J.S. (1980). McGraw-Hill Publishing Company, 1221 Avenue of the Americas, New York, NY 10020.

2. *Essential Aspects of Career Planning and Development.* (1977). Atherton, J.C., and Mumphiey, A. 2nd ed. Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

3. *Agricultural Business Sales and Marketing.* (1984). Stewart, B.K., McCaskey, M.J., Mullinex, M.K. Catalog Number AG-S1-I, Instructional Materials Laboratory, 10 Industrial Education Building, University of Missouri-Columbia, Columbia, MO 65211.

4. *Human Resource Management, Employer/ Employee Relationships.* (1988). (Subject Matter Unit #8716-B). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Work Ethics in Agribusiness

INFORMATION SHEET #2 — Specific Issues Addressed

INFORMATION SHEET #3 — Mentors in the Workplace

TRANSPARENCY MASTER #1 — Essentials for Agribusiness Growth

TRANSPARENCY MASTER #2 — Code of Ethics (with discussion guide)

INFORMATION SHEET #1

Work Ethics in Agribusiness

The competent employee has a code of ethics or some basic philosophic principles which determine the employer's attitudes and direct his or her actions. The quality of work done is a direct result of the philosophy of the individual. The relationship with the management of the firm and with the other employees is determined, at least partially, by the convictions of the worker. Each person operates within the framework of personal beliefs and prejudices.

It would be worthwhile for the worker to examine his or her basic attitudes and to make revisions in them if there is sufficient reason for doing so. Since one's behavior is closely associated with this, it seems wise that one make a conscious effort to build and maintain a philosophy that would be conducive to building a successful career.

The competent employee is a student of the field in which he or she is employed, and more particularly of the area of specialty. The employee is continually adding to his or her knowledge, skills, understanding, and appreciation of this observation. Related information is not slighted. Conferences and improvement discussion sessions are welcomed. There is maintained a willingness to apply new and improved practices in the performance of duties. More effective procedures are welcomed and used when feasible.

The capable worker is loyal to the firm and its members. The employee supports the efforts of the business. The employee works responsibly with those with whom he or she is associated. The employee supports the decisions of the organization. The employee has no part with envy, strife, backbiting, and jealousy. Confidences are zealously safeguarded and gossip, both the telling and listening to it, is avoided.

The competent worker recognizes the need for an orderly system of operations within the business. The worker respects lines of authority and follows them. The worker strives to be fair to both superiors and those over whom control is exercised. The employee sets an example for others by his or her exemplary behavior.

The effective worker recognizes and accepts the obligations which accompany every right and privilege he or she enjoys. There is a recognition that the right to hold a job and to receive good wages carries a corresponding responsibility to earn these rights. The right to enjoy the privileges of an adult member of society are accompanied by the obligation to act in ways acceptable to citizens of the community. The right to freedom of opinion places upon the individual the obligation to respect the opinions of others. The right to continued development and growth through education is predicated upon one's duty to put forth effort to become better educated. The right to the fruits of society and its achievements carries a responsibility to be productive so that there will be even more abundant goods available for the use of all.

Almost all businesses have high standards for their managerial personnel. To reach the top levels within a firm an individual must "measure up" to the ideals set for persons who occupy such positions. The young employee will find it to his or her advantage to incorporate these behavior patterns into life early in his or her career. Since this is what management is seeking, it seems logical that one should show through one's attitudes and actions that one has those qualities.

Self-discipline and dedication are involved along with some personal sacrifice, but the results are rewarding and much satisfaction comes to one who knows that one's duties have been well done and that his or her efforts have been appreciated. Returns usually come in two forms. There are the promotions with accompanying responsibilities and higher incomes. Then there is the internal feeling of well-being which comes from the realization that one has had a part in contributing to the welfare of the company and that one's efforts have been useful.

One may get a better insight into difficulties that arise in daily tasks if these are accepted as opportunities to exhibit one's skill, ability, and ingenuity. In most jobs, if it were not for the problems involved, there would be little need for the worker being retained on the payroll. The task of the employee is to comprehend the problem, to visualize one's capabilities to handle the difficulty, and then solve the job through appropriate action. This is what makes the individual valuable to the firm.

From *Essential Aspects of Career Planning and Development*, 2nd ed., by J.C. Atherton and Anthony Mumphrey. Danville, IL: Interstate Publishers, Inc., 1977.

INFORMATION SHEET #2

Specific Issues Addressed

Each person has either consciously or unconsciously developed a personal code of ethics. Many forces were brought to bear upon each individual which resulted in the particular code of ethics that person adheres to. Some of those forces were and may continue to be: parents, siblings, neighbors, peers, teachers, religious affiliations, coaches, community leaders, employers, media (television, radio, motion pictures, and entertainers), and society as a whole. These forces helped to shape each person's ethical code which in turn affects how each individual deals with such issues as: honesty, loyalty, willingness to learn, willingness to assume responsibility, respect for authority, ability to get along with others, willingness to cooperate, rules and regulations, tardiness and absenteeism, personal image, motivation, personal effort, willingness to consider other's points of view, willingness to act alone contrary to the group when appropriate, and many others.

All of these issues and many more are addressed almost daily by everyone to some degree. A code of ethics causes each person to deal with these issues so that there is the least amount of inner conflict. However, there will be times when the code of ethics of an individual is not sufficient to handle a situation and an adjustment is called for. Those individuals that are open enough to see the need for change, carefully analyze the situation and its requirements, and make appropriate adjustments will lead happier, more satisfying and successful lives. Just as the Transparency Master #1 depicts sending and receiving messages and making adjustments, it is necessary for the employer as well as the employee to adjust so that the model works.

INFORMATION SHEET #3

Mentors in the Workplace

Agribusiness, like most other industries, has gradually developed either formally or informally, a mentoring system to aid employees at all levels within a business. Webster's New World Dictionary defines a mentor as: 1) a wise, loyal advisor, 2) a teacher or coach. For a young person a parent, relative, neighbor, or older friend may serve in this capacity. In school a teacher or coach may take over this function partially or totally, but when an individual begins to work as an employee it is more beneficial for a mentor to be someone higher up in the company with several years experience that is respected by those he or she supervises and is supervised by. Depending on the size of the company and the number of levels of management or supervisors, there may be several mentors that work with employees under their supervision.

A mentor looks for individuals that demonstrate an ability to do well and will then work with those individuals to see that their efforts are not wasted. If as a beneficiary of a mentor, an employee takes advantage of the help and assistance, the employee and the employer will benefit considerably. Mentors are usually individuals who have accepted the responsibility of making individuals who show potential aware of such things as: company philosophy, company image, short-cuts to success, company policy on and off the job, informal unwritten ways in which to deal with situations, introduction to important others within and outside of the workplace, and much more. Certainly nothing unethical or illegal would be engaged in because everything that a mentor would know would also be available to any employee. The important issue is that a mentor can cause things to happen at a more rapid pace for those willing to listen and work. Suggestions may be as simple as indicating a way to do something which will increase a person's efficiency many times. The person, in time, may come to realize this on his or her own, but because the mentor suggests it, results are achieved earlier. A mentor may see great potential in an individual but also detect some small trait or characteristic in that same individual that could delay his or her advancement and through friendly coaching speed up the advancement process.

As individuals advance, mentors often change because advancement has resulted in the individual's exceeding the ability of a previous mentor to help. Agribusiness personnel see the mentoring system as an ethical way to assist young people in becoming successful because it not only benefits the young person but the business as well. Many times a mentor may see potential in an individual which even the individual does not recognize but through the mentoring process that person becomes successful. In ethics it is important to be open to other points of view and value others' opinions. Here is an example of where an ethical code for openness can pay off well. Mentors generally do not announce their position and purpose but appear as friendly helpful employees, supervisors or managers. This unannounced plan serves to strengthen their belief in an individual by checking his or her response to suggestion.

A final word or statement: Once mentored it is important to become a mentor. All will benefit.

TRANSPARENCY MASTER #1

Essentials for Agribusiness Growth

Employer Sender → Encoding → Message → Decoding

↓

Employee Receiver

↓

Reaction → Feedback → Analysis

↑

Adjust

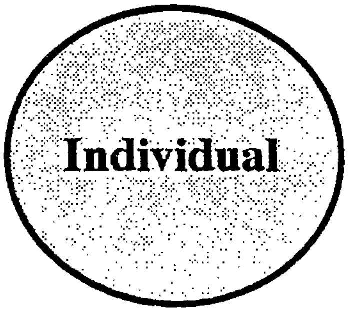
↑

Employer Sender

TRANSPARENCY MASTER #2

Code of Ethics

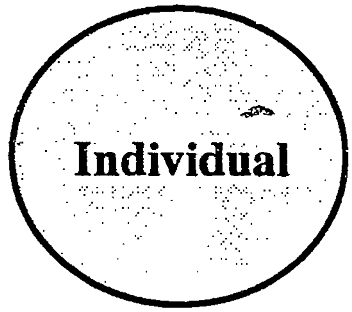
Code of Ethics



As individuals move closer to one another issues become more apparent.
Questions for consideration:

1. Should the code of ethics circles ever touch?
2. Should the code of ethics circles ever overlap?
3. Should the code of ethics circles always remain separated to some degree?
4. Should the code of ethics circles completely overlap one another?
5. Should the code of ethics circle of one individual change its relationship to another individual's code of ethics circle as situations change? Why or why not?
6. How are these decisions made?
7. What results when there is disagreement over the position of the code of ethics circles?

Code of Ethics



TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #2

Transparency Master #2 consists of two transparencies which should be placed one over the other and slid back and forth to demonstrate the different situations in the questions for considerations.

It is not the intent of this exercise or problem area to tell students what code of ethics they should have, rather this entire problem area is designed to get students to think about the ethical codes they have. It is also the intent of this problem area to have students evaluate their individual code of ethics to see if adjustments are called for based upon classroom discussion and critical thought of areas

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — The Loyal Employee

STUDENT WORKSHEET #2 — Conflict

STUDENT WORKSHEET #3 — The New Employee

STUDENT WORKSHEET #4 — Quiz

STUDENT WORKSHEET #5 — Work Ethics *for* Agribusiness

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

The Loyal Employee

CASE STUDY: Read the following case study and write an essay for your response.

This case pertains to the loyalty of the boss. Assuming Norman is a loyal employee, what should he do?

Norman Jones, an employee in a farm supply store, has sold goods in this store for a number of years. He has come to know and to appreciate his co-workers and the manager of the business office. As far as he knows, the store has always attempted to give good service to its customers.

This afternoon, Wayne Wilson, ordinarily an intelligent and mild-mannered local farmer, came into the store very upset. An insecticide which he had purchased at the store and applied to his alfalfa had seriously damaged the crop. Wayne believed the store manager had deliberately sold him the wrong kind of insecticide.

Wayne and a group of neighbors have been pooling their orders and ordering protein supplement directly from a soybean processing plant. By ordering in carload lots and splitting it among members of the group, they can purchase the supplement much cheaper than the store can afford to sell it to them. Wayne believes this is the reason the store manager sold him the wrong insecticide for his alfalfa.

Wayne came to the counter and demanded in a loud voice to see the manager. Norman looked for the manager but couldn't find him. Wayne did not want to wait, so he left the store mumbling to himself. When the manager came in, Norman related the story for him. They found the sales slip which gave the name of the insecticide which was sold to Wayne Wilson. It was appropriate for alfalfa. They read the instructions and decided Wayne must have made the spray mixture too strong.

Since the agricultural business didn't want to offend a customer, the manager asked Norman to drive out to Wayne Wilson's farm and explain the situation to him. When Norman arrived at the farm, he found a neighbor of Wayne's helping him assemble some machinery. Norman carefully explained what must have happened, showing Wayne the sales receipt. Like most of us, Wayne did not want to admit the damage to his alfalfa was his fault. Wayne was critical of the store, and said, "The store manager deliberately gave me wrong information."

STUDENT WORKSHEET #2

Conflict

CASE STUDY: Read the following case study and write an essay for your response. Address what legal and ethical alternatives Alvin should consider. Make a specific recommendation and defend it on ethical grounds.

The following is a case of an employee in conflict with his immediate supervisor. What would you expect the foreman, Alvin, to do with this employee? How do you feel about Jake's comments?

The Quick-Trim Landscaping Company is a small agricultural business which employs various teams of workers to perform a variety of duties. The company has contracts for maintenance of cemeteries, parks, etc. It also establishes new lawns. Within each work team, some tasks are more specialized than others. Alvin Meyers, the foreman of one six-person work crew, likes each individual to be familiar with a number of tasks and a variety of skills. When an individual is absent or is sick, another person from the same group can take over the responsibilities. These new skills are taught to the workers during slack periods in certain seasons of the year.

Last week, Alvin asked Jake Hanson, one of the oldest employees in his group, to learn how to operate a surveyor's level. The instrument is used in determining field grades and drainage ditch routes and in selecting and checking the level of seed bed on an area to be landscaped. Jake is a 35-year old employee who is married and has two school-age children. He has very little initiative; in fact, he has had trouble keeping a job. He hasn't had much to say, keeping to himself and doing only what was asked of him. When Alvin asked Jake to use the level, he replied, "I'm not getting paid to run that thing and do that kind of work. I don't want anything to do with it."

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STUDENT WORKSHEET #3

The New Employee

CASE STUDY: Read the following case study and write an essay for your response. Address what legal and ethical alternatives Lynn should consider. Make a specific recommendation and defend it on ethical grounds.

Lynn, a recent high school graduate, has been employed by a local farm machinery dealer. Lynn would like to become a machinery salesperson, and the owner agreed to train Lynn in the sales department. Lynn discovered that considerable knowledge was required about various pieces of equipment. In order to learn as much as possible and in the shortest period of time, she took advantage of her free time during the lunch hour and passed up the afternoon coffee break and went to the equipment showroom to read display folders and instruction manuals. The owner of the company observed Lynn and gave her extra materials which he thought would be helpful. Also, at times Lynn came in a little early in the morning to observe equipment that was in the shop.

After a couple of weeks, one of the older employees privately told Lynn, "You are new here and the sales staff likes you; but there are a few things you should know. You are not going to receive any advancements. I have been here ten years and am still making the same as when I started. The other employees do not like your coming to work early and failing to take a coffee break. This casts a reflection on the rest of us. You might as well take it easy, and we will all get along better."

STUDENT WORKSHEET #4

Quiz

MULTIPLE CHOICE: Write the letter of the correct answer in the space provided.

_____ 1. Many occupations deal primarily with machines, equipment, or paper work; that is, they deal with things. In business, however, most of the jobs involve close contact with (a) employers, (b) supervisors, (c) people, or (d) other workers.

_____ 2. The best way to achieve occupational goals is to follow one's rights and desires and also (a) the wishes of your boss, (b) the advice of co-workers, (c) the Golden Rule, or (d) just what you feel like doing.

_____ 3. Do the best work possible for the important jobs and (a) don't worry about the little jobs, (b) let others do the little jobs, (c) also do the most routine jobs, or (d) everything else will take care of itself.

_____ 4. In addition to doing the best work possible, it is important to (a) learn as much as possible about the company, (b) see what you can get on your boss, (c) keep up on the latest gossip, or (d) be seen and not heard.

_____ 5. The right to think and act as individuals (a) is not, (b) may be, or (c) is normally shared by most people.

_____ 6. Which of the following do most people have in common? (a) Right to work at a job of own choice, (b) desire to get ahead, (c) desire to be accepted and approved, (d) all of these, or (e) none of these.

_____ 7. Which of the following is *not* a desirable trait of an employee? (a) Sense of humor, (b) tact, (c) indifference, or (d) initiative.

_____ 8. Exploiting others for gain is (a) desirable, (b) okay if you can get away with it, (c) undesirable, or (d) not too bad.

_____ 9. When one is criticized by a superior, it is best to (a) act indifferent, (b) tell him to do it himself, (c) take it constructively, or (d) shrug it off.

_____ 10. Loyalty includes (a) working hours only, (b) both the time to and from work, (c) all the time, or (d) just when you feel like it.

_____ 11. To approach a job with enthusiasm, it is necessary to (a) fool the boss, (b) impress your co-workers, or (c) be glad to be part of the team.

_____ 12. A good way to get along in a new job is to (a) be willing to learn, (b) impress co-workers with knowledge, or (c) ask the boss.

_____ 13. To show a willingness to work means to (a) work as hard as possible, (b) be willing to perform any job assigned, or (c) work harder than co-workers.

_____ 14. An employee's business morale is (a) beyond the employee's control, (b) a matter for the boss, (c) each employee's responsibility, or (d) unimportant.

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STUDENT WORKSHEET #5

Work Ethics *for* Agribusiness

Information Sheet #1 was written as a guide for employees to follow from the business point of view.

Ask students how they feel about these statements and how they might like to change them. Ask students to develop an equally comprehensive set of statements for employers called "Work Ethics *for* Agribusiness". You may wish to use the Information Sheet as a basis for class discussion or as a basis for written assignments. In either case students should be required to *present* and *defend* their position.

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Gaining Employment in an Agricultural Occupation

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture
3. Developing Mathematics Skills in Agriculture
4. Developing Transition Skills in Agriculture
5. Identifying and Practicing Ethics in Agricultural Occupations
6. Developing Problem Solving Skills in Agriculture

PREREQUISITE PROBLEM AREA(S)

1. Developing Human Relations Skills in Agriculture
2. Developing Safe Work Habits in Agricultural Occupations
3. Developing Communications Skills in Agriculture

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Language Arts and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to read, comprehend, evaluate, and use written material.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Locate information that is explicitly stated in the text.					
*2. Summarize the important ideas of the text and the important supporting details.					
*3. Adjust their strategies for reading and understanding, using decoding skills, context clues, self questioning, predicting, use of reference materials, rereading and adjusting rereading speed based on the demands of the reading situation.					
*4. Explain and verify answers to questions about what has been read.					
5. Identify personal career goals and evaluate occupational options.					
6. Locate and obtain information concerning employment opportunities.					
7. Apply for a job.					
572					573

ISBE 41-78 (1/88)

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Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to listen critically and analytically.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Evaluate the content of an oral message of an appropriate length.					
*2. Respond effectively and appropriately to oral messages.					
3. Interview for a job.					
4. Describe techniques for responding to a conflict on the job.					

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Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the knowledge and skills required for success in selected fields of work.					
*2. Understand how employers, labor unions, managers, and workers interact with one another to achieve a common goal.					
*3. Recognize that competence in a field of work entails the development of a wide range of skills.					
*4. Distinguish between rights and responsibilities of employers and workers in the work place.					
5. Identify personal career goals and evaluate occupational options.					
6. Identify skills necessary to keep a job.					
7. Describe techniques for responding to conflict on the job.					
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LEARNING ASSESSMENT PLAN

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Submission Date ______

☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to write standard English in a grammatical, well organized, and coherent manner for a variety of purposes.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know the purposes of public and personal writing.					
*2. Use the various forms of public and personal writing.					
*3. Use information from other sources when writing.					
4. Locate and obtain information concerning employment opportunities.					
5. Apply for a job.					
575					

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LEARNING ASSESSMENT PLAN

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Submission Date ______

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Expand or limit a topic for an oral presentation to meet time, setting, and audience needs.					
*2. Organize information in an oral message.					
*3. Organize a persuasive oral message.					
4. Interview for a job.					
5. Describe techniques for responding to conflict on the job.					
530					
					531

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Gaining Employment in an Agricultural Occupation

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define terms integral to gaining employment.
2. Identify personal career goals and evaluate occupational options.
3. Describe basic occupational competencies desired by employers.
4. Identify personal occupational competencies and compare them to those desired by employers.
5. Locate and obtain information concerning employment opportunities.
6. Apply for a job.
7. Interview for a job.
8. Identify skills necessary to keep a job.
9. Describe techniques for responding to conflict on the job.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Gaining Employment in an Agricultural Occupation

PROBLEMS AND QUESTIONS FOR STUDY	INSTRUCTOR'S NOTES AND REFERENCES
1. How does one discover one's career goals?	
2. How does one identify one's career goals?	
3. How does one learn what career options are available?	
4. What personality characteristics are important to employers?	
5. What personal skills are essential for job success?	
6. How can one improve on the personal skills needed for success in gaining employment?	
7. Where can one locate available jobs?	
8. What is a resumé?	
9. How does one develop a resumé?	
10. How does one apply for a job?	
11. How does one interview for a job?	
12. What questions will a job seeker be asked during an interview?	
13. What questions should one ask a prospective employer during a job interview?	
14. How should one follow up a job interview?	
15. How should one decide whether to take a job that is offered?	
16. What if one is rejected for a job?	
17. Once one has a job how does one keep it?	
18. What are the conflicts that can occur on the job?	
19. How does one handle conflicts on the job?	

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Gaining Employment in an Agricultural Occupation

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use problem areas *Developing Human Relations Skills in Agriculture, Developing Safe Work Habits in Agriculture,* and *Developing Communications Skills in Agriculture* as prerequisite problem areas. The skills and habits introduced in these problem areas will supplement those developed in this problem area.

2. Use Transparency Master #1 and have students complete Student Worksheets #1 and #2. Ask students to compare their responses to the competencies desired by the employers. Lead students in a discussion of why these competencies are important in the workplace.

3. Distribute Student Worksheet #4 for students to complete. Discuss the characteristics listed. Have students ask a friend or relative to complete the worksheet also. Compare both sets of answers to assess personality strengths and weaknesses and make changes accordingly.

4. To assist students in becoming aware of their skills, distribute Student Worksheet #5. Students may need individual help in realizing their own experience and the skills they have acquired. Have students work on Student Worksheet #6 as they complete Student Worksheet #5.

5. Distribute VAS Subject Matter Unit 6001a — *Applying for a Job.* Divide the class into groups to present panel discussions on the topic areas presented in the VAS unit. Use VAS Slidefilm 390 — *Applying for a Job* to summarize essential facts.

6. Utilize Transparency Master #5 to review sources for locating jobs.

7. Organize and execute a field trip to a public or private placement office. Following the field trip, discuss the office's policies and how they affect job searchers and employers. Alternatively, invite a representative from a state employment agency to explain how employment agencies can help students gain employment.

8. Ask the local school counselor or school placement officer to explain the school's placement program if one is available.

9. Distribute Information Sheet #2. Following a discussion of each item listed, provide students with a copy of Student Worksheet #7 to complete.

10. Provide students with agricultural magazines and various newspapers to enable them to locate a job of personal interest. Distribute Student Worksheet #8 for the students to complete. Scissors and tape will be necessary for this activity.

11. Gather additional sample resumes from local sources to share with the students. Distribute and discuss Information Sheet #3 utilizing Information Sheet #4 and Information Sheet #5 as examples. Have students complete Student Worksheet #9. Have students develop their own resume or data sheet for the job selected in Student Worksheet #8 while utilizing this material. Provide additional examples if possible.

12. Distribute and discuss Information Sheet #6. Have students write a letter of job inquiry and a letter of job application for their selected job using this information and Student Worksheet #10.

13. Using Student Worksheet #11 have students fill out the job application form.

14. Divide the class into two groups of three students each with two copies of Student Worksheet #12. Have each student evaluate his or her own application, then, as a group, evaluate the others.

15. Distribute and discuss Information Sheet #7. Have students practice the correct procedures using play phones or unplugged telephones.

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Gaining Employment in an Agricultural Occupation

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES (con't.)

16. Distribute VAS Subject Matter Unit 6001b — *Applying for A Job*. A list of 94 questions frequently asked during an interview is given on pages #10 and #11. Ask each student in class how they would answer some of these questions. The questions could also be used when role-playing job interviews.

17. Ask students what they would want to ask a prospective employer about their selected job. Discuss which questions would be appropriate to ask during a job interview. After the discussion distribute Information Sheet #8.

18. Distribute and discuss Information Sheet #9. Point out how both verbal and nonverbal forms of communication affect the job interviewing process.

19. Have a student read aloud Information Sheet #10. Discuss what the prospective employer meant by the letter.

20. Distribute Information Sheet #11 and discuss as a class.

21. Invite a resource person (business owner, personnel manager, or principal) to discuss what he or she looks for on resumés, application letters and forms, and during interviews.

22. Utilizing the materials the students have developed for their selected job including their letter of application, resumé or data sheet, job research sheet, and interviewer questions, have the students interview for their job in a role-play situation. If possible, arrange to have each student interviewed by an adult that has been briefed on the student's selected job. Local administrators, teachers, alumni members, or agribusiness people may be selected as interviewers. Arrange to have the interview videotaped. Provide each interviewer in advance any materials included in this problem area that would be of assistance to the interviewer in preparing for the interview as well as a copy of the student's letter of application and resumé or data sheet. Arrange the available facility to resemble an actual interview situation. After the interview collect the interviewer's evaluation on Student Worksheet #13. Replay the interview videotape allowing the student to complete the evaluation form and discuss ways to improve the student's interviewing skills.

23. Distribute and discuss Information Sheet #12. Have students write a follow-up letter.

24. After distributing Information Sheet #13, discuss as a group.

25. Discuss good work habits. Ask students to consider their role as a student and as an employee. What type of work habits have they developed? What might they wish to improve on? Discuss the appropriate Transparency Master.

26. Invite a panel of local agribusiness people to discuss the importance of employee work habits and attitudes and how they affect the entire business.

27. Use Transparency Masters #6 through #10 and lead students in a discussion of conflicts that can arise on the job and various alternatives in responding to those conflicts.

28. Distribute Student Worksheet #15 and divide the class into small groups; have the students read the scenario and respond to the questions. Use the Key as a reference source.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Gaining Employment in an Agricultural Occupation

REFERENCES | **INSTRUCTOR'S NOTES AND REFERENCES**

*1. *Applying for a Job.* (VAS Unit #6001b). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*2. *Find It; Get It; Keep It: A Pre-Employment Skills Curriculum for the Special Needs Individual.* (1986). Research and Development Section, Department of Adult Vocational and Technical Education, Illinois State Board of Education. Curriculum Publications Clearinghouse, Western Illinois University, Horribin Hall 46, Macomb, IL 61455. (800) 322-3905.

3. *Methods and Materials for Teaching Occupational Survival Skills.* (1978). Research and Development Section, Department of Adult Vocational and Technical Education, Illinois State Board of Education. Curriculum Publications Clearinghouse, Western Illinois University, Horribin Hall 46, Macomb, IL 61455. (800) 3[illegible]-3905.

4. *Personal Characteristics Needed for Successful Employment.* (1986). Montana State University, Department of Agricultural and Industrial Education, Room 126, Cheever Hall, Bozeman, MT.

5. *How to Get a Job, How to Keep a Job.* (1986). Posters: Career Publishing, Inc., Orange, CA 92667.

*6. *Working: Today and Tomorrow.* Campbell, R., Thompson, M.J. (1987). The Changing Times Education Service Division, EMC Publishing, 300 York Avenue, St. Paul, MN 55101.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to Be Defined

INFORMATION SHEET #2 — Want-Ads

INFORMATION SHEET #3 — Guidelines for Developing a Resumé and Data Sheet

INFORMATION SHEET #4 — Sample Resumé

INFORMATION SHEET #5 — Sample Personal Data Sheet

INFORMATION SHEET #6 — Guidelines for Writing Letters of Inquiry and Application

INFORMATION SHEET #7 — Making Appointments by Telephone

INFORMATION SHEET #8 — Questions I Should Ask During my Job Interview

INFORMATION SHEET #9 — The Do's and Don'ts of Interviewing for Jobs

INFORMATION SHEET #10 — Letter to Job Applicants

INFORMATION SHEET #11 — The Interview From the Other Side

INFORMATION SHEET #12 — Guidelines for Writing a Follow-up Letter

INFORMATION SHEET #13 — Rejection Shock

INFORMATION SHEET #14 — Additional Resources

TRANSPARENCY MASTER #1 — Basic Occupational Skills Employers Want (with discussion guide)

TRANSPARENCY MASTER #2 — Is This Work? (with discussion guide)

TRANSPARENCY MASTER #3 — Life Style (with discussion guide)

TRANSPARENCY MASTER #4 — The Changing Pattern of Adult Concerns and Time Allotments (with discussion guide)

TRANSPARENCY MASTER #5 — Sources for Locating Jobs (with discussion guide)

TRANSPARENCY MASTER #6 — Survival Skills: Handling Conflicts (with discussion guide)

TRANSPARENCY MASTER #7 — Taking Sides (with discussion guide)

TRANSPARENCY MASTER #8 — Keeping Score (with discussion guide)

TRANSPARENCY MASTER #9 — Showdown (with discussion guide)

TRANSPARENCY MASTER #10 — Adjustments (with discussion guide)

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INFORMATION SHEET #1

Terms to Be Defined

Employment

Abbreviate — to shorten the spelling of a word.

Accomplishments — things people have done well.

Adapted — changed.

Advertise — to make public.

Agency — business that helps people.

Annual — yearly, happening every year.

Application — form filled out in order to try to get a job.

Apply — to try to get a job.

Background — those things that have happened in the past.

Categories — areas.

Chronological — order in time that things happen.

Client — a customer.

Column — vertical (up and down) line of words.

Competition — a contest.

Confidence — the ability to be sure of yourself.

Contract — an agreement between a company and its employees.

Controversies — disagreements.

Counseling — talking to someone in order to help him or her.

Crucial — the most important.

Description — the way something has been described.

Distributing — handing out.

Employer — the person in a company who hires people for jobs.

Encourage — to give hope to.

Environment — areas around you or others.

Evaluation — a rating or grading.

Exaggerations — acts of making things seem better or bigger than they are.

Exchanging — trading.

Experience — skills and knowledge a person has gained from working on jobs.

Forecast — to tell what will happen.

Format — outline, form.

Fringe Benefits — extras given a worker in addition to salary.

Function — the way something works.

Garnish — to legally take money from a paycheck because of nonpayment of bills.

Geographical — area of the country.

Graduate — having received a diploma from a school.

Impressive — looks good.

Interview — talking to an employer about getting a job.

Legislation — laws.

Mature — grown up.

Mediocre — not very good.

Misrepresentations — lies, untruths.

Objective — something you want to get done.

Occupation — another word for a job.

Preference — something that someone likes more.

Proofread — to read over to make sure something is written correctly.

Prospective — possible, what could be.

Qualifications — skills, knowledge, or abilities that fit a person for a certain job.

Recruiting — hiring.

Referral — a sending of a person to someone else.

Reflect — to show.

Regional — having to do with a certain area.

Relevant — important.

Represent — to act in the place of someone.

Requirements — things needed for a person to be hired.

Reveal — to make known.

Salary — money a person gets for working.

Situation — position or place of employment.

Strictly — solely, only.

Temporary — lasting for only a short time.

Vacancy — an opening for a job.

Versatile — able to do many things.

Want-Ads — a list of jobs in a newspaper.

Abbreviations Used in Want Ads

adv. — advertising

aft. — after

a.m. — morning

appt. — appointment

asst. — assistant (helper)

b.a. — board assistant

bet. — between

bgn. — begin or beginning

bldg. — building

bus. — business

clk. — clerk

coll. — college

comm. — commission (pay based on how much business you do)

co. — company

const. — construction

corp. — corporation

dept. — department

dir. — director

div. @ division (part of a company)

elec. — electric

empl. — employment

eqpt. — equipment

etc. — etcetera (Latin for and so on)

eves. — evenings

exc. — excellent

exp. — experience

ext. — extension

ftr. — future

gd. — good

gen. — general

grad. — graduate

hosp. — hospital

hqtrs. — headquarters

hr. — hour

hrly. — hourly

H.S. — high school

hvy. — heavy

incl. — including

ind. — industrial

ins. — insurance

jr. — junior (beginner or assistant)

lic. — license

lt. @ light (a little)

mach. — machine

maint. — maintenance

manuf. — manufacturing

mech. — mechanic or mechanical

med. — medical

mgr. — manager

mo. — month/monthly

nec. — necessary

op., oper. — operator/operate

pd. — paid

p.m. — afternoon/evening

pref. — prefer/preferred

pt. — part/part-time

rm. — room

ref., refs. — reference/references

sal. — salary

secy. — secretary

sh., shrhd. — shorthand

sr. — senior

temp. — temporary

trnee. — trainee (beginner)

typ. — typing/typist

U-W — underwriter (insurance company salesperson)

wk. — week/work

wkr. — worker

wpm — words per minute (typing)

yr. — year

On Resumés, Letters of Inquiry, and Letters of Application

Acceptance — taking what was offered or given.

Appreciate — to think highly of something or someone.

Body of letter — the main part of a letter, the reason that the letter was written.

Complimentary closing — part of a letter just above the signature (e.g., Sincerely yours,).

Conditions — the way things are.

Convince — to make a person agree with what you believe.

Courtesy — politeness.

Delay — to put off until later.

Evidence — proof.

Heading — date block of a letter.

Inquiry — a question.

Inside address — part of the letter that has the name, job title, and address of the person getting the letter.

Position — place.

Positive — being sure.

Reasonable — sensible, not foolish.

Refuse — to say "no."

Rejection — to be "turned down," not accepted.

Respect — to feel or show honor.

Response — answer.

Salesmanship — being able to sell things.

Salutation — greeting of a letter (e.g., Dear George,).

Self-Confidence — one's belief in oneself and one's abilities.

Signature — letter writer's written (not printed or typed) name.

Tactful — being able to say and do the right thing.

On Application Forms

Address — street, number, city, state, and zip code.

Apprentice — a person learning a trade.

Aptitude — ability.

Arrest — to take to jail or court.

Birth certificate — a legal paper to prove date of birth, place of birth, and parents' names.

Blank — empty.

Bonded — a legal paper saying that a person, working with money, will do his or her job honestly and correctly.

Character — the moral makeup of a person.

Chronic — happening for a long time.

Citizen — a legal member of a nation.

Company — a place of business.

Compensation — something given to make up for a loss.

Complete — with all the parts, whole, entire.

Confidential — spoken or written as a secret.

Convicted — proven guilty.

Courses — classes (as in school).

Defect — a fault, a lack of something important.

Dependent — a person taken care of by another person.

Disability — being unable to do some things; not having ability.

Discharged — released, let go.

Documents — legal papers.

Education — schooling, knowledge, and skills gained through training.

Eligible — able to be chosen.

Emergency — a need for action right now.

Employed — having a job, working.

On Employment Tests

Adaptability — able to change.

Adjustment — act of changing with conditions.

Administered — given.

Aggressiveness — energetic conduct; forcefulness.

Capacity — the ability to hold a certain amount.

Coordination — ability to do things well together (e.g., use both hands at the same time).

Eliminate — to get rid of.

Endurance — ability to last a long time.

Exception — different than others.

Extroversion — trait of being outgoing and talkative.

Factual — true.

Fortify — to make stronger.

Illustrates — shows.

Indicator — something that shows or directs.

Inherent — born with, belonging by nature.

Introversion — trait of being withdrawn; shy, not talkative.

Manipulate — to control.

Penalty — punishment.

Potential — possible.

Precise — exact.

Preference — favorite, something you like the best.

Receptacles — containers, holders.

Scrutinize — to check very carefully.

Stupor — a condition of dullness.

Tolerance — ability to put up with something.

Dealing with Job Interviews

Ambitious — wanting to do well and to get ahead.

Anxious — worried, nervous.

Appearance — the way something or someone looks.

Appropriate — suitable, right for what is going on.

Arranged — set up.

Communication — exchange of information.

Confidence (confident) — feeling sure of yourself.

Conservative — careful.

Conversation — verbal communication.

Enthusiasm — strong excitement over something or someone.

Evasive — trying to avoid something or someone.

Frequently — happening often.

Impression — feeling.

Impressive — well thought of.

Initial — first.

Participation — the act of joining in, doing.

Rapport — goodwill, harmony; getting along well.

Response — an answer.

Review — to look over again, to study again.

Selection — a choice.

Simulated — acted out as if it were real, practiced.

Specific — clear, exact.

Temperament — the way you act and feel.

Unique — one of a kind.

Dealing with Rejection

Caution — care, thought.

Common — regular, usual.

Consolation — comfort, sympathy, relief.

Control — to guide, to master, to manage.

Depression — feeling "down," feeling the "blues," a feeling of hopelessness.

Determination — willpower, strength, courage.

Discouraged — depressed, feeling "down."

Mental — having to do with the mind or brain.

Natural — normal, matter-of-fact.

Preparation — the act of getting ready.

Probably — likely, seemingly.

Rejection — act of turning down, not taking.

Ruin — to destroy, to wreck, to defeat.

Serious — dangerous, alarming, severe.

Shock — a state of being "down."

Successful — perfect, complete.

Symptoms — signs, warnings.

Unsuccessful — failed, losing, useless.

Violent — hard, strong.

Dealing with Job Survival

Accept — to take.

Adjustment — a change.

Ambition — goal, dream, wish.

Attitude — the way you feel about things.

Beneficial — good, helpful.

Confinement — the act of being in a closed place (like a room or building).

Cooperation — the act of working together, getting along.

Dependability — the trait of being able to be counted on to get a job done.

Disposition — the way you act.

Effort — a struggle, a try.

Expected — wanted or required.

Human relations — the way people get along.

Mature — grown-up, adult-acting.

Motivation — something that causes a person to want to do well.

Necessary — important, needed.

Overanxious — in too much of a hurry.

Productivity — how much work a person does.

Progress — getting better.

Regulations — rules.

Relationships — the way people get along.

Reputation — what people think about a person, place, or thing.

Situation — a job.

Supervisor — boss.

Surroundings — the things around you.

Survival — staying or lasting.

INFORMATION SHEET #2

Want-Ads

1. Read want-ads every day, all of them — especially on Sundays (usually longer listings); get local papers and those from areas in which you are interested in working. Also check the journals and literature of the area you're interested in for want-ads.

2. Circle the ones you are interested in.

3. Note all the particulars, so you are prepared when you call for an interview.

4. If the telephone number is listed, call right away. Have a note pad handy to write down names, addresses, details, and appointment dates.

5. If an address is given, go in person. Personal interviewing techniques will be covered in a later Information Sheet. *Don't* interview over the telephone; the purpose for calling is to arrange for an interview.

6. If a letter is requested, write immediately. Include your name, address, phone number, and resume.

7. Be quick; others are looking too!

8. Apply in person for jobs that are closely related to those you are looking for since employers may have other openings not advertised.

9. The more concrete and specific facts it mentions, the more the job offers.

10. Legitimate ads will give specific requirements job seekers must meet in order to be considered; training, education, experience, physical demands, minimum age.

11. Avoid "Attractive Phrasing" like:

    a. "Public Contact" or "Public Relations" — usually means soliciting door to door or by phone.
    b. "Sales Promotion" — direct selling.
    c. "Outside order taking" — house to house canvassing.
    d. "Supervisory Position or Management Candidate" — if no specific requirements, refers to gathering your friends and neighbors into a sales team.
    e. "Earnings" or "Opportunity to Earn" — not what you *will* earn.

12. A **BLIND AD** is one put in by an employment agency but doesn't say so in the advertisement. You must pay a fee to get a job through a private employment agency, though some fees may be paid by the employer. **CHECK FIRST!**

13. When you call about the ad, don't sound hesitant, nervous, bored, or unassured. Be clear, pleasant, and have answers to the questions you may be asked. But remember, your purpose is to get an interview. The less you say over the phone, the better. Be *sure* to get the person's name right (you may ask to have it spelled for you), the date and time of the interview, and the address. If you'll need directions on how to get there, ask.

14. Don't forget the yellow pages — they have advertisements telling location and type of possible employers.

Reprinted from *Job-Link: A Career Development Manual for Counselors.* Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational, and Technical Education, 1978.

INFORMATION SHEET #3

Guidelines for Developing a Resumé and Data Sheet

A resumé is a brief, typed statement or summary of your qualifications and experience used in applying for a job. A resumé or data sheet can be sent along with a letter of inquiry or application to provide the employer with additional information in regard to your background and experience. The information given below should be considered when writing a resumé or data sheet.

1. Information to include in a resumé:

   a. Name, address, and phone number.

   b. Career objective which should be a short, one or two sentence statement. *Be brief and specific.*

   c. Educational background — name of schools attended (listed in reverse chronological order), dates attended, major field of study, subjects studied relating to job, degrees or diplomas.

   d. Leadership/student activities, honors and accomplishments.

   e. Work experience — list (in reverse chronological order), length of time worked, brief description of duties and responsibilities, special training programs or courses, involvement in supervised occupational experience programs.

   f. Special technical skills and interests related to the job.

   g. References — usually three non-relatives. (Be sure to obtain permission before naming someone as a reference.) Include one or two former teachers plus one or more individuals who have been an employer or supervisor in the past. Send thank you notes to those that provide your references.

2. Standards to follow for a resumé:

   a. Information tailored to fit position desired.

   b. Limited to one page if possible.

   c. Neatly typed and error free.

   d. Logically organized in outline form.

   e. Honestly listed qualifications and experiences.

   f. Your best qualifications emphasized by how they are placed and organized on the resumé.

   g. No unexplained blank periods of time in the resumé.

CAUTION: Employers are looking for a quick overview of who you are and how you fit into their business. The employer will spend less than 10 seconds reading a resumé. Be sure to present relevant information clearly and concisely in an eye-catching format.

INFORMATION SHEET #4

Sample Resumé

TIMOTHY ERIC JOHNS

Address

204 Ripley
Brown, Illinois 62353
(217) 773-1018

Career Objective

A position in sales with an established agribusiness firm that supplies resources to farmers.

Education

High School Diploma, Tamarack High School, Brown, Illinois, June 1989.

Courses Related to Career Objective

Vocational Agriculture, Cooperative Vocational Education, Bookkeeping, Computer Science, Power Mechanics.

Honors

Dekalb Award for Agricultural Leadership
John Phillip Sousa Award
Outstanding Senior Award

Employment History

Assistant, Shiffer's Feed Company, Bucyrus, Illinois, August 1988 - present.

Related Activities and Achievements

Responsible for the total operation of Shiffer's Feed Company in the absence of the owner.

Developed public relations, salesmanship, and employment skills through the Cooperative Vocational Education Program.

Developed leadership skills as president of the Brown Chapter of FFA and National Honor Society and as captain of the Tamarack Wrestling Team.

Interests

Showing cattle, skiing, fishing, reading.

References

Ms. Jane Martin, Instructor
Vocational Education
Tamarack High School
2102 Paddock Drive
Brown, IL 62353

Ms. Becky Zabel
English Teacher
Tamarack High School
2102 Paddock Drive
Brown, IL 62353

Mr. Fred Fisher
Shiffer Feed Company
Rural Route 2
Bucyrus, IL 64820

INFORMATION SHEET #5

Sample Personal Data Sheet

Name Tim Johns

Address: 204 Ripley
Brown, Illinois 62353

Telephone: (217) 773-1018

Education: High School Diploma — June, 1989 from Tamarack High School.

Subjects Studied:

Vocational Agriculture:	8 semesters
Cooperative Education:	2 semesters
Bookkeeping:	2 semesters
Computer Science:	2 semesters
Power Mechanics:	2 semesters

Work Experience:

Assistant, Shiffer's Feed Company, Bucyrus, Illinois, August 1988-present.

Technical Skill:

Trained in the operation of electronic cash registers and promotion and sales of agricultural products.

Leadership Activities:

President, FFA
Vice President, Senior Class
National Honor Society
Captain, Wrestling Team

Honors and Other Accomplishments:

Dekalb Award for Agricultural Leadership
John Phillip Sousa Award
Outstanding Senior Award

References:

Ms. Jane Martin, Instructor
Vocational Education
Tamarack High School
2102 Paddock Drive
Brown, IL 62353

Ms. Becky Zabel
English Teacher
Tamarack High School
2102 Paddock Drive
Brown, IL 62353

Mr. Fred Fisher
Shiffer Feed Company
Rural Route 2
Bucyrus, IL 64820

INFORMATION SHEET #6

Guidelines for Writing Letters of Inquiry and Application

The purpose of a letter of inquiry is to obtain information about possible job vacancies. The purpose of a letter of application is to apply for a specific position that has been publicly advertised. Both letters indicate your interest in working for a particular company, acquaint employers with your qualifications, and encourage the employer to invite you for a job interview.

Letters of inquiry and application represent **YOU**. Therefore, they should be accurate, informative, and attractive. Your written communications should present a strong, positive, professional image both as a job seeker and future employee. The following list should be used as a guide when writing letters of inquiry and application.

1. Standards to follow for letters of inquiry and application:

   a. Short and specific, one or two pages (details left to resumé). Use 8•" x 11" white typing paper, not personal or fancy paper.

   b. Neatly typed and error free.

   c. Attractive form, free from smudges.

   d. Write to a specific person. Use "To Whom It May Concern" if answering a blind ad.

   e. Logical organized paragraphs which are to the point.

   f. Carefully constructed sentences free from spelling or grammatical errors.

   g. Positive in tone.

   h. Ideas expressed in a clear, concise direct manner.

   i. Avoid slang words and expressions.

   j. Avoid excessive use of the word "I."

   k. Avoid mentioning salary and fringe benefits.

   l. Write a first draft, then make revisions.

   m. Proofread final letter yourself, and also have someone else proofread.

   n. Address and sign correctly. Type envelope addresses.

2. Information to include in a letter of inquiry:

   a. Specify the reasons why you are interested in working for the company and ask if there are any positions available now or in the near future.

   b. Express your interest in being considered a candidate for a position when one becomes available.

   c. Since you are not applying for a particular position, you cannot relate your qualifications directly to job requirements. (However, you can explain how your personal qualifications and work experience would help to meet the needs of the company.)

d. Make mention of and include your resumé.

e. State your willingness to meet with a company representative to discuss your background and qualifications. (Include your address and phone number where you can be reached.)

f. Address letters of inquiry to the personnel manager unless you know his or her name.

3. Information to include in a letter of application:

a. Indicate your source of the job lead.

b. Specify the particular job you are applying for and the reason for your interest in the position and company.

c. Explain how your personal qualifications meet the needs of the employer.

d. Explain how your work experience relates to job requirements.

e. Make mention of and include your resumé.

f. Request for an interview and state your willingness. (Include your address and phone number where you can be reached.)

Sample Letter of Inquiry

204 Ripley
Brown, IL 62353
April 15, 1989

Mr. Dan Blentlinger, Manager
Eddington Farm Service
200 Curtis Road
Barfield, IL 61874

Dear Mr. Blentlinger:

I am currently in the process of exploring career opportunities available in agribusiness following my June graduation from Tamarack High School.

During my high school career I have strived to increase my employability in agribusiness. My grade point average is 4.15 on a 5 point scale. I have enrolled in vocational agriculture during my last three years of high school. My occupational experience program during my junior and senior years consisted of working as an assistant at Shiffer's Feeds in Bucyrus, Illinois.

I will appreciate any information you can give regarding vacancies at Eddington Farm Service. Thank you for your assistance.

Sincerely,

Tim Johns

Tim Johns

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Sample Letter of Application

204 Ripley
Brown, Illinois 62353
May 1, 1989

Clint Sieben
Personnel Manager
Eichelburger Ag Supply Company
923 Wagner Street
Bucyrus, IL 64820

Dear Mr. Sieben:

Please consider me for the sales position at Eichelburger Ag Supply Company which you advertised in the Bucyrus News Press.

In June I will graduate from Tamarack High School, where my program included three years of vocational agriculture and two semesters of cooperative vocational education. While enrolled in the cooperative vocational course I was employed by Shiffer's Feeds in Bucyrus, Illinois. The skills and knowledge gained through these experiences would help me to be a valuable addition to your firm. A more complete description of my qualifications is provided in the enclosed resume.

My work experience for Shiffer's Feed was enjoyable, and it is my ambition to continue work in agribusiness. May I come for an interview at your convenience anytime after school? I can be reached by phone at 773-2287 after 3:30 pm, or by mail at 204 Ripley Avenue, Brown, IL 62353.

Thank you for your consideration.

Sincerely,
Tim Johns
Tim Johns

Enclosure

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INFORMATION SHEET #7

Making Appointments by Telephone

There will often be times when you will have to arrange an appointment to interview for a job by telephone. Certain procedures should be followed when making appointments. This call may be the first contact you have with the company. It is important to be polite and courteous, so that you make a good first impression. Remember that the receptionist is there to help you, so it is important to keep him or her on your side. Also, remember that it is not appropriate to ask about salary over the phone. Use the checklist below to help you properly make an appointment by telephone.

Checklist for Making Appointments by Telepone

1. Did you prepare a rough outline of what you wanted to cover before making the call?	Yes	No
2. Were you prepared before calling?	Yes	No
3. Did you have to pause and stammer to find the right words?	Yes	No
4. Did you immediately identify yourself?	Yes	No
5. Did you immediately state your reason for calling?	Yes	No
6. Did you ask when would be the best time for the employer to interview you?	Yes	No
7. Did you record the exact day, time, and place of the interview?	Yes	No
8. Were you courteous and friendly?	Yes	No
9. Did you thank the receptionist for his or her help?	Yes	No

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INFORMATION SHEET #8

Questions I Should Ask During My Job Interview

When interviewing for a job you will probably have several questions to ask the interviewer. However, interviewers will often eliminate the need for asking some questions, due to the information they provide during the interview. While it is important to be prepared to ask questions yourself, you should wait to see how many questions are answered during the course of the interview. A list of appropriate questions to ask the interviewer is given below:

1. What are the typical working hours?
2. What will be the actual starting date for the job?
3. What are the specific job responsibilities?
4. Does the company offer a training program to allow employees to learn new skills?
5. Do employees specialize in a particular aspect of work for the business?
6. What is the established line of authority? Who would be my immediate supervisor?
7. Where exactly would I be working? What are the general working conditions?
8. What types of machinery, tools, and equipment would I be operating?
9. Am I expected to supply any of my own tools? If so, what do I need to supply?
10. How much overtime is generally needed and expected?
11. What is the policy for promotions and raises?
12. What is the policy for vacation and sick leave? (Note: Be careful not to give the impression your main concern is *not* working!)
13. What type of salary and fringe benefits can be expected? (Note: this question should be asked only toward the end of an interview. Many interviewers prefer to discuss salary and benefits only after you have been offered the job. Let the employer take the lead to introduce this topic.)
14. When will I be contacted regarding your decision on filling the position?
15. Is this position filled on a year-round or seasonal basis?

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INFORMATION SHEET #9

The Do's and Don'ts of Interviewing for Jobs

DO:

1. Find out about the company before you interview (its products, who its customers are, etc.).
2. Be neat and well-groomed, dress conservatively.
3. Be punctual (15-20 minutes early).
4. Have your resumé and examples of your work available for quick reference.
5. Have a pen and note pad to take notes.
6. Have a prepared list of questions you are interested in regarding the job. (These may be answered by the interviewer during the course of the interview.)
7. When meeting the receptionist, smile, introduce yourself, state you have an appointment, follow the receptionist's instructions, and wait patiently.
8. Greet the interviewer with a smile and by name.
9. If the interviewer offers his or her hand, shake it firmly.
10. Introduce yourself and state the purpose of your appointment.
11. Be seated only after the interviewer has asked you to do so.
12. Sit and stand erect.
13. Be polite and courteous.
14. Be sincere, enthusiastic, friendly, and honest.
15. Let the interviewer take the lead in the conversation.
16. Be alert (sit slightly forward in the chair to give an alert appearance).
17. Be confident, look directly at the interviewer.
18. Make an effort to express yourself clearly and distinctly.
19. Speak correctly, use proper grammar, speak in clear moderate tones.
20. Take time to think about your answer, choose words carefully.
21. Answer questions completely, but give only essential facts.
22. Convey positive answers.
23. Speak positively of former employers and associates.
24. Watch for signs that the interview is over such as interviewer shuffling papers, moving chair around, etc.
25. Thank the interviewer for his or her time.
26. Shake hands with the interviewer and leave promptly at the completion of the interview.
27. Write a follow-up letter to express your interest in the job and your appreciation for the opportunity to interview.

DON'T:

1. Take others with you to the interview (parents, friends, etc.).
2. Put your hat or coat on the interviewer's desk.
3. Use a limp or overpowering handshake.
4. Lean against a wall, chair, or desk.
5. Interrupt the interviewer.
6. Chew gum, smoke, eat candy, etc.
7. Giggle, squirm in your chair, tap your fingers, swing a crossed leg, etc.
8. Use slang or swear.
9. Talk too long.
10. Try to flatter the interviewer.
11. Give all yes or no answers.
12. Talk about personal problems.
13. Press for a decision on being hired.

INFORMATION SHEET #10

Letter to Job Applicants

Dear Job Applicant:

Today you asked me for a job. From the look of your shoulders as you walked out, I suspect you've been turned down before, and maybe you believe by now that people just out of high school can't find work.

But I did hire a teen-ager today. You saw him. He was the one with the polished shoes and a necktie. What was so special about him? Not experience; neither of you had any. It was his attitude. Yes, attitude! He wanted that job badly enough to look neat, and to look in the phone book to find out what this company does. He did his best to impress me. That's how he edged you out.

You see, people who hire people aren't "with" a lot of things. Some of us have what you may call Stone Age ideas about who owes whom a living. But there's nothing wrong with the checks we sign, and if you want one, you'd better tune in to our wavelength, too.

Ever hear of "empathy?" It's the trick of seeing the other fellow's side of things. I couldn't have cared less that you're behind in your car payments. That's your problem. What I needed was someone who'd go out into the plant, keep his eyes open, and work for me as if he were working for himself. If you have even the slightest idea of what I am trying to say, let it show the next time you ask for a job. You'll be head and shoulders over the rest.

Look, the only time jobs grew on trees was while most of the manpower was wearing GI's and pulling KP. Maybe jobs aren't as plentiful right now as you'd like but a lot of us can remember when master craftsmen were walking the streets. By comparison, you don't know the meaning of scarce.

You may not believe it, but all around you are employers looking for young men and women smart enough to go after a job in the old-fashioned way. When they find one, they can't wait to unload some of their worries on him or her.

For both our sakes, get eager, will you?

Sincerely yours,

Prospective Employer

The *New Mexico Horticultural Core Curriculum* was the source of the above letter.

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INFORMATION SHEET #11

The Interview From the Other Side

The interview from the other side of the desk isn't so easy, either. Interviewing people for jobs frequently involves seeing and evaluating a great many applicants in one day, and it is often a trying task. The most common reasons for not being able to place applicants in a job are:

1. Poor attitude
2. Unstable work record
3. Bad references
4. Lack of self-selling ability
5. Lack of skill and experience
6. Not really anxious to work
7. "Bad mouthing" former employers
8. Too demanding (wanting too much money, or to work only under certain conditions)
9. Unable to be available for interviews or cancelling out

Are any of these qualities pertinent to you? If so, you should consciously and constructively work to improve upon them. You may want to "slant" your resumé and overall job hunting approach to minimize certain of the qualities you can't actively control, such as being too specialized in low demand areas.

It is generally agreed that most employers are apt to evaluate you in an interview according to the following general criteria:

1. Appearance
2. Personality, "people" skills, attitudes, poise
3. Knowledge of job, education, and experience
4. Drive, enthusiasm, interest, attitudes
5. Good references
6. Complete, well-organized application or resume
7. Stable work record reflecting growth

From this list, which isn't necessarily in the order of importance, you can nonetheless see that while skills, education, and experience are areas in which you will be evaluated, other qualities may be equally important. From the employer's point of view, skills may always be taught, thereby providing education, and experience can always be developed. The other things — like character, personality, attitudes, enthusiasm — can't be taught or provided by the employer.

Here are some of the things commonly encountered by interviewers that tend to "turn them off":

1. Poor appearance
2. Poor attitude
3. Lack of manners and personal courtesy
4. Chewing gum, smoking, fidgeting
5. No attempt to establish rapport; not looking the interviewer in the eye
6. Being interested only in the salary and benefits of the job
7. Lack of confidence; being evasive
8. Poor grammar, use of slang
9. Immaturity
10. Not having any direction or goals

NOTE: Interviewers prefer people who are interested in the job, the company, and the company's goals rather than persons who seemingly are interested only in what they have to do to receive a certain amount of money. Interviewers prefer persons that can skillfully uphold their part of the interview process, so that the result of the interview is a give-and-take of meaningful dialogue, and not just a bunch of rambling, disorganized conversation.

Adapted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

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INFORMATION SHEET #12

Guidelines for Writing a Follow-up Letter

Follow-up letters are sent immediately after you have had an interview. The follow-up letter demonstrates your knowledge of business etiquette and protocol. Always send a follow-up letter regardless of whether or not you had a good interviewing experience and regardless of whether you are no longer interested in the position. When employers do not receive follow-up letters from job candidates, they often assume the candidate is not aware of professional protocol they will need to demonstrate on the job.

The major purpose of a follow-up letter is to thank those individuals who participated in your interview. In addition, a follow-up letter reinforces your name, application, and qualifications to the employer, and indicates whether you are still interested in the job position. The following list should be used as a guide when writing a follow-up letter.

1. Letters should include an expression of appreciation for the interviewer's time and interest in you as a candidate.
2. If you are no longer interested in the position indicate this as clearly and politely as you can. You may wish to indicate why you are no longer interested in the position (accepted a job elsewhere, decision to continue education). You are not required to provide a reason. However, it is polite and often helpful to employers to do so.
3. If you are interested in the position indicate this as clearly as you can. Summarize your qualifications. Reemphasize your strengths as shown on your application letter and resumé, plus any other strengths overlooked previously.
4. Letters should include your name, address, and phone number to make it easier for the employer to contact you.
5. Letters should be typed and error free.
6. Letters should be clean, neat, and arranged attractively on the paper.
7. Letters should be free from spelling, punctuation, and grammatical errors.
8. Letters should be proofread by you and another person before mailing.
9. Letters should be sent within a day or two after the interview.
10. A follow-up serves as a last bid for a job position. Make it a prime example of your excellent work habits. Be sure it is as clean, neat, and well-groomed as possible.

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Sample Follow-up Letter

204 Ripley Street
Brown, Illinois 62353
May 10, 1989

Mr. Clint Sieben
Personnel Manager
Eichelburger Ag Supply Company
923 Wagner Street
Bucyrus, Illinois 64820

Dear Mr. Sieben:

Thank you for the interesting and informative interview for the position of salesperson with the Eichelburger Ag Supply Company.

The interview enabled me to learn more about Eichelburger Ag Supply, and about the duties and responsibilities of a salesperson in your company. I am confident that my abilities, experience, and interests would be valuable as an agriculture supply salesperson.

I am most appreciative of your interest in me as a candid~te for this position and am looking forward to hearing from you. Please contact me for any additional information that would be of assistance in your evaluation of me as a possible employee of Eichelburger Ag Supply Company. You may contact me at the above address or by phone after 3:30 at 773-2287.

Sincerely,

Tim Johns

Tim Johns

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INFORMATION SHEET #13

Rejection Shock

As a job hunter, be forewarned of a common ailment particular to the species: "Rejection Shock."

What exactly is this? And when does it occur? These questions might come to mind.

"Rejection Shock" — let's break it down technically:

1. Rejection — the action of rejecting, the state of being rejected, something rejected; synonymous with exclusion, denial, dismissal, veto, repudiation, renunciation; antonymous with acceptance, admission, being chosen, selection.

2. Shock — a violent shock or jar, concussion, an effect of violent disturbance, state of profound depression of the vital processes. Synonymous with impact, onset, attack, clash, jolt, outrage, violence, fury, outburst, agitation. Antonymous with soothe, calm, lull, quiet, comfort, console, relieve, humor, compose.

There are more strict definitions of terms. In the context of job hunting "Rejection Shock" as described by Richard Bolles in his book, *What Color is Your Parachute?*, occurs when persons set out to look for a job, confidently follow all instructions that are given . . . only to discover that none of that works for them; and after a lengthy time are still unemployed; then go into Shock, "characterized by slow and rapid erosion of self-esteem, a conviction that there is something wrong with them, leading to lower expectations, depression, desperation, and/or apathy. This assumes, consequently, all the proportions of a major crisis in life, personal relations, and family, leading to loneliness, irritability, and withdrawal, where divorce is a consequence and even suicide is possible."

Sounds pretty bleak? It's the pits and it happens, is happening, and will continue to happen to countless job hunters, even to you.

However, because everybody looks for jobs and everybody gets rejected from time to time, cures to this ill have been developed.

Prescribed cures are:

1. Preparation — prepare to avoid the obvious adversity that each job hunter is likely to encounter. Prepare yourself with the resources at hand, mainly *you*.

2. Caution — it is easy to slip into the quicksand of rejection shock, especially while embarked on the not-so-easy task of job hunting. The hardest job you may ever have is that of looking for a job.

3. Consolation — console yourself, there's nothing wrong with you — everyone feels similar despair.

4. Determination — determine to help yourself and others by sharing your better understanding of the blight of "Rejection Shock" . . . as we hope you will be better prepared by our explanation of this pitfall in the job-hunting process.

Adapted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

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INFORMATION SHEET #14

Additional Resources

1. Video cassettes (VHS) on topics: Choosing Careers, Appearance, Motivation, Positive Attitudes, and Job Skills Series. AAVIM, The National Institute for Instructional Materials, 120 Driftmier Engineering Center, Athens, GA 30602. (404) 542-2586.

2. Computer programs (Apple and IBM) on topics: Career Planning, Job Hunting, Resume Writing, Job Applications, Interviewing, Job Success, and Motivation. Career Aids, 20417 Nordhoff Street, Department B4, Chatsworth CA 91311. (818) 341-2535.

3. All areas of career planning and job searching materials: Texts, Workbooks, Computer Software, Filmstrips, Audiotapes, Videotapes, Instructional Aids. Jist Works, Inc., 720 North Park Avenue, Indianapolis, IN 46202. (800) 648-JIST.

TRANSPARENCY MASTER #1

Basic Occupational Skills Employers Want

Competencies	Activites which will develop these areas
1. Punctuality	1.
2. Dependability	2.
3. Getting along with others	3.
4. Working as a team member	4.
5. Organizing the work activities of others	5.
6. Understanding written information	6.
7. Basic writing skills	7.
8. Basic speaking skills	8.
9. Being neat and clean in appearance	9.
10 Maintaining good health	10.
11. Knowing your strengths and weaknesses	11.
12. Giving an honest day's work	12
13. Loyalty to your organization	13.
14. Making independent decisions	14.

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Competencies	Activites which will develop these areas
15. Using initiative and imagination	15.
16. Knowing what is expected	16.
17. Basic arithmetic skills	17.
18. Knowing how to use materials and equipment	18.
19. Locating information	19.
20. Having specialized training	20.
21. Knowledge of operating procedures	21.
22. Following instructions	22.
23. Working without close supervision	23.
24. Working under pressure	24.
25. Adjusting to work situations	25.
26. Managing time and materials effectively	26.
27. Following safety regulations	27.

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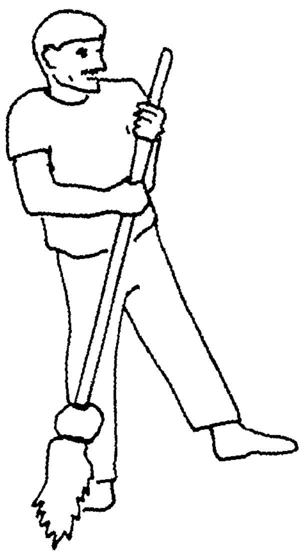
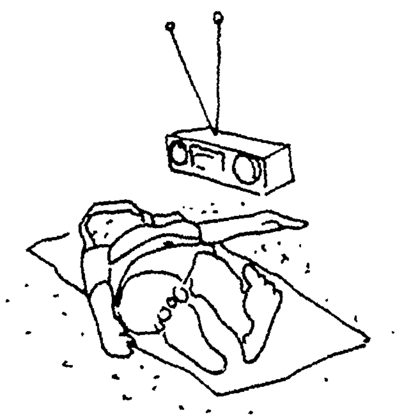
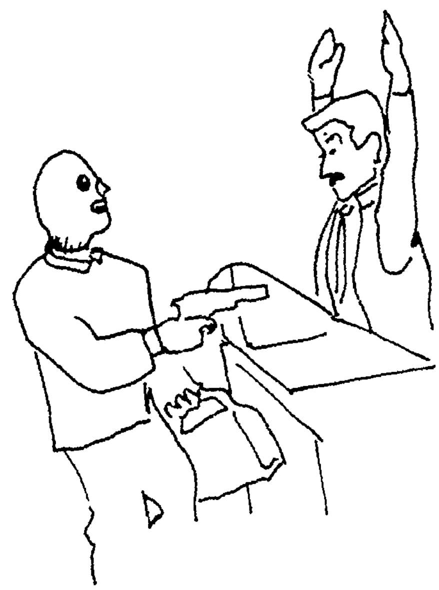
TRANSPARENCY MASTER #2

Is This Work?







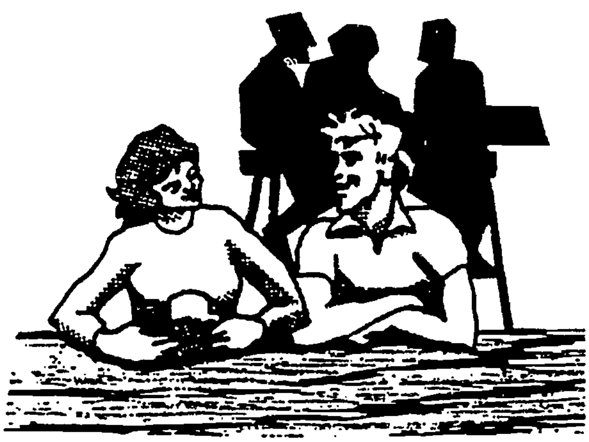
TRANSPARENCY MASTER #3

Lifestyle

Family

Leisure activities

Spiritual well-being



Friends

Profession

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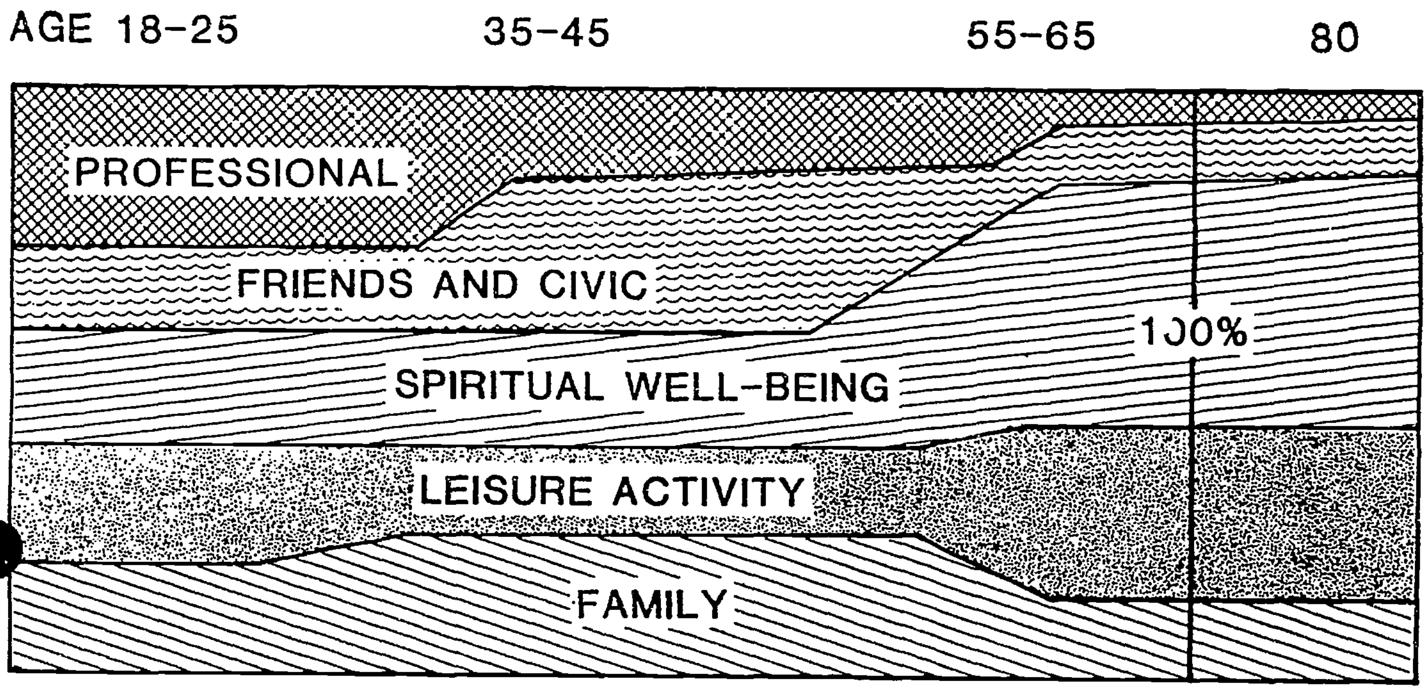
TRANSPARENCY MASTER #4

The Changing Pattern of Adult Concerns and Time Allotment



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TRANSPARENCY MASTER #5

Sources for Locating Jobs

1. Newspapers — classified advertisement section

2. Magazines or trade journals and publications

3. Local labor union business offices

4. Personal contacts

    a. Friends
    b. Relatives
    c. Teachers
    d. School guidance counselors
    e. Employees of a company you are interested in

5. Placement offices

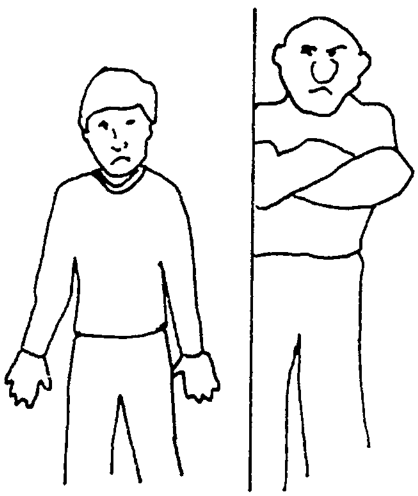
    a. Public
    b. Private
    c. School

6. Employment or personnel office of company

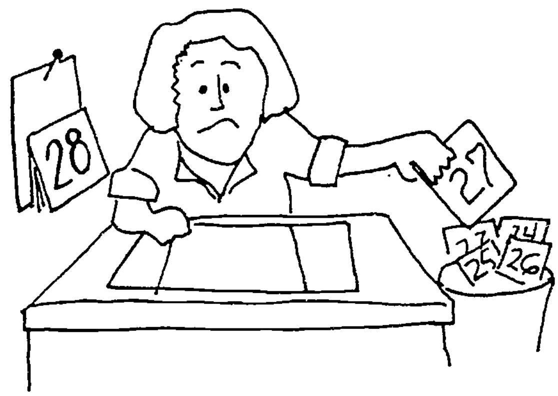
7. Public notices — window signs in business

TRANSPARENCY MASTER #6

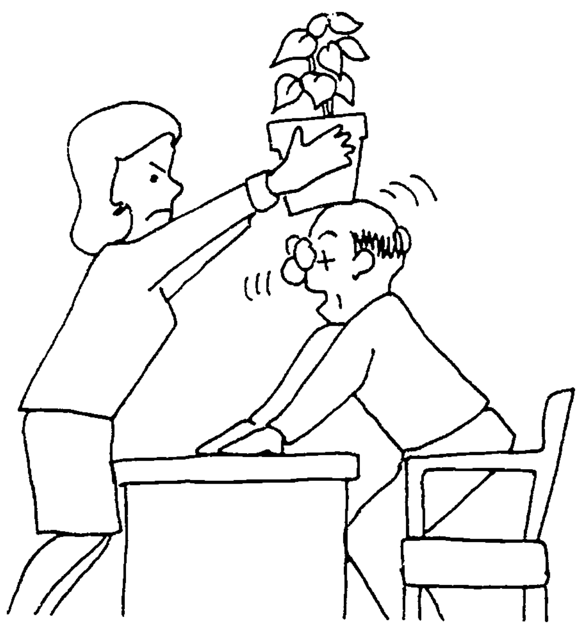
Handling Conflicts



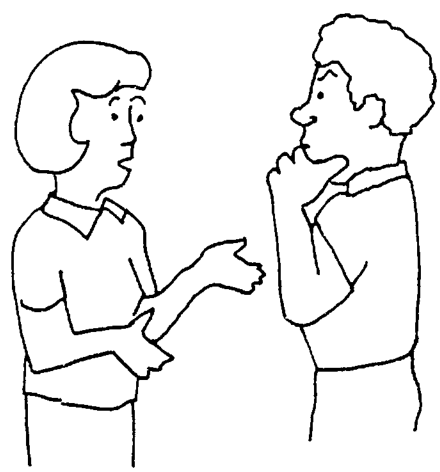
Avoiding



Delaying



Confronting: Power

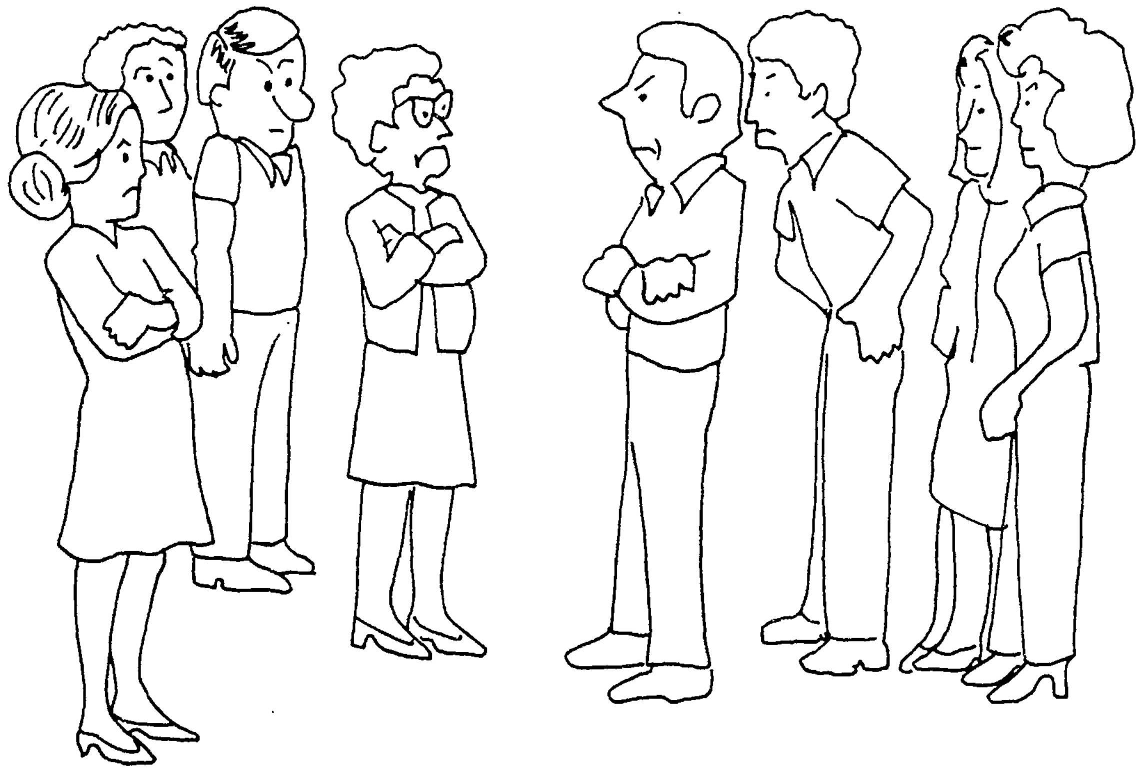


Confronting: Compromise

Adapted from: Occupational Survivor Skills, DAVTE / ISBE

TRANSPARENCY MASTER #7

Taking Sides



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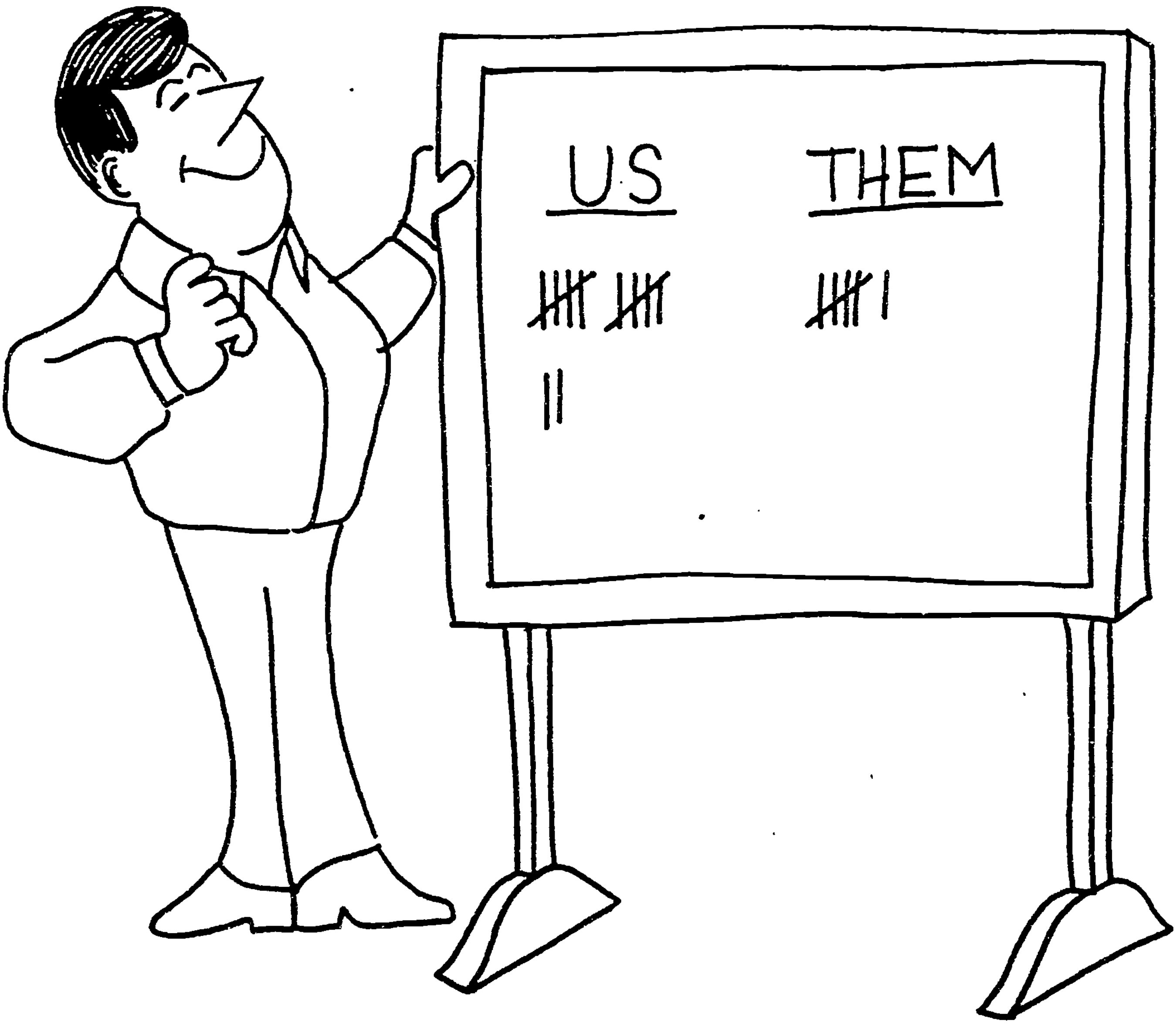
Adapted from: Occupational Survivor Skills, DAVTE / ISBE

TRANSPARENCY MASTER #8

Keeping Score



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Adapted from: Occupational Survivor Skills, DAVTE / ISBE

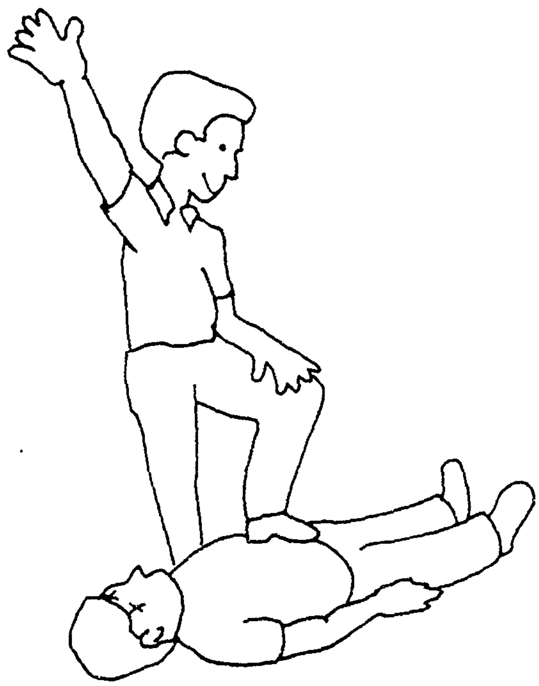
TRANSPARENCY MASTER #9

Showdown

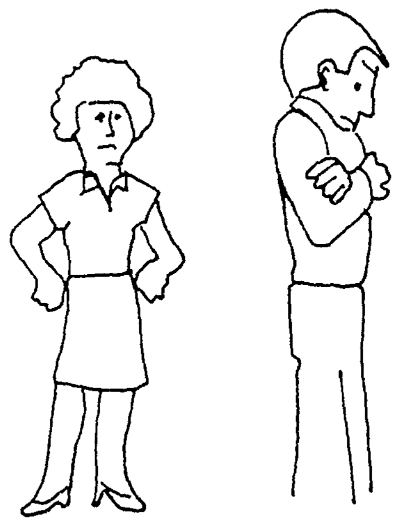
Adapted from: Occupational Survivor Skills, DAVTE / ISBE

TRANSPARENCY MASTER #10

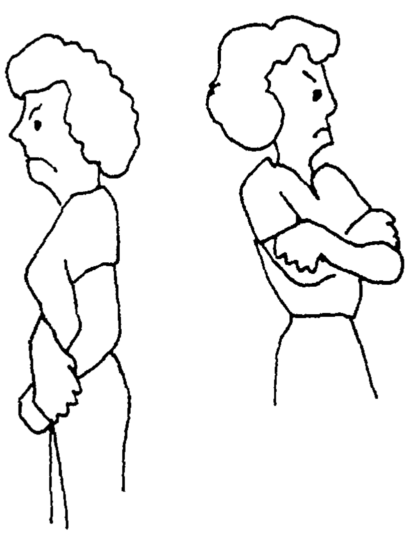
Adjustments



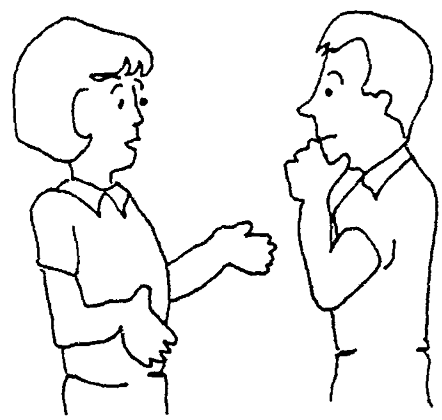
Win-Lose (Domination)



Withdrawal



Cold War



Compromise

Adapted from: Occupational Survivor Skills, DAVTE / ISBE

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #1

1. Have students review the items and identify where they could receive training on each skill (such as FFA, SAE, on-the-job, laboratory, etc.).

2. Divide the class into three groups and have each group "rank order" their nine items on importance to job success using their personal opinions. Let each group discuss their rankings with the rest of the class.

3. Identify the top ten items by combining the three groups' top rankings.

4. Compare and discuss their ranking with those below which were completed by secondary school personnel, students, and parents.

Overall Ranking		Individual Group Ranking: Secondary School Personnel	Students	Rural Parents
1.	Have basic speaking skills	1	1	1
2.	Have basic arithmetic skills	2	3	2
3.	Use initiative and imagination	3	2	3
4.	Know what an employer expects	12	4	5
5.	Get along with a variety of people	4	5	9
6.	Be dependable	5	6	6
7.	Maintain good health	11	7	7
8.	Have basic writing skills	7	9	4
9.	Be punctual	6	8	8
10.	Manage time and materials efficiently	19	11	12
11.	Work as a team member	9	13	11
12.	Work under tension or pressure	16	10	13
13.	Adapt to varying work situations	8	12	10
14.	Organize work activities of others	17	15	14
15.	Use information, materials, equipment	10	14	15
16.	Follow instructions	14	17	17
17.	Follow safety regulations	13	18	16
18.	Be loyal to employer	15	16	19
19.	Work without close supervision	18	19	20
20.	Make decisions on your own	20	20	18
21.	Be neat and clean in appearance	21	21	21

Transparency Master #2

1. Using the definition of "work" as that which is done consciously to try to satisfy your own needs as well as others, have the class determine which pictures illustrate work. Work is being done by the bell ringer, floor mopper, and sales person.

2. Discuss how each picture defines work.

Transparency Master #3

1. The people we share our activities with and the amount of time spent on each activity make up our lifestyle.

2. Discuss each area of a person's lifestyle illustrated in the transparency. Each part of lifestyle affects the others. Careers are the central activity around which we plan out daily lives.

3. Ask students to discuss why people have different lifestyles. Lifestyle patterns develop because of different sets of values. All persons determine their own lifestyles, although some people are highly influenced by others. It is important to emphasize the students' roles in determining their own lifestyles.

4. Have students sketch the lifestyle diagram on a sheet of paper making the size of each box represent the relative importance of each part of

their life in their lifestyle. This activity is for their own personal development and should not be collected. After the students have completed the activity discuss how the dominance of one activity requires a sacrifice in importance of another since our time and resources are limited.

Transparency Master #4

This transparency can be used to stimulate a discussion of the effect of a person's age on his or her lifestyle.

Transparency Master #5

1. Discuss the various methods that can be used to locate jobs such as personal contacts, newspaper ads, etc.

    a. Local labor unions' business offices can provide information on apprenticeship programs.
    b. Interviewing several groups of people already working for a company you are interested in helps provide information about the company.
    c. Public notices located in post offices can provide information such as federal civil service jobs.

2. Placement offices provide vocational counseling, give aptitude and ability/interest tests, locate jobs, and arrange job interviews. There are three types of placement offices — public, private, and school.

    a. Public — supported by federal and state funds, services are free, contact State Employment Commission.
    b. Private — charge for services provided usually a percentage of your beginning salary, must sign a contract before they provide services, many specialize in only one occupational area.
    c. School — high schools, trade schools, and colleges provide vocational services for their students.

Transparency Master #6

Summarize the discussion by describing the different ways people handle conflict. Have students give examples for each method of handling conflict from their own experiences.

1. Avoiding — by staying away from the person, changing the subject when the conflict comes up in conversation, quitting a job.

2. Delaying — settling small parts of the conflict while leaving the important issues unsettled, postponing the discussion, cooling off the situation temporarily.

3. Confronting - Compromise — talking it over (not arguing): listening to both sides, stating and clarifying the problem, considering many solutions, deciding on a solution all persons can accept, putting the solution into action, evaluating the results. When this method is used, *everybody wins* — and everybody has to "give and take."

Ask students to decide which method they think would have worked best in their conflict fantasies. Have them give reasons for choosing one method instead of another. Ask how the methods can be combined.

Transparency Master #7

Taking sides — When a tense situation develops, each person involved decides on a position. That is, people make up their own minds who is right and who is wrong. This stage can involve two people or many people. Have students think of a conflict in their own lives and imagine how people took sides. Did those involved in a conflict try to get others to take their side? If so, how?

Transparency Master #8

Keeping score — After a conflict situation begins, those involved often keep track of what the other person "does to them." During this stage, each side tries to prove how unreasonable the other is. They may even "keep score" on behavior that is not related to the original conflict. Have students think of a conflict situation in which people "kept score." How do people feel when keeping score?

Transparency Master #9

The showdown — Sooner or later people involved in a conflict will decide they "have had it" or they "just can't take it any more" and decide to confront the other person. This can be done in a constructive way by talking the situation over and coming to compromises, or it can be done destructively by quitting, threatening others, or firing. A strike is an example of a showdown. How do people feel during a showdown?

Transparency Master #10

Adjustments — After the showdown, one or both sides may decide to make some changes in their behavior. Sometimes this means a "get tough" policy; sometimes it means trying to be more understanding. *The adjustments that people make determine how well the conflict is settled.* For example, if one side is expected to do all the "adjusting," it may become angry, causing the conflict to start all over again.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Comparing Occupational Choices

STUDENT WORKSHEET #2 — Evaluating My Career Goals

STUDENT WORKSHEET #3 — Evaluating My Personal Appearance, Feelings, and Habits

STUDENT WORKSHEET #4 — Self Improvement: Do You See Yourself As Others See You?

STUDENT WORKSHEET #5 — Job Skills and Attitude Survey

STUDENT WORKSHEET #6 — Employability Word Search

STUDENT WORKSHEET #7 — Want-Ad Abbreviations

STUDENT WORKSHEET #8 — Researching a Job Opening

STUDENT WORKSHEET #9 — Personal Data Sheet

STUDENT WORKSHEET #10 — Letter of Application

STUDENT WORKSHEET #11 — Completing a Job Application Form

STUDENT WORKSHEET #12 — Job Application Evaluation

STUDENT WORKSHEET #13 — Interview Evaluation

STUDENT WORKSHEET #14 — Evaluating the Job Offer

STUDENT WORKSHEET #15 — Who's Boss

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

Comparing Occupational Choices

Using information you gathered about three occupations of your choice and characteristics about yourself, compare the characteristics required by the occupation and those you possess by answering the following questions.

	OCCUPATION 1		OCCUPATION 2		OCCUPATION 3	
	YES	NO	YES	NO	YES	NO
1. Does the job description fit your interests?						
2. Is this the level of occupation in which you wish to engage?						
3. Does this type of work appeal to your interests?						
4. Are the working conditions suitable to you?						
5. Will you be satisfied with the salaries and benefits offered?						
6. Can you advance in this occupation as rapidly as you would like?						
7. Does the future outlook satisfy you?						
8. Is there enough demand for this occupation that you should consider entering it?						
9. Do you have or can you get the education needed for the occupation?						
10. Can you get the finances needed to get into the occupation?						
11. Can you meet the health and physical requirements?						
12. Will you be able to meet the entry requirements?						
13. Are there any other reasons you might not be able to enter this occupation?						
14. Is the occupation available locally or are you willing to move to a part of the country where it is available?						

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STUDENT WORKSHEET #2

Evaluating My Career Goals

Part I

Name of Occupation ______________________

Duties of the Worker

Job	Often	Frequent	Rarely

Personal Requirements

Age range __________

Interests and abilities needed:

____

____

____

Personality and physical requirements:

____

____

____

Educational Requirements

Recommended high school program:

____

Post-high school education required or recommended (trade school, college, apprenticeship, on-the-job training):

____

Advantages and Disadvantages

(Earnings, hours, conditions, security of employment, opportunity for advancement)

Advantages: ______________________________

____

____

Disadvantages ______________________________

____

____

Present Demand & Future Outlook

Number of workers:

National ____________ State ____________ Local ____________

Present need for workers:

Great ______ Moderate ______ Slight ______

Probable future trend:

Little change ______ Increasing need ______ Decreasing need ______

Are jobs confined to certain areas?

Yes ______ No ______

Entering the Occupational Area

Any special entrance requirements (minimum education, entrance exams, experience, capital, licensing, union)

____

____

Source of additional information

____

Part II

Now that you have information on an occupation in which you are interested, it is time to identify and develop a short-term career plan. In the space below identify essential school courses or special training which you need to obtain before you are qualified for employment. Also identify essential skills or competencies needed in the occupation. Identify the date the training or competency was completed on the line beside it.

Occupation: *Conservation Technician* (Example)

Formal Courses/Special Training		Essential Competencies	
Example: *Ag Surveying*	*Fall 89*	*Keep records/record data*	*Fall 89*

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STUDENT WORKSHEET #3

Evaluating My Personal Appearance, Feelings, and Habits

Directions: Answer the following questions by circling "A" for Always, "U" for Usually, "S" for Sometimes, or "N" for Never. Review your answers to determine which areas you need to improve.

Part I: Personal Appearance

1.	Are you aware that personal cleanliness and neatness have an effect on those around you?	A	U	S	N
2.	Do you shower or bathe at least once daily and after strenuous exercise?	A	U	S	N
3.	Do you use an effective deodorant daily?	A	U	S	N
4.	Do you brush your teeth at least twice daily?	A	U	S	N
5.	Do you keep your hair clean and well-groomed?	A	U	S	N
6.	Do you wear clothes that are becoming to you and appropriate to the occasion?	A	U	S	N
7.	Are your clothes neat and clean?	A	U	S	N
8.	Do you keep your weight at the pound recommendation for your height and body frame?	A	U	S	N
9.	Do you eat a well-balanced diet each day?	A	U	S	N
10.	Do you exercise regularly?	A	U	S	N
11.	Do you get enough sleep each night?	A	U	S	N
12.	Do you maintain straight, correct posture when sitting, standing, and walking?	A	U	S	N

Part II: Working With Others

1.	If someone asks you for help, do you give it cheerfully?	A	U	S	N
2.	Do you laugh at the mistakes of others?	A	U	S	N
3.	Is it easy for you to praise and compliment other people?	A	U	S	N
4.	Do you enjoy gossip?	A	U	S	N
5.	Do you feel awkward around strangers?	A	U	S	N
6.	Are you able to ask others for help when you need it?	A	U	S	N
7.	Do you try to see the other person's point of view?	A	U	S	N
8.	Do others enjoy being around you?	A	U	S	N
9.	Do you take a sincere interest in those around you?	A	U	S	N
10.	Can you offer constructive criticism in a polite manner?	A	U	S	N
11.	Do you congratulate your friends upon their achievements?	A	U	S	N
12.	Do you enjoy being part of a group?	A	U	S	N
13.	Do you make friends easily?	A	U	S	N
14.	Are you thoughtful of the feelings of others?	A	U	S	N
15.	Do you get along well with others?	A	U	S	N
16.	Do people ask for your advice?	A	U	S	N
17.	Does conversation stop when you join a group?	A	U	S	N
18.	Do you sense that others feel uncomfortable around you?	A	U	S	N
19.	Do you keep the promises you make to others?	A	U	S	N
20.	Do you become jealous of others?	A	U	S	N

Part III: Communication Skills

1.	Do you organize your thoughts and ideas before you speak?	A	U	S	N
2.	Do you concentrate on the meaning you are trying to convey?	A	U	S	N
3.	Do you make grammatical and spelling errors when speaking or writing?	A	U	S	N
4.	When you are listening to someone, are you easily distracted by outside sights and sounds?	A	U	S	N
5.	Do you use clear, distinct speech?	A	U	S	N
6.	Do you have a pleasant speaking voice?	A	U	S	N

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Part IV: Personal Feelings and Attitudes

1. Do you try to have a positive attitude?	A	U	S	N
2. Do you approach your work confidently?	A	U	S	N
3. Are you willing to accept responsibility?	A	U	S	N
4. Are you able to act naturally under all circumstances?	A	U	S	N
5. Do you worry about past mistakes and failures?	A	U	S	N
6. Do you control your temper?	A	U	S	N
7. Are you able to make decisions about everyday things easily?	A	U	S	N
8. Are you able to keep your personal troubles to yourself?	A	U	S	N
9. Do you react constructively to criticism?	A	U	S	N
10. Do you accept blame for things that are your fault?	A	U	S	N
11. Do you tell the truth and are you honest?	A	U	S	N
12. Are you easily discouraged?	A	U	S	N
13. Can you adapt to all situations?	A	U	S	N
14. Do you persevere until you achieve success?	A	U	S	N
15. Can you make decisions quickly and accurately?	A	U	S	N
16. Are you afraid to express your opinions and ideas?	A	U	S	N
17. Are you ambitious?	A	U	S	N
18. Do you complain when things don't go the way you would like?	A	U	S	N
19. Do you become impatient with yourself and others?	A	U	S	N
20. Do you feel you are a unique and valuable person?	A	U	S	N

Part V: Plans for Improvement

1. What do you feel are you strengths regarding personal appearance, feelings, and habits?

2. What do you feel are your weaknesses regarding personal appearance, feelings, and habits?

3. In what ways do you want to change or improve your personal appearance, feelings, and habits?

4. Now that you have decided what to improve about yourself, you must decide how you can make the improvements. One way is to develop a self-improvement plan of action with a reward/penalty system. For example, you may decide you need to spend more time studying. Your plan of action may be to study two hours each day after school. If you study for two hours, reward yourself with a pleasurable activity such as watching TV, playing a game of basketball, eating a piece of cake, etc. If you do not study you must give up one of the pleasurable activities you had planned to do.

SELF - IMPROVEMENT PLAN

NAME ______________________________ DATE ______________

I do hereby agree to ______________________________________

______________________________________ (activity or behavior) for a period of

______________ (number) days. In return I will receive the rewards listed below.

REWARD ______________________________________

____

____

If I fail to live up to this self-improvement plan, the following penalties will take effect:

PENALTIES ______________________________________

____

____

SIGNATURE______________________________________

STUDENT WORKSHEET #4

Self-Improvement: Do You See Yourself As Others See You?

Directions: Before you can project personal characteristics necessary for gaining employment, you must determine if you possess them. It is important that you evaluate yourself truthfully so you can improve your personality. Rate yourself on the following scale by marking either "A" for Always, "U" for Usually, "S" for Sometimes, or "N" for Never. Have a friend or relative rate you as they see you. Compare your answers to determine those areas needing improvement.

Desirable Characteristics

1.	Accurate	A	U	S	N
2.	Agreeable	A	U	S	N
3.	Ambitious	A	U	S	N
4.	Appreciative	A	U	S	N
5.	Attentive	A	U	S	N
6.	Broadminded	A	U	S	N
7.	Cheerful	A	U	S	N
8.	Confident	A	U	S	N
9.	Conscientious	A	U	S	N
10.	Considerate	A	U	S	N
11.	Cooperative	A	U	S	N
12.	Courteous	A	U	S	N
13.	Creative	A	U	S	N
14.	Dependable	A	U	S	N
15.	Efficient	A	U	S	N
16.	Enthusiastic	A	U	S	N
17.	Friendly	A	U	S	N
18.	Good Natured	A	U	S	N
19.	Honest	A	U	S	N
20.	Leadership Qualities	A	U	S	N
21.	Loyal	A	U	S	N
22.	Mature	A	U	S	N
23.	Modest	A	U	S	N
24.	Obedient	A	U	S	N
25.	Optimistic	A	U	S	N
26.	Patient	A	U	S	N
27.	Perseverance	A	U	S	N
28.	Poised	A	U	S	N
29.	Positive	A	U	S	N
30.	Practical	A	U	S	N
31.	Punctual	A	U	S	N
32.	Realistic	A	U	S	N
33.	Reasonable	A	U	S	N
34.	Resourceful	A	U	S	N
35.	Self-conscious	A	U	S	N
36.	Self-control	A	U	S	N
37.	Self-starting	A	U	S	N
38.	Sense of Humor	A	U	S	N
39.	Sensible	A	U	S	N
40.	Sincere	A	U	S	N
41.	Sympathetic	A	U	S	N
42.	Tactful	A	U	S	N
43.	Thoughtful	A	U	S	N
44.	Tolerant	A	U	S	N
45.	Trustworthy	A	U	S	N

Undesirable Chacteristics

1.	Apathetic	A	U	S	N
2.	Argumentative	A	U	S	N
3.	Artificial	A	U	S	N
4.	Boastful	A	U	S	N
5.	Conceited	A	U	S	N
6.	Critical	A	U	S	N
7.	Deceitful	A	U	S	N
8.	Defensive	A	U	S	N
9.	Domineering	A	U	S	N
10.	Emotional	A	U	S	N
11.	Forgetful	A	U	S	N
12.	Greedy	A	U	S	N
13.	Impulsive	A	U	S	N
14.	Inferiority Complex	A	U	S	N
15.	Inhibited	A	U	S	N
16.	Irritable	A	U	S	N
17.	Jealous	A	U	S	N
18.	Militant	A	U	S	N
19.	Moody	A	U	S	N
20.	Pessimistic	A	U	S	N
21.	Rebellious	A	U	S	N
22.	Restless	A	U	S	N
23.	Rude	A	U	S	N
24.	Sarcastic	A	U	S	N
25.	Selfish	A	U	S	N
26.	Shrewd	A	U	S	N
27.	Stubborn	A	U	S	N
28.	Sulky	A	U	S	N
29.	Timid	A	U	S	N
30.	Vicious	A	U	S	N

STUDENT WORKSHEET #5

Job Skills and Attitude Survey

Complete the following questions.

1. Do I like to be alone or with people?
2. Am I mechanical or artistic?
3. Would I rather sell or work under supervision?
4. Would I like to think or be active?
5. Could I take authority and responsibility for others?
6. Must I have freedom to express creativity?
7. What things do I like to do?

   a.
   b.
   c.
   d.
   e.

8. At what time of day can I work best?
9. Can I work under pressure or stress?
10. Make a list of your strong points. Consider skills (also hobbies, leisure time, and skills) you can offer an employer.

    a.
    b.
    c.
    d.
    e.

11. Now make a list of school subjects, evening classes, lessons, etc, that have given you job abilities.

Adapted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

STUDENT WORKSHEET #6

Employability Word Search

Locate and circle 20 words describing desirable characteristics for gaining and maintaining employment. List the words in the space provided.

O	R	J	Q	G	A	E	R	A	L	E	C	D	R	B	M	K	P	Y	A
R	T	N	E	I	T	A	P	O	M	C	E	H	O	N	E	S	T	Y	E
O	W	E	D	L	J	Z	T	P	K	T	U	E	A	W	K	X	F	J	M
H	R	N	J	E	E	E	A	C	A	M	T	G	Z	T	N	S	N	E	T
W	I	T	X	Y	Z	T	F	V	J	A	S	H	P	O	O	A	W	V	K
N	E	H	X	K	H	I	I	F	R	R	S	H	E	I	W	W	L	I	Q
Y	G	U	U	E	T	T	N	U	I	O	A	R	X	N	L	D	T	T	K
G	T	S	T	N	O	R	C	A	O	C	U	I	B	J	E	U	Q	I	F
X	L	I	J	M	D	C	T	L	G	T	I	M	B	G	D	B	Y	S	G
O	C	A	B	S	A	E	M	N	A	R	F	E	D	Z	G	C	O	O	U
N	M	S	V	W	U	O	R	M	E	N	O	P	N	P	E	G	Q	P	Y
C	K	T	A	E	I	O	P	S	R	D	O	P	Y	T	A	B	V	V	Y
K	W	I	L	M	L	P	E	E	T	E	I	I	G	X	B	X	B	J	K
A	C	C	I	U	B	B	L	T	O	A	Y	F	S	O	L	M	Z	F	F
J	Z	S	S	F	F	I	A	M	R	Y	N	U	N	S	E	X	X	N	Z
X	O	U	L	Q	A	T	T	T	A	U	X	D	L	O	E	H	C	A	V
R	Q	K	Z	B	T	C	C	I	P	L	O	W	I	O	C	F	G	C	D
B	Y	N	L	M	H	U	P	A	O	A	U	C	C	N	Y	Q	O	S	Q
G	F	E	W	U	C	C	H	M	T	U	D	I	H	C	G	A	B	R	V
S	Q	M	A	E	N	N	C	L	K	B	S	A	C	S	T	M	L	K	P

The following words are hidden in the puzzle:

Accurate
Adaptable
Ambitious
Confident
Courteous
Efficient
Empathetic
Enthusiastic
Honest
Knowledgeable
Loyal
Mature
Motivated
Organized
Patient
Positive
Professional
Reliable
Tactful
Understanding

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STUDENT WORKSHEET #6 — Key

Employability Word Search

Locate and circle 20 words describing desirable characteristics for gaining and maintaining employment. List the words in the space provided.

•	•	•	•	•	•	•	•	•	•	E	•	D	•	•	•	•	•	•	•
•	T	N	E	I	T	A	P	•	M	•	E	H	O	N	E	S	T	•	•
•	•	E	D	•	•	•	•	P	•	T	•	E	•	•	K	•	•	•	•
•	•	N	•	E	•	E	A	•	A	•	T	•	•	•	N	•	•	E	•
•	•	T	•	•	Z	T	F	V	•	A	•	•	•	•	O	•	•	V	•
•	•	H	•	•	H	I	I	F	R	•	•	•	E	•	W	•	•	I	•
•	•	U	U	E	•	T	N	U	I	•	•	R	•	•	L	•	•	T	•
•	•	S	T	N	O	•	C	A	•	C	U	•	•	•	E	•	•	I	•
•	•	I	•	M	D	C	T	L	G	T	I	•	•	•	D	•	•	S	•
•	C	A	•	S	A	E	•	N	A	R	•	E	•	•	G	•	•	O	•
•	•	S	•	•	U	•	R	M	E	N	O	•	N	•	E	•	•	P	•
•	•	T	A	E	•	O	•	S	R	D	O	•	•	T	A	•	•	•	•
•	•	I	L	M	L	•	E	E	T	•	I	I	•	•	B	•	•	•	•
•	•	C	•	U	B	B	L	T	•	A	•	F	S	•	L	•	•	•	•
•	•	•	•	•	F	I	A	•	R	•	N	•	N	S	E	•	•	•	•
•	•	•	•	•	A	T	T	T	•	U	•	D	L	O	E	•	•	•	•
•	•	•	•	B	•	•	C	I	P	•	O	•	I	O	C	F	•	•	•
•	•	•	L	•	•	•	•	A	O	A	•	C	•	N	Y	•	O	•	•
•	•	E	•	•	•	•	•	•	T	U	D	•	•	•	G	A	•	R	•
•	•	•	•	•	•	•	•	•	•	•	S	A	•	•	•	•	L	•	P

The following words are hidden in the puzzle:

Accurate
Adaptable
Ambitious
Confident
Courteous
Efficient
Empathetic
Enthusiastic

Honest
Knowledgeable
Loyal
Mature
Motivated
Organized
Patient
Positive

Professional
Reliable
Tactful
Understanding

STUDENT WORKSHEET #7

Want-Ad Abbreviations

The price of a want-ad in most newspapers is figured on the number of lines in the ad. Therefore, in order to use as few lines as possible and save money, people who put ads in newspapers generally use as many abbreviations as they can. Find the abbreviations in the want ads for the words that are listed, and then write them in the empty spaces

A. manufacturing company ____________

B. doctor's office ____________

C. chemistry aptitude ____________

D. including Saturday ____________

E. license required ____________

F. excellent opportunity ____________

G. hospital and insurance ____________

H. light typing ____________

I. laboratory technician ____________

J. experience necessary ____________

K. television and advertising ____________

L. extension ____________

M. salary ____________

N. full-time ____________

O. floor ____________

P. opportunity ____________

Q. avenue ____________

R. hours ____________

S. trainees ____________

T. high school ____________

U. paid ____________

V. part-time ____________

W. graduates ____________

HELP WANTED

Routemen
Linen & Towel Supply
No exp nec . . . Good sal
Hosp & Ins Benefits
11 Cascade Road See Mr. Lund
MORNINGS ONLY

CLERICAL LITE TYP $200
TV/ADV FEE PD
5 days incl Sat Oppty
VALOR AGENCY
370 Bellrose Ave

MACHINE SHOP TRNEES
exc oppty for high school grads.
State approved apprentice program
Patton Mfg Co 5 Janse Ave

Lab tech - F/T - Chem apt
Beginner O.K. Call/apply
Personnel Office
Mount Royal Hospital

BOYS - AIRPORT — $160 week
Driver lic req
Phone 763-8245 X21

P/T Receptionist Dr's ofc
hrs 9 - 1 or 3 - 7 $3.75 hr
Y7645 Times - Herald

Factory Helpers - No exp nec
$3.75 to start plus benefits
& overtime . . . at least 2 years HS.
Apply 83 Main 5th flr

ERIC

A. east ______	**HELP WANTED**
B. major medical ______	Exp checker needed by leading corp. Resp for million dollar shipments. Good salary and maj med PLEASE CALL Miss Strang 627-4400
C. telephone clerk ______	Htl Rm Clk Nite shift R. Melling Agency 18 E. Davis
D. bookkeeper assistant ______	BKPR ASST to $200 exp/inexp Downtown Must spk Span Mr. Hernandez RE 7-2231
E. good speaking ______	LABORATORY TECHS BS/MS degree Liberal Salary and Benefits - Refs Req Hempstead Laboratories Inc. 58 East 11th Street
F. boulevard ______	Tel clk gd spkg voice $160 Freed Agency 10 Harris
G. corporation ______	Med recept Plastic Surgeon $200 Carroll Agency 9 Pudding Lane
H. Bachelor of Science or Master of Science ______	STORE MGR TRNEE $9500 Contact emp div - Harper Employment Agency 14 Rutgers Bld
I. hotel room clerk ______	
J. night ______	
K. incorporated ______	
L. references required ______	
M. manager trainee ______	
N. responsible ______	
O. speak Spanish ______	
P. technicians ______	
Q. medical receptionist ______	
R. employment division ______	

Reprinted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

STUDENT WORKSHEET #7 — Key

Want-Ad Abbreviations

The price of a want-ad in most newspapers is figured on the number of lines in the ad. Therefore, in order to use as few lines as possible and save money, people who put ads in newspapers generally use as many abbreviations as they can. Find the abbreviations in the want ads for the words that are listed, and then write them in the empty spaces

A. manufacturing company ______ *Mfg Co*
B. doctor's office ______ *Dr's Ofc*
C. chemistry aptitude ______ *Chem apt*
D. including Saturday ______ *incl Sat*
E. license required ______ *lic req*
F. excellent opportunity ______ *Exc oppty*
G. hospital and insurance ______ *hosp & ins*
H. light typing ______ *lite typ*
I. laboratory technician ______ *lab tech*
J. experience necessary ______ *exp nec*
K. television and advertising ______ *tv/adv*
L. extension ______ *x*
M. salary ______ *sal*
N. full-time ______ *F / T*
O. floor ______ *flr*
P. opportunity ______ *oppty*
Q. avenue ______ *ave*
R. hours ______ *hours*
S. trainees ______ *trnees*
T. high school ______ *HS*
U. paid ______ *pd*
V. part-time ______ *P / T*
W. graduates ______ *grads*

HELP WANTED
Routemen
Linen & Towel Supply
No exp nec . . . Good sal
Hosp & Ins Benefits
11 Cascade Road See Mr. Lund
MORNINGS ONLY

CLERICAL LITE TYP $200
TV/ADV FEE PD
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VALOR AGENCY
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MACHINE SHOP TRNEES
exc oppty for high school grads.
State approved apprentice program
Patton Mfg Co 5 Janse Ave

Lab tech - F/T - Chem apt
Beginner O.K. Call/apply
Personnel Office
Mount Royal Hospital

BOYS - AIRPORT — $160 week
Driver lic req
Phone 763-8245 X21

P/T Receptionist Dr's ofc
hrs 9 - 1 or 3 - 7 $3.75 hr
Y7645 Times - Herald

Factory Helpers - No exp nec
$3.75 to start plus benefits
& overtime . . . at least 2 years HS.
Apply 83 Main 5th flr

A. east ____E____

B. major medical ____maj med____

C. telephone clerk ____Tel clk____

D. bookkeeper assistant ____BKPR ASST____

E. good speaking ____gd spkg____

F. boulevard ____Bld____

G. corporation ____corp____

H. Bachelor of Science or Master of Science ____BS / MS____

I. hotel room clerk ____Htl Rm Clk____

J. night ____Nite____

K. incorporated ____Inc____

L. references required ____Refs Req____

M. manager trainee ____MGR TRNEE____

N. responsible ____resp____

O. speak Spanish ____Spk Span____

P. technicians ____techs____

Q. medical receptionist ____Med recept____

R. employment division ____emp div____

HELP WANTED

Exp checker needed by leading
corp. Resp for million dollar
shipments.
Good salary and maj med
PLEASE CALL Miss Strang
627-4400

Htl Rm Clk Nite shift
R. Melling Agency 18 E. Davis

BKPR ASST to $200
exp/inexp Downtown
Must spk Span
Mr. Hernandez RE 7-2231

LABORATORY TECHS
BS/MS degree Liberal Salary
and Benefits - Refs Req
Hempstead Laboratories Inc.
58 East 11th Street

Tel clk gd spkg voice
$160 Freed Agency 10 Harris

Med recept Plastic Surgeon
$200 Carroll Agency
9 Pudding Lane

STORE MGR TRNEE $9500
Contact emp div - Harper
Employment Agency
14 Rutgers Bld

Reprinted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

STUDENT WORKSHEET #8

Researching a Job Opening

1. Look through the help wanted ads in a newspaper or professional magazine for an employment ad of personal interest. Affix it to the space below.

2. Locate the following information concerning the potential employer in the above advertisement.

   a. Name of company ______________________

   b. Name of personnel manager ______________________

   c. Company address ______________________

   ____

   d. Position available ______________________

   e. Requirements for the position ______________________

   ____

   f. Geographic scope of company (local, county, state, region, national) ______________________

   ____

   ____

   g. Company's output product(s) ______________________

   ____

   h. Recent company developments ______________________

   ____

   i. Responsibilities of position ______________________

   ____

   j. Demand for the company's product(s) ______________________

   ____

STUDENT WORKSHEET #9

Personal Data Sheet

NAME ______________________________

ADDRESS ______________________________

PHONE NUMBER ______________________________

EDUCATION:

HIGH SCHOOL ______________________________

MAJOR COURSES ______________________________

____

TECHNICAL SKILLS ______________________________

____

LEADERSHIP ACTIVITIES ______________________________

____

____

HONORS AND OTHER ACCOMPLISHMENTS

____

WORK EXPERIENCE: (Briefly list jobs held, employers' names and addresses, and length of service for each. Begin with present or last job first.)

____

____

____

____

____

____

REFERENCES: (Include complete name, title, address, and phone numbers.)

____

____

____

____

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STUDENT WORKSHEET #10

Letter of Application

HEADING
(Your complete address and date)

INSIDE ADDRESS
(name, title and complete address of employer)

SALUTATION

(name job and where you learned of opening)

(education, training, and related experience)

(request for interview, where, when, how you may be reached)

COMPLIMENTARY CLOSING

SIGNATURE

(Enclosure)

ERIC

STUDENT WORKSHEET #11

Completing a Job Application Form

When completing a job application, remember you are trying to sell yourself by the information given. Review the entire application form before you begin. Pay particular attention to any special instructions to print or write in your own handwriting.

When answering ads that require potential employees to apply in person, be prepared to complete an application form on the spot. Take two good ink pens and two sharpened pencils. Prepare a list of information you will need to complete the application form. The information may include: your social security number; the addresses of schools you have attended; names, phone numbers, and addresses of previous employers and supervisors; names, phone numbers, and addresses of references.

The following guidelines will provide you some direction when completing application forms. After you review these guidelines, complete the sample application form attached.

1. Follow all instructions carefully and exactly.
2. If handwritten, rather than typed, write neatly and legibly. Handwritten answers should be printed unless otherwise directed.
3. Application forms should be written in ink unless otherwise requested. If you make a mistake, mark through it with one neat line.
4. Be honest and realistic.
5. Give all the facts for each question.
6. Keep answers brief.
7. Fill in all the blanks. If the question does not pertain to you, write "not applicable" or "N/A." If there is no answer, write "none" or draw a short line through the blank.
8. Many application forms ask what salary you expect. If you are not sure what is appropriate, write "negotiable," "open," or "scale" in the blank. Before applying try to find out what the going rate for similar work is at other locations. Give a salary range rather than exact figure.
9. Write the complete names, titles, addresses, and phone numbers of all references and former employers when completing the application form.
10. Make sure you have included any of your special abilities and accomplishments.
11. Upon completing the application form, check for completeness, accuracy, and correct spelling.
12. Have another person proofread the form before submitting it.

Application for Employment

Personal Information

Date ____________

Name ____
Last First Middle

Present Address ____
Street City State Zip

Permanent Address ______________________________________
Street City State Zip

Phone No. ____________________ Social Security Number ____________________

____________________ Referred by ____________________

Employment Desired

Position ____________ Date you can start ____________ Salary desired ____________

Are you employed now? ____________ If so may we inquire of your present employer? ____________

Ever applied to this company before? ____________ Where? ____________ When? ____________

Education	Name and Location of the School	Years Attended	Date Graduated	Subjects Studied
Grammar School				
High School				
College				
Trade, Business or Correspondence School				

Subjects of Special Study or Research Work ________________________________

U.S. Military or Naval Service ____________ Rank ____________ Present Membership in National Guard or Reserves ____________

Activities Other Than Religious
(Civic, Athletic, Fraternal, Etc.) ________________________________
Exclude organizations, the name or character of which indicates the race, creed, color or national origin of its members.

(continued on the next page)

ERIC Full Text Provided by ERIC

Former Employers (List below last four employers, starting with last one first.)

Date Month and Year	Name and Address of Employer	Salary	Position	Reason for Leaving
From To				
From To				
From To				
From To				

References: Give below the names of two persons not related to you whom you have known at least one year.

Name	Address	Business	Years Acquainted
1.			
2.			

Physical Record:

List any phycial defects

Were you ever injured? Give details

Have you any defects in hearing? In vision? In speech?

In case of emergency notify

Name Address Phone

I authorize investigation of all statements contained in this application. I understand that misrepresentation or omission of facts called for is cause for dismissal. Further, I understand and agree that my employment is for no definite period and may, regardless of the date of payment of my wages and salary be terminated at any time without any previous notice.

Date Signature

Do Not Write Below This Line

To be completed day employment begins Date

Height Weight Age Date of birth

Single Married Widowed Citizen USA Sex

The above information needed for pension, hospitalization insurance, etc., and not for hiring purposes.

Interviewed by Date Remarks

Neatness		Character	
Personality		Ability	

Hired For Dept. Position Will Report Salary wages

Approved: 1. 2. 3.

Employment Manager Dept. Head General Manager

STUDENT WORKSHEET #12

Job Application Evaluation

When filling out a job application form, you are making an impression on paper to your prospective employer. Application forms are a very important part of the hiring process, thus care should be taken when filling one out.

DIRECTIONS: Here are some points to consider when filling out a job application form. Check the appropriate column indicating your evaluation of the application form.

	YES	NO
1. Has the applicant followed instructions carefully?	____	____
a. Printed where required?	____	____
b. Circled response when called for?	____	____
c. Underlined a response when called for?	____	____
d. Placed an X where appropriate?	____	____
e. Has not filled in spaces where it says "do not write in space"?	____	____
2. Have all the blanks been filled in? If the question does not apply, is the appropriate response given (not applicable, N/A, a line drawn through a blank, or a diagonal line [/] drawn through a whole section that does not apply)?	____	____
3. Is the application neat — printed, typed, or written clearly?	____	____
4. Is the application filled in accurately — spelling exact?	____	____
5. Are answers brief?	____	____
6. Is the work experience listed from most recent to earliest?	____	____
7. Are the complete names and addresses of all references and previous employers given?	____	____
8. Are references appropriate?	____	____
9. Are dates correct for work experience?	____	____

Adapted from *Job-Link: A Career Development Manual for Counselors*. Developed by Southeastern Illinois Career Center, Flora, Illinois, and the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, 1978.

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STUDENT WORKSHEET #13

Interview Evaluation

Person Interviewed ______________________________

Please Check the Appropriate Response:

	Lacking	Adequate	Average	Good	Excellent
First impression and handshake					
Overall appearance					
Ability to express himself/herself					
Courtesy and politeness					
Self-confidence and poise					
Personality					
Enthusiasm and interest in the interview					
Intelligence and knowledge of the situation					
Eye contact					
Asked appropriate questions					

Additional Comments: ______________________________

____

____

____

____

Recommended Employment Yes ☐ No ☐

____
Evaluator's Signature

C46

STUDENT WORKSHEET #14

Evaluating the Job Offer

How do you feel about the following aspects of the position?

Positive	Negative	Item
________	________	Immediate Supervisor
________	________	Co-workers
________	________	Company
________	________	How your friends view the position
________	________	Amount of job security
________	________	Contribution to society
________	________	Advancement potential
________	________	Training program
________	________	Value of experience to your career
________	________	Overtime
________	________	Travel
________	________	Job location
________	________	Job security
________	________	Work environment (safe, clean, pleasant, etc.)
________	________	Personnel turnover
________	________	Promotion policies
________	________	Salary (amount and method of payment)
________	________	Benefit plan (insurance, sick leave, vacation,savings plans, etc.)
________	________	Firm's financial position
________	________	Raise policies
________	________	Retirement plan
________	________	Required working hours and scheduling
________	________	Lifestyle
________	________	Union membership

STUDENT WORKSHEET #15

Who's Boss

Susan Phillips had been employed for two weeks as a carpenter for Nogle Brothers. Susan is a highly qualified carpenter, yet she felt lucky to get the job with Nogle Brothers since many of the companies she applied to were hesitant to hire a woman as a carpenter. Susan gets along fine with the boss, Jack Nogle, and most of the other employees. The exception is "old bossy" Al Perry. Al is nosy and constantly checks to see what Susan and the others are doing. Al is also extremely bossy. He tells Susan and the other workers how to do every little bit of work and doesn't get his own work done. Then he tells Susan to help out with his work.

Susan doesn't like being bossed around by Al. Trying to work with him is just impossible. The problem is that Al has worked for the Nogle Brothers for twelve years and is a good friend of the co-owner, Jerry Nogle. Susan likes her job and needs the money. Today is Friday, and Susan has special plans for the evening. She usually doesn't mind working a few minutes late, but she really needs to get home on time tonight. Al has let his work fall far behind and tells Susan to help him finish. She would really like to tell Al off and leave him stuck with all his work, but she is afraid she would be risking her job.

1. What is causing the conflict?

2. Who is involved?

3. How would you describe Al's behavior?

4. Why do you think Al acts the way he does?

5. If you were Susan, how would you be feeling?

6. What are some ways you could work out the conflict?

7. If you were Susan, would you try to handle the conflict yourself? Or would you try to get assistance from your co-workers?

Adapted from: Occupational Survivor Skills, DAVTE / ISBE

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STUDENT WORKSHEET #15 — Key

Who's Boss

ACTIVITY: Who's Boss? — A Case Study

1. Divide the class into small groups of 4 - 5 students
2. Distribute Student Worksheet #15 to the students.
3. Instruct the groups to read through the case study and then discuss the conflict, using the questions on the worksheet as a guide.

FOLLOW-UP: Discuss student's ideas for handling the situation. The questions on the worksheet may be helpful in your discussion. Possible responses are given below.

1. Susan is irritated by Al's nosiness and bossiness. Al's behavior is also causing Susan to have to do part of Al's work as well as her own.
2. This situation involves Al and all the workers who come into contact with him. It also involved Jack and Jerry Nogle.
3. Al's behavior is nosy, bossy, and in a way irresponsible since he is getting behind in his own work when it is not necessary.
4. Perhaps Al feels he is better than the other workers since he has worked for the company for 12 years, and he is a personal friend of one of the owners. Another possibility is that he feels left out of the group and being nosy and bossy is his way of trying to be part of the group. Students may have other ideas about Al's behavior.
5. Susan probably is frustrated and angry since Al is making the work situation unpleasant and is causing Susan to have to do extra work. She also may feel a bit sorry for Al since none of the other workers seem to like him.

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Safe Work Habits in Agricultural Occupations

RELATED PROBLEM AREAS:

1. Identifying Careers in Agriculture/Horticulture
2. Recognizing the Role of Agriculture in the Society
3. Identifying and Using Agricultural Organizations, Agencies, and Sources of Information about Agriculture
4. Developing Communication Skills in Agriculture
5. Developing Human Relations Skills in Agriculture
6. Developing Transition Skills in Agriculture
7. Identifying and Practicing Ethics in Agricultural Occupations
8. Gaining Employment in an Agricultural Occupation

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

The content of this problem area should be infused in varying degrees as needed throughout the occupational tasks.

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Language Arts and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D
Research Assistant: Robert E. Petrea

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ERIC Full Text Provided by ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to listen critically and analytically.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze accurately the content of an oral message of appropriate length.					
*2. Follow theme in an oral presentation from its introduction to conclusion.					
*3. Demonstrate interaction skills in a variety of contexts.					

652 653

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA (check one)
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to read, comprehend, interpret, evaluate, and use written material.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (circle one) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Locate information that is explicitly stated in the text.					
*2. Summarize the important ideas of the text and the important supporting details.					
*3. Explain and verify answers to questions about what has been read.					
654					
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ISBE 41-78 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the knowledge and skills required for success in selected fields of work.					
*2. Recognize that competence in a field of work entails the development of a wide range of skills.					
*3. Evaluate the costs and benefits of a particular course of action.					
656					657

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Safe Work Habits in Agricultural Occupations

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Describe where accidents are most likely to happen.
2. Identify the relative hazards of working in specific industries.
3. Identify factors associated with common accidents and describe their effect.
4. Explain the various costs associated with accidents.
5. Identify and explain habits that help prevent accidents.
6. Identify agencies concerned with workplace safety and explain their role.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Safe Work Habits in Agricultural Occupations

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. Where are accidents most likely to happen?
2. What are some of the reasons that accidents happen?
3. What are the major industries?
4. Why is there a difference in the number of accidents and deaths in each industry?
5. Are certain people really accident prone?
6. What are human errors?
7. How can human errors cause accidents?
8. What steps can one take to eliminate some of one's own errors?
9. What costs are associated with accidents?
10. How can an accident influence one's future?
11. How does one's personal habits influence the likelihood of an accident on the job?
12. Why should one consider one's job when planning free time?
13. What governmental agencies are concerned with workplace safety?
14. How has the workplace changed since the government has set certain standards?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Safe Work Habits in Agricultural Occupations

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use problem areas *Identifying and Using Agricultural Tools and Equipment, Identifying Basic Agricultural Mechanics Principles*, or any of the agricultural engineering/mechanization problem areas as resources for activities which require cooperation and specific skills to accomplish.

2. Bring into class readily available safety equipment and clothing for class discussions on their application, and demonstrate proper use.

3. Invite a safety engineer or supervisor from a local factory or plant to give a presentation of safety issues and concerns.

4. Conduct a field trip to specific agribusinesses such as equipment dealerships, production facilities, and commercial enterprises to observe and survey the concerns for safety and what measures have been taken to address those concerns.

5. Invite a victim of an agribusiness accident to address the class on the costs of the accident in the four areas mentioned in Transparency Master #5.

6. Use the discussion guide for the transparencies as a reference for additional topics and areas for discussion.

7. Have students research the effect of Occupational Safety and Health Administration (OSHA) on a local agribusiness. Have students contact a local elevator, fertilizer dealer, equipment dealer, feed store, or electric cooperative and conduct an interview with the safety coordinator. Have students report their findings to the class. Use Student Worksheet #1.

8. Have students research local newspapers or agribusiness publications about safety issues currently in the news. Use Student Worksheet #2.

9. Lead students in a discussion on how the safety aspects of a particular industry would affect their choice of a career in that field.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Generalizable Skills in Agricultural Occupations

PROBLEM AREA: Developing Safe Work Habits in Agricultural Occupations

REFERENCES

*1. *Working: Today and Tomorrow.* Campbell, R.T., Thompson, M.J. (1987). The Changing Times Education Service Division, EMC Publishing, 300 York Avenue, St. Paul, MN 55101.

2. *Succeeding in the World of Work.* Kimbrezl, G., Vineyard, B. (1975). McKnight Publishing Co., Bloomington, IL 61701.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Farm Accidents

TRANSPARENCY MASTER #1 — Where Disabling Injuries Happen (with discussion guide)

TRANSPARENCY MASTER #2 — Work-Related Deaths (with discussion guide)

TRANSPARENCY MASTER #3 — Death Rates for Major Industries in 1987 (with discussion guide)

TRANSPARENCY MASTER #4 — Injury Locations (with discussion guide)

TRANSPARENCY MASTER #5 — Costs Associated with Accidents (with discussion guide)

TRANSPARENCY MASTER #6 — Factors Associated with Accidents (with discussion guide)

TRANSPARENCY MASTER #7 — Accident Prevention (with discussion guide)

TRANSPARENCY MASTER #8 — Agencies Associated with Workplace Safety (with discussion guide)

INFORMATION SHEET #1

Farm Accidents

Preliminary results of a recent major study by Dr. Robert Aherin, Safety Specialist, Agricultural Engineering, at the University of Illinois confirm agriculture's position as the most hazardous industry. Farms have an average of 36 fatalities per year, which translates into 51 deaths per 100,000 workers and is the highest of any industry. In addition, farms have 22 accidents per million hours exposure which contrasts with an average of 7 accidents per million hours exposure for other industries for which statistics are computed.

One of the categories to be analyzed is roadway accidents, which continue to rise from 280 accidents 5 years ago to 400 accidents in 1988. The occurrences in this category seem to be related to lighting of vehicles and equipment. Another category is the age of those operating the equipment. Approximately 22-23% of those surveyed allowed 7-9 year olds to operate equipment and 63% allowed 10 year olds to operate equipment. Current figures show that the accident rate for those under 15 years old is 42 accidents per million hours exposure, nearly twice that of the industry as a whole. The study is currently undergoing final analysis to be completed late in 1989.

TRANSPARENCY MASTER #1

Where Disabling Injuries Happen

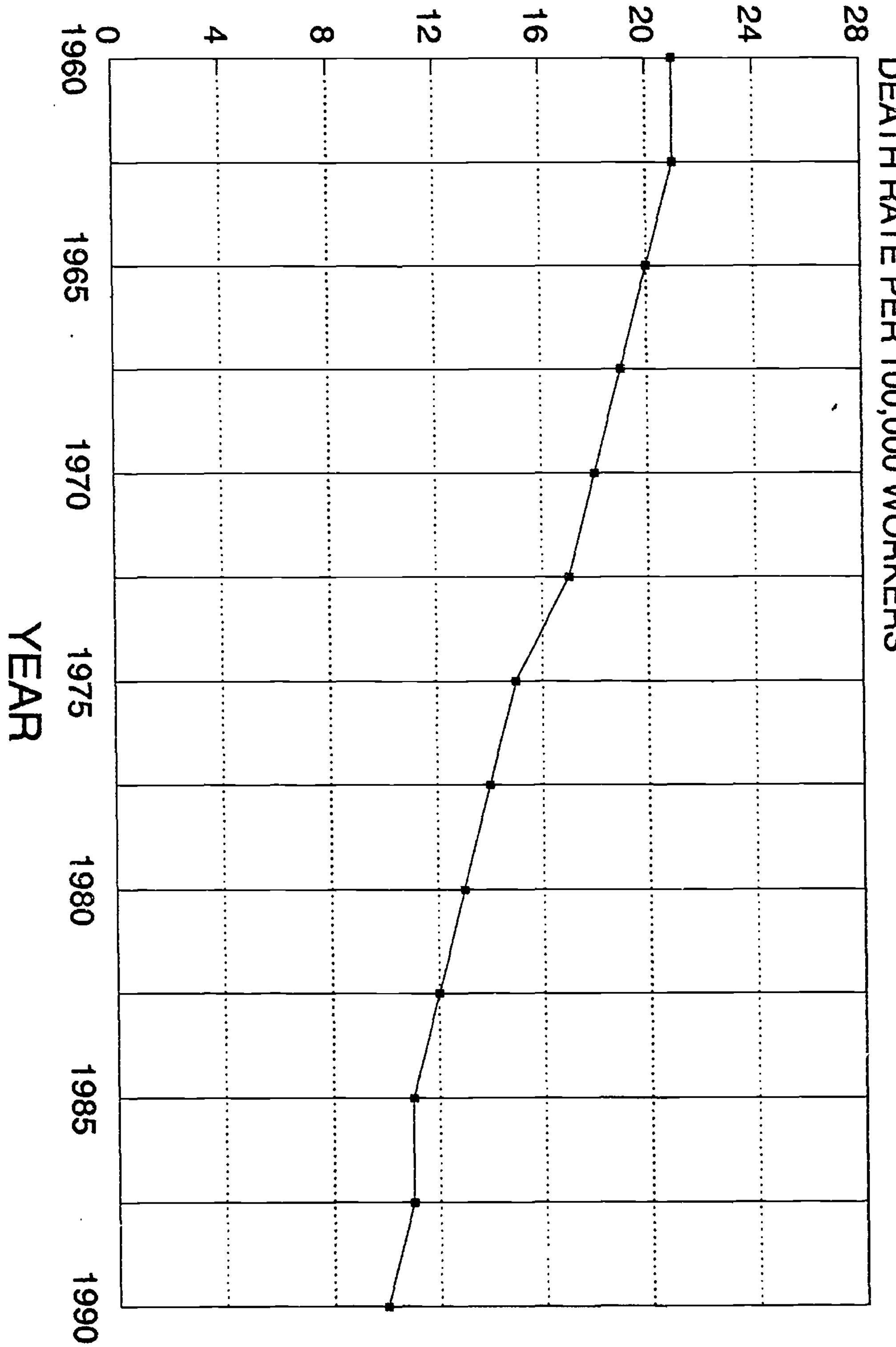
At Home	36%
At Work	24%
In a Vehicle	22%
In Public	18%

664

Source: National Safety Council

TRANSPARENCY MASTER #2

Work-Related Deaths

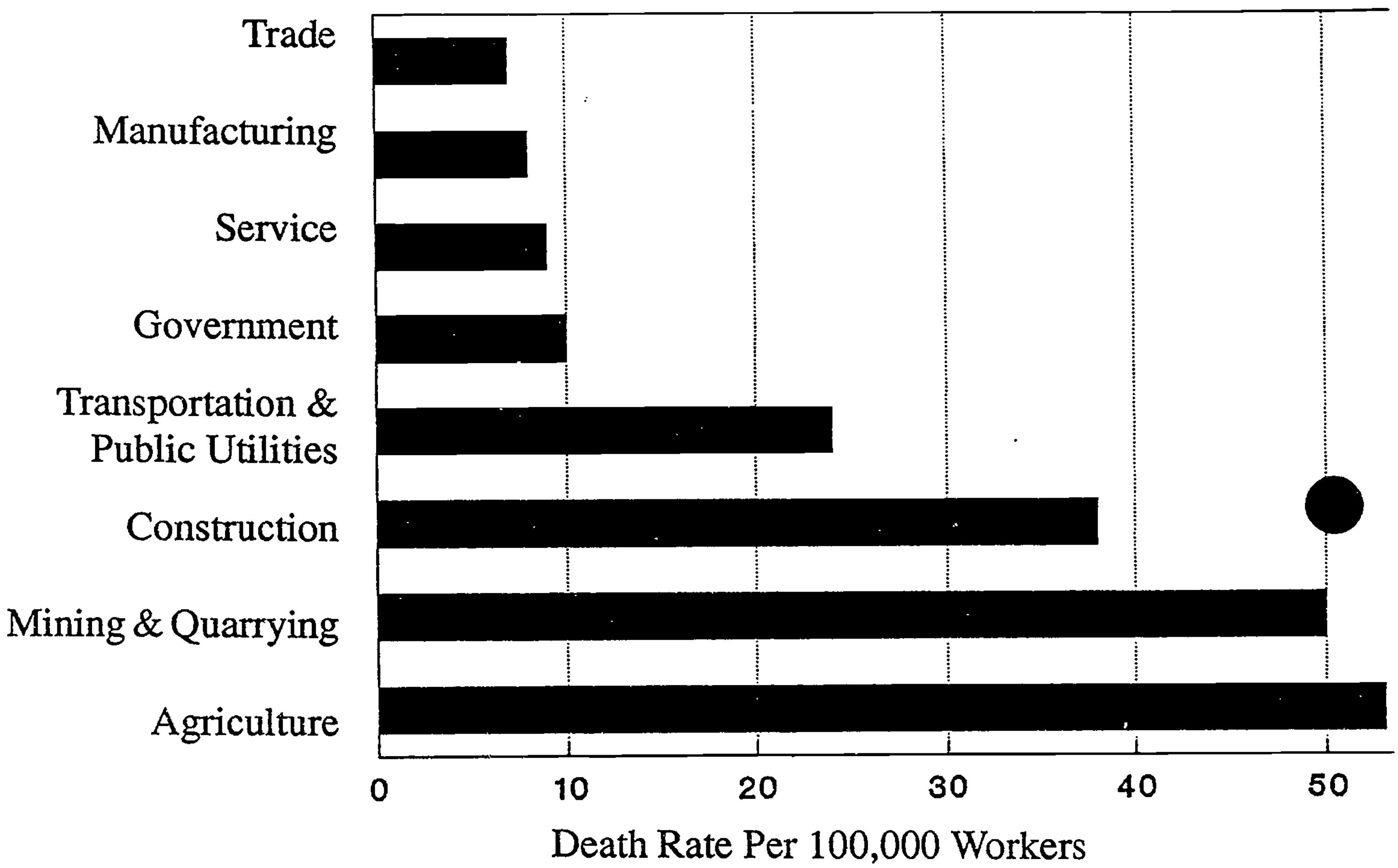


Source: National Safety Council

ERIC

TRANSPARENCY MASTER #3

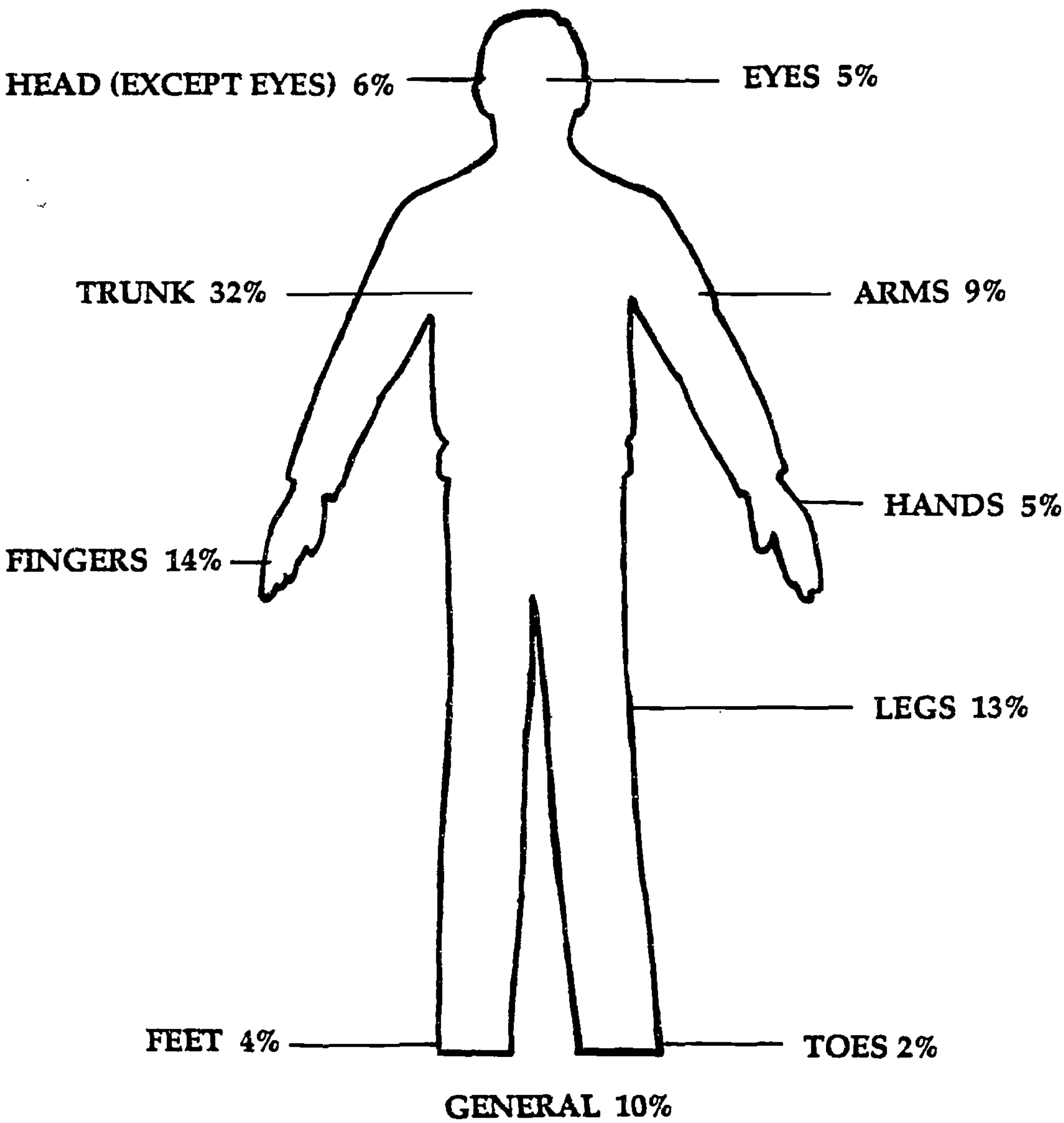
Death Rates for Major Industries in 1987



Source: National Safety Council

TRANSPARENCY MASTER #4

Injury Locations



Source: National Safety Council

ERIC

TRANSPARENCY MASTER #5

Costs Associated with Accidents

Monetary

Personal

Career

Future

ECS

TRANSPARENCY MASTER #6

Factors Associated with Accidents

Human Error

Lack of Knowledge

Lack of Skill

Poor Safety Attitudes

Physical Limitations

Fatigue and Illness

Job Site

Unsafe Work Environment

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TRANSPARENCY MASTER #7

Accident Prevention

Proper Nutrition

Adequate Sleep

Regular Exercise

Proper Clothing

Read Instructions

Knowledge of Job

Knowledge of Workplace

Maintain a Safe Work Area

Using the Proper Equipment

ERIC

TRANSPARENCY MASTER #8

Agencies Associated with Workplace Safety

OSHA — Occupational Safety and Health Administration

NIOSH — National Institute for Occupational Safety and Health

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TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #1

1. Point out that the home has more disabling accidents than any other single location.
2. Lead students in a discussion of how attitudes towards safety in the home carry over to work.
3. Point out that together, accidents at work and in a vehicle total almost one-half of all disabling accidents.
4. Since most people must use a vehicle to get to work, the workplace is the most hazardous overall.

Transparency Masters #2 and #3

1. Use these transparencies to introduce the death rates for all industries and the death rates for individual industries.
2. Lead the students in a discussion of the reasons why certain industries would seem more likely to have accidents.
3. Use Information Sheet #1 as a reference for particular concerns on the farm.
4. While no individual statistics are given for nonfarm agribusinesses, lead students in a discussion on similarities.

Transparency Master #4

1. Lead the students in a discussion of why certain areas of the body are more likely to sustain injuries.
2. Have students name pieces of equipment associated with certain tasks or occupations and how they can cause injury.

Transparency Master #5

1. Lead students in a discussion of each of the costs listed.
2. Have students identify individuals they know who have suffered accidents and how those accidents affected that individual.
3. Point out that almost 2 million people are injured on the job each year.
4. Point out that out of every 100 workers:
   a. One will die from a work related accident.
   b. Six will suffer a permanent injury.
   c. Seventy will be injured at some time.

Transparency Master #6

Lead students in a discussion of each of the human errors:

1. Lack of knowledge — refers to being unknowledgeable about a particular tool, being untrained or lacking the specific training with that tool. It can also refer to being unfamiliar with the location or surroundings.
2. Lack of skill — refers to lacking of skill with a particular procedure or tool. While you may have some knowledge about a tool or procedure, you may not yet have the skill to perform at the level needed.
3. Poor safety attitudes — refers to the attitude that "it can't happen to me" or that "I know how to take a short cut" that circumvents safety rules and procedures, also that "as long as I'm protected I don't need to worry about co-workers," or trying to work after using drugs or alcohol.
4. Physical limitations — refers to trying to do a job beyond one's capabilities or without the right equipment.
5. Fatigue or illness — refers to trying to work when sickness causes a lack of attention or when lack of sleep and rest makes one careless.
6. Job site, unsafe work environment — refers to lack of attention to keep the work area clean, not cleaning up spills, and lack of attention to other workers and procedures being performed.

Transparency #7

1. Lead the students in a discussion of each of the factors that can contribute to preventing accidents.
2. Ask students to give a specific example of how each of the factors can adversely affect one's performance on the job if not followed.

Transparency #8

1. OSHA — The agency's aim is to create health and safety standards for business and industry, inspect businesses for compliance to rules, and oversee corrections of violations.
2. NIOSH — The instutite collects data on accidents and illnesses, recommends new standards, and does research into the effects of new substances on workers.
3. Lead students in a discussion of the cost to taxpayers of an agency such as OSHA versus the savings to industry and workers in terms of earnings, and the savings of expenses for lost time.
4. Have students identify other agencies with safety programs for agricultural industries.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Safety Interview

STUDENT WORKSHEET #2 — Safety Article

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Safety Interview

Student Name ______________________

Date ______________________

Business Name ______________________

Address ______________________

Type of Business ______________________

Official Interviewed: ______________________

Title: ______________________

Major OSHA Guidelines: ______________________

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Current Safety Program: ______________________

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STUDENT WORKSHEET #2

Safety Article

Student Name ______________________

Date ______________________

Publication Name ______________________

Date, Edition ______________________

Article Title ______________________

Summary of Article ______________________

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Major Safety Concern Addressed ______________________

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CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Basic Soil Science Principles

RELATED PROBLEM AREA(S):

1. Understanding the World Food and Fiber Chain
2. Conserving Agricultural Resources
3. Enhancing Soil Fertility (Agricultural Business and Management Cluster)
4. Preventing Soil Erosion and Managing Land (Agricultural Business and Management Culture)
5. Classifying Soils (Agricultural Business and Management Cluster)
6. Understanding Plant Germination, Growth, and Development (Horticulture Cluster)
7. Surveying, Grading, and Tiling (Horticulture Cluster)
8. Enhancing Soil Fertility (Horticulture Cluster)
9. Conserving Soil (Agricultural Resources Cluster)
10. Maintaining Wildlife Habitat (Agricultural Resources Cluster)
11. Managing Parks and Recreational Areas (Agricultural Resources Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business Management Cluster

Duty L: Growing Corn, Soybeans, Small Grains, or Forage Crops

1. Plan planting schedules
2. Prepare seed bed
3. Select planting method

Duty P: Scouting Fields for Weed, Disease, Insect, or Other Damage

1. Evaluate soil conditions

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Horticulture Cluster

Duty A: Propagating Plants, Seeds, and Cuttings

1. Plan planting schedules
2. Maintain sod

Duty B: Preparing Soils and Planting Media

1. Mix media materials
2. Prepare seed bed

Duty C: Controlling the Plant Environment

1. Aerate compacted soil

Duty D: Applying Fertilizers and Chemicals

1. Test soil
2. Collect soil sample for fertilizer test

Duty K: Maintaining and Improving Grounds

1. Aerify turf
2. Verticut turf

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions an · codes for this form are provided on a separate sheet.

Submission Date ______

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand ways that people can minimize the depletion of the earth's resources.					
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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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Submission Date ________
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Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA (check one)
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ________
Title: ________
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (circle one) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Define basic terms relevant to soil science principles.					
2. Recognize the importance of soil to the food and fiber chain.					
3. Recognize the elements involved in the formations of a soil.					
4. Recognize the components which constitute a soil.					
5. Recognize the different characteristics to be found in a soil.					
6. Identify and describe the basic systems found within a soil and how these systems interact.					
*7. Observe examples of change in matter and decide if they are of a physical or chemical nature.					
680 *8. Identify several ways that people's activities accelerate soil erosion.					681

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding Basic Soil Science Principles

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define basic terms relevant to soil science principles.

2. Recognize the importance of soil to the food and fiber chain.

3. Identify the elements involved in the formation of a soil.

4. Identify the components which constitute a soil.

5. Identify different types of soils by their characteristics.

6. Recognize that the interaction of soil formation elements may result in soils with differing properties.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding Basic Soil Science Principles

PROBLEMS AND QUESTIONS FOR STUDY	INSTRUCTOR'S NOTES AND REFERENCES
1. What is soil?	
2. Why is soil important?	
3. What are factors which impact the importance of soil?	
4. If soil is renewable, why is it important to conserve soil?	
5. What are soil parent materials?	
6. What is the difference between a residual and a transported parent material?	
7. What is topography?	
8. What is climate?	
9. What are the organisms associated with soil?	
10. What is weathering?	
11. How does weathering affect a soil?	
12. Why do various mixtures of parent material, topography, climate, organisms, and weathering result in different soils?	
13. What are the four main components of a soil?	
14. What factors affect the proportions of these components?	
15. What are soil horizons?	
16. What is soil porosity?	
17. How do size separates affect soil porosity?	
18. What are soil minerals?	
19. What are aggregates?	
20. Why are aggregates important?	

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding Basic Soil Science Principles

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

INSTRUCTOR'S NOTES AND REFERENCES

1. Use local SCS and ASCS personnel as resource persons for technical expertise.

2. Lead students in a discussion on the importance of soil to everyone, not just producers.

3. Lead students in a discussion of local activities that have an effect on soil characteristics such as:

   a. Encroachment by towns for houses, retail business, landfills.
   b. Crop and livestock farming practices.
   c. Government actions including set aside programs and conservation plans.

4. Conduct a field trip to a building site or a dug pit to examine topography and soil characteristics of color, structure, and texture.

5. Have students complete Student Worksheet #1.

6. Have students complete Student Worksheet #2.

7. Have students complete Student Worksheet #3.

8. Have students collect soil samples from various locations to compare texture, structure, organic matter, color, and drainage qualities.

9. Lead students in a discussion of the overall soil formation elements, what elements contributed to the characteristics of our present soil, how current actions of people will affect the soil for future use, and which of those factors are subject to change.

10. Have students participate in local and/or Sectional FFA land use contest(s).

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Agricultural Literacy

PROBLEM AREA: Understanding Basic Soil Science Principles

REFERENCES | **INSTRUCTOR'S NOTES AND REFERENCES**

1. *Agriculture in our Lives*. (1984). Krebs, Alfred H. Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

2. *Our Natural Resources*. (1982). Kircher, Harry B., Wallace, Donald L. Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

3. *Soils: An Introduction.* (1987). Singer, Michael J., Munns, Donald N. Macmillan Publishing Co., 866 Third Avenue, New York, NY 10022.

*4. *Soils of Illinois*. (1984). Bulletin 778. University of Illinois at Urbana-Champaign, College of Agriculture, Agriculture Experiment Station, in Cooperation with the Soil Conservation Service, U.S. Dept. of Agriculture.

*5. *Understanding Soil.* (VAS Unit #4052.) Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

6. *Conserving Soil.* (1988). National Association of Conservation Districts, Box 855, League City, TX 77573.

7. *Our Soils and their Management.* (1985). Donahue, R.L., Follett, R.H., Tulloch, R.W. The Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

*8. *Soil Science Simplified.* (1988). Harpstead, M.I., Hole, F.D., Bennett, W.F. Iowa State University Press, Ames, IA 50010.

9. *Soil Science.* (1985). Hausenbuiller, R.L. William C. Brown Publishers, Dubuque, IA.

*Indicates highly recommended references

INSTRUCTIONAL MATERIALS

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Soil Inorganic Minerals

INFORMATION SHEET #3 — Cation Exchange and pH

INFORMATION SHEET #4 — Organic Matter

INFORMATION SHEET #5 — Soil Organisms

INFORMATION SHEET #6 — Soil Water

INFORMATION SHEET #7 — Soil Atmosphere and Aeration

TRANSPARENCY MASTER #1 — Why Soils are Important (with discussion guide)

TRANSPARENCY MASTER #2 — Soil Origins (with discussion guide)

TRANSPARENCY MASTER #3 — The Original Source of Nutrients for Plants and Animals is the Soil (with discussion guide)

TRANSPARENCY MASTER #4 — Physical Breakdown of Rocks (with discussion guide)

TRANSPARENCY MASTER #5 — Extent of Glaciation in Illinois (with discussion guide)

TRANSPARENCY MASTER #6 — Parent Materials and Loess Deposition (with discussion guide)

TRANSPARENCY MASTER #7 — Soil Profile (with discussion guide)

TRANSPARENCY MASTER #8 — Native Vegetation (with discussion guide)

TRANSPARENCY MASTER #9 — Crystalline Structure of Clay (with discussion guide)

TRANSPARENCY MASTER #10 — Guide to Minerals

TRANSPARENCY MASTER #11 — Water Capacity of Size Separates

TRANSPARENCY MASTER #12 — Concentration of H^+ and OH^- with varying pH

TRANSPARENCY MASTER #13 — Water Structure; Hygroscopic, Capillary, and Free Water

TRANSPARENCY MASTER #14 — Soil Aeration

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INFORMATION SHEET #1

Terms to be Defined

Acre — a unit of measurement of land. It is equal to the area of land inside a square that is about 209 feet on each side (43,560 square feet).

Algae — microscopic green plants that live in water and on land. They serve as food for other organisms.

Bacteria — microscopic organisms that live on water and on land. They help break down organic materials into simpler nutrients in a process called decay. Bacteria release nutrients to the soil.

Bedrock — a more or less solid layer of rock found on the surface of the land or below the soil.

Cell division — the process by which a plant or animal cell splits in half to form younger cells.

Cleavage — the tendency of crystalline rocks or mineral particles to split along thin parallel lines into thin sheets.

Commodity — a useful or valuable product for agriculture such as soybeans, beets, or cattle.

Composting — mixing decaying organic matter (food scraps, grass clippings, leaves) to form a rich soil conditioner.

Condensation — changing a gas into a liquid; for example, when steam or water vapor turn into water.

Elongation — the process in which something, such as a plant cell, becomes longer as it grows.

Evaporation — changing a liquid to a gas; for example, when water turns into steam or water vapor.

Export — a product (such as grain or meat) that is traded with another nation.

Famine — an extreme shortage of food in a given area.

Feedlot — an enclosed area in which animals, such as hogs or cattle, are fed before being sold for meat.

Floc — a cluster of soil.

Flocculation — the process by which suspended colloidal or very fine particles are assembled into larger masses or floccules which eventually settle out of suspension.

Fungi (plural of fungus) — a group of nongreen plants, such as molds, and mushrooms, that live on dead or dying organic matter. Fungi release nutrients to the soil.

Geological — relating to the earth's surface features.

Goods — items or things, such as bread, meat, or fruit, that people are willing to buy.

Habitat — an area of land in which plants and animals live, grow, and reproduce.

Horizon — layer of soil with characteristics produced by soil-forming processes.

Humus — highly decomposed plant and animal residue that is a part of soil.

Hydrologic cycle — the cycle of water movement from the atmosphere to the earth, and transpiration, condensation, precipitation, percolation, runoff, and storage.

Irreversible — a situation that is impossible to change. For example, it is impossible to change a shopping mall back to farmland.

Land — one of the major factors of production that is supplied by nature and includes all natural resources in their original state such as mineral deposits, wildlife, timber, fish, water, and the fertility of the soil.

Landfill — a location where solid waste (garbage) is disposed of.

Moraine — an accumulation of soil and rock deposited by a glacier.

Leaching — the removal of soluable minerals from soil by the downward movement of water.

Mineral — a naturally occurring inorganic substance with definite chemical and physical properties and a definite crystal structure.

Monoculture — the cultivation of a single type of crop over a large area which excludes other uses of that land.

Native Americans — the people who lived in the United States before it was in habited by people from Europe, Asia, and other countries.

Natural resources — materials and capacities (soil, water, minerals, etc) supplied by nature.

Nematodes — microscopic, elongated worms that live on other organisms in the soil.

Nutrient — a substance that supplies nourishment for an organism to live. It can be food or chemicals, depending upon the organism.

Nutrient exchange — the process by which plant roots exchange an acid for nutrients from the soil.

Organic matter — plant and animal material in various stages of decomposition that may be part of the soil.

Parent material — the earthy materials, both mineral and organic, from which soil is formed, or the unconsolidated mass of mineral or rock from which the upper layers of the soil profile are formed.

Percolation — the downward movement of water in soil.

Permeability — the quality of soil that allows air or water to move though it.

Photosynthesis — the process in which green plants combine water and carbon dioxide gas in the presence of light to form sugars and oxygen gas.

Plains States — the area of the United States that is generally west of the Mississippi River and east of the Rocky Mountains (also called the Great Plains).

Polymer — a chemical compound or mixture of compounds formed by a combination of molecules forming larger molecules.

Pore spaces — the area of the soil through which water and air move; the space between soil particles.

Precipitation — rain, snow, and other forms of water that fall to the earth.

Productivity — the amount of crops or animals that can be harvested from land. It can also mean the general amount of goods made in a given time or in a given area.

Residual — refers to the soils formed from bedrock materials that have not been moved or transported from their original location.

Respiration — the process by which organisms obtain energy when sugars combine with oxygen. Carbon dioxide and water are given off.

Row crops — agricultural crops, such as corn and soybeans, that are grown in rows.

Runoff — water that flows off land into streams and other waterways.

Soil — a naturally occurring mixture of minerals, organic matter, water, and air which has a definite structure and composition and forms on the surface of the land.

Soil color — the color of a sample of soil.

Soil horizon — a layer of soil that is nearly parallel to the land surface and is different from layers above and below.

Soil mineral — that portion of the soil that is inorganic and neither air nor water.

Soil profile — a vertical section of soil from the surface through all its horizons.

Soil survey — the identification, classification, mapping, interpretation, and explanation of the soil over a given area of land.

Soil texture — the relative amounts of sand, silt, and clay in a given soil sample.

Soil tilth — the condition of the soil structure.

Technology — the many different methods used to provide goods for human needs and wants.

Topography — shape of the ground as determined by such major features as hills, mountains, or large plants.

Water storage — the locations in which water is stored. They can be above ground in lakes and rivers.

Zone of accumulation — the layers in a soil into which soluble compounds are moved and deposited by water.

Zone of decomposition — surface layers in a soil in which organic matter decays.

Zone of leaching — the layers in a soil from which soluble nutrients are removed by water.

INFORMATION SHEET #2

Soil Inorganic Minerals

The inorganic minerals present in the soil were contained in the original rock and subjected to various amounts of weathering. These minerals may be "primary" as found in the clay minerals montmorillonite, kaolinite, and illite. A second class of inorganic minerals are those containing silicon and oxygen. A third class of inorganic minerals are the non-silicates, mostly containing sodium and calcium.

It has been said that the ideal soil would contain 50% solid space (5% organic, 45% mineral) and 50% pore space (25% micro, 25% macro). It is the inorganic minerals that play the most important role in making up this soil. The soil texture, which is the relative proportion of the various-sized particles (separates), and the soil structure, which is the manner in which individual particles bind together into aggregates, both depend on the inorganic minerals present. The size of separates relates directly to the amount of surface area present. The size of the separates affects the rate and extent of chemical reactions, retention and availability of water, soil aeration, cation exchange capacity, and thus farmers' land use and tillage requirements. The structures aggregated relate directly to the solid space and pore space available. For example, sandy soils have a large percent of macropores which allow drainage and aeration, but few of the micropores needed for capillary water (which plants use). Clay soils have a large percent of micropores and retain capillary water, but few macropores to allow drainage and to provide the air pockets which are needed for the roots' removal of oxygen from soil atmosphere.

Silicon and oxygen are the two most abundant elements found in the earth's crust and form the basis for the primary silicate minerals. In the silicates the silicon has 4 fewer electrons than protons and carries a net +4 charge. Oxygen tends to gain two extra electrons and carries a net -2 charge. As oxygen and silicon combine they form the silica tetrahedron, which is the result of 4 oxygen atoms fitting neatly around 1 silicon atom. Since each oxygen has another electron charge (each oxygen has a -2; one electron is filled by the silicon, leaving 4 oxygens around the silicon, each with a -1 charge) it attempts to fill that charge with another silicon. This forms the three-dimensional structure of quartz which makes up the majority of sands. The feldspars are a similar arrangement, except that half the silicons are replaced by aluminum.

The secondary minerals contain silicon and oxygen with the addition of hydrogen and aluminum and form the aluminum silicates or clay minerals. The aluminum molecule has a +3 charge and attracts six oxygens to form a six-sided octahedron. The silicon tetrahedron and the aluminum octahedron form the building blocks of the clay minerals by being stacked one on top of another to form layers. In 1:1 clay minerals, 1 tetrahedron layer is on top of 1 octahedron layer. In 2:1 clay minerals, 1 tetrahedron layer is on top of 1 octahedron layer which is on top of another tetrahedron layer. These unit layers (either 1:1 or 2:1) are held together by less than valence charges in the interlayer (between unit layers). This is the major location for the cation exchange capacity (in addition to the layer edges) when H^+ ions exchange with other cations. The differences in the strength at which the H^+ or other cations are held, weakly or strongly, accounts for the differences in different soils' abilities to hold nutrients for plants and thus the abilities to produce crops.

The nonsilicate minerals do not use silicon for a base and instead use sodium and calcium. These soils tend to be basic, rather than acidic, and require different management techniques. These soils, in areas of little precipitation, leave salts such as NaCl, $NaSO_4$, $CaCO_3$ (Calcite), and $CaSO_4$ (Gypsum).

INFORMATION SHEET #3

Cation Exchange and pH

Cation Exchange Capacity

Cations are those elements that contain a positive charge such as H^+, CA^{++}, MG^{++}, K^+, Na^+. The ability of a soil to exchange and retain these cations is called cation exchange capacity (CEC) and is expressed in milliequivalents (meq) of H^+, or that amount of H^+ that will be taken up by a dry sample of soil. Kaolinite (a 1:1 clay) has a CEC of 10 meq/100g; montmorillonite (a 2:1 clay) has a CEC of 100 meq/100g; and organic soils have the highest cec, 150-300 meq/100g, which is the reason higher organic soils produce more crops, that is, there is more area for nutrients to be held and available for plants to absorb.

The difference in the CEC of a 1:1 clay and a 2:1 clay relates directly to the bonding between the Micelles, the sheets of tetrahedral-octahedral (1:1) or the sheets of tetrahedral-octahedral-tetrahedral (2:1). In the 1:1 clays the OH^- on the bottom of the octahedral faces the O^{--} on the top of the tetrahedral and allows for H^+ to become static between the layers. Thus the H^+ is not available for exchange with other cations. In the 2:1 clays, the O^- molecules on the bottoms of the tetrahedrals face and repel each other. This holds the H^+ molecules weakly, allowing for cations with a larger valence number (such as Ca^{++} instead of K^+) to be exchanged with them. Thus nutrients are held for plant use.

The nonsilicate minerals are useful to provide cations to replace the H^+ cations found in acidic soils and raise the concentration of OH^-, thus raising the pH. Such happens when limestone is spread on the soil.

Soil pH

Soil pH is the expression of the negative log of the H^+ ion activity found in the soil solution. This expression is designated by the numbers 0 through 14. 0 is the lowest acidic rating and expresses the highest percent of H^+ ions. 14 represents the highest percent of OH^- and is the highest alkaline rating. At the number 7 the concentrations of H^+ and OH^- are relatively equal and thus the solution is neutral.

The H^+ are made available from the combination of CO_2, given off in respiration by roots and by the multitude of organism in the soil, and H_2O present. The carbonic acid formed dissociates and leaves H^+ free to exchange with other cations on clay particles as those cations are taken up by plants to use for nutrients. This action will eventually lead to a high percent of H^+ ions and thus a low pH. When $CaCO_3$ is added to the soil the high amount of Ca^{++} available helps to replace (exchange with) H^+ on clay particles, thus lowering the percent of H^+. This forms hydronium, leaving the OH^- (hydroxide) free to increase the percent of OH^- and thus raise the pH.

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H^+ + HCO_3^-$$

$$H_2O \leftrightarrow \underset{\text{Hydronium}}{\underset{H + H_2O}{H_3O^+}} + \underset{\text{Hydroxide}}{OH^-}$$

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INFORMATION SHEET #4

Organic Matter

The organic matter of the soil is that which has been received from living organisms and is usually given the collective name of humus. Humus, however, is more correctly defined as the resistant material of either animal, higher plant, or microbial origin that is left after those materials have been subjected to decomposition by the enzymatic digestion of soil microorganisms. In this digestion the sugars, starches, and simple proteins are rapidly decayed and what we see in the soil as organic matter is the semi-cellulose, lignin, wax, and fat that is resistant. This dark, amorphous, colloidal substance is non-cohesive which allows it to coat soil particles and act both as protection for soil minerals and as a cementing agent to hold aggregates together to form stable structures. It is found in the O layer of organic soils and the A layer of mineral soils.

Organic matter contributes to soil not only through the carbon-nitrogen cycle which gives bacteria the nitrogen necessary for decomposition, but also by providing water-soluble proteins which are decomposed into amino acids and ammonium. This ammonium is converted to nitrates, the form used by plants and by certain other bacteria, nitrobacillus and nitrobacter. Another major characteristic of organic matter is its ability to absorb even more nutrients than the clays. This is the reason it is so desirable in soils. Perhaps the most essential contribution of organic matter is the ability to hold water. Organic matter has the ability to absorb large amounts of water relative to its weight, like a sponge, and it is porous, which allows water to freely infiltrate and drain away.

Soils are frequently classified by the content of organic matter. Mineral soils have up to 10% organic material, muck soils have 10-40% organic material, and peat soils have 40-100% organic material. Muck and peat soils form in shallow marches and old lake beds in which the organic matter settles to the bottom. Some anaerobic decomposition takes place but it is much less efficient than the aerobic. The latter occurs after the organic material is exposed to air by cultivation and drainage.

INFORMATION SHEET #5

Soil Organisms

Soil organisms play a most important role in the development of a soil from inorganic minerals. While the physical elements reduce the size of soil particles and transport minerals for soils, organisms are required to invade these minerals before actual development can take place.

Higher plants are considered the primary organisms of soil. Their roots penetrate crevices, assisting physical breakdown of rock matter. The CO_2 they give off in respiration forms carbonic acid, which further aids in the chemical breakdown of minerals. The organic matter that collects with seasonal changes or as a result of plant death contributes to the formation of soil humus and the maintenance of bacterial populations. Channels left after the decay of dead roots allow for greater water percolation in the soil.

Bacteria are present in all soils and release minerals contained in organisms. These minerals are recycled again by plants. Bacteria may be beneficial, like those which convert nitrogen compounds in the soil atmosphere for general plant use or those nitrogen-fixing bacteria associated with specific plants. Harmful bacteria may cause plant diseases or oxidize ferrous iron to ferric iron and contribute to the impermeable hard pan.

Fungi perform functions similar to bacteria and may be found in decomposing organic matter or in symbiosis with plant roots, especially woody roots. This tpye of symbiosis is called mycorrhiza. This association provides minerals and water from the fungus to the roots, and carbohydrates from the roots to the fungus. Another symbiosis is the lichen, which is a relationship of a fungus and an alga. The alga photosynthesizes and together they slowly dissolve the rocks on which they reside, in addition to accumulating dust for soil formation.

Arthropods (crayfish, mites, ants, centipedes and insects) and annelids (segmented worms) and nematodes contribute to soil aeration by tunneling. The decay of their bodies after death also adds organic matter to the soil. Annelids and nematodes recycle subsurface soil in the form of castings. Nematodes are important as they may be pathogenic to plants or distribute parasitic fungi.

Vertebrate animals such as mice, shrews, ground squirrels, gophers, moles, badgers, and foxes must be considered not so much for their tunneling and boring but for being pests when present in large numbers.

ERIC

INFORMATION SHEET #6

Soil Water

Water is a constituent of all cells and is the most limiting factor in the growth of a plant. Water may comprise as little as 3% of a peanut seed, 40% of dormant wood, or up to 95% of succulent fruits such as a peach. Water is a solvent system for transport of nutrients and products and is necessary for turgor within the cell. The water found within the plant makes up only 10-15% of the water that is necessary for plant functions. An alfalfa plant requires 858 pounds of water to produce 1 pound of dry materials. The majority of water is lost through the transpirational process that exchanges water for the carbons in CO_2 to be used in photosynthesis. In addition water vapor is lost to the moving air which helps to keep the plant cool.

The water (H_2O) molecule is triangular in structure with two hydrogen atoms bonded to an oxygen atom and located 105° apart. Though the H_2O molecule is technically neutral, it is in fact "polar." The oxygen atom is electrophyllic and tends to pull electrons from the hydrogen atoms. This makes the hydrogen atoms somewhat positive and the oxygen atom somewhat negative. The molecular structure, therefore, has a slightly uneven distribution of charge.

The polarity of water is important to soils in that the attraction of water molecules for each other (cohesion) allows for clusters to form. This polarity also affects the H_2O attraction for solid surfaces, such as soil particles.

The total amount of water that can be put into a quantity of soil brings that soil to the saturation point. After the free water leaves, that is, the water is drawn from the soil by gravity, the water that is retained is said to leave the soil at filled capacity. Capillary water is that water held in soil micropores by capillary forces. These forces include cohesion and adhesion. If a quantity of soil is allowed to air dry, the only water that will remain is that which is tightly adhered to the soil particles and that which is chemically bonded to the soil. This latter is called hygroscopic water.

The total amount of water in a soil is not as important as that which is available. Tension is the force required to move water and is measured by a tensionmeter. It is expressed in atmospheres (atm). Free water flows to gravity and has 0 atm. Field capacity water is said to be at 1/3 atm. Capillary water is from 1/3 atm to 31 atm. 31 atm is the point of air dry. The tension in atmospheres of hygroscopic water depends upon the soil and can only be found by properly drying a sample. The water available to a plant is only a portion of the capillary water, that from 1/3 atm (field capacity) to 15 atm, which is known as the permanent wilting point. At the permanent wilting point a plant can no longer remove H_2O from the soil, and if more H_2O is not added the plant will die. The range from 1/3 atm to 15 atm is known as plant available water. The amount of available water depends on soil structure. Sandy soils afford better drainage but clay soils afford better water retention. The soil structure directly affects the space that roots may occupy and roots can only use that water which they come in contact with. The structure also relates to how fast water from deeper in the soil moves up toward roots by capillary action.

Movement of water through soil can be divided into three types of flow: saturated, unsaturated, and vapor equalization. Saturated flow is the movement of free water in response to gravity. This movement depends on the texture and structure of the soil. The movement through a sandy loam will be more downward than in a clay loam, where the smaller-sized particles restrict downward movement and force the water farther out laterally.

Unsaturated flow is the movement of water by the adjustment of film tension and occurs form 1/3 atm to 31 atm. Water tends to flow from low tension, thick film to high tension, thin film. As water is absorbed into a root the tension is increased (the outside film gets thinner). Water tends to move toward that higher tension, partly because of the cohesion of the water molecules. Unsaturated flow requires a continuous film of water to be pulled through the capillaries in the soil. If the film is broken, unsaturated flow stops.

Vapor equalization is the movement of water vapor from a high concentration to a low concentration. This usually occurs from warm to cool areas and sometimes from moist to dry. An example is when warm vapor comes in contact with cool soil. In this case, the vapor condenses and forms films, which in turn will help pull more water toward the surface (low tension to high tension) and allow for more evaporation.

INFORMATION SHEET #7

Soil Atmosphere and Aeration

The atmosphere within the soil is similar to the atmosphere above ground in content. However, the proportion of gases is different. The oxygen amount of 20% decreases to close to 0% from use by microbes and plant roots. The percentage of CO_2 increases from .03% to .10% with that produced from the microbial action of decomposition and root respiration. The atmosphere of the soil is contained in pore spaces not filled with water. These are not necessarily continuous, as isolated pockets occur from structure, the management technique, and weather. When the relative humidity of the soil stays near 100% in reaction to temperature fluctuations, the higher the temperature, the more water can be stored in the soil.

Soil aeration properties are those most affected by management. A well-aerated soil is one in which neither the amount nor the composition of substances is limiting to plant growth. This requires a sufficient drainage and a rapid exchange of gases between the atmospheres. The aeration status of a soil will affect the O_2 and CO_2 content (previously mentioned), the amount of root growth (which is a function of the level of O_2 in the soil, and which becomes severely limited when that level falls below 10%), and the oxidation-reduction chemistry taking place (a well-aerated soil will follow the nitrification path, whereas a poorly aerated soil will follow denitrification and lose N_2 and NO gas to the atmosphere).

Gas movement into and out of the soil usually proceeds by diffusive transfer, and occasionally by mass flow and turbulent transfer. These latter two are faster methods because they do not depend solely on individual molecular movement. Diffusive transfer is simply the movement is response to a concentration gradient and is important particularly at the 6" level. Mass flow is the movement of all gases present in the soil atmosphere (down to the 6" level) leaving and being replaced by above ground atmosphere. This occurs twice daily, early morning and evening, in response to temperature differentials between atmosphere and soil. Turbulent transfer is similar to diffusion but is accelerated by the physical stirring caused from thermal convection and wind.

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TRANSPARENCY MASTER #1

Why Soils are Important

1. Plants grow in and on soil.

2. Plants support animal life.

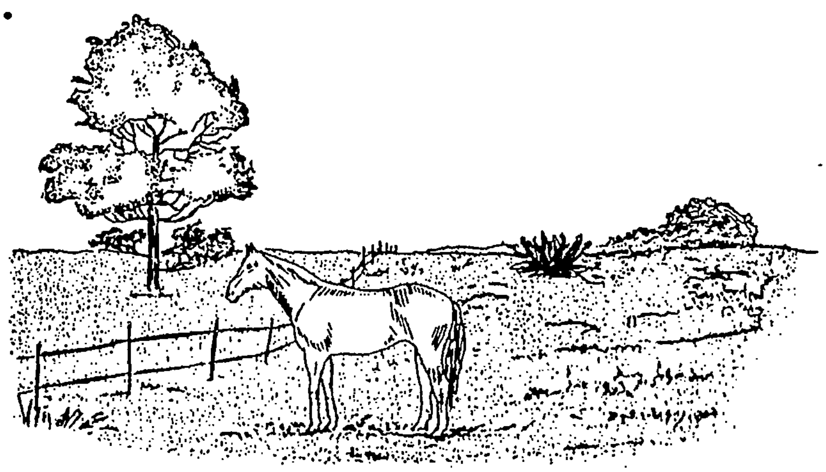
3. Plants and animals support human life.

4. World population is rapidly increasing.

5. A large part of the world's population has inadequate nutrition.

6. World supply of productive soil is limited.

7. Improved soil management could feed more people.



TRANSPARENCY MASTER #2

Soil Origins

I. Residual

A. Inorganic matter (from minerals and rock)

1. Igneous
2. Sedimentary
3. Metamorphic

B. Organic matter (from plant or animal life)

II. Transported

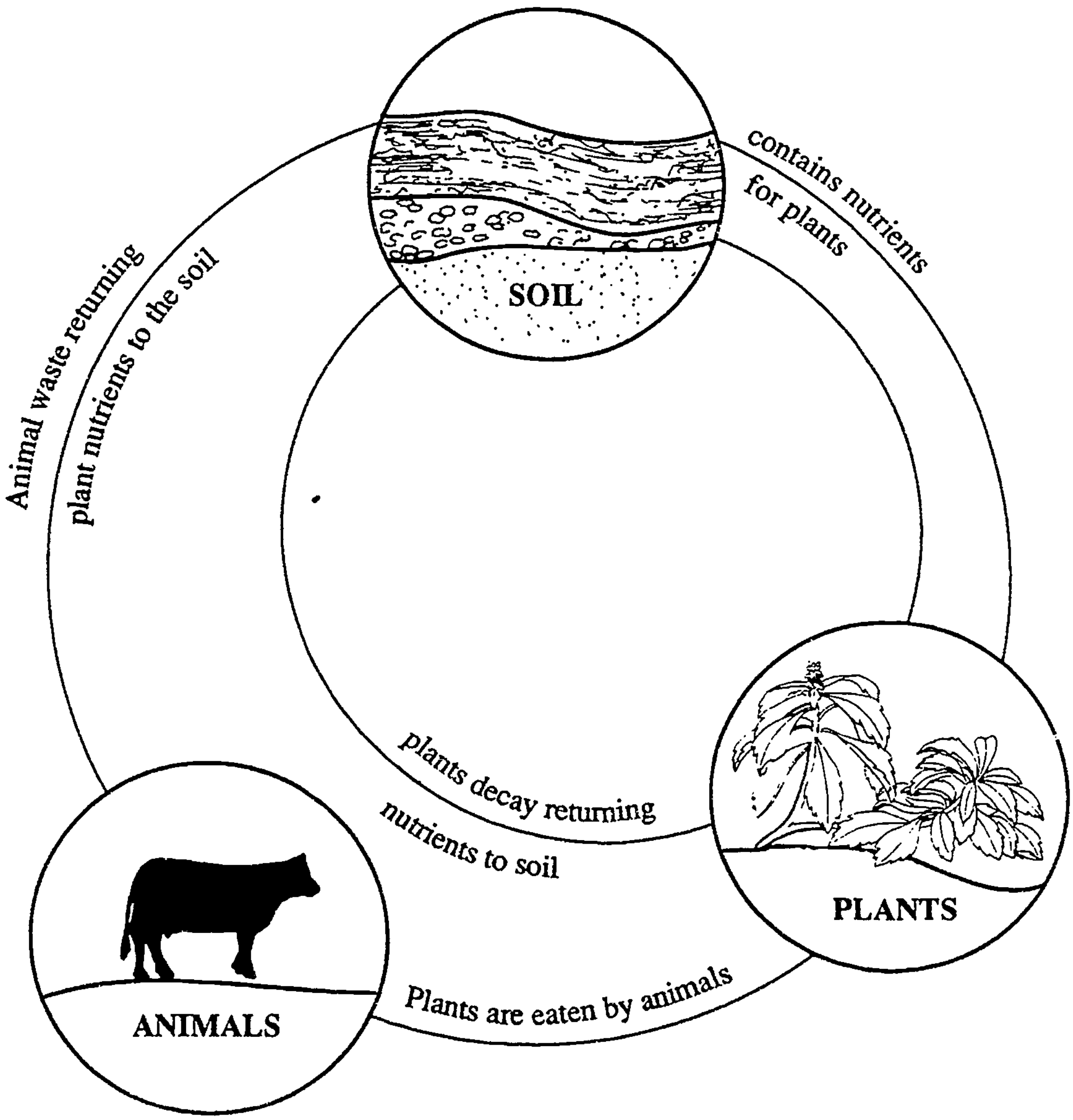
A. Wind (loess)

B. Water (alluvial)

C. Ice (glacial till)

TRANSPARENCY MASTER #3

The Original Source of Nutrients for Plants and Animals is the Soil



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TRANSPARENCY MASTER #4

Physical Breakdown of Rocks

Wind

Plants and animals

Heating and cooling

Freezing and thawing

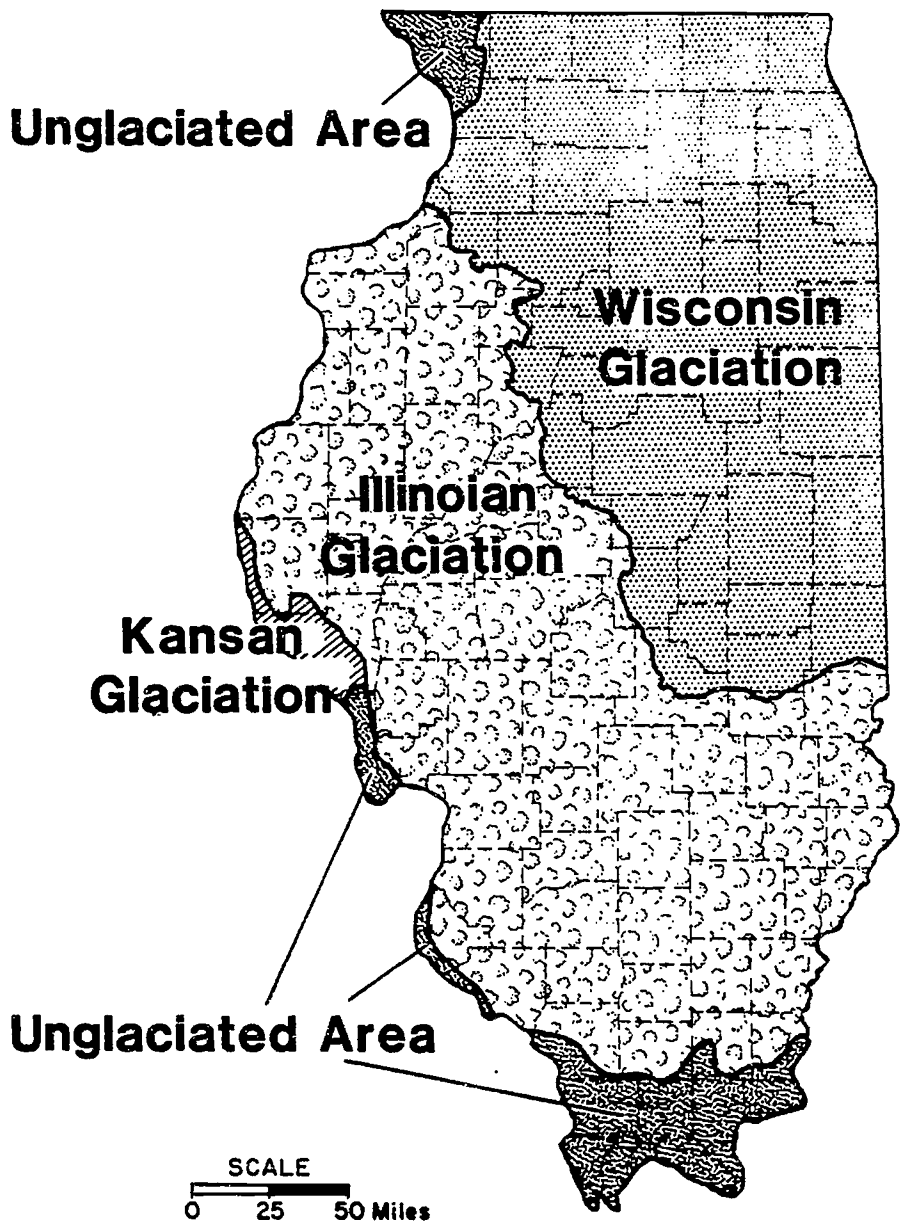
Wetting and drying

Rivers

(Glaciers and landslides)

TRANPARENCY MASTER #5

Extent of Glaciation in Illinois



TRANSPARENCY MASTER #6

Parent Materials and Loess Deposition

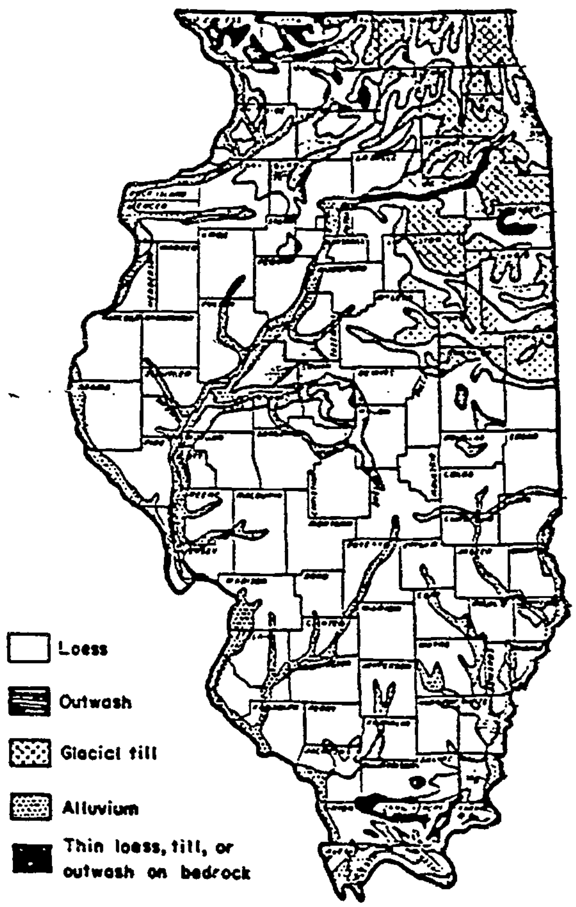


Figure 1 - The main kinds of soil parent materials in Illinois.

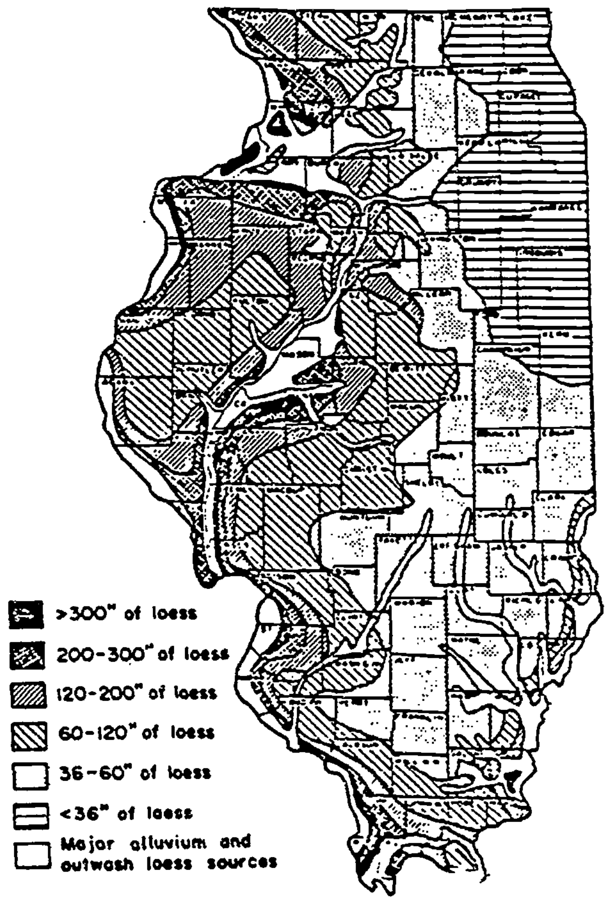
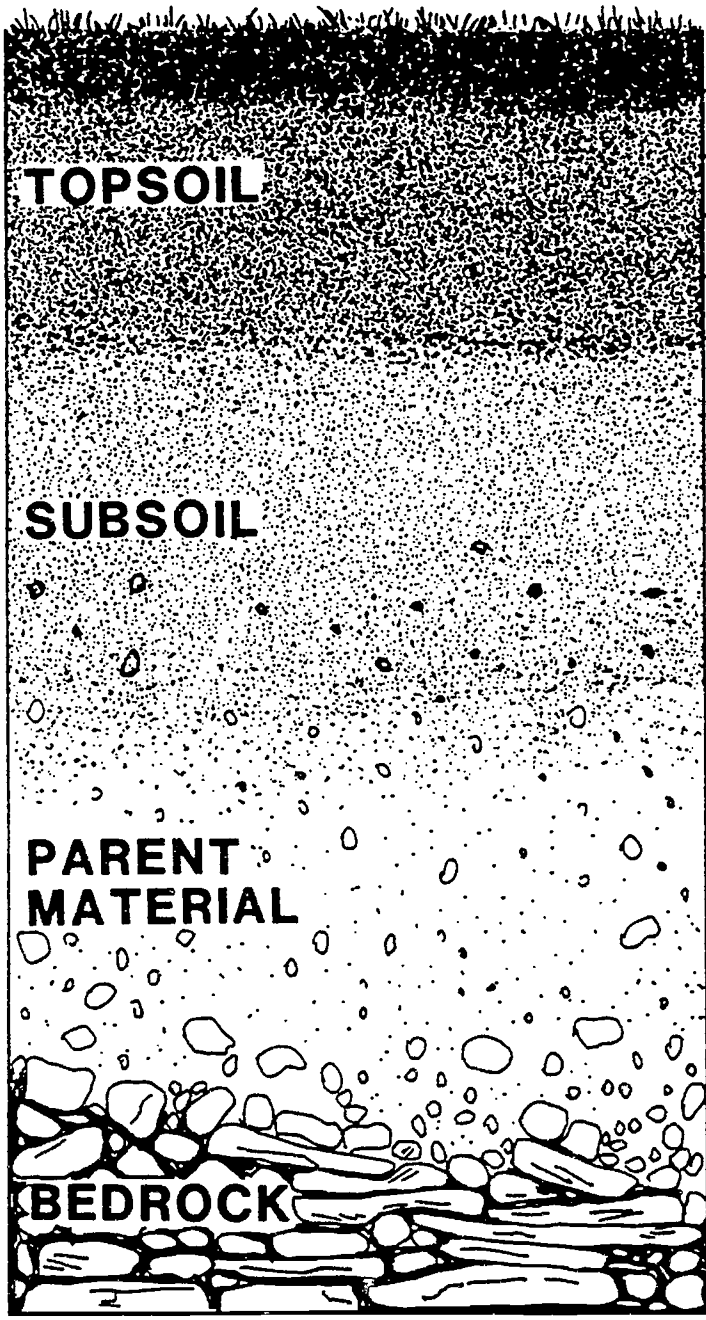


Figure 2 - Approximate loess depth (in inches) on nearly level, uneroded topography in Illinois.

TRANSPARENCY MASTER #7

Soil Profile



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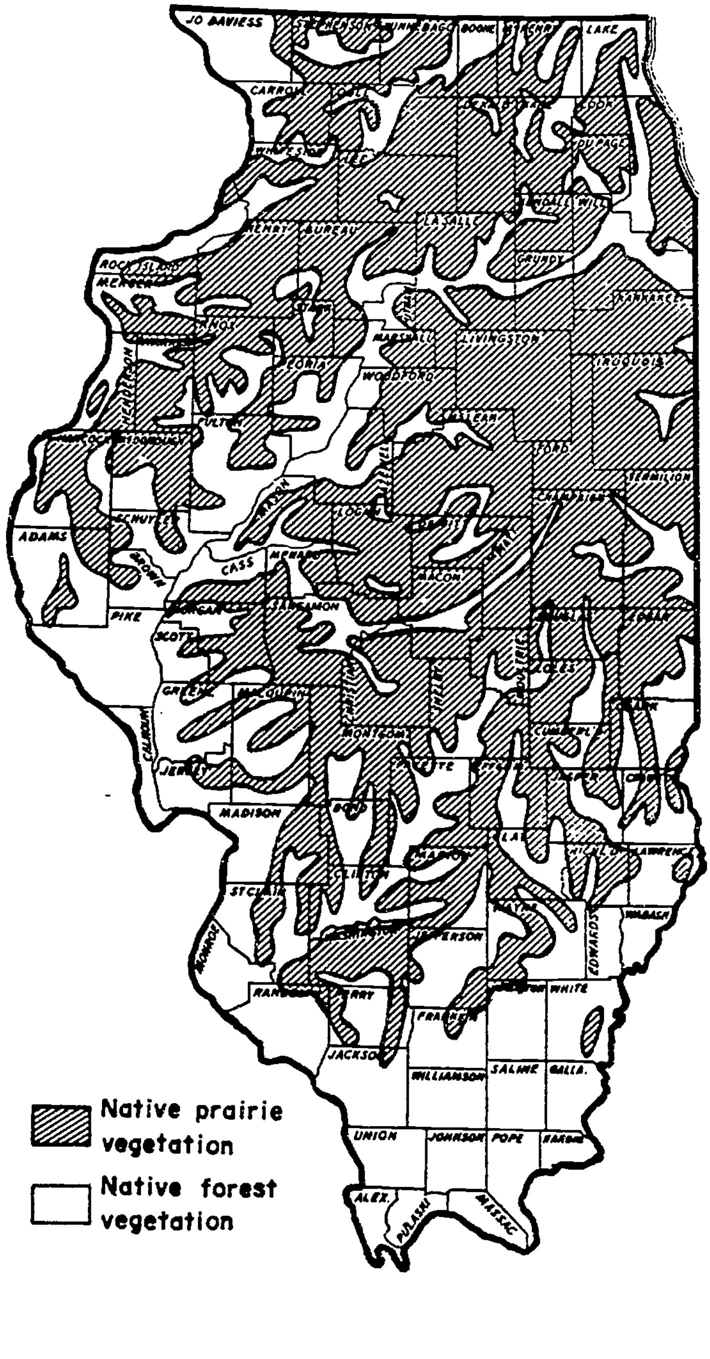
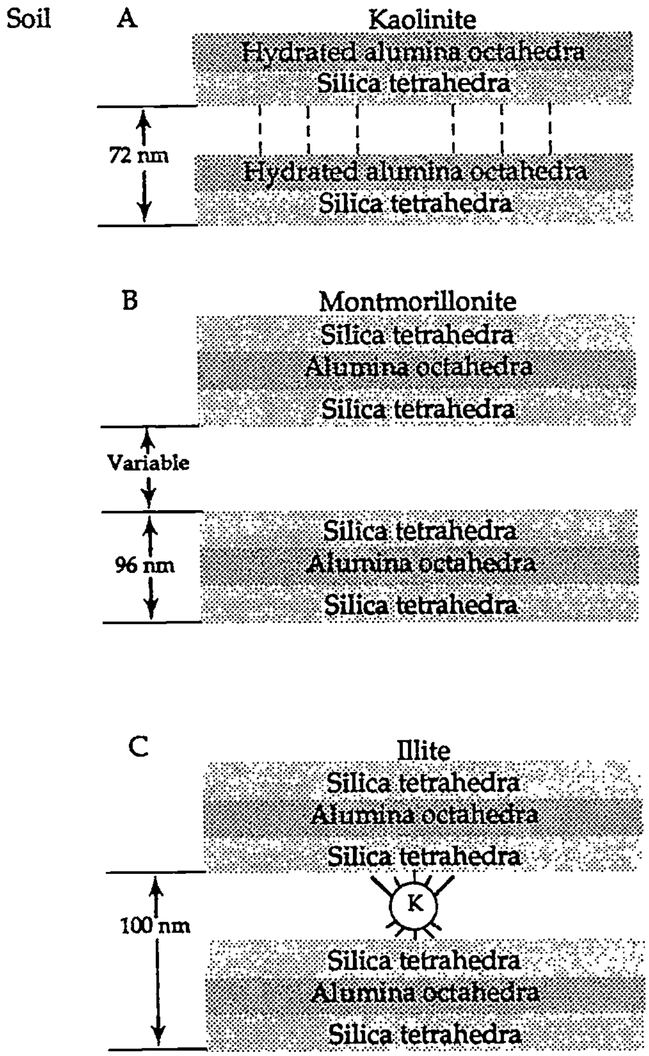
TRANSPARENCY MASTER #8

Native Vegetation



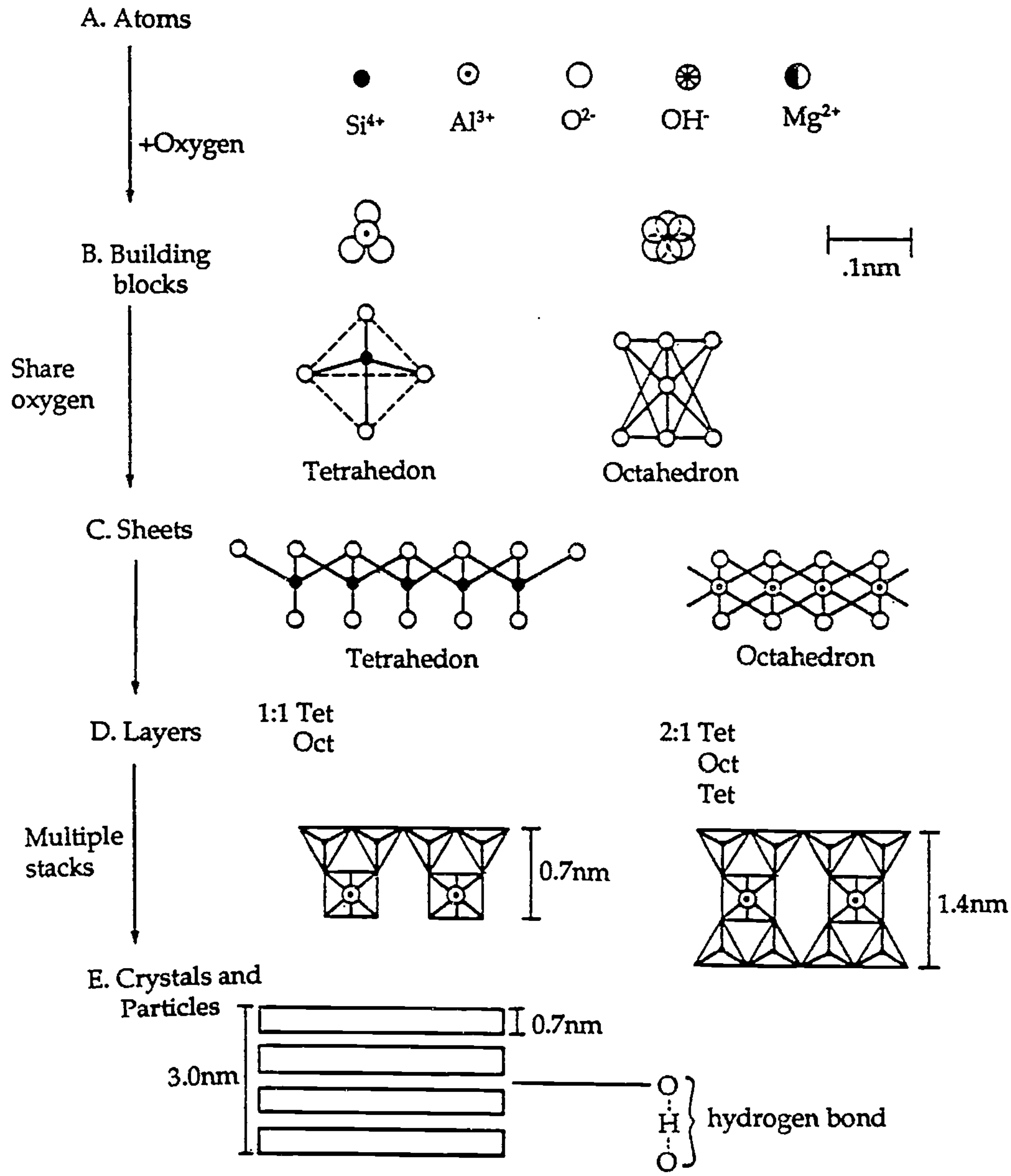
TRANSPARENCY MASTER #9

Crystalline Structure of Clay



TRANSPARENCY MASTER #10

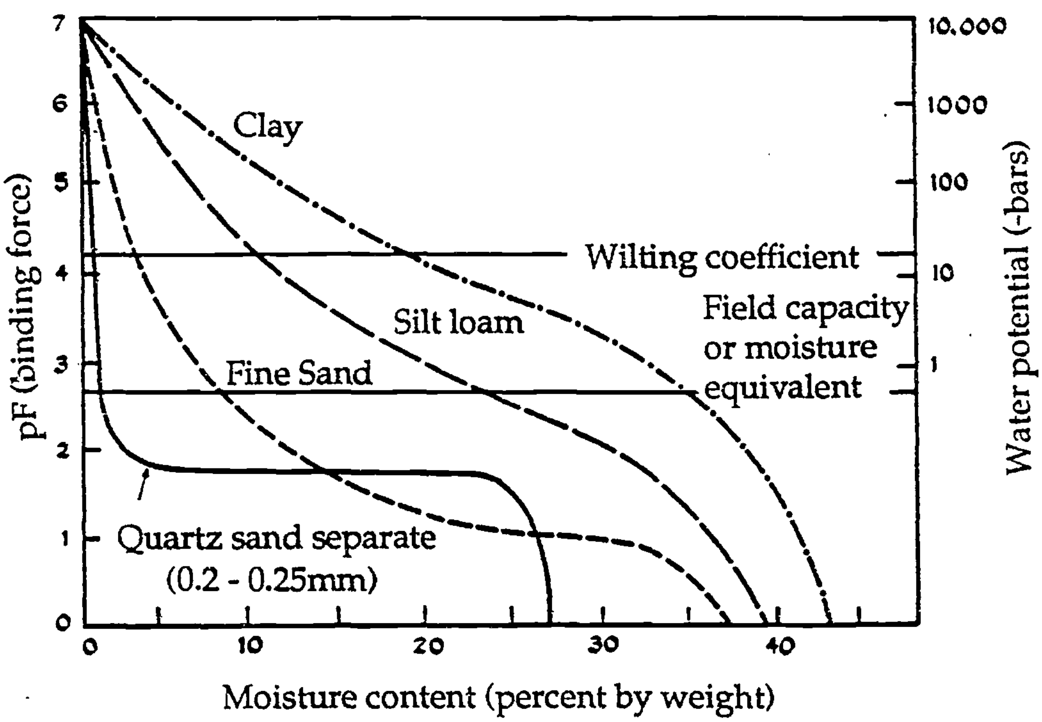
Guide to Minerals



A. Atoms
B. Open diagram
C. Joined tetrahedral, octahedral
D. Unit layer construction by sheets
E. Hydrogen bond of layers

TRANSPARENCY MASTER #11

Water Capacity of Size Separates



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TRANSPARENCY MASTER #12

The Concentration of H^+ and OH^- with Varying pH

pH	Soil reaction			H^{+*} Concentration (moles per l)	OH^{-**} Concentration (moles per l)	Reaction of Common Substances
0				10^{-0}	10^{-14}	
1				10^{-1}	10^{-13}	
2				10^{-2}	10^{-12}	
3	Acidity	very stong	Soil range	10^{-3}	10^{-11}	Lemon juice
4		strong		10^{-4}	10^{-10}	Orange juice
5		moderate		10^{-5}	10^{-9}	
6		slight		10^{-6}	10^{-8}	Milk
7		neutral		10^{-7}	10^{-7}	Pure water
8	Alkalinity	slight		10^{-8}	10^{-6}	Sea water
9		moderate		10^{-9}	10^{-5}	Soap solution
10		strong		10^{-10}	10^{-4}	
11		very stong		10^{-11}	10^{-3}	
12				10^{-12}	10^{-2}	
13				10^{-13}	10^{-1}	
14				10^{-14}	10^{-0}	

*1 mole of H = 1 g

** 1 mole of OH = 17 g

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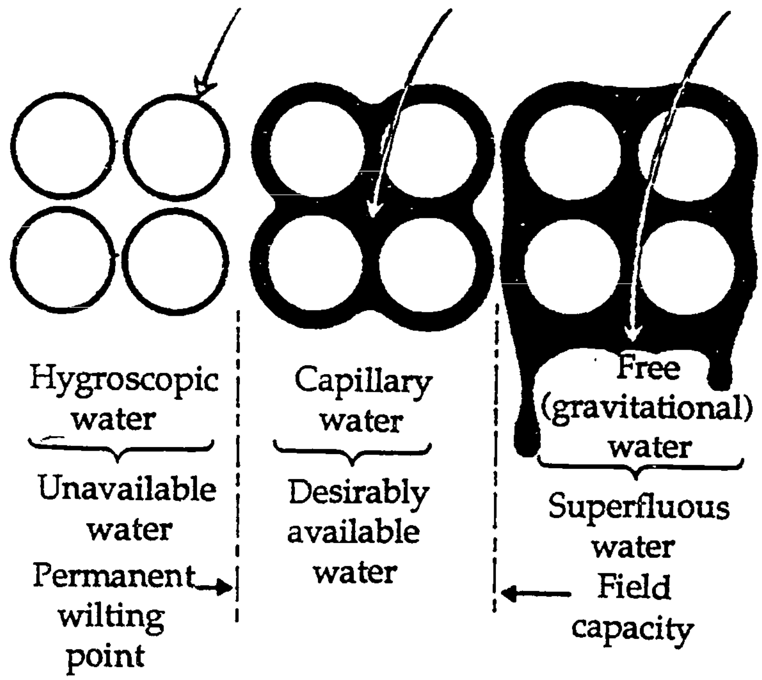
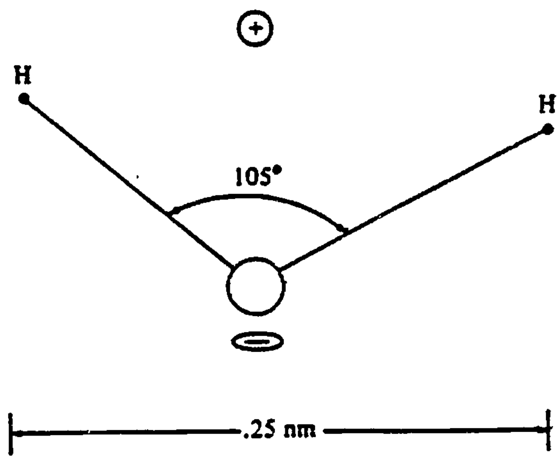
TRANSPARENCY MASTER #13

Water Structure; Hygroscopic, Capillary, and Free





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TRANSPARENCY MASTER #14

Soil Aeration

Diffusion — Higher to lower concentration

Higher O_2 Lower CO_2

$\Downarrow$ $\Uparrow$ Soil

Lower O_2 Higher CO_2

Mass Flow = whatever present moves

Upper 4" - 6" of soil

Occurs at: 2-4 am Evening

20° - 21° C 20° C Air

Cool $\Uparrow$ $\Uparrow$ Cool

$\Downarrow$ Warm Warm $\Downarrow$ Soil

20 - 25° C 24°C

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TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #1

A. Use this transparency to supplement students' ideas and to promote further class discussion.

B. Ask students to identify places in the community, state, or world where soil is being abused and how it is being abused.

C. Point out the importance of soil to the Illinois economy.

D. Point out the fact that Illinois has the best soil in the world for crop production. The reasons for this are as follows:

1. The lower elevation of Illinois land relative to surrounding areas helped influence the direction and extent of glaciation which leaves a relatively young (lightly weathered) soil.
2. The river drainage systems present played an important distribution role for loess and outwash. The outwash was deposited according to size and the loess was carried downstream for deposition and eolian relocation. Loess comprises about 60% of the land area and contributes to soil properties of micropores (spaces for water storage) and macropores (spaces for atmosphere and gas exchange).
3. Illinois has a humid, temperate climate that is conducive to mineral breakdown, clay formation, and material translocation without the heavy rains and extremes in temperature that aggrevate clay destruction and leaching.
4. During the period 4000-6000 years ago most of the state was covered with prairie vegetation. This remnant of a warm, dry period left a soil with a high organic matter content which is conducive to high crop production.

Transparency Masters #2 - #3

A. Explain why it is necessary to understand the origin of parent material before we can understand soils.

1. Geological formation is beginning soil material.
2. Parent material varies in thickness from few to many feet.
3. When parent material gets exposed to the surface elements, soil formation begins.
4. Productive soils are developed from parent materials which contain an abundant supply of all essential elements needed for plant growth and on which the other formation elements have sufficiently acted.

B. Residual parent materiels can be organic or inorganic.

C. Sedimentary rock is the most common inorganic formation for soil parent material. Examples of inorganic residual materials are limestone, sandstone, shales, and slates.

D. Organic material is partially decomposed plant or animal material.

E. Transported materials which are common to Illinois are:

1. Loess — soil materials transported by wind.
2. Alluvial — soil materials transported by flowing water.
3. Glacial till — soil materials transported by ice.

F. Soil formation is more complicated than just the weathering of rocks. Chemical, physical, and mechanical processes must interact to form the distinguishing soil layers or horizons.

Transparency Master #4

A. Weathering of rock produces soil parent material.

B. Breakdown of rock involves physical and chemical processes.

C. This process goes on constantly.

1. Physical processes — those which alter the size and shape of the minerals. The decrease in size increases the surface area which in turn increases reaction rates and increases the soluability of applied agents.
2. Chemical processes — those which alter the composition of minerals.

D. Hydration is the reaction of a substance with water in a definite ratio: as when Anhydrite forms Gypsum

E. Hyrolysis is the reaction of a substance with water wherein it is changed into one or more other substances, as when Feldspar is broken into Halloysite

F. Oxidation-Reduction is the gaining of electrons by one reactant (reduction) and the losing of electrons by another reactant (oxidation) in a reaction, as when Sulfite forms Sulfuric Acid.

G. Dissolution is the dissolving of a compound, as when Salt breaks into Sodium and Chloride.

Transparency Masters #5 - #6

A. Illinoian and Wisconsin glaciers furnished most of Ilinois' soil material.

B. Kansan glacier was the first glacier to cover Illinois.

C. Illinoian glacier was the second glacier to cover Illinois. It covered nearly all the state except the seven southernmost counties.

D. Wisconsin glacier later covered some of the same area but did not advance as far south.

E. Point out that the A and B horizons are the major parts of a soil profile.

F. The C horizon is loose parent material.

G. The D horizon is not parent material but can physically affect the characteristics of the soil above it.

Transparency Master #7

A. The transparency shows a vertical section of soil which extends through all the horizons.
B. Soils can be identified and classified by studying the soil profile.
C. Horizons vary in depth and often mix with one another.
D. Major horizons are A, B, and C. These are then further subdivided as follows:

A_{00} — undecomposed plant and animal material, loose leaves, grass, etc.
A_0 — partially decomposed organic matter
A_1 — mineral soil mixed with organic materials; usually the horizon with the most biological activity and the darkest color
A_2 — light colored, only found in timber soils; clay, minerals, and organic materials in solution have been removed
A_3 — changing to B, only found in prairie soils
B_1 — a lot like A_3; sometimes absent
B_2 — high in clay content, iron, or organic materials; zone of accumulation; maximum blocky or prismatic structure development
B_3 — changing to C, mixed with C
C1 — may be either similar to or unlike the parent material of the soil column; has not been greatly affected by the soil-forming process
R(D) — consolidated bedrock such as limestone or sandstone

Transparency Master #8

A. Two main types of vegetation which have influenced Illinois soils are:

1. Grass or prairie.
2. Trees or forest.

B. Point out that about 55% of Illinois had prairie soil and about 45% had forest vegetation when Illinois was being settled.

C. Prairie soils are generally dark colored and high in organic matter, unless they are highly weathered and matured, as in Southern Ilinois.

A prairie is an area in a subhumid and moderate temperate climate characterized by tall grasses and forbs with abundant and fibrous root systems. These areas are usually flat to moderately rolling and the vegetation has allowed a thick, dark, humus-rich A-horizon to develop, as seen in Mollisols.

D. Forest soils are generally light colored and low in organic matter. The A horizon is not very deep.

Transparency Master #9

The crystalline structure of clay is of three types:

A. The simplest clay mineral is called kaolinite. The micelles of kaolinite consist of two different layers, one of silica and the other of alumina. Kaolinitic clay micelles are relatively large and are bound together tightly. The distance between the alumina and silica layers is rigidly fixed and does not increase when water is adsorbed on the surfaces of the individual micelles. The internal space is not available for surface reactions. Such clays do not shrink greatly when dry or expand much when hydrated.

B. Montmorillonite is more complex, and each micelle consists of an alumina layer sandwiched between two layers of silica. These clays are not bound together tightly, and they swell when wet because the hygroscopic surfaces between layers absorb water and force the layers apart. All surfaces can adsorb water and minerals.

C. The micelles of illite consist of an alumina layer between silica layers, and adjacent layers are held together by potassium atoms. Surface adsorption can take place between crystal surfaces to a limited degree. Illite is less abundant than kaolite or montimorillonte.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Soil Formation

STUDENT WORKSHEET #2 — Soil Color

STUDENT WORKSHEET #3 — Soils: What Are They?

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

Soil Formation

1. What is soil?

2. What is the make-up of soil?

3. Soils are composed of one or more layers or ____________.

4. Most soils have ____________ principal horizons, which are designated by capital letter: the __________ or A horizon, the subsoil or _____ horizon, and the ____________ underlying the subsoil or _____ horizon.

5. Parent materials

   glacial origin

   a. Finely ground rock, "glacial four" distributed by wind is __________.
   b. Glaciers carried large amounts of rocky material, grinding much of it into a mixture of gravel, sand, silt, and clay. This mixture is called ___________.
   c. Glacial runoff water deposited ___________ in layers during mild periods.

   water deposited

   a. Sediments in floodplains are called ____________.

6. Topography refers to ________________________________.

7. Soils on steep topography are likely to be subject to severe ______________ .

8. Native vegetation determines the ________ and _________ of organic matter in the soil.

9. Under forest cover, the organic matter is in the form of ___________. Since the material is on the surface, it decays _____________ and leaves only a small residue. Total organic matter, therefore, is quite ________.

10. Most prairie soils have a _________ surface layer that is fairly __________. Wild prairie grasses and other plants have abundant __________ which filled the top of the soil 1 or 2 feet down. Partial decay of these roots over a long period of time gave us the high _________________________ content of prairie soils, and along with it, the _________ color.

11. Soils at different stages in the _______________ process will differ widely.

12. Many soils are now _______ because the calcium originally in them has been __________ away.

13. When the soil is young, ____________________ accumulates, but as soils get older, organic matter and production decline, and clay accumulates in the _________________.

14. Weathering depends on _____________.

15. As a rule, the surface of the soil is darker than the subsoil because it contains more __________________.

16. The darker the surface soil, the ____________ the organic matter.

17. Subsoil colors of Illinois soils are due to the status of ________ compounds. Well-drained soils have __________ colored subsoils because the iron compounds are ____________. Soils with poor natural drainage have dull gray or olive gray subsoils because the iron has been ___________.

18. The moisture-holding capacity of a soil is closely related to its ______________. As the clay content increases, there are _________ soil particles to hold water. So a soil higher in clay holds ____________________ water than a sandy soil.

19. While moisture-holding capacity is important, too much water will crowd the __________ out of the soil. If water moves freely through the profile, air can fill the empty __________ spaces. When water moves too fast, however, the result is a _______________ soil.

20. Water drains very slowly from the small __________; therefore, fine-textured soils have_______ permeability unless the structures of the surface and subsoil permit water to pass through.

21. If crops are to produce heavily, they must have a ____________ system so that they can get nutrients and water from a large volume of ____________. Coarse _________ and _________ discourage root growth because they have little ________________ or plant nutrients.

22. The _________________ is the most valuable part of the soil profile since it contains more _______________ and organic matter, and can often absorb more moisture than the other layers.

23. The principal loss of soil is usually by _________ erosion.

STUDENT WORKSHEET #1 — Key

Soil Formation

1. What is soil? *(See VAS Unit #4052, part 1)*

2. What is the make-up of soil? *mineral matter, organic matter, water and air*

3. Soils are composed of one or more layers or *horizons*.

4. Most soils have *three* principal horizons, which are designated by capital letter: the *surface* or A horizon, the subsoil or *B* horizon, and the *substratum* underlying the subsoil or *C* horizon.

5. Parent materials

   glacial origin

   a. Finely ground rock, "glacial four" distributed by wind is *loess*.
   b. Glaciers carried large amounts of rocky material, grinding much of it into a mixture of gravel, sand, silt, and clay. This mixture is called *glacial till.*
   c. Glacial runoff water deposited *outwash* in layers during mild periods.

   water deposited

   a. Sediments in floodplains are called *alluvium*.

6. Topography refers to *slope characteristics of a soil.*

7. Soils on steep topography are likely to be subject to severe *erosion*.

8. Native vegetation determines the *kind* and *amount* of organic matter in the soil.

9. Under forest cover, the organic matter is in the form of *duff.* Since the material is on the surface, it decays *rapidly* and leaves only a small residue. Total organic matter, therefore, is quite *low*.

10. Most prairie soils have a *dark* surface layer that is fairly *deep*. Wild prairie grasses and other plants have abundant *roots* which filled the top of the soil 1 or 2 feet down. Partial decay of these roots over a long period of time gave us the high *organic matter* content of prairie soils, and along with it, the *black* color.

11. Soils at different stages in the *weathering* process will differ widely.

12. Many soils are now *acid* because the calcium originally in them has been *leached* away.

13. When the soil is young, *organic matter* accumulates, but as soils get older, organic matter and production decline, and clay accumulates in the *B horizon.*

14. Weathering depends on *climate*.

15. As a rule, the surface of the soil is darker than the subsoil because it contains more *organic matter*.

16. The darker the surface soil, the *higher* the organic matter.

17. Subsoil colors of Illinois soils are due to the status of *iron* compounds. Well-drained soils have *brightly* colored subsoils because the iron compounds are *oxidized.* Soils with poor natural drainage have dull gray or olive gray subsoils because the iron has been *reduced.*

18. The moisture-holding capacity of a soil is closely related to its *texture*. As the clay content increases, there are *more* soil particles to hold water. So a soil higher in clay holds *more* water than a sandy soil.

19. While moisture-holding capacity is important, too much water will crowd the *air* out of the soil. If water moves freely through the profile, air can fill the empty *pore* spaces. When water moves too fast, however, the result is a *drouthy* soil.

20. Water drains very slowly from the small *pores*; therefore, fine-textured soils have *low* permeability unless the structures of the surface and subsoil permit water to pass through.

21. If crops are to produce heavily, they must have a *large root* system so that they can get nutrients and water from a large volume of *soil*. Coarse *sand* and *gravel* discourage root growth because they have little *moisture* or plant nutrients.

22. The *top soil* is the most valuable part of the soil profile since it contains more *nutrients* and organic matter, and can often absorb more moisture than the other layers.

23. The principal loss of soil is usually by *sheet* erosion.

STUDENT WORKSHEET #2

Soil Color

1. What gives the surface soil its dark color?

2. What caused the thick, dark surface layer in prairie soils?

3. Why is the surface layer thinner on timber soils?

4. Why are the prairie soils of Southern Illinois lighter than those of northern Illinois?

5. Why is erosion more hazardous on timber soils than on prairie soils?

6. What other than organic matter influences subsoil colors?

7. Why do soils that are poorly drained tend to be dull colored?

8. What colors are found in subsoils that are wet part of the time?

9. What names are used to describe surface soil colors? Subsoil colors?

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STUDENT WORKSHEET #2 — Key

Soil Color

See VAS Slidefilm #708 or VAS Unit #4029

1. What gives the surface soil its dark color? *Refer to frame 9.*

2. What caused the thick, dark surface layer in prairie soils? *Refer to frame 13.*

3. Why is the surface layer thinner on timber soils? *Refer to frame 17.*

4. Why are the prairie soils of Southern Illinois lighter than those of northern Illinois? *Refer to frame 19.*

5. Why is erosion more hazardous on timber soils than on prairie soils? *Refer to frame 21.*

6. What other than organic matter influences subsoil colors? *Refer to frame 26.*

7. Why do soils that are poorly drained tend to be dull colored? *Refer to frames 28 and 29.*

8. What colors are found in subsoils that are wet part of the time? *Refer to frame 30.*

9. What names are used to describe surface soil colors? Subsoil colors? *Refer to frames 31 and 33.*

STUDENT WORKSHEET #3

Soils: What Are They? — Observational Exercise

Purpose:

1. To identify the major components of a soil sample.
2. To analyze the physical differences among soil samples.
3. To recognize differences in soil structure.

Materials:

1. Soil samples
2. Magnifying glasses
3. Microscopes
4. Plastic or metal sieves

Procedure:

1. Obtain a soil sample which contains enough of the top two (2) inches of the soil to fill a pint jar. Observe the soil carefully and answer the following questions:

   A. Describe the location where the sample was collected.

   B. Describe the color of your soil sample.

   C. What does the soil sample smell like?

   D. What does the soil sample feel like?

   E. Does your soil sample contain any plants or animals? Describe what they look like.

2. Soil samples contain a mixture of four ingredients. These ingredients change in amount from one soil to another. An average soil will contain approximately:
   45% minerals
   (clay, silt, sand)
   5% organic matter
   (plants, animals)
   25% air
   25% water

Observe your sample again and answer the following questions.

   A. Use a magnifying glass to determine the structure of the soil. What structures are present? Draw a picture of each.

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B. Use a magnifying glass and describe what the organic matter looks like.

C. Does the amount of water a soil can hold change? Why?

D. Air and water make up about half your soil sample. Where is the air and water found?

3. Trade your soil sample with your classmates and follow the procedures in items 1 and 2 on their soil samples. How do their samples differ from yours?

STUDENT WORKSHEET #3 — Discussion Guide

This activity is designed to assist the student in learning to appreciate soil. It could be pointed out that soil is naturally occuring and is a mixture of organic and mineral materials arranged to form a specific structure and composition unique to its particular location. The exercise will point to the small plants and animals within a particular sample and an opportunity to make comparisons with other samples. This comparison will facilitate learning that samples from similar locations will have characteristics in common and that different locations will have differences.

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CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying and Using Agricultural Tools and Equipment

RELATED PROBLEM AREAS:

A majority of the problem areas in the following units are related to this problem area.

1. Central Core Cluster
   a. Agricultural Literacy
   b. Basic Principles of Agricultural Science

2. Agricultural Business and Management Cluster
   a. Animal Science
   b. Plant and Soil Science
   c. Agricultural Engineering and Mechanization

3. Horticulture Cluster
   a. Horticultural Science and Production
   b. Horticultural Mechanics
   c. Landscaping
   d. Floral Design

4. Agricultural Resources Cluster
   a. Environmental Protection
   b. Forestry
   c. Fish and Wildlife Management
   d. Outdoor Recreation

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty I: Assembling, Servicing, and Maintaining Equipment and Facilities

1. Service business vehicle
2. Service conveyor equipment
3. Maintain hand tools
4. Perform maintenance checks on equipment
5. Service fuel systems
6. Service electrical systems
7. Service lubricating systems
8. Service cooling systems

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Horticulture Cluster

Duty O: Servicing and Maintaining Equipment and Facilities

1. Service tillage preparation equipment
2. Service planting equipment
3. Service cultivation equipment
4. Service harvesting equipment
5. Servce conveyance systems
6. Service business vehicle

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences and Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum
Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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Submission Date ______
☐ Original submission ☐ Revision | Page ____ of ____

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understanding the knowledge and skills required for success in selected fields of work.					
*2. Understand how employees, labor unions, managers, and workers interact with one another to achieve a common goal.					
3. Demonstrate the proper use of commonly used agricultural laboratory tools and equipment.					
4. Recognize the value of a positive safety attitude.					
5. Demonstrate the knowledge and practice of safe agricultural laboratory techniques and procedures.					
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ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision   Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes, techniques, methods, equipment, and available technology of science.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify appropriate methods of measurement of a given task.					
2. Identify commonly used agricultural laboratory tools and equipment.					

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ISBE 41-78 (1/86)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying and Using Agricultural Tools and Equipment

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Identify commonly used agricultural laboratory tools and equipment.

2. Demonstrate the proper use of commonly used agricultural laboratory tools and equipment.

3. Recognize the value of a positive safety attitude.

4. Demonstrate a knowledge and practice of safe agricultural laboratory techniques and procedures.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying and Using Agricultural Tools and Equipment

PROBLEMS AND QUESTIONS FOR STUDY

1. What tools and equipment are available for use in the agricultural laboratory?
2. Why does one need to be able to identify agricultural tools and equipment?
3. Why does one need to be able to properly use agricultural tools and equipment?
4. How are agricultural tools and equipment used?
5. What hazards are present in an agricultural laboratory?
6. What protective measures are used in the agricultural laboratory?
7. Why does one always need to wear safety glasses in an agricultural laboratory?
8. How do power tools and equipment differ from hand tools and equipment?
9. How do the various power tools and equipment operate?
10. What safety precautions should we use when operating power tools and equipment?
11. Why should one practice safe procedures in the agricultural laboratory?
12. What are the safe procedures that one should practice?
13. How will knowing safe practices and procedures benefit one outside the agricultural laboratory?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying and Using Agricultural Tools and Equipment

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use other vocational and science personnel as resource persons for ideas, techniques, equipment, and materials.

2. Use appropriate Vocational Agriculture Service subject matter units as student reference materials, student resources for instructor prepared study guides, and as guides for laboratory activities.

3. Lead the class in a discussion of agricultural laboratory tools and equipment using VAS transparency set #T457 and a science laboratory manual such as *Basic Skills in the Laboratory* as resources.

4. Distribute Student Worksheet #1 for student practice and review on agricultural laboratory tools and equipment. This worksheet can be used as transparency masters as needed.

5. Secure copies of Instructional Materials Service #8412, *Performing Basic Skills in Agriculture Construction — Tools* for use as student references and study guides.

6. Obtain *Charts on Safety Rules* (VAS) and *Laboratory Techniques Chart* (NASCO or Carolina Biological Supply) to be placed in strategic locations in the laboratory for easy student reference.

7. Use appropriate Vocational Agriculture slide films and study guides or Instructional Materials Service #8601, *Identifying and Using Power Tools* as student references and study guides for power equipment.

8. Secure copies of Vocational Agriculture Service #U3022A *Safety in the Shop*, U3044 *A Color Code for Shop Safety*, and/or Instructional Materials Service #8411 *Identifying Safety and Laboratory Procedures* for student use as references and study guides on SAFE laboratory practices and procedures.

9. Obtain computer programs such as "Tool Safety: Shop and Laboratory Related Review" and "Power Tool Safety and Operation" (HOBAR) for both instructor use in subject matter delivery and student use in individual review and evaluation.

10. Plan field trips to production facilities, industry, research agencies, private businesses, and universities where students can see the application of the subject matter.

11. Have students complete Student Worksheets #2 - #5 as individual or small group activities and report and demonstrate the findings to the rest of the class.

12. Lead students in discussions of safety, how one's actions affect others, and how individual attitudes on safety affect others working in the same environment.

13. Use a science laboratory skills manual such as *Basic Skills in the Laboratory* as a resource for activities and to reinforce student skills in using glassware, microscopes, and dissection equipment used in certain agricultural laboratory activities.

14. After proper demonstration and sufficient supervised practices, use activities that require the use of as many tools and pieces of equipment as practical to complete the projects or experiments.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying and Using Agricultural Tools and Equipment

REFERENCES

*1. *Laboratory Techniques Chart; Laboratory Safety Chart.* Carolina Biological Supply Company, 2700 York Road, Burlington, NC 27213. (800) 334-5551.

2. *Tool Safety: Shop and Laboratory Related Review; Power Tool Safety and Operation.* (Computer Programs) Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112. (612) 633-3170.

*3. *Performing Basic Skills with Agricultural Construction Tools* (Subject Matter Unit #8412); *Identifying and Using Power Tools* (Subject Matter Unit #8601); *Identifying Safety and Laboratory Procedures* (Subject Matter Unit #8411). Industrial Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588. (409) 845-6601.

*4. *Laboratory Techniques Chart; Laboratory Safety Chart.* NASCO, 901 Janesville Avenue, Fort Atkinson, WI 53538. (800) 558-9595.

*5. *Sharpening Hand Tools* (VAS Unit #U3005); *Safety in the Shop* (VAS Unit #U3022A); *A Color Code for Shop Safety* (VAS Unit #U3044); *Safety in the Shop* (VAS Questions #Q3022A); *The Jointer — How to Use it Safely* (VAS Filmstrip #F460); *Drill Press — How to Use it Safely* (VAS Filmstrip #F461); *Circular Saw — How to Use it Safely* (VAS Filmstrip #F462); *Power Grinder — How to Use it Safely* (VAS Filmstrip #F463); *Radial Arm Saw — How to Use it Safely* (VAS Filmstrip #F464); *Port, Electrical Saw — How to Use it Safely* (VAS Filmstrip #F465); *Using Power Lawn Mowers Safely* (VAS Filmstrip #F498); *Shop Tool Identification* (VAS Transparency Set #T457); *Charts on Safety Rules for Power Tools Set* (VAS Poster Set #MZ 490). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801. (217) 333-3871.

6. *Agricultural Mechanics: Fundamentals and Applications.* Cooper, Ezmerl. Pelmar Publishers, Inc.

*7. *Mechanics in Agriculture.* (1983). Phipps, L.J. The Interstate Printers and Publishers Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

8. *Developing Shop Safety Skills; Safety Color Coding for the Shop.* American Association of Vocational Instructional Materials (AAVIM), Curriculum Publishing Clearinghouse, Harrabin Hall 46, Western Illinois University, Macomb, IL 61455. (800) 322-3905.

*9. *Basic Skills in the Laboratory.* (1977). Towne, C.E. NASCO, 901 Janesville Avenue, Fort Atkinson, WI 53538. (800) 558-9595.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

TRANSPARENCY MASTER #1 — Safety Rules in Agricultural Laboratories

TRANSPARENCY MASTER #2 — Safety Rules with Laboratory Tools and Equipment

TRANSPARENCY MASTER #3 — Parts of a Typical Microscope

TRANSPARENCY MASTER #4 — Recommended Eye Protection

TRANSPARENCY MASTER #1

Safety Rules in Agricultural Laboratories

1. Always follow directions! If something is not understood, always ask your instructor.

2. No horseplay!

3. Keep the work area neat and orderly.

4. Use proper equipment for handling hot objects.

5. Wear proper clothing and equipment.

6. Perform only these exercises or experiments assigned by your instructor.

7. Know the locations and use of fire extinguishers, fire blankets, eye washes, safety shovels, and fire escape routes.

8. Report ALL accidents and injuries immediately.

9. Return all equipment to its proper location.

10. Always wash hands at the end of laboratory period.

11. Be aware of others.

12. BE CAREFUL!

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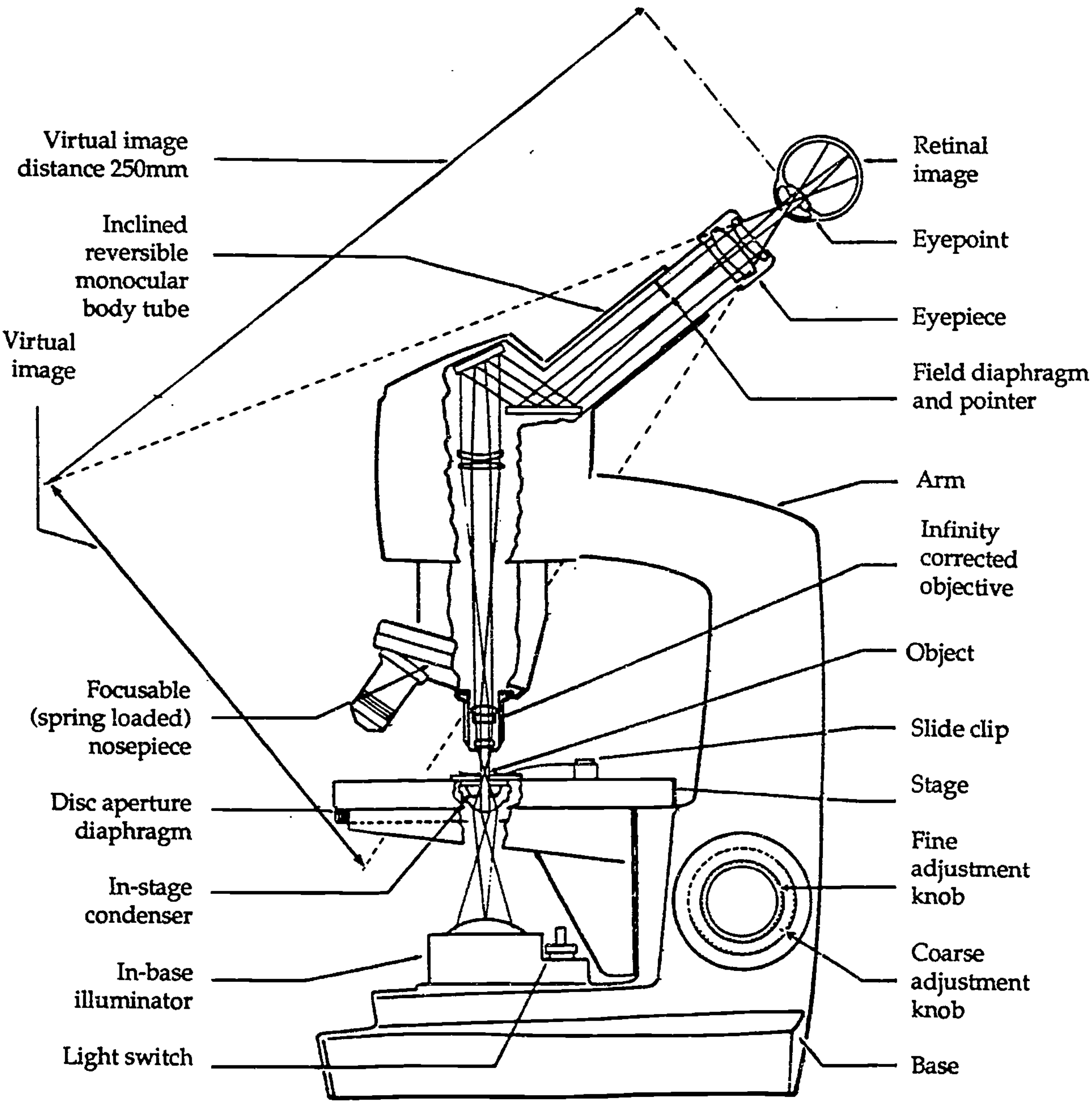
TRANSPARENCY MASTER #2

Safety Rules with Laboratory Tools and Equipment

1. Always wear safety glasses.
2. Never leave any activity involving the application of heat or the use of chemicals.
3. Always allow plenty of time for glassware and metals to cool.
4. Always use the proper equipment for the exercise. Do not use thermometers for stirring rods or screwdrivers for pry bars.
5. Always work away from your body when using knives, scalpels, needles, chisels, or razors.
6. Never stand in front of someone using an open flame, torch or hammer.
7. Always report to your instructor any equipment that is broken. Never use cracked glassware or tools that have been temporarily repaired.
8. When heating liquids always use proper containers and the appropriate heating source.
9. Always keep knives, scalpels, and edge tools sharp.
10. Always return tools and equipment to their proper location and store in the proper manner.

TRANSPARENCY MASTER #3

Parts of a Typical Microscope



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TRANSPARENCY MASTER #4

Recommended Eye Protection

Activity or Operation	*Eye Hazards*	*Eye Protective Device(s)*
General shop/laboratory operations (power, carpentry, electricity, metal work, woodworking, etc.)	Flying chips, particles, dust, solder splash, or objects	Spectacles with attached sideshields or dust goggles — additional face shield for severe exposure
Lubricating, spray painting, steam and solvent cleaning, finishing materials, solvents	Grease, hot steam, mists, splashing liquids	Chemical goggles
Battery service	Acid, sparks, explosion	Chemical goggles
General farm activities (Production Agriculture)	Flying dust, chaff	Spectacles with attached sideshields or dust goggles — additional face shield for severe exposure
Agricultural chemicals — preparation, application and handling, especially with Anhydrous Ammonia	Splashing, mists	Chemical goggles
Electric arc welding	Welding flash, sparks, sputtering, molten metal, air bubble explosions	Welding helmet with correct filter lens over safety spectacles with attached sideshields
Gas welding, cutting, burning, and metalizing	Flying sparks and metal	Wearing goggles over safety spectacles with attached sideshields
Chipping, grinding	Flying chips, slag, and particles	Spectacles with attached sideshields

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Agricultural Tool and Equipment Identification

STUDENT WORKSHEET #2 — Identifying Agricultural Tools and Equipment

STUDENT WORKSHEET #3 — Agricultural Tool and Equipment Demonstration

STUDENT WORKSHEET #4 — Identifying Agricultural Power Tools and Equipment

STUDENT WORKSHEET #5 — Agricultural Power Tool and Equipment Demonstration

STUDENT WORKSHEET #6 — Safety in the Agricultural Laboratory

STUDENT WORKSHEET #7 — Checklist of Laboratory Hazards

STUDENT WORKSHEET #8 — Color Code for Shop Safety

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructors Guide.

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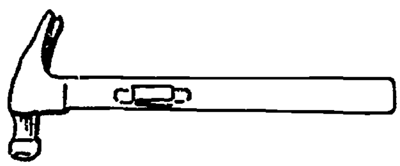
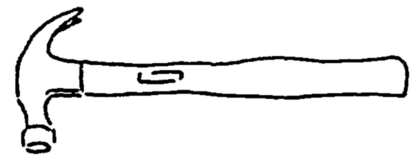
STUDENT WORKSHEET #1

Agricultural Tool and Equipment Identification



1. ______________________________



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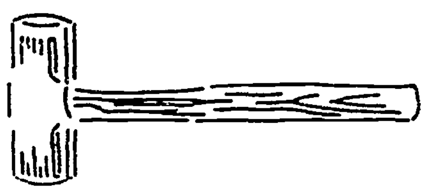

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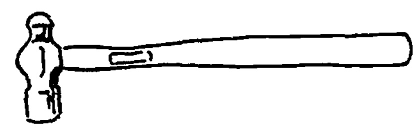

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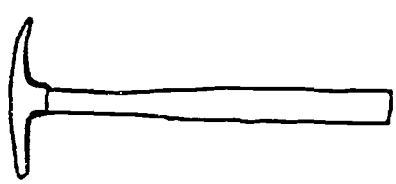

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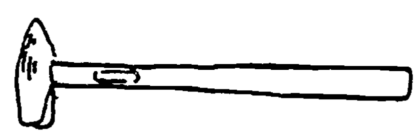

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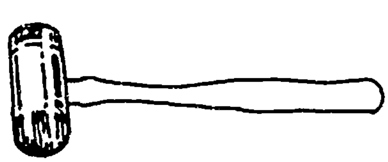

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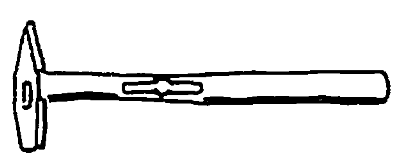

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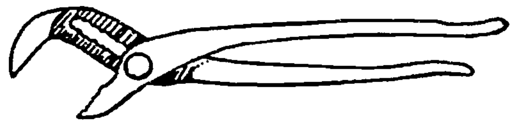

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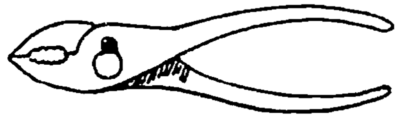

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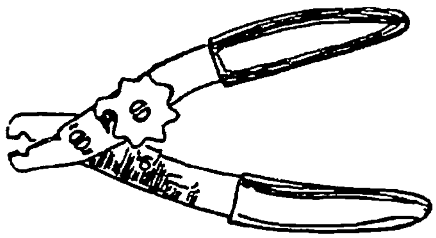

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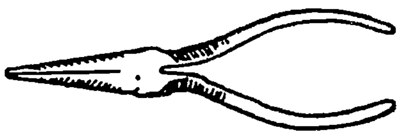

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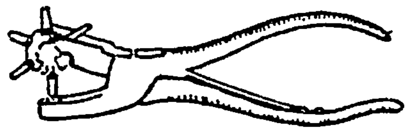

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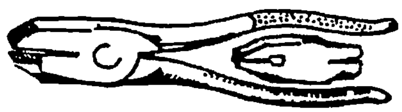

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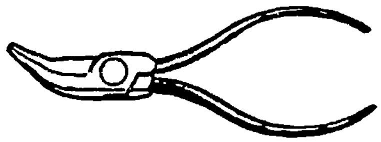

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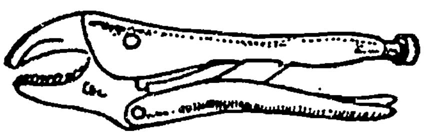

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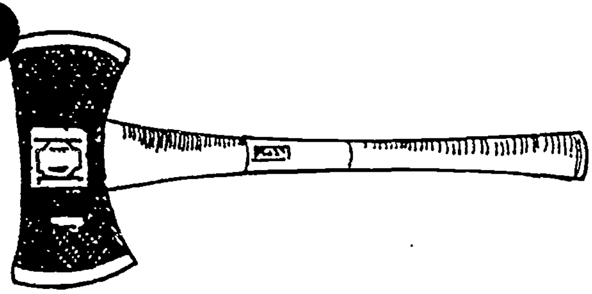

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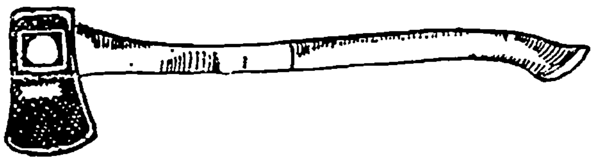

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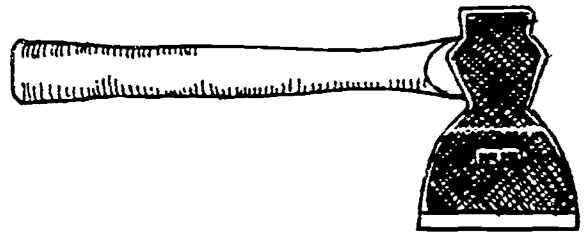

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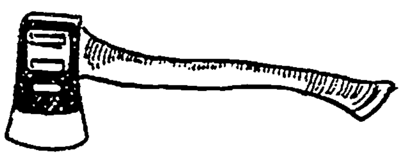

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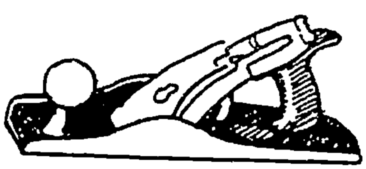

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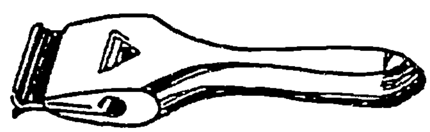

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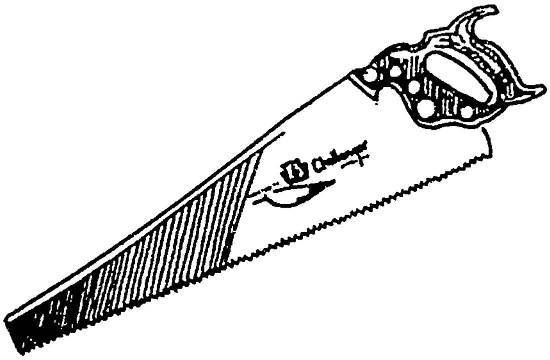

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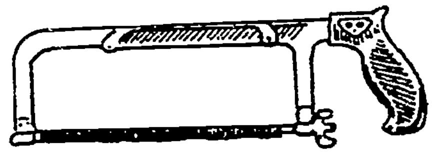

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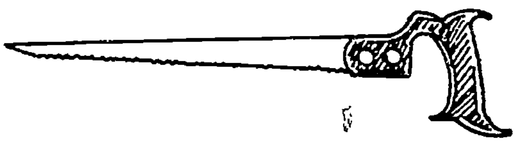

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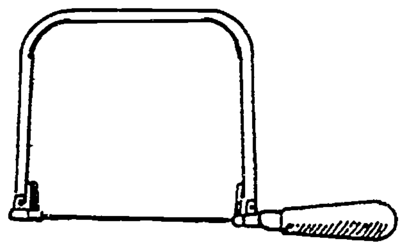

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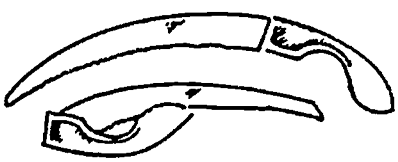

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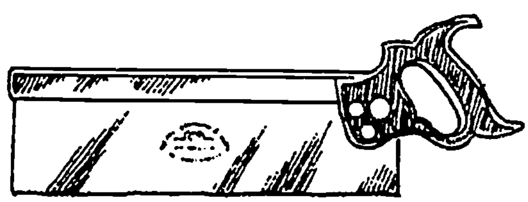

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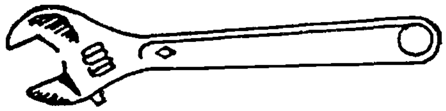

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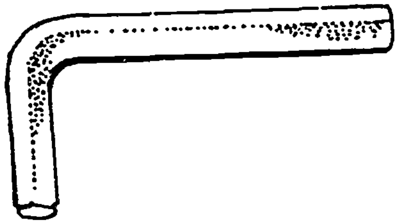

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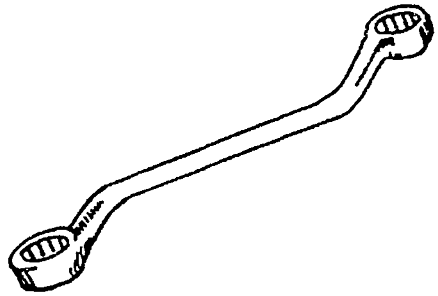

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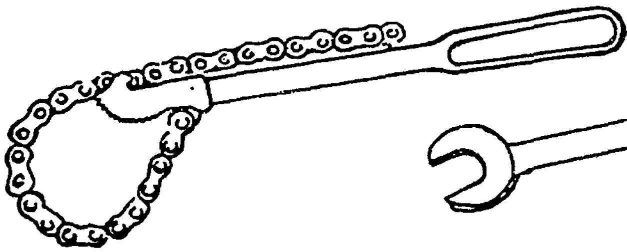

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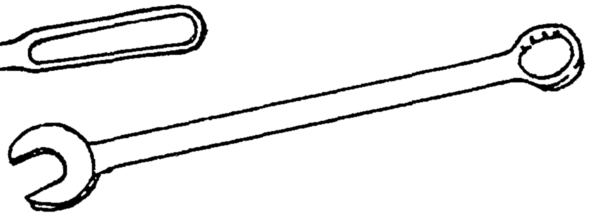

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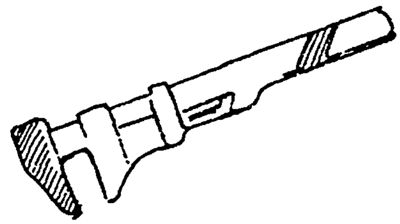

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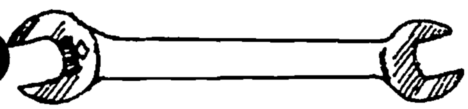

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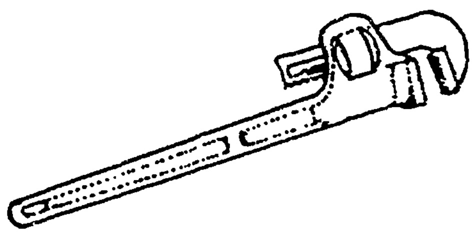

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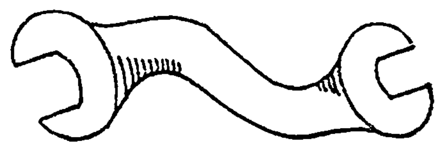

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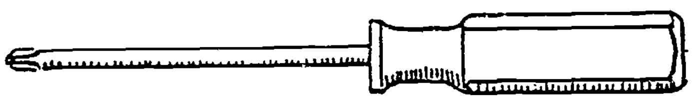

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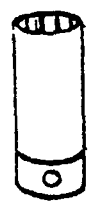

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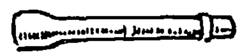

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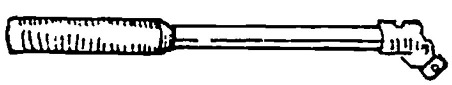

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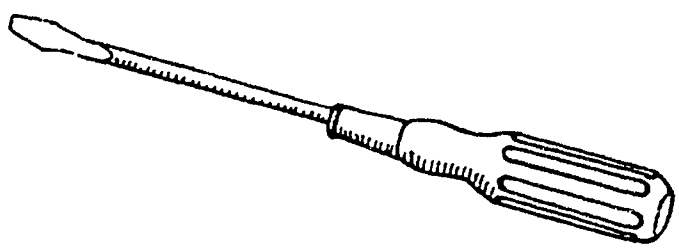

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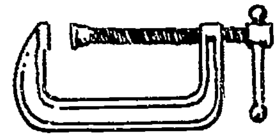

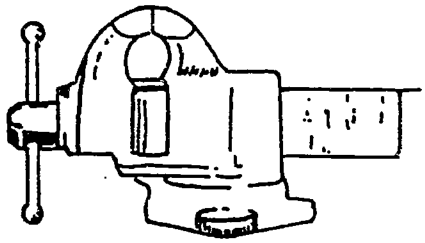

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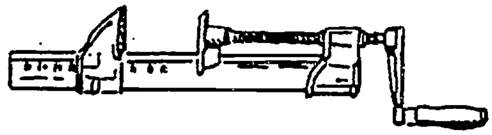

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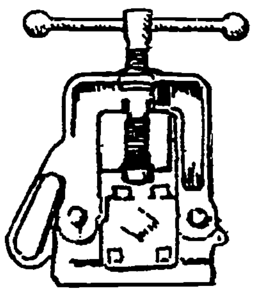

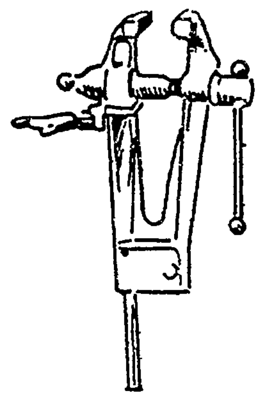

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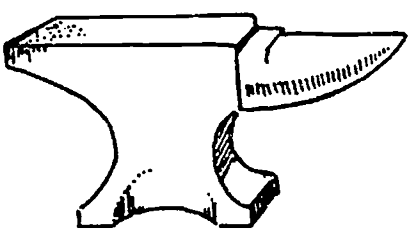

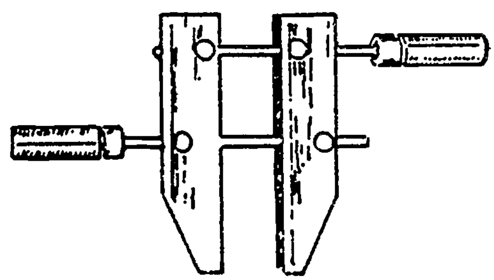

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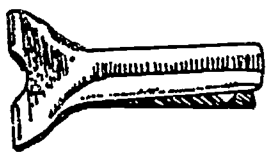

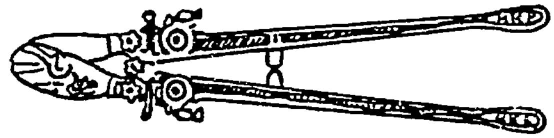

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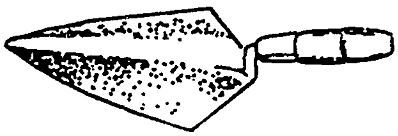

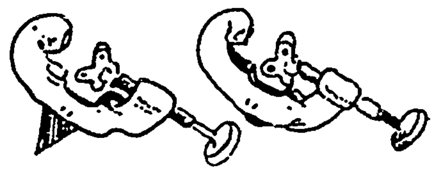

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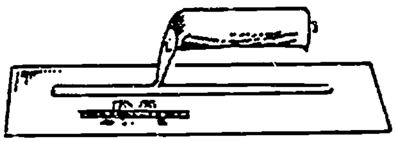

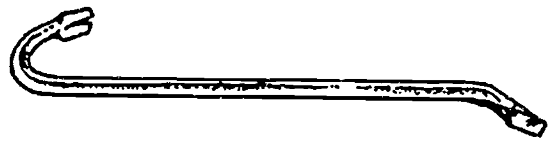

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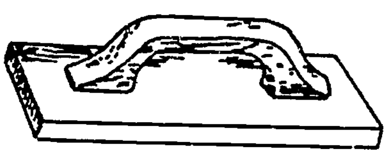

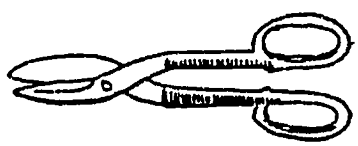

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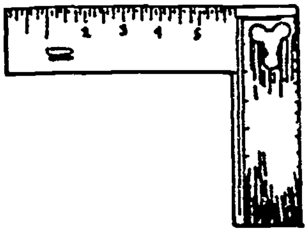

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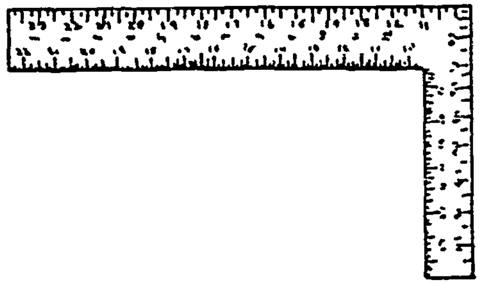

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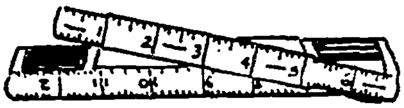

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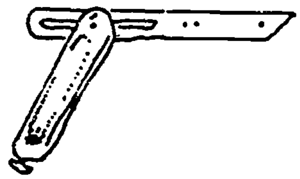

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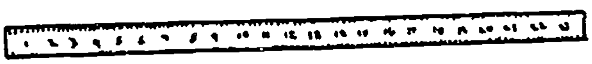

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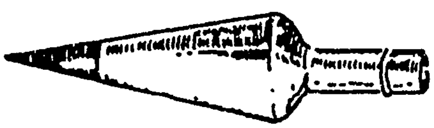

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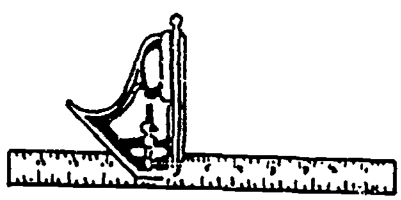

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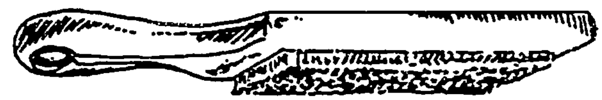

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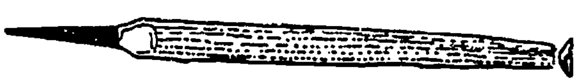

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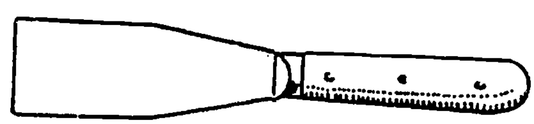

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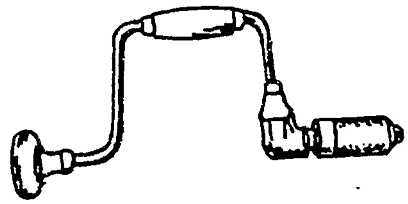

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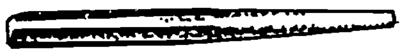

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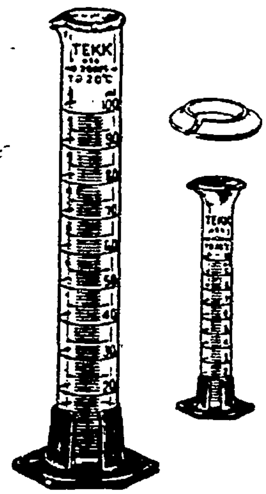

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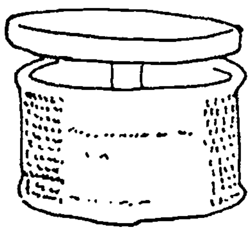

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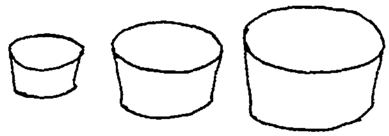

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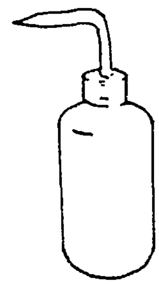

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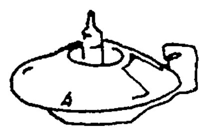

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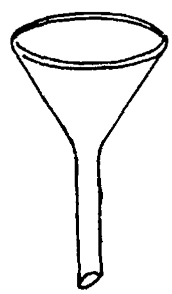

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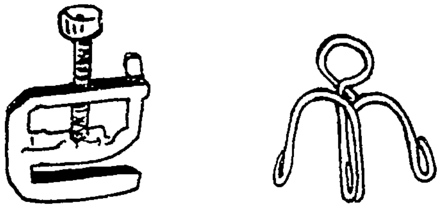

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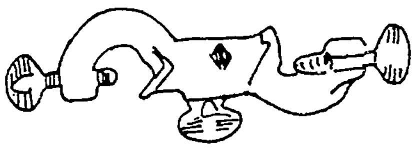

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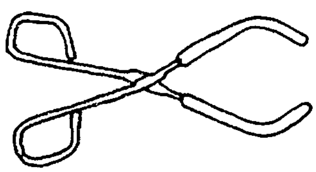

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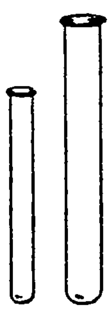

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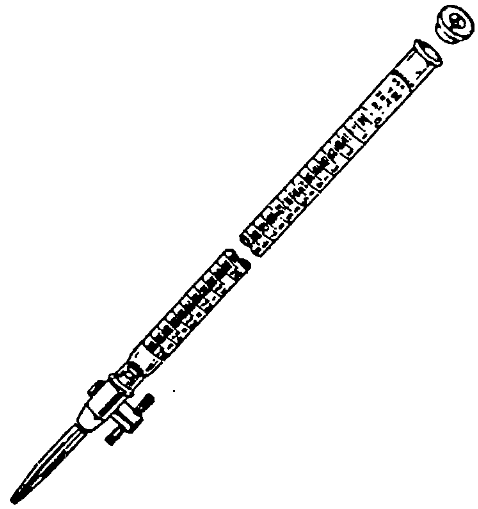

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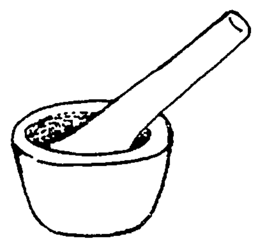

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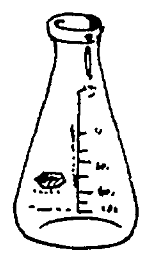

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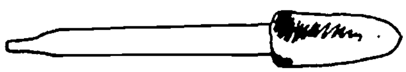
103. ______________________________



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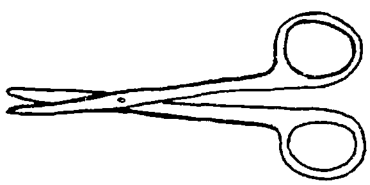

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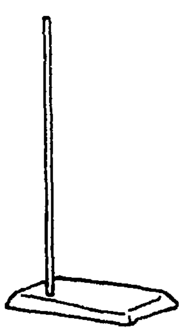

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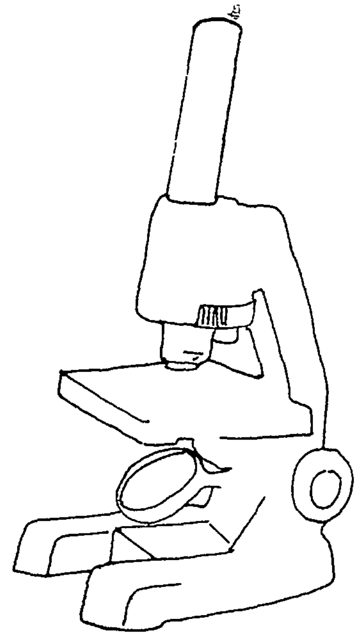

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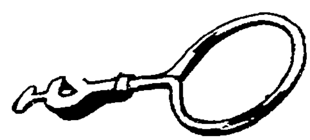

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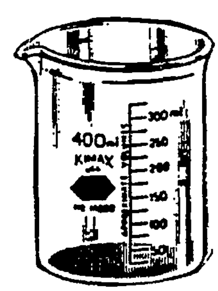

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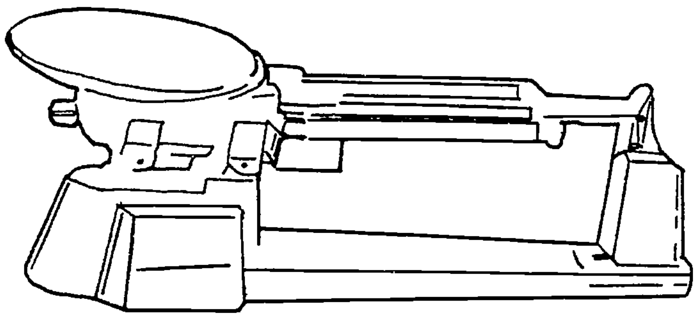

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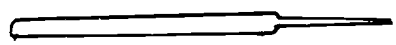

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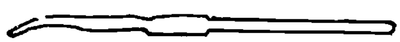

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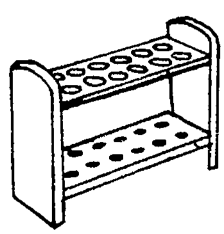

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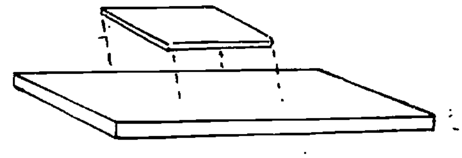

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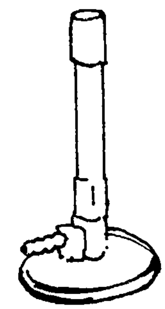

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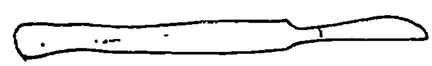

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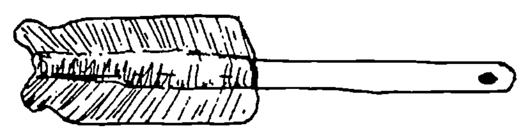

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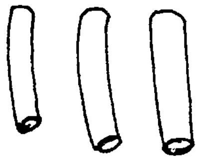

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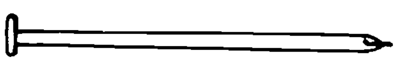

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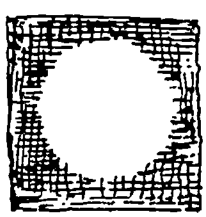

121. ______________________________

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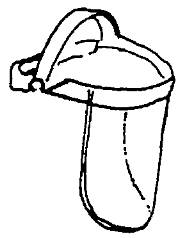

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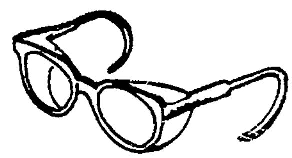

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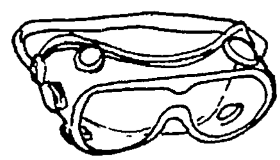

125. ______________________________

STUDENT WORKSHEET #1 — Key

Agricultural Tool and Equipment Identification

1. Straight claw or ripping hammer
2. Curved claw hammer
3. Sledge hammer
4. Ball pen or machinist's hammer
5. Tack hammer
6. Blacksmith's hammer
7. Mallet or soft-headed hammer
8. Tinner's hammer
9. Fence pliers
10. Water pump pliers
11. Battery pliers
12. Slip joint pliers
13. Diagonal pliers
14. Wire stripper
15. Long nose pliers
16. Revolving or leather punch
17. Lineman or electrical pliers
18. Curved-needle nose pliers
19. Lever-jawed wrench or locking pliers
20. Double bit axe
21. Shingler's hatchet
22. Single bit axe
23. Broad hatchet
24. Hand axe
25. Glass cutter
26. Jack plane
27. Wood scraper
28. Hand saw
29. Hack saw
30. Keyhole or compass saw
31. Coping saw
32. Pruning saw
33. Back saw
34. Adjustable or crescent wrench
35. Allen or setscrew wrench
36. Box end wrench
37. Chain wrench
38. Combination end wrench
39. Monkey wrench
40. Open end wrench
41. Pipe wrench
42. Double open end S wrench
43. Phillips screw driver
44. Deep socket
45. Extension bar
46. Flex handle
47. Universal joint
48. Screw driver
49. "C" clamp
50. Machinist's vise
51. Bar clamp
52. Pipe vise
53. Blacksmith's or leg vise
54. Anvil
55. Hand screw
56. Non-metallic cable ripper
57. Bolt cutters
58. Brick trowel
59. Tubing cutter
60. Concrete finishing trowel
61. Wrecking, ripping, or pinch bar
62. Concrete float
63. Tinner's shears
64. Tri square
65. Carpenter's or framing square
66. Folding rule
67. Sliding "T" bevel
68. Steel rule or bench rule
69. Carpenter's level
70. Plumb bob
71. Combination square
72. Wood rasp
73. File card
74. Single cut file
75. Cold chisel
76. Taper or triangular file
77. Wood chisel
78. Half-round file
79. Putty knife
80. Center punch
81. Bit brace
82. Drift punch
83. Auger bit
84. Nail set

85. Expansion bit
86. Pin punch
87. Straight shank twist drill
88. Prick punch
89. Graduated cylinder
90. Hot plate
91. Test tube holder
92. Stoppers
93. Washbottle
94. Alcohol burner
95. Funnel
96. Tubing clamp
97. Clamp holder
98. Beaker tongs
99. Test tubes
100. Burette
101. Mortar and pestle
102. Flask
103. Forceps
104. Pipette
105. Dissecting scissors
106. Ring stand
107. Microscope
108. Ring holder
109. Beaker
110. Balance
111. Dissecting needle
112. Probe and seeker
113. Test tube rack
114. Microscope slides and cover lens
115. Bunsen burner
116. Scalpel
117. Beaker brush
118. Tubing
119. Test tube brush
120. Dissecting pin
121. Gauze iron wire
122. Lab apron
123. Plastic face shield
124. Safety glasses w/eye cups and side shields
125. Chemical goggles w/hooded vents

STUDENT WORKSHEET #2

Identifying Agricultural Tools and Equipment

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

Name ____________________ Price ________
Give one use: ____________________

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STUDENT WORKSHEET #3

Agricultural Tool and Equipment Demonstration

Questions:

1. Name of tool or equipment ____________________
2. Primary function ____________________
3. Can this tool be adjusted? ____________________
   If so, how and where? ____________________
   ____
   ____
4. Can tool be sharpened? __________ If so, how and where? __________
   ____
   ____

Observations:

List step-by-step method of correctly using the tool. Draw and identify the major parts of the tool.

____
____
____
____
____

Conclusion:

List safety practices identified and how to properly clean and store the tool.

____
____
____
____
____

STUDENT WORKSHEET #4

Identifying Agricultural Power Tools and Equipment

Name ____________________ Price ________
Give one use: ____________________
____
____
____

Name ____________________ Price ________
Give one use: ____________________
____
____
____

Name ____________________ Price ________
Give one use: ____________________
____
____
____

Name ____________________ Price ________
Give one use: ____________________
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Name ____________________ Price ________
Give one use: ____________________
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Name ____________________ Price ________
Give one use: ____________________
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Name ____________________ Price ________
Give one use: ____________________
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____
____

Name ____________________ Price ________
Give one use: ____________________
____
____
____

STUDENT WORKSHEET #5

Agricultural Power Tool and Equipment Demonstration

Questions:

1. Name of tool or equipment ____________________
2. Primary function ____________________
3. Can this tool be adjusted? ____________________
   If so, how and where? ____________________
   ____
   ____
4. Can tool be sharpened? __________ If so, how and where? ____________________
   ____
   ____

Observations:

List step-by-step method of correctly using the tool. Draw and identify the major parts of the tool.

____
____
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____

Conclusion:

List safety practices identified and how to properly clean and store the tool.

____
____
____
____
____

757

STUDENT WORKSHEET #6

Safety in the Agricultural Laboratory
(For use with VAS Unit #U3022)

1. Name three ways to dress properly for shop work:
   a. ______________________________
   b. ______________________________
   c. ______________________________

2. List at least one reason why you should:
   a. Keep all edge tools sharp. ______________________________
   b. Use wrenches of the proper kind. ______________________________
   c. Use files with handles. ______________________________
   d. Not use a punch with a mushroomed head. ______________________________
   e. Adjust the jaws of adjustable wrenches. ______________________________
   f. Not use a wrench as a hammer. ______________________________

3. Why should you not use a penny as a substitute for an electrical fuse?
   ____

4. List one unsafe way to use the following:
   a. Pliers ______________________________
   b. Screwdriver ______________________________
   c. Carpenter's hammer ______________________________

5. List five possible hazards while working with electricity in the shop.
   a. ______________________________
   b. ______________________________
   c. ______________________________
   d. ______________________________
   e. ______________________________

6. What do you think are the most important safety rules for shop work?
   a. ______________________________
   b. ______________________________
   c. ______________________________
   d. ______________________________
   e. ______________________________

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ERIC

STUDENT WORKSHEET #7

Checklist of Laboratory Hazards

(To be filled out in laboratory area)
List and give the location of possible safety hazards in the laboratory.

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

759

STUDENT WORKSHEET #8

Color Code for Shop Safety
(For use with VAS Unit #U3044)

1. List the purposes of the safety color code as used in agricultural laboratories.
   a. ____________________
   b. ____________________
   c. ____________________
   d. ____________________

2. Match the colors used in the safety color code to the proper descriptions.

   1. Green
   2. Aluminum
   3. Yellow
   4. Red
   5. Blue
   6. Orange
   7. Ivory

   ______ a. Applied to electrical switches, interior surfaces of doors, fuse and electrical boxes, movable guards and parts, inside of nonremovable guards, traffic lanes, and overhead hazards; used to designate dangerous parts of equipment which may cut, crush, shock, or otherwise injure.

   ______ b. Applied to operating levers, wheels, handles, and hazardous areas which may cause stumbling, falling, or tripping; used to designate caution.

   ______ c. Applied to noncritical parts of equipment and matching surfaces, nameplates, and bearing surfaces; used to designate the location of safety and first aid equipment.

   ______ d. Applied to tops of tables and work areas to provide contrast with work.

   ______ e. Used to identify the location of fire fighting equipment.

   ______ f. Applied to table edges, vise jaws, and edges of tool rests to reflect light and "show the way."

   ______ g. Used as the basic color for designating caution against starting equipment while it is being worked on or against the use of defective equipment.

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ERIC

STUDENT WORKSHEET #8 — Key

Color Code for Shop Safety
(For use with VAS Unit #U3044)

1. List the purposes of the safety color code as used in agricultural laboratories.
   a. *Reduces glare by diffusing light for better vision.*
   b. *Reduces eyestrain, tension, and fatigue.*
   c. *Points out critical parts and areas.*
   d. *Provides a more pleasing environment.*

2. Match the colors used in the safety color code to the proper descriptions.

   1. Green
   2. Aluminum
   3. Yellow
   4. Red
   5. Blue
   6. Orange
   7. Ivory

   6 a. Applied to electrical switches, interior surfaces of doors, fuse and electrical boxes, movable guards and parts, inside of nonremovable guards, traffic lanes, and overhead hazards; used to designate dangerous parts of equipment which may cut, crush, shock, or otherwise injure.

   3 b. Applied to operating levers, wheels, handles, and hazardous areas which may cause stumbling, falling, or tripping; used to designate caution.

   1 c. Applied to noncritical parts of equipment and matching surfaces, nameplates, and bearing surfaces; used to designate the location of safety and first aid equipment.

   2 d. Applied to tops of tables and work areas to provide contrast with work.

   4 e. Used to identify the location of fire fighting equipment.

   7 f. Applied to table edges, vise jaws, and edges of tool rests to reflect light and "show the way."

   5 g. Used as the basic color for designating caution against starting equipment while it is being worked on or against the use of defective equipment.

UNIT C: Basic Principles of Agricultural Science

PROBLEM AREAS:

1. Understanding Basic SoilScience Principles
2. Identifying and Using Agricultural Tools andEquipment
3. Understanding Basic Genetics and Reproduction
4. Using Energy Efficiently
5. Identifying Basic Principles of Plant Science
6. Identifying Basic Principles of Animal Science
7. Identifying Basic Principles of Electricity
8. Understanding and Using Pesticides
9. Identifying Basic Agricultural Mechanics Principles
10. Conserving Agricultural Resources
11. Understanding Food Science Technology

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Basic Genetics and Reproduction

RELATED PROBLEM AREAS:

1. Identifying the Basic Principles of Plant Science
2. Identifying the Basic Principles of Animal Science
3. Understanding Animal Anatomy and Physiology
4. Understanding Animal Breeding and Reproduction (Agricultural Business and Management Cluster)
5. Understanding Plant Germination, Growth, and Development (Agricultural Business and Management Cluster)
6. Understanding Plant Germination, Growth, and Development (Horticulture Cluster)
7. Recognizing the Impact of Technology on Agriculture: Biotechnology

PREREQUISITE PROBLEM AREA(S) None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management

Duty A: Formulating Livestock Feeding Programs

1. Assess livestock needs, such as growing and fattening, nursing production, or special nutritional needs.

Duty H: Managing the Business

1. Evaluate agribusiness productivity
2. Maintain production records
3. Maintain animal records

Duty L: Growing Corn, Soybeans, Small Grains, or Forage Crops

1. Select seed varieties

Duty N: Breeding, Handling, and Caring for Animals

1. Evaluate animals for registry

Horticulture Cluster

Duty A: Propagating Plants, Seeds, and Cuttings

1. Plan planting schedule
2. Select seed varieties

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify the components of the DNA molecule.					
*2. Know the genetic basis of diversity.					
*3. Recognize that the basic unit of inheritance is DNA.					
4. Define terms integral to basic genetics and reproduction.					
5. Explain the difference between sexual and asexual reproduction.					
6. Describe the transmission of genetic characteristics.					
7. Differentiate between mitosis and meiosis.					
8. Demonstrate the probable results of either single or multiple trait crosses using a square diagram.					

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize the implications of modern technology.					

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA (*check one*)
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the principles of scientific research and their application in simple research projects.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (*circle one*) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Demonstrate the ability to draw conclusions from collected data.					

7:1 770

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Basic Genetics and Reproduction

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define terms integral to basic genetics and reproduction.
2. Explain the difference between sexual and asexual reproduction.
3. Describe the transmission of genetic characteristics and protein synthesis.
4. Differentiate between mitosis and meiosis.
5. Demonstrate the probable results of either single or multiple trait crosses using a square diagram.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Basic Genetics and Reproduction

PROBLEMS AND QUESTIONS FOR STUDY

1. What is sexual reproduction?
2. What is asexual reproduction?
3. How are the characteristics of an animal determined?
4. What are chromosomes?
5. What are genes?
6. How are genes replicated?
7. How do cells reproduce?
8. What is the difference between plant reproduction and animal reproduction?
9. How can one determine the characteristics of offspring?
10. What is mitosis?
11. What is meiosis?
12. What are dominant and recessive genes?
13. What is a mutation?
14. What is the difference between genotype and phenotype?
15. What is the difference between homozygous and heterozygous?
16. What is the relationship between heredity and the organism's environment?
17. How does technology affect genetics and reproduction?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Basic Genetics and Reproduction

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use other life science personnel as resource persons for ideas, techniques, equipment, and speakers.

2. Use the transparencies in conjunction with the student worksheets to provide visual and psychomotor reinforcement for concepts.

3. Use the student activities to point out characteristics which are easily observable and to point out that variations are possible.

4. Plan a field trip to:

   a. Production facilities where various combinations of characteristics can be seen.
   b. Seed companies and/or universities where experimentation and research for desirable characteristics are conducted.

5. Secure copies of Vocational Agriculture Service Publication #U1009A, *Improving Animals Through Breeding,* to be used as student study materials.

6. Secure copies of Instructional Materials Service #8406, *Animal Genetics,* and #8387, *Plant Genetics,* to use as student study materials and student study guides.

7. Consult with life science personnel for models, slides, and other examples of cell division for student use.

8. Refer to the *Recognizing the Impact of Technology on Agriculture: Biotechnology,* for a discussion of recombinant DNA technology and lead the class in a discussion of its effect on heredity and the ethical issues it presents.

9. Use representatives of seed companies, breeding coops, universities and laboratories; and local producers as resource persons for class presentations of methods of collection and uses of pedigree and progeny information in making relevant breeding decisions.

10. Secure copies of videotapes and computer programs.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Basic Genetics and Reproduction

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Reproduction in Farm Animals.* (1974). Hafez, E.S.E. Lea and Febiger, Washington Square, Philadelphia, PA 19106.

2. *Biology: Living Systems.* (1986). Oram, R.F., Hummer, P.S., Smoot, R.C. Charles E. Merrill Publishing Company, Columbus, OH 43216.

*3. *Animal Genetics* (Subject Matter Unit #8406); *Plant Genetics* (Subject Matter Unit #8387). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588.

*4. *Improving Animals Through Breeding* (VAS Unit #U1009A); *Animal Genetics and Breeding* (VAS Transparency Set #T130). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Reproduction

INFORMATION SHEET #3 — Transmission of Characters

TRANSPARENCY MASTER #1 — Cell Structure

TRANSPARENCY MASTER #2 — Parts of Cell Nucleus (with discussion guide)

TRANSPARENCY MASTER #3 — Steps in Animal Cell Mitosis (with discussion guide)

TRANSPARENCY MASTER #4 — Maturation Process in Animal Cells (Meiosis) (with discussion guide)

TRANSPARENCY MASTER #5 — Plant Mitosis (with discussion guide)

TRANSPARENCY MASTER #6 — Plant Meiosis (with discussion guide)

TRANSPARENCY MASTER #7 — Sex Determination in Animals (with discussion guide)

TRANSPARENCY MASTER #8 — A Diagram for Determining the Probable Results from a Dominant and Recessive Character (with discussion guide)

TRANSPARENCY MASTER #9 — Color Determination in Shorthorns (with discussion guide)

TRANSPARENCY MASTER #10 — A Cross with Two Characters (with discussion guide)

TRANSPARENCY MASTER #11 — Anatomy of the Egg and Sperm (with discussion guide)

TRANSPARENCY MASTER #12 — Fertilization (with discussion guide)

TRANSPARENCY MASTER #13 — An Example of Gene Pairs Dividing (with discussion guide)

TRANSPARENCY MASTER #14 — Physical Characteristics (with discussion guide)

TRANSPARENCY MASTER #15 — DNA Bases and Structural Base (with discussion guide)

TRANSPARENCY MASTER #16 — DNA Structure and Duplication (with discussion guide)

TRANSPARENCY MASTER #17 — DNA and RNA Differences (with discussion guide)

TRANSPARENCY MASTER #18 — Amino Acids with Some mRNA Codons (with discussion guide)

TRANSPARENCY MASTER #19 — mRNA and tRNA (with discussion guide)

TRANSPARENCY MASTER #20 — Protein or Polypeptide Formation (with discussion guide)

INFORMATION SHEET #1

Terms to be Defined

Adaptation — inherited characteristic that promotes survival and reproduction in a natural environment.

Allele — dominant or recessive form that a gene may take.

Anaphase — phase of mitosis during which one strand of each chromosome is pulled to each pole of the cell; phase in meiosis I in which homologous chromosomes are separated and pulled to each pole of the cell.

Anticodon — set of three bases at one end of tRNA; fits with specific codons of mRNA.

Artificial selection — procedure in which humans choose organisms to breed that have desirable features.

ATP-ADP cycle — series of reactions by which ATP is converted to ADP and ADP is converted back to ATP.

Bacterial transformation — form of genetic recombination that occurs when one bacterium breaks open and part of its DNA enters another bacterium.

Centrioles — pair of organelles that play an important role in division of animal cells.

Chromatid — individual strand in a double-stranded chromosome.

Chromatin — mass of material inside the nuclear membrane that appears as chromosomes during cell division.

Chromosome — distinct body in the nucleus that appears during cell division; contains genes.

Chromosome Theory of Heredity — genes are located on chromosomes.

Codon — sequence of three bases representing a certain amino acid.

Continuous variation — existence of varying degrees of a characteristic; controlled by more than one pair of genes.

Deoxyribonucleic acid (DNA) — nucleic acid that contains the "genetic message."

Deoxyribose — a sugar that joins with a nitrogen base and a phosphate group to form a nucleotide.

Dominant trait — genetic trait that dominates or prevents the expression of the recessive trait.

First filial — first offspring produced from a parental cross.

Gametes — sex cells; sperm and eggs.

Gene — unit responsible for transmitting hereditary traits; segment of a DNA molecule.

Gene pool — all the genes of a population; sum of genetic information that will be passed to each new generation.

Genetic engineering — altering an organism's genetic makeup.

Genetic recombination — rearranging of genetic instructions.

Genetics — science of heredity.

Identical twins — twins that have the same genotypes, resulting from the splitting of a zygote into two separate parts.

Inheritance of acquired characteristics — invalid hypothesis that states that characteristics that each individual acquires during its lifetime are passed on to the offspring of that individual.

Interphase — period between mitosis during which chromosomes are replicated; period before meiotic division.

Lamarckism — theory of evolution proposed by Jean Baptiste de Lamarck; ideas that explained evolution of adaptations through laws of use and disuse and inheritance of acquired characteristics.

Law of dominance — the dominant form of a trait dominates or prevents the expression of the recessive form.

Law of independent assortment — different chromosomes separate independently during gamete formation.

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Law of segregation — during gamete formation the pair of alleles responsible for each trait separate so each gamete contains only one allele for each trait.

Meiosis — process of division whereby monoploid reproductive cells or nuclei are produced from diploid parent cells.

Metaphase — phase of mitosis in which chromosomes move to the "equator" of the cell and become attached to spindle fibers at their centromeres.

Microtubule — long, thin structure that provides support and shape to a cell.

Mitosis — process of nuclear replication in a cell.

Parental cross — mating of two organisms to produce offspring; usually refers to first mating in a series.

Post-transcriptional event — event that occurs after transcription of DNA that can determine if the product of the gene is made.

Prophase — first stage in mitosis during which the nucleolus and the nuclear membrane disappear and chromosomes become clearly visible as separate bodies; stage in meiosis I when homologous chromosomes pair.

Recombinant DNA — DNA that results from the combination of DNA from two organisms.

Recombination gametes — gametes that contain an allele combination different from the parental linked combination.

Replication — duplication.

Reverse transcription — process in RNA viruses in which DNA is made from RNA.

Second filial generation — generation of offspring produced from interbreeding offspring of the first filial generation.

Selective breeding — mating of animals or plants to produce offspring with desired features.

Sperm nuclei — two monoploid nuclei produced by mitosis from the generative nucleus in the pollen tube.

Spermatids — four monoploid cells produced during meiosis II that mature into sperm cells.

Spindle — oval-shaped structure composed of fibers between opposite poles of the cell; structure to which chromosomes become attached during mitosis and meiosis.

Telophase — last phase of mitosis in which the events are opposite those of prophase; stage in meiosis I and meiosis II.

Transcription — transferring the genetic code from DNA to RNA in protein synthesis.

Transfer RNA — RNA that brings amino acids to messenger RNA in protein synthesis.

Translation — operation and interaction of messenger RNA, transfer RNA, and amino acids to form a protein.

X chromosome — one of the chromosomes that determines sex; a sex chromosome.

Y chromosome — one of the chromosomes that determine sex; a sex chromosome.

Zygote — fertilized egg resulting from the union of a sperm and an egg.

INFORMATION SHEET #2

Reproduction

1. Asexual reproduction:

   a. Occurs without the aid of germ cells.
   b. Uses simple cell division in some cases, as with bacteria.
   c. Uses budding in some cases, as with yeast.

2. Sexual reproduction:

   a. Occurs with the start of a fertilized cell.
   b. Proceeds via the union of gametes, the cells from which a new individual is produced.
   c. Uses sperms, or spermatozoa, the germ cells produced by the male.
   d. Uses eggs, or ova, the germ cells produced by the female.

3. In the maturation process the number of chromosomes in both the male and female germ cells are reduced by one-half the original number. This is known as meiosis in sex cells.

4. Mutations occur when a gene fails to exactly duplicate itself and a "new gene" is born.

   a. Lethal mutations:

      1. Occur where there is a lack of a chromosome.
      2. Cause death of the organism either before or at birth.

   b. Sub-lethal mutations:

      1. Could be more serious than lethals as they can be carried by an animal unnoticed but be visible in offspring.
      2. Could eventually cause death of the organism.
      3. Could cause changes in phenotype.

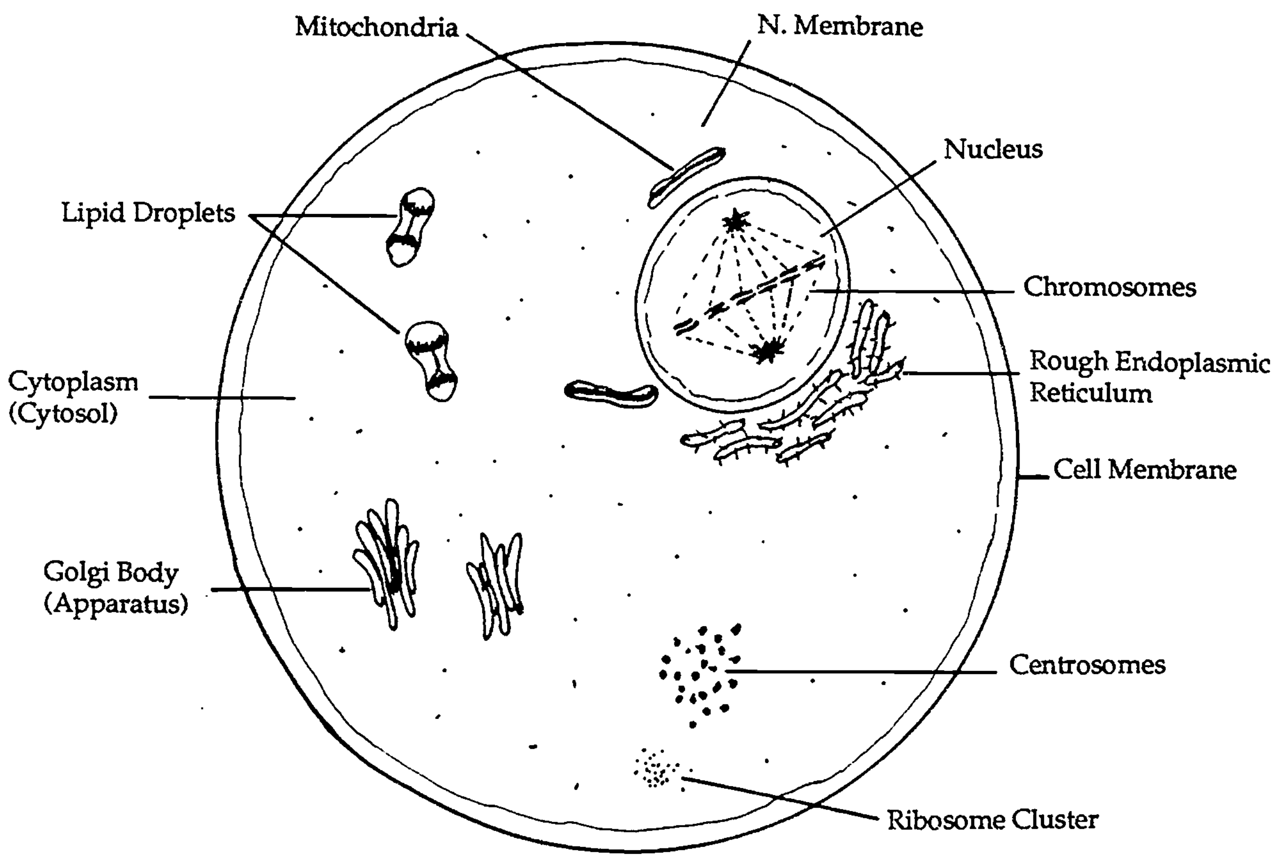
INFORMATION SHEET #3

Transmission of Characters

1. A character may be defined as a distinguishing detail of structure or form in an individual.
2. Genes that are located in the reproductive cells are the source of a character.
3. Dominant genes hide or mask the presence of another (usually designated by capital letters).
4. Recessive genes will express their character only in the absence of the dominant character (usually designated by small letters).
5. Homozygous characteristics have two like genes for the same character.
6. Heterozygous characteristics have two different genes that affect a character.
7. Phenotype is how an animal looks, genotype is the genetic makeup of the cells of the animal.
8. Inbreeding is the mating of closely related animals (such as sire to daughter, sister to brother, dam to son).
9. Sire selection is generally more important than dam because the sire affects the offspring of the entire herd.
10. The sire determines the sex of the offspring because his reproductive cells contain both X and Y sex chromosomes, and the dam has only the X sex chromosomes.
11. All chromosomes other than sex chromosomes are called autosomes.

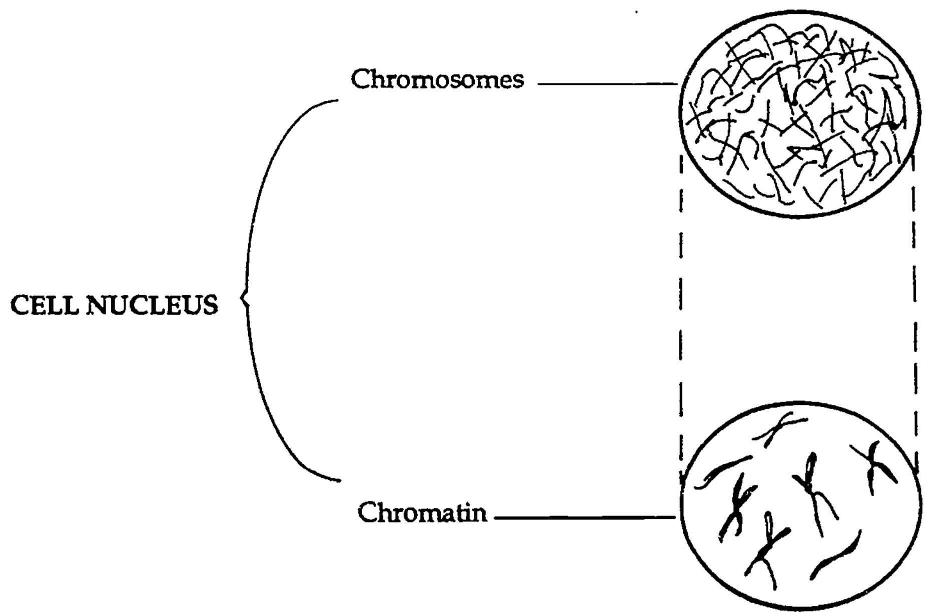
TRANSPARENCY MASTER #1

Cell Structure



TRANSPARENCY MASTER #2

Parts of Cell Nucleus



(Chromatin material is located within the nucleus of the cell. In certain stages the chromatin changes into rather definite bodies, called chromosomes.)

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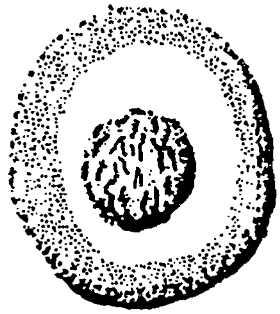
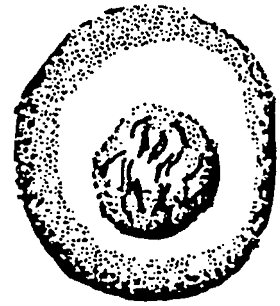
TRANSPARENCY MASTER #3

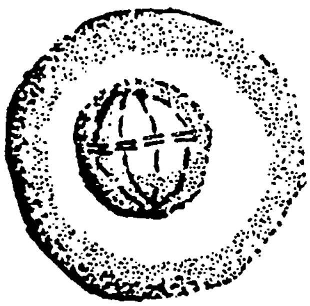
Steps in Animal Cell Mitosis



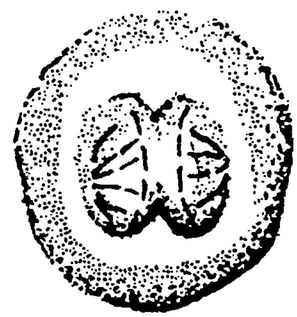
RESTING CELL
INTERPHASE



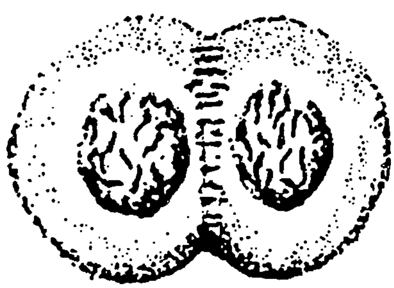
CHROMOSOMES FORMING
PROPHASE



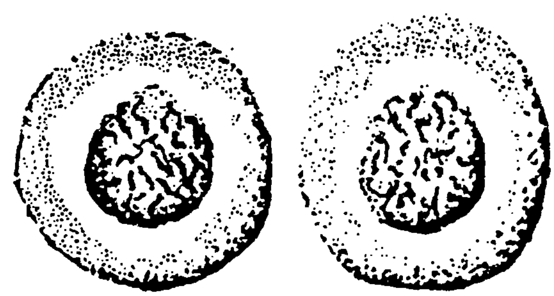
CHROMOSOMES DIVIDING
METAPHASE



CHROMOSOMES AND NUCLEUS SEPARATING
ANAPHASE



CELL DIVIDING
TELOPHASE



TWO CELLS FORMED
INTERPHASE

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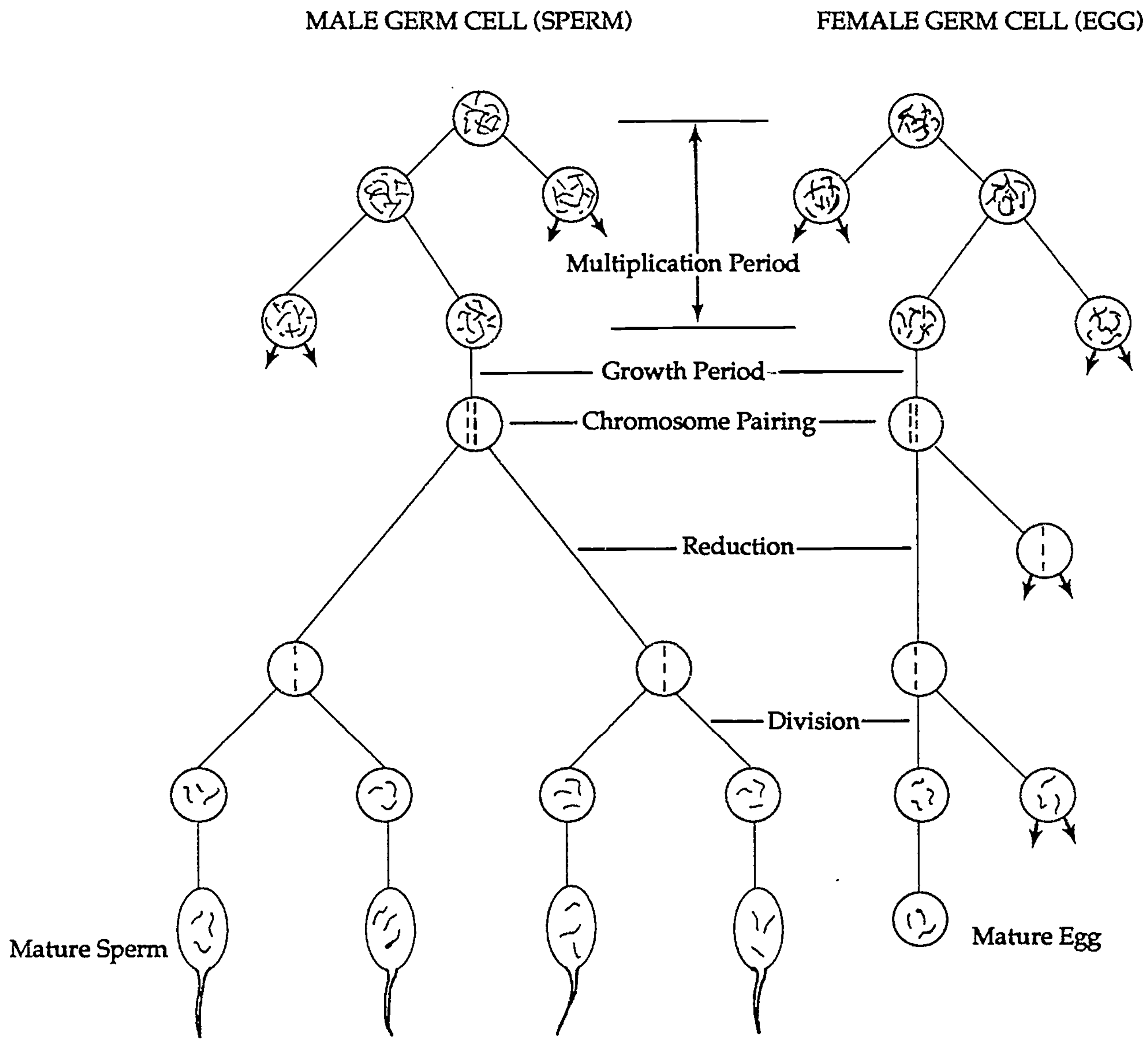
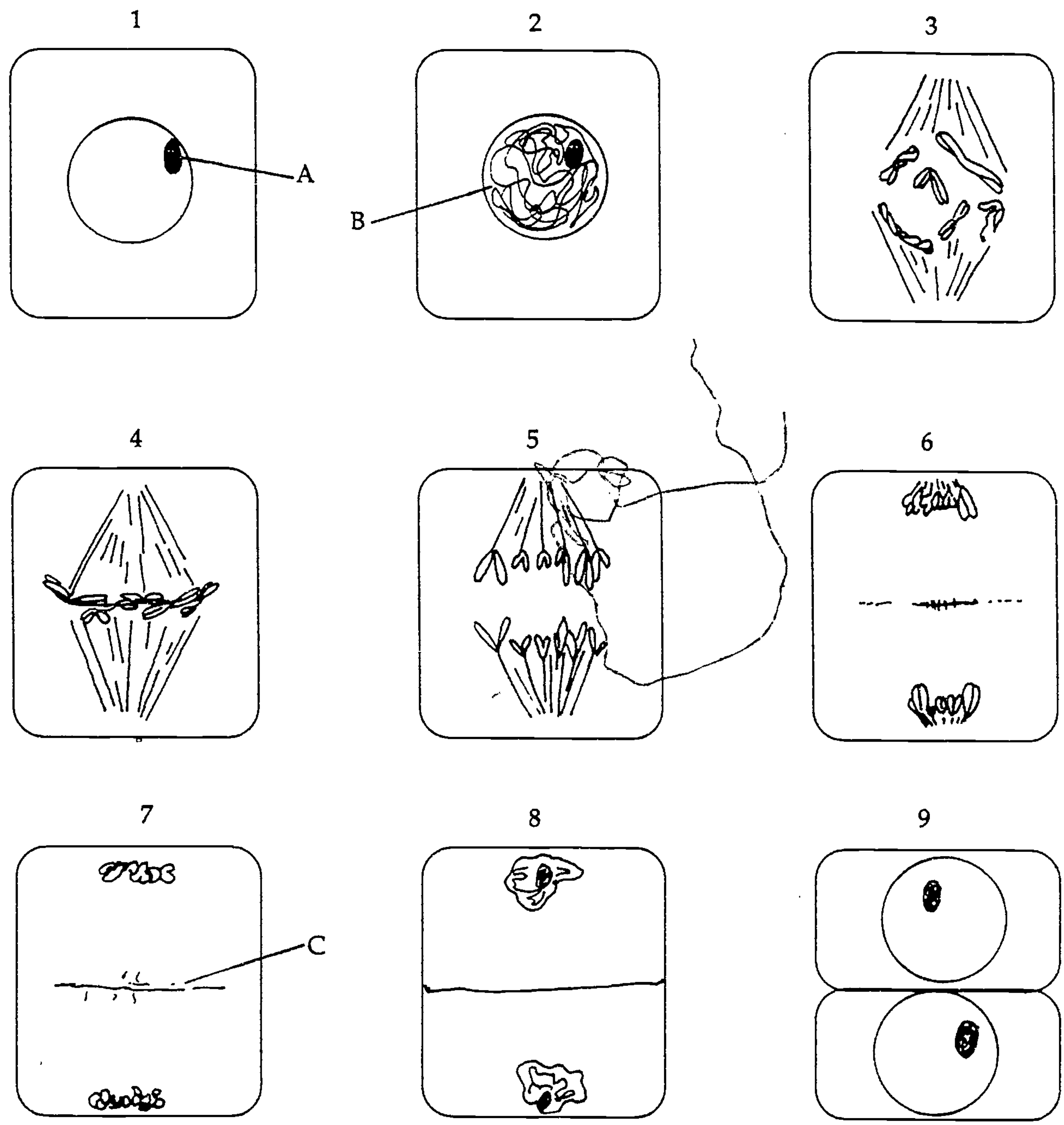
TRANSPARENCY MASTER #4

Maturation Process in Animal Cells (Meiosis)



TRANSPARENCY MASTER #5

Plant Mitosis



1. Interphase
2. Prophase
3. Early metaphase
4. Late metaphase
5. Early anaphase
6. Late anaphase
7. Early telophase
8. Late telophase
9. Interphase

a. Nucleolus
b. Centromere
c. Cell plate

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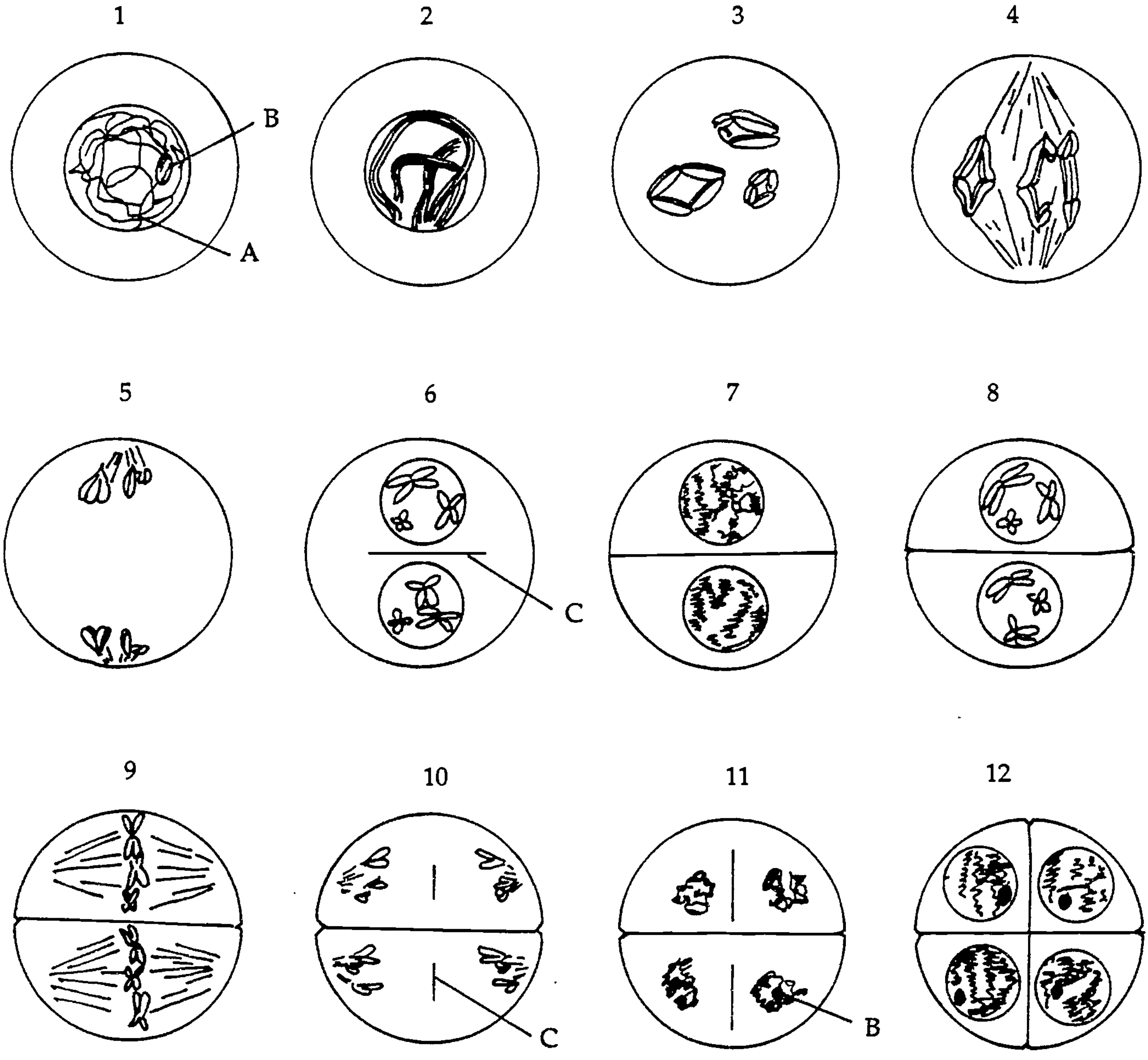
TRANSPARENCY MASTER #6

Plant Meiosis

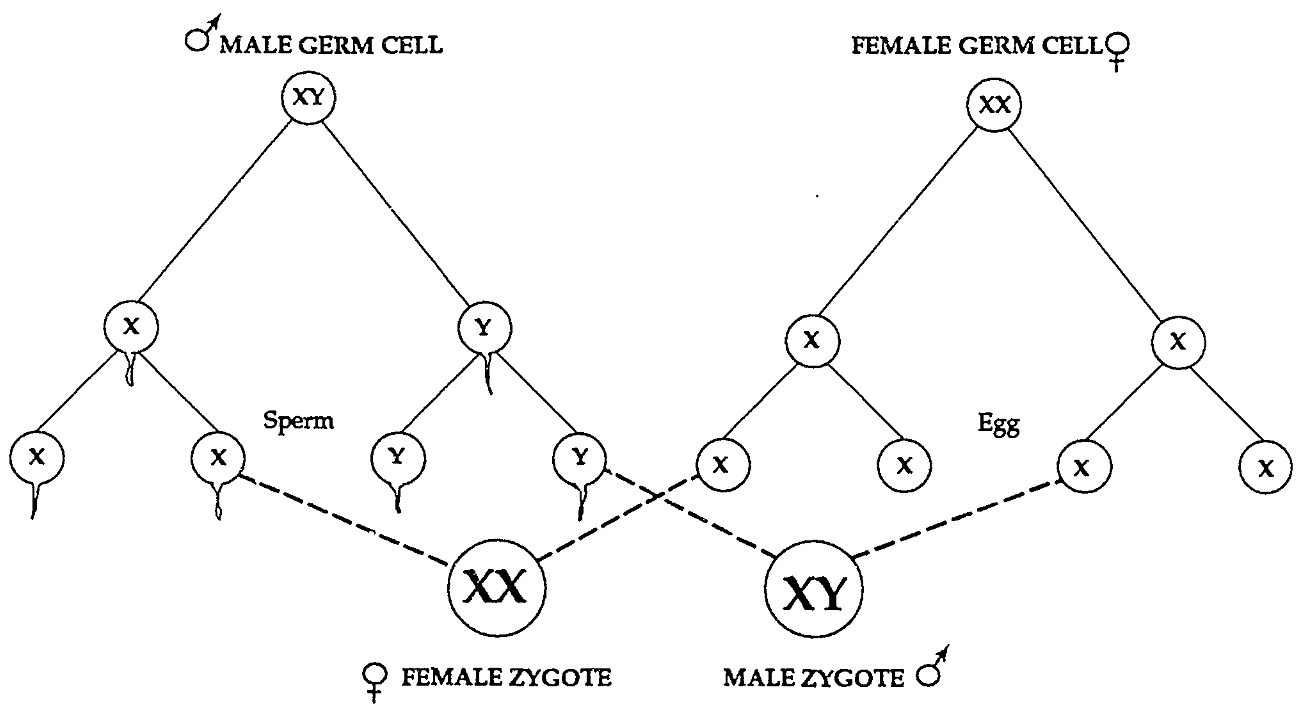


1. Early prophase I
2. Mid-prophase I
3. Late prophase I
4. Metaphase I
5. Anaphase I
6. Telophase I
7. Interphase
8. Prophase II
9. Metaphase II
10. Anaphase II
11. Telophase II
12. Gametophytes

a. Centromere
b. Nucleolus
c. Cell plate

TRANSPARENCY MASTER #7

Sex Determination in Animals

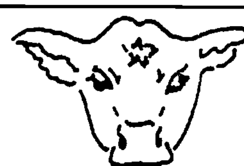
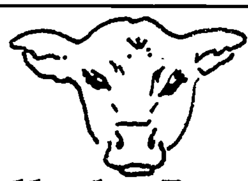
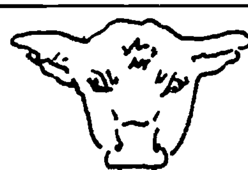


TRANSPARENCY MASTER #8

A Diagram for Determining the Probable Results from a Dominant and Recessive Character

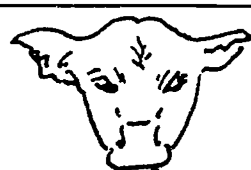
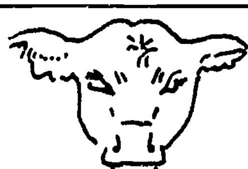
Male

Female

	P	P
p	Pp  (Polled - Impure)	Pp  (Polled - Impure)
p	Pp  (Polled - Impure)	Pp  (Polled - Impure)

Male

Female

	P	p
P	PP  (Polled - Pure)	Pp  (Polled - Impure)
p	Pp  (Polled - Impure)	pp  (Horned - Pure)

TRANSPARENCY MASTER #9

Color Determination in Shorthorns

Male

Female	R	R
W	RW (Roan)	RW (Roan)
W	RW (Roan)	RW (Roan)

Male

Female	W	W
R	RW (Roan)	RW (Roan)
W	WW (White)	WW (White)

TRANSPARENCY MASTER #10

A Cross With Two Characters

Male

Female

	PW	Pw	pW	pw
PW	☆ PPWW	☆ PPWw	☆ PpWW	☆ PpWw
Pw	☆ PPWw	★ PPww	☆ PpWw	★ Ppww
pW	☆ PpWW	☆ PpWw	✪ ppWW	✪ ppWw
pw	☆ PpWw	★ Ppww	✪ ppWw	● ppww

☆ — 9 Polled, Whitefaced

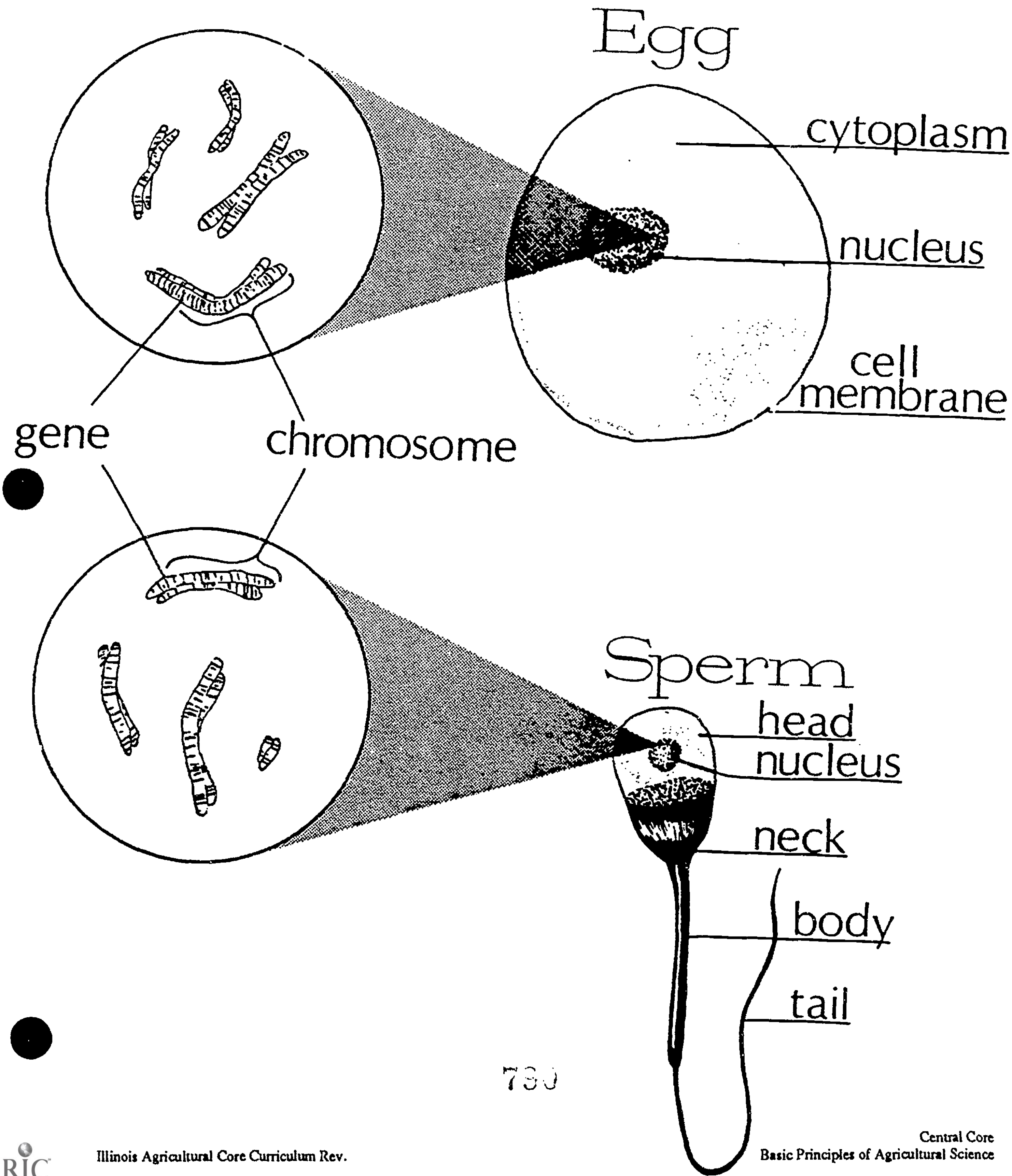
★ — 3 Polled, Coloredfaced

✪ — 3 Horned, Whitefaced

● — 1 Horned, Coloredfaced

TRANSPARENCY MASTER #11

Anatomy of the Egg and Sperm



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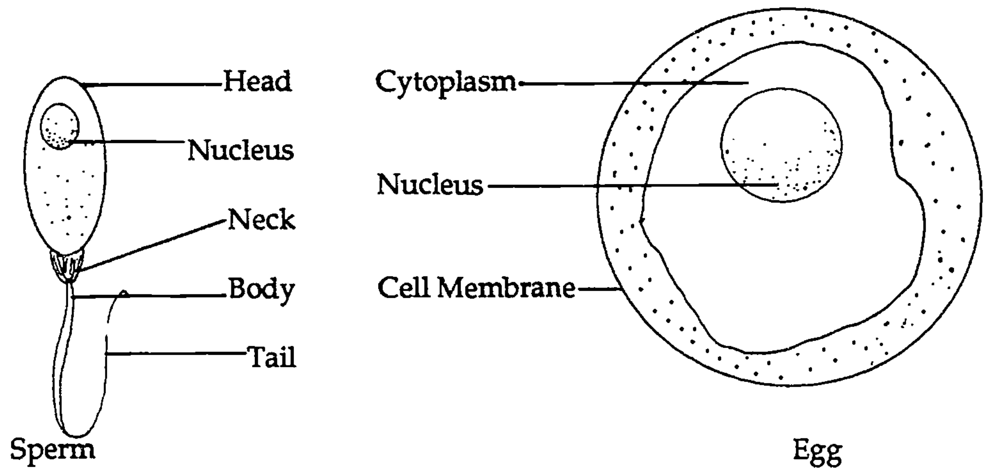
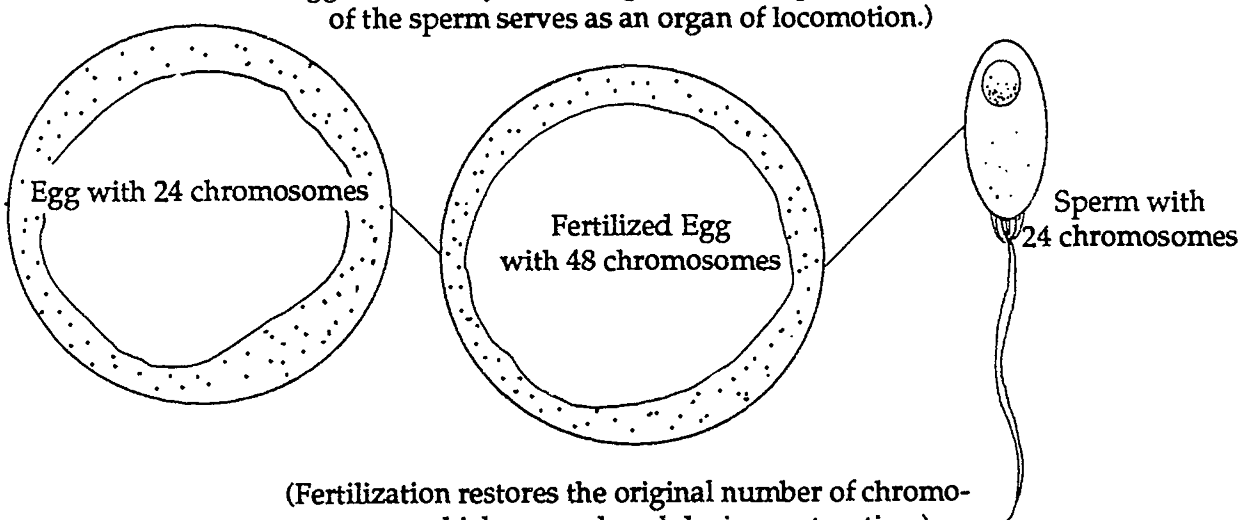
ERIC

TRANSPARENCY MASTER #12

Fertilization



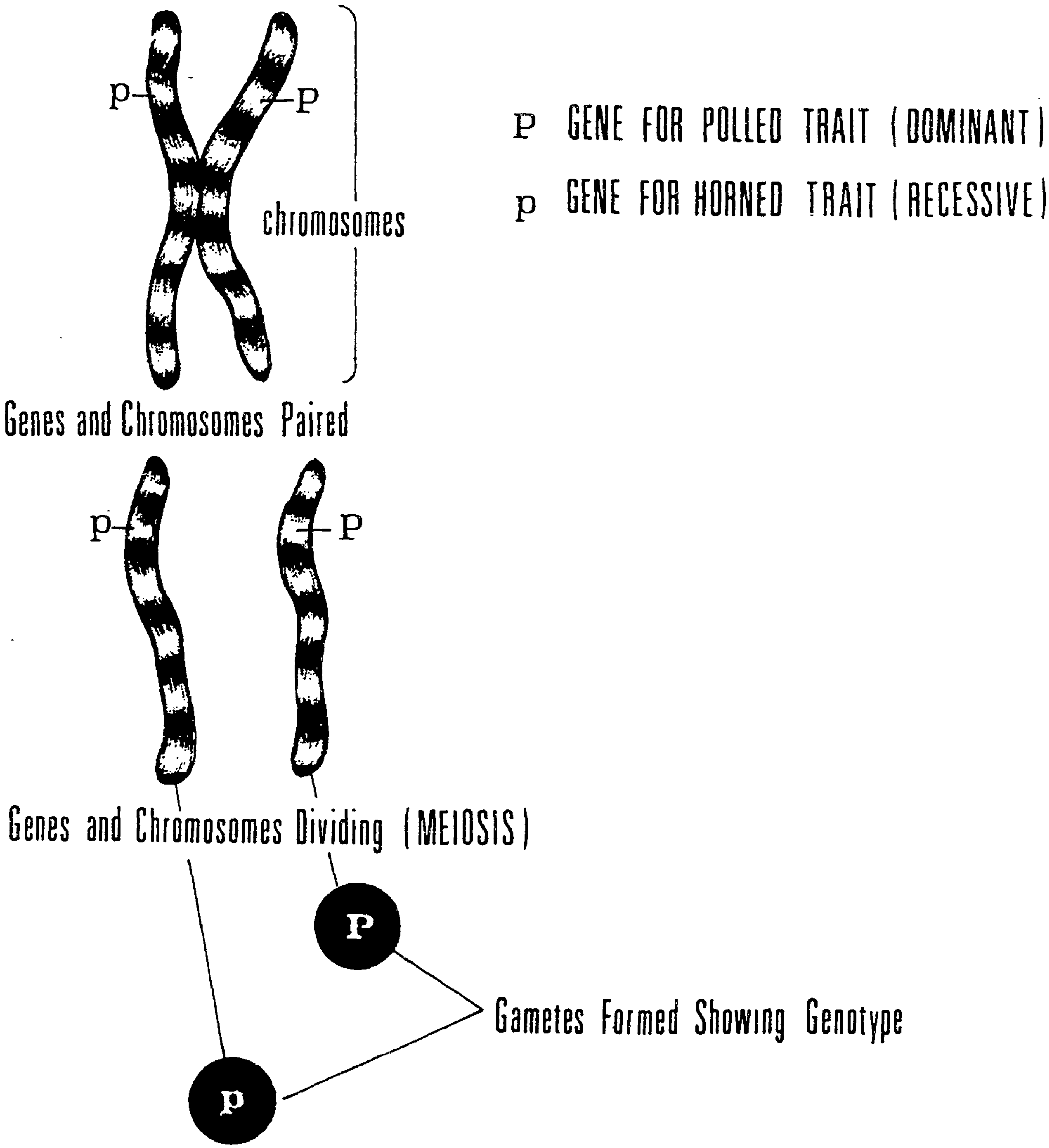
(Eggs are usually much larger than the sperm. The tail of the sperm serves as an organ of locomotion.)



(Fertilization restores the original number of chromosomes, which was reduced during maturation.)

TRANSPARENCY MASTER #13

An Example of Gene Pairs Dividing



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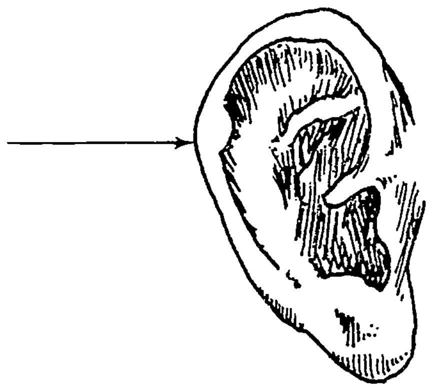
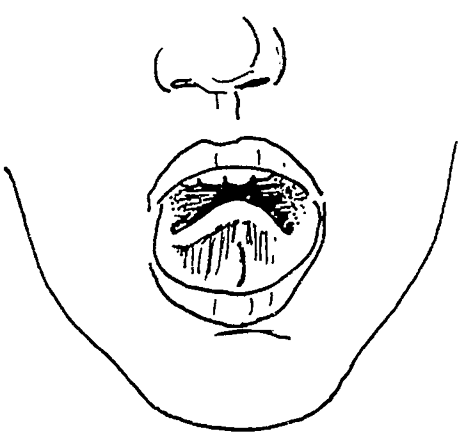
TRANSPARENCY MASTER #14

Physical Characteristics

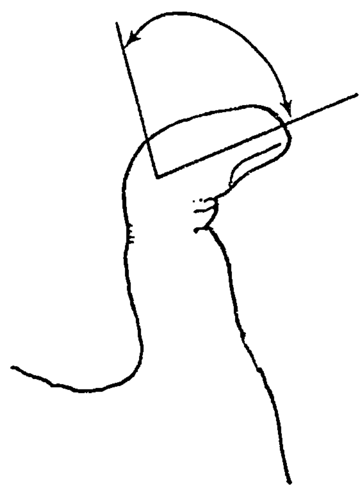


A. Darwin's earpoint

B. Widow's peak



C. Tongue Folding



D. Hyperextension of the Distal Thumb Joint

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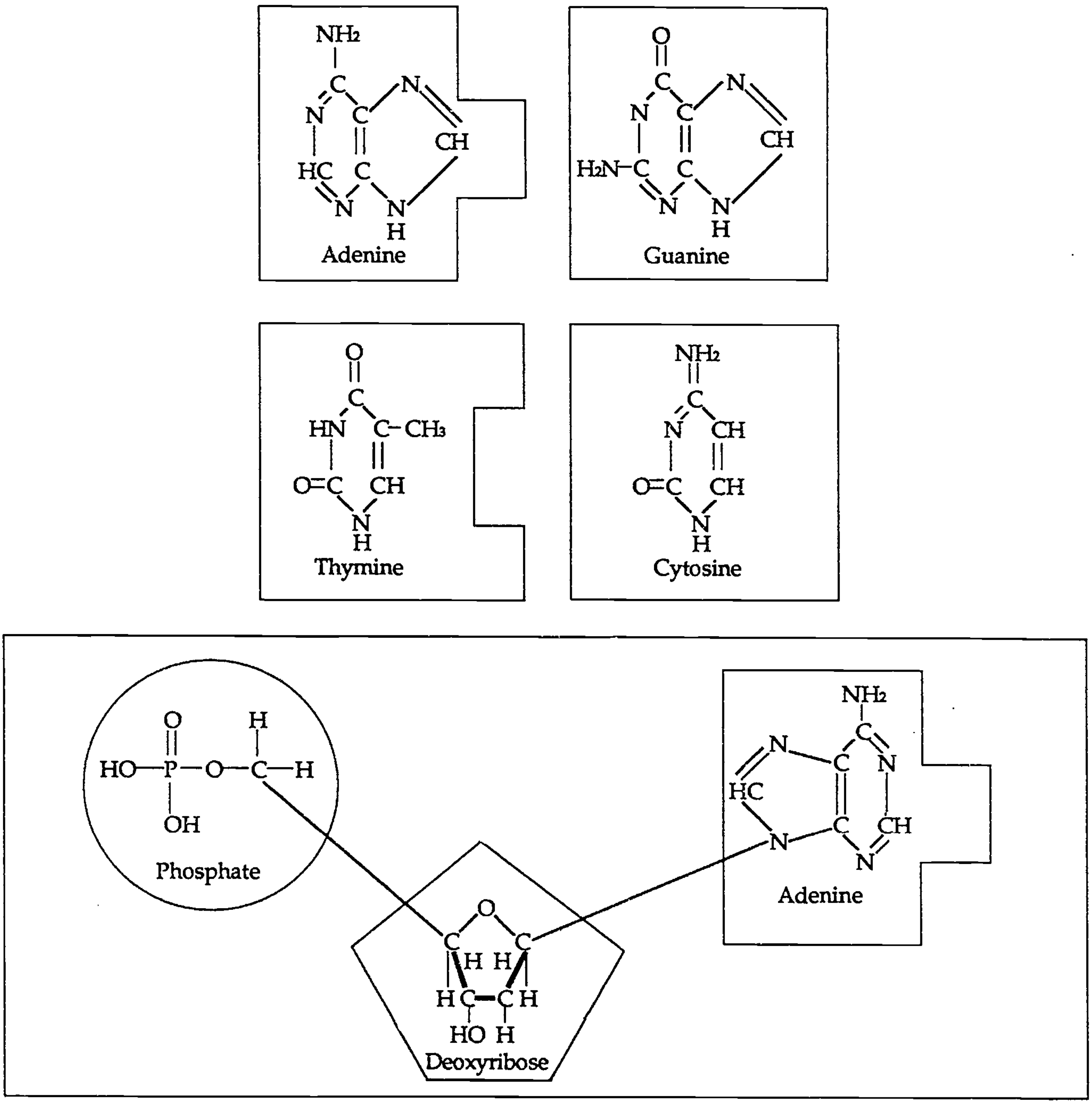
TRANSPARENCY MASTER #15

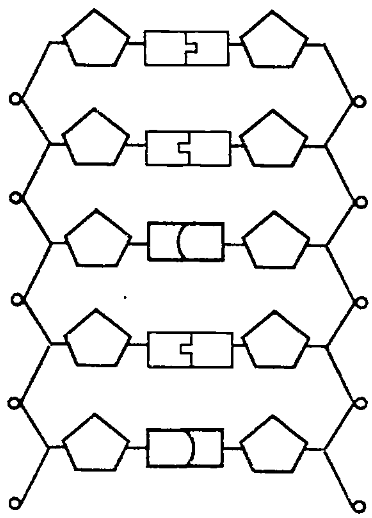
DNA Bases and Structural Base



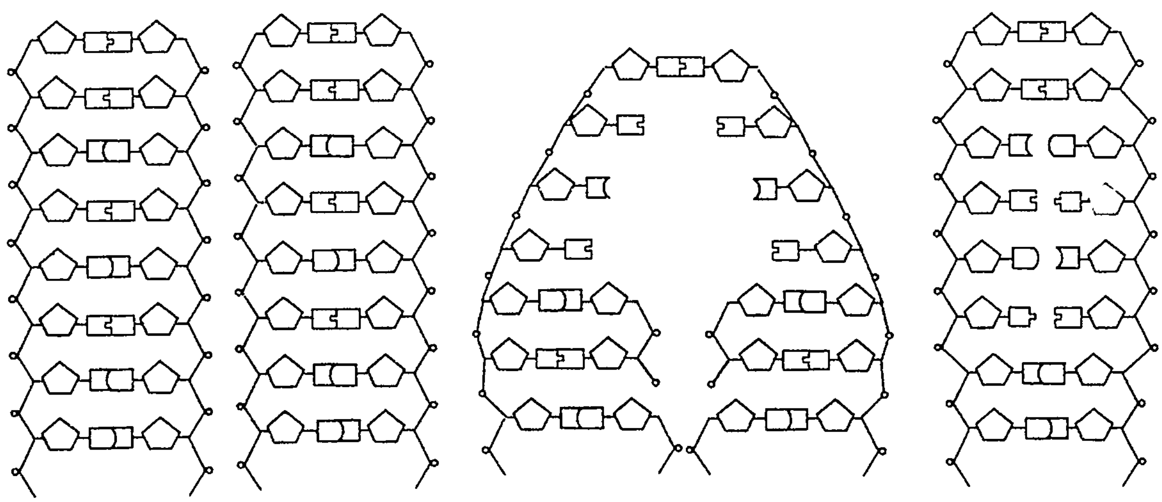
TRANSPARENCY MASTER #16

DNA Structure and Duplication

DNA Structure with Matched Base Parts



DNA Duplication

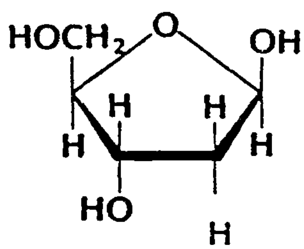


Two DNA Molecules Adding New Parts Unzipping of DNA Molecule

ERIC

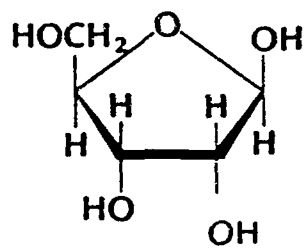
TRANSPARENCY MASTER #17

DNA and RNA Differences

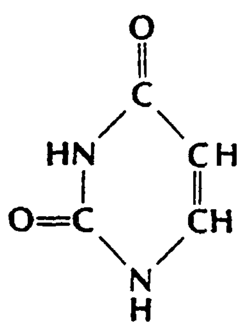


Deoxyribose

Is Replaced By

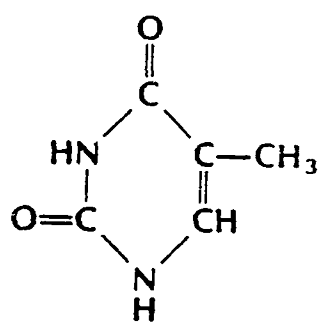


Ribose



Thymine

Is Replaced By



Uracil

TRANSPARENCY MASTER #18

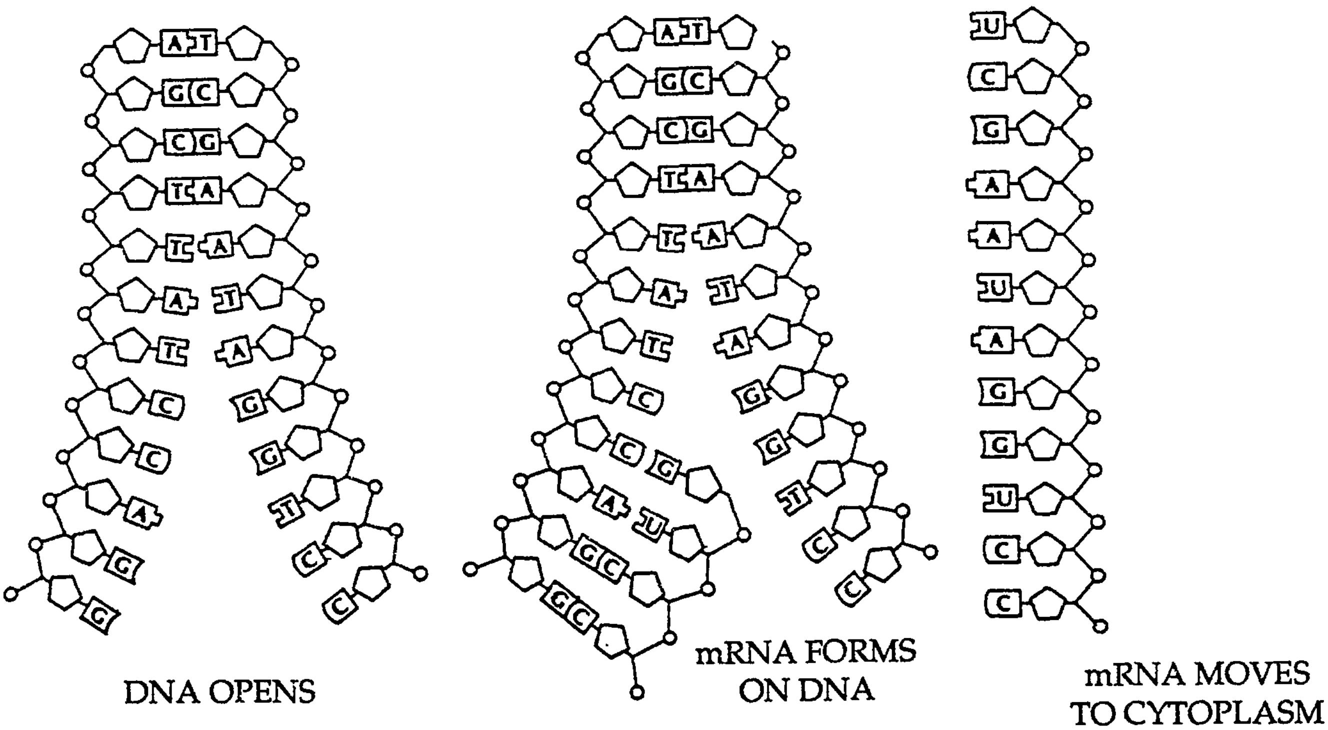
Amino Acids with Some mRNA Codons

Amino Acid	Codons		
Alanine	GCU	GCC	GCA
Arginine	CGU	CGC	CGA
Asparagine	AAU	AAC	
Aspartic acid	GAU	GAC	
Cysteine	UGU	UGC	
Glutamic acid	GAA	GAG	
Glutamine	CAA	CAG	
Glycine	GGU	GGC	GGA
Histidine	CAU	CAC	
Isoleucine	AUU	AUC	
Leucine	UUA	UUG	CUU
Lysine	AAA	AAG	
Methionine	AUG		
Phenylalanine	UUU	UUC	
Proline	CCU	CCC	CCA
Serine	UCU	UCG	AGU
Threonine	ACU	ACC	ACG
Tryptophan	UGG		
Tryosine	UAU		
Valine	GUU	GUC	

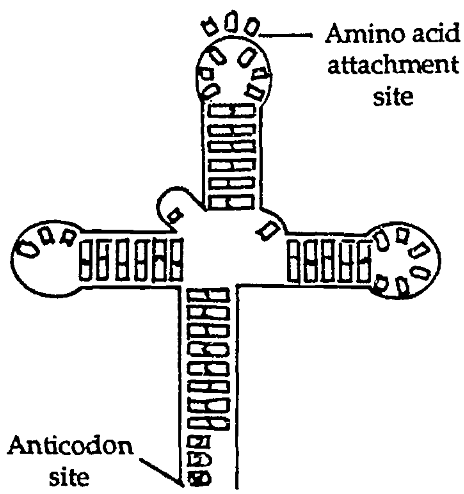
TRANSPARENCY MASTER #19

mRNA and tRNA

TRANSCRIPTION BY mRNA

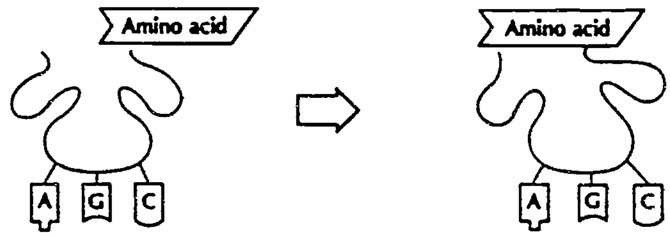


tRNA

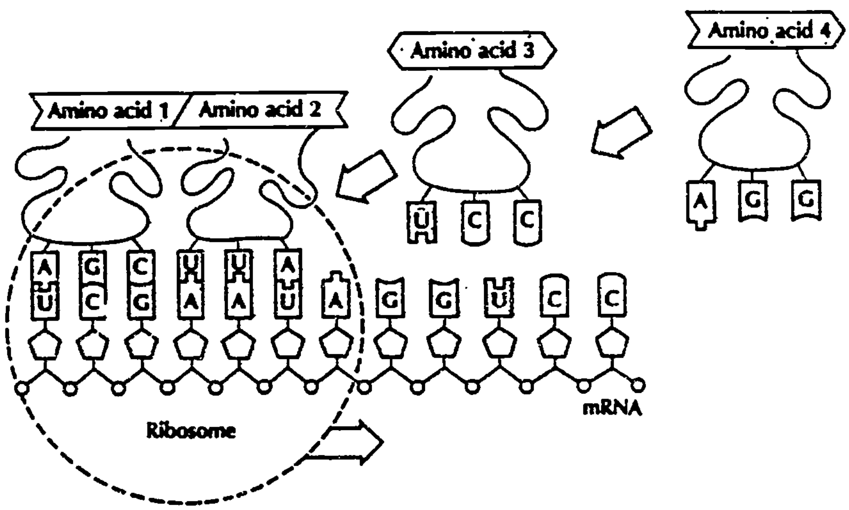


TRANSPARENCY MASTER #20

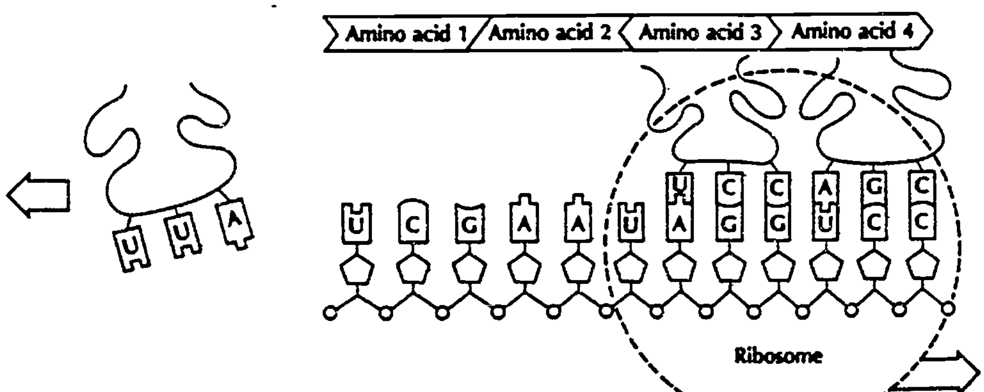
Protein or Polypeptide Formation



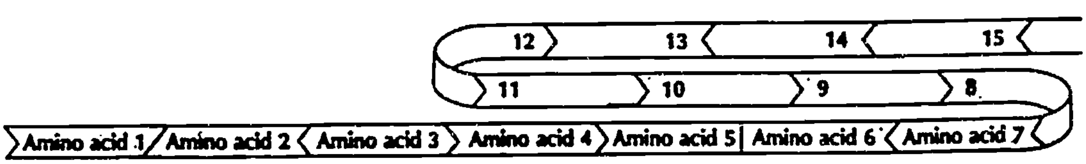
STEP 1: tRNA AND AMINO ACIDS COMBINE



STEP 2: TRANSLATION BEGINS



STEP 3: TRANSLATION CONTINUES



STEP 4: FINISHED PROTEIN OR POLYPEPTIDE FORMED

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #2

Chromatin — Part of the protoplasm material in the cell which carries the genes.

Chromosomes — Organized masses of chromatin that carry the genes. Chromosomes are sometimes referred to as the carriers of the hereditary material.

Gene — That material in the reproductive cell that gives rise to a character. The smallest unit of inheritance.

The number of chromosomes possessed by some animals are as follows:

Swine	38
Man	46
Cattle	60
Horse	64
Sheep	54
Chicken	78
Cat	38
Donkey	62
Mule	63
Dog	78
Mink	30

Transparency Master #3

This transparency shows the steps in cell division. A cell divides into two cells, then these two cells divide into four cells, and so on, until an animal becomes an adult. The division of cells is *mitosis*.

Stages of Division

1. Interphase — resting stage, state before and after division, nuclear membrane visible.
2. Prophase — follows interphase, nuclear membrane breaks down, nucleolus begins to disintegrate, chromosomes become visible, microtubules form, chromotids joined at centromere.
3. Metaphase — follows prophase, chromosomes move towards center, centromeres attach to spindle fiber.
4. Anaphase — follows metaphase, chromotids separate, at end of anaphase one set of single-stranded chromosomes at each end of cell, cell plate forms in plant cells.
5. Telophase — end of division, opposite occurrences of prophase

Transparency Master #4

Before the male and female germ cells unite, they go through a process called *maturation*, a process where the chromosomes in both the male and the female germ cells are reduced to one-half of the original number. The maturation process in the male and female germ cell are different. Only one in four of the female germ cells are productive, while all of the male germ cells will reproduce after uniting with an egg. Stages of division are the same, the difference is the resultant cells are haploid in number instead of diploid.

Transparency Masters #5 and #6

Point out the similarities to and differences from animal cell division.

Transparency Master #7

Sex of an animal is determined at the time of fertilization. In all animals but poultry, the female has, in addition to the regular chromosomes, two sex chromosomes, designated by the letters XX. In the male only one sex chromosome (X) is present, and the other is designated as Y.

After maturation one-half of the sperms and all of the eggs carry an X chromosome. The other one-half of the sperms carry a Y.

If in fertilization, a sperm carrying an X chromosome unites with an egg the offspring will be a female (XX). If a sperm carrying a Y chromosome unites with an egg, the offspring will be a male (XY).

In poultry the male carries the two sex chromosomes, while the female carries only one.

Transparency Master #8

The "square" or "checkerboard" diagram is used to determine the probable results in breeding livestock. The male germ cells are indicated in one margin (usually across the top) and the female germ cells are indicated in the other margin. A cross between a bull homozygous for polled condition (PP) and cow homozygous for horned condition (pp) will produce only polled offsprings in the F1s (upper diagram).

800

The offspring from individuals heterozygous for the polled character (Pp) will be in the approximate ratio of three polled to one horned (lower diagram). This is influenced by chance. The horned individuals produced from this cross (lower right-hand block) will not carry a gene for the polled character even though both parents were polled.

Using the information furnished above, one may wish to determine which animals are homozygous for the polled character. To determine if a polled bull is homozygous for the polled character, the bull should be bred to horned cows. If he is pure, his offsprings will be polled. From a bull with a heterozygous polled character, one-half of the calves will be horned and one-half will be polled. The above information may also be used to determine whether animals are homozygous or heterozygous for other characters.

A character can be the result of incomplete dominance. Roan color in shorthorn cattle is the result of *incomplete dominance of red and white.* In this case, capital letters are used to designate each gene (R = red; W = white).

Transparency Master #9

Breeding shorthorn animals, as shown in upper illustration, would produce offsprings which would be all roan. The crossing of roan and white individuals, as shown in the lower illustration would produce offsprings in the approximate proportion of two roan to two white.

Up until now, single characters are all that have been considered. There are a number of characters in any cross. You could expect a ratio of 3:1 based on appearance in the offsprings of a cross between individuals heterozygous characters would be 9:3:3:1. With each additional character the ratio is changed to the extent of multiplying the preceding ratio by 3:1.

Transparency Master #10

Crosses between individuals impure for both horned and whitefaced conditions (PpWw) should give a ratio of nine polled, whitefaced; three polled, coloredfaced; three horned, whitefaced; and one horned coloredfaced. One can see that breeding animals to improve a particular character is complicated.

Transparency Master #11

The sperm is very small and must be magnified many times before it is visible. Because the egg contains the food material for the developing young, it is much larger than the sperm. Some eggs are 1/150 of an inch in diameter. The sperm and egg are the parent germ cells and transmit all the characters that offspring will inherit.

The number of offspring produced by the female will give an indication as to the number of eggs produced by a species. A sow produces more eggs than a cow. Not all of the eggs produced by an animal are fertilized. Sometimes a fertilized egg will separate into two parts, and each part will form an individual. These individuals of the same sex have similar features and are called *identical twins*. Twins developed from separate fertilized eggs are referred to as *fraternal twins.*

Transparency Master #12

Fertilization is the union of the nuclei of the male and female reproductive cells, restoring the original number of chromosomes which were reduced in maturation.

1. Zygote — the fertilized egg that contains all of the hereditary material which the developing plant or animal will ever have.

2. Identical twins — two individuals produced from one fertilized egg that separated into two parts; from each part one of the individuals was produced.

3. Fraternal twins — two individuals produced from two separate fertilized eggs.

4. Freemartin — heifer calf born twin with bull calf. The female may be sterile due to an undeveloped reproductive tract.

Transparency Master #13

This transparency shows two genes, representing the polled character in cattle, (PP or Pp) dividing during the maturation process. Genes P and p are known as *alleles.*

When recessive and dominant genes are united in the *F1 generation*, the dominar characters are carried by the progeny. Some of the animals in the F2 generation will show dominant characters and others will show recessive characters.

Transparency Master #14

A. Darwin's Ear Point — The presence of a conspicuous point on the outer rim of the ear is inherited as a dominant character. This dominant gene shows variability in the way it is expressed. For example, some individuals have a Darwin's point on only one ear. Furthermore, some individuals transmit the dominant gene, although they themselves manifest the recessive phenotype.

B. Widow's Peak — Individuals whose hair line dips down in the middle of the forehead are said to have a "widow's peak." Examine your hair line and those of your classmates. What percentage of the students in your class possess this characteristic?

C. Tongue Folding — The capacity to fold the tongue backward, without pressing it against the upper teeth is very rare, occurring in the human population at a frequency of less than one per thousand individuals.

D. Hyperextension of the Distal Thumb Joint — Individuals who are homozygous recessive for this trait can bend the distal segment of the thumb backwards so that an angle of sixty degrees is made between the axes of the proximal and distal thumb segments. Examine your thumbs and those of your classmates and determine the percentage that have this character.

Transparency Masters #15 and #16

Several experiments and considerable research have supported the theory that deoxyribonucleic acid (DNA) is the agent of heredity. DNA is made of subunits composed of sugar (deoxyribose), phosphate groups and base compounds. These subunits are known as nucleotides. The base compounds occur as nitrogen-containing structures. These bases are adenine, guanine, thymine, and cytosine. The DNA structure is similar to a spiral loaded with the rungs containing two bases with weak chemical bonds. The bases will be found with the adenine nucleotides always joined with thymine nucleotides, and cytosine nucleotides always joined with guanine nucleotides.

The replication of DNA is required for cell division and is accomplished by the DNA molecule first unwinding and the weak base bonds being broken. This process exposes the DNA as single strands with one of each of the base pairs on each side. The exposed bases will then be joined to previously formed nucleotides found in the nucleus. Since only specific nucleotides will bond with any of the exposed bases the result will be two identical strands of DNA.

DNA is the material which makes up genes. Since genes make up chromosomes the replication process must occur before mitosis or meiosis. While the number of DNA molecules in a particular chromosome is not certain, DNA is the transmitting agent for characteristics and chromosomal replication is essentially DNA replication.

Transparency Masters #17 - #20

Since DNA controls the stuff of heredity and DNA makes up genes, it is not far removed to think that DNA may play a role in the formation of unique organic substances such as proteins. It has been shown that genes control the synthesis of not only enzymes but also every type of protein. In addition, a particular gene may be responsible for the formation of a single polypeptide (a portion of a protein). The base of each protein is the specific combination of amino acids. A particular protein may be hundreds or thousands of amino acids long which will curl and fold giving a unique shape. It is the function of RNA to turn the code found in DNA into the amino acids needed for cell formation.

RNA differs from DNA in that ribose substitutes for deoxyribose and the base uracil substitutes for thymine.

There are twenty amino acids found in different combinations and sequences to make up proteins. Since there are only four DNA bases, an amino acid cannot be represented by a single base. In fact, it takes three bases in a row to represent an amino acid. A quick multiplication will show that three bases in a row represent sixty-four code "words" (the combination number of three bases in a row). This number of possible combinations is sufficient to accommodate twenty amino acids. Some amino acids, however, require more than one sequence of three to be represented. A sequence of three bases in a row is a codon.

The messenger RNA (mRNA) molecule is a single strand of nucleotides that is determined by the sequence of bases on the DNA from which it is made. The mRNA will contain the opposite bases which would combine with the exposed bases of the DNA. The process of transferring the DNA code to the mRNA is *transcription*.

Transfer RNA (tRNA) is composed of nucleotides arranged in a cloverleaf shape. The tRNA's function is to combine with amino acids and take them to the mRNA. One end of the tRNA has attachment points for the amino acid, the other end contains an *anticodon*, a set of three exposed bases. Each type of tRNA has a different anticodon. As a protein is being synthesized the tRNA anticodons attach to the mRNA codons in the order necessary for the particular polypeptide or protein being constructed. This process of interaction between the tRNA, mRNA, and ribosomes (which move along the mRNA) is known as *translation*. The process is completed by the mRNA ending in UAG, UAA, or UGA. There are no tRNA that fit these sequences and the chain breaks away for cell use.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Parts of Animal Cells

STUDENT WORKSHEET #2 — Steps in Animal Cell Mitosis

STUDENT WORKSHEET #3 — Maturation Process (Meiosis) in Animal Cells

STUDENT WORKSHEET #4 — Transmission of Characters

STUDENT WORKSHEET #5 — Inheritance of Physical Characters — Tongue Rolling

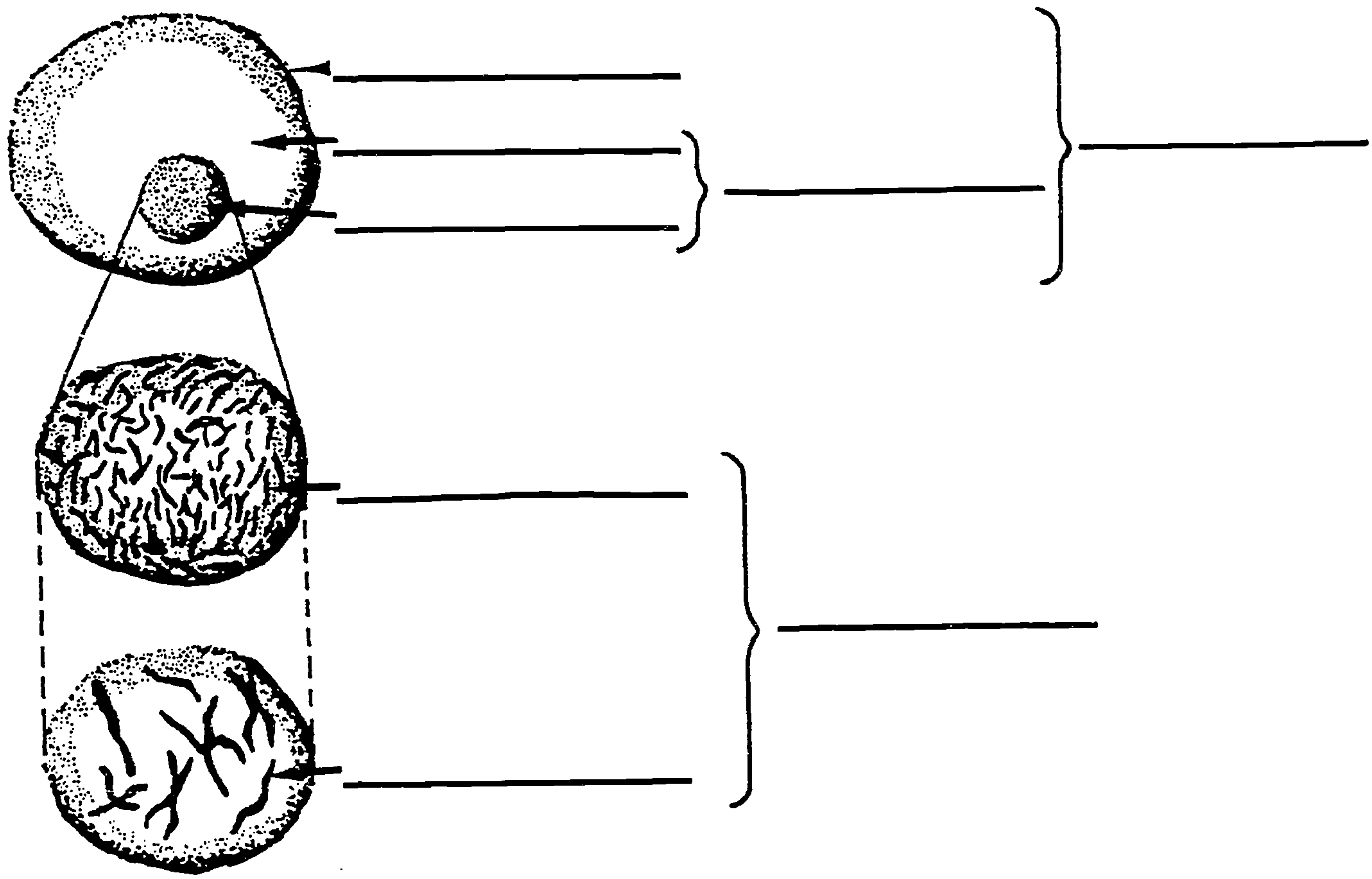
STUDENT WORKSHEET #6 — Inheritance of Physical Characters — Hair Whorl ("Cowlick")

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

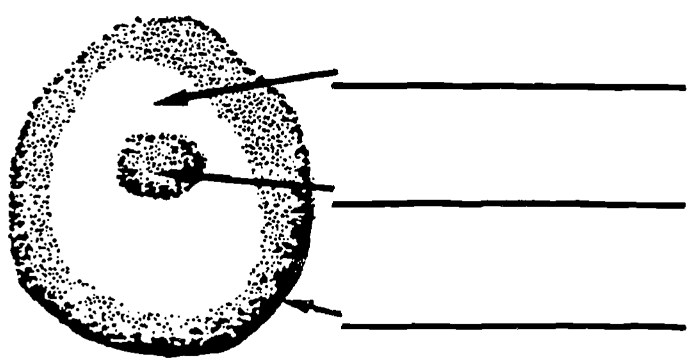
STUDENT WORKSHEET #1

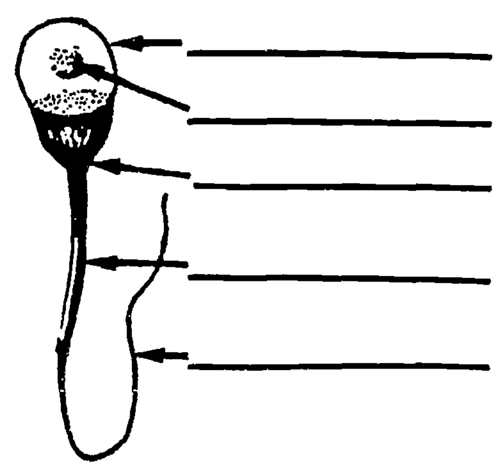
Parts of Animal Cells

1. Identify the following parts of the cell.



2. Identify the following parts of the egg and sperm cells.





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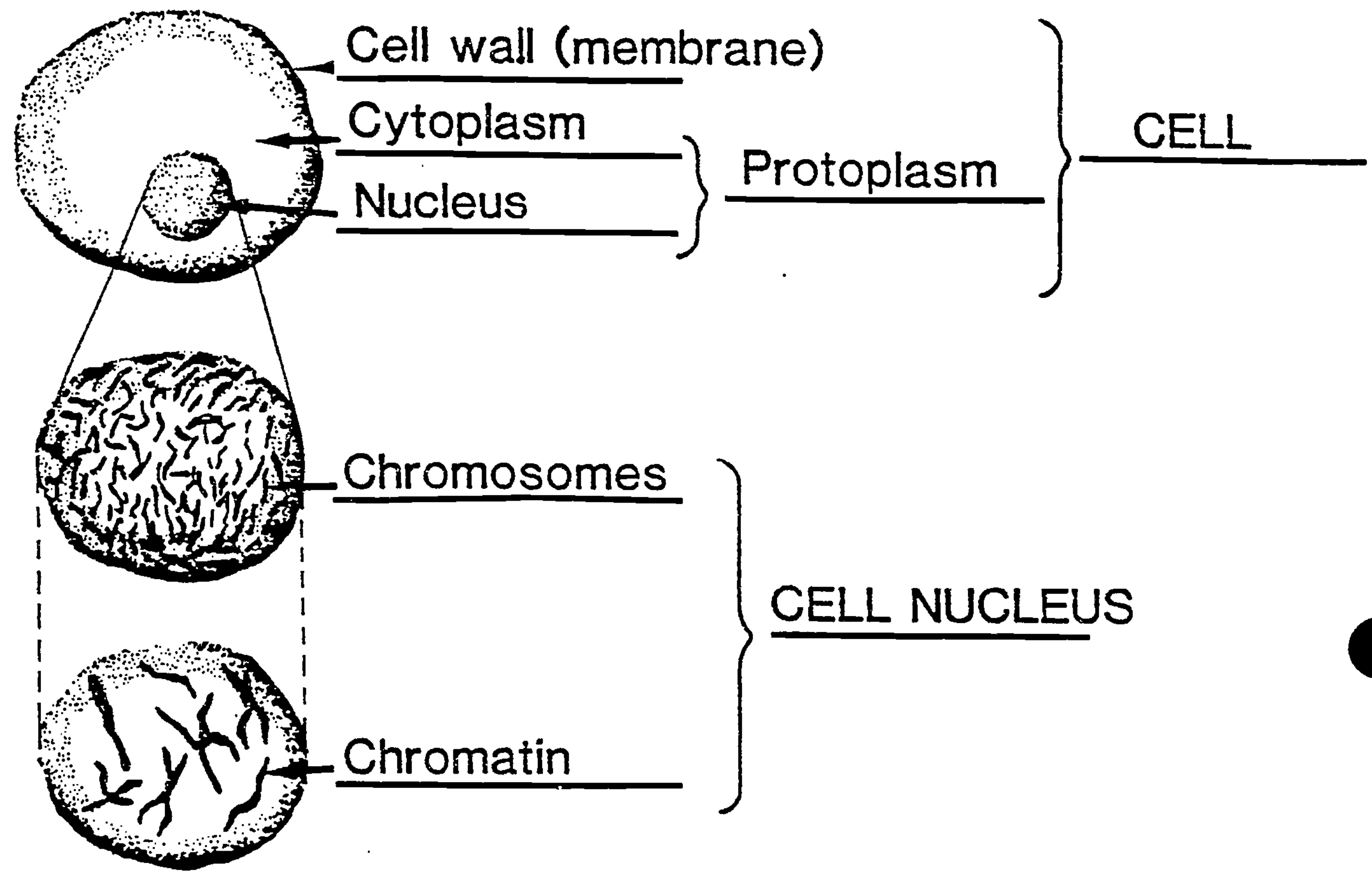
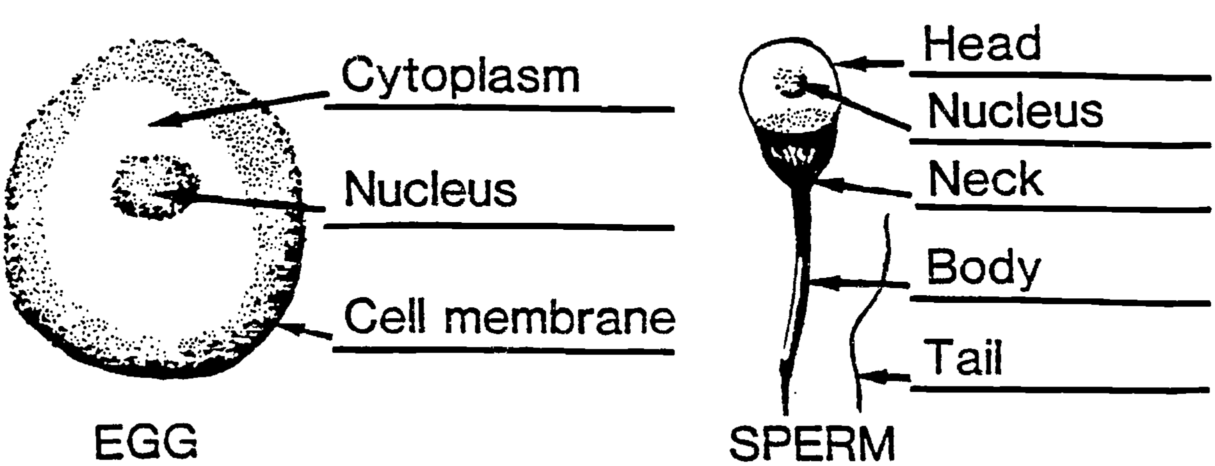
STUDENT WORKSHEET #1 — Key

Parts of Animal Cells

1. Identify the following parts of the cell.



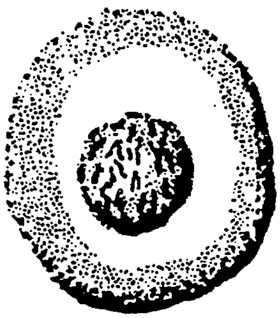
2. Identify the following parts of the egg and sperm cells

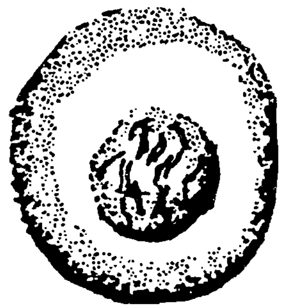


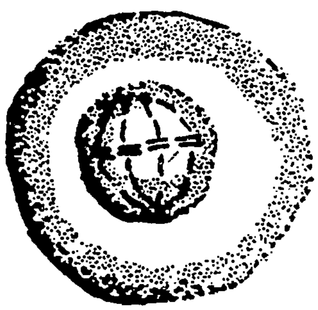
STUDENT WORKSHEET #2

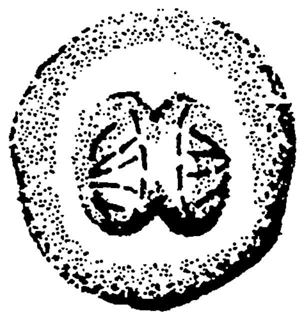
Steps in Animal Cell Mitosis

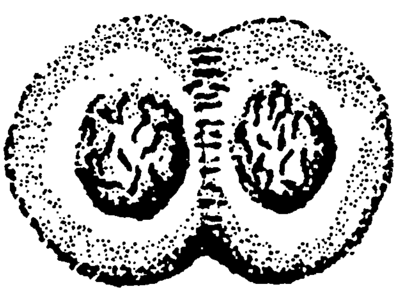
Correctly label the steps in mitosis.

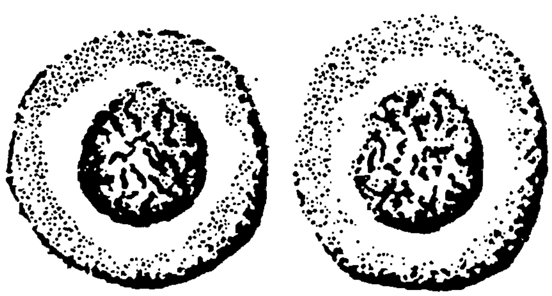






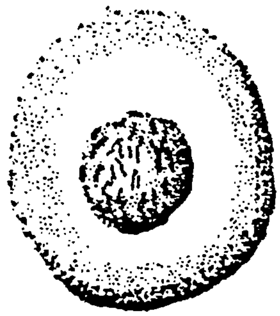




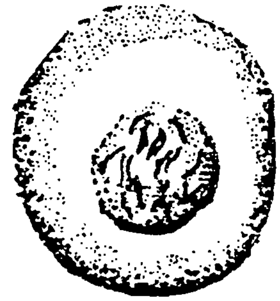


STUDENT WORKSHEET #3 — Key

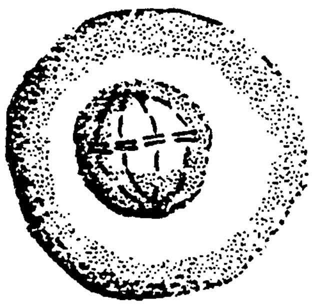
Steps in Cell Animal Mitosis



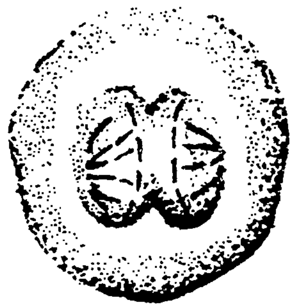
RESTING CELL



CHROMOSOMES FORMING



CHROMOSOMES DIVIDING



CHROMOSOMES AND NUCLEUS SEPARATING

CELL DIVIDING

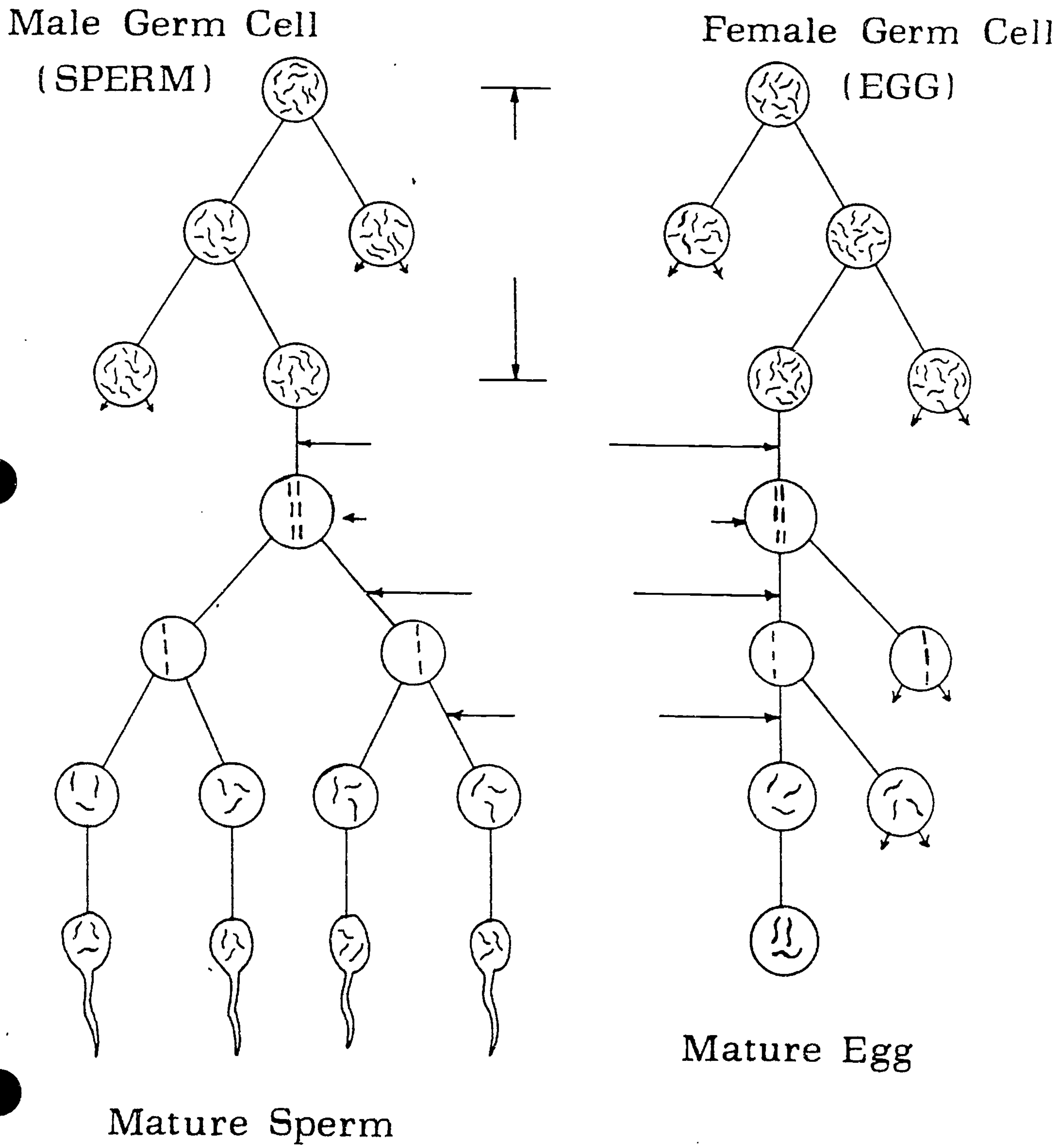
TWO CELLS FORMED

ERIC

STUDENT WORKSHEET #3

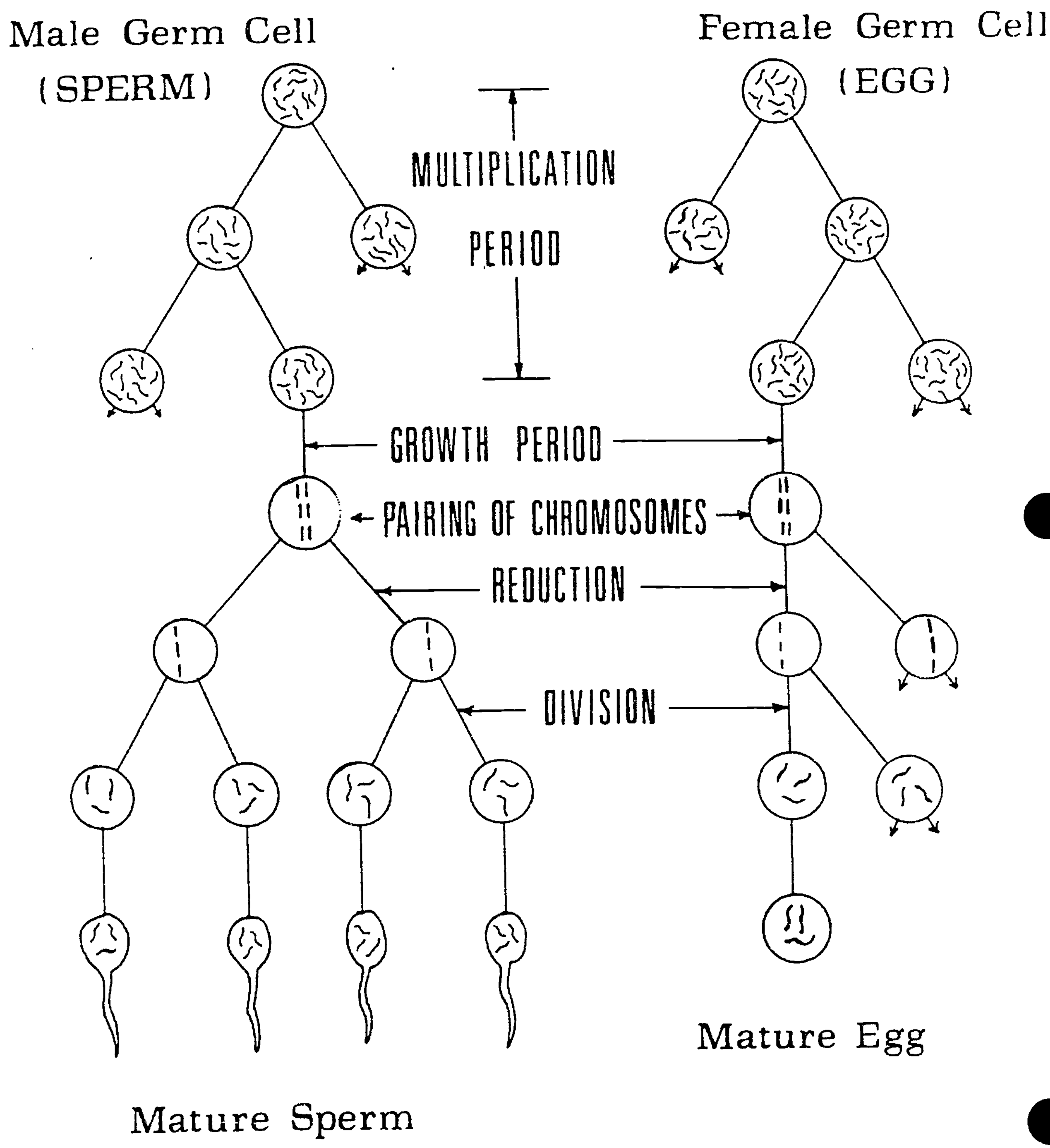
Maturation Process (Meiosis) in Animal Cells

Correctly label the process of maturation.



STUDENT WORKSHEET #3 — Key

Maturation Process (Meiosis) in Animal Cells



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STUDENT WORKSHEET #4

Transmission of Characters

Fill out the chart above for the possible characteristics from the following mating: The bull is homozygous for black (BB) and the cow is homozygous for black (BB). Indicate whether the offspring will be homozygous (pure) or heterozygous (impure).

Fill out the above chart for the possible characteristics from the following mating: The bull is homozygous for black (BB) and the cow is heterozygous for black (Bb). Indicate whether the offspring will be homozygous (pure) or heterozygous (impure).

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Fill out the above chart for the possible characteristics from the following mating: The bull is heterozygous for black (Bb) and the cow is heterozygous for black (Bb). Indicate whether the offspring will be homozygous (pure) or heterozygous (impure).

STUDENT WORKSHEET #4 — Key

Transmission of Characters

	B	B
B	BB (Pure)	BB (Pure)
B	BB (Pure)	BB (Pure)

Fill out the chart above for the possible characteristics from the following mating: The bull is homozygous for black (BB) and the cow is homozygous for black (BB). Indicate whether the offspring will be homozygous (pure) or heterozygous (impure).

	B	B
B	BB (Pure)	BB (Pure)
b	Bb (Impure)	Bb (Impure)

Fill out the above chart for the possible characteristics from the following mating: The bull is homozygous for black (BB) and the cow is heterozygous for black (Bb). Indicate whether the offspring will be homozygous (pure) or heterozygous (impure).

	B	b
B	BB (Pure)	Bb (Impure)
b	Bb (Impure)	bb (Pure)

Fill out the above chart for the possible characteristics from the following mating: The bull is heterozygous for black (Bb) and the cow is heterozygous for black (Bb). Indicate whether the offspring will be homozygous (pure) or heterozygous (impure).

STUDENT WORKSHEET #5

Inheritance of Physical Characteristics — Tongue Rolling

Tongue Rolling

Many people can turn the sides of their tongues so that, near the tip, the sides nearly touch on top (Figure 1). When everyone in the class has tried to do this record the results in Table 3. Also record the data of other class sections and determine the percentages of "rollers" and "nonrollers." Percentages, however, will not tell you whether the ability to roll the tongue is inherited or, if it is inherited, whether a dominant or recessive gene is involved. To learn this, determine how many members of your family have this trait and record your findings in Figure 4. Write the symbol (+) in the circle or square to indicate an individual who can roll his tongue and the symbol (-) for one who cannot do this.

Using *T* to represent the dominant character and *t* the recessive character, indicate the genotype (that is, *TT, Tt, tt*) of each member of your family.

To aid you in deciding on the method of inheritance it may be helpful to examine the inheritance of hair color in human beings as illustrated in Figure 2. For example, it is possible for two parents who do not have red hair to have a child who does. However, because there are genes at two loci producing red hair in humans, two red-haired parents could have children who do not have red hair. This is not common, however, because the second locus is rather rare in the population.

Using the information you have collected, indicate whether the ability to roll the tongue is inherited as a dominant or recessive gene.

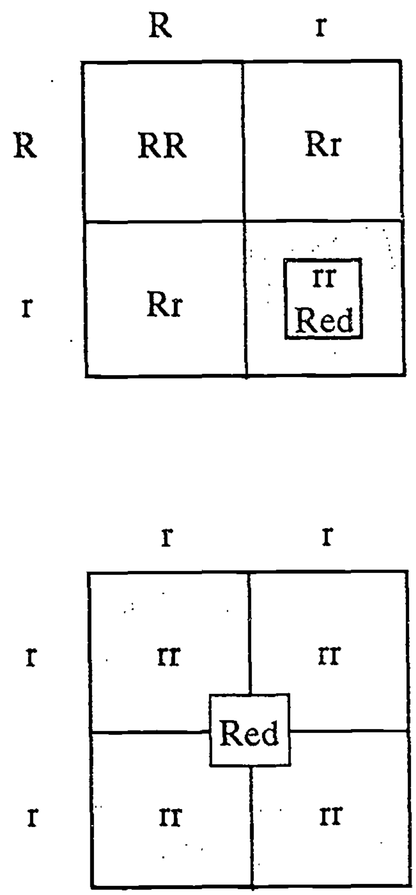


Figure 2. Inheritance of hair color.

From:
An Experimental Approach to Biology, 2nd ed. Peter Abramoff and Robert G. Thompson. W.H Freeman and Company.

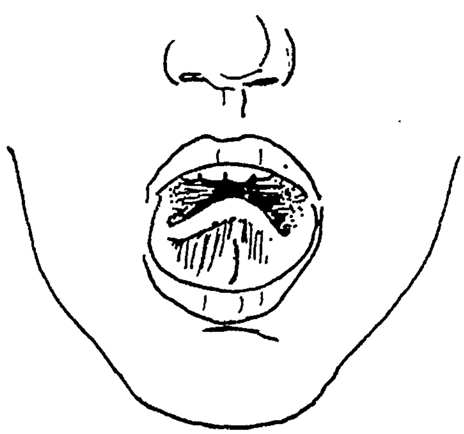


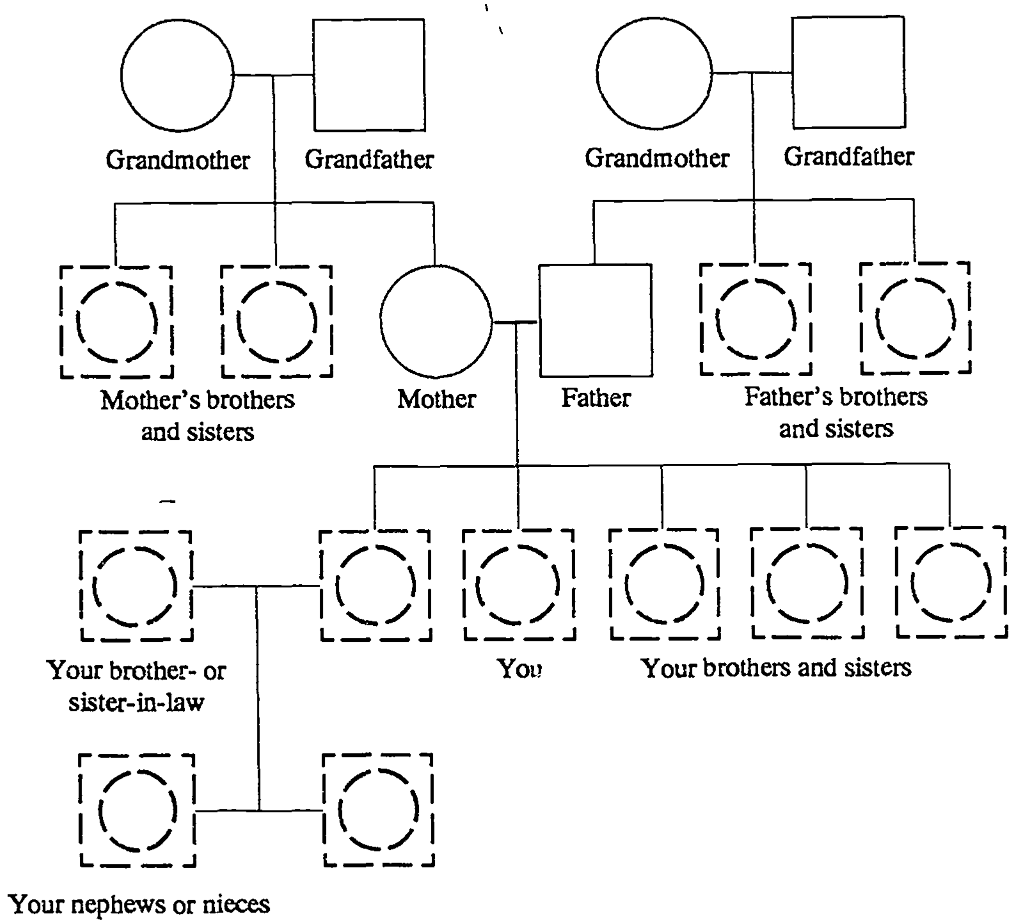
Figure 1. Tongue rolling.

Table 3
Analysis of the ability to roll the tongue

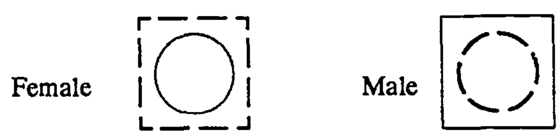
Class section number	# of students in class	# of tongue rollers	# of nonrollers	% of rollers	% of nonrollers
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

815

Figure 4.
Inheritance of tongue rolling.



Connect dashes to make solid-line squares for males and solid-line circles for females as follows:



STUDENT WORKSHEET #6

Inheritance of Physical Characteristics — Hair Whorl ("Cowlick")

Hair Whorl ("Cowlick")

Near the top of the head locate a hair whorl, which may rotate in either a clockwise or a counter-clockwise direction. Have your laboratory partner determine the direction of your hair whorl and those of your classmates. Record this data in Table 5. Also record the data of other class sections. From the information obtained, which direction (of hair whorl) seems to be predominant among your classmates?

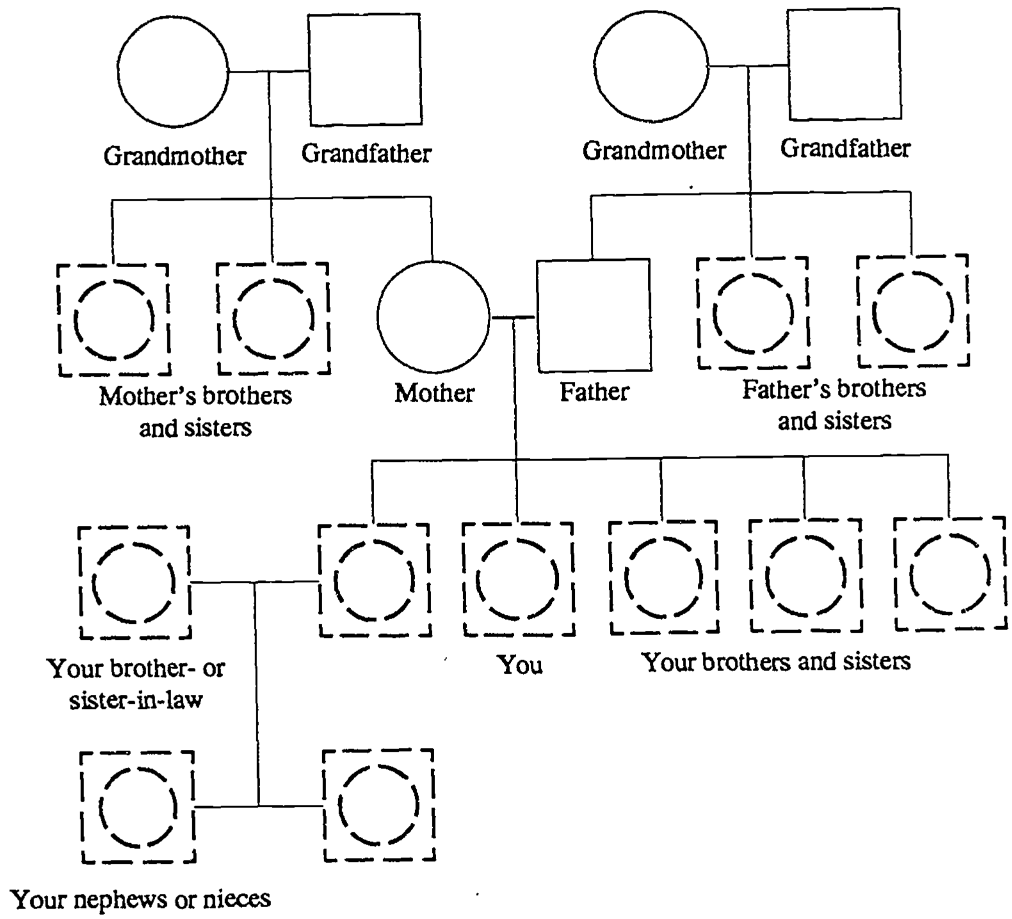
Because population frequency alone cannot be used as a basis for dominance or recessiveness of an allele, determine how many members of your family have this trait and record your findings in Figure 6. From the study of your family, indicate whether hair whorl is inherited as a dominate or recessive gene.

Table 5.
Analysis of a hair whorl.

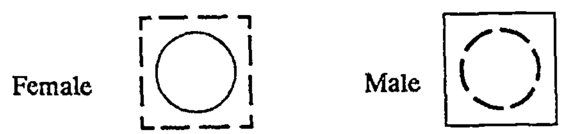
Class section number	# of students in class	# with clockwise rotation	# with counterclockwise rotation	% of clockwise rotation	% of counterclockwise rotation
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

817

Figure 6.
Inheritance of hair whorl.



Connect dashes to make solid-line squares for males and solid-line circles for females as follows:



CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Using Energy Efficiently

RELATED PROBLEM AREAS:

1. Identifying Basic Principles of Electricity
2. Conserving Agricultural Resources
3. Utilizing Energy Alternatives (Horticulture Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes,techniques, methods, equipment, and available technology of science.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze the results of an experiment.					
*2. Identify appropriate methods of measurement for a given task.					
3. Measure specific energy losses using experiment-based methods.					

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify technologies that use renewable energy resources.					
2. Relate future energy to the need for new resources.					
*3. Identify specific uses of energy in homes and businesses and discuss techniques to reduce energy consumption.					
4. Give examples of recommended practices to conserve energy at home and at agricultural establishments.					
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ISBE 41-78 (1/88)

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LEARNING ASSESSMENT PLAN

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Submission Date ____
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Page ____ of ____

(Affix label or complete district information.)
COUNTY ____ DISTRICT ____ ESC ____
District Name
City

Contact Person: ____
Title: ____
Phone: (   )

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize that good conservation practices depend on understanding the balance between living things and their environment.					
*2. Recognize the results of the effect of heat energy on samples of matter.					
3. Define terms related to energy use.					
4. List common types of energy used in Illinois and recognize the natural forms from which that energy is derived.					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Using Energy Efficiently

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define terms related to energy use.
2. List common types of energy used in Illinois and recognize the natural forms from which that energy is derived.
3. Identify specific uses of energy in homes and businesses and describe techniques to reduce energy consumption.
4. Give examples of recommended practices to conserve energy at home and at agricultural establishments.
5. Measure specific energy losses using experiment-based methods.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Using Energy Efficiently

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. What are our major sources of energy in Illinois?
2. What are the types of energy used in homes and agribusinesses?
3. What is an alternative energy source?
4. What types of alternative energy are available?
5. Why should one be concerned about the amount of energy one uses?
6. What is the difference between a renewable and nonrenewable resource?
7. How is energy used in the home?
8. What are energy conservation practices?
9. How can one implement conservation practices in one's home or agribusiness?
10. How can one measure the energy loss in one's home or agribusiness?
11. What is insulation?
12. How is insulation rated?
13. What areas of a home or agribusiness are energy inefficient?
14. Where can one find out about energy and its conservation?
15. What agencies are concerned with and involved in energy conservation and public awareness?

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Using Energy Efficiently

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use other science personnel, utilities, and governmental agencies as resources for ideas, materials, equipment, and speakers.
2. Use resource personnel as guest speakers on energy forms, energy exploration, generation and transmission, and construction or remodeling for energy efficient buildings.
3. Have students use VAS #3050, *How can I save money by insulating my home*, to complete Student Worksheet #1.
4. Obtain copies of Instructional Materials Service #8417 *Alternative Energy Sources*, #8418 *Energy Conservation*, and #8351 *Renewable and Non-renewable Agricultural Resources*, to be used as student resources and study guides.
5. Conduct field trips to utilities to observe generation and transmission of energy and to construction locations to observe installation of energy saving technology and use of alternative energy sources.
6. Obtain pertinent and relevant films, slides, posters, and other educational materials from Information Sheet #1.
7. Use Student Worksheet #6 as a class activity to observe and record differences in types of insulation available.
8. Use Student Worksheets #2 - #5 as individual or small group activities to provide students exposure to practical steps that can be taken to use energy efficiently.
9. Use Student Worksheet #7 as an in-class activity for estimating the loss of energy in selected locations.
10. Use the information gathered in the student worksheets and activities as a basis for development by students of an energy conservation plan for a selected location.
11. Secure copies of VAS slidefilms #411-1 and #411-2, *Energy: Challenges and Choices* (parts 1 and 2) to be used in presenting background material on energy use and supply (part 1) and home energy management (part 2).
12. Obtain copies of materials on specific energy issues such as VAS #U3060, *Collecting and Using Solar Energy.*
13. Consult problem area *Identifying Basic Agricultural Mechanics Principles* for an activity on passive solar energy.
14. Obtain the film *Energy Saving on the Farm* for student viewing and discussion.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Using Energy Efficiently

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Cutting Energy Costs: The 1980 Yearbook of Agriculture.* United States Department of Agriculture. U.S. Government Printing Office, Washington, DC 20402.

2. *Using our Natural Resources: The 1983 Yearbook of Agriculture.* United States Department of Agriculture. U.S. Government Printing Office, Washington, D.C. 20402.

3. *Alternative Energy Sources* (Subject Matter Unit #8417); *Renewable and Non-Renewable Agricultural Resources* (Subject Matter Unit #8351); *Energy Conservation* (Subject Matter Unit #8418). Instructional Materials Service. Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588.

*4. *How Can I Save Money and Energy by Insulating My Home* (VAS Unit #U3050); *Collecting and Using Solar Energy* (VAS Unit #U3060); *Energy: Challenges and Choices, Part 1: Energy Use and Supply* (VAS Filmstrip #F411-1); *Energy: Challenges and Choices, Part 2: Home Energy Uses* (VAS Filmstrip #F411-2); *Collecting and Storing Solar Energy* (VAS Transparency Set #T428); *Using Solar Energy* (VAS Transparency Set #T429). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 Maryland Dr., Urbana, IL 61801. (217) 333-3871.

5. *Energy Saving on the Farm.* 16mm color film (1981). Bureau of Audiovisual Instruction, P.O. Box 2093, Madison, WI 53701.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Resources for Information

TRANSPARENCY MASTER #1 — Available Forms of Energy (with discussion guide)

TRANSPARENCY MASTER #2 — Home Energy Use (with discussion guide)

TRANSPARENCY MASTER #3 — Reducing Home Energy Consumption (with discussion guide)

TRANSPARENCY MASTER #4 — Recommended Minimum R-Values by Area and Climate (with discussion guide)

TRANSPARENCY MASTER #5 — Points of Heat Gain and Loss in Homes (with discussion guide)

TRANSPARENCY MASTER #6 — Agricultural Energy Conservation — Areas of Concern (with discussion guide)

INFORMATION SHEET #1

Resources for Information

Several agencies, both Federal and State, provide information on various aspects of energy, both renewable and nonrenewable, and its conservation and use. This listing provides some of those agencies and materials available.

FEDERAL:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402
(202) 783-3238
Ask for "Publications Information"on Government Sponsored Products.

Consumer Information Center
Pueblo, Colorado 81009
Consumer Information Catalog
Lists both free and charge publications that are consumer oriented.

Conservation & Renewable Energy Inquiry & Referral Service
P.O. Box 8900
Silver Spring, MD 20907
(800) 523-2929
Distributes both technical and nontechnical information and provides referral service on solar problems.

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650
Provides a publication list on special projects

U.S. Department of Energy
Technical Information Center
Box 62
Oak Ridge, TN 37830
(615) 576-1302
Ask for "Publications Information"

U.S. Department of Agriculture
Science & Education Administration
Room 6022, South Agriculture Building
Washington, DC 20250
Distributes technical scientific information and Educational Materials

STATE: Illinois Department of Energy and Natural Resources
325 West Adams Street
Springfield, IL 62706
(217) 785-2431
(800) 252-8955

Provides newsletter *Illinois Resources* and serves as an important clearing house

Energy Information Library
Illinois Department of Energy and Natural Resources
Room 300, 325 West Adams Street
Springfield, IL 62706

Serves as a resource for energy films and slides

Department of Agricultural Engineering
College of Agriculture
University of Illinois
338 Agricultural Engineering
1304 West Pennsylvania
Urbana, IL 61801

Cooperative Extension Service
County Office Personnel

Can provide specific information for your location

Utility Company

The energy providers in your area can be used as a resource for information specific to your area

TRANSPARENCY MASTER #1

Available Forms of Energy

MAJOR	oil natural gas coal nuclear
MINOR	water solar wind geothermal refuse — garbage plant products agricultural residues

Classify the above sources of energy as **exhaustible** or **inexhaustible** and as **renewable** or **nonrenewable.**

TRANSPARENCY MASTER #2

Home Energy Use

Heating and cooling dwelling

Hot water heater

Refrigerator and freezer — preserving food

Cooking food

Dishwashers

Clothes washers and dryers

Lighting

Other small appliances

TRANSPARENCY MASTER #3

Reducing Home Energy Consumption

Insulate home walls and ceiling

Weather strip doors and windows

Install insulated storm doors and windows

Clean furnace filter and service furnace regularly

Lower thermostat on hot water heater

Reduce home temperature - setting in winter and increase temperature - setting for summer

Repair leaking water faucets

Use energy-efficient lighting

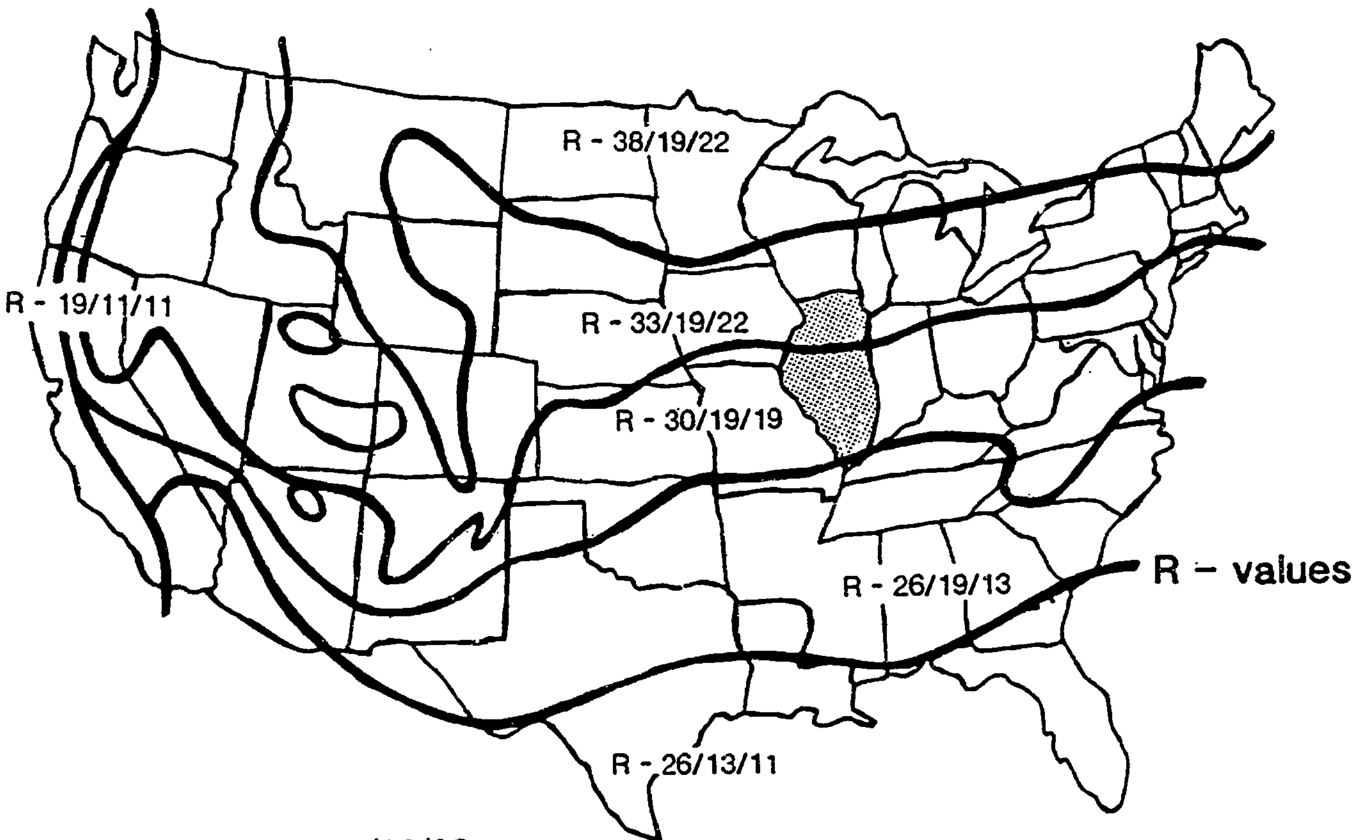
Insulate furnace lighting

Plan for efficient food preparation and laundering tasks

Use energy-efficient supplementary heating units

TRANSPARENCY MASTER #4

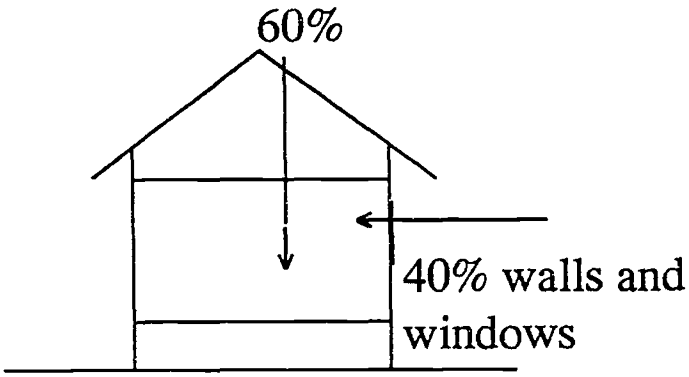
Recommended Minimum R-Values by Area and Climate



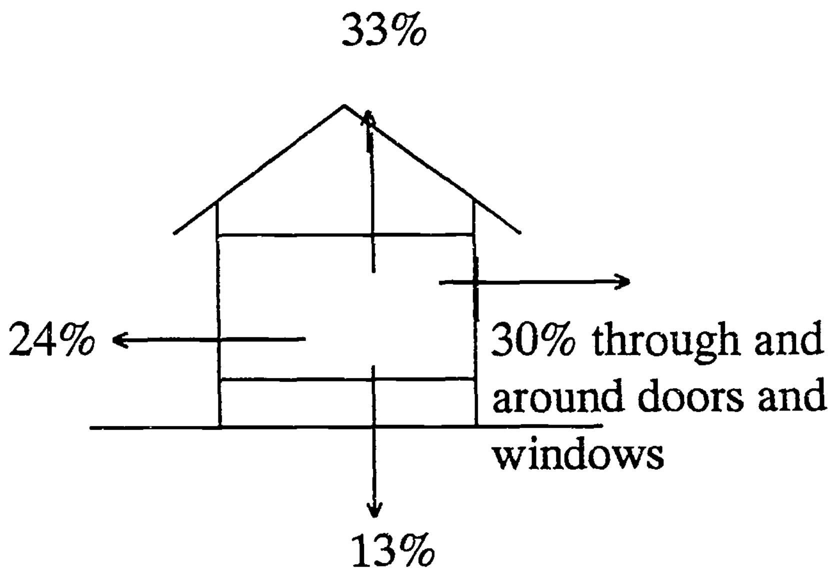
Note: R — 38/19/22
Ceilings — R-38
Walls — R-19
Floor — R-22

TRANSPARENCY MASTER #5

Points of Heat Gain and Loss in Homes



points of
HEAT GAIN
summer



points of
HEAT LOSS
winter

TRANSPARENCY MASTER #6

Agricultural Energy Conservation — Areas of Concern

Agricultural Machinery and Equipment

Selecting Machinery and Equipment
Operating Machinery and Equipment

Production Inputs

Fertilizer
Application Rates
Application Timing
Placement
Soil Practices

Pesticides

Electrical Energy

Electrical Equipment Selection
Electrical Equipment Operation

Building Construction and Insulation

TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #1

A. Have students name as many sources of energy as they can think of for home or agriculture uses.

B. Have students classify these sources as major and minor sources in Illinois.

C. Classify the named sources as exhaustible or inexhaustible.

D. Classify the energy sources as renewable or non-renewable.

E. Suggest energy-efficient uses for plant products, such as gasohol, and agricultural residues, such as manure digesters.

Transparency Masters #2 - #5

A. Review the causes or uses of home energy consumption.

B. Have students identify methods of reducing home energy uses.

C. Point out the average amounts of heat gain and loss in homes and how these can be controlled.

Transparency Master #6

A. Review concerns of diesel vs. gas and fuel efficiencies of competing brands.

B. Review operation concerns such as horse power required for a procedure and equipment servicing and adjustment.

C. Point out that it takes 4 pounds of fossil fuel to manufacture, transport, and apply 2 pounds of nutrients. Discuss five effects of management practices of fertilizer effectiveness.

D. Point out that pesticides make other inputs more effective by increasing production and lowering equipment use. Contrast advantages with disadvantages of energy used to produce pesticides and environmental damage of overuse and mismanagement.

E. Read a discussion in the ratings on electrical equipment for efficiency and the use of off-peak hours for conservation and savings.

F. Lead a discussion of practices in Student Worksheets #1 - #4 and how location, construction, and insulation affect energy use.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Insulating my Home

STUDENT WORKSHEET #2 — Home Energy Inventory

STUDENT WORKSHEET #3 — Energy Management Program

STUDENT WORKSHEET #4 — Truck and Automobile Program

STUDENT WORKSHEET #5 — Farm Energy Management Program

STUDENT WORKSHEET #6 — Insulation Comparison Experiment

STUDENT WORKSHEET #7 — Construct a Draftometer

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Insulating My Home

(Refer to VAS Unit #3050, *How Can I Save Money and Energy by Insulating My Home?*)

1. List 4 reasons why homeowners should insulate their homes:

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

2. Define "R" value: ____________________

   ____

3. How should different insulation be compared to determine which one is the best buy? ____________________

   ____

4. Before adding insulation first caulk and weatherstrip around ________ and ________.

5. ________ air rises so insulating the ________ is extremely important.

6. Name the 4 forms of insulation and give an example of each:

	Form	Example
a.	____________	____________
b.	____________	____________
c.	____________	____________
d.	____________	____________

7. List 8 commonly used insulating materials:

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

   e. ____________________

   f. ____________________

   g. ____________________

   h. ____________________

ERIC

8. The vapor barrier should always face the side of the wall that is ______________ .

9. ______ air can hold more water vapor than ______________ air.

10. Moisture condensation on inside walls or in the insulation can be prevented by using a ______________ and properly ______________ your house.

11. What are 3 things that can be done to help prevent heat loss around windows?

a. ______________________________

b. ______________________________

c. ______________________________

12. Name 6 different sources of additional information on insulating your home:

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

STUDENT WORKSHEET #1 — Key

INSULATING MY HOME

(Refer to VAS Unit #3050, *How Can I Save Money and Energy by Insulating My Home?*)

1. List 4 reasons why homeowners should insulate their homes:
   a. *to save money*
   b. *to increase comfort*
   c. *to conserve energy*
   d. *to prevent condensation*

2. Define "R" value: *"R" value is the ability of a material to resist the flow of heat.*

3. How should different insulation be compared to determine which one is the best buy? *Compare cost per unit of "R" value.*

4. Before adding insulation first caulk and weatherstrip around *windows* and *doors*

5. *Warm* air rises so insulating the *attic (or ceiling area)* is extremely important.

6. Name the 4 forms of insulation and give an example of each:

	Form	Example
a.	*blankets*	*fiberglass*
b.	*loose fill*	*cellulose or rock wool*
c.	*rigid board*	*blue board, thermax, beadboard*
d.	*foam*	*urea formaldehyde, polyurethane*

7. List 8 commonly used insulating materials:
   a. *fiberglass*
   b. *cellulose*
   c. *rock wool*
   d. *molded polystrene (beadboard)*
   e. *extruded polystrene (Styrofoam TG or blue board)*
   f. *polyurethane*
   g. *urea formaldehyde*
   h. *polyisocyanurate (thermax or high-R sheathing)*

8. The vapor barrier should always face the side of the wall that is *heated in the winter.*

9. *Warm* air can hold more water vapor than *cold* air.

10. Moisture condensation on inside walls or in the insulation can be prevented by using a *vapor barrier* and properly *ventilating* your house.

11. What are 3 things that can be done to help prevent heat loss around windows?
   a. *storm windows*
   b. *caulk*
   c. *weatherstrip*

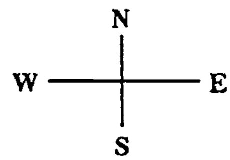
12. Name 6 different sources of additional information on insulating your home:
   a. *cooperative extension service*
   b. *agriculture teacher*
   c. *public utility companies*
   d. *Illinois Institute of Natural Resources*
   e. *insulation companies*
   f. *Internal Revenue Bureau (tax credit information)*

STUDENT WORKSHEET #2

Home Energy Inventory

Complete the information on an assigned home. This inventory will help you evaluate and document the overall energy efficiency of a home. From this inventory you should be able to identify areas which need critical attention plus areas which are better than average.

1. Sketch an outline of the shape of the home. Include landscape features which influence energy use.



2. Identify the following characteristics of the home.

   a. Type of exterior siding: ______________________

   b. Number of floor levels: ______________________

   c. Type and color of roofing materials: ______________________

   d. Crawl space or basement: ______________________

3. Home insulation in:

	Actual	Recommended Standards
a. ceiling	________	________
b. outside walls	________	________
c. floor	________	________

4. Are storm windows present and in good condition? ______________________

   Type of window? ______________________

5. Are storm doors present on outside doorways? ______________________

   If yes, are they insulated? ______________________

6. Are windows and doors caulked and weatherproofed? ______________________

7 Hot water heater:

   a. age ______________________

   b. capacity ______________________

   c. efficiency rating ______________________

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d. insulation value ______

e. electric or gas ______

f. recovery time ______

g. temperature setting ______

8. Are hot water pipes insulated? ______

9. Home heating system: ______

a. type of furnace (gas, electric) ______

b. age ______

c. capacity rating ______

d. efficiency rating ______

e. condition of filter ______

f. thermostat setting ______

g. heat ducts insulated ______

10. Attic ventilation system ______

11. Is fireplace present? ______

If yes, describe its condition and type ______

______

12. Home cooling system (fans, air conditioning, etc)

a. age ______

b. capacity ______

c. efficiency rating ______

13. Home appliance inventory: Briefly describe each major appliance.

a. refrigerator-freezer ______

b. laundry appliances ______

c. cooking appliances ______

d. other major kitchen appliances ______

e. other major home appliances ______

14. After completing this inventory, review your findings and identify those items which are in most need of improvement to increase the home's energy efficiency.

Results of Survey	Recommended Standards

15. After identifying items which are in need of improvement, rank them in one of three categories below. Then, number the order in which the improvements will be done (1, 2, 3, 4, . . .).

Little or no cost improvement	Moderate cost improvement	Major cost improvement

STUDENT WORKSHEET #3

Energy Management Program

The following survey has been divided into specific areas of concern with regard to energy use. All areas area applicable to most homes and many are applicable to agribusinesses. Allow students to select a specific location and complete the survey.

Temperature Control

Do you:	Yes	No	Improvement Needed
1. Reduce daytime home heating in winter, maintaining 65°F (18°C) or lower temperature?	______	______	____________
2. Set air-conditioning unit to recirculate cool air instead of pulling in warmer outside air?	______	______	____________
3. Increase temperature setting for summer air conditioning to 78°F (26°C) or higher?	______	______	____________
4. Reduce nighttime winter temperature 5°-8°F (3°-5°C) or more?	______	______	____________
5. Use window and attic fans for cooling during summer when outside temperature is below temperature in home?	______	______	____________
6. Maintain heating and cooling equipment in good operating condition?	______	______	____________
7. Keep air filters clean to make it easier for heating and cooling system to do its job?	______	______	____________
8. Close off unused rooms and closets?	______	______	____________
9. Use kitchen and bathroom exhaust fans only when necessary?	______	______	____________
10. Install an exhaust fan in the attic to remove hot air in the summer?	______	______	____________
11. Shade windows from direct sun in summer with draperies and roll-up shades?	______	______	____________
12. Open draperies and raise shades to receive sun's heat in winter?	______	______	____________
13. Close door of attached garage in winter?	______	______	____________
14. Close damper when fireplace is not in use?	______	______	____________
15. Select an energy-efficient air-conditioning unit the proper size for space to be cooled. It is better to buy a slightly undersized unit, rather than an oversized one?	______	______	____________

Do You:	Yes	No	Improvement Needed
16. Repair leaks and insulate heating and cooling ducts in spaces not heated or cooled?	______	______	____________
17. Adjust radiator valves, air duct dampers, or heat registers according to activity in area?	______	______	____________
18. Reduce heating and cooling temperatures when away from home for long periods of time?	______	______	____________

Seal Air Leaks

Do You:

1. Weather-strip doors, windows, and all movable joints?	______	______	____________
2. Caulk interior and exterior cracks?	______	______	____________
3. Seal unused doors?	______	______	____________
4. Cap unused flues and (or) chimneys?	______	______	____________
5. Install storm windows and storm doors?	______	______	____________
6. Cover windows and doors with plastic?	______	______	____________

Protect Buildings from Environment

Do You:

1. Plant or build windbreak landscape treatment?	______	______	____________
2. Use garage entrance where possible?	______	______	____________
3. Protect entrances with double-door arrangement?	______	______	____________
4. Plant deciduous trees?	______	______	____________
5. Install a roof overhang to protect windows?	______	______	____________
6. Use awnings or other treatment?	______	______	____________
7. Close windows during midday?	______	______	____________
8. Open windows in evening?	______	______	____________

Lighting

Do You:

1. Turn off unnecessary lights, indoors and out?	______	______	____________

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Do You:	Yes	No	Improvement Needed
2. Reduce lighting levels to minimum for task to be performed?	______	______	____________
3. Use bulbs with lower wattage in halls, stairways, and other areas of general illumination?	______	______	____________
4. Use light colors in decorating to improve lighting efficiency?	______	______	____________
5. Do tasks that require a high light level during daylight hours when possible?	______	______	____________
6. Keep lighting fixtures clean?	______	______	____________
7. Use fluorescent lighting for maximum light from electrical energy used?	______	______	____________
8. Use timers to turn lights on in the evening rather than leaving lights on all day when no one is home?	______	______	____________

Heating Water

Do You:	Yes	No	Improvement Needed
1. Reduce amount of hot water used?	______	______	____________
2. Insulate long hot water pipes, especially those under the home or those that go through unheated basements or crawl spaces?	______	______	____________
3. Repair leaky faucets?	______	______	____________
4. Maintain regular temperature setting of 110°-120°F (43°-49° C) on water heater if automatic dishwasher is not used; 140°F (60°C) if automatic dishwasher is used?	______	______	____________

Laundry

Do You:	Yes	No	Improvement Needed
1. Wash only full loads of laundry?	______	______	____________
2. Use heated water in only wash cycle?	______	______	____________
3. Use water no hotter than necessary for adequate soil removal and sanitation?	______	______	____________
4. Use good laundry techniques to obtain satisfactory results in one washing process?	______	______	____________
5. Avoid overdrying in clothes dryer?	______	______	____________
6. Sort dryer loads by weight?	______	______	____________

Do You:	Yes	No	Improvement Needed
7. Line-dry garments and household items when practical?			
8. Use dryer efficiently. Avoid drying one or two items at a time?			
9. Vent electric dryer indoors during heating season?			
10. Remove items when dryer stops to avoid unnecessary wrinkling, which will require ironing to remove?			
11. Reduce ironing to a minimum by careful selection of garments and household linens?			

Dishwashing

Do you:	Yes	No	Improvement Needed
1. Accumulate dishes; hold until dishwasher is filled. If dishes are hand washed, rinse and hold breakfast and lunch dishes until evening?			
2. Not let hot water run continuously while washing or rinsing dishes?			
3. Omit dishwasher drying cycle; open the door at end of the rinse cycle?			

Food Preservation: Refrigerator, Freezer

Do you:	Yes	No	Improvement Needed
1. Avoid opening door or holding it open unnecessarily?			
2. Keep grilles and evaporator coils clean?			
3. Locate cooling appliances away from heat sources such as a range, hot air register, or direct sunlight?			
4. Defrost as needed?			
5. If cold air is leaking around the door, have door adjusted or gasket replaced?			
6. Turn off, empty, clean, and leave refrigerator door open when taking extended vacation?			

Food Preparation

Do You:	Yes	No	Improvement Needed
1. Use oven to capacity?			

Do You:	Yes	No	Improvement Needed
2. Use cooking utensils that fit surface unit?	____	____	________
3. Use tight-fitting lids on cooking utensils, when appropriate?	____	____	________
4. Reduce heat to maintain necessary cooking temperature when using surface units?	____	____	________
5. Use small appliances for cooking if they are more efficient than a range?	____	____	________
6. Preheat oven only for leavened foods. Do not preheat longer than needed to attain required temperature?	____	____	________
7. Turn off oven and surface units when food is cooked?	____	____	________

Cleaning and Maintenance

Do You:			
1. Empty or replace vacuum cleaner bag frequently to keep it functioning efficiently?	____	____	________
2. Use hand equipment rather than power tools when practical?	____	____	________
3. Develop preventive maintenance practices. Routine check-up and servicing will prevent greater problems later?	____	____	________

*Originally developed by: Pennsylvania State University, Agricultural Education Department, State College, Pennsylvania.

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STUDENT WORKSHEET #4

Truck and Automobile Program*
Agribusiness Energy Analysis

Trucks and automobiles account for about 20% of all energy used in agricultural enterprises. Careful thought and conscientious efforts applied to fuel reduction concepts can pay good dividends.

No-Cost Maintenance and Management Practices

Do You:	Yes	No	Improvement Needed
1. Clean out car trunks and truck beds to reduce unnecessary weight? (It takes energy to move any weight.)	______	______	____________
2. Keep records in your vehicles that show trips you make, and their purpose? (Use these to help you decide: "Is this trip necessary?")	______	______	____________
3. Plan trips carefully and combine errands as much as possible?	______	______	____________
4. Call implement dealers before making a trip for parts to reduce both energy and time expenditures? (Use one stop service if and where possible.)	______	______	____________
5. Use the most economical vehicle for errands? (If you have a choice, use an automobile instead of a truck unless you have a large load to carry.)	______	______	____________
6. Drive at modest speeds locally, look ahead and anticipate stops?	______	______	____________
7. Use engines as soon as started and shut off when visiting? (Most vehicles do not require warm-ups.)	______	______	____________
8. Always load trucks properly? (While slight overloads on short runs may sometimes be justified, keep in mind that a 10% overload increases fuel consumption by about 20%.)	______	______	____________
9. Check tire pressure frequently? (10% underinflation can cause a 5% loss, and a 20% underinflation can cause a 15% loss in fuel efficiency.)	______	______	____________
10. Check regularly for leaks in the engine's vacuum system, carburetor, and fuel line?	______	______	____________
11. Drive at reasonable constant speeds and avoid jackrabbit starts and sudden stops?	______	______	____________
12. Purchase properly sized vehicles for jobs to be done?	______	______	____________

Do You:	Yes	No	Improvement Needed
13. Open or remove tailgates in pickup trucks, whenever possible, to reduce wind resistance and to increase fuel efficiency?	____	____	________
14. Use air conditioners only when really necessary?	____	____	________
15. Consider towing a trailer to reduce number of trips when hauling bulky items?	____	____	________
16. Use your 4-wheel drive vehicles only when needed for purposes designed?	____	____	________

Low Cost Maintenance and Management Practices

Do You:			
1. Replace or clean clogged, dirty air filters so that engines have maximum power and economy?	____	____	________
2. Tune-up engines regularly and as needed? (A single spark plug misfiring reduces fuel efficiency by 7%, two plugs misfiring can reduce fuel use efficiency 20%. Retiming the ignition can improve fuel efficiency by 5%.)	____	____	________
3. Check engine thermostat performance frequently, replacing as necessary to assure good operating efficiency?	____	____	________
4. Drain cooling system, flush and replace antifreeze-coolant at manufacturer's recommended intervals?	____	____	________
5. Use radial tires to reduce rolling resistance and to increase fuel efficiency? (Steel belted tires can save up to 10% in fuel use over rayon bias tires.)	____	____	________
6. Change oil and oil filter and lubricate chassis on a regular schedule as prescribed by manufacturer?	____	____	________
7. Service automatic transmissions, including filter change and necessary adjustments, at specified intervals?	____	____	________

Significant Cost Improvement/Investments

Do You:			
1. Justify a truck or automobile purchase on the basis of fuel efficiency, provided all other requirements are met? (For example, can you use diesel-fueled instead of a gasoline-fueled vehicle?)	____	____	________

Do You:	Yes	No	Improvement Needed
2. For bulky loads, such as hay or straw, build a deck over the (large) truck cab, extending the bed to haul more and reducing the number of trips? (Guard against exceeding permissible weight limits and be sure such extensions are approved in state where used.)	____	____	________
3. Use a small 3-wheel motor bike for short on-farm and/or off-farm trips?	____	____	________
4. Use vehicles with standard transmissions rather than automatic?	____	____	________
5. Use 2-wheel drive instead of 4-wheel drive trucks?	____	____	________
6. Use a smaller, lower powered pickup than you now use?	____	____	________

*Originally developed by: National Food and Energy Council, 409 Vandiver West, Suite 202, Columbia, Missouri 65202. (314) 875-7156.

STUDENT WORKSHEET #5

Farm Energy Management Program*

Farm Tractors and Equipment

Do You:

	Yes	No	Improvement Needed
1. Select the proper tractor size to fit the operation?			
2. Size the equipment to match the tractor?			
3. Practice minimum tillage where practical?			
4. Follow regular maintenance and tune-ups?			
5. Merge small fields into large fields to reduce turning and have longer rows?			
6. Keep all implements lubricated and properly adjusted?			
7. Use tractor weights to distribute load for minimum wheel slippage?			
8. Check tire pressure?			
9. Replace faulty radiator thermostats?			
10. Keep tillage tools sharp and properly lubricated?			
11. Avoid excessive idling and engine warm-up time?			
12. Remove tractor wheel weights when not needed?			
13. Use preventative maintenance?			

Tillage Management

Do You:

	Yes	No	Improvement Needed
1. Omit plowing, harrowing, disking, or cultivation where good management practices will permit?			
2. Not plow quite as deep unless there is subsurface compaction?			
3. Keep plow shares sharpened?			
4. Plow when soil moisture is favorable?			
5. Plow around fields instead of inlands?			
6. Harrow fields diagonally when two passes are needed?			

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Do You:	Yes	No	Improvement Needed
7. Work the long way of the field?	______	______	____________
8. Have a good soil and water conservation plan?	______	______	____________
9. Use contour strip cropping?	______	______	____________
10. Combine some field operations into one?	______	______	____________
11. Apply liquid nitrogen and herbicides?	______	______	____________
12. Disk and apply pesticides?	______	______	____________
13. Plant and apply pesticides?	______	______	____________

Fertility Management

Do You:

1. Use high analysis fertilizers?	______	______	____________
2. Use ammoniated starters to enhance early germination and reduce replanting risk?	______	______	____________
3. Plow down all P & K when planting clear-seeded alfalfa for 3-year stands?	______	______	____________
4. Handle and store manure in semi-dry form?	______	______	____________
5. Spread manure less frequently?	______	______	____________
6. Plow down manure promptly?	______	______	____________
7. Handle less weight?	______	______	____________
8. Grow forage legumes?	______	______	____________

Grain Drying

Do You:

1. Use early maturing varieties?	______	______	____________
2. Field dry to the fullest possible extent?	______	______	____________
3. Buy a good moisture tester and use it?	______	______	____________
4. Not overdry?	______	______	____________
5. Clean grain to remove fines and reduce power needed to move air through grain?	______	______	____________
6. Use as little grain depth as possible and level the top?	______	______	____________

Do You:	Yes	No	Improvement Needed
7. Operate dryer at optimum levels recommended by manufacturer and keep serviced properly?			
8. Use dryeration process?			
9. Preserve grain with organic acid?			

Farm Trucks and Autos

Do You:	Yes	No	Improvement Needed
1. Carry loads to vehicle capacity? (Do not overload.)			
2. Plan and schedule trips?			
3. Follow regular maintenance programs?			
4. Buy the right size vehicle properly equipped to do the job?			
5. Inflate all tires to proper pressure peak?			
6. Avoid excessive motor idling?			

Water Heating

Do You:	Yes	No	Improvement Needed
1. Preheat incoming water with heat exchanger?			
2. Drain water heater and remove lime deposits on a periodic basis?			
3. Repair all leaking faucets?			
4. Use automatic waterers rather than continuous flow?			
5. Insulate around outside of water heater and between its base and the floor?			
6. Insulate hot water lines which run through unheated areas?			
7. Keep temperature setting at low level?			
8. Use hot water conservatively?			

Ventilation

Do You:	Yes	No	Improvement Needed
1. Eliminate mechanical ventilation in animal housing facility wherever practical by using natural ventilation?			

Do You:	Yes	No	Improvement Needed
2. When warm animal housing facilities are required, consider a convertible system, closed, warm, and mechanically ventilated during cold months — open and naturally ventilated during summer months?	______	______	__________
3. Reduce ventilation rates (cfm) to minimum levels in animal housing facilities mechanically ventilated year round and increase air circulation within the structure during hot months to compensate?	______	______	__________
4. Turn fans off when ventilation is not required?	______	______	__________
5. Select fans with a high cfm/watt rating?	______	______	__________
6. Clean fans and shutters frequently?	______	______	__________
7. Lubricate fans per manufacturer's recommendation?	______	______	__________
8. Keep belts tight?	______	______	__________
9. Check thermostats?	______	______	__________
10. Keep controls properly set to prevent over-ventilation during cold weather months and wasting supplemental heat?	______	______	__________
11. Use temperature-controlled, variable speed fans, 2-speed fans, or motor-operated fan shutters to reduce fuel consumption in heated buildings?	______	______	__________

Lighting

Do You:			
1. Switch to lower wattage bulbs?	______	______	__________
2. Switch incandescent to lower wattage or to lower wattage reflector bulbs?	______	______	__________
3. Use task lighting and reduce whole area lighting?	______	______	__________
4. Replace regular fluorescents with new GE Watt Misers?	______	______	__________
5. Reduce total light burning hours by turning off when not in use?	______	______	__________
6. Use light dimmers where total wattage of bulbs gives more light than needed?	______	______	__________
7. Eliminate unnecessary dusk-to-dawn lights?	______	______	__________

Refrigeration

Do You:	Yes	No	Improvement Needed
1. Use a heat exchanger coupled with a refrigerant compressor?	______	______	__________
2. Remove half of the heat from fruits or vegetables brought from the field?	______	______	__________
3. Use a multitube pre-cooler, using well water to pre-cool milk?	______	______	__________
4. Keep compressor condensers and fans clean?	______	______	__________

Electric Motors

Do You:			
1. Load motor with work as near as possible to its related capacity? (Size motor to the job.)	______	______	__________
2. Avoid overheating?	______	______	__________
3. Avoid letting motors run idle?	______	______	__________
4. Start motors in sequence rather than simultaneously if there are two or more large motors?	______	______	__________
5. Keep motors and equipment lubricated and clean?	______	______	__________
6. If you are on demand billing, operate as few motors and lights at one time as practical?	______	______	__________
7. Install electric wiring for motors which is heavy enough gauge for minimum voltage drops?	______	______	__________
8. Maintain proper V-belt tension?	______	______	__________
9. Use electrical equipment powered by motors of correct type and size?	______	______	__________
10. Use distribution pole near center of load?	______	______	__________
11. Use all equipment supplied with correct voltage?	______	______	__________

*Originally developed by: Pennsylvania State University, Department of Agricultural Education, State College, Pennsylvania.

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STUDENT WORKSHEET #6

Insulation Comparison Experiment*

Purpose:

1. To compare the effectiveness of various insulation materials.

Materials:

1. One piece of 3/4" plywood 16" x 7' for base
2. Two pieces of pine 2" x 2" x 6' and two pieces 2" x 2" x 16" for frame of base
3. 4 pieces of 1/2" plywood 12" x 5' for cubes
4. 2 strap hinges
5. 4 keyless porcelain receptacles
6. 14 2 NM cable with ground
7. 1 single pole switch and box
8. 1 male electrical plug
9. 4 100W light bulbs
10. 4 corks and thermometers
11. Various types of insulation materials such as:
    a. glass wool
    b. polystyrene extruded
    c. molded boards (polystyrene)
    d. expanded urethane

Procedure:

1. Measure and cut lumber to proper dimensions for base.

2. Construct base and sand smooth.

3. Cut lumber for cubes and assemble. Leave the bottom of the cubes open. Drill hole for cord and thermometer in top of each cube. Sand smooth.

4. Measure and attach electrical devices to base. Have connections checked by instructor before closing electrical devices.

5. Attach various insulating materials to insides of the cubes. Have one cube without insulation and cracks at the joints for temperature control.

6. Measure temperature changes at 30 second time intervals. **Caution:** Do not leave the lights on for longer than 4 minutes because of the heat buildup and fire hazard.

7. Record your results and conclusions.

Conclusions: Briefly describe the results of your experiment with various insulating materials.

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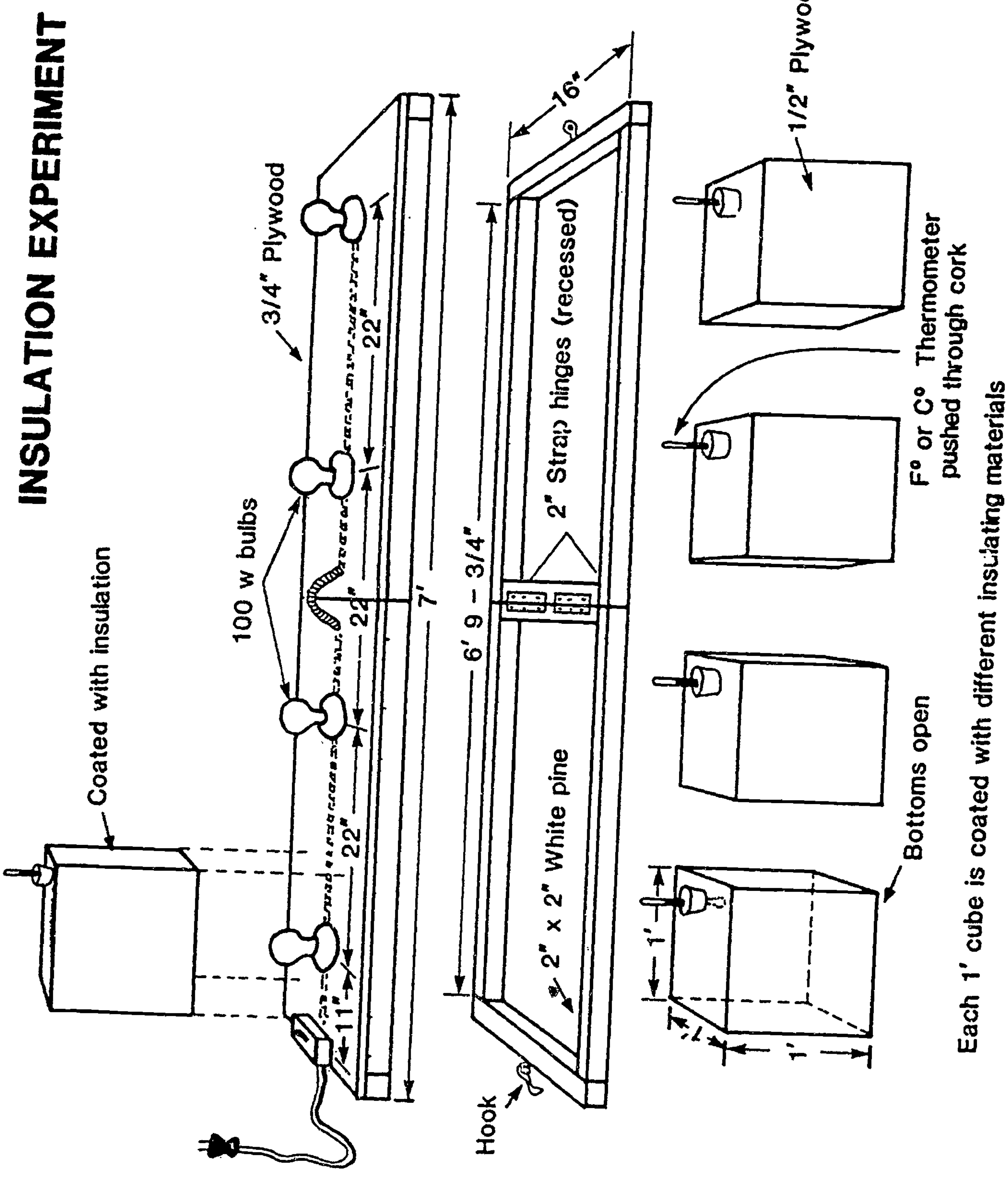
*Originally developed by: Pennsylvania State University, Department of Agricultural Education, State College, Pennsylvania.

INSULATION EXPERIMENT MODEL



STUDENT WORKSHEET #7

Construct a Draftometer*

Purpose:

1. To detect excessive air currents caused by improperly sealed windows and doors.

Materials:

1. Piece of wood 1" x 2" x 12"
2. Wood dowel 3/8" x 5"
3. Strip of plastic food wrap 5" x 10"
4. Wood glue
5. Five thumbtacks
6. 2 flat head wood screws #6 x 1"

Procedure:

1. Mark and cut the 1" x 2" x 12" piece of lumber into two pieces which are approximately 6" long.

2. Measure and drill a 3" hole through one 1" x 2" piece, one inch from the end.

3. Glue the wood dowel into the hole.

4. Fasten the two 1" x 2" pieces together with glue and wood screws.

5. After glue has dried, wrap the plastic strip around the dowel until about 4 inches of plastic wrap remain as a sail. Secure with 4 or 5 thumbtacks.

6. Hold the draftometer near the edges of doors, windows, etc., to detect air currents and areas of excessive heat loss. The lightweight plastic wrap will act like a flat and respond to the slightest air current. Excessive movement indicates poor weatherstripping and sealing.

Conclusions: Briefly report your findings from the use of the draftometer and make recommendations for corrections of located problem areas.

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*Originally developed by: Pennsylvania State University, Department of Agricultural Education, State College, Pennsylvania.

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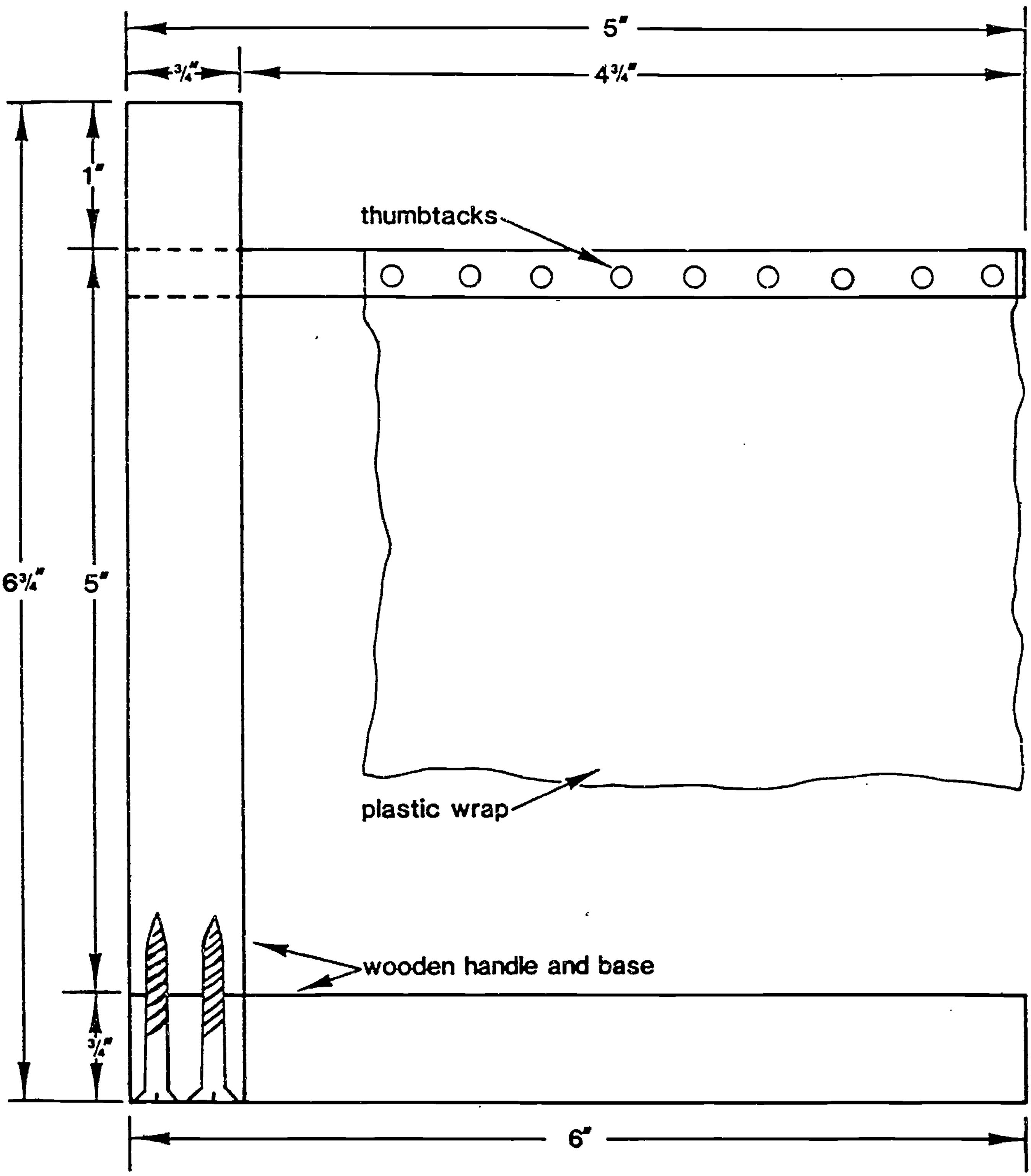
DRAFTOMETER



CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Plant Science

RELATED PROBLEM AREAS:

1. Understanding Plant Germination Growth and Development (Agricultural Business and Management Cluster)

2. Propagating Plants (Agricultural Business and Management Cluster)

3. Understanding Plant Germination Growth and Development (Horticulture Cluster)

4. Understanding Plant Anatomy and Physiology (Horticulture Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty J: Applying Fertilizers and Chemicals

1. Prepare chemical program
2. Prepare fertilizer program
3. Time fertilizer and chemical applications

Duty L: Growing Corn, Soybeans, Small Grains, or Forage Crops

1. Select planting method
2. Monitor plant growth
3. Cultivate crop

Horticulture Cluster

Duty C: Controlling the Plant Environment

1. Cultivate plants

Duty D: Applying Fertilizer and Chemicals

1. Time chemical applications

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and guides for this form are provided on a separate sheet.

Submission Date ____________
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Compare processes by which matter and energy are transported throughout an organism. *2. Recognize and compare major cell processes such as respiration, protein synthesis, and photosynthesis.					
*3. Relate the processes that organisms capture, utilize, and release energy. 4. Define terms associated with plant biology.					
5. Identify and describe the function of structures associated with the anatomy of plant roots.					
6. Identify and describe the function of structures associated with plant cell anatomy.					
7. Identify and describe the function of structures associated with the anatomy of plant stems.					
8. Identify and describe the function of structures associated with the anatomy of plant leaves.					
9. Outline the absorption and transport systems found within plants.					
803					803

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the principles of scientific research and their application in simple research projects.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Demonstrate the ability to draw conclusions from collected data.					
2. Perform simple experiments related to plant science.					
87_					
					87_

ISBE 41-78 (1/86)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Plant Science

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define terms associated with plant biology.
2. Identify and describe the function of structures associated with plant cell anatomy.
3. Identify and describe the function of structures associated with the anatomy of plant roots.
4. Identify and describe the function of structures associated with the anatomy of plant stems.
5. Identify and describe the function of structures associated with the anatomy of plant leaves.
6. Outline the absorption and transport systems found within plants.
7. Summarize the processes of photosynthesis, respiration, anabolism, and catabolism.
8. Perform simple experiments related to plant science.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Plant Science

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. What are plants?
2. What benefits are produced by plants?
3. How are plants similar to animals?
4. How are plants different from animals?
5. What are common characteristics of plants?
6. What are the parts of plants?
7. What are the parts of plant cells?
8. What cells make up plant tissue?
9. What cells and tissues make up plant roots?
10. What cells and tissues make up a plant stem?
11. What cells and tissues make up a plant leaf?
12. What is photosynthesis? Where does this function take place?
13. What is respiration? How is it different from photosynthesis?
14. How do plants take up water and nutrients?
15. How are absorbed and cell-produced nutrients moved within the plant?

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Plant Science

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use resources available through the local cooperative extension service such as agronomists or plant biologists for expertise in this area.
2. Coordinate the use of materials and equipment from the school district's biology and chemistry departments for those exercises which require it.
3. Emphasize to and lead students through a discussion of the basics of the content materials and the relevance to common occurrences such as lawn mowing, gardening, wood cuttings, herbicide applications, and conservation practices.
4. Have students make a collection of common plants for a comparison of the anatomical features among those plants and the content presented.
5. Use the Information Sheets as teacher background materials for use in preparing lesson plans appropriate for the students.
6. Use the transparencies as visual aids to coordinate with the lesson content.
7. Have students complete the appropriate laboratory activities as either an interest approach to create a felt need or an alternative learning and reinforcement experience.
8. Use the Information Sheets as guides for using the Transparency Masters during content presentation.
9. Secure copies of IMS #8384, *Plant Structure and Functions of Plant Parts* for use as a student reference and as a study guide.
10. Obtain prepared slides and models for comparison with student drawings in the student worksheets.
11. Use a laboratory skills manual such as *Basic Skills in the Laboratory* (NASCO) to orient and reinforce skills, practices, and procedures necessary in a science laboratory.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Plant Science

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Crop and Soil Science: A Curriculum Guide for Idaho Vocational Agriculture Instructors.* Illinois Vocational Curriculum Center, Sangamon State University, Springfield, IL 62794. (800) 252-4822.

2. *Botany: Basic Concepts in Plant Biology.* (1978). Hufford, Terry L. Harper & Row, Publishers.

*3. *Plant Structure and Functions of Plant Parts* (Subject Matter Unit #8384) Instructional Materials Service. Texas A&M University, P.O. Box 2588, College Station, TX 77843-2588.

4. *Horticultural Science.* (1986). Janick, Jules. W.H. Freeman and Co.

5. *Introductory Plant Biology.* (1988). Stern, Kingsley R. Wm. C. Brown Publishers, 2460 Kerper Blvd., Dubuque, IA 52001.

6. *Botany: A Brief Introduction to Plant Biology.* (1979). Rost, T.L., Barbour, M.G., Thornton, R.M., Weier, T.E., Stocking, C.R. John Wiley & Sons, Inc., 605 3rd Ave., New York, NY 10158-0012.

*7. *Science Laboratory Exercises for Vocational Agriculture Students.* (1986). Thompson, Dale E. Illinois Vocational Curriculum Center, Sangamon State University, Springfield, IL 62708. (800) 252-4822.

8. *Basic Skills in the Laboratory.* Towne, C.E. (1977). NASCO, 901 Janesville Ave., Ft. Atkinson, WI. 53538. (800) 558-9595.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Plant Ancestry

INFORMATION SHEET #2 — Terms to be Defined

INFORMATION SHEET #3 — Cell Summary

INFORMATION SHEET #4 — Tissue Summary

INFORMATION SHEET #5 — Stem Summary

INFORMATION SHEET #6 — Root Summary

INFORMATION SHEET #7 — Leaf Summary

INFORMATION SHEET #8 — Outline of Absorption and Transport Systems

INFORMATION SHEET #9 — Outline of Photosynthesis and Respiration

TRANSPARENCY MASTER #1 — Functions of Leaves, Stems, Roots, and Flowers

TRANSPARENCY MASTER #2 — Comparison of Dicot and Monocot Plant Parts

TRANSPARENCY MASTER #3 — Plant Cell

TRANSPARENCY MASTER #4 — Cell Wall of Plants

TRANSPARENCY MASTER #5 — Plant Meristems

TRANSPARENCY MASTER #6 — Epidermal Cells

TRANSPARENCY MASTER #7 — Parenchyma Tissue

TRANSPARENCY MASTER #8 — Collenchyma Tissue

TRANSPARENCY MASTER #9 — Sclerenchyma Tissue

TRANSPARENCY MASTER #10 — Phloem Tissue

TRANSPARENCY MASTER #11 — Tracheid, Vessels, and Pits

TRANSPARENCY MASTER #12 — Arrangement of Tissue in Stems

TRANSPARENCY MASTER #13 — Stems

TRANSPARENCY MASTER #14 — Stem Cross Section

TRANSPARENCY MASTER #15 — Bark

TRANSPARENCY MASTER #16 — Specialized Stems 870

TRANSPARENCY MASTER #17 — Cross Section of a Tree

TRANSPARENCY MASTER #18 — Roots

TRANSPARENCY MASTER #19 — Types of Roots

TRANSPARENCY MASTER #20 — Leaf Types

TRANSPARENCY MASTER #21 — A Stereoscopic View of a Portion of a Typical Leaf

TRANSPARENCY MASTER #22 — Stoma

TRANSPARENCY MASTER #23 — Important Plant Processes

TRANSPARENCY MASTER #24 — Importance of Photosynthesis

TRANSPARENCY MASTER #25 — Photosynthesis

TRANSPARENCY MASTER #26 — Photosynthesis and Respiration in Relation to Dry Weight

TRANSPARENCY MASTER #27 — Relationship Between Photosynthesis and Respiration

TRANSPARENCY MASTER #28 — Transpiration

TRANSPARENCY MASTER #29 — Root Hairs, Soil Particles, and Moisture

TRANSPARENCY MASTER #30 — Osmosis

TRANSPARENCY MASTER #31 — Absorption

TRANSPARENCY MASTER #32 — Guard Cell Movement

TRANSPARENCY MASTER #33 — Water Movement

TRANSPARENCY MASTER #34 — Phloem Transport

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INFORMATION SHEET #1

Plant Ancestry

The attempts to define what is or is not a plant is always full of exceptions given the fact that natural boundaries are difficult to find. Perhaps two features useful in the determination are the presence of cell walls and the ability to perform photosynthesis.

Cell walls are characterized by a network of tough cellulose fibers as opposed to the more flexible membranes found in animals. Also present in the cell walls of plants are the plasmodesmate, which are fine strands of cytoplasm which allow for transport of materials from cell to cell. Such connections are not found in animal cell membranes. Another feature of plant cells is the formation of cell plates during division as opposed to the invagination of the cell membrane during the mitotic process.

The ability to perform photosynthesis is another feature of the broad category of plants. As with any classification there are segments of the kingdom plantae that do not trap radiant energy from sunlight to construct organic materials. This has lead to alternative classification systems to deal with those organisms that only have cell walls or some of the life cycle characteristics of green plants that photosynthesize.

Prokaryotes

The present day bacteria and blue-green algae are examples of organisms that have their DNA floating free within the cytoplasmic material. The evolution of these organisms is, like most theories, subject to debate. However, there is a sequence of events that may be offered as a reasonable guess.

1. Within the primordial soup, which was the oceans at the time of the earth's cooling, were organic and inorganic molecules. These molecules aggregated and formed more complex molecules which eventually led to the living cells called protoorganisms. It is on this point the crux of the two theories clash. There is ample evidence to show that the development of the amino acids necessary for life could not develop under the circumstances present. Another contraindication is that the formation process of peptides is one of condensation, a process difficult in an aqueous environment.

2. In order for the protoorganisms to survive, a means of self-replication was necessary. Somehow this genetic apparatus was developed, and soon to follow were the proteins needed for the enzymes to bring about energy generating systems. These systems depended on materials available in the environment. They were heterotrophs.

3. As there was no atmosphere, these heterotrophs were anaerobic and used the products of fermentation (anaerobic breakdown) of organic compounds synthesized by the conditions of the environment (abiological). Representative organisms present today are the mycoplasms, which contain none of the porphyrin needed for pigments of photosynthesis.

4. The next organisms contained an iron porphyrin and were able to carry out energy-forming reactions anaerobically but were unable to use nutrients not processed by fermentation. Present-day examples are the anaerobic bacteria.

5. The development of magnesium-containing porphyrins by organisms led to anaerobic photoheterotrophism. This ability to use sunlight for energy still required organic compounds to supply the synthetic reactions in the cell but allowed the organisms to invade areas which contained fewer of these substances.

6. The development of carbon dioxide-fixing pathways led to the anaerobic photoautotrophs which used sunlight for energy and for forming the organic substrates necessary for cell building.

7. Finally, the linkage of the two phases of photosynthesis was accomplished by the use of water-soluble pigments and the use of the hydroxyl ions of water as electron donors and the release of O_2 into the atmosphere. This O_2 helped the development of the ozone layer, which protected living organisms from the ultraviolet rays of the sun and led to organism movement to shallower water and finally to land. Present day examples of these organisms are the blue-green algae.

Eukaryotes

Once the level of blue-green algae is reached another division is needed. Eukaryotes are those organisms which have their DNA separated from the cytoplasmic material by a membranous envelope. It should be stated that it is felt that prokaryotes and eukaryotes have a common point in the past and not that one came from or developed into the other. Among the eukaryotes are fungi, green plants, and animals. Since the term incorporates both plants and animals it is necessary to return to one of the features that characterize plants, which is the ability to photosynthesize. Necessary for photosynthesis are the choloroplasts which contain chlorophyll. Thus if an organism contains chloroplasts it is in the kingdom Plantae.

Another question that arises is, how did the ability to photosynthesize develop in those organisms which contain it? There are two theories which are popular. The first is a symbiosis theory that supposes that free-living bacteria that developed the photosynthesis capability entered cells of eukaryotes, and the union became permanent with the subsequent loss of separateness. An example of a present-day situation to use as a beginning model is that of the bacteria in the root modules of the legumes.

The second is the classical mutation theory that chloroplasts may have developed in a single line of cells and were simply carried forward. The answer continues to elude researchers.

At this point the green plants, with which agriculturists are familiar, come into focus. It seemed appropriate that considerable time be spent on background information as to how the chloroplast-containing eukaryotes may have evolved to be that way. The absence of a sequence of development for a particular eukaryote is perhaps less critical than for the prokayotes, since the prokayote development of photosynthesis is easier to explain.

INFORMATION SHEET #2

Terms to be Defined

Abscission — the separation of leaves, flowers, and fruits from plants after the formation of an abscission zone at the base of their petioles, peduncles, and pedicels.

Active transport — the expenditure of energy by a cell in moving a substance across a plasma membrane against a diffusion gradient.

Adventitious — said of buds developing in internodes or on roots, or of roots developing along stems or on leaves.

Aerobic respiration — respiration that requires free oxygen.

Agar — a gelatinous substance produced by certain red algae; also, used as a culture medium.

Alternation of generations — alternation between a haploid gametophyte phase and a diploid sporophyte phase in the life cycle of sexually reproducing organisms.

Amino acid — one of the organic, nitrogen-containing units from which proteins are synthesized.

Anaerobic respiration — respiration in which the hydrogen removed from the glucose during glycolysis is combined with an organic ion (instead of oxygen).

Annual — a plant that completes its entire life cycle in a single growing season.

Annual ring — a single season's production of xylem (wood) by the vascular cambium.

Anther — the pollen-bearing part of a stamen.

Apical dominance — suppression of growth of lateral buds by hormones.

Apical meristem — a meristem at the tip of a shoot or root.

Asexual reproduction — any form of reproduction not involving the union of gametes.

Assimilation — cellular conversion of raw materials into cell structures.

Atom — the smallest individual unit of an element that retains the properties of the element.

ATP — adenosine triphosphate, a cell molecule with three phosphate groups; it is the principle vehicle for energy storage and exchange in cell metabolism.

Autotrophic — descriptive of an organism capable of sustaining itself with nutrients through conversion of inorganic substances to organic material.

Auxin — a growth-regulating substance produced either naturally by plants or synthetically.

Bark — tissues of a woody stem between the vascular cambium and the exterior.

Berry — a thin-skinned fruit that usually develops from a compound ovary and commonly contains more than one seed.

Biennial — a plant that normally requires two seasons to complete its life cycle.

Bivalent — an associated pair of homologous chromosomes as seen in prophase I of meiosis.

Blade — the conspicuous, flattened part of a leaf.

Botany — science involving the study of plants.

Bract — a structure that is usually leaflike and modified in size, shape, or color.

Bulb — an underground food-storage organ that is essentially a modified bud consisting of fleshy leaves that surround and are attached to a small stem.

Callus — undifferentiated tissue that develops around injured areas of stems and roots.

Cambium — a meristem producing secondary tissues; see vascular cambium and cork cambium.

Capillary water — water held in the soil against the force of gravity.

Carbohydrate — an organic compound containing carbon, hydrogen, and oxygen, with twice as many hydrogen as oxygen atoms per molecule.

Casparian strip — the band of suberin around the radial and transverse walls of an endodermal cell.

Cell — the basic structural and functional unit of living organisms.

Cell membrane — see plasma membrane.

Cell plate — the precursor of the middle lamella; it forms at the equator during telophase.

Cellulose — a complex, insoluble carbohydrate that constitutes the principal component of plant cell walls.

Cell wall — the relatively rigid boundary of cells of plants and certain other organisms.

Chlorenchyma — tissue composed of parenchyma cells that contain chloroplasts.

Chlorophyll — green pigments essential to photosynthesis.

Chloroplast — an organelle containing chlorophyll.

Chromatid — one of the two strands of chromosome; they are united by a centromere.

Chromatin — a readily staining complex of DNA and proteins found in chromosomes.

Chromoplast — a plastid containing pigments other than chlorophyll; the pigments are usually yellow to orange.

Chromosome — a body composed of DNA and proteins; chromosomes are found in cell nuclei and appear in contracted form during mitosis and meiosis.

Class — a category of classification between a division and an order.

Cohesion-tension theory — theory that explains the rise of water in plants through a combination of cohesion of water molecules in capillaries and tension on the water columns brought about by transpiration.

Coleoptile — a protective sheath surrounding the emerging shoot of seedlings.

Collenchyma — tissue composed of cells with unevenly thickened walls.

Companion cell — a specialized cell derived from the same parent cell as the closely associated sieve-tube element immediately adjacent to it.

Conifer — a cone-bearing tree or shrub.

Cork — tissue composed of cells whose walls are impregnated with suberin at maturity; the outer layer of tissue of an older woody stem.

Cork cambium — a narrow cylindrical sheath of cells between the exterior of a woody root or stem and the central vascular tissue; it produces cork to its exterior and phelloderm to its interior.

Corm — a vertically oriented, thickened food-storage stem.

Cortex — a primary tissue composed mainly of parenchyma; the tissue usually extends between the epidermis and the vascular tissue.

Cotyledon — an embryo leaf ("seed leaf") that usually either stores or absorbs food.

Covalent bond — a force provided by pairs of electrons that travel between two or more atomic nuclei, holding atoms together and keeping them at a stable distance from each other.

Cuticle — a waxy or fatty layer of varying thickness of the outer walls of epidermal cells.

Cytokinesis — cell division.

Cytoplasm — the protoplasm of a cell exclusive of the nucleus.

Dark reactions — a cyclical series of chemical reactions that utilizes carbon dioxide and energy generated during the light reactions of photosynthesis, producing sugars, some of which are stored as insoluble carbohydrates while others are recycled; the reactions are independent of light and occur in the stoma of choloroplasts.

Deciduous — shedding leaves annually.

Dicotyledon — a class of angiosperms whose seeds commonly have two cotyledons; the term is frequently abbreviated to dicot.

Differentially permeable membrane — a membrane through which different substances diffuse at different rates.

Differentiation — the change of a relatively unspecialized cell to a more specialized one.

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Diffusion — the random movement of molecules or particles from a region of higher concentration to a region of lower concentration, ultimately resulting in uniform distribution.

Dikaryotic — having a pair of nuclei in each cell or a type of the mycelium in club fungi.

Dioecious — having unisexual flowers or cones, with the male flowers or cones confined to certain plants, and the female flowers or cones of the same species confined to other different plants.

Diploid — having two sets of chromosomes in each cell; the $2n$ chromosome number characteristic of the sporophyte generation.

DNA — standard abbreviation of deoxyribonubleic acid, the carrier of genetic information in cells.

Dormancy — a period of growth inactivity in seeds, buds, bulbs, and other plant organs even when environmental conditions normally required for growth are met.

Egg — a nonmotile female gamete.

Electron — a negatively charged particle of an atom.

Embryo — immature sporophyte that develops from a zygote within a ovule after fertilization.

Endodermis — a single layer of cells surrounding the vascular tissue in roots and some stems.

Endoplasmic reticulum — a complex system of interlinked double membrane channels; parts of it are lined with ribosomes.

Endosperm — a food-storage tissue that develops through divisions of the primary endosperm nucleus.

Enzyme — one of numerous complex proteins that speeds up a chemical reaction in living cells without being used up in the reaction (i.e, it catalyzes the reaction).

Epidermis — the exterior tissue, usually one cell thick, of leaves and young stems and roots.

Etiolation — a condition characterized by long internodes, poor leaf development, and pale, weak appearance, due to a plant's having been deprived of light.

Eukaryotic — pertaining to cells having distinct membrane-bound organelles.

Fermentation — respiration in which the hydrogen removed from the glucose during glycolysis is transferred back to pyruvic acid, creating substances such as ethyl alcohol or lactic acid.

Fertilization — formation of a zygote through the fusion of two gametes.

Food chain — a natural chain of organisms of a community wherein each member of the chain feeds on members below it and is consumed by members above it.

Fruit — a mature ovary usually containing seeds.

Gamete — a sex cell; one of two cells that unite, forming a zygote.

Gene — a unit of heredity; part of a linear sequence of such units occurring in the DNA of chromosomes.

Generative cell — the cell of the male gametophyte of angiosperms that divides, producing two sperms; also producing a sterile cell and spermatogenous cell in gymnosperms.

Genetic engineering — the introduction, by artificial means, of genes from one form of DNA into another form of DNA.

Golgi body — an organelle consisting of disc-shaped, often branching hollow tubules that apparently function in accumulating and packaging substances used in the synthesis of materials by the cell.

Gravitational water — water that drains out of the pore spaces of a soil after a rain.

Ground meristem — meristem that produces all the primary tissues other than the epidermis and stele.

Guard cell — one of a pair of specialized cells forming a stoma.

Gymnosperm — a plant whose seeds are not enclosed within an ovary during their development.

Haploid — having one set of chromosomes per cell, as in gametophytes; also referred to as having n chromosomes.

Heartwood — nonliving, usually darker-colored wood whose cells have ceased to function in water conduction.

Herbaceous — referring to nonwoody plants.

Heterotrophic — incapable of synthesizing food and therefore dependent on other organisms for it.

Hormone — an organic substance generally produced in minute amounts in one part of an organism and transported to another part of the organism where it controls or affects specific metabolic processes.

Hybrid — offspring of two parents that differ in one or more genes.

Hydrolysis — the breakdown of complex molecules to simpler ones as a result of the union of water with the compound.

Imbibition — absorption of water by nonliving materials and subsequent swelling because of the adhesion of the water molecules to the internal surfaces.

Inferior ovary — an ovary to which parts of the calyx, corolla, and stamens have become more or less united so that they appear to be attached at the top of it.

Leaf — a flattened, usually photosynthetic structure arranged in various ways on a stem.

Leaf gap — a parenchyma-filled interruption in a stem's cylinder of vascular tissue immediately above the point at which a branch of vascular tissue (leaf trace leading to a leaf) occurs.

Leaflet — one of the subdivisons of a compound leaf.

Leaf scar — the suberin-covered scar left on a twig when a leaf separates from it through abscission.

Lenticel — one of usually numerous, slightly raised, somewhat spongy groups of cells in the bark of woody plants; lenticels permit gas exchange between the interior of a plant and the external atmosphere.

Light reactions — a series of chemical and physical reactions through which light energy is converted to chemical energy with the aid of chlorophyll molecules.

Lignin — an organic hardening substance with which certain cell walls (e.g., those of wood) become impregnated.

Meiosis — the process of two successive nuclear divisions through which segregation of genes occurs and a single diploid cell ($2n$) becomes four haploid (n) cells.

Meristem — a region in which undifferentiated cells divide.

Mesophyll — parenchyma (chlorenchyma) tissue between the upper and lower epidermis of a leaf.

Metabolism — the use of all the interrelated chemical processes occurring in a living organism.

Middle lamella — a layer of pectic material that cements two adjacent cell walls together.

Midrib — the central (main) vein of a pinnately veined leaf or leaflet.

Mitochondrion — an organelle containing enzymes that function in the Krebs cycle and the electron transport chain of aerobic respiration.

Mitosis — nuclear division during which the chromatids of the chromosomes separate and two genetically identical daughter nuclei are produced.

Molecule — the smallest unit of an element or compound retaining its own identity; it consists of two or more atoms.

Monocotyledon — a class of angiosperms whose seeds have a single cotyledon.

Monoecious — having unisexual male flowers or cones and unisexual female flowers or cones both on the same plant.

Mutation — an inheritable change in a gene or chromosome.

Neutron — an uncharged particle in the nucleus of an atom.

Node — region of a stem where one or more leaves are attached.

Nucleolus — a somewhat spherical body within a nucleus; it contains primarily RNA and protein.

Nucleus — the organelle of a living cell that contains chromosomes and is essential to the regulation and control of all the cell's functions; also, the core of an atom.

Organelle — a membrane-bound structure in the cytoplasm of cell.

Organic — pertaining to or derived from living organisms, and to the chemistry of carbon-containing compounds.

Osmosis — the diffusion of water or other solvents through a differentially permeable membrane from a region of higher concentration to a region of lower concentration.

Osmotic potential — potential pressure that can be developed by a solution separated from pure water by a differentially permeable membrane (the pressure required to prevent osmosis from taking place).

Palisade mesophyll — mesophyll having relatively uniform rows of tightly packed aprenchyma (chlorenchyma) cells located beneath the upper epidermis of a leaf.

Parenchyma — thin-walled cells varying in size, shape, and function; the most common type of plant cell.

Pectin — a water-soluble organic compound occurring primarily in the middle lamella.

Perennial — a plant that continues to live indefinitely after flowering.

Pericylce — tissue sandwiched between the endodermis and phloem of a root; the site of origin of branch roots.

Periderm — outer bark; it is composed primarily of cork cells.

Permanent tissue — a tissue composed of cells that have assumed various shapes and sizes related to their function as they matured following their production by a meristem.

Petiole — the stalk of a leaf.

pH — a symbol of hydrogen ion concentration indicating the degree of acidity or alkalinity.

Phloem — the food-conducting tissue of a vascular plant.

Photoperiodism — the initiation of flowering and certain vegetative activities of plants in response to relative lengths of day and night.

Photosynthesis — the conversion of light energy, water, and carbon dioxide in the presence of chlorophyll to carbohydrate, with oxygen being released as a by-product.

Phytochrome — pigment associated with the absorption of light; it is found in the cytoplasm of cells of green plants.

Pith — central tissue of a dicot stem and certain roots; it usually consists of parenchyma cells that become crushed in woody plants as cambial activity increases the organ's girth.

Plasma membrane — the outer boundary of the protoplasm of a cell; also called cell membrane, particularly in animal cells.

Plasmodesma — minute strands of cytoplasm that extend between adjacent cells through pores in the walls.

Plastid — an organelle associated primarily with the storage or manufacture of carbohydrates.

Polar nuclei — nuclei, frequently two in number, that unite with a sperm in an embryo sac, forming a primary endosperm nucleus.

Pollination — the transfer of pollen from an anther to a stigma.

Pressure-flow hypothesis — the theory that food substances in solution in plants flow along concentration gradients between the sources of the food and sinks (places where the food is utilized).

Procambium — the primary meristem that gives rise to primary xylem and phloem.

Prokaryotic — having a cell or cells that lack a distinct nucleus and other membrane-bound organelles (e.g., bacteria).

Protein — an organic compound containing carbon, hydrogen, oxygen, nitrogen, and frequently sulphur in complex molecules composed of numerous amino acids linked together by peptide bonds.

Protoderm — the primary meristem that gives rise to the epidermis.

Proton — a positively charged particle in the nucleus of an atom.

Protoplasm — the living substance of a cell.

Quiescence — a state in which a seed or other plant part will not germinate or grow unless environmental conditions normally required for growth are present.

Rachis — the axis of a pinnately compound leaf or frond extending between the lowermost leaflets or pinnae and the terminal leaflet or pinna (corresponds with the midrib of a simple leaf).

Radicle — the part of an embryo in a seed that develops into a root.

Ray — radially oriented tiers of cells that conduct food, water, and other materials laterally in the stems and roots of woody plants.

Reproduction — the development of new individual organisms through either sexual or asexual means.

Respiration — cellular breakdown of sugar and other foods, accompanied by release of energy; in aerobic respiration oxygen is utilized.

Rhizome — granular particles each composed of two subunits consisting of RNA and proteins; they lack membranes and are very numerous in living cells.

RNA — the standard abbreviation for ribonucleic acid; an important cellular substance that occurs in three forms, all involved in the synthesis of proteins.

Root — a plant organ that functions in anchorage and absorption; most roots are produced below ground.

Root cap — a thimble-shaped mass of cells at the tip of a growing root; it functions primarily in protection.

Root hair — a delicate protuberance that is part of an epidermal cell of a root; root hairs occur in a zone behind the growing tip.

Sapwood — outer, usually functional layers of wood in a tree trunk; sapwood is usually lighter in color than heartwood.

Sclereid — a sclerenchyma cell with pits; it may vary in shape but usually one axis is not conspicuously longer than the other.

Seed — a mature ovule containing an embryo and bound by a protective seedcoat.

Sexual reproduction — reproduction involving the union of gametes.

Sieve plate — area of the wall of a sieve-tube element that contains several to many perforations that permit cytoplasmic connections between similar adjacent cells.

Sieve tube — column of sieve-tube elements arranged end to end; food is conducted from cell to cell through sieve plates.

Sieve-tube element — a single cell of a sieve tube.

Spongy mesophyll — mesophyll having loosely arranged cells and numerous air spaces; it is generally confined to the lower part of the interior of a leaf just above the lower epidermis.

Stele — the central cylinder of tissues in a stem or root; it usually consists primarily of xylem and phloem.

Stem — a plant axis with leaves or enations.

Stipule — one of a pair of appendages of varying size, shape, and texture present at the base of the leaves of some plants.

Stock — the rooted portion of a plant to which a scion is grafted.

Stoma — a minute pore or opening in the epidermis of leaves and herbaceous stems; it is flanked by two guard cells that regulate its opening and closing and thus regulate gas exchange and transpiration.

Stroma — a colorless fluid substance constituting the bulk of the volume of a chloroplast or other plastid; it contains enzymes that in chloroplasts play a key role in photosynthetic reactions.

Suberin — fatty substance found primarily in the cell walls of cork and the Casparian strips of endodermal cells.

Sucrose — the primary form in which sugar produced by photosynthesis is transported throughout a plant.

Superior ovary — an ovary that is free from the calyx, corolla, and other floral parts so that the sepals and petals appear to be attacked at its base.

Symbiosis — an intimate association between two dissimilar organisms that benefits both of them.

Tendril — a slender structure that coils on contact with a support of suitable diameter; it usually is a modified leaf or leaflet, and aids the plant in climbing.

Tissue — an aggregation of cells having a common function.

Tracheid — a xylem cell that is tapered at the ends and has thick walls containing pits.

Transpiration — loss of water in vapor form; most transpiration takes place through the stomata.

Turgid — firm or swollen because of internal water pressures resulting from osmosis.

Turgor pressure — pressure within a cell resulting from the uptake of water.

Vacuolar membrane — a membrane between the cytoplasm and a vacuole of a cell.

Vacuole — a pocket of cell sap that is separated from the cytoplasm of a cell by a membrane; also, food-storage or contractile pockets within the cytoplasm of unicellular organisms.

Vascular bundle — a strand of tissue composed mostly of xylem and phloem and usually enveloped by a bundle sheath.

Vascular cambium — a narrow cylindrical sheath of cells that produces secondary xylem and phloem in stems and roots.

Water potential — the chemical potential of water expressed in pressure units - a measure of the tendency of water molecules to diffuse.

Xylem — the tissue through which most of the water and dissolved minerals utilized by a plant are conducted; it consists of several types of cells.

Zygote — the product of the union of two gametes.

Adapted from: *Introductory Plant Biology*, Stern, K.R.

INFORMATION SHEET #3

Cell Summary

The cell is the basic unit of all living organisms. Cells are microscopic in size, 1/10 to 1/100 millimeter in diameter, and are differentiated according to function. Some cells live a few days and other cells may live many years. Plant cells are bound by walls and contain the main living components. Taken together the living parts are called protoplasm and are surrounded entirely by a flexible plasma membrane, plasmalemma. The plasma membrane is double sided (unit), forms folds, is differentially permeable and has enzymatic functions. The nucleus functions to control cell activity and the cytoplasm is a fluid in which various membrane-bound organelles are located.

The nucleus is bound by a two-unit membrane that is porous and differentially permeable. Within the nuclear fluid, nucleoplasm, are the spherical nucleoci and chromatin strands, that condense into chromosomes during division. The nucleus apparently controls cell division and is though to mediate cellular activities through the transcription of information from the DNA and the nucleolus.

Within the cytoplasm the endoplasmic reticulum is a membrane channel that may be continuous with the outer membrane of the nucleus and appears to be involved in storing and transporting protein and chemical products. Associated with the endoplasmic reticulum, as well as free floating, are granular bodies, ribosomes, which are involved in protein synthesis. Mitochondria are small organelles with inner platelike folds and are the principal sites of respiration of organic compounds which provide energy for cell functions. Golgi bodies, dictyosomes, are flat disc-shaped (sac-like) organelles which appear in groups and function as collecting and packaging centers. Plastids are large organelles and may be green (chloroplasts), red (chromoplasts) or colorless (leucoplasts). Chloroplasts contain chlorophyll and are involved in photosynthesis. Chlorophyll is found in stacks of coin-shaped membranes called thylakoids. Chromoplasts are associated with caratenoid pigments and leucoplasts are usually associated with food storage. Vacuoles may make up 90% of a mature cell and contain a watery fluid, cell sap, which contains dissolved substances. Microbodies are associated with metabolic reactions. Microtubules are tube-like structures just inside the plasmalemma and are involved with cell wall formation and cellulose addition for maintenance.

Plant cells are bonded by a fairly rigid cell wall secreted by the protoplast. The primary cell wall and the secondary cell wall are composed mostly of cellulose but also contain lignin and pectin with the concentrations of each making for differences in stability, plasticitiy, and elasticity. The middle lamella is sandwiched between the primary cell walls of adjacent cells and is a pectic material that helps cement (bond) the individual cells together. Contact is made between cells by fine strands of cytoplasm plasmodesmata, which may extend through minute holes in wall depressions called pits and serve as an extension of the endoplasmic reticulum for intercellular chemical communication.

Cells are normally associated into tissues by virtue of some similarity. Tissues comprise the next higher order of plant anatomy.

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INFORMATION SHEET #4

Tissue Summary

Although a plant is derived from a single fertilized egg cell, the cell division and differentiation that then occur lead to a complex and diverse organism. The differences in cell morphology (form) and arrangement result in the variations found among plants and within an individual plant. A group of cells organized into masses of similar type and definite pattern is called a tissue. Tissues may be classified as meristematic or permanent. This division, like most dealing with organisms, is tenuous, as is evident when permanent tissue, properly stimulated, assumes meristematic activity.

Meristematic tissue may be seen as actively dividing undifferentiated cells involved in cell growth. Apical meristems are meristematic tissues found in the tops of shoots and roots. Lateral meristems account for the growth in girth of stems. They are specifically called cambium, vascular or cork; are composed of cellulose and pectin; and provide mechanical support for the plant. Sclerenchyma may be found in two types of thick walled tissue: long, tapered end fibers and short, pointed sclerid, which provides the gritty texture of pears. Sclerenchyma cells are distinct from the other types in that when reaching maturity they are usually dead.

Complex tissues may be divided into principal types of phloem, xylem, and periderm. Phloem is the main conducting tissue for dissolved food material. Phloem is basically composed of cells called sieve elements arranged into sieve tubes and comprised of thin elongated cells with cellulose walls. Companion cells are found adjacent to sieve elements and apparently provide regulation. Also found in phloem are parenchyma, ray cells, and fibers. Xylem, which constitutes the majority of wood, is the principal conductor of water and dissolved nutrients. A third meristematic tissue, intercalary meristem, is found near the "nodes" of grasses and is the reason for continuous growth after mowing.

Permanent tissues are nondividing differentiated cells produced by meristems. Permanent tissues may be divided into simple, composed of one type of cell, and complex, composed of a mixture of cell types. Epidermis is a simple tissue usually one cell thick that may secrete protective substances, such as cutin on the outer layer of fruits. It also functions to protect the organisms from insects in addition to moisture control, as when found in the guard cells of the stoma or the root hair extensions. Parenchyma cells are thin walled and comprise the most common and abundant plant tissue making up the fleshy part of the organism and functioning in food and water storage. Collenchyma cells are unevenly thick walled and found throughout the plant. Xylem is made up mostly of traceids, which are nonliving cells with tapering ends that overlap, and vessels, which are living cells lined up end to end. Ray cells are involved in lateral conduction of water. Also found in xylem are parenchyma and fibers. Periderm (bark) is comprised of cork cambium, phloem, and other parenchymatous tissue and serves as protection of the underlying tissues in addition to providing areas for gas exchange known as lenticels.

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INFORMATION SHEET #5

Stem Summary

The stem is the central axis of a shoot and serves to support the food-producing appendages in addition to connecting these appendages to the nutrient-gathering roots. Stems are often erect but may be horizontal or may be modified to permit climbing or storage of water and food.

Exterior features which may be seen on the stem are nodes, regions where leaves are attached, and internodes, the area between nodes. Embryonic stems are called buds and these growing points may be often found as terminal buds, which occur at stem tips, and axillary buds, which occur at the axils (base) of leaf petioles. Most buds are visible but may also be bedded deep within the stem tissue. Those visible are covered by scales for protection. Buds may develop into either leaves (leaf bud), flowers (flower bud), or both (mixed bud).

Each stem has at its tip the apical meristem which increases the stem length. This new tissue may develop into one of three primary meristems: the ground meristem produces cortex and pith; the procambium produces primary xylem and phloem; and the protoderm gives rise to epidermis. A vascular cambium may develop between the primary xylem and phloem and produce secondary tissue. Secondary phloem cells include sieve-tube elements and companion cells. Secondary xylem include tracheids, vessel elements, and fibers.

A herbaceous dicot stem has the vascular bundle arranged in a ring in the stem, beginning on the outside . The epidermis provides protection; the cortex food storage; the phloem food solvent movement; the cambium phloem and xylem production; the xylem water solution movement, and the central pith additional food storage.

Woody dicot stems are usually arranged in concentric circles with the most conspicuous and abundant tissue being the secondary xylem located in the older "heartwood" in the center. The annual growth rings represent yearly xylem growth and may be traversed by lateral ray cells. The younger functional wood "sap wood" is close to the surface and is made up of xylem, cambium and phloem. Also present on many plants outside the phloem is a cork cambium which produces cork cells on the outer surface and phelloderm cells in the inner surface. Cork cells contain suberin, a waterproof fatty substance, to protect against moisture formation and also to allow for lenticel formation to permit gas exchange.

Monocot stems have their vascular bundles scattered and contain neither vascular cambium nor cork cambium. The food storage areas are not divided into pith and cortex but are called either ground or fundamental tissue. Sclerenchyma tissue surrounds each vascular bundle. These bundles as well as a band of sclerenchyma and thick parenchyma tissue beneath the epidermal surface aid in stem stability.

Stem modifications may be found both above and below ground. Above ground modifications include: crowns immediately above ground which include parts of roots and stems; stolons running along the ground which are horizontal stems with long internodes; and tendrils which may be aerial and aid stem stability. Below ground modifications include: rhizomes, which are stems that grow horizontally to the surface; bulbs, which may be disc shaped or flattened stems; corms, which are fleshy short stems with few nodes; and tubers, which are fleshy underground stems.

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INFORMATION SHEET #6

Root Summary

Plant roots perform the principle functions of water and nutrient absorption, plant anchorage, and conduction of absorbed materials. Roots may comprise 50% of a plant's weight and develop from the radicle of the germinating seed. Roots differ from stems by the lack of nodes or internodes. Plants may have taproots with branch roots, fibrous roots which are all approximately the same size, or a combination of the two. All three may develop adventitious roots as they mature. Developing young roots are frequently divided into four regions: the root cap, located at the tip and providing protection for the growing region; a region of cell division, located immediately behind the root cap in which the apical meristem divides into the protoderm, procambium, and ground meristem; a region of elongation in which the divided cells lengthen and become thinner; and a region of maturation where the cells mature into primary tissue.

In the region of maturation the epidermis, from the protoderm, may develop protuberances, known as root hairs, which increase the absorption surface area. Next, the cortex, from the ground meristem, has as its inner boundary the endodermis. The endodermis is surrounded by a one cell wide casparian strip, a surerized cylindrical band, which prevents water passage and forces all solution through the endodermal protoplast. The pericylce, internal to the endodermis, represents the outer boundary of the vascular bundle, separating it from the procambium. The pericycle has differentiated from the procambium and gives rise to vascular or cork cambium or branch roots. The vascular bundle in cross section of most dicot roots shows a solid xylem core that is star shaped with three to several arms. The phloem develops in discrete patches between the arms. As secondary tissue is added the familiar concentric circles form. The vascular bundles of monocots will contain the center pith and be similar to stem tips.

Root modifications include aerial roots such as photosynthetic prop roots and sucker roots, as found on clinging ivy. Pneumatophores facilitate respiration in plants growing in swamps, and serve as food storage roots in plants such as sweet potatoes. Contractile roots, found on dandelion, ginseng, and some corms, pull the structure deeper into the ground. Buttress roots aid plant stability. Another example is mycorrhizae which are short roots and represent an association with a soil-borne fungus. A final example is the nitrogen-fixing bacteria found in nodules on roots of legumes and alders.

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INFORMATION SHEET #7

Leaf Summary

The plant leaf is covered with a transparent epidermis that admits light to the interior and allows for the manufacture of food through the process of photosynthesis. The lower and sometimes the upper surfaces are perforated with stomata which allow air circulation needed for photosynthesis in addition to respiration, transpiration, and waste removal.

The tissues of which the leaf is comprised may be divided into three groups. The epidermis occurs as a single layer and a thin cuticle covers both upper and lower areas. The lower, and often the upper, epidermis is dotted with stoma which are small pores controlled by guard cells that regulate both water vapor and gas exchange. The mesophyll, a unique tissue found only in leaves, is located between the upper and lower epidermis and may be undifferentiated or divided into the palisade layer, two rows of tightly packed parenchyma cells rich in chloroplasts and the lower spongy layer, loosely packed parenchyma cells that provide area for gas exchanges from transpiration and photosynthesis. Veins (vascular bundle) traverse the mesophyll carrying food products and nutrient solution.

All leaves develop from primordia that is produced by the apical meristem. Most leaves contain a flattened blade that is attached to the stem by a petiole. The exceptions to this include the gymnosperms (conifers) which have needle-like leaves and stomata in longitudinal rows and the monocots which contain a sheath and ligule. Leaves may be pinnate or palmate.

Leaves may be modified in association with specific environmental factors. Tendrils aid in the support of vining plants; floral showy leaves (bracts); spines to reduce leaf surface and give protection; and thickened leaves, reduction of the number of stomata, water storage leaves, or no leaves at all in arid regions.

Leaves provide showy color in the fall because the green chlorophyll breaks down allowing other pigments or water-soluble anthocyanin and betacyanin, that can be red or blue and has accumulated in cell vacuoles, to show through. Leaves fall from deciduous trees, normally at the same time, when environmental changes allow the hormone that inhibits the formation of the abscission layer to fall below a certain level. The abscission layer consists of a protective layer of suberized cells, which produce a waterproof fatty substance suberin, and a separation layer of cells that allow the petiole to no longer be attached to the stem.

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INFORMATION SHEET #8

Outline of Absorption and Transport Systems

A. Water moves within the plant toward a location where the water potential (pure water has the highest potential) is low (the more of a substance added to water the lower the potential); toward any region where solution concentration is rising or where water is being removed.

B. Osmosis is the movement of water across a differentially permeable membrane and occurs when the solutions on the two sides of the membrane have different potentials.

C. Turgor pressure is the outward pressure exerted on the cell wall by crowded molecules within the cell. The cell wall is a dilute carbohydrate salt solution. The protoplasm is a more concentrated solution, therefore the potential is lower and water moves across the plasmalemma by osmosis.

D. Diffusion is the movement of molecules from an area of higher concentration to an area of lower concentration. Diffusion proceeds from wet areas to dry areas. Thus, water vapor is lost during transpiration.

E. Cohesion is the attraction of like molecules for each other, such as water. Adhesion is the attraction of unlike molecules for each other, such as water droplets adhering to a windshield.

F. Water molecules and molecules of nutrients in the soil solution enter root hair cells, pass through the cortex, are filtered by protoplasms of the endodermal cells, cross the pericycle, and enter the primary xylem. Absorption is by diffusion, cohesion, adhesion, osmosis.

G. Roots do not search for water, they only grow in moist soil in a geotropic fashion.

H. Transpiration (water vapor loss from the leaf) - pull theory states that evaporation of water from the leaf pulls the solution up through the xylem. Cohesion (of water to each other) and adhesion (to the xylem wall) aid in preventing the water column from breaking under tension.

I. When no transpiration takes place water may move into the xylem by osmosis, creating a positive root pressure to push water up the plant. An example is when a stem is cut off and sap runs out the top of the stem.

J. Minerals move passively through the roots with the water flow until membranes are met, then the carriers control the movement through the membranes.

K. Carbon dioxide is absorbed from the air through the stomata and reaches leaf cells through the intercellular spaces, especially the spongy mesophyll. Gas exchange occurs in limited manner through the lenticels in the cork.

L. Stomata are opened and closed by pumping potassium ions into and out of the guard cells, which raises and lowers the turgor pressure. Water follows the ions by osmosis. Light exposure and CO_2 depletion stimulate the stomata to open. High turgor pressure causes the thinner rear membrane of the guard cell to bend out, pulling the thicker front adjacent membranes apart.

M. O_2 absorption occurs from the air at night and the roots usually absorb O_2 from the soil atmosphere.

N. The mass flow theory of organic solute movement through the phloem states that the solution moves en masse from areas of high turgor pressure to areas of low turgor pressure. High turgor pressure comes from pumping of sucrose into sieve-tubes, followed by water entry by osmosis. The opposite happens in a low pressure area. (Sucrose is taken into cells for respiration followed by water.) Another rate conrol may be the size of sieve pores controlled by enzymes.

INFORMATION SHEET #9

Outline of Photosynthesis and Respiration

A. Photosynthesis is the primary energy-storing process of life. Light is converted to chemical energy and stored in organic compounds

B. Photosynthesis requires the presence of light and chlorophyll and combines carbon dioxide and water to produce sugar (glucose) and oxygen.

C. Chlorophyll *a* is the principal chlorophyll pigment, chlorophyll *b*, *c*, *d*, and *e* make it possible for photosynthesis to occur across a broader spectrum of light than can be used by chlorophyll *a* alone.

D. The energy of photons (light) removes electrons from chlorophyll which are used, in addition to hydrogen ions and water, by NADP to form NAPDH. The remainder of the photoelectrons return to the chlorophyll ions after passing along chains of electron carriers. During transport some electron energy is transferred to produce the energy-storing unit ATP.

E. The electrons lost by chlorophyll in constructing NAPDH are replaced by electrons from water. This transfer splits the water molecule to release hydrogen ions (H^+) plus oxygen (O_2).

F. The "light reactions" are those that require light to form ATP, NADPH, and O_2 and occur in the thylakoids in the chloroplasts.

G. In the stoma of the chloroplasts the "dark reactions" occur by using ATP as the energy source. The H and electrons of NADPH are first transferred to organic compounds and these compounds are used in reactions that incorporate CO_2 and produce molecules of sugar.

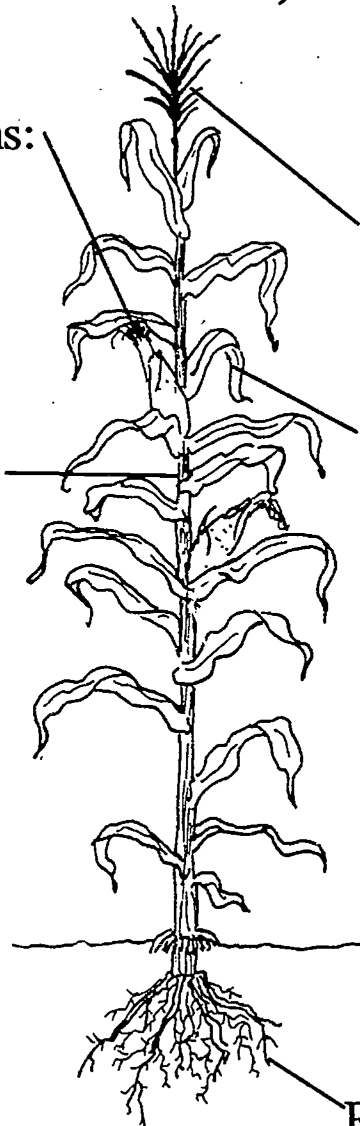
H. The photosynthetic process captures only a fraction of the light energy available and may be limited by the supply of CO_2, light, temperature, minerals, and genetics.

I. Respiration uses the simple sugars produced by photosynthesis for energy and is the energy-releasing process that takes place in the mitochondria of cells. Aerobic respiration uses oxygen; carbon dioxide and water are released as by-products. Anaerobic respiration and fermentation do not use oxygen and release much less energy.

8?3

TRANSPARENCY MASTER #1

Functions of Leaves, Stems, Roots, and Flowers



Female Flower Functions:

a. Reproduction
b. Store food — in seeds and fruits

Male Flower Function:

a. Pollination

Stem Tissue Functions:

a. Conducts water and raw minerals from soil to leaves
b. Conducts manufactured food from leaves to other plant parts
c. Produces leaves and displays them to light
d. Supports leaves, flowers, and fruit
e. Stores food reserves in some plants — Irish potato, asparagus, cabbage hearts, etc.

Leaf Functions:

a. Photosynthesis
b. Transpiration
c. Food storage in some crops — lettuce, cabbage, etc.

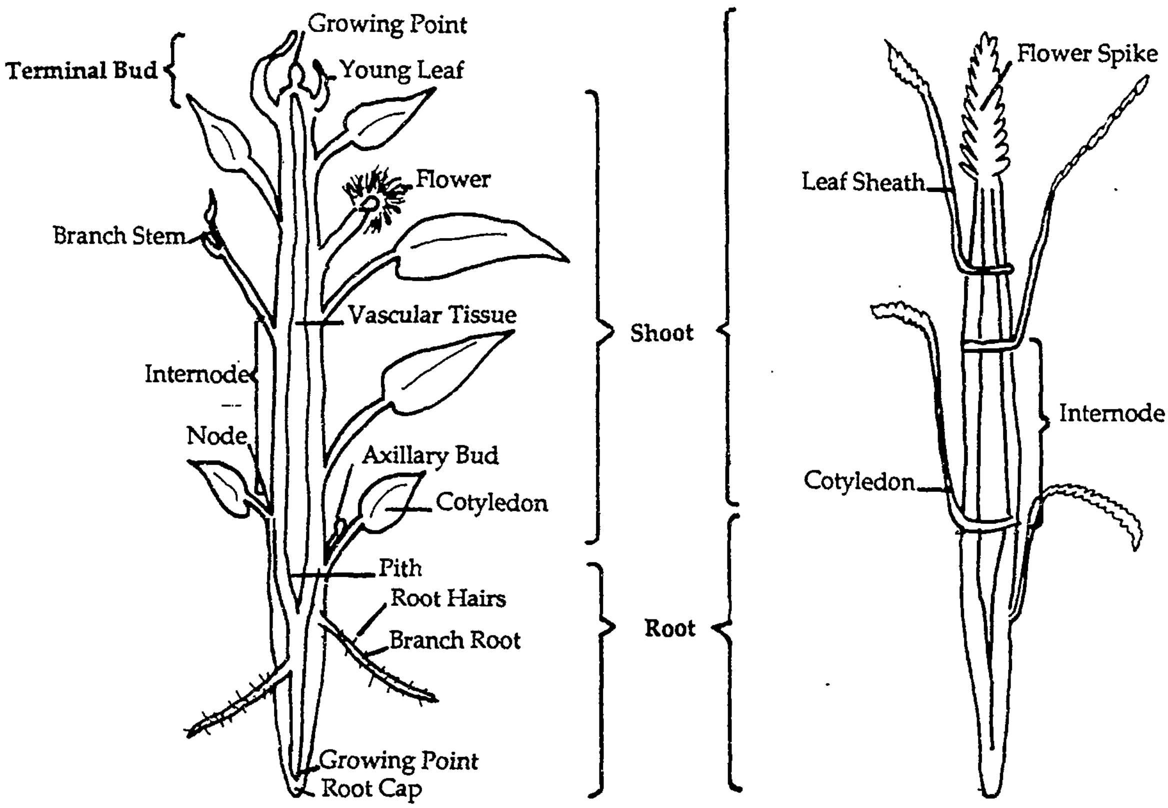
Root Functions:

a. Absorb water and raw minerals
b. Anchor plant
c. Store food reserves in some crops — carrots, beets, turnips, etc.

TRANSPARENCY MASTER #2

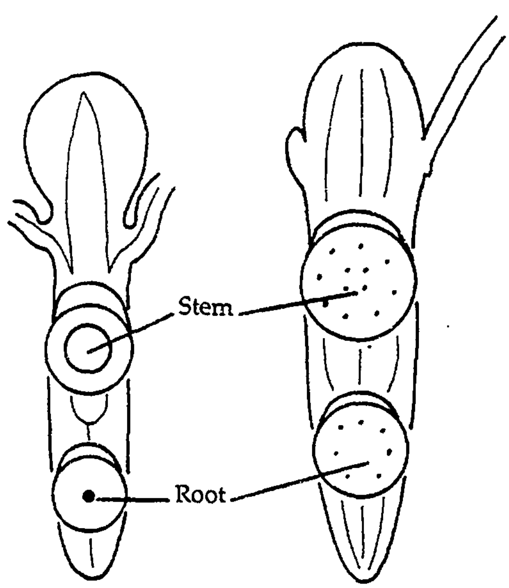
Comparison of Dicot and Monocot Plant Parts

The Cell and Its Components

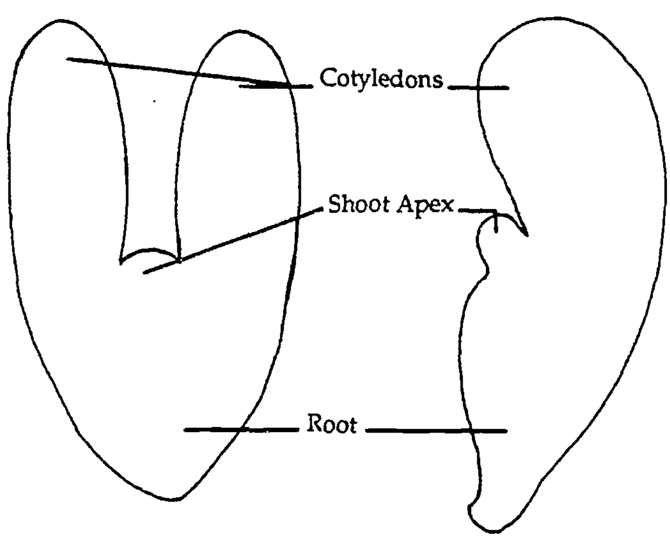


DICOTYLEDON

MONOCOTYLEDON



Cross Section

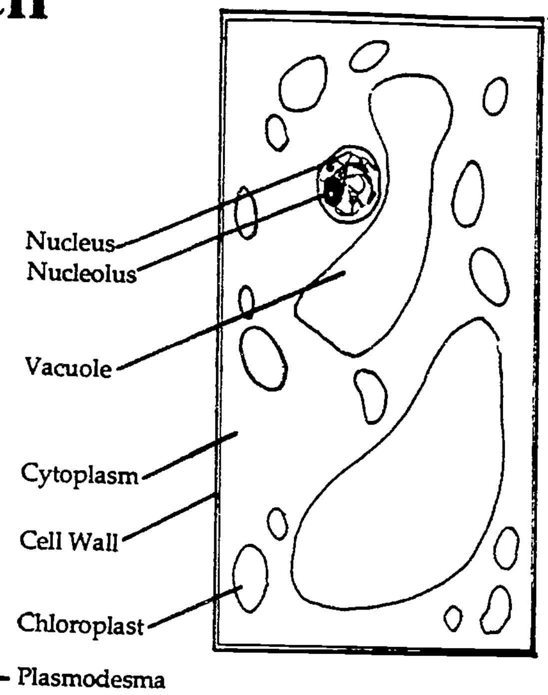


Embryo

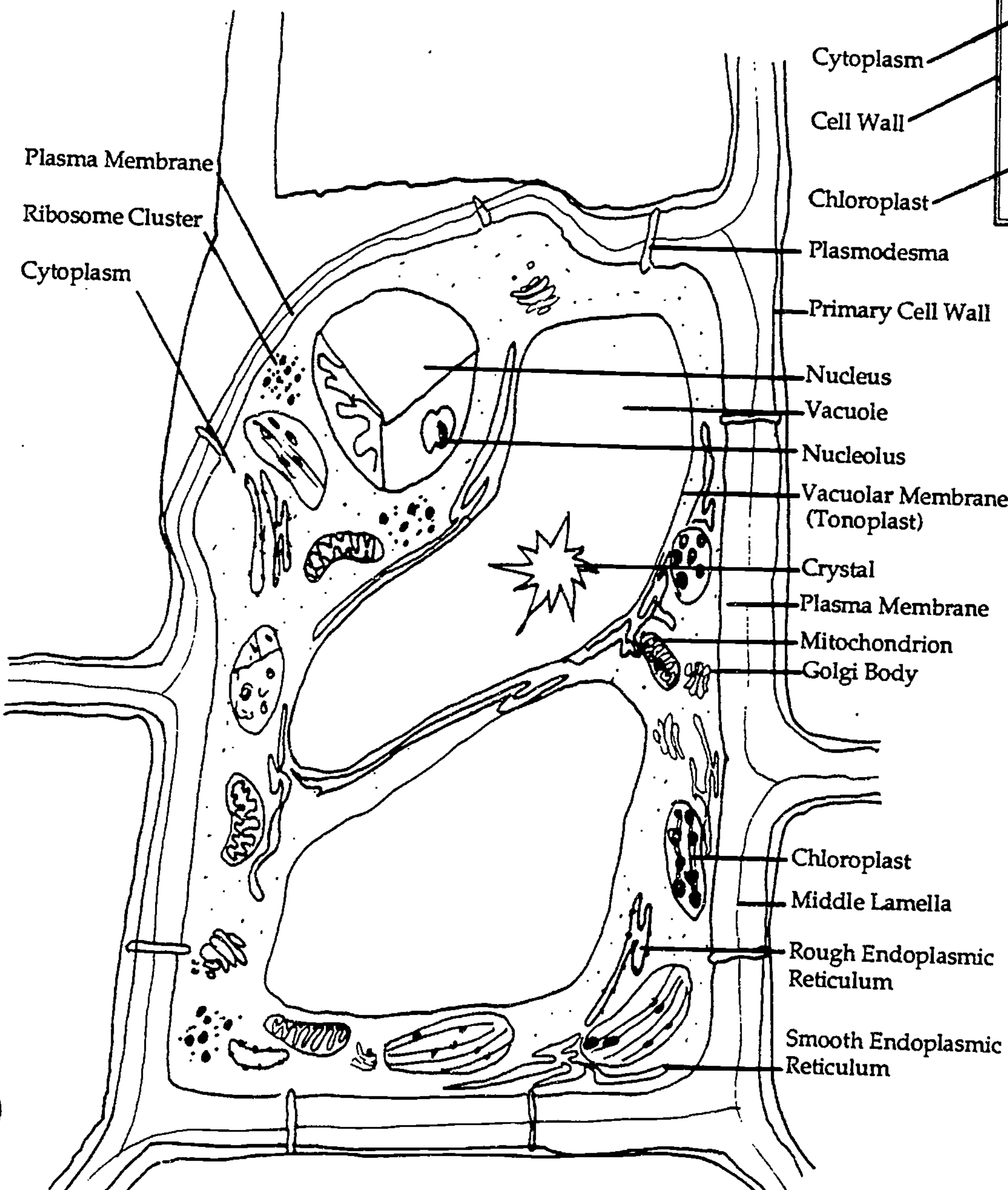
TRANSPARENCY MASTER #3

Plant Cell

A. A leaf cell diagrammed with the aid of a light microscope. B. The same cell greatly enlarged to show submicroscopic features.



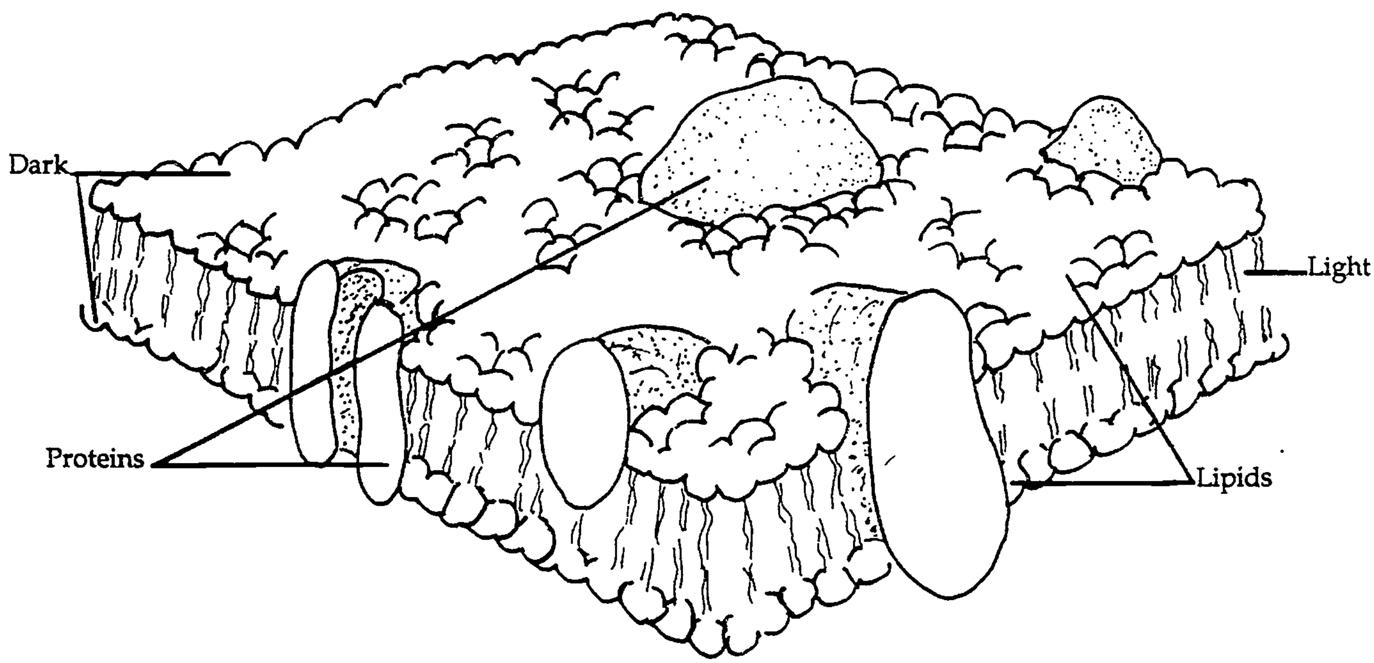
A.



B.

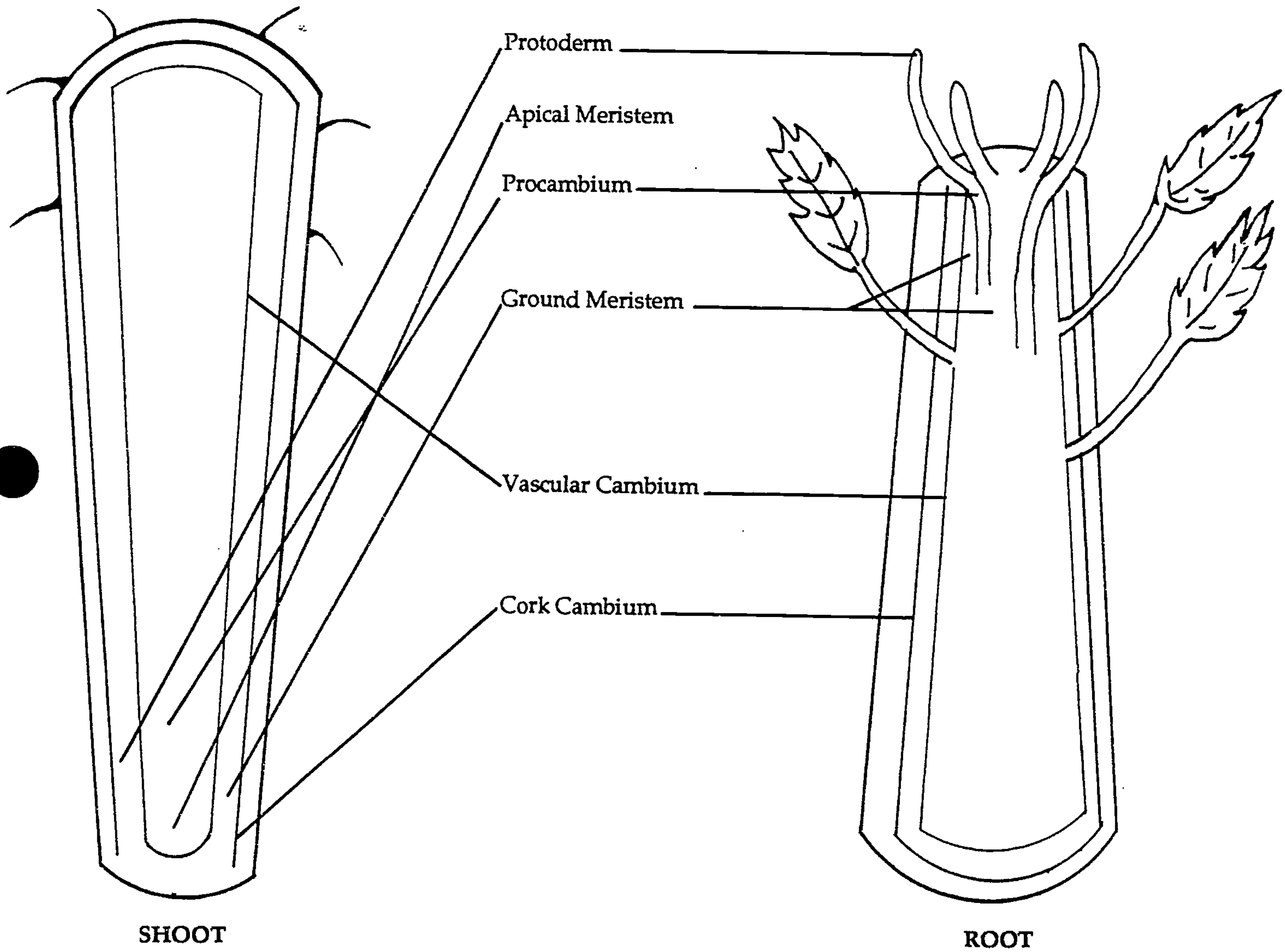
TRANSPARENCY MASTER #4

Cell Wall of Plants



TRANSPARENCY MASTER #5

Plant Meristems



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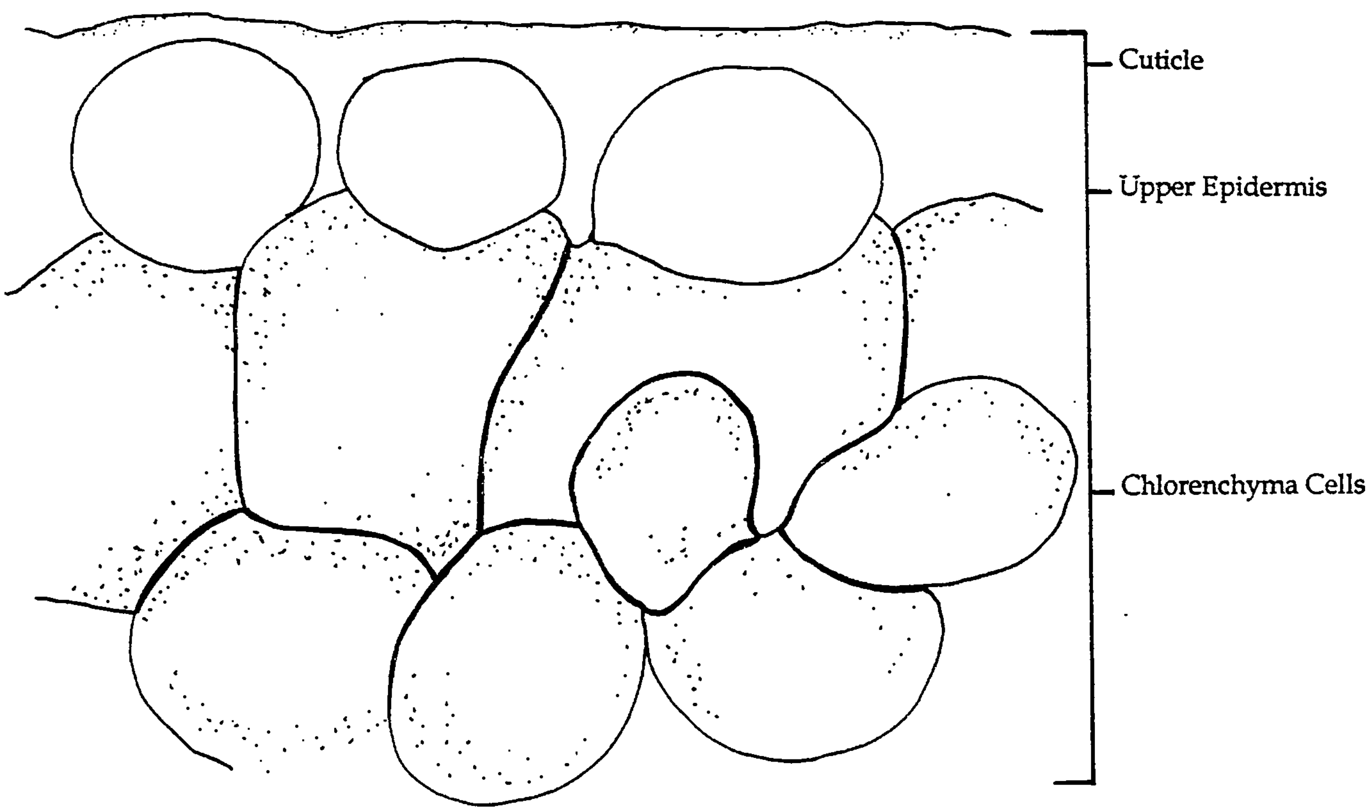
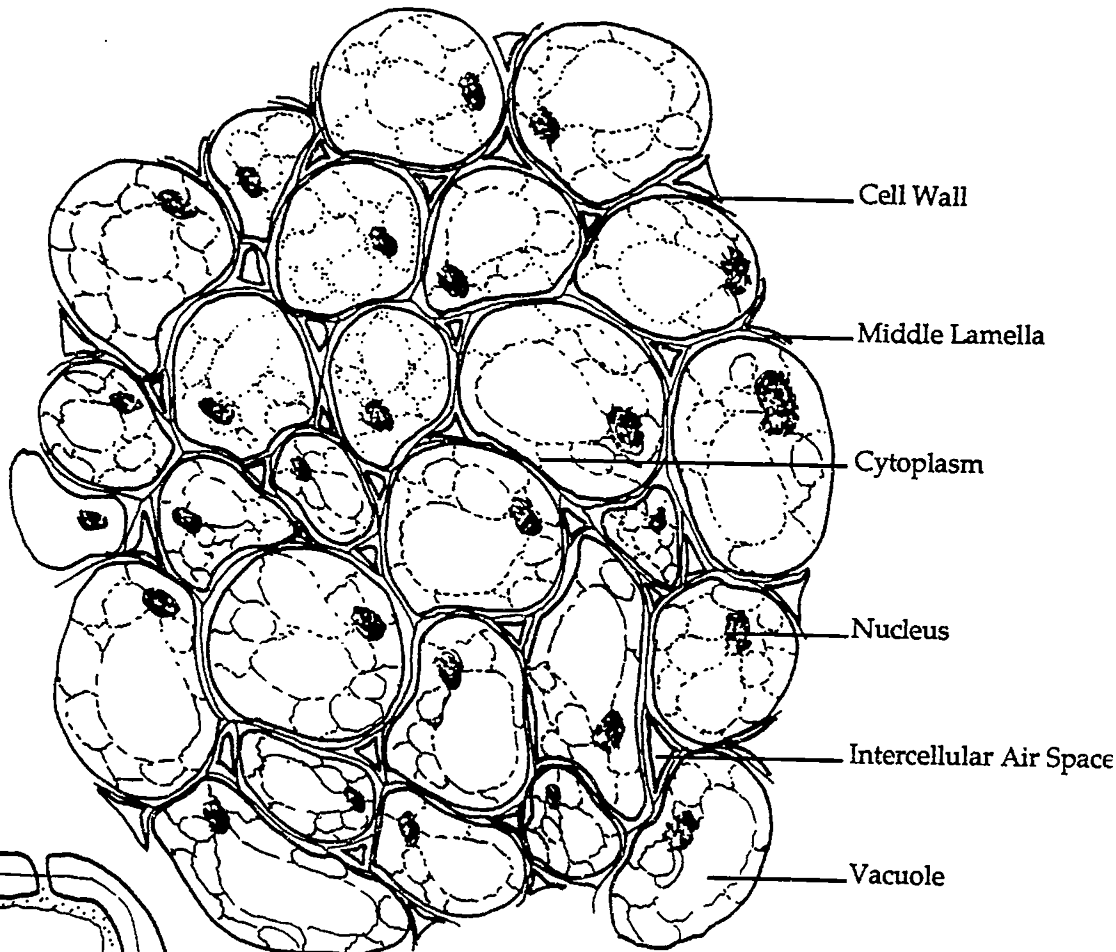
TRANSPARENCY MASTER #6

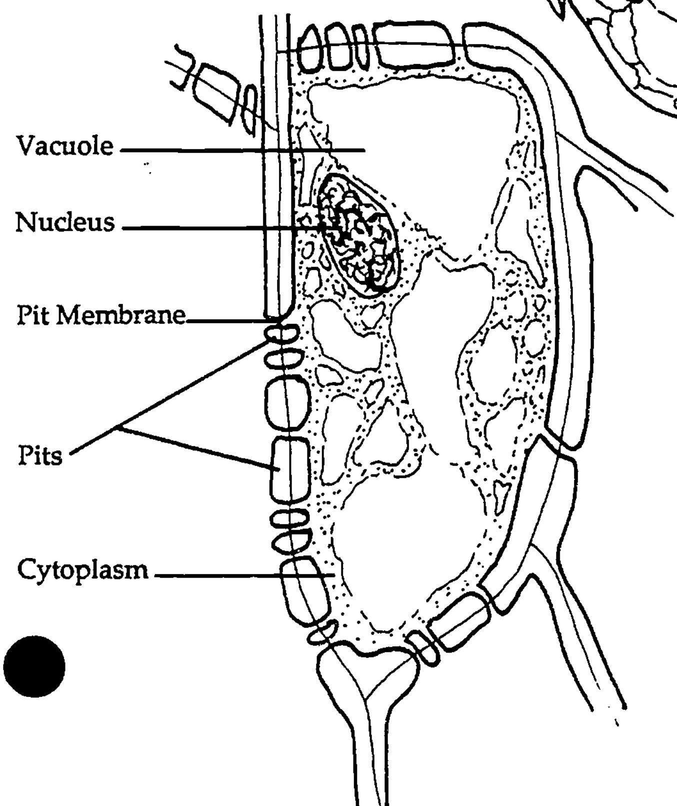
Epidermal Cells



TRANSPARENCY MASTER #7

Parenchyma Tissue

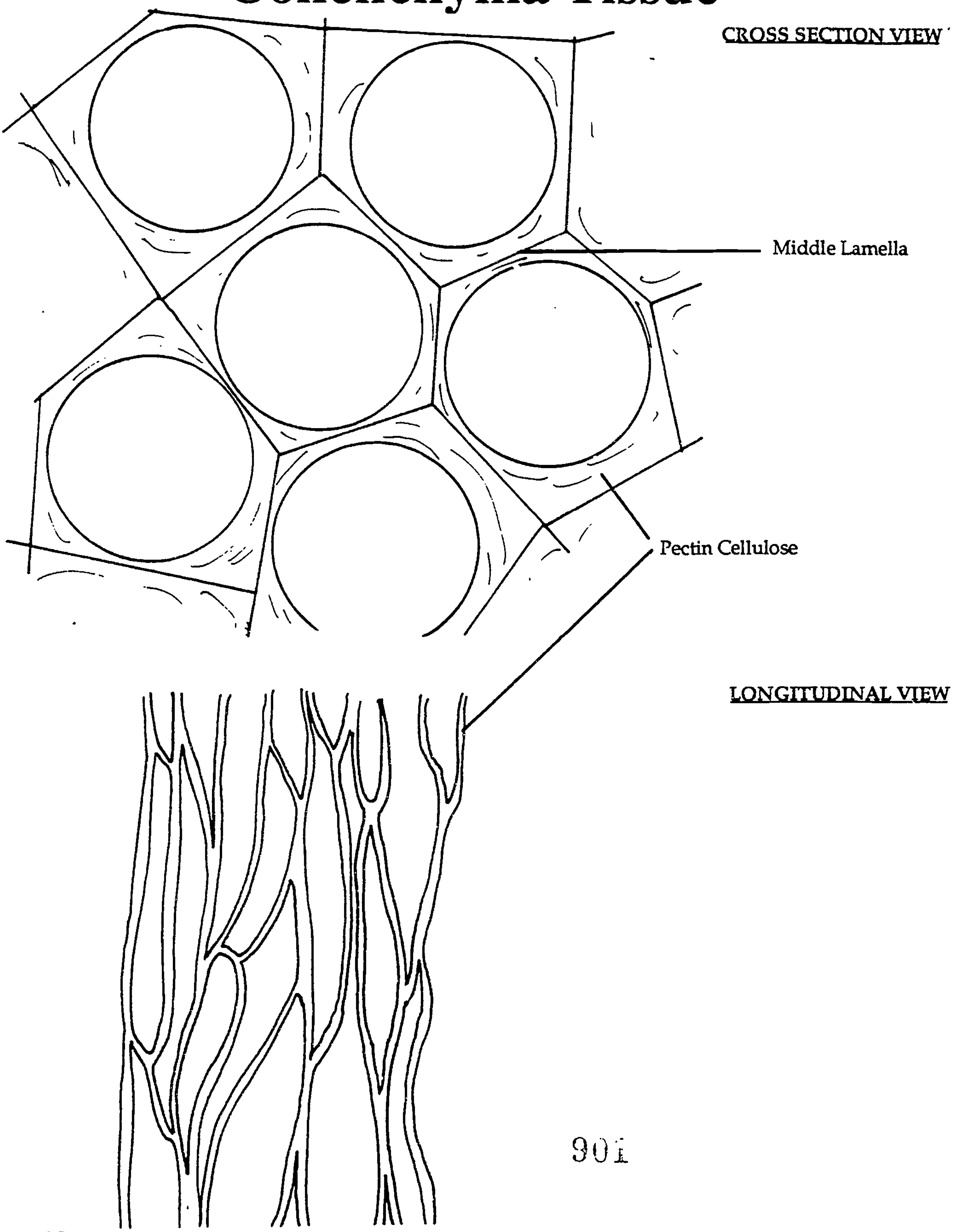




A. Aerenchyma type: contains air spaces.
B. Woody type.

TRANSPARENCY MASTER #8

Collenchyma Tissue



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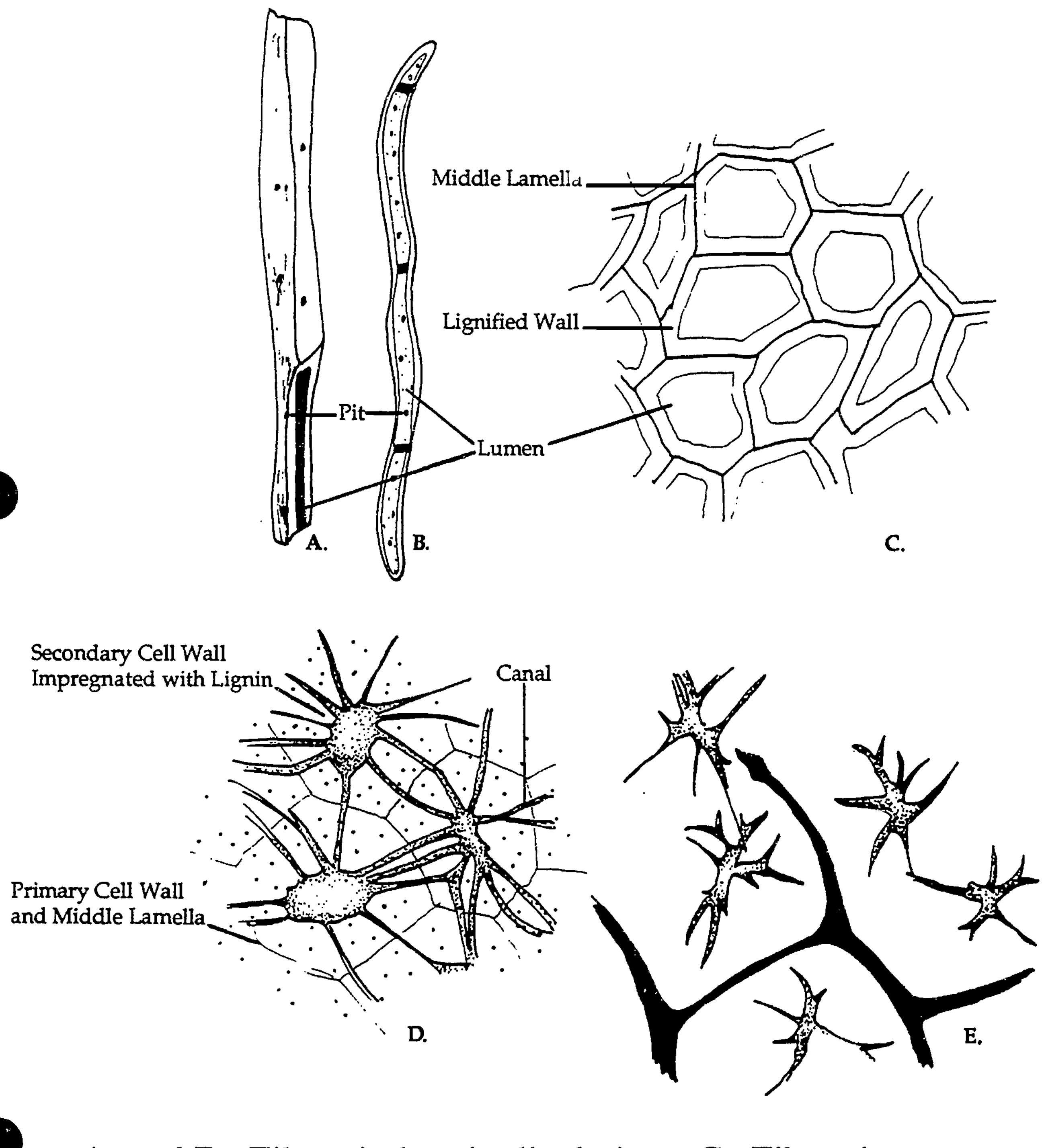
TRANSPARENCY MASTER #9

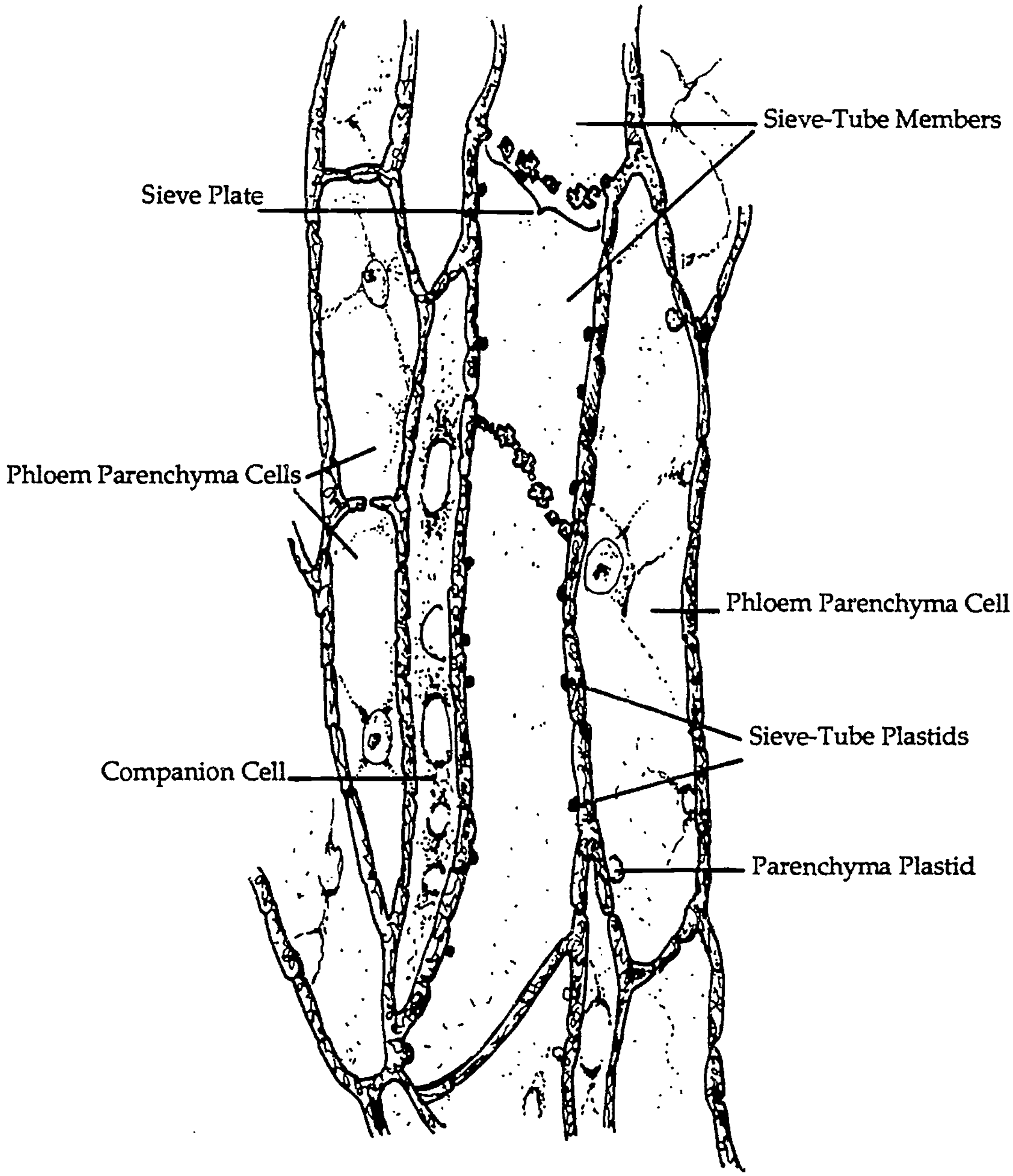
Sclerenchyma Tissue



A. and B. Fibers in longitudinal view. C. Fibers in cross section. D. Stone cells of pear. E. Sclereid in wheat leaf.

TRANSPARENCY MASTER #10

Phloem Tissue



Phloem tissue from the stem of tobacco (*Nicotiana*).

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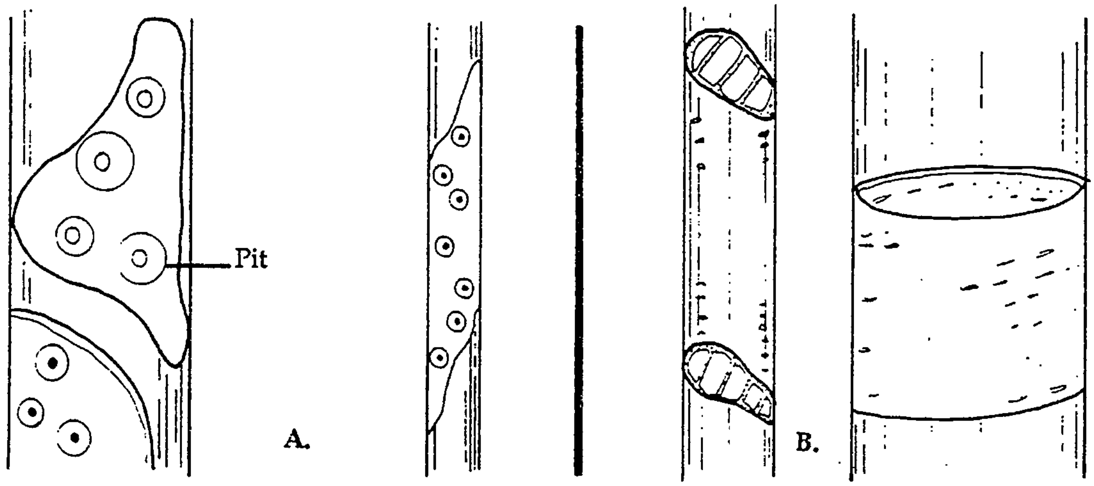
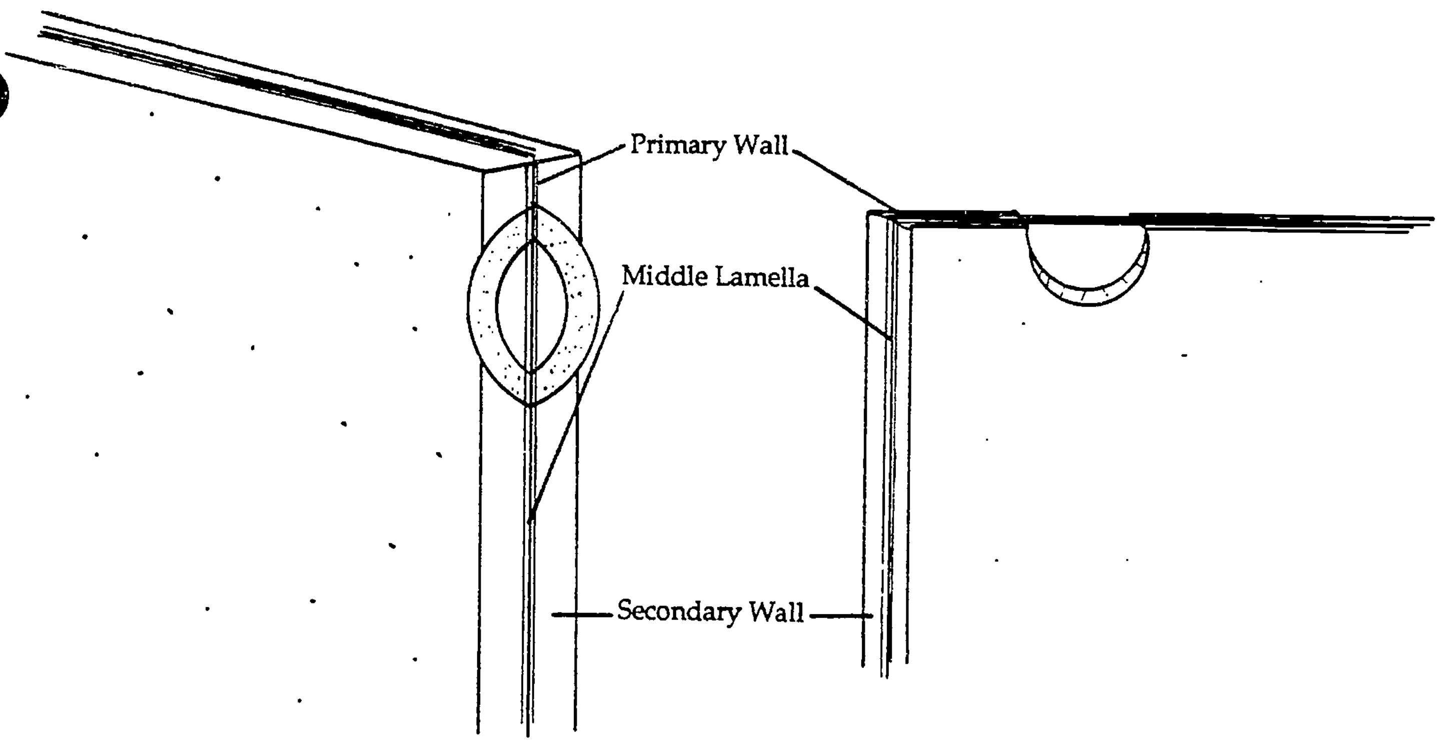
TRANSPARENCY MASTER #11

Tracheid, Vessels, and Pits



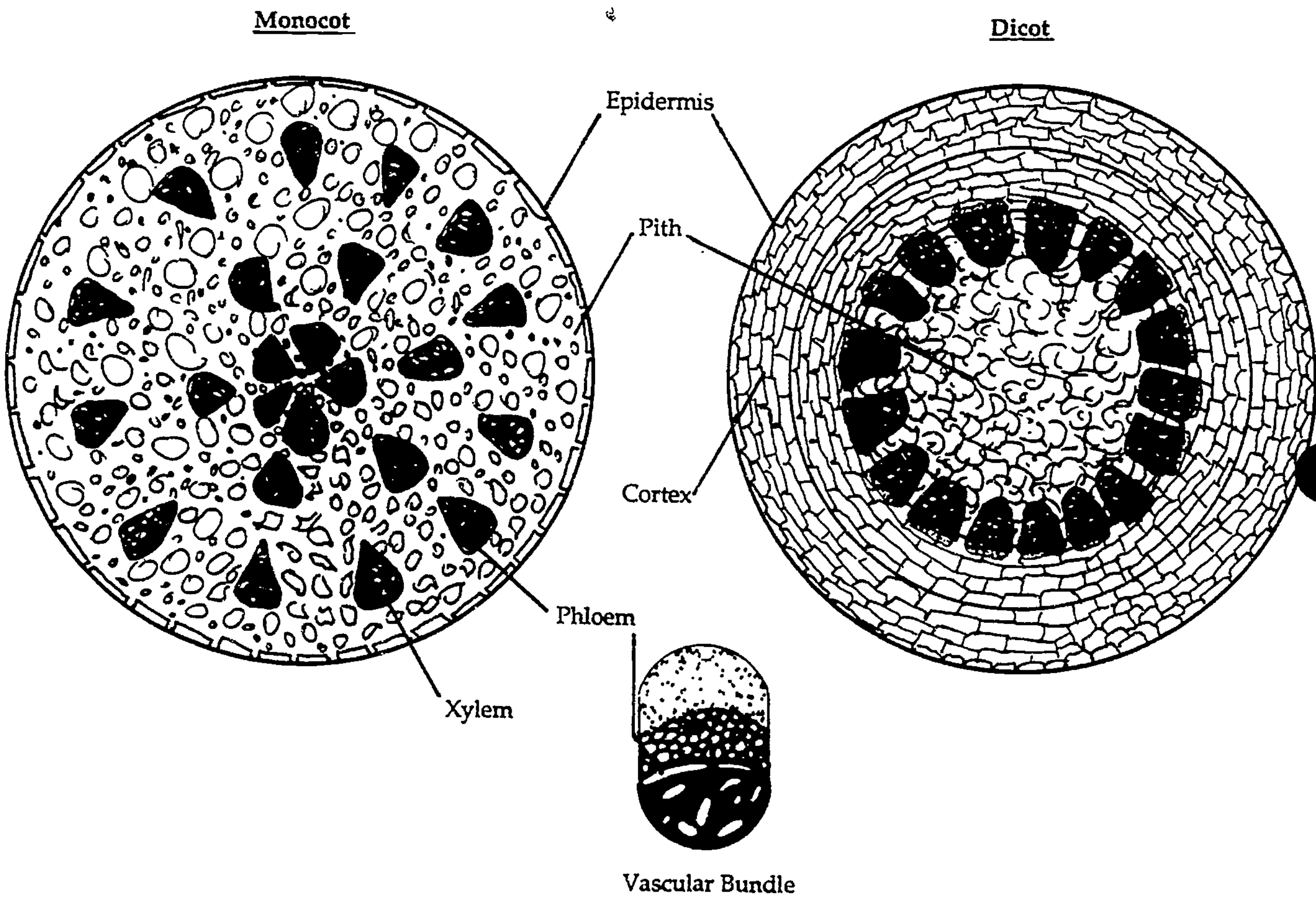
Lengthwise views of water-conducting cells of A. Tracheids B. Vessel elements.



Pits are depressions or cavities in cell walls where the secondary wall does not form and allows for water passage from cell to cell. There may be from one or two to several thousand in a cell. They always occur in pairs, with one on each side of the middle lamella. Some, called *bordered pits*(left), bulge out from the wall and resemble doughnuts in surface view, while others, called *simple pits* (right), do not bulge.

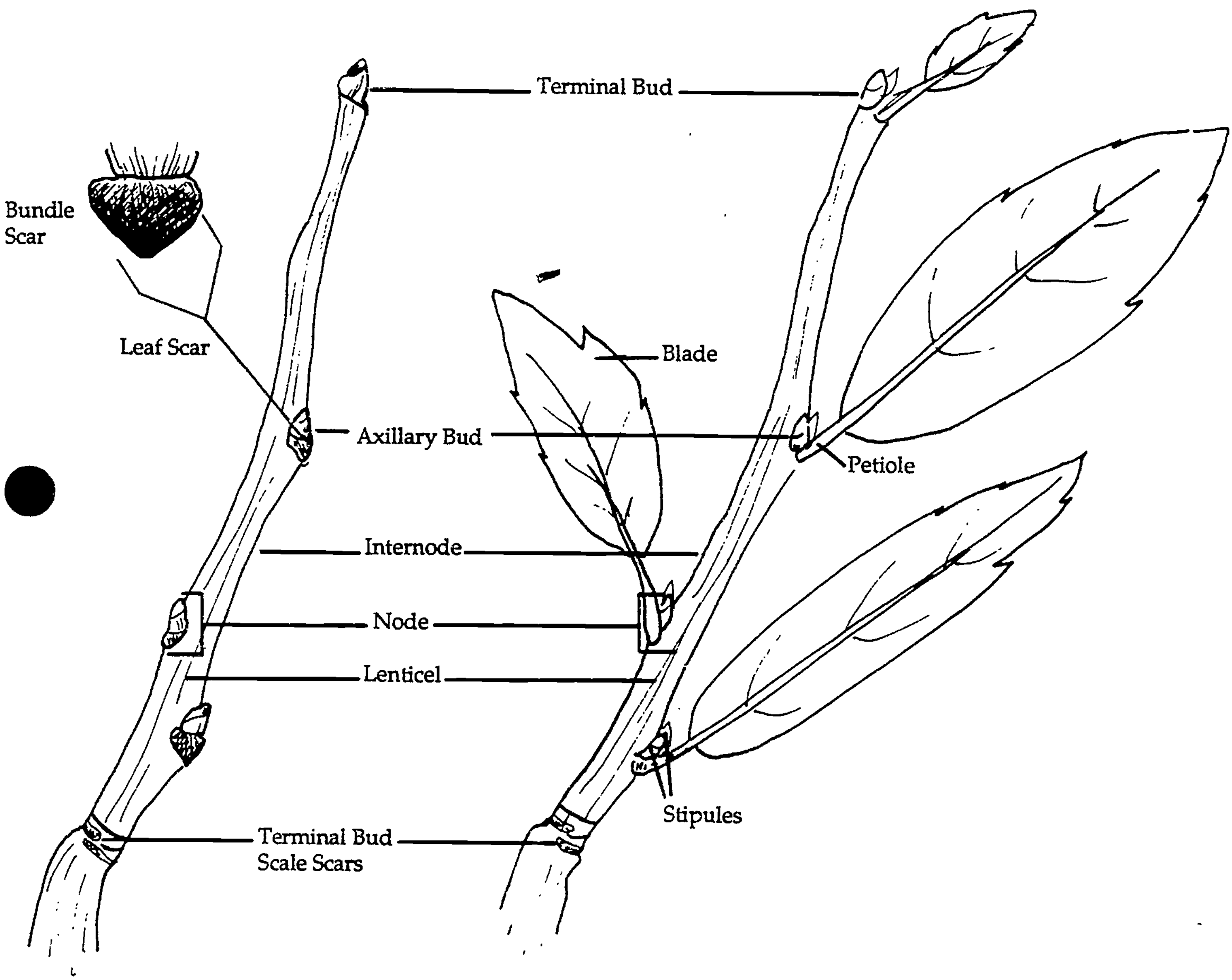
TRANSPARENCY MASTER #12

Arrangement of Tissue in Stems



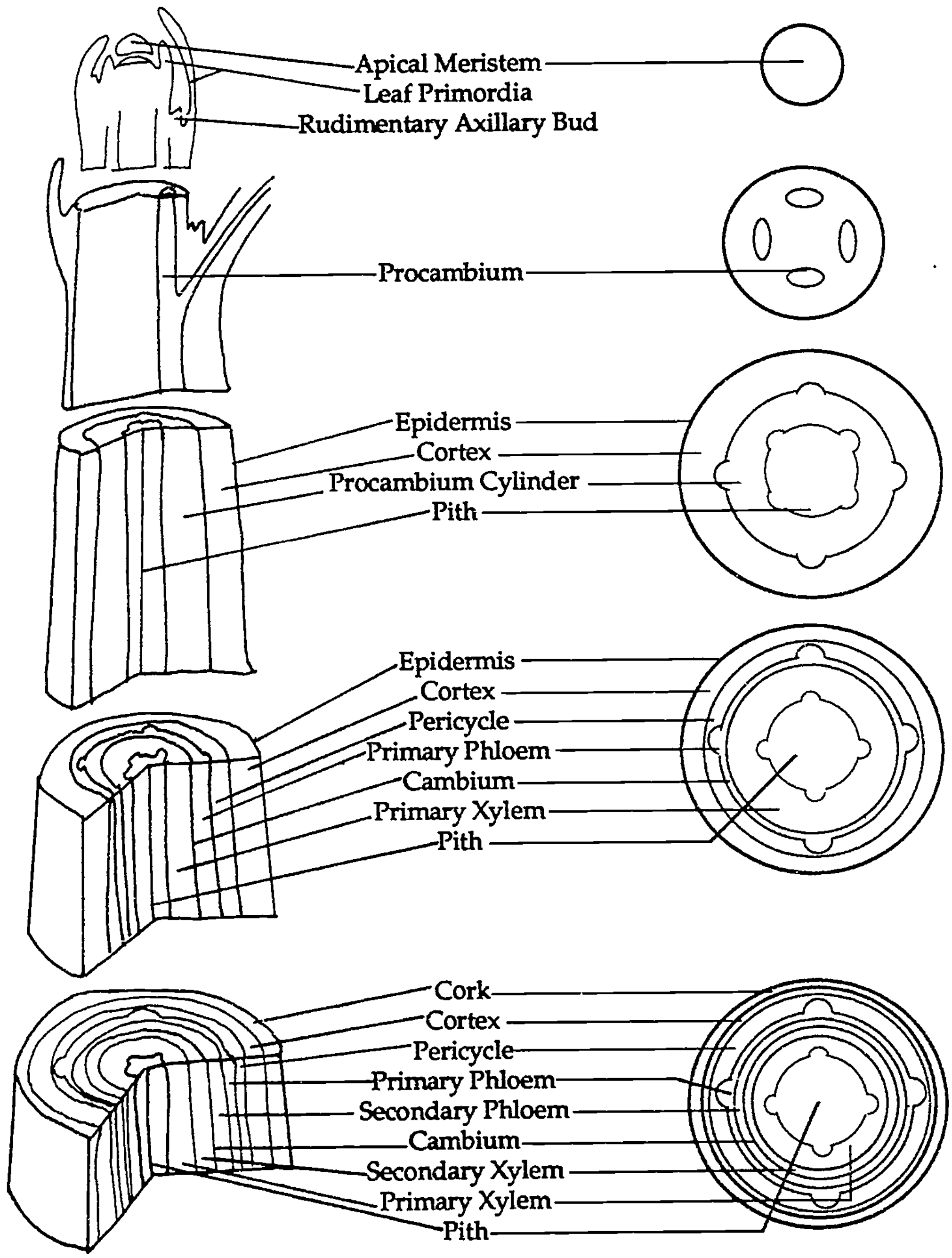
TRANSPARENCY MASTER #13

Stems



TRANSPARENCY MASTER #14

Stem Cross Section



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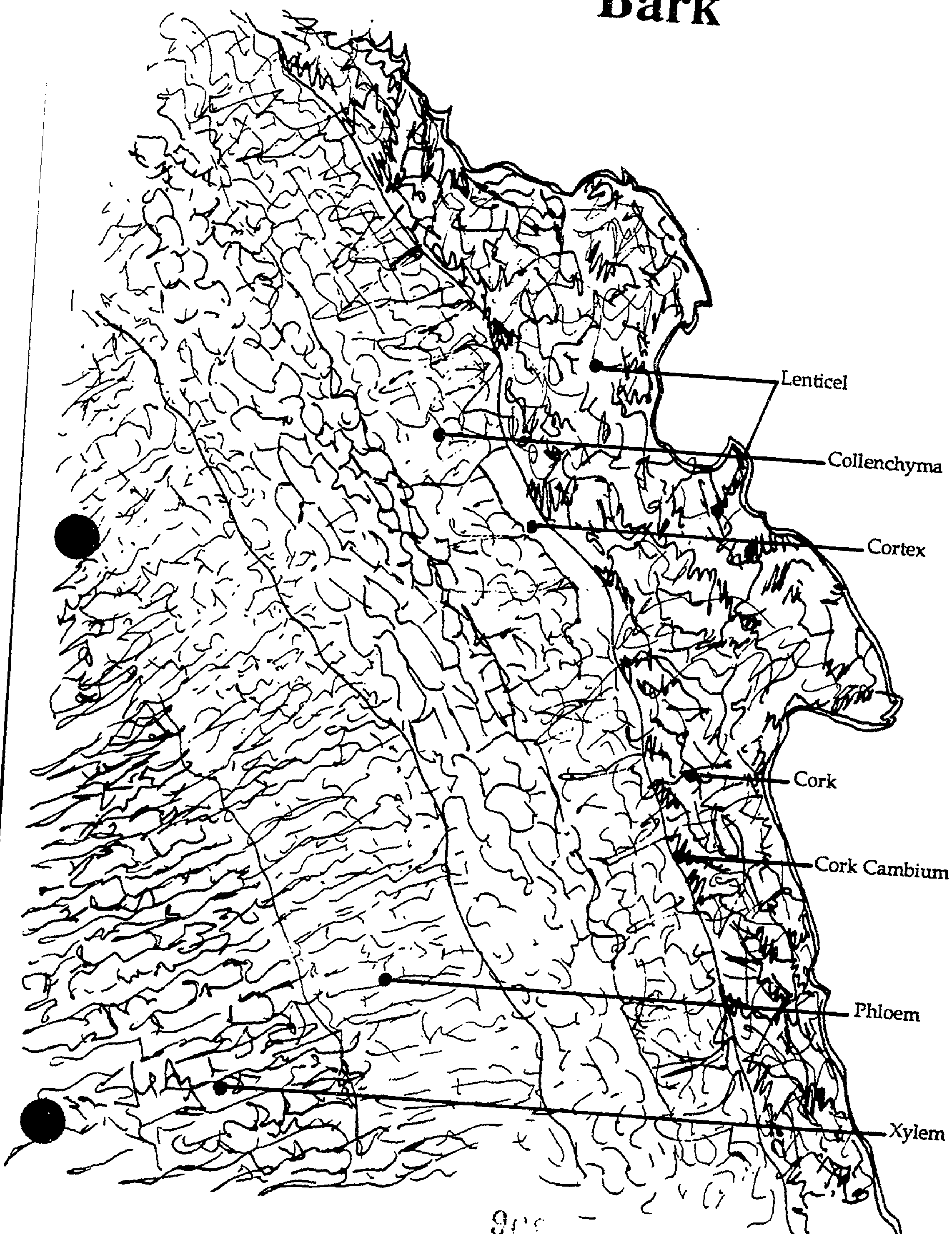
TRANSPARENCY MASTER #15

Bark



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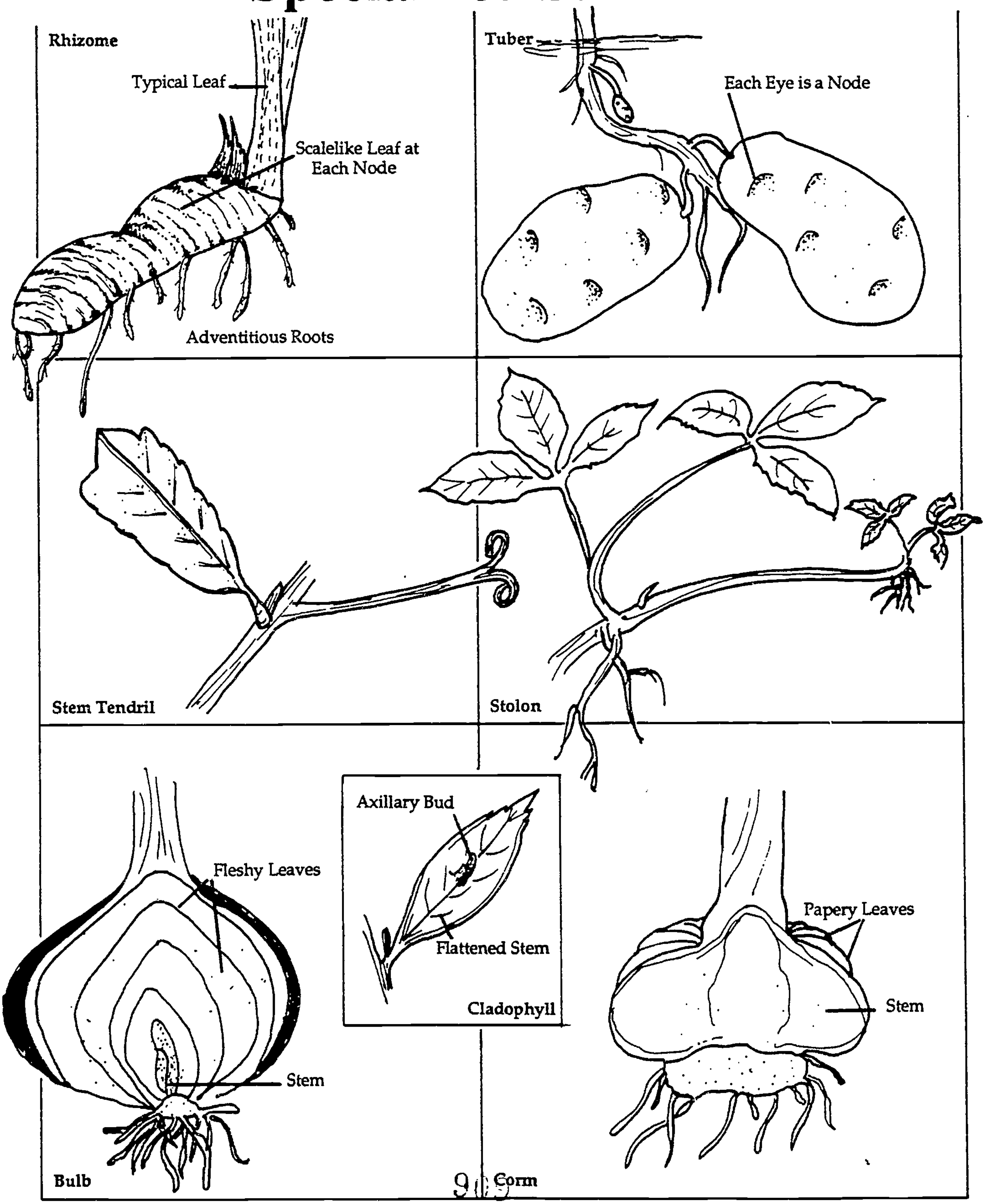
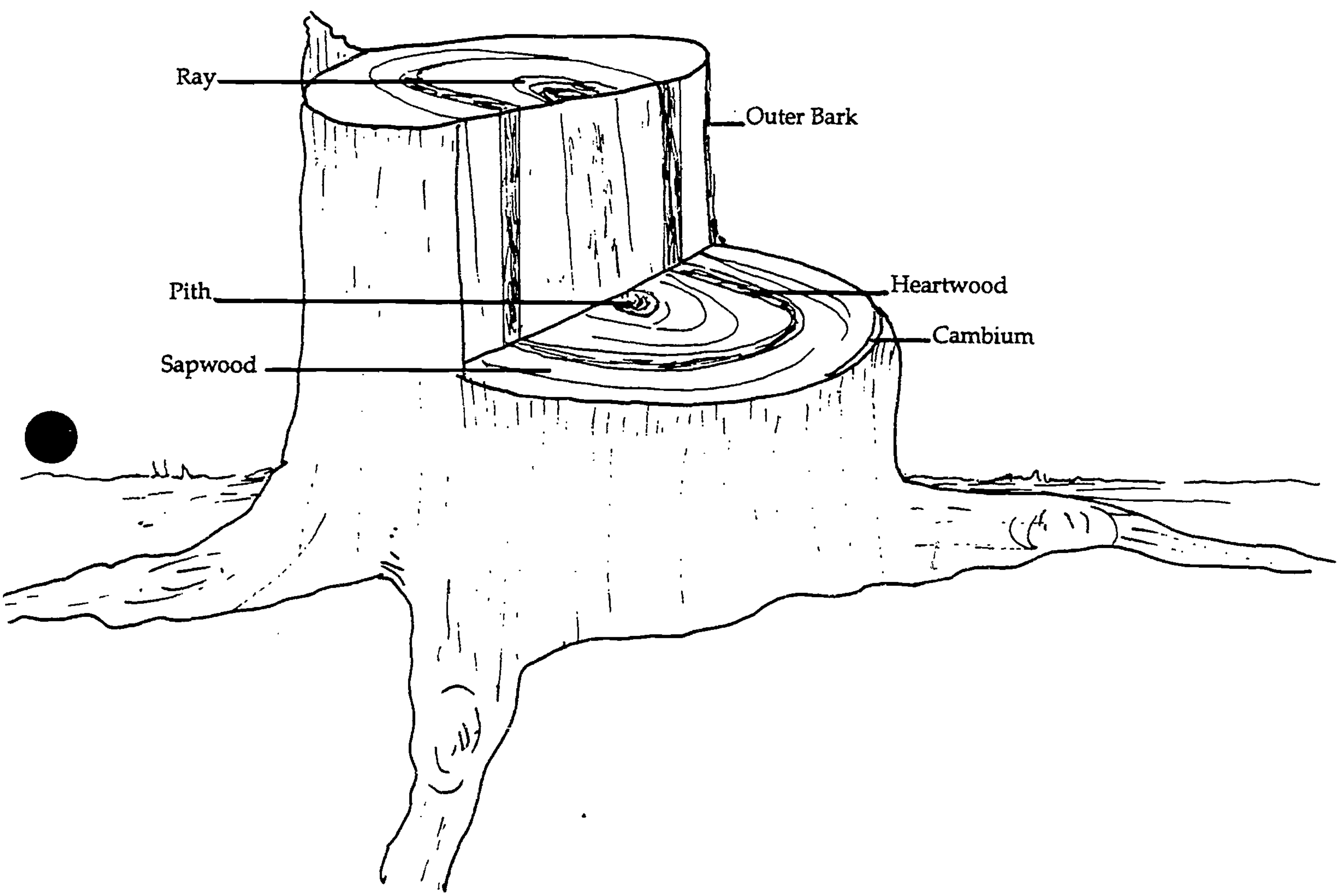
TRANSPARENCY MASTER #16

Specialized Stems



TRANSPARENCY MASTER #17

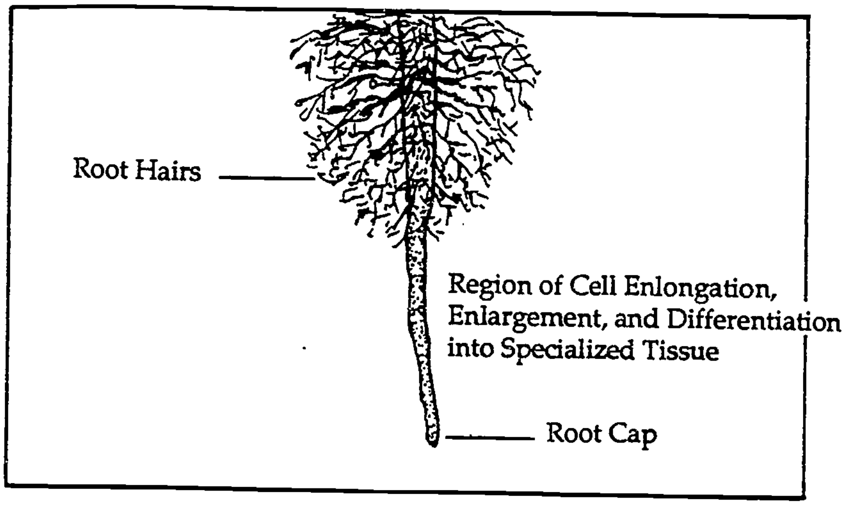
Cross Section of a Tree



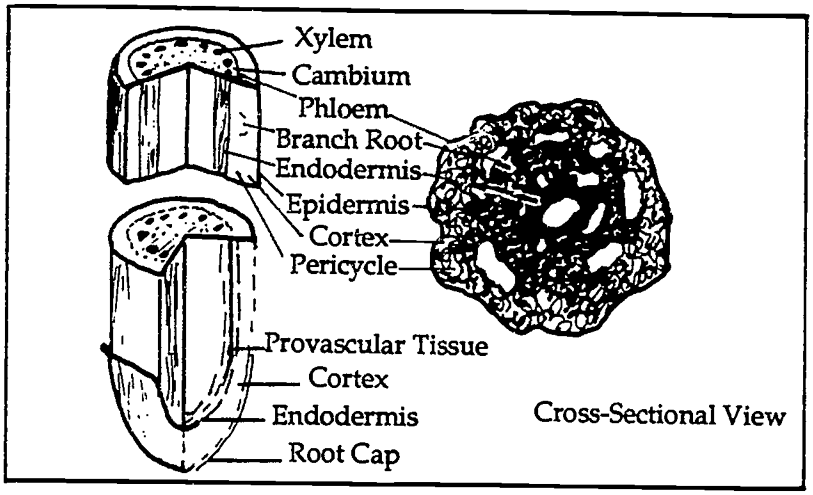
TRANSPARENCY MASTER #18

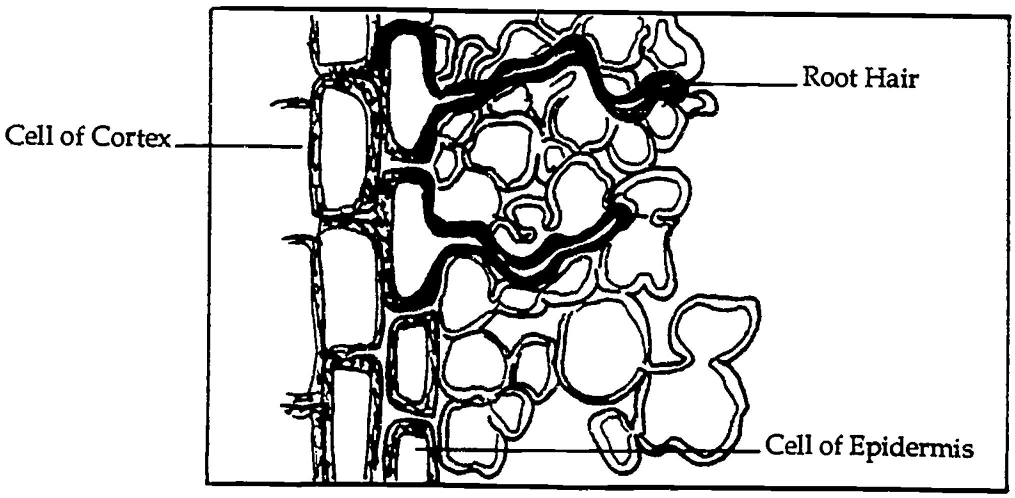
Roots

Plant Root



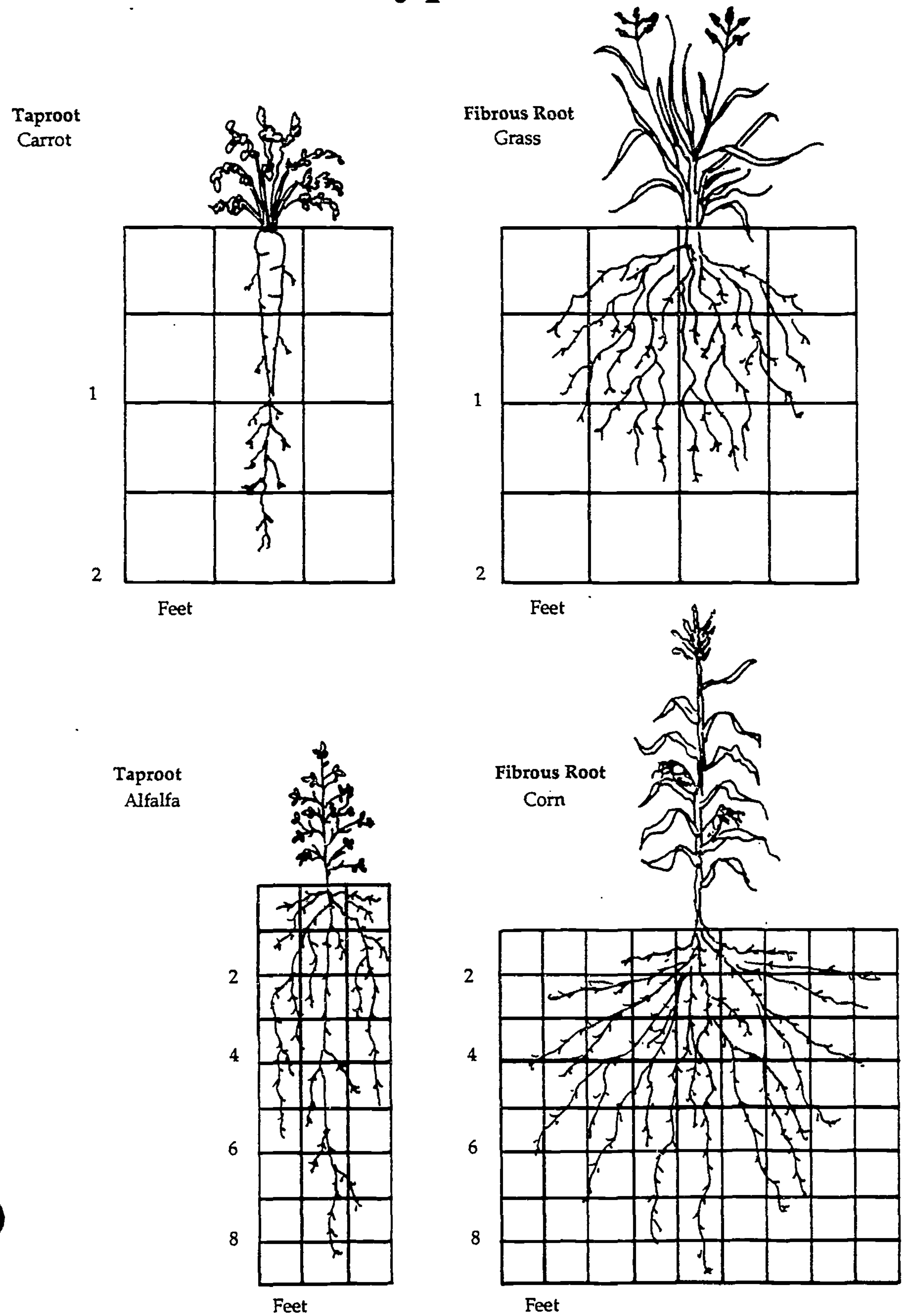
Plant Root





TRANSPARENCY MASTER #19

Types of Roots



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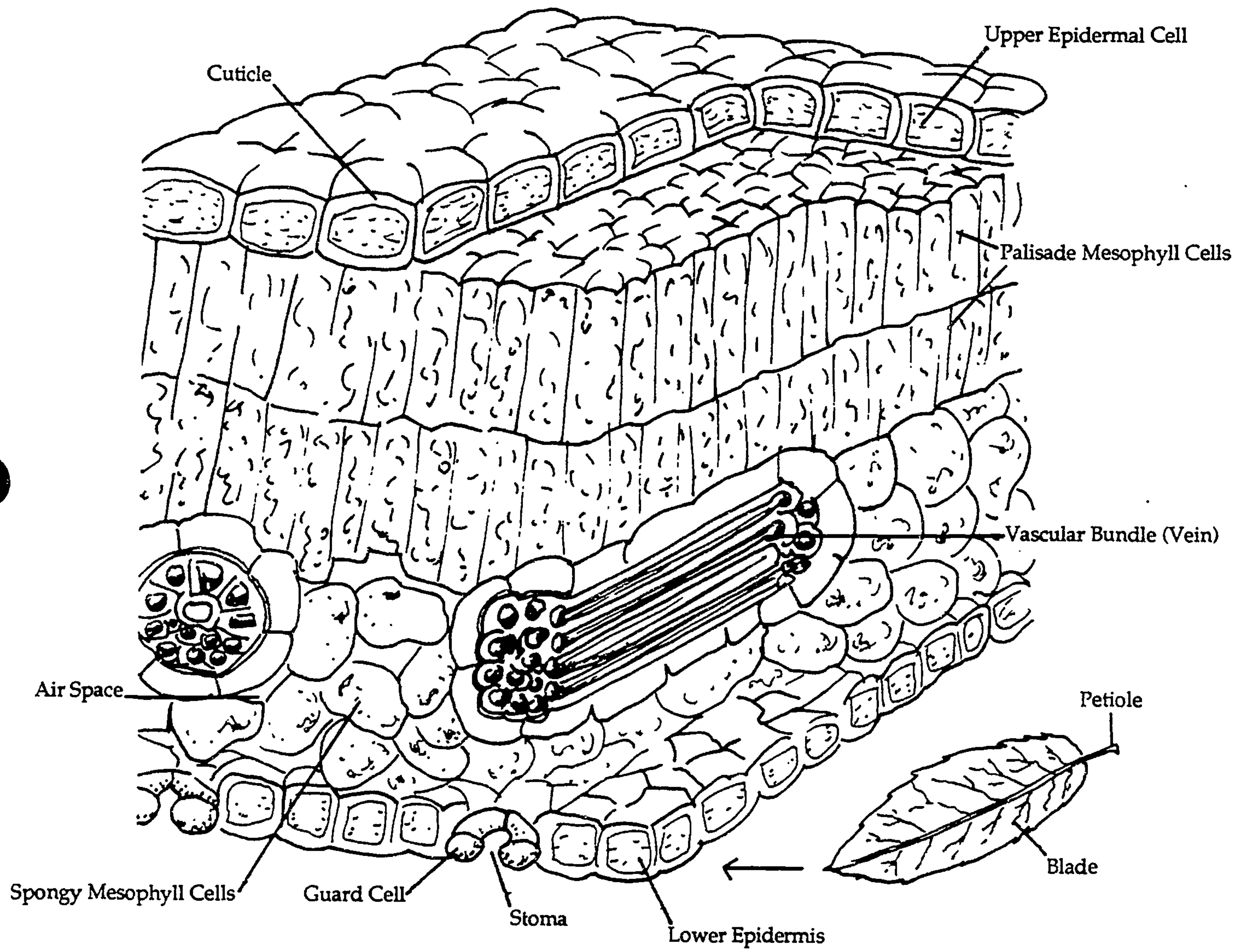
TRANSPARENCY MASTER #20

Leaf Types

Types of leaves and leaf arrangements. A. Palmately compound leaf of a buckeye. B. Pinnately compound leaf of a black walnut. C. Alternate, simple but lobed leaves of a tulip tree. D. Opposite, simple leaves of dogwood. E. Palmately veined leaf of a maple. F. Globe-shaped succulent leaves of string-of-pearls. G. Pinnately veined, lobed leaf of an oak. H. A grass leaf. I. Whorled leaves of a bedstraw. J. Linear leaves of a yew. K. Fan-shaped leaf of a *Gingko* tree, showing dichotomous venation.

TRANSPARENCY MASTER #21

A Stereoscopic View of a Portion of a Typical Leaf



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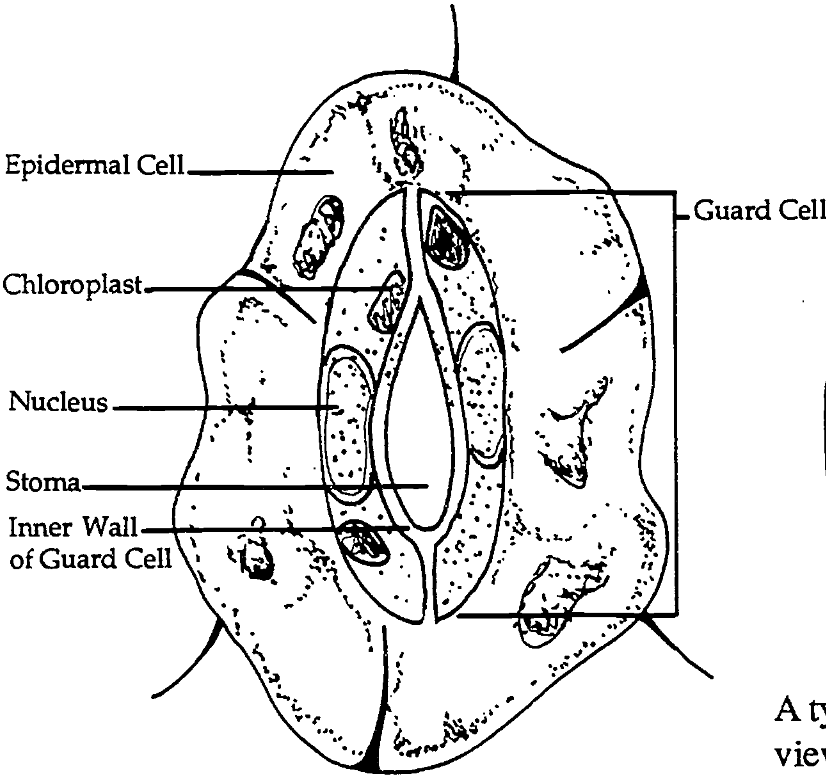
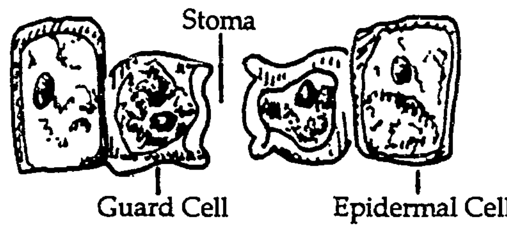
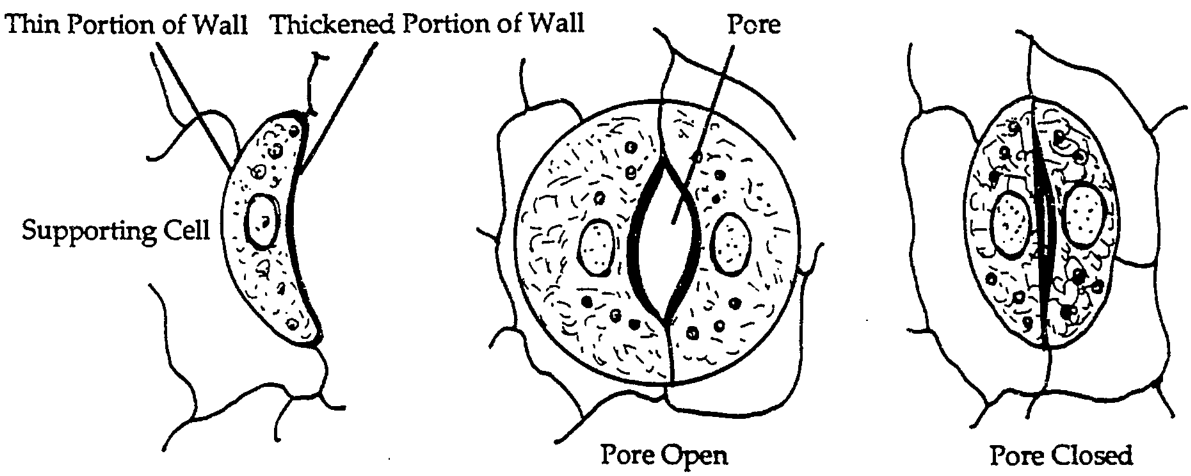
TRANSPARENCY MASTER #22

Stoma





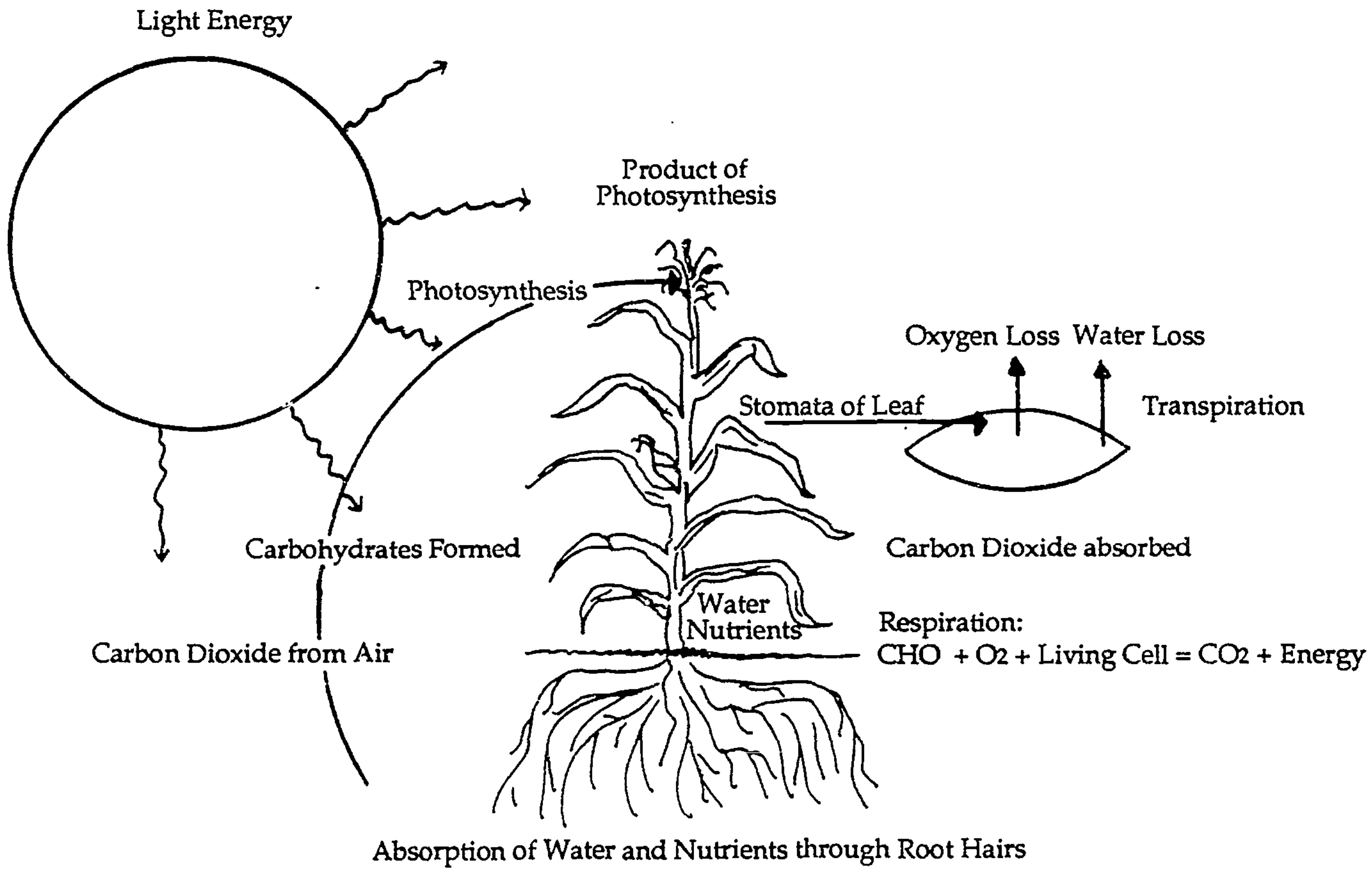
A typical dicot stoma. A. Surface view, and B. View in transverse section.



The stomata are epidermal structures composed of two guard cells that form a pore. The portion of the guard cell wall abutting the pore is thicker than the rest of the cell wall. This causes the pore to open when the guard cells become turgid.

TRANSPARENCY MASTER #23

Important Plant Processes

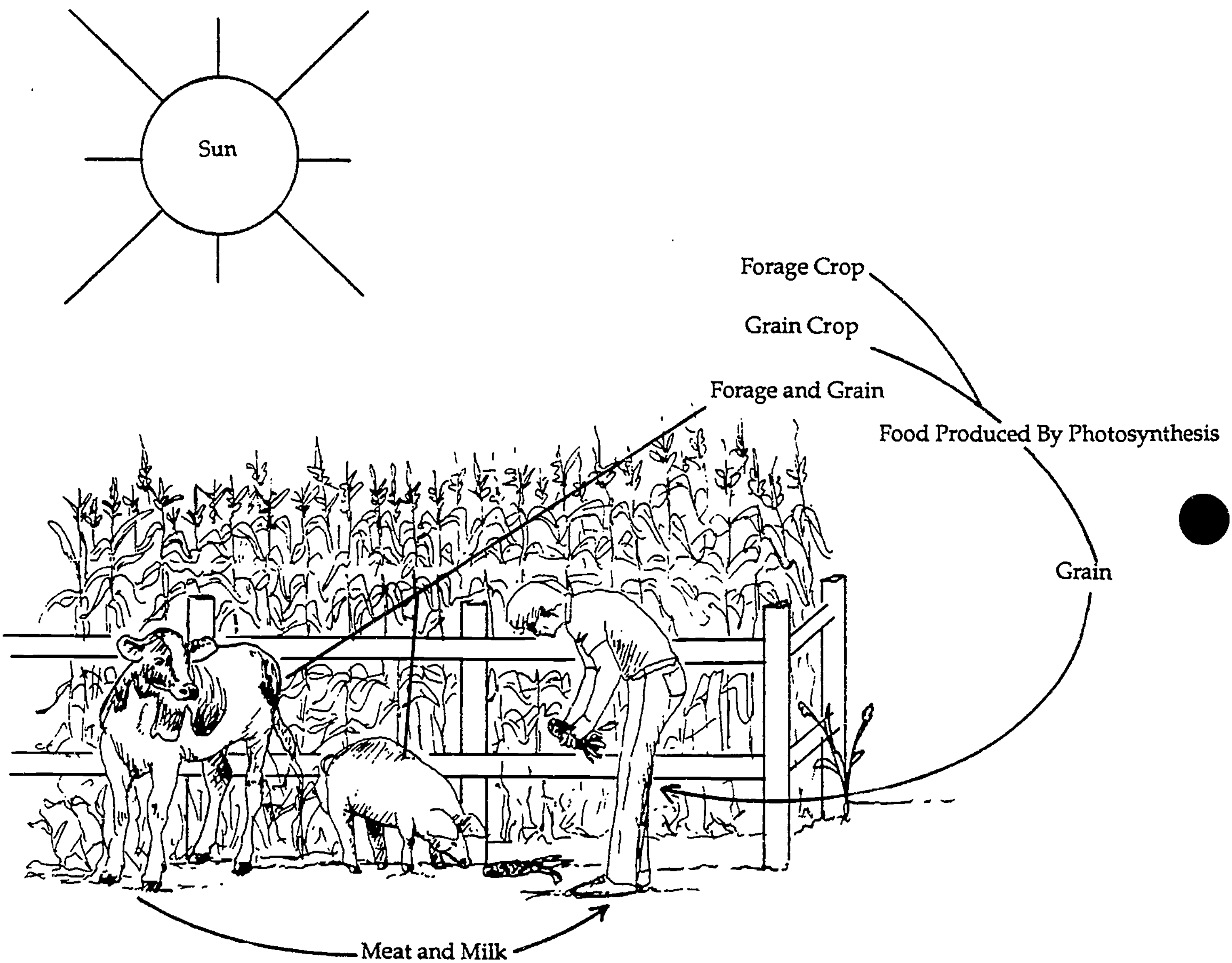


A series of events must take place for plant growth to occur. Important ones are:

- Photosynthesis
- Respiration
- Transpiration
- Absorption

TRANSPARENCY MASTER #24

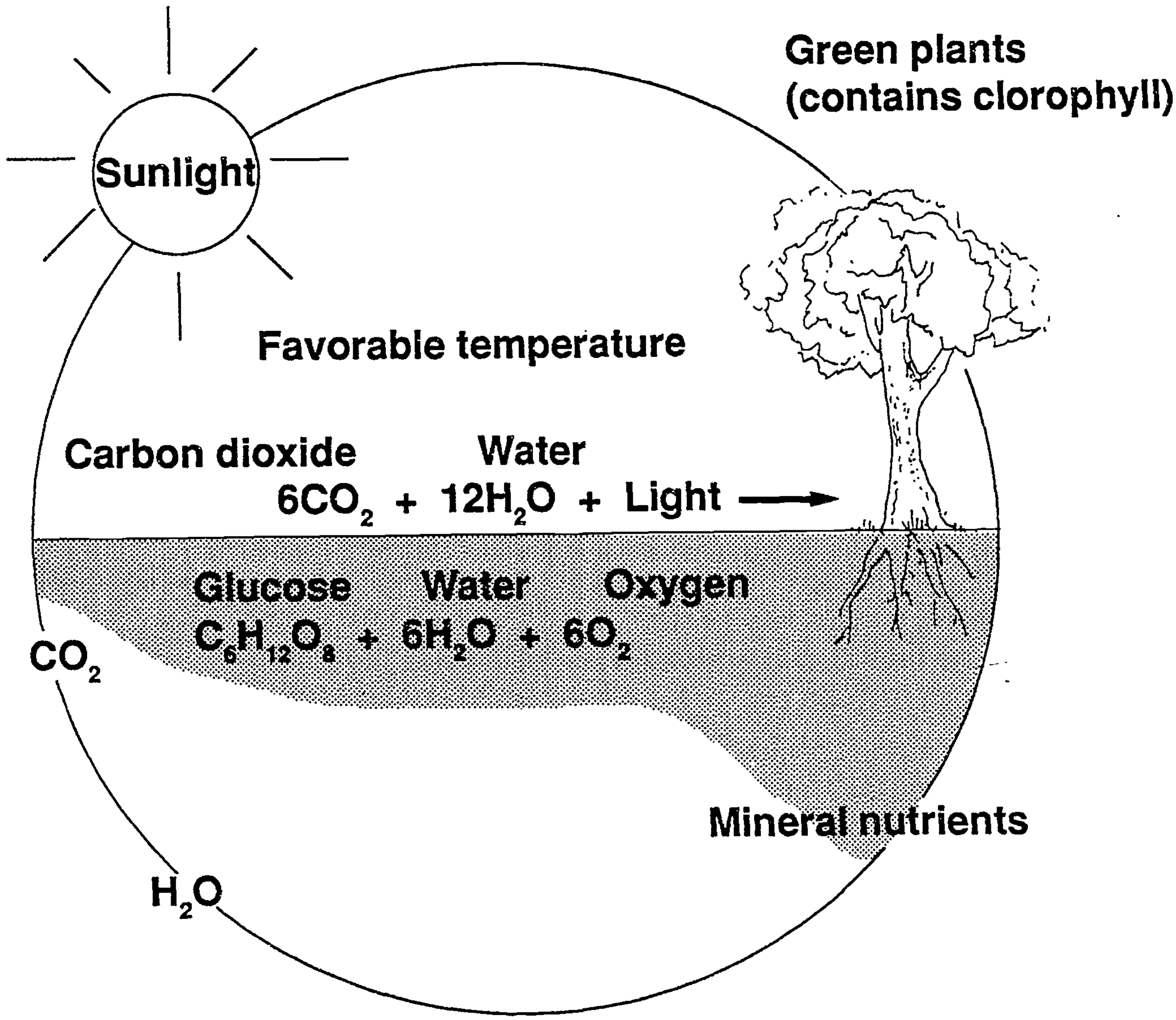
Importance of Photosynthesis



This plant-produced food is used directly by man or indirectly through meat and milk produced by livestock.

TRANSPARENCY MASTER #25

Photosynthesis



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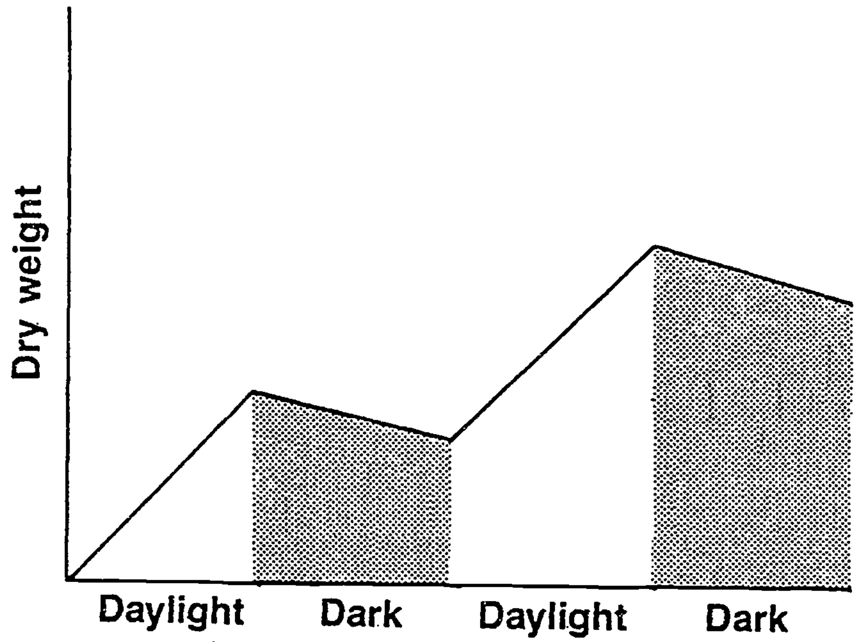
TRANSPARENCY MASTER #26

Photosynthesis and Respiration in Relation to Dry Weight



Daylight Hours

The sugar produced by photosynthesis is greater than the sugar used by respiration.

Result is increase in dry weight.

Dark Hours

No sugar is produced by photosynthesis.

Sugar is used by respiration.

Result is decrease in dry weight. 91C

TRANSPARENCY MASTER #27

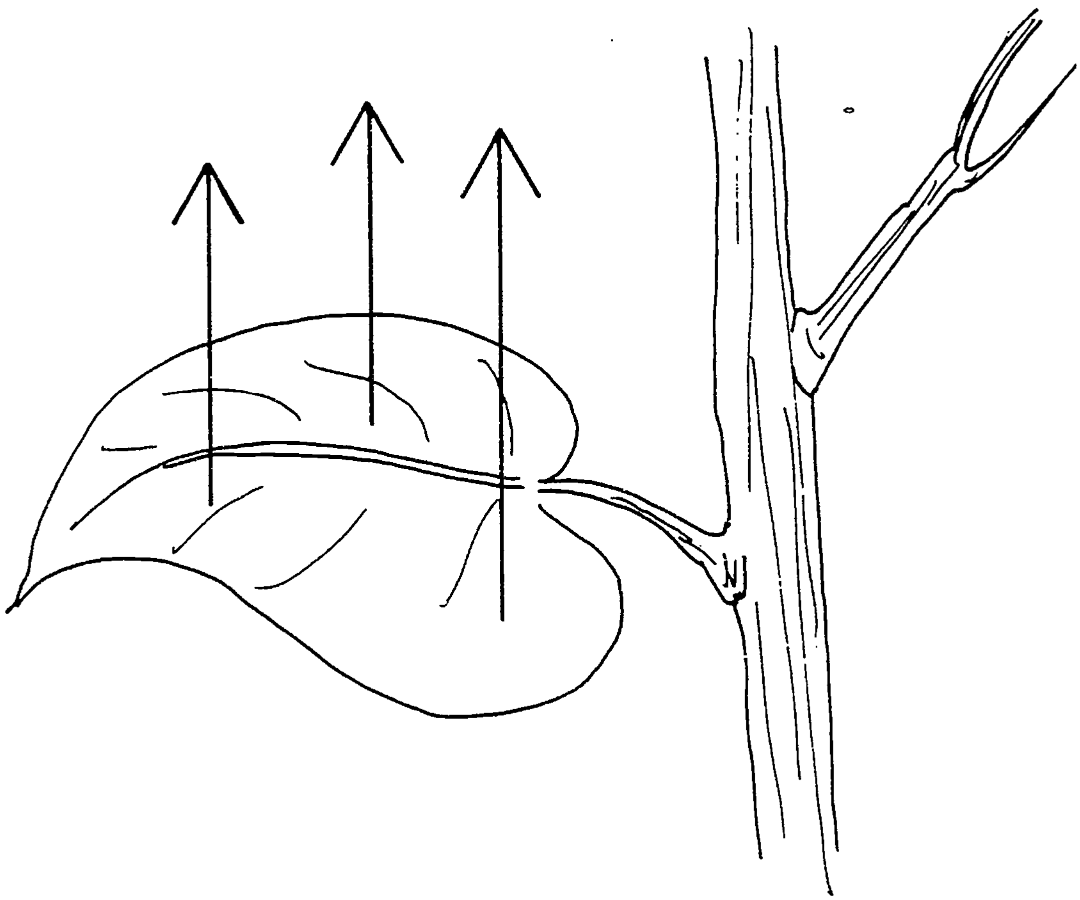
Relationship Between Photosynthesis and Respiration

Photosynthesis	*Respiration*
1. A building process (+)	1. A destruction process (-)
2. Sugars manufactured	2. Sugars consumed
3. CO_2 is consumed	3. CO_2 is given off
4. Oxygen is given off	4. Oxygen is consumed
5. Requires light	5. Goes on day and night
6. Only takes place in cells containing chlorophyll	6. Carried on in all cells
7. Sugar ($C_6H_{12}O_6$) is the end product	7. Energy produced for plant functions is end product

Note: A green plant grown in the dark loses in weight because its stored foods are respired and nothing is added through photosynthesis.

TRANSPARENCY MASTER #28

Transpiration



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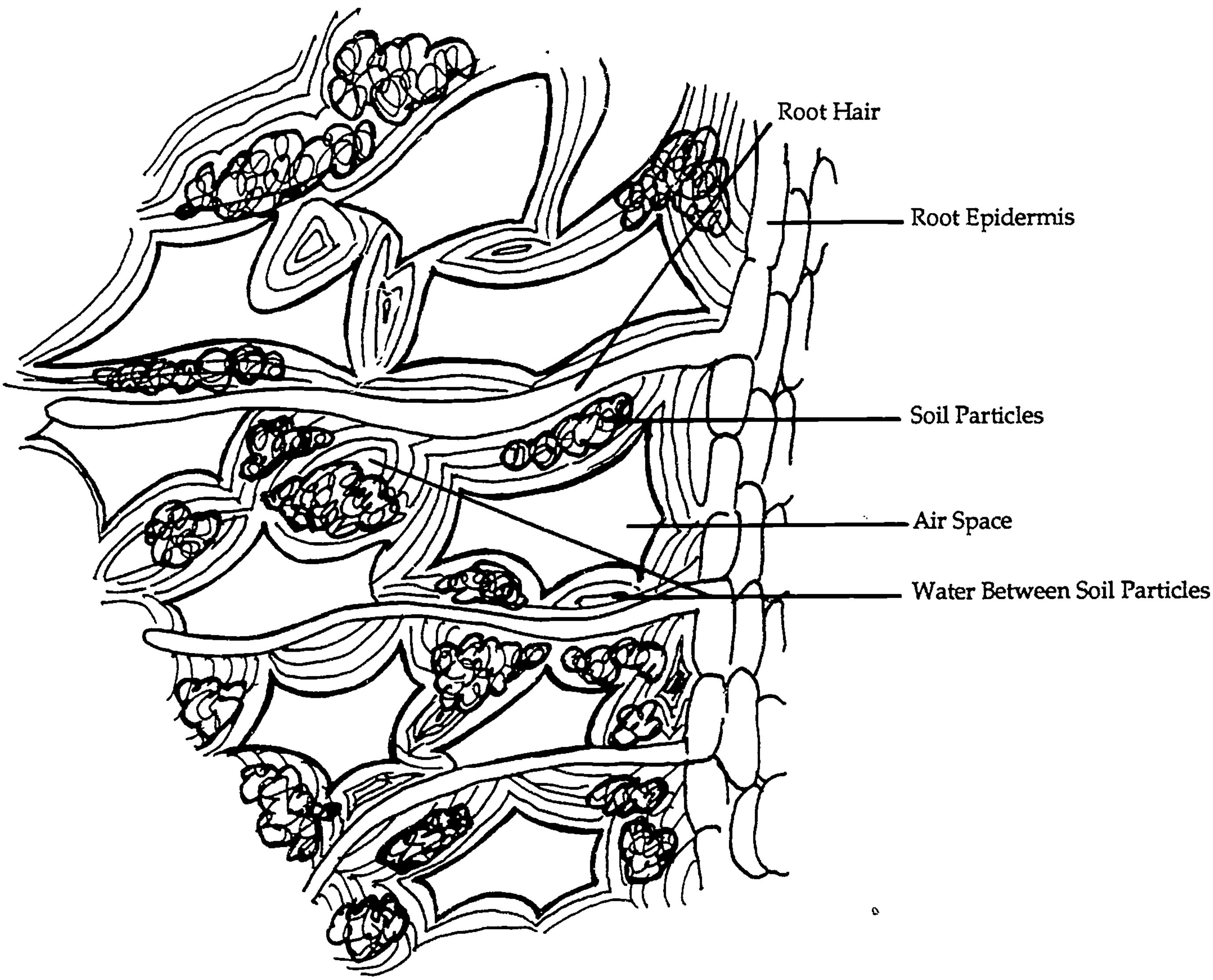
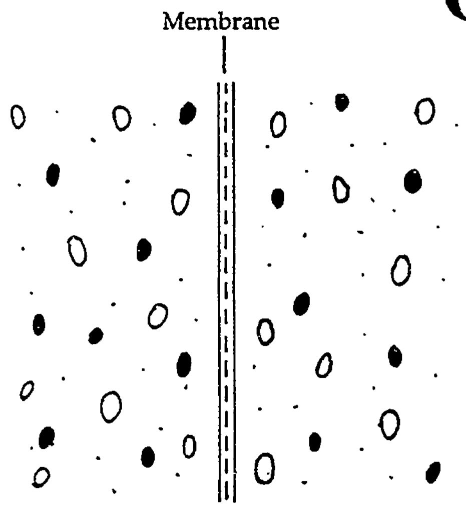
TRANSPARENCY MASTER #29

Root Hairs, Soil Particles, and Moisture

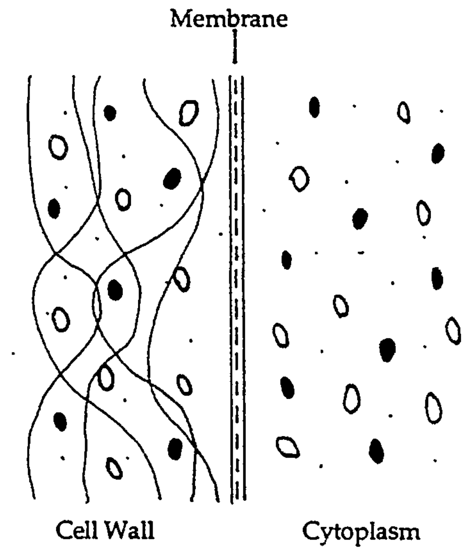


TRANSPARENCY MASTER #30

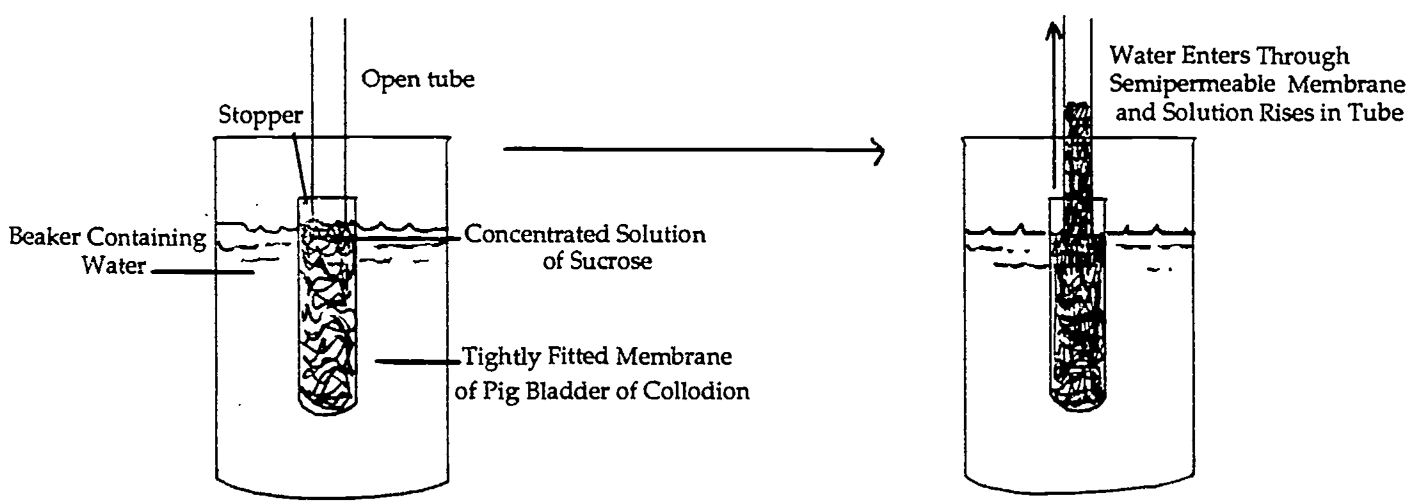
Osmosis



System that would show osmosis. A membrane separates two solutions that contain water (o) and solute (—) molecules. The pores in the membrane permit water but not solutes to pass. Water potential will be lower in the left-hand solution; water will move into that solution.



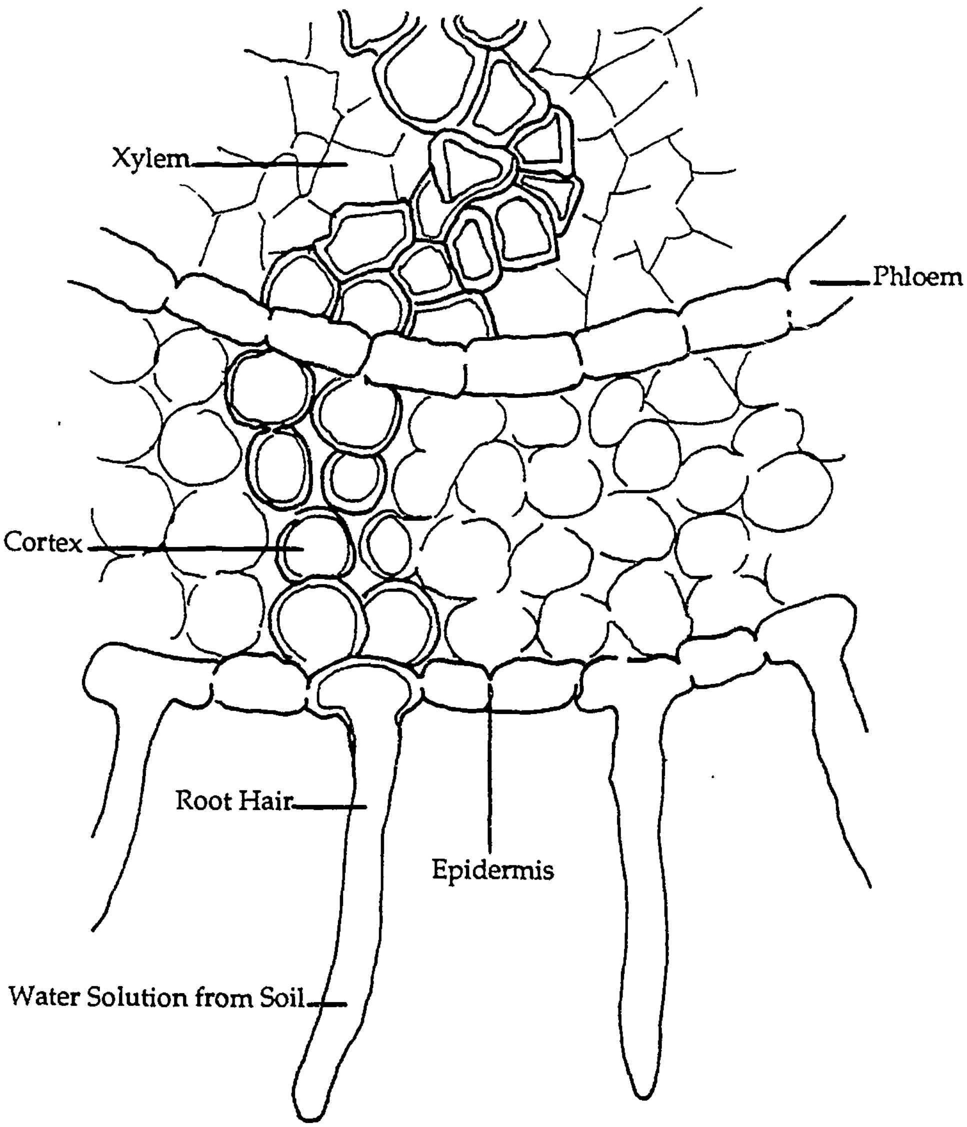
Conditions at the surface of the cell, affecting water movement. The solution in the cell wall contains fewer solutes than cytoplasm, but polymers such as cellulose are present.



Diffusion in an artifical osmotic system.

TRANSPARENCY MASTER #31

Absorption



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TRANSPARENCY MASTER #32

Guard Cell Movement

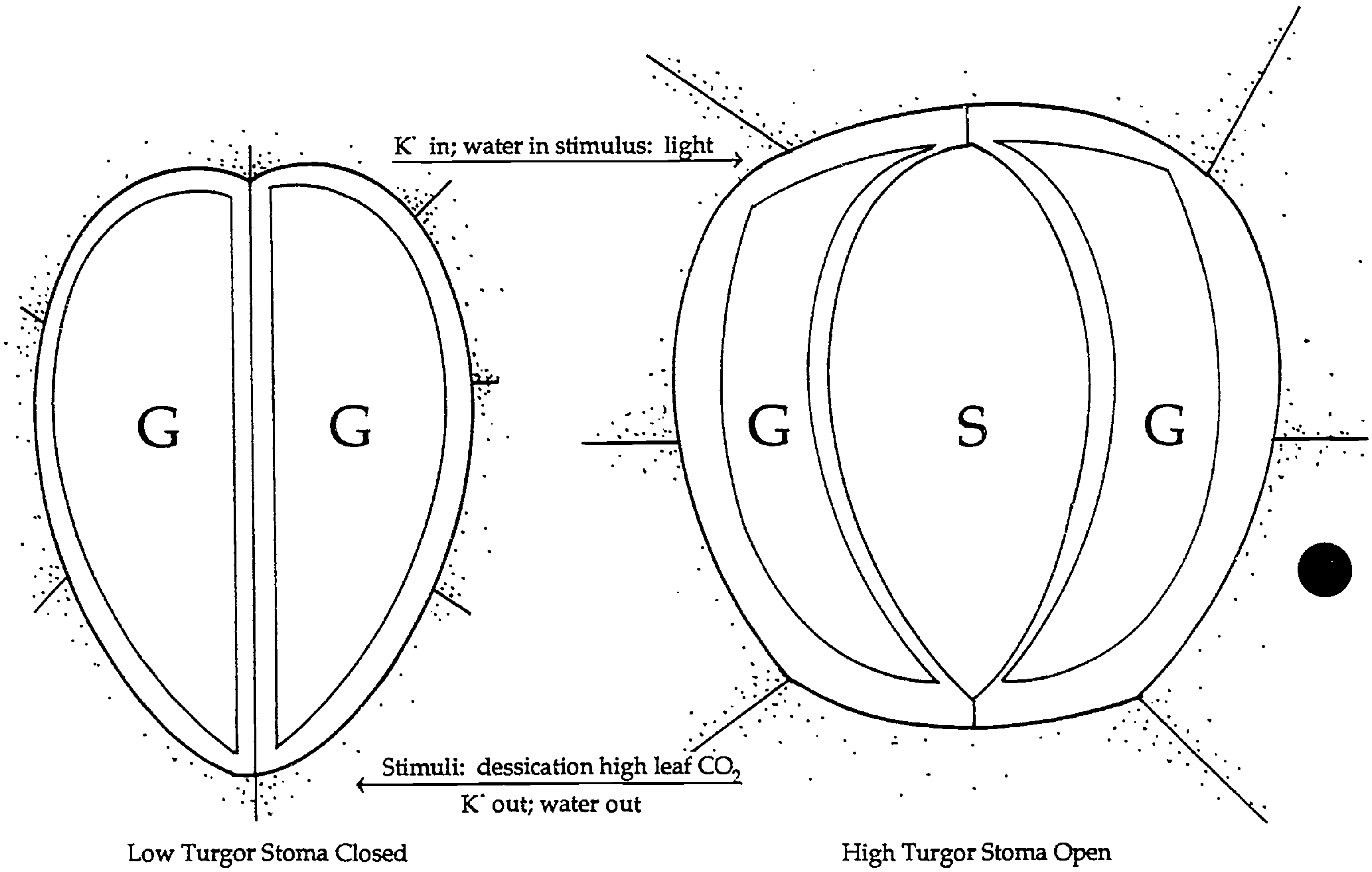
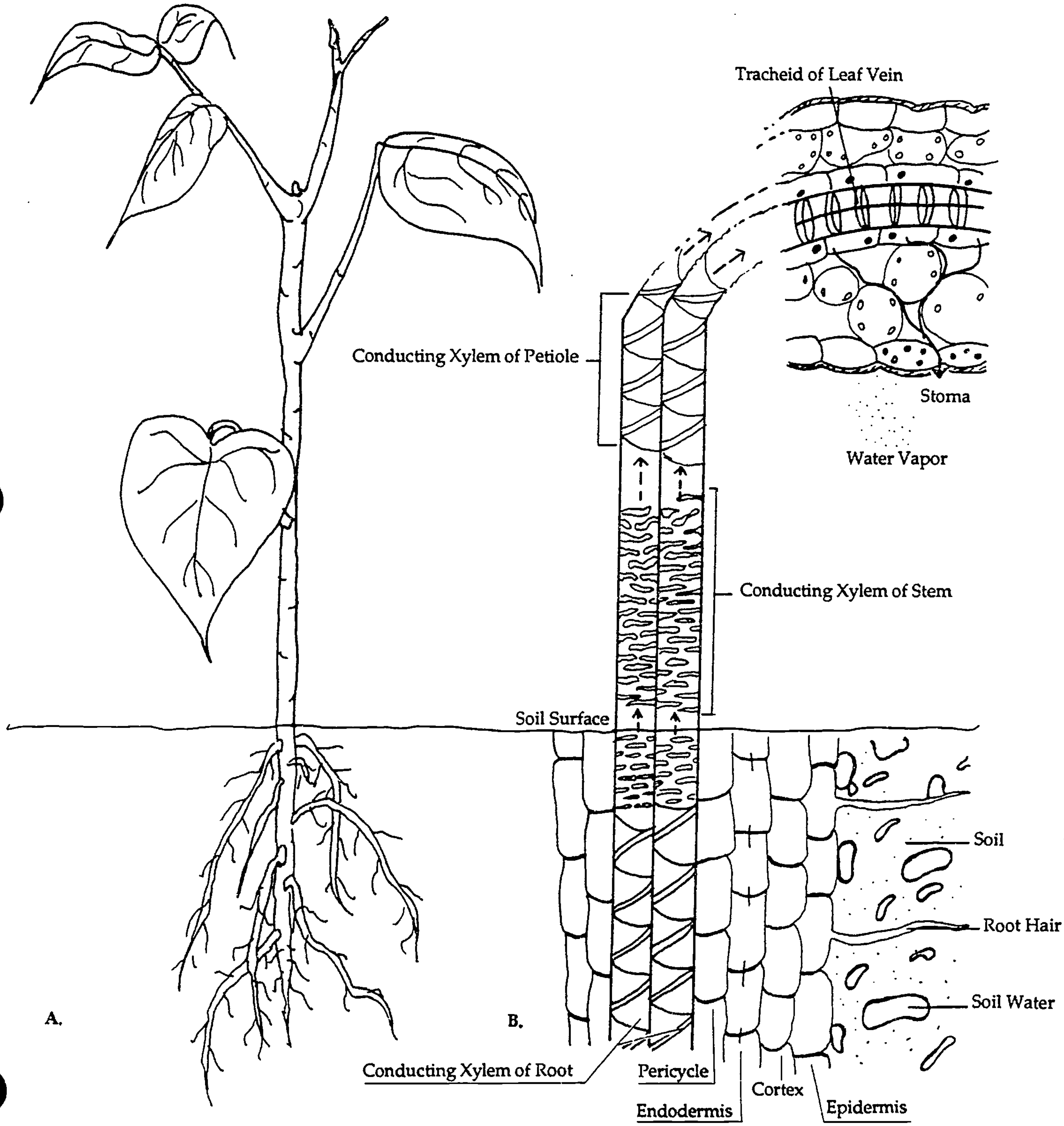


Diagram summarizing the mechanism by which guard cells open and close stomata. The gain or loss of K^+ involves active transport; water follows by osmosis. G = guard cell; S = stoma.

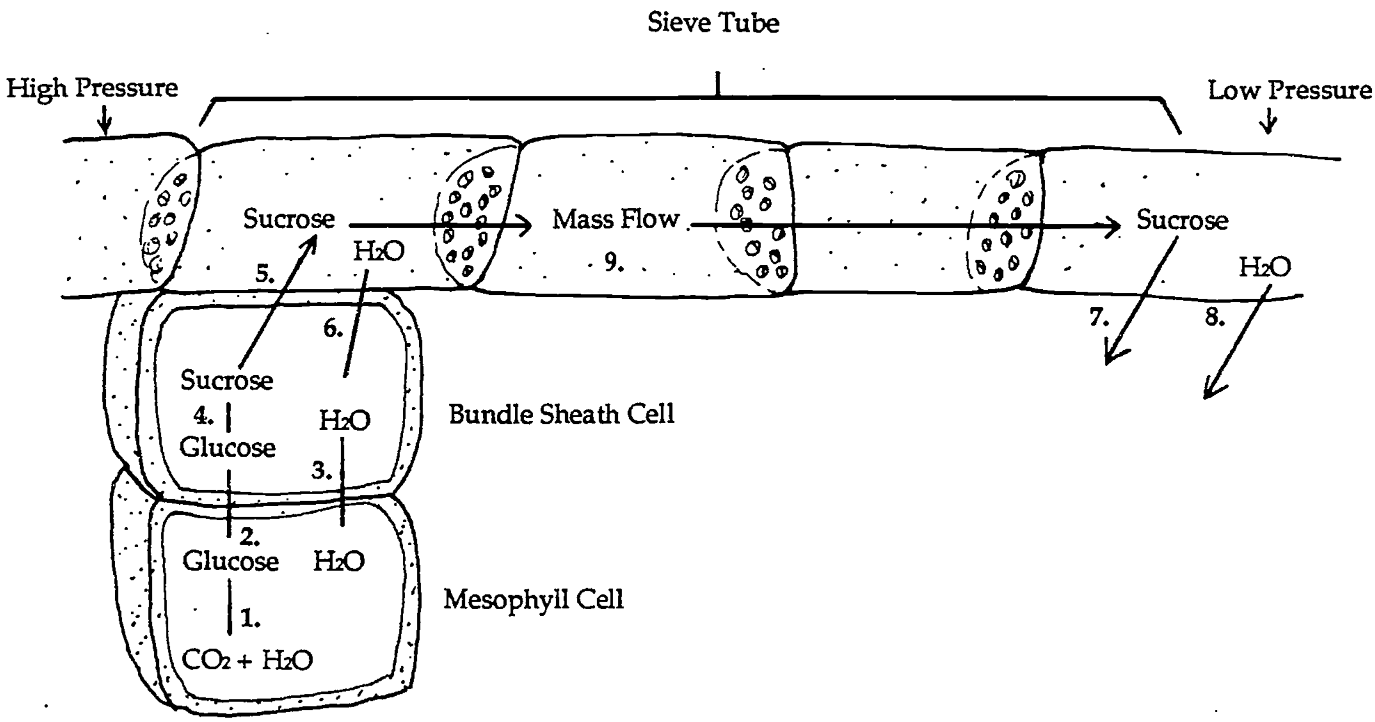
TRANSPARENCY MASTER #33

Water Movement



TRANSPARENCY MASTER #34

Phloem Transport



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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Plant Tissues

STUDENT WORKSHEET #2 — Stem and Leaf Tissues

STUDENT WORKSHEET #3 — Apical Meristems

STUDENT WORKSHEET #4 — Measuring Loss from Transpiration

STUDENT WORKSHEET #5 — Rate of Transpiration

STUDENT WORKSHEET #6 — Effects of Light on Photosynthesis

STUDENT WORKSHEET #7 — Separation of Plant Pigments by Chromatography

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Plant Tissues

Purpose:

1. To locate the two vascular and the other four specialized tissues, given a monocot or dicot.
2. To describe the functions of these specialized tissues.

Materials:

1. 1 large carrot or woody branch
2. 1 cornstalk or picture of cross section of cornstalk
3. Sharp knife

Procedure:

1. Cut the carrot or branch straight across with the knife.

2. Cut the cornstalk straight across.

   Note: Have your teacher see that you have made the cuts in the right way.

3. Locate the vascular tissues in each.

4. Compare then, and draw pictures of what you observe. Label all parts.

   Note: Show your labeled drawings to your teacher.

Questions:

1. Why don't monocots form annual rings?

2. How many cotyledons does a dicot have?

3. Which plant will have a terminal growing point?

4. What is the usual leaf venation of a monocot?

5. What is the leaf venation of a dicot?

STUDENT WORKSHEET #2

Stem and Leaf Tissues

Purpose:

1. To identify the different cells of the stem and leaf tissues.
2. To explain the functions of the stem and leaves.

Materials:

1. Microscope
2. Dissecting set
3. Assorted plant stems and leaves
4. Prepared slides

Procedure:

1. Look at the prepared slides to get an idea of what to look for, before you look at the plant tissues.

   Note: When you locate the tissue you wish to sketch let the teacher look at it under the microscope.

2. Sketch and label a stem tissue. (monocot or dicot)

3. Sketch and label a section of leaf tissue. (monocot and dicot)

4. Sketch and label the parts of a plant cell.

Questions:

1. What is the function of the xylem? The phloem?
2. What role do the guard cells play in the leaf tissue?
3. Under what condition are the guard cells likely to open, in a drought condition or when they have been well watered?

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STUDENT WORKSHEET #3

Apical Meristems

Purpose:

1. To locate the three meristematic tissues, given any plant.
2. To describe the three meristematic tissues.

Materials:

1. Bean Sprouts
2. Marking pen
3. Pint jar
4. Cotton (enough to half fill the jar)
5. Nutrient solution

Procedure:

1. Choose five healthy, well-sprouted bean seedlings.

2. Mark each one at the root tip with indelible ink.

3. Place the bean seedlings on the cotton in the jar and make sure the cotton is well saturated with nutrient solution.

   Note: Your teacher will see that the cotton is sufficiently saturated with the nutrient solution.

4. Allow the jar to sit undisturbed for two days.

5. Observe the locations of the marks.

6. Draw what you have observed and label the areas of the three meristematic tissues.

Questions:

1. Where do apical meristems occur?

2. What is the reason behind the statement: "growth only takes place in meristematic tissues"?

3. What is the definition of a tissue?

STUDENT WORKSHEET #4

Measuring Loss from Transpiration

Materials:

1. A growing plant in a pot, bucket, or other container, or a plant growing in a convenient location
2. Plastic bag or sheet of clear plastic that will cover the plant or a branch of the plant containing 10-12 leaves.
3. String, rubber bands, or other suitable tie materials
4. Stake to support the weight of the plastic
5. Plastic straw or other suitable tubing for a drain
6. Measuring cup or beaker

Procedure: (See Figure 1)

1. Be sure plant has been watered.
2. Cover the entire vegetative portion of the plant or a section with plastic material.
3. Locate tubing at bottom of plastic covering to serve as a water drain.
4. Place plant in sunny location for an entire day; measure the water collected; empty container.
5. Measure water collected during dark period of the day.
6. Compare differences in the amount of water collected.

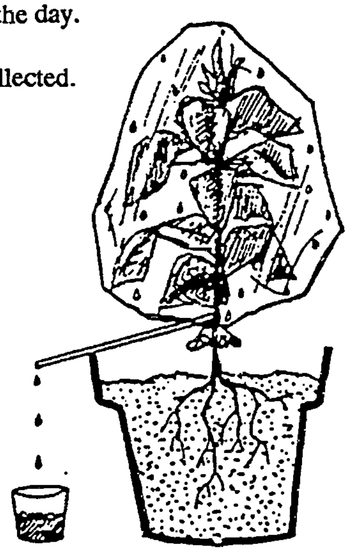


Figure 1.

Questions:

1. Which period produced the most water in the container? Why?

2. Does temperature have an effect on transpiration rates? Does light? Does air humidity?

STUDENT WORKSHEET #5

Rate of Transpiration

Purpose:

1. To demonstrate how the leaf area of a plant affects the rate of transpiration.

Materials:

1. Four graduated cylinders
2. Four corks or stoppers
3. Four geranium cuttings (one with one leaf, one with two leaves, one with three leaves, and one with four or more leaves)
4. Water

Procedure:

1. Make a hole in each cork or stopper to fit the stem of a geranium cutting.

2. It is important to have the hole in the cork and the geranium stem the same size so that the amount of evaporation around it is negligible.

3. Push the cuttings through the hole in the stopper and cut off the end of the plant under water to prevent air pockets.

4. Immediately insert corks into the graduated cylinders with the stem well below the waterline. (Push the stem of the plant nearly to the bottom of the cylinder.)

5. Record the water level.

6. Keep a record of the water level over a period of several days or weeks and record data.

Questions:

1. Which plant used the most water?

2. How did the amount of leaf area affect transpiration?

3. What is meant by "rate of transpiration"?

STUDENT WORKSHEET #6

Effects of Light on Photosynthesis

Purpose:

1. To show the effect that light has on photosynthesis.

Materials:

1. Any plant that has a large green leaf, such as a coleus or philodendron
2. Six corks (the corks may be sliced into 1/4-inch pieces and the pieces used in place of the whole corks)
3. Three straight pins

Procedure:

1. Select one of the above plants and place one cork on the top of a large green leaf.
2. Place another cork directly beneath the top cork on the underside of the leaf.
3. Insert a straight pin through both corks and the leaf. This will eliminate light from an area of the leaf.
4. Repeat the above procedures on two other leaves of the plant.
5. Remove one pair of corks at the end of 24 hours, another pair at the end of 48 hours, and the last pair at the end of 72 hours.
6. After removal of the corks, observe the plants for three days.

Questions:

1. At the time the corks are removed, describe the color of the spots under the corks removed at the end of:

   a. 24 hours

   b. 48 hours

   c. 72 hours

2. After three days, did spots on any of the plants turn green?

   If so, which ones?

   If not, why not?

STUDENT WORKSHEET #7

Separation of Plant Pigments by Chromatography

Purpose:

1. To separate the pigments in green leaves into their components.
2. To demonstrate that green leaves contain chlorophyll and several other colored compounds that are important in plant growth.

Materials:

1. Filter paper, coffee filters, or heavy commercial paper towels
2. Rubbing alcohol containing 70% isopropyl alcohol
3. Drinking glass, wide mouth jar, or beaker
4. Clear plastic wrap
5. Pencil
6. Paper clips
7. Leaf
8. Coin

Procedure:

1. Cut the filter paper into strips about 1 inch wide and 6 inches long.

2. Place the green leaf at one end of the paper and use the coin to make a heavy green mark about 1/2 inch from one end.

3. Wrap the other end of the strip over a pencil and use a paper clip to hold it in place.

4. Add 70% isopropyl alcohol to the jar to make a layer about • inch deep.

5. Place the pencil with the paper on top of the glass and adjust the paper so that only the end is touching the liquid.

6. Make sure the paper does not touch the side of the glass.

7. Cover the top with clear plastic wrap to prevent evaporation.

8. Allow the setup to stand until the liquid level almost reaches the paper clip.

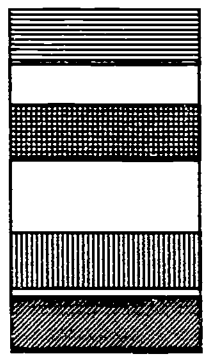
9. Remove the paper and allow it to dry.

Discussion:

1. Did the paper separate into different colored bands?

Chromatography is a method for separating a mixture into its individual components. In paper chromatography, the mixture is placed on the paper (stationary phase). The paper is placed upright in a container with a shallow layer of solvent on the bottom. By capillary action the solvent (mobile phase) moves up the paper. As the solvent passes over the mixture, the components of the mixture are carried along with the solvent. Separation results because different components in the mixture have different attractions for the stationary versus the mobile phase. Substances with high attraction for the paper move only a short distance, while substances attracted to the solvent move large distances.

In this experiment you may be able to see 4 different colored bands resulting from the green streak of leaf. The two chlorophylls are responsible for capturing the energy of sunlight and using this energy in the photosynthesis process, or the conversion of carbon dioxide from the atmosphere and water into sugar. The plant then uses the sugar as its energy source for growth and reproduction. Carotene, the yellow pigment, is believed to protect the plant from damage by oxygen. The xanthophylls are the colors seen in autumn leaves after the chlorophylls die off.



As an extension of this activity, try leaves from different plants or leaves from the same plant collected at different seasons.

Applications: plant growth and development, pesticide and drug identification,

Reference:

"Chromatography, Graphing of Colors," David Katz, Department of Chemistry, Community College of Philadelphia, 1700 Spring Garden Street, Philadelphia, PA 19130.

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CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Animal Science

RELATED PROBLEM AREAS:

1. Understanding Basic Genetics and Reproduction
2. Classifying and Selecting Animals (Agricultural Business and Management)
3. Understanding Animal Anatomy and Physiology (Agricultural Business and Management)
4. Meeting Nutritional Needs of Animals (Agricultural Business and Management)
5. Understanding Animal Breeding and Reproduction (Agricultural Business and Management)
6. Maintaining Animal Health (Agricultural Business and Management)
7. Meeting the Environmental Requirements of Animals (Agricultural Business and Management)
8. Caring for Animals (Agricultural Business and Management)
9. Recognizing the Impact of Technology on Agriculture: Biotechnology

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty A: Formulating Livestock Feeding Programs

1. Assess livestock needs such as growing and fattening, nursing, production, or special nutritional needs

Duty N: Breeding, Handling, and Caring for Animals

1. Inseminate animals artificially
2. Pregnancy test animals
3. Assist animals in delivery
4. Assist young to nurse
5. Castrate animals
6. Dehorn animals
7. Restrain animals

Duty O: Maintaining Animal Health

1. Inspect animals for disease
2. Administer medication
3. Treat wounds

Duty Q: Loading, Securing, Transporting, and Unloading Agricultural Products

1. Load livestock
2. Unload livestock

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum
Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understanding that complex animals carry out vital processes within organ systems which are separate in function but mutually dependent.					
*2. Identify and describe functions of tissues and organs. *3. Identify body changes and explain how hormones cause some of these body changes.					
4. Define basic terms integral to animal science. 5. Describe characteristics associated with the anatomy of animal cells.					
6. Describe characteristics associated with the anatomy of the various animal tissues. 7. Name the major systems occurring in common vertebrates and match the proper structures associated with that system.					
8. State the main components found in animal blood and describe their functions. 9. Describe the general symmetry of the animal body and use associated descriptive terms appropriately.					
10. Summarize the major characteristics of animal development, growth, and aging process.					
*11. Recognize and compare major cell processes such as respiration, protein synthesis, and photosynthesis.					
*12. Understanding that all life is derived from living organisms.					

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ERIC Full Text Provided by ERIC

Submission Date ____
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Page ____ of ____

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ____
Title: ____
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify major factors which affect population, growth, and decline.					

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes, technologies, methods, equipment, and available technology of science.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze the results of an experiment.					
2. Perform simple experiments to see similarities in living organisms.					
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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Animal Science

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define basic terms integral to animal science.
2. Describe the general symmetry of the animal body and use associated descriptive terms appropriately.
3. Describe characteristics associated with the anatomy and physiology of animal cells.
4. Describe characteristics associated with the anatomy and physiology of the various animal tissues.
5. Name the major systems occurring in common vertebrates and match the proper structures associated with that system
6. State the main components found in animal blood and describe their functions.
7. Summarize the major characteristics of animal development, growth, and aging process.
8. Perform simple experiments to see similarities in living organisms.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Animal Science

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. What is life?
2. What is an animal?
3. How does an animal differ from a plant?
4. What are the parts of animal cells?
5. How do animal cells differ from plant cells?
6. What are tissues?
7. What are the different types of tissues found in animals?
8. What are the major systems found in animals?
9. What structures are found in the various systems?
10. What are the terms used in anatomy?
11. What do the terms mean?
12. What is blood?
13. What are the components of blood?
14. How does blood perform its function?
15. What are germ layers?
16. What structures develop from the different germ layers?
17. What is growth?
18. What is aging?
19. What is embryology?
20. How is embryology similar for various species?
21. What are the stages of natal development?

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Animal Science

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Consult with other life science personnel as resource persons for ideas, techniques, and equipment.

2. Conduct field trips to a:

   a. Local slaughter facility.
   b. Animal diagnostic laboratory.
   c. Veterinary office.
   d. Any establishment where developing embryos and fetuses may be found.

3. Lead students in a discussion of technologies such as biotechnology, embryo transfers, etc., and their effects on animal development.

4. Use the information sheets as instructor reviews of possible subject matter content.

5. Use the transparency masters as visual aids for an alternative delivery medium.

6. Obtain prepared slides of cells, tissues, and blood from the biology or physiology instructors, and use the slides for student activities to observe the similarities and differences of cells, tissues, and blood among different species of animals.

7. Have students complete Student Worksheet #1 to observe one type of living cell found in their body.

8. Obtain film of embryo transfer techniques and biotechnology manipulations for students to view.

9. Secure Instructional Materials Service publication #8391, *Animal Growth and Development*, for use as a student study guide and worksheet.

10. Obtain slides or videos of developmental stages and dissection procedures for student review and topics of discussion on animal rights and associated concerns.

11. Use the vocabulary list not only as a source for definitions but also as a source of additional subject matter content to be used as warranted by individual class needs.

12. Use a laboratory skills manual such as *Basic Skills in the Laboratory*, (NASCO) to orient and reinforce skills, practices, and procedures necessary in a science laboratory.

13. Obtain models or preserved specimens for student use in identification and examination.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Animal Science

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Anatomy and Physiology of Farm Animals.* (1974). Frandson, R.D. Lea and Febiger, Washington Square, Philadelphia, PA 19106.

2. *College Zoology.* (1981). Boolootian, R.A., Stiles, K.A. MacMillan Publishing Company, 866 Third Avenue, New York, NY 10022.

*3. *Integrated Principles of Zoology.* (1988). Hickman, C.P., Jr., Roberts, L.S., Hichman, F.M. Times Mirror/Mosby College Publishing, 11830 Westline Industrial Drive, St. Louis, MO 63146. (Teacher Reference).

*4 *Animal Growth and Development.* (Subject Matter Unit #8391). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588.

5. *Introduction to Animal Biology.* (1979). Villee, C.A., Walker, Jr, W.F., Barnes, R.D. W.B. Saunders Company, West Washington Square, Philadelphia, PA 19105.

*6. *Basic Skills in the Laboratory.* (1977). Towne, C.E. NASCO, 901 Janesville Avenue, Ft. Atkinson, WI 53538. (800) 558-9595.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Zoology: The Study of Animal Biology

INFORMATION SHEET #3 — Animal Symmetry

INFORMATION SHEET #4 — Animal Cell Anatomy

INFORMATION SHEET #5 — Animal Tissue

INFORMATION SHEET #6 — Blood

INFORMATION SHEET #7 — Animal Development

TRANSPARENCY MASTER #1 — Descriptive Anatomical Terms

TRANSPARENCY MASTER #2 — Comparison of Prokaryote and Eukaryote Cells

TRANSPARENCY MASTER #3 — Animal Cell

TRANSPARENCY MASTER #4 — Types of Animal Cells

TRANSPARENCY MASTER #5 — Types of Epithelial Tissue

TRANSPARENCY MASTER #6 — Connective Tissue

TRANSPARENCY MASTER #7 — Muscular Tissue

TRANSPARENCY MASTER #8 — Typical Neuron

TRANSPARENCY MASTER #9 — Intestine with Various Tissues Identified

TRANSPARENCY MASTER #10 — Anatomical Systems and Associated Structures

TRANSPARENCY MASTER #11 — Formed Elements of Blood

TRANSPARENCY MASTER #12 — Tissues Developing from Ectoderm, Mesoderm, and Endoderm

TRANSPARENCY MASTER #13 — Prenatal Development from Conception to Birth

TRANSPARENCY MASTER #14 — Developmental Stages of Representative Animal

TRANSPARENCY MASTER #15 — Invagination Process

TRANSPARENCY MASTER #16 — Spread and Differentiation of Mesoderm

INFORMATION SHEET #1

Terms to be defined

Adaptation — a characteristic which enables the organism to survive in its environment.

Adipose — tissue in which fat is stored, or the fat itself.

Aerobic — metabolizing only in the presence of oxygen.

Allele — alternative form of a gene that may occur at a given site (locus) on a chromosome.

Anabolism — chemical reactions in which simpler substances are combined to form more complex substances, resulting in the storage of energy and the production of new cellular materials and growth.

Atom — composed of an atomic nucleus containing protons and neutrons together with electrons that circle the nucleus.

Autotrophs — organisms that manufacture organic nutrients from inorganic raw materials.

Axon — part of a neuron which conducts nerve impulses away from the dendrite.

Biogenesis — the theory that all living things come only from preexisting living things.

Biome — large, easily differentiated community unit arising as a result of complex interactions of climate, other physical factors, and biotic factors.

Blastocoele — the fluid-filled cavity of the blastula, the mass of cells produced by cleavage of a fertilized ovum.

Blastula — structure produced by cleavage of a fertilized ovum, consisting of a single layer of cells surrounding a cavity.

Blood plasma — the liquid portion of the blood in which the corpuscles are suspended.

Catabolism — chemical reactions by which complex substances are converted into simpler compounds with the release of energy.

Cation — a positively charged ion.

Cells — the microscopic units of structure and function that compose the bodies of plants and animals.

Centriole — small, dark-staining organelle lying near the nucleus in the cytoplasm of animal cells.

Cephalization — concentration of nervous tissue and sene organs at the anterior end of the body.

Chordate — the phylum of animals characterized by the presence of a notochord at some stage of development.

Coelom — body cavity of triploblastic animals lying within the mesoderm.

Collagen — protein in connective tissue fibers.

Colony — association of unicellular or multicellular organisms of the same species.

Community — an assemblage of populations that live in a defined habitat. The organisms constituting the community interact in various ways with one another.

Conservation of energy, law of — a fundamental law of physics which states that in any given system the amount of energy is constant; energy is neither created nor destroyed but only transformed from one form to another.

Conservation of matter, law of — a fundamental law of physics which states that in any chemical reaction atoms are neither created nor destroyed but simply change partners.

Consumer organisms — those elements of an ecosystem that eat other plants or animals.

Contraception — method of birth control which involves the use of mechanical or chemical agents to prevent the sperm from reaching and fertilizing the egg.

Cortex — the outer layer of an organ.

Cytokinesis — the division of the cytoplasm during mitosis or meiosis.

Dendrite — the part of the neuron specialized for receiving excitation either from environmental stimuli or another cell.

Dermis — the deeper layer of skin of vertebrates and some invertebrates.

Differentiation — a process of changing a relatively unspecialized cell to a more specialized cell.

Diffusion — the movement of molecules from a region of high concentration to one of lower concentration.

DNA — deoxyribonucleic acid: present in chromosomes and containing genetic information.

Ecology — the study of the interrelations between living things and their environment.

Ecosystem — all of the organisms of a given area.

Ectoderm — the outer of the two germ layers of the gastrula.

Element — atoms all of which have the same number of protons in the atomic nucleus and the same number of electrons circling in the orbits.

Embryo — the early stage of development of an organism.

Endoderm — the inner germ layer of the gastrula that forms the epithelial cells of the digestive tract.

Endothermic — condition in which internal body temperature is derived from the metabolic heat produced by the animal.

Epidermis — the outermost layer of cells of an organism.

Epigenesis — the theory that development proceeds from a structureless cell by the successive formation and addition of new parts which do not preexist in the fertilized egg.

Erythrocyte — red blood cell.

Eukaryotic — organisms that have nuclei surrounded by membranes, Golgi apparatus, and mitochondria.

Fermentation — anaerobic decomposition of an organic compound by an enzyme system; energy is made available to the cell for other processes.

Fetus — the unborn offspring that has developed rudimentary organs.

Fibrin — delicate protein threads derived from soluble fibrinogen in the presence of the enzyme thrombin as during the formation of a blood clot.

Fossils — any remains of an organism that have been preserved in the earth's crust.

Gamete — a reproductive cell; an egg or sperm.

Gastrula — early embryonic state which follows the blastula; consists initially of two layers, the ectoderm and the endoderm, and of two cavities, the blastocoele between ectoderm and endoderm and the archenteron, formed by invagination, lying within the endoderm, and opening to the exterior through the blastopore.

Gastrulation — the process by which the young embryo becomes a gastrula.

Genus — taxonomic classification in which closely related species are grouped together.

Glycolysis — the metabolic conversion of sugars into simpler compounds.

Golgi bodies — cell organelles found in the cytoplasm of all cells except mature sperm and red blood cells.

Hemocoel — the spaces between the cells and tissues of many invertebrates; derived from the blastocoel.

Hemoglobin — the red, iron-containing, protein pigment of the erythrocytes that transports oxygen and carbon dioxide and aids in regulation of pH.

Hemostasis — the stopping of blood flow from an injured blood vessel.

Herbivore — a plant-eating animal.

Heterotrophs — organisms which cannot synthesize their own food from inorganic materials.

Hydrolysis — the splitting of a compound into parts by the addition of water between certain of its bonds, the hydroxyl group being incorporated in one fragment and the hydrogen atom in the other.

Hypertonic — having a greater concentration of solute molecules and a lower concentration of solvent (water) molecules, and hence an osmotic pressure greater than that of the solution with which it is compared.

Integument — skin, the covering of the body.

Invagination — the infolding of one part within another, specifically a process of gastrulation in which one region infolds to form a double-layered cup.

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Ion — an atom or a group of atoms bearing an electric charge, either positive (cation) or negative (anion).

Isotonic or Isosmotic — having identical concentrations of solute and solvent molecules and hence the same osmotic pressure as the solution with which it is compared.

Karyokinesis — the phenomena involved in division of the nucleus in mitosis and meiosis.

Kinesis — the activity of an organism in response to a stimulus; the direction of the response is not controlled by the direction of the stimulus (in contrast to a taxis).

Leukocytes — white blood cells; colorless cells exhibiting phagocytosis and ameboid movement.

Linkage — the tendency for a group of genes located in the same chromosome to be inherited together in successive generations.

Lysosome — intracellular organelle present in many animal cells; contains a variety of hydrolytic enzymes that are released when the lysosome ruptures.

Mammal — a member of a class of vertebrates characterized by having hair and mammary glands; includes such diverse types as shrews, bats, cats, whales, cattle, and humans.

Matrix — nonliving material secreted by and surrounding the connective tissue cells; frequently contains a thick, interlacing matted network of microscopic fibers.

Medulla — the inner part of an organ, e.g., the medulla of the kidney; the most posterior part of the brain, lying next to the spinal cord.

Meiosis — kind of nuclear division, usually two successive cell divisions, which results in daughter cells with the haploid number of chromosomes, one half the number of chromosomes in the original cell.

Mesoderm — the middle layer of the three primary germ layers of the embryo, lying between the ectoderm and the endoderm.

Messenger RNA — a particular king of ribonucleic acid which is synthesized in the nucleus and passes to the ribosomes in the cytoplasm; combines with RNA in the ribosomes and provides a template for the synthesis of an enzyme or some other specific protein.

Metabolism — the sum of all the physical and chemical processes by which living organized substance is produced and maintained; the transformation by which energy and matter are made available for the uses of the organism.

Metamerism — the division of the body into a linear series of similar parts or segments, as in annelids and chordates.

Microtubule — a cytoplasmic organelle, an elongate slender tube; contains a specific protein, tubulin.

Mitochondria — spherical or elongate intracellular organelles which contain the electron transmitter system and certain other enzymes; site of oxidative phosphorylation.

Mitosis — a form of cell or nuclear division by means of which each of the two daughter nuclei receives exactly the same complement of chromosomes as the parent nucleus had.

Molecule — the smallest particle of a covalently bonded element or compound having the composition and properties of a larger part of the substance.

Morphogenesis — the development of form, size and other features of a particular organ or part of the body.

Mosaic development — embryonic development in which the capacities of the cells are restricted to the structures they normally form.

Mutation — a stable, inherited change in a gene.

Myofibrils — the contractile fibrils visible in muscle tissue with light microscopy. Composed of groups of myofilaments of actin (q.v.) and myosin.

Nerve — a cordlike collection of neurons and associated connective tissue that extends between the central nervous system and other parts of the body; most nerves contain both the afferent and efferent neurons.

Neuron — a nerve cell with its processes, collaterals and terminations; the structural unit of the nervous system.

Neurula — the early embryonic stage during which the primitive nervous system forms.

Neutrons — electrically uncharged particles of matter existing along with protons in the atomic nucleus

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Neutrons — electrically uncharged particles of matter.

Notocord — the rod-shaped body in the anteroposterior axis which serves as an internal skeleton in the embryos of all chordates, and that is replaced by a vertebral column in most adult vertebrates.

Nucleolus — a spherical body found within the cell nucleus believed to be the site of synthesis of ribosomes.

Nucleus — the organelle of a cell containing the hereditary material.

Organelle — one of the specialized structures within a cell, e.g., the mitochondria, Gogli complex, ribosomes, contractile vacuole, and so on.

Orthogenesis — straight-line evolution progressing in a given direction.

Osmosis — the passage of solvent molecules from the lesser to the greater concentration of solute when two solutions are separated by a membrane which selectively prevents the passage of solute molecules but is permeable to the solvent.

Outbreeding — the mating of individuals of unrelated strains.

Parturition — the process of giving birth.

Peritoneum — epithelium and supporting connective tissue which lines the body cavity.

Permeability — the property of a membrane that permits the passage of a given substance.

Phenotype — the visible expression of the hereditary constitution of an organism.

Phylogeny — the evolutionary history of a group of organisms.

Plasma membrane — a living, functional part of the cell through which all nutrients entering the cell and all waste products or secretions leaving it must pass.

Plasmolysis — contraction of the cytoplasm of a cell due to the loss of water by osmotic action.

Platelet — a small colorless blood corpuscle of mammals that plays an important role in blood coagulation.

Polar body — body formed during oogenesis, maturation of the egg, and appears as a speck at the animal pole of the egg.

Polarity — in biology, the tendency of a piece of an organism to retain its original body orientation, regenerating a head at the original anterior end and so on.

Polymorphism — occurrence of several distinct phenotypes in a population.

Population — the group of individuals of a given species inhabiting a specified geographic area.

Primitive streak — a longitudinal groove which develops on the embryonic disc of the eggs chordates as a consequence of the movement of cells and formation of mesoderm; marks the future longitudinal axis of the embryo.

Primordium — the earliest discernible indication during embryonic development of an organ or part.

Prokaryotic — organisms that lack membrane-bound nuclei, plastids and Gogli apparatus.

Pseudocoelom — a body cavity between the mesoderm and endoderm.

Radial cleavage — type of cleavage pattern in which the spindle axes are parallel or at right angles to the polar axis.

Regeneration — regrowth of a lost or injured tissue of an organism.

Respiration — process by which animal and plant cells utilize oxygen, produce carbon dioxide, and conserve energy in biologically useful forms such as ATP.

Reticulum — a network of fibrils or filaments, either within a cell or in the intercellular matrix.

Ribonucleic acid (RNA) — nucleic acid containing the sugar ribose; present in both nucleus and cytoplasm and of prime importance in the synthesis of proteins.

Ribosomes — minute granules composed of protein and ribonucleic acid; the site of protein synthesis.

Saprophytic nutrition — a type of heterotrophic nutrition in which organisms absorb their required nutrients through the cell membrane following the extracellular digestion of nonliving organic material.

Schizocoel — a body cavity formed by splitting of embryonic mesoderm into two layers.

Segmentation — division of a body or structure into similar parts.

Senescence — the gradual loss of vigor through the aging process

Serum — the clear portion of a biological fluid separated from its particulate elements.

Somites — paired, blocklike masses of mesoderm, forming the vertebral column and dorsal muscles.

Species — the unit of taxonomic classification, a population of similar individuals, alike in their structural and functional characteristics.

Spiral cleavage — a cleavage pattern characteristic of a number of invertebrate phyla in which the cleavage planes are oriented obliquely to the polar axis of the egg.

Standard metabolism — the amount of energy expended by an animal at rest.

Stimulus — any agent, act, or influence that produces functional or trophic reaction in a receptor or in an irritable tissue.

Synapse — the junction between the axon of one neuron and the dendrite of the next.

Taxonomy — the science of naming, describing, and classifying organisms.

Telolecithal — type of egg in which the yolk material is concentrated on one side.

Territoriality — behavior pattern or mold in which one organism (usually a male) delineates a territory of his own and defends it against intrusion by other members of the same species and sex.

Theory — hypothesis supported by a large body of observations and experiments.

Thermodynamics, first law of — law which states that energy is neither created nor destroyed but only transformed from one kind to another.

Thrombin — the enzyme derived from prothrombin which participates in blood clotting.

Tissue — specialized cells which together perform certain special functions; e.g., muscle tissue, bone tissue, nerve tissue.

Transduction — the transfer of a genetic fragment from one cell to another.

Transfer RNA — a form of RNA which serves as a type of adaptor molecule in the synthesis of proteins. An amino acid is bound to a specific kind of transfer RNA and then arranged in order by the complementary nature of the nucleotide triplet (codon) in template or messenger RNA and the triplet antocodon of transfer RNA.

Vacuole — small space within a cell, filled with watery liquid and separated by a vacuolar membrane from the rest of the cytoplasm.

Visceral — pertaining to the internal organs, e.g., the visceral muscles of the gut wall.

Zygote — the cell formed by the union of two gametes; a fertilized egg.

INFORMATION SHEET #2

Zoology: The Study of Animal Biology

Zoology is defined as the scientific study of animals and is considered to be a subdivision of the wider science of Biology, the study of life.

Before studying the differences between plants and animals, it is first necessary to answer the question, What is the difference between a living and a nonliving thing? In studying the distinctions, it is useful to consider the following characteristics: organization, metabolism, development, reproduction, environmental interaction, and genetic control.

Organization is the combination of atoms and molecules into patterns in living organisms, and the coordination of their physical and chemical activities. Metabolism is the term used for anabolic and catabolic reactions that occur as essential chemical processes of living cells. Development refers to the ongoing process of change that is required for life's maintenance. Reproduction is the ability of a population as a whole to replicate itself and is necessary as a consequence of development. Environmental interaction is the response by a living organism to environmental stimuli and is the basis for change and adaption. Genetic control refers to the passing of an information package from one generation to the following, with the changes and differing combinations that make evolution possible. It needs to be emphasized that each criterion of the living has a close parallel within the nonliving. It is the *combination* of these criteria into structures and patterns that constitutes living organisms.

The answer to the question of the differences between plants and animals is somewhat more definite but with its own difficulties. Animals may be said to have cells in which the genetic material is collected in a nucleus (an enclosed membrane), which cannot produce organic compounds from light energy, and which have cells not enclosed by cell walls. These differences separate animals from bacteria (which have cell walls and do not collect genetic material in a membrane), from fungi (which have cell walls), and from plants (which photosynthesize and mostly have cell walls). There are, however, those organisms such as *euglena* which cross boundaries. *Euglena* functions as an animal, through mobility, at night, and as a plant, through photosynthesis, in the day. Thus, the finer the definition, the more exceptions that are generated.

Biological Principles

As can be seen from the previous example, statements of definition and facts are subject to exceptions and will be subject to revision as new knowledge becomes available. Statements of principles and facts that have wide application can be used to formulate other principles and concepts. The following list contains a few of the important principles on which there is current agreement that demonstrate commonness among organisms.

1. Environmental interaction
   a. Cells in organisms affect and interact with each other.
   b. Cells and organisms react and interact with their environment.

2. Genes
   a. All organisms pass on function and structure to their offspring.
   b. The combination of gene characteristics is variable.
   c. The DNA contains the genetic code in a linear arrangement.
   d. The RNA is the means of replicating and passing on the genetic code.

3. Life
   a. Life comes from life.
   b. Reproduction is required for life continuation.

4. Physical and chemical reactions
   a. Physical and chemical laws are obeyed by living creatures.
   b. All living organisms use the common molecular, biological, and chemical reaction means.
   c. All living organisms must capture, store, and release energy to sustain life.

5. Evolution
   a. All organisms arise from preexisting organisms. (The exception would be the assumption that the original living cell arose spontaneously. This assumption is commonly accepted but subject to serious question by some investigators.)
   b. Natural selection is responsible for organism evolution.
   c. The embryos of developing animals tend to resemble the embryos of their ancestors.
   d. Organisms adapt to their habitat through selection from environmental pressures.

6. Cells
   a. Cells are the fundamental units of life.
   b. Cells contain structures which are differentiated and interdependent.

7. Development
   a. All organisms exhibit characteristics of cell enlargement or cell division or both. This characteristic is termed growth.
   b. All organisms develop a characteristic body plan.

INFORMATION SHEET #3

Animal Symmetry

Just as townships and ranges are used to designate a particular location in relation to a county, so are anatomical terms used to designate areas of an animal's body in relation to itself. These terms apply regardless of the position or direction of the animal. The following terms are, like townships and ranges, arbitrary impositions but fulfill the need of an understood form of reference:

1. Cranial and Anterior — directional terms referring to "towards the head."
2. Caudal posterior — directional term referring to "towards the tail."
3. Median or Sagittal — an imaginary plane that divides the body into equal right and left halves. Sagittal can also refer to any plane parallel to a median plane.
4. Transverse plane — a plane that divides a body and provides a cross section at right angles to the median plane.
5. Frontal plane — a plane that divides a body into upper (dorsal) and lower (ventral) segments and is at right angles to both the median and transverse planes.

In addition to planes, other terms that are used are:

6. Medial — adjective meaning closer to or toward the median plane.
7. Lateral — opposite of medial, farther away from the median plane.
8. Dorsal — directional term for toward or beyond the vertebral column; also relative position of one organ to another.
9. Ventral — directional term for away from the vertebral column.
10. Deep and Internal — toward the center of a body or extremity.
11. Superficial and External — toward the surface of body or extremity.
12. Proximal — nearer the middle of the body than the reference point.
13. Distal — farther away from the middle of the body than the reference point.
14. Prone — refers to a position in which the dorsal aspect of the body is uppermost.
15. Supine — refers to a position in which the ventral aspect of the body is uppermost.
16. Pectoral — refers to the chest region or that supported by the forelegs.
17. Pelvic — refers to the hip region or that supported by the hind legs.

Bilateral Symmetry

Bilateral symmetry refers to the ability to divide a body into mirrored halves and can only be accomplished by a division along the medial (sagittal) plane. This characteristic is exhibited by those organisms which feature a predominant forward directional movement. It needs to be emphasized that though an organism may be bilaterally symmetrical it may have unpaired organs in addition to those paired organs that are similar but not interchangeable. Unpaired organs are generally located on, near, or across the median plane.

INFORMATION SHEET #4

Animal Cell Anatomy

In the evolution theory it is hypothesized that all present life evolved from a spontaneous development of living cells from various compounds present at the time. (For a more detailed explanation, please see the problem area *Understanding Basic Principles of Plant Science.*) These original organisms were similar to present bacteria and are prokaryotes, lacking a membrane-bound nucleus and organelles. After the development of an oxidizing atmosphere, eukaryotes, which have a membrane-bound nucleus and organelles, arose from the symbiotic union of two or more prokaryotes. Eukaryotes include the organisms within the animal kingdom.

While the cells within animals take many different shapes according to location and function, all cells contain the same principal organelles necessary for maintenance activities. The following list contains the primary organelles to be found within the cytoplasmic material. The membrane which bounds these organelles is thought to be derived from, or continuous with, the plasma membrane. Animal cells contain no plastids or cell wall.

1. Plasma membrane — thin, differentially permeable membrane surrounding the cytoplasmic material and regulating the flow of material of the cell and its environment.
2. Nuclear envelope — most prominent organelle, surrounded by a double layer membrane envelope and containing the nucleolus.
3. Nucleolus — granular structures that contain copies of DNA material to synthesize RNA
4. Mitochondrion — double membrane organelle with a smooth outer membrane and an inner membrane folded into platelike or fingerlike projections; found in various sizes and may be localized or scattered. This is the area of enzyme activity which carries out the energy-yielding steps of aerobic metabolism.
5. Golgi bodies — a stack of smooth folds which serve as storage vessels and for packaging secretory products which are then released as vesicles. These vesicles may contain products for export or may stay within the cell.
6. Endoplasmic reticulum — organelle with spaces between membranes that serve as routes for transporting substances and for separating end products from the synthesis point. May be either smooth or rough. The rough sometimes contain ribosomes.
7. Ribosomes — the product of the combination of ribosomal RNA and different proteins.
8. Lysosomes — vesicles containing digestive enzymes which remain in the cell that produces them. These enzymes may break down foreign material such as bacteria or injured or diseased cells.
9. Microvilli — modified plasma membrane that forms fingerlike projection for more surface area, found in intestines.
10. Centrioles — microtubule bodies which aid in maintaining cell shape and organelle translocation found in pairs at right angles.

Membrane Function

The function of the plasma membrane, as noted, is to regulate the flow of solvents and liquids into and out of the cell. The principles of osmosis and diffusion are of central importance to this function. Please refer to the problem area *Understanding the Basic Principles of Plant Science* for a discussion of these two processes.

INFORMATION SHEET #5

Animal Tissue

As the number of cells which make up an organism increase, certain cells will specialize in function. These specialized cells will group together to form tissue. The primary tissues include epithelial, connective, muscle, and nervous tissue.

Epithelial Tissue

Epithelial tissue is that which covers an internal or external surface. This includes the surface of the body, the lining of body cavities, ducts and passages of the body, and the secretory portion of glands which provide lubricating mucus or hormones and enzymes. Types of epithelial tissue include:

Simple (Single - Layered)

1. Squamous — flat, as found in blood vessels and linings of body cavities and viscera.
2. Cubodial — short prism, as found in ducts and passageways and the active tissue of glands.
3. Columnar — tall, as found in intestines; may also be ciliated, as found in the trachea.
4. Pseudostratified columnar — appear to vary in length and found in the upper respiratory.

Stratified (Multi - Layered)

1. Stratified squamous — forms outer layer of skin, the first part of the digestive tract, and, in ruminants, the forestomach; cubodial shaped, thickest and toughest of epithelial tissues.

2. Stratified columnar — as found in the pharynx and salivary ducts.

3. Transitional — forms in areas subjected to stretching as in the bladder; stretches from many layers thick to single layer.

4. Glandular — can be cuboidal or columnar, found in mucous or hormonal glands.

5. Yellow — kinked fibers that tend to regain shape after being stretched, as found at the base of the skull.

6. Branching — netlike, star-shaped, as found in lymphatic tissue and bone marrow.

Connective Tissue

Loose Connective

1. Areolar — found throughout the body where protection is needed, as around blood vessels and at body prominences; attaches skin to muscle.

2. Adipose — cells that have taken up fat for storage, if so filled with fat that the connective tissues bind and connect all other structures. These tissues give form and strength and provide protection. Connective tissue is made up of relatively few cells and a large amount of formed material such as fiber and the grounding material matrix. The connective tissue is in three fiber types:

   a. white (collagenous)
   b. yellow (elastic)
   c. branching (reticular)

   Connective tissue is found as either loose connective (reticular, areolar, or adipose) or dense connective (sheaths, ligaments, tendons, or bone).

3. Collagenous — the most common type of connective tissue, with white fibers. The nucleus of its cells is pushed to one side; thus the cell shape becomes spherical.

Dense Connective

1. Tendons — parallel bundles forming bands which connect muscle to bone.

2. Ligaments — parallel bundles forming bands which connect bone to bone.

3. Cartilage — specialized tissue more firm than fibrous but not as hard as bone; makes up active growing bone, the external ear, and vertebral discs.

4. Bone — formed by bone-forming cells called osteoblasts which produce osteoid tissue which is later calcified to form bone.

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Muscular Tissue

Muscular tissue is the most common tissue found in most animals. The cell or muscle fiber is made up of elongated strands specialized for contraction. The contractile elements of the fiber are microfibrils. The types of muscular tissue are striated and smooth.

Striated

1. Voluntary (skeletal) — makes up the flesh, along with some connective tissue of meat-producing animals. Each muscle fiber cell has its own nerve supply that stimulates the microfibrils to contract. When stimulated the whole fiber contracts; found in bundles, nuclei located on edge of fiber.

2. Involuntary (cardiac) — shorter fibers than skeletal and found in sheets in the heart of vertebrates and controlled by the autonomic system.

Smooth

1. Smooth — spindle-shaped with a centrally located nucleus, found in walls of intestines, walls of blood vessels, and urinary and reproductive tract. Smooth muscles contract more slowly than striated.

Nervous Tissue

Nervous tissue conducts impulses after receiving some stimulus. The neuron is the essential cell of the nervous tissue. The nerve fibers (process) connected to the nerve cell body are called dendrites if they conduct impulses towards the cell body and axons if the impulses are conducted away from the cell body. The neurons are arranged in chains, at times containing thousands of processes, and the contact point between neurons is a synapse. Types of neurons are:

1. Sensory — conduct impulses from skin or sense organs to nerve centers.

2. Motor — conduct impulses from the nerve centers to muscles or glands.

3. Association — form connections between other neurons.

INFORMATION SHEET #6

Blood

Blood is referred to at times as a complex liquid connective tissue arising from the fact that some components have similar origins. If mammalian blood is centrifuged, the contents will separate into two distinct portions: (1) plasma, which contains mostly water, dissolved solids, metabolic waste, and dissolved gases, and (2) formed elements, which are red blood cells, white blood cells, and platelets.

Plasma, being ninety percent water, is the carrying mechanism for blood contents. The dissolved solids portion consists of proteins, enzymes, antibodies, hormones, and metabolic wastes. The dissolved gas present is oxygen, carbon dioxide, and nitrogen.

The formed elements portion's major constituent is the erythocyte red blood cell. This biconcave disc contains a baglike structure which contains hemoglobin. Hemoglobin has the ability to combine with oxygen or carbon dioxide, whichever is in higher concentration, which allows the same cell to carry oxygen to the lung and carbon dioxide away from the lung. The other major components are white blood cells, which serve as scavengers and defense cells in a wandering system of protection, and the platelets, which contain substances that are acted upon by chemicals released by damaged tissues. These substances, in turn, convert a soluble blood protein to a gel which helps to coagulate the blood at the wound. It should be noted that red blood cells lack nuclei and are unable to reproduce. An individual red blood cell may exist for up to four months. The supply of red blood cells is continuously replenished by the bone marrow.

INFORMATION SHEET #7

Animal Development

Natal Growth

While a full discussion of the embryonic process of mammals, the study of which is called embryology, is much too complicated for a complete coverage at this time, the basics will be presented as representative of those animals with which we are familiar. The embryo stage refers to that stage beginning at the formation of the zygote by the combination of the ovum and the sperm, and continuing to the formation of the fetus. From this one-celled zygote develops all that makes up the organism.

The process of cleavage is the first dividing of the zygote. The first cell divides into two cells, those two divide into four cells, those four into eight, and so on. It is important to realize that each subsequent cell division reduces each cell by half, thus the overall size of the cluster of cells remains the same as when the process began. The dividing cells tend to fill the central cavity of the cluster of cells leaving a small cavity, called the blastocoel, which designates the next stage, blastulation.

The blastula, a cluster of cells, consists of a few thousand cells in which the DNA content has greatly increased but in which the cells have become increasingly smaller, as mentioned above.

The next stage, gastrulation, is the period in which the cells become rearranged into positions to form all future structures. The vegetal pole, that which contained a large portion of yolk, and the animal pole, that which contained mostly cytoplasm, end up with respective differences in cell number and size. The vegetal contains fewer, larger cells and the animal contains many, smaller cells. The animal pole cells will become the ectoderm and the vegetal pole cells will form the endoderm. During gastrulation the cleavage divisions slow in the vegetal half and cells near the animal pole surface begin to sink inward and invaginate to form two germ layers, the endoderm and the ectoderm. As this invagination proceeds, the mesoderm rolls over the blastopore and penetrates the endoderm on the inside and the ectoderm on the outside, forming the three layers which form all other structures. The formation of the coelom occurs at this time to form the true body cavity which will contain the viscera.

The differentiation process continues after the formation of the primary germ layers and cells increasingly become committed to specific directions of development and become specific structures. The ectoderm will give rise to epithelium (skin, wool, hair, hooves), the central nervous system, and the brain. The mesoderm will differentiate into the muscles, blood vessels, circulatory system, and connective tissue. The endoderm will develop into the digestive system and certain endocrine glands. There is a specific sequence to development with the cephalic region developing before the pelvic region and the central nervous system developing before other organs. The process of differentiation continues until all structures are formed.

Fetal Growth

At the time that all structures have been formed the embryo becomes the fetus. The fetal period is a time of mostly an increase in size, similar to that which we witness after birth, only on a smaller scale. The differentiated structures will increase in size and cells will die and be replaced. Certain cells, such as red blood cells, liver cells, and skin cells are constantly being renewed. Other cells, such as brain, nerve and muscle cells are not replaced after the embryologic stage and any damage now or in the future will be permanent.

Postnatal Growth

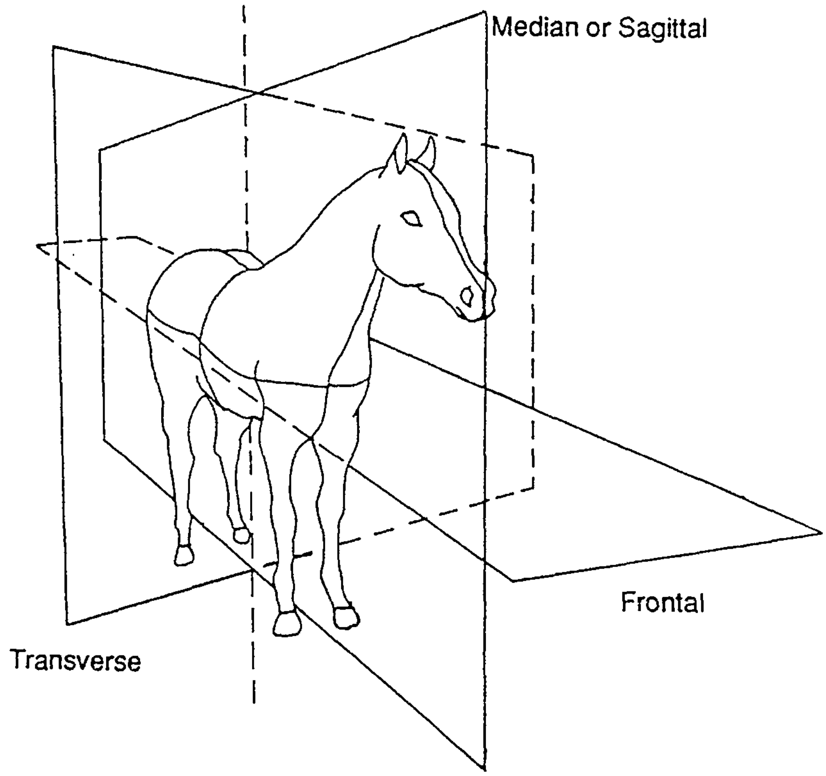
At the time of birth, or parturition, most parts of an animal's body are formed and functioning. The digestive and respiratory systems are the major exceptions as most mammals and avians require further development of these for independent function. The growth of various parts of the body does not occur at the same rate, nor do different species develop at the same rate. The genetic potential of a species overall and of an individual in particular for growth can be adversely affected by not only the lack of essential nutrients but also the physical environment even if the nutrient supply is sufficient. The postnatal growth requirements of individual species are more appropriately studied by other specific disciplines.

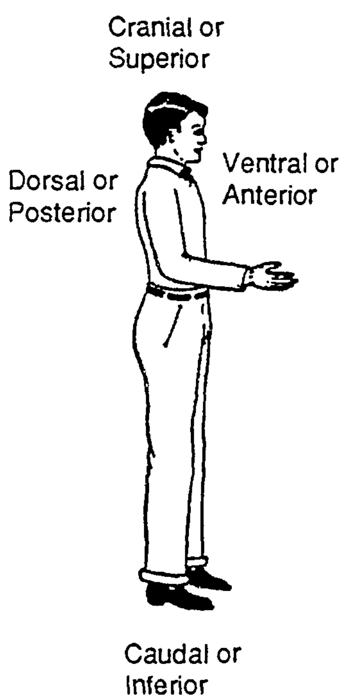
Aging

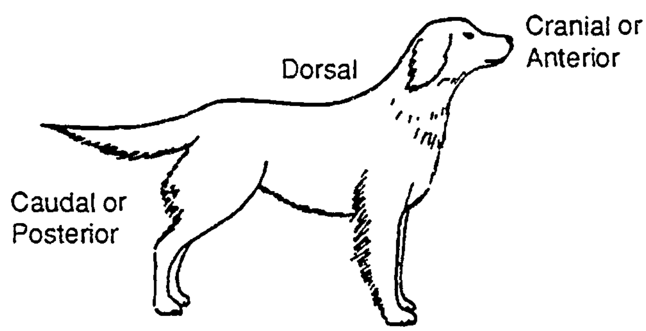
Each species has a definite cycle which that organism goes through, with death being the final result. The length of this cycle has a genetic maximum which cannot be lengthened regardless of treatment. Most physiological functions begin deteriorating, in a true sense, immediately after development, though the maximum capability for replacement has not been reached. The nervous system, present since the fetal stage, is an obvious example of one that is prone to deterioration. Muscular strength, vessel elasticity, and hormonal output are other results of natural aging. The longevity of an organism can be lessened by environmental factors, improper diets, and artificial stimulation of production.

TRANSPARENCY MASTER #1

Descriptive Anatomical Terms







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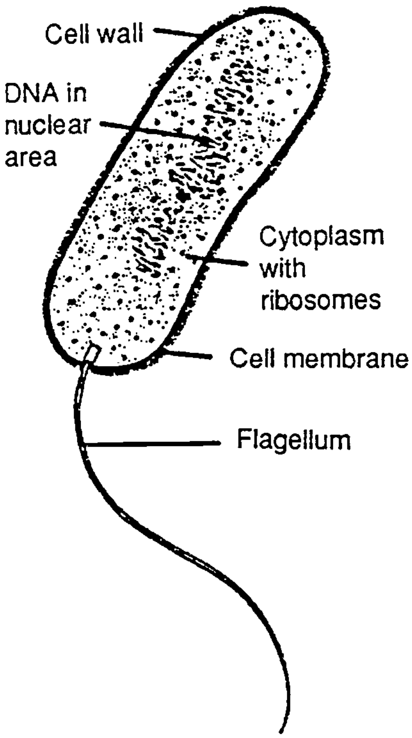
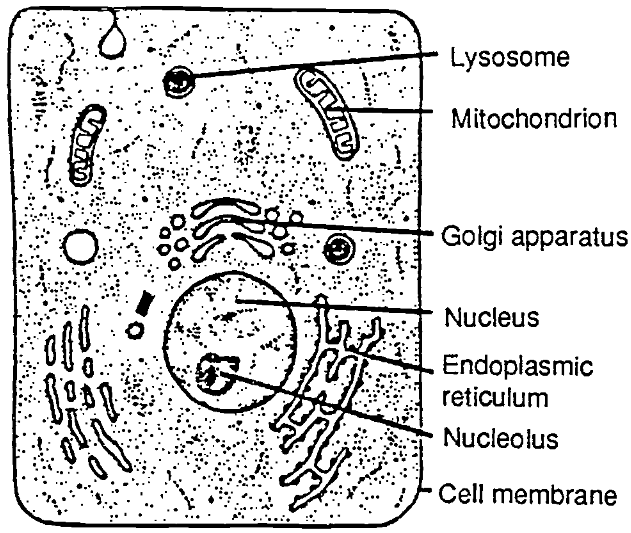
TRANSPARENCY MASTER #2

Comparison of Prokaryote and Eukaryote Cells



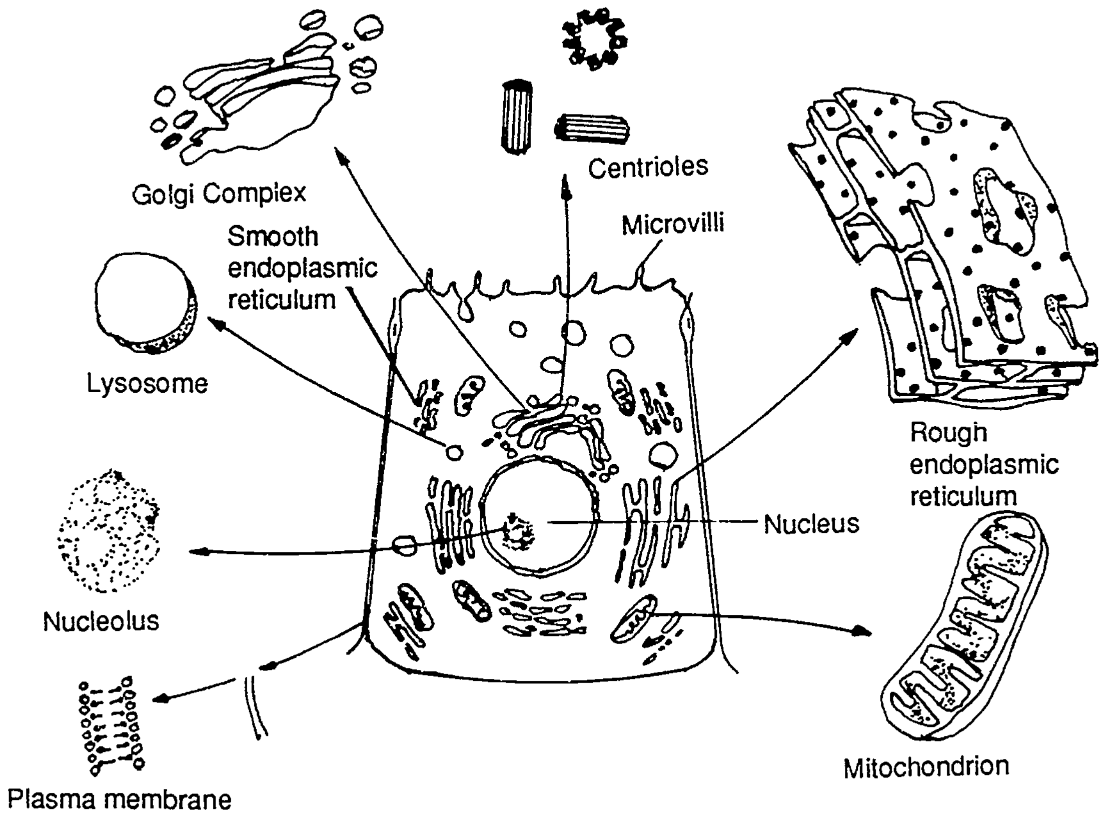
Prokaryote



Eukaryote

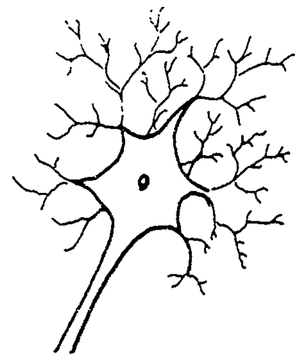
TRANSPARENCY MASTER #3

Animal Cell



TRANSPARENCY MASTER #4

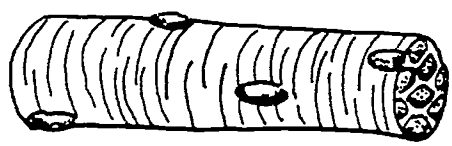
Types of Animal Cells



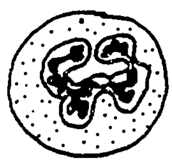
Nerve cell, showing cell body (soma) surrounded by numerous dendritic extensions and a portion of the axon extending below.

Epithelial cell from lining of the mouth.

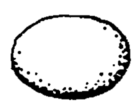
Smooth musle cell from intestinal wall.



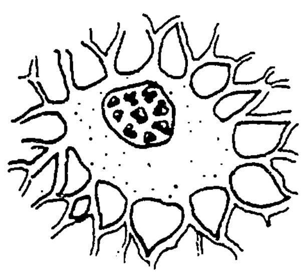
Striated muscle cell from skeletal muscle.



White blood corpuscle.



Red blood corpuscle (erythrocyte).



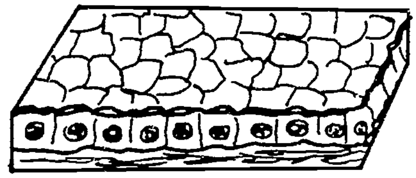
Bone cell.

Human spermatozoon. (Not drawn to the same scale.)

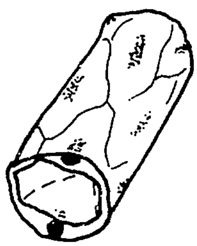
TRANSPARENCY MASTER #5

Types of Epithelial Tissue

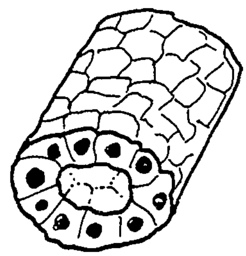
Simple Squamous



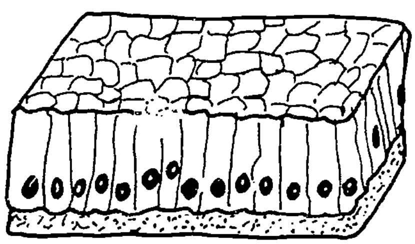
Simple Cuboidal



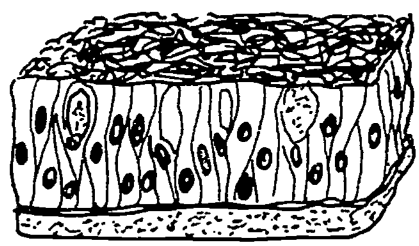
Simple Squamous in Tubular Arrangement



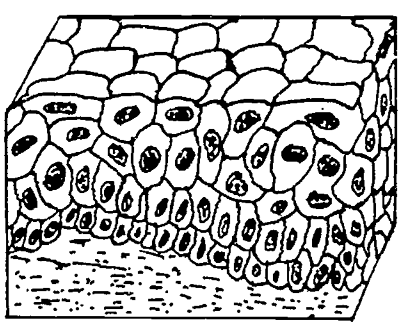
Simple Cuboidal forming a small duct



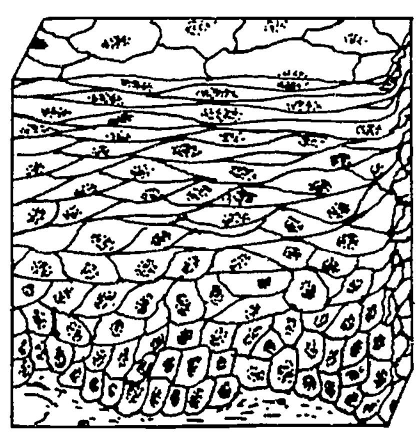
Simple Columnar



Pseudostratified Columnar with Cilia



Transitional

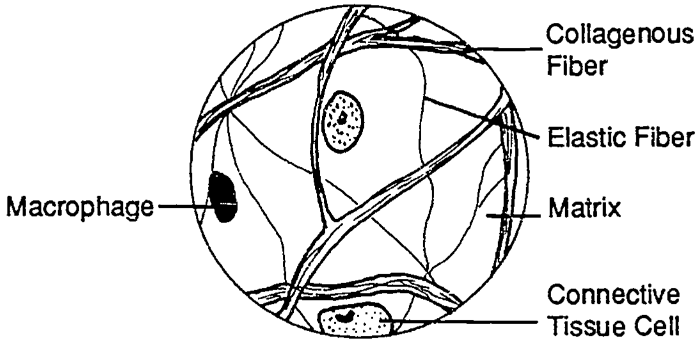


Stratified Squamous (Moist Type)

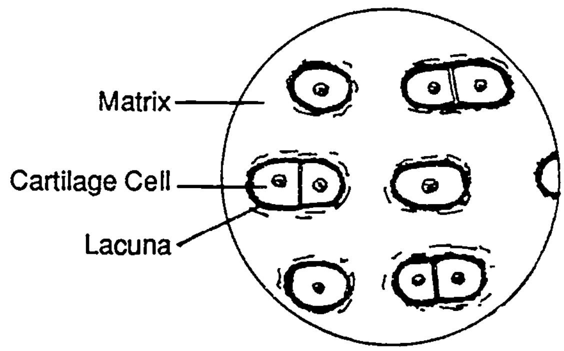
ERIC

TRANSPARENCY MASTER #6

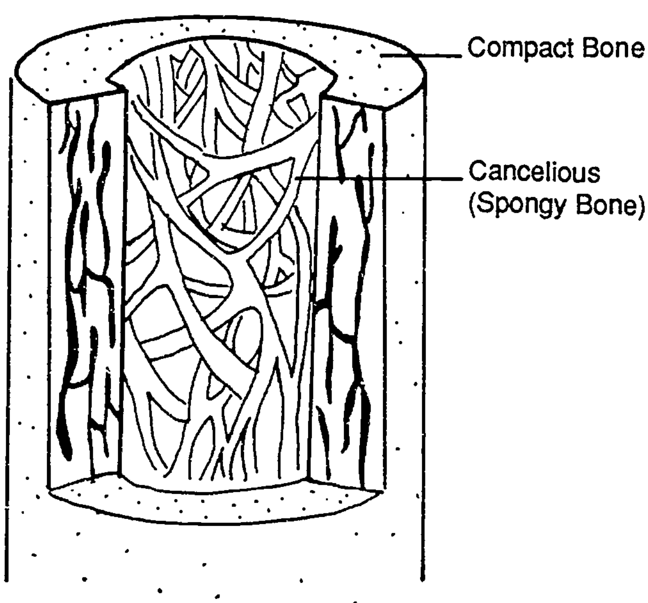
Connective Tissue



Areolar



Cartilage



Section of a Long Bone

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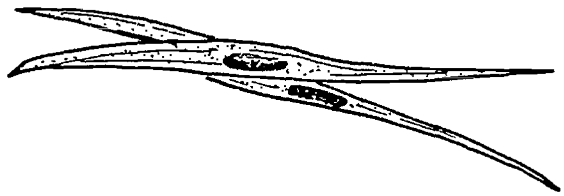
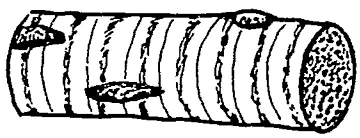
TRANSPARENCY MASTER #7

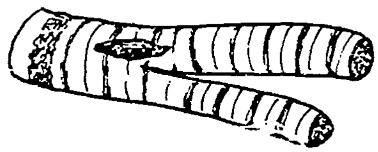
Muscular Tissue



Elongate, spindle-shaped, pointed ends - Smooth



Elongate, cylindrical, blunt ends - Skeletal



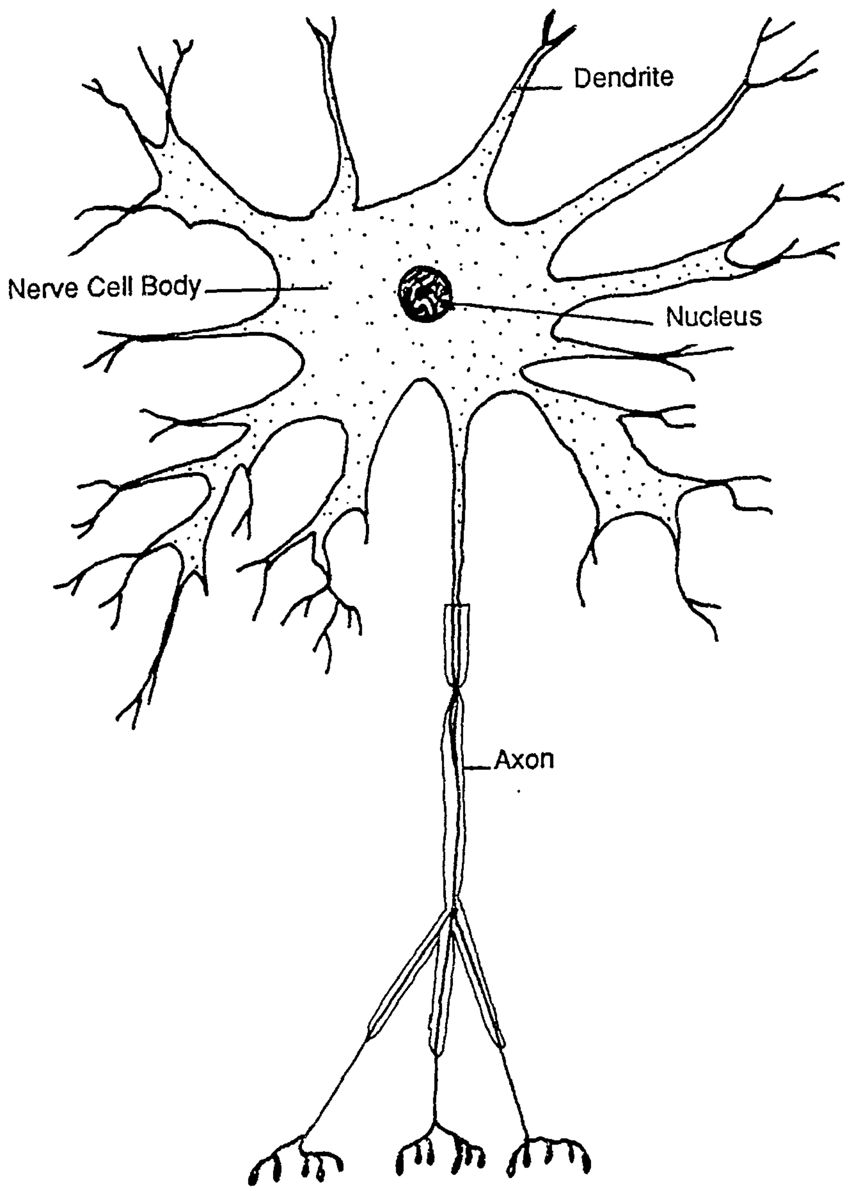
Elongate, cylindrical; fibers branch and fuse - Cardiac

Comparison

	Skeletal	*Smooth*	*Cardiac*
Location	Attached to skeleton	Walls of viscera	Wall of heart
Number of nuclei per cell	Many	One	One
Position of nuclei	Peripheral	Central	Central
Cross striations	Present	Absent	Present
Speed of contraction	Most rapid	Slowest	Intermediate
Ability to remain contracted	Least	Greatest	Intermediate
Type of control	Voluntary	Involuntary	Involuntary

TRANSPARENCY MASTER #8

Typical Neuron



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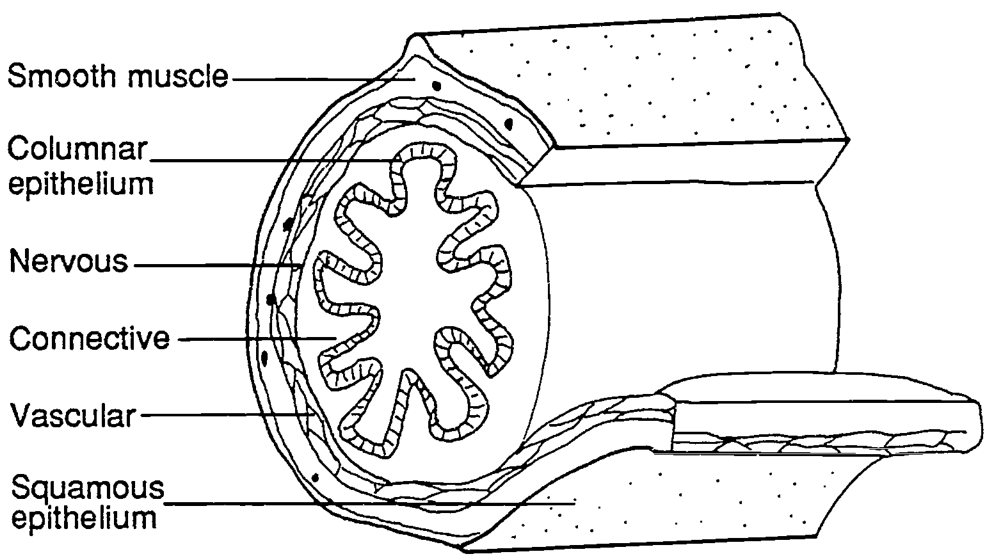
TRANSPARENCY MASTER #9

Intestine with Various Tissues Identified



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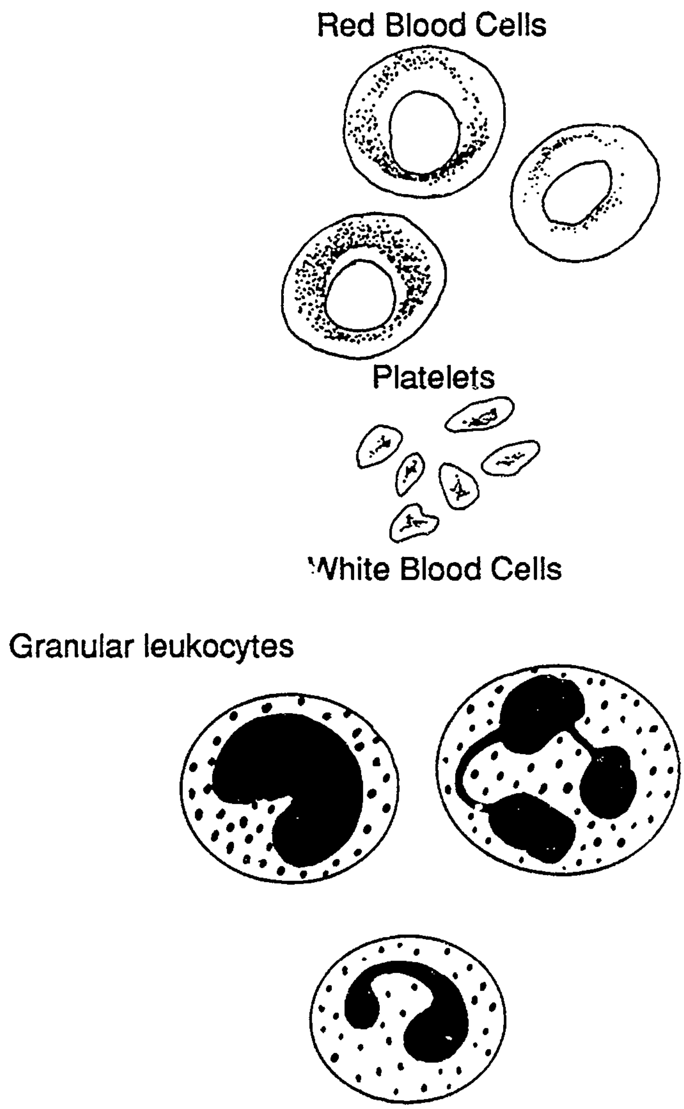
TRANSPARENCY MASTER #10

Anatomical Systems and Associated Structures

System	*Chief Structures*
Skeletal system	Bones, joints
Muscular system	Muscles
Digestive system	Stomach and intestines
Respiratory system	Lungs and air passages
Urinary system	Kidneys and bladder
Reproductive system	Ovaries and testes
Endocrine system	Ductless glands
Nervous system	Brain, spinal cord nerves
Circulatory system	Heart, vessels
Integumentary system	Skin
Sensory system	Eye, ear

TRANSPARENCY MASTER #11

Formed Elements of Blood



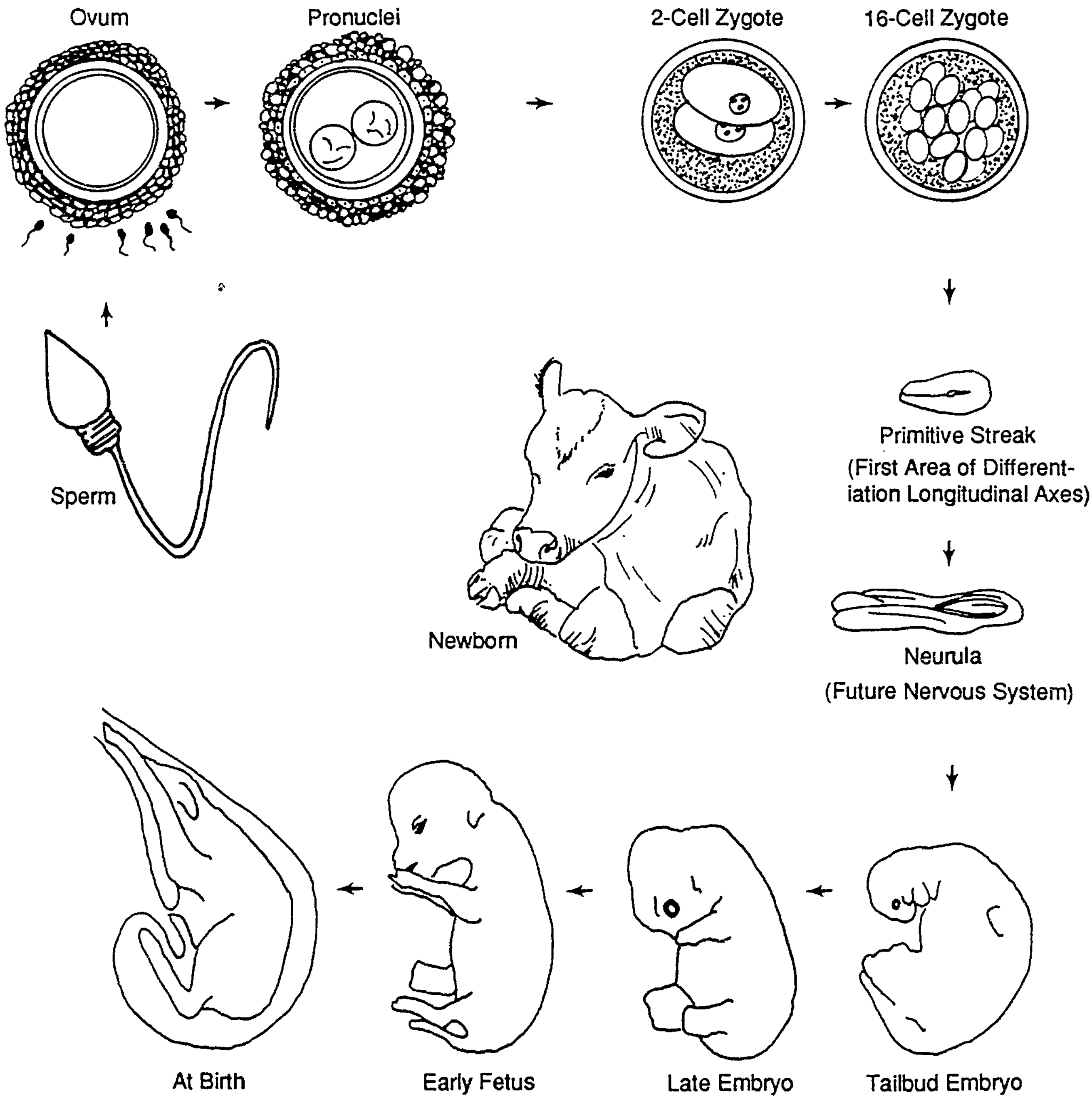
TRANSPARENCY MASTER #12

Tissues Developing from Ectoderm, Mesoderm, and Endoderm

Ectoderm	*Mesoderm*	*Endoderm*
1. Epidermis: Hair; nails; lens. 2. Nervous tissue. Epithelium of: 3. Sense organs. 4. Nasal cavity; sinuses. 5. Mouth.	1. Muscle (all types). 2. Connective tissue; cartilage; bone; notochord. 3. Blood; bone marrow. 4. Lymphoid tissue. Epithelium of: 5. Blood vessels; lymphatics. 6. Body cavities. 7. Kidney; ureter. 8. Gonads; genital ducts.	Epithelium of: 1. Pharynx. 2. Larynx; trachea; lungs. 3. Digestive tube, including: associated glands. 4. Bladder. 5. Urethra, including: associated glands.

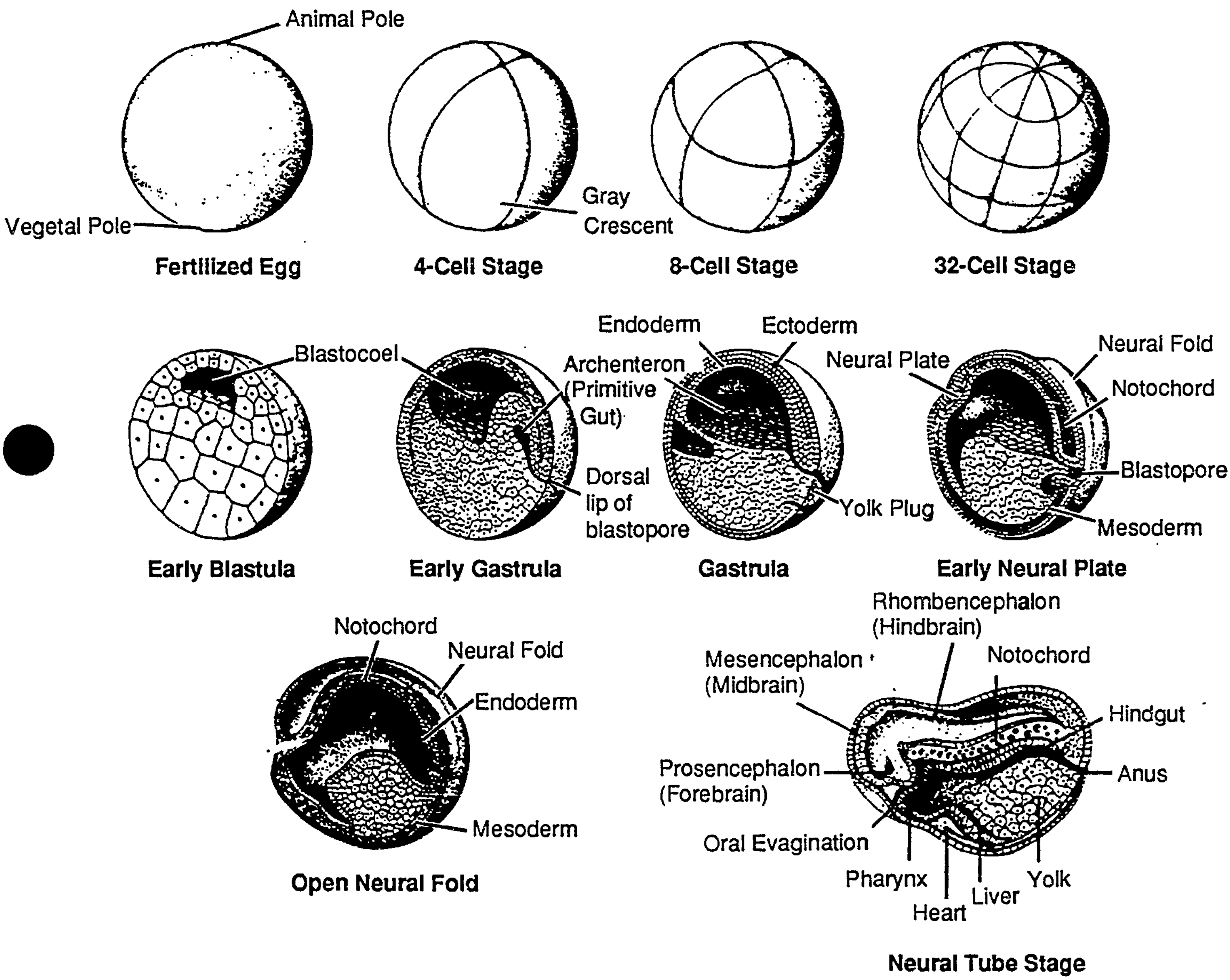
TRANSPARENCY MASTER #13

Prenatal Development from Conception to Birth



TRANSPARENCY MASTER #14

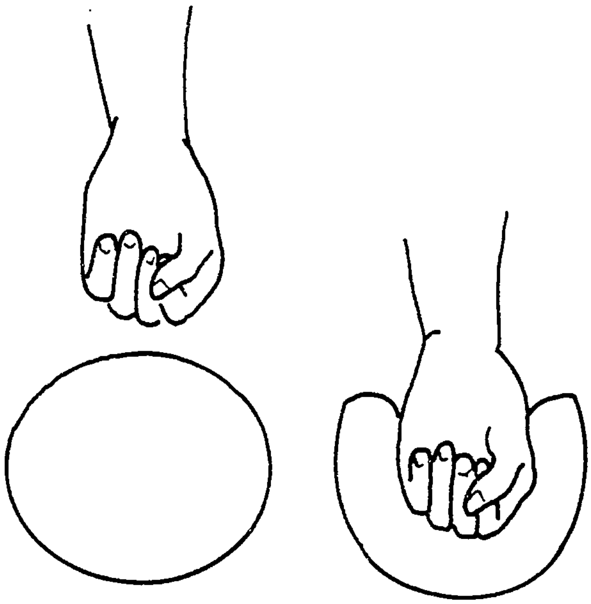
Developmental Stages of Representative Animal



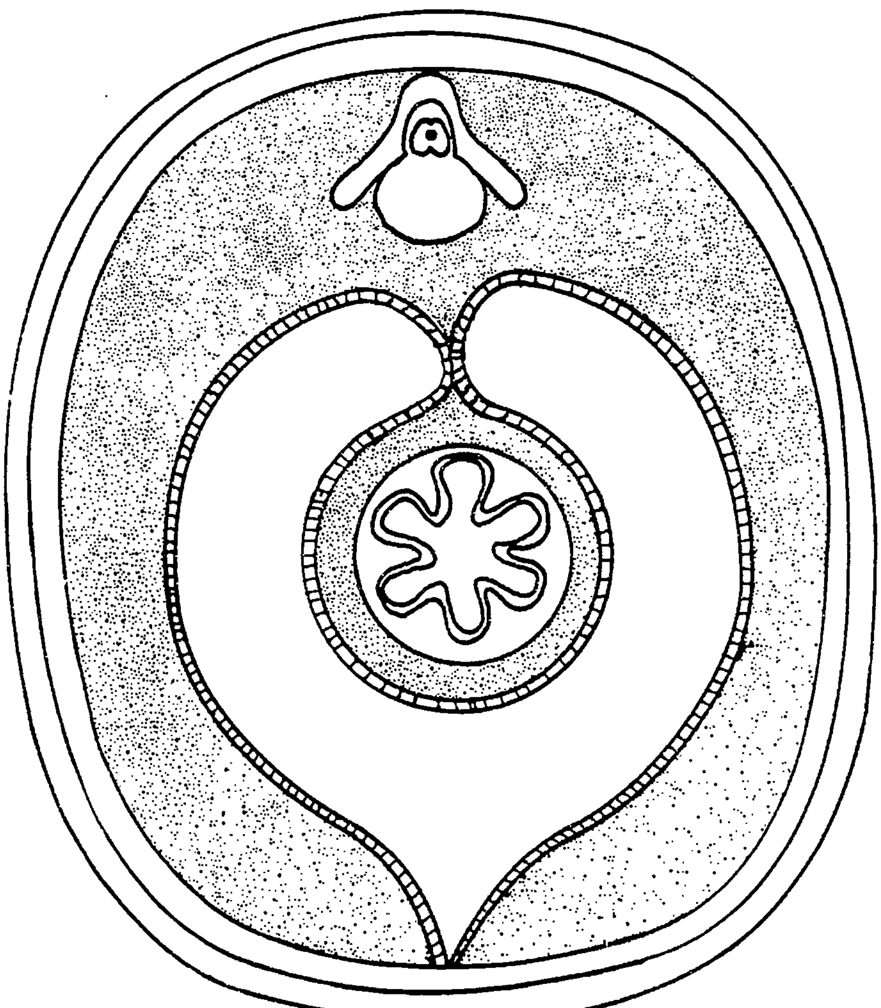
NOTE: The animal represented is the frog. The frog was chosen for its clarity in stages and ability to see origin points. Mammalians are so complex as to obscure the origin points even though a generally similar process takes place.

TRANSPARENCY MASTER #15

Invagination Process

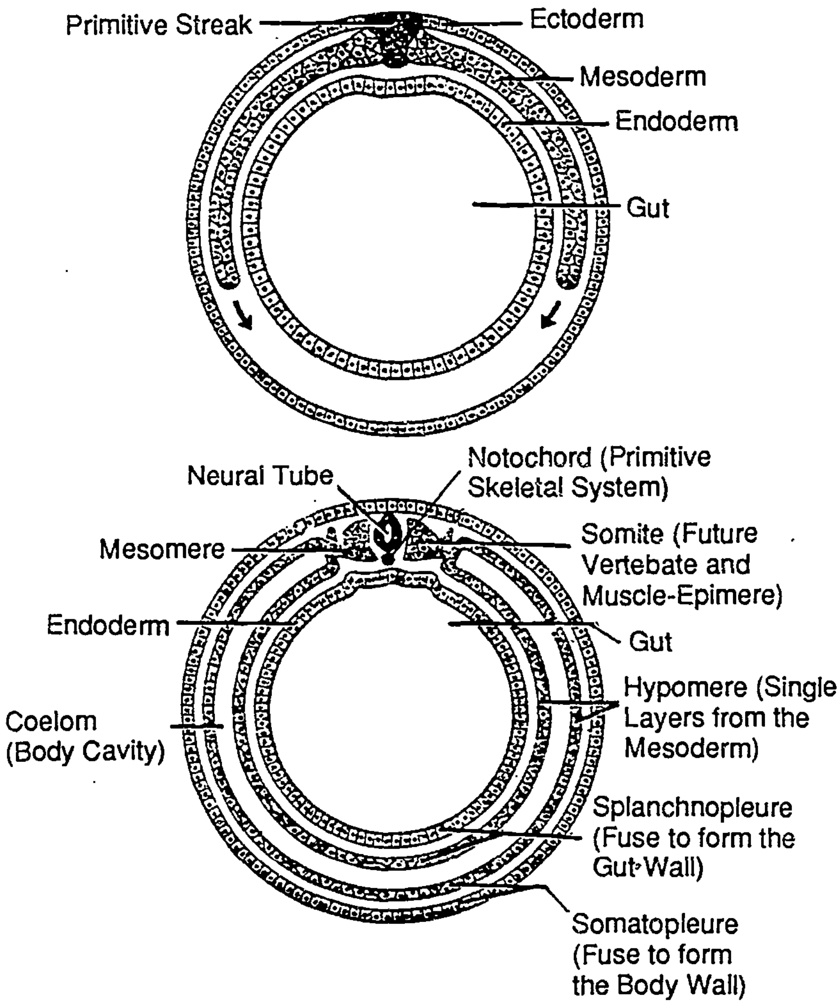


Result - Development of body cavity and meso-derm surrounding endoderm



TRANSPARENCY MASTER #16

Spread and Differentiation of Mesoderm



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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Squamous Epithelial Cells

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

ERIC

STUDENT WORKSHEET #1

Squamous Epithelial Cells

Purpose:

1. To observe living cells under a microscope.
2. To recognize similarities among individuals.

General Description:

The procedure will allow observation of living cells under a microscope and allow students to readily see that even though each is an individual with unique characteristics, basic similarities in makeup are present.

Materials:

1. Microscopes
2. Microscope slides w/cover lens
3. Sterile tongue depressors or cotton swab handles

Procedure:

1. Pass out tongue depressors and microscope slides with covers to students.

2. Have students gently scrape the inside of their cheeks with the tongue depressor.

3. Place cheek scraping in middle of microscope slide.

4. Gently place microscope cover lens directly on top of scraping (this step may be omitted if cover lens unavailable; lens allows for easier focusing of microscope as cells are on a more equal plane).

5. Place microscope slide on microscope table.

6. Adjust microscope.

Observations:

1. Draw a representative cell seen.

2. Trade slides with other students and observe cells. Are there differences?

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Electricity

RELATED PROBLEM AREA(S):

1. Recognizing the Impact of Technology on Agriculture: Electronics

2. Meeting the Environmental Requirements of Animals (Agricultural Business and Management Cluster)

3. Designing, Building, and Maintaining Agricultural Structures (Agricultural Business and Management Cluster)

4. Repairing and Maintaining Agricultural Equipment (Agricultural Business and Management Cluster)

5. Manufacturing, Distributing, Selling, and Servicing Agricultural Equipment (Agricultural Business and Management Cluster)

6. Designing, Building, and Maintaining Horticultural Structures (Horticulture Cluster)

7. Repairing, Maintaining, Operating Horticultural Equipment (Horticulture Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty I: Assembling, Servicing, and Maintaining Equipment and Facilities

1. Maintain hand tools
2. Service electrical outlets and extensions
3. Perform maintenance checks on equipment
4. Lubricate equipment
5. Replace bearings
6. Repair electrical defects
7. Troubleshoot equipment failure
8. Service electrical systems

Duty K: Maintaining and Construction Structures

1. Plan building construction
2. Service electrical systems of buildings
3. Service livestock feeding equipment
4. Service livestock watering equipment

ERIC

Duty N: Breeding, Handling, and Caring for Animals

1. Control building temperature
2. Control building ventilation
3. Control building lighting

Duty R: Applying Safety Practices

1. Comply with shop and equipment safety rules
2. Correct safety hazard

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences and Mathematics. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum
Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify variables that affect the size of electric and magnetic fields.					
*2. Recognize the results of the effect of heat energy on samples of matter.					
*3. Recognize the results of the effect of heat energy on samples of matter.					
4. Define electricity and related terms.					
5. Describe the atomic structure that allows for electrical energy.					
6. Describe magnetism and its relationship to electricity.					
7. Describe the principle of induction and its application in electric motors and generators.					
986					984

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the principles of scientific research and their application in simple research projects.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Replicate the results of an experiment.					
2. Identify common symbols used in circuit diagrams and use these symbols in planning a simple circuit.					
3. Identify common electrical devices and demonstrate their appropriate use.					

ISBE 41-78 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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Submission Date ______
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes, techniques, methods, equipment, and available technology of science.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify appropriate methods of measurement of a given task.					
2. Identify common electrical devices and demonstrate their appropriate use.					

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
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LEARNING ASSESSMENT PLAN

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Submission Date ______
☐ Original submission ☐ Revision   Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to make and use measurements, including area and volume.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Measure in a variety of contents using appropriate units.					
2. Define electricity and related terms.					
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ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Electricity

STUDENT LEARNING OBJECTIVES:

Upon completion of their study of this problem area, students will be able to:

1. Define electricity and related terms.
2. Describe the atomic structure that allows for electrical energy.
3. Describe magnetism and its relationship to electricity.
4. Distinguish between alternating and direct current.
5. Identify characteristics of single and three phase systems.
6. Describe the principle of induction and its applications in electric motors and generators.
7. Identify common symbols used in circuit diagrams and use those symbols in planning and wiring a simple circuit.

INSTRUCTORS' NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Electricity

PROBLEMS AND QUESTIONS FOR STUDY

1. What is atomic structure?
2. What are the components of atomic structure?
3. What is electricity?
4. What is alternating current?
5. How does alternating current differ from direct current?
6. What is voltage?
7. How is voltage measured?
8. What are amperes?
9. How are amperes measured?
10. What is wattage?
11. How are watts measured?
12. What is a kilowatt?
13. What is resistance?
14. What are ohms?
15. How does one calculate ohms?
16. What is a three phase electrical system?
17. How does a single phase system differ from a three phase system?
18. What is magnetism?
19. What is induction?
20. How are induction and magnetism related?
21. What was Oersteds discovery?
22. What was Henry and Faraday's discovery?
23. What is Lenz's Law?
24. What are some simple circuit diagram symbols?
25. How are circuit diagram symbols used?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Electricity

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use school personnel as resource persons for equipment and expertise in this area.
2. Have an electrical company representative speak to the class on generation, transmission, and usage for the local area.
3. Conduct a field trip to observe generation stations, transmission compounds, and transformers used for various facilities.
4. Have students observe and list items from their homes that use electricity.
5. Use demonstrations provided to precede and introduce appropriate electrical systems.
6. Use Student Worksheets #1 - #3 at appropriate times to check student understanding of basic principles.
7. Use Information Sheets and Transparency Master Discussion Guides as a self-review of content covered.
8. Emphasize safety concerns associated with electricity prior to laboratory activities.
9. Use laboratory activities to assist students in understanding basic principles and equations.
10. Read laboratory activities prior to use for equipment needed and principles illustrated.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Principles of Electricity

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Agricultural Electrification.* (1985). Surbrook, T.C., Mullin, R.C. South-Western Publishing Co., 355 Conde Street, West Chicago, IL 60185. (800) 323-1530.

2. *Electronics the Easy Way.* (1988). Miller, Rex. Barron's Educational Series, Inc., 250 Wireless Boulevard, Hauppauge, NY 11788.

3. *Physics Made Simple.* (1965). Freeman, Ira M. Bantam Doubleday Bell Publishing Group, Inc., 666 Fifth Avenue, New York, NY 10103.

*4. *Principles of Technology.* (1987). Center for Occupational Research and Development. Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322-3905.

*5. All Subject Matter Units and Transparencies on electricity. Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Basic Electricity Summary

INFORMATION SHEET #3 — Summary of Terms in Electrical Systems

TRANSPARENCY MASTER #1 — Molecular Structure (with discussion guide)

TRANSPARENCY MASTER #2 — Atoms (with discussion guide)

TRANSPARENCY MASTER #3 — Protons, Electrons, and Neutrons (with discussion guide)

TRANSPARENCY MASTER #4 — Free Electrons (with discussion guide)

TRANSPARENCY MASTER #5 — Electron Flow (with discussion guide)

TRANSPARENCY MASTER #6 — Electricity Generation with Magnet (with discussion guide)

TRANSPARENCY MASTER #7 — Magnetism (with discussion guide)

TRANSPARENCY MASTER #8 — Magnetic Flux Patterns (with discussion guide)

TRANSPARENCY MASTER #9 — Induced Voltage (with discussion guide)

TRANSPARENCY MASTER #10 — Electric Generators (with discussion guide)

TRANSPARENCY MASTER #11 — Electromagnet (with discussion guide)

TRANSPARENCY MASTER #12 — Lines of Force Cut Through Coil (with discussion guide)

TRANSPARENCY MASTER #13 — Induction (with discussion guide)

TRANSPARENCY MASTER #14 — Electric Motor Rotor (with discussion guide)

TRANSPARENCY MASTER #15 — Electric Transmission (with discussion guide)

TRANSPARENCY MASTER #16 — Three Phase Electricity (with discussion guide)

TRANSPARENCY MASTER #17 — Three Phase Electricity (with discussion guide)

TRANSPARENCY MASTER #18 — Single Phase Electricity (with discussion guide)

TRANSPARENCY MASTER #19 — Single Phase Electricity (with discussion guide)

INFORMATION SHEET #1

Terms To Be Defined

Ampere — a unit of measurement for current. It is equal to one coulomb in motion.

Amplitude — used to designate the height of an AC voltage or current.

Battery — an electrochemical device that serves as a DC power source.

Capacitance — that property of a capacitor that opposes any change in circuit voltage.

Capacitive reactance (X_c) — the opposition a capacitor produces when the circuit has alternating current. It is measured in ohms.

Capacitor — a device that consists of two plates and a dielectric material.

Circuit — a path for electrons to move through components and wires.

Circuit diagram — a drawing made in shorthand (using symbols) to show how components are connected.

Component — a term that is used to refer to small electronic parts.

Connector — a device that permits electrical separation of one part of a system from another while providing convenience in disconnection and connection.

Coulomb — the unit of measure for electrical charge equal to the total charge contained in 6.25×10^{18} electrons. A coulomb also equals the amount of charge that moves past a point in a circuit when one ampere of current flows for one second.

Current — the flow of electrons from negative to positive.

Cycle — an older term used to represent frequency. The term is still used to indicate the completion of a cycle or 360° of rotation of a generator.

Dielectric — it is the insulating material located between the two plates of a capacitor.

Diode — a two-terminal device that has two electrodes. It allows current to flow in only one direction.

Direct current (DC) — current that flows in only one direction.

Dry cell — a primary cell that is made up of zinc and carbon with an electrolyte of sal ammoniac. Other types are also available.

Eddy current — an induced current in the core of a transformer, inductor, or solenoid that is caused by the varying magnetic field produced by alternating current.

Effective voltage — term used to describe an rms voltage. It is 0.7071 times the peak voltage.

Electric charge — a fundamental characteristic of matter. Each electron in an atom carries one unit of negative charge. Each proton carries one unit of positive charge.

Electrical work — the product of the forcelike quantity (voltage) and the displacementlike quantity (electrical charge).

Electricity — the flow of electrons along a conductor.

Electromagnet — a magnet that has a field which is produced by an electric current through a coil wire.

Electromagnetism — a temporary magnetic field produced by electron flow through a coil of wire.

Electromotive force (emf) — term used for voltage or the force that moves electrons.

Electron — a negatively charged particle of an atom.

Frequency — how many times something occurs in a given time period; the number of times something oscillates per second.

Gain — a proportional increase in voltage or current produced by an electronic circuit.

Generator — an electromechanical device used to produce electrical power.

Ground — used to designate the actual connection to earth.

Grounding — establishing a common connection to earth or ground.

Harmonic — an even number multiple of a given frequency.

Heat sink — a clamp or some other device used to dissipate undesired heat from the leads of heat-sensitive components during soldering. It can also refer to large fins placed on transistors and diodes to dissipate heat generated during operation.

Hertz (Hz) — the unit of measure for frequency. It may also be seen as kilohertz (kHz) or megahertz (MHz).

Horsepower — a unit of power in the English system. The amount of power required to lift a weight of 550 pounds through a height of one foot (at constant speed) in one second.

Impedance — unit of opposition measured in ohms. It represents the total opposition to current flow in an AC circuit consisting of any combination of resistance, capacitance, and inductance. The symbol for impedance is Z.

Induced current — the current caused by magnetic lines cutting a conductor.

Inductance — the ability of a coil, choke, or inductor to oppose any change in circuit current. It is represented by the symbol L and is measured in henrys.

Inductive reactance (X_L) — the opposition to current flow in an alternating current circuit caused by an inductor. It is measured in ohms.

Inductor — a device that is used to oppose any change in circuit current.

Input — the location where signals or information enter a stage or system.

Insulator — any material that inhibits or slows the flow of electrons.

Kirchhoff's Current Law — describes the relationships that determine current at a junction; in the analysis of complex circuits in which the same current flowing to the junction flows away from the junction.

Kirchhoff's Voltage Law — states that the sum of the voltage drops around a complete loop equals the applied voltage.

Law of Conservation of Energy — a fundamental law of nature stating that energy can be neither created nor destroyed. Energy can only change form.

Left-hand rule — if a current-carrying conductor is grasped with the left hand and the thumb is pointing in the direction of current flow, then the fingers will indicate the direction of the magnetic lines around the conductor.

Magnet — an object that possesses magnetism and attracts magnetic materials.

Magnetic lines — invisible lines that form loops around a magnet. They leave the north pole and enter the south pole.

Measurement — an act of measuring.

Mechanical work — the product of the force applied to an object along its direction of motion and the distance the object moves while the force is applied.

Mega — a prefix used to designate 1,000,000 (also written as 1M).

Micro — a prefix used to designate 0.000001 (also written as 10^{-6}).

Milli — a prefix used to designate 0.001 (also written as 10^{-3}).

Modulation — the process whereby an audio frequency is impressed upon a radio frequency carrier.

Motor — a device that converts electrical energy to mechanical energy.

Multimeter — a test instrument or meter used to measure voltage, current, and resistance.

Mutual inductance — the inductance that results when there is an interaction of adjacent inductors. It is measured in henrys.

Neutron — a neutral particle that has no charge and is located in an atom's nucleus.

Nucleus — the central part of an atom that contains neutrons and protons.

Ohm's Law — says that the current is inversely proportional to the resistance in a circuit. It also says that the voltage and current are directly proportional.

Open circuit — a circuit that has an interrupted flow of current.

Oscilloscope — a device used to display and measure voltage and time.

Output — the location where signals or information leave a circuit or system.

Permanent magnet — a magnet that retains its magnetism even after a magnetizing force has been removed.

Phase — the relationship between zero-voltage crossings of two signals expressed in degrees.

Polarity — two points of a voltage source that are normally identified as negative and positive. Polarity is also used to indicate the magnetic properties of a magnet.

Positive ion — an atom with a deficiency of one electron.

Power — voltage times current equals power (P) and it is measured in watts (W).

Reluctance — the opposition to the flow of magnetic lines. It compares with resistance in a resistor.

Residual magnetism — that magnetism left after a magnetizing force has been removed.

Resistance — opposition to current flow.

Resistivity — the extent to which a material resists electron flow.

Resistor — a device designed to offer a specific amount of opposition to current flow.

Resonance — the condition of a circuit which occurs when the capacitive reactance is equal to the inductive reactance.

Resonant frequency — the frequency at which $X_L = X_C$.

Rheostat — a two-terminal device used as a variable voltage control.

Right-hand rule — the rule used to find the direction of motion in the rotor conductors of a motor.

Rotor — the moving part of an electric motor or an AC or DC generator, or the moving element in a variable capacitor.

Schematic — a drawing that uses symbols to show how components in an electrical circuit are connected.

Series circuit — an arrangement of a circuit whereby the total circuit current flows through every component.

Shielded cable — a cable with one of its conductors wrapped with a clothlike outer covering made of finely woven wire that acts as a shield.

Static electricity — electricity usually generated by friction that stands still or does not move until a path is provided for it.

Switch — a device designed to quickly connect or disconnect an electrical circuit.

Thermal conduction — the movement of heat energy from a hot region to a cold region by direct transfer of molecular vibration from molecule to molecule.

Transformer — an electrical device that changes high voltage to low voltage and low voltage to high voltage.

Troubleshooting — the process of measurement and analysis used to determine a cause of electrical malfunction.

Volt — the unit of measurement for voltage. It represents electrical pressure; abbreviated as V.

Voltage drop — the voltage that results from current flow through a resistor.

VOM — an abbreviation for an analog multimeter that can measure volts, ohms, and milliamperes.

Watt (W) — the unit of measurement for electrical power. It is the product of voltage and current.

Wet cell — a cell made with a liquid elecrolyte. It is usually referred to as a secondary cell and can be recharged.

Zero-adjusted potentiometer — an adjustment used in a VOM to adjust for the steady decline of a battery used in its ohmmeter circuit.

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INFORMATION SHEET #2

Basic Electricity Summary

Electricity is defined as the flow of electrons along a conductor. Electrons are the smallest part of an atom. an atom is the smallest part of an element which contains all its properties. Electrons can be directed along a given path called a circuit by means of magnetism, heat, light, or pressure. Electrons that move in a random motion are called free electrons. These free electrons when directed in a given direction make up what is called electricity.

Current flow is the flow of electrons along a conductor. Current flow is from negative to positive.

A material through which electricity passes easily is called a conductor. An insulator is a material with very few, if any, free electrons. No known materials are perfect insulators.

The diameter of an electron is about 0.00000000000022 inches. Materials used in the manufacture of transistors and diodes have a conductivity between that of a good conductor and a good insulator.

Electricity is measured in terms of volts, amps, and ohms. Meters are used to measure the flow of electrons, the voltage drop across resistors, and the opposition put up to the flow of electrons by certain materials.

Resistance is the opposition to the movement of electrons. Resistance is measured in ohms. Resistors are devices which provide measured amounts of resistance. There are two types of resistors: wirewound and carbon-composition.

Power is defined as the rate at which work is done. Power measured in terms of electrical energy is designated as watts. The watt is one volt times one ampere for one second. The kilowatt is one thousand watts. The kilowatt-hour is one thousand watts for one hour.

It takes 746 watts to produce one horsepower. It takes a mechanical horsepower defined in terms of 33,000 pounds lifted one foot in one minute to equal one electrical horsepower defined in terms of watts or 746 watts equal one horsepower.

Ohm's law states that the current in any circuit is equal to the voltage divided by the resistance. It can also be substituted so that the voltage is equal to the current times the resistance, or the resistance is equal to the voltage divided by the current.

Inductance is the ability of a coil or inductor to oppose any change in circuit current. An inductor is a device made up of a coil of wire and, in some cases, a core. The words inductor and coil are used interchangeably to mean the same. The unit of measure for inductance is the henry (H). The symbol for inductance is L. Five factors influence the mutual inductance of coils; there are the:

1. Physical size of the two coils.
2. Number of turns in each coil.
3. Distance between the two coils.
4. Distance between the axes and the two coils.
5. Permeability of the cores.

Self-inductance occurs when a collapsing magnetic field around a coil induces an emf in the coil. Self-inductance and mutual inductance are both properties of a coil or choke.

Lenz's law says the induced current, or emf, in a coil is in the opposite direction of that which caused it.

Alternating current is constantly changing in magnitude and direction. Alternating current (AC) is generated mostly in power line frequencies of 25, 40, and 60 hertz (Hz). It is also generated by large generators and separated into single phase when used by homes and stores.

The term frequency is used to indicate how many times the alternating current changes direction. The unit of measurement for frequency is the hertz (Hz).

Root-mean-square is abbreviated rms, and refers to ac being converted to its equivalent of dc in terms of heating effect. The transformer has the ability to step up or step down ac voltages and currents.

Inductive reactance is the opposition generated to the changing of direction of the ac by a coil or choke.

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INFORMATION SHEET #3

Summary of Terms in Electrical Systems

Force:

1. Electron movement from one atom to another.
2. Speed of electron movement dependent on current and resistance.
3. Direction of electron movement — AC or DC.
4. Equal to voltage.

Work:

1. Force pushes electrons through circuit.
2. Electrons move from one place to another.
3. Voltage times charge moved.

Rate:

1. How slow or fast something moves.
2. Current is the amount of charge moved during an elapsed time period.
3. Frequency is the cycles per second of a wave form.
4. Displacement Quantity/Elapsed Time.

Resistance:

1. An opposition to movement.
2. Voltage difference across an electrical element.
3. Rate of flow of charge through a system.
4. Voltage Difference/Rate of Charge Flow.

Energy:

1. The ability to do work.
2. Potential energy is the change in an object's position from a force applied.
3. Kinetic energy comes from motion of an object.
4. Energy loss is due to resistance.
5. Total energy = potential energy + kinetic energy + energy loss.
6. Law of conservation of energy says energy cannot be created or destroyed but it can change forms (i.e. a clock pendulum).

Power:

1. Rate of doing work.
2. Electrical Work/Time.

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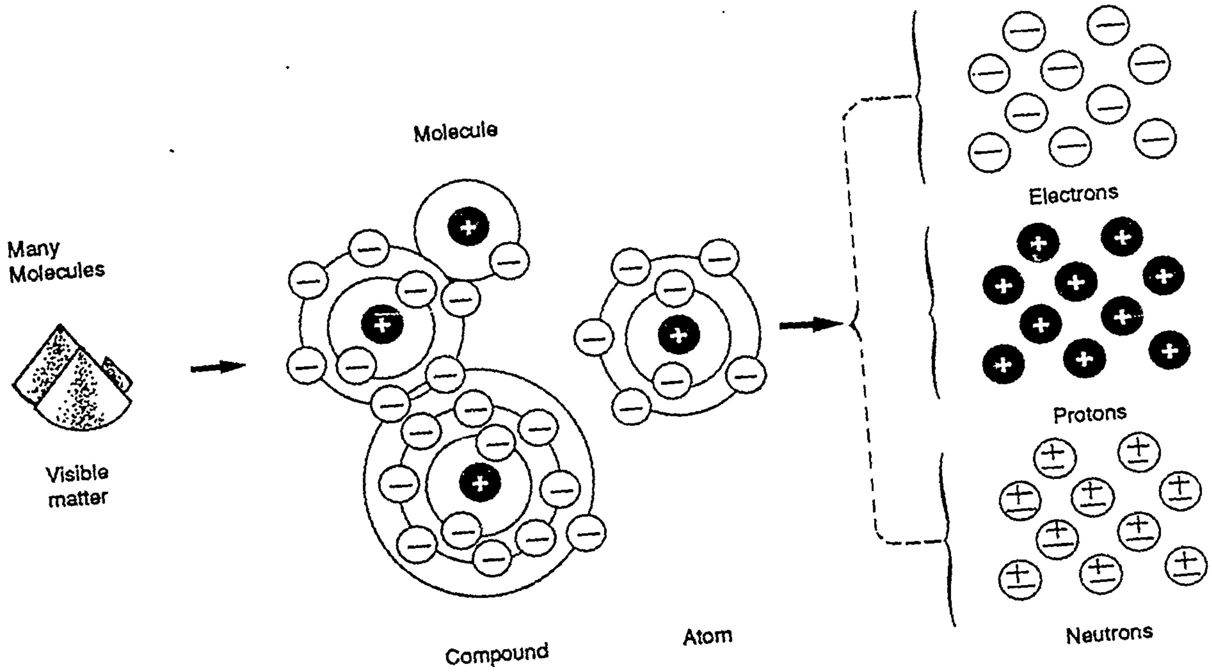
TRANSPARENCY MASTER #1

Molecular Structure

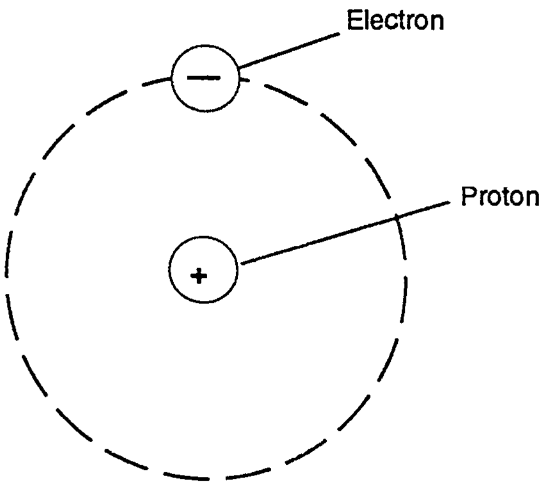


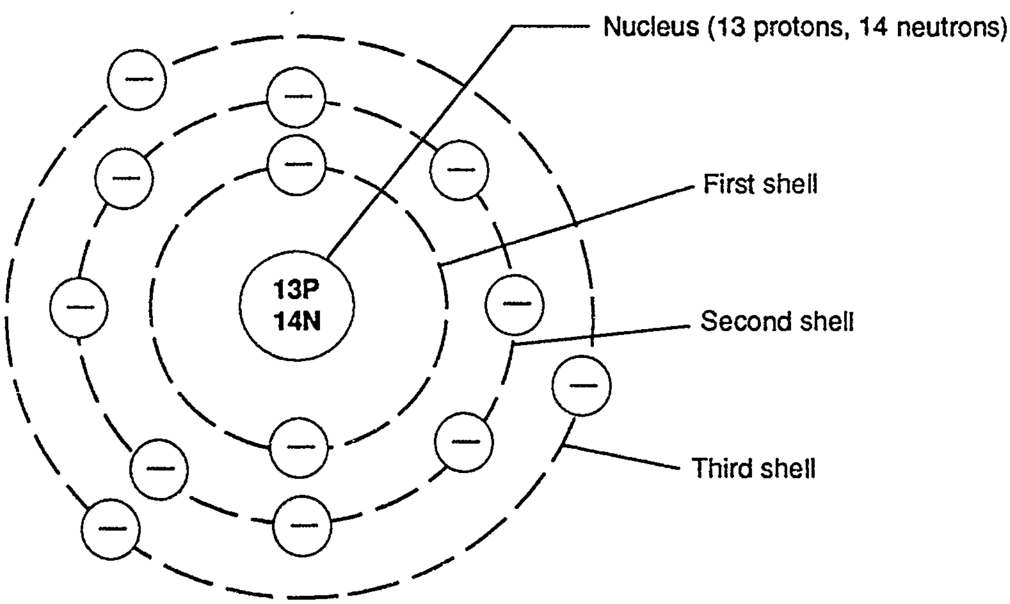
Molecular structure. The negative (—) particles are electrons.

1001

TRANSPARENCY MASTER #2

Atoms





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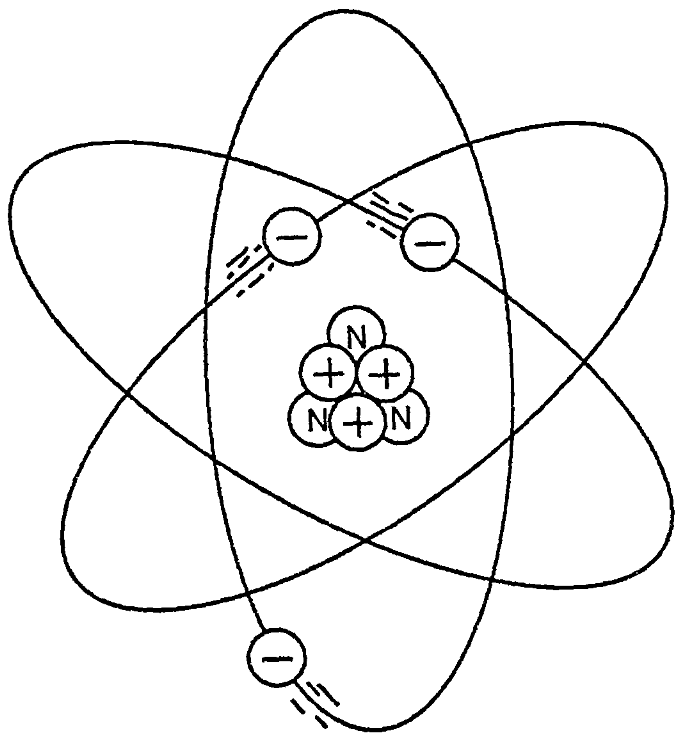
TRANSPARENCY MASTER #3

Protons, Electrons, and Neutrons



Three dimensional depiction of atom with protons and neutrons in nucleus. Electrons are shown orbiting the nucleus.

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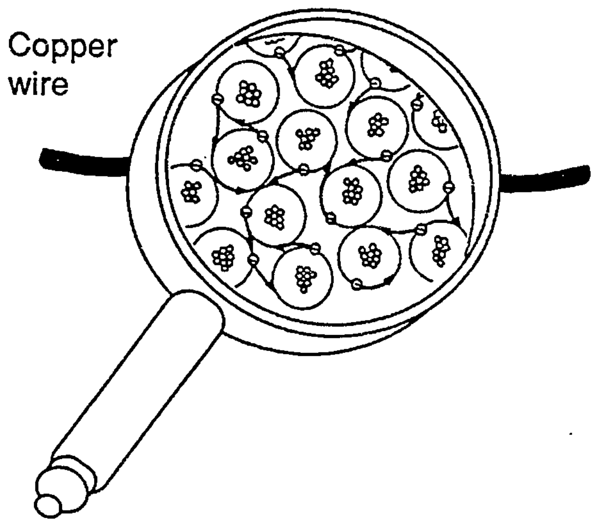
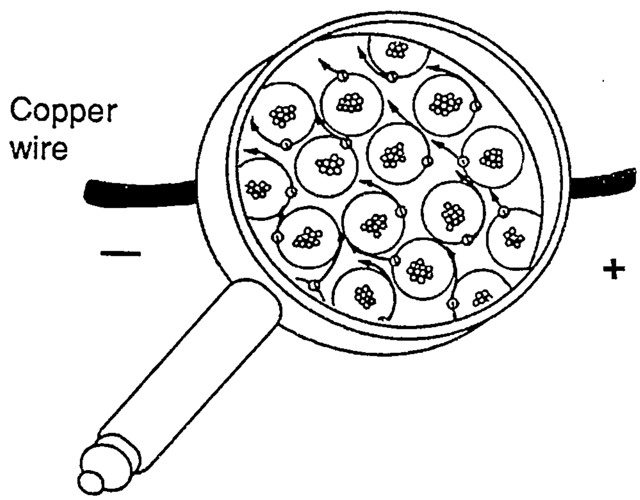
TRANSPARENCY MASTER #4

Free Electrons



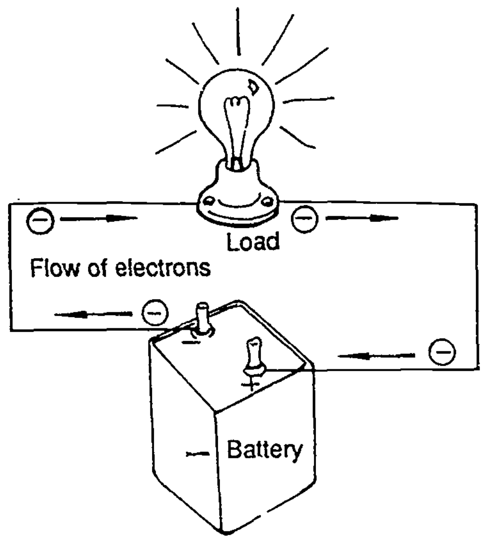
The outer electrons of metals are available to move freely from one atom to another.



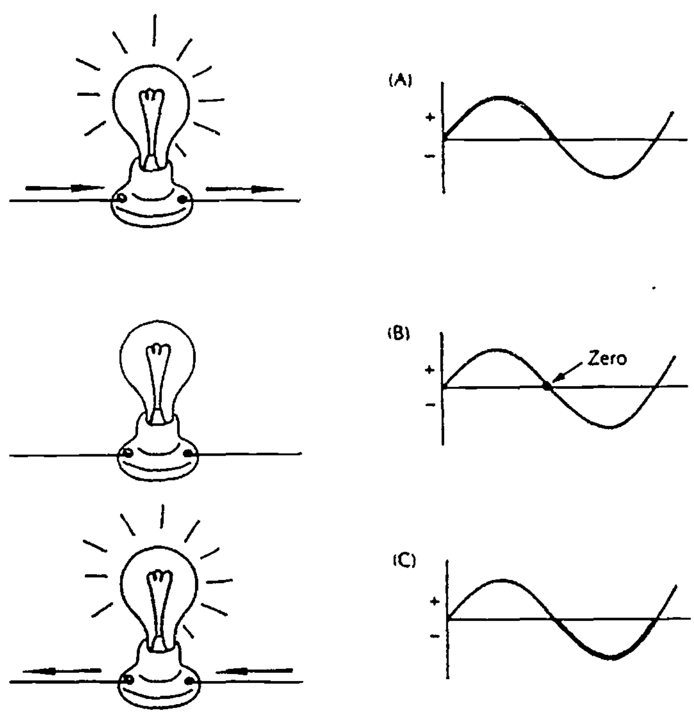
The free electrons are repelled by the negative side and attracted to the positive side causing a flow of electrons.

TRANSPARENCY MASTER #5

Electron Flow



Electrons shown flowing from negative post and positive post in a direct current (DC) system.



Electrons shown alternating directions in an alternating current (AC) system.

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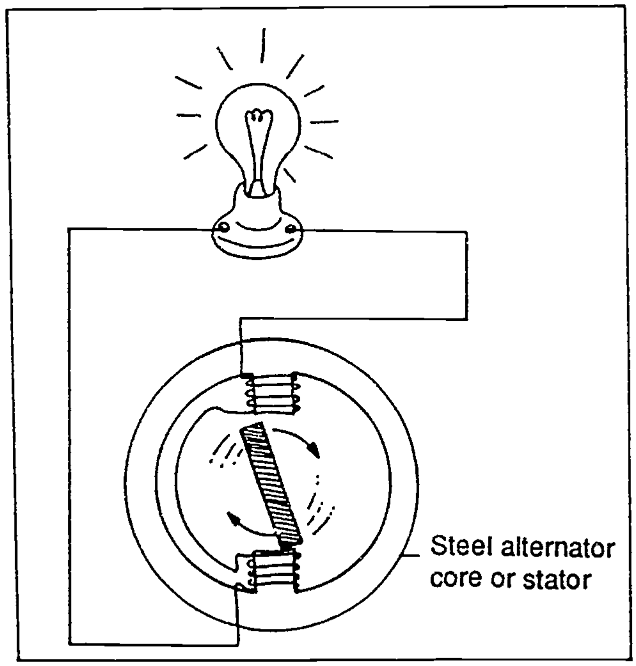
TRANSPARENCY MASTER #6

Electricity Generation with Magnet



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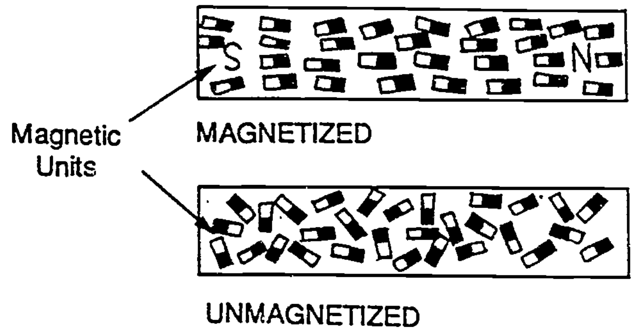
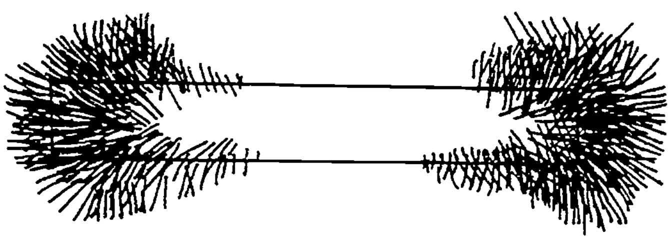
TRANSPARENCY MASTER #7

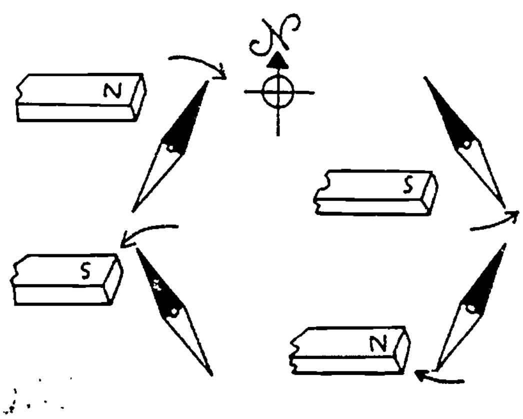
Magnetism



The bar becomes a magnet when the individual magnetic units are lined up.



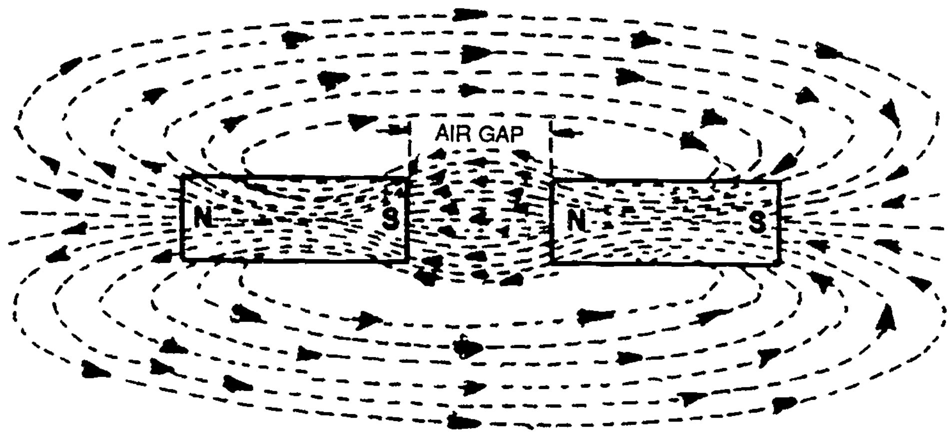
Bits of iron cling to the magnet near it's poles.



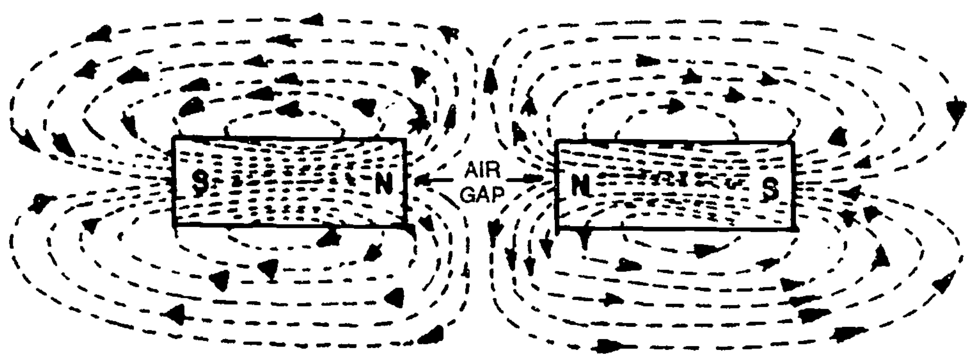
Like poles repel; unlike poles attract.

TRANSPARENCY MASTER #8

Magnetic Flux Patterns



UNLIKE POLES ATTRACT



LINES OF FORCE
LIKE POLES REPEL

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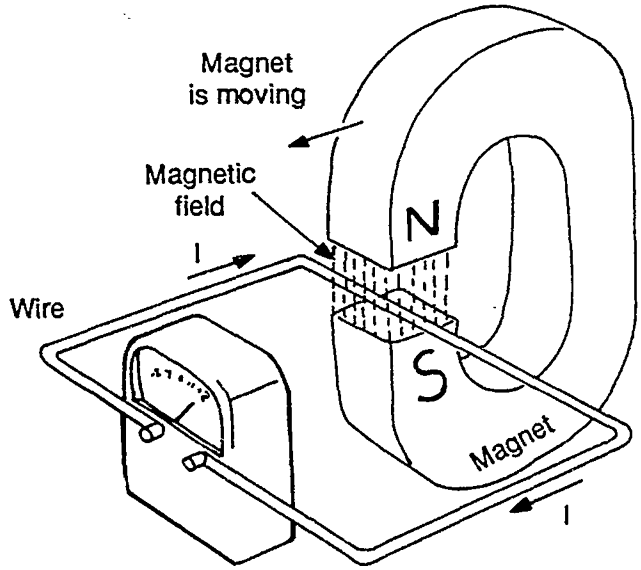
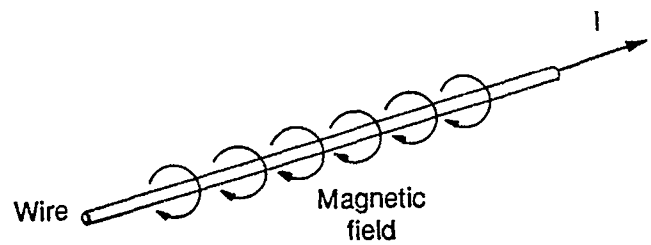
TRANSPARENCY MASTER #9

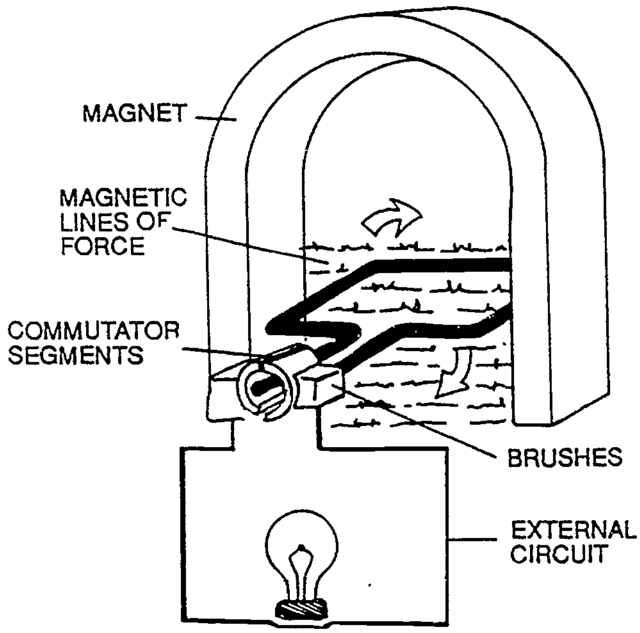
Induced Voltage



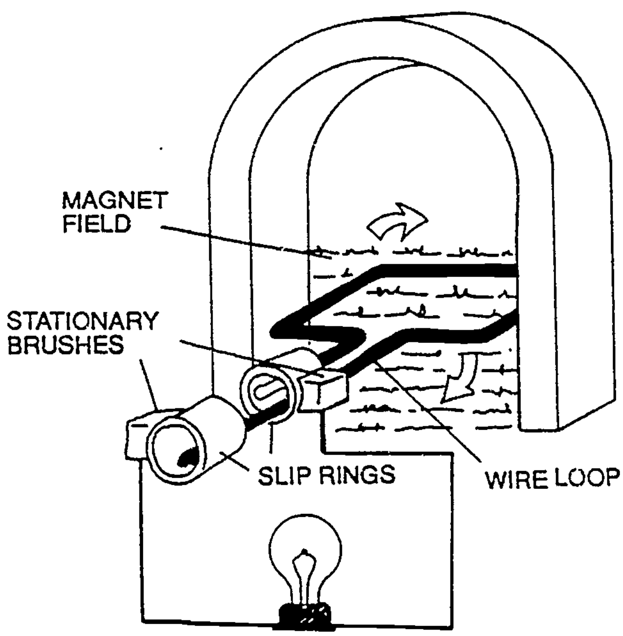


TRANSPARENCY MASTER #10

Electric Generators



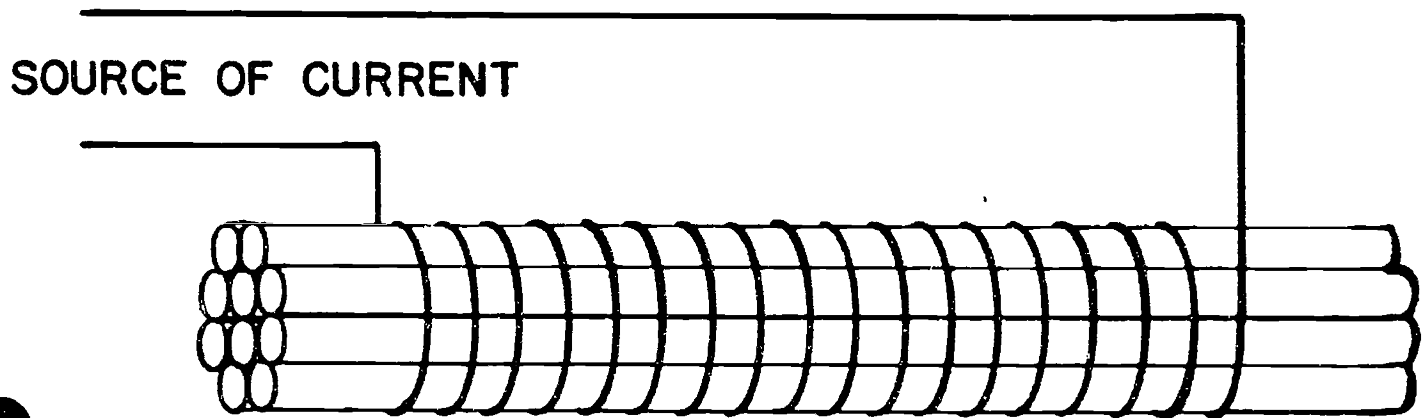
Principle of a simple direct-current generator.



Principle of a simple alternating-current generator.

TRANSPARENCY MASTER #11

Electromagnet



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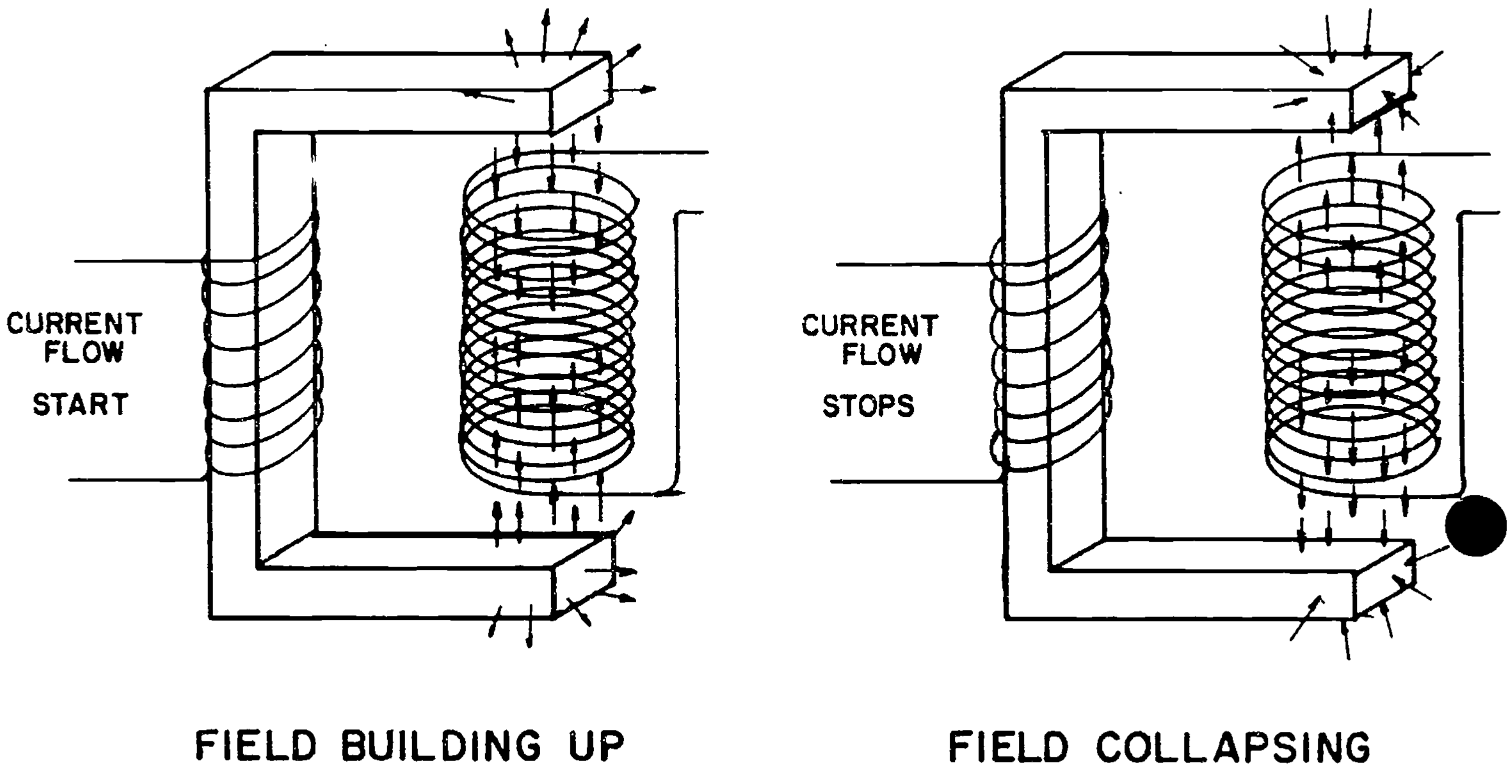
TRANSPARENCY MASTER #12

Lines of Force Cut Through Coil



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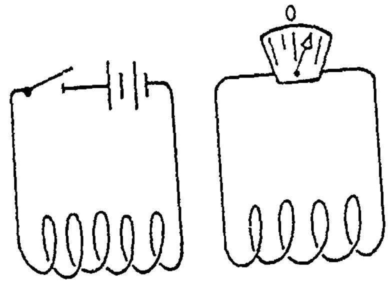
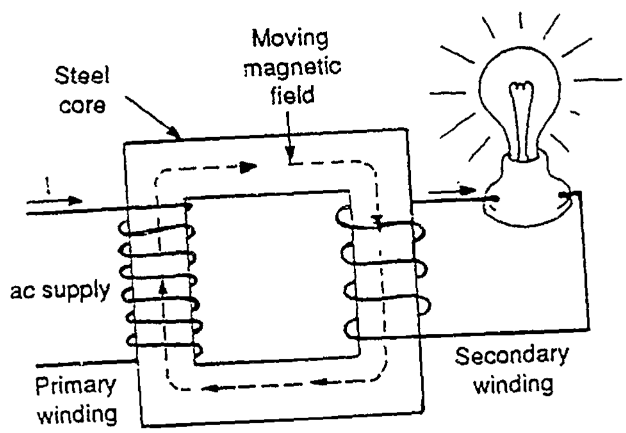
TRANSPARENCY MASTER #13

Induction



Induction in a nearby circuit



Transformer winding induction

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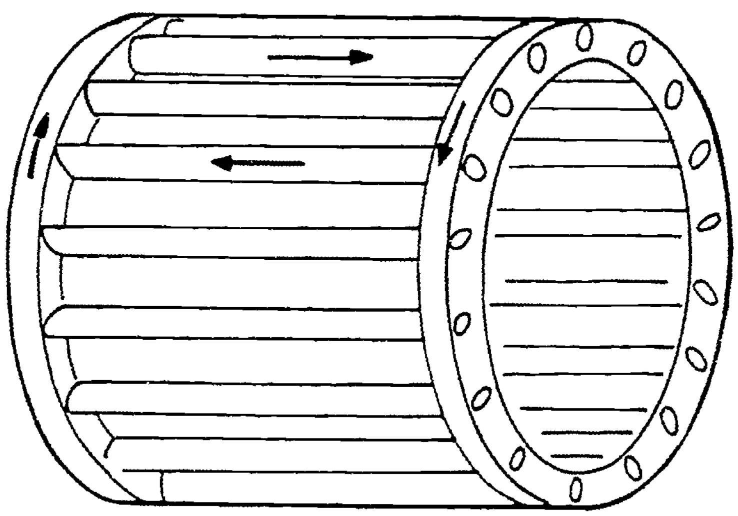
TRANSPARENCY MASTER #14

Electric Motor Rotor



Current flow is induced into the squirrel cage of the rotor by the rotating magnetic field created by the stator windings.

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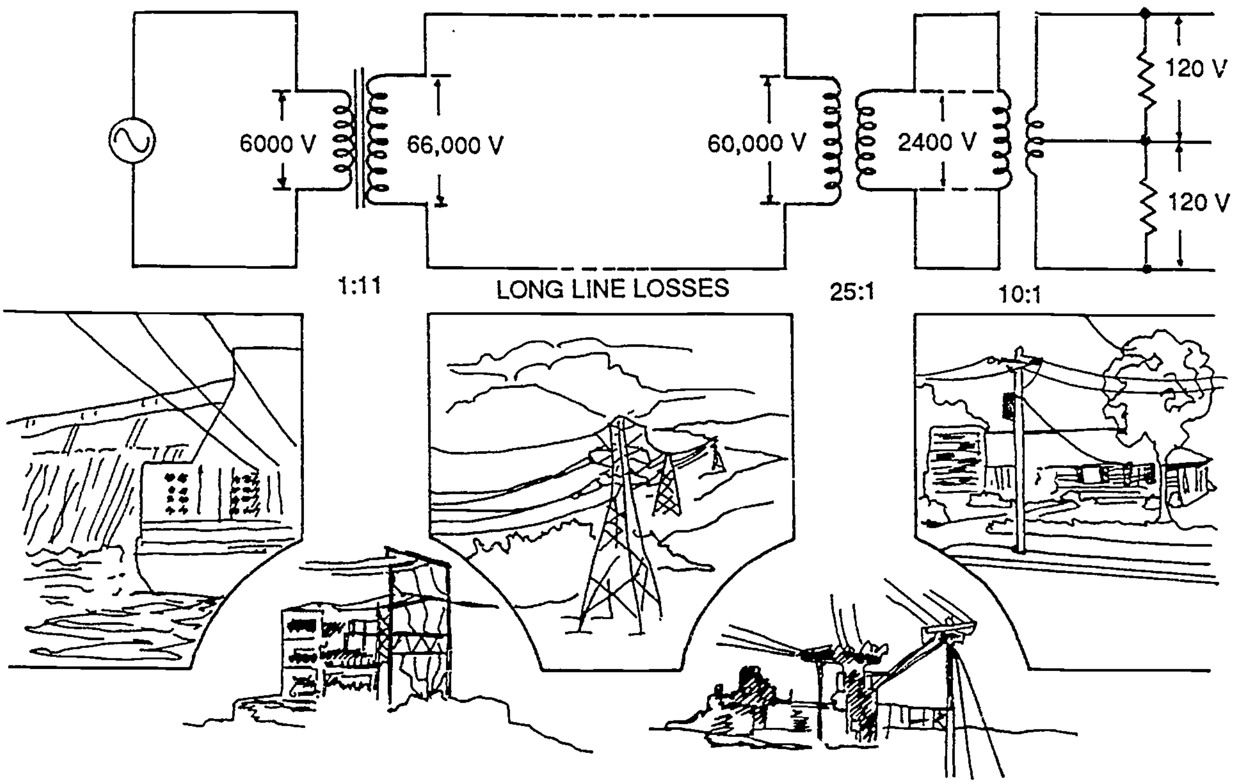
TRANSPARENCY MASTER #15

Electric Transmission



Using transformers to distribute AC over long distances.

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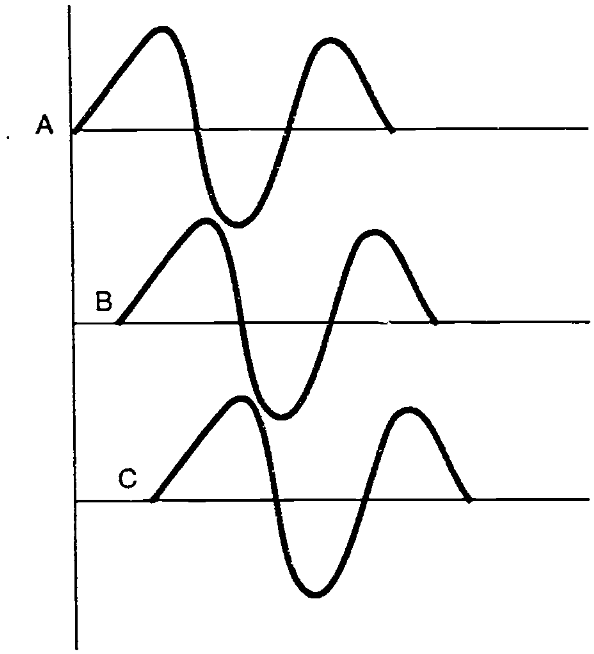
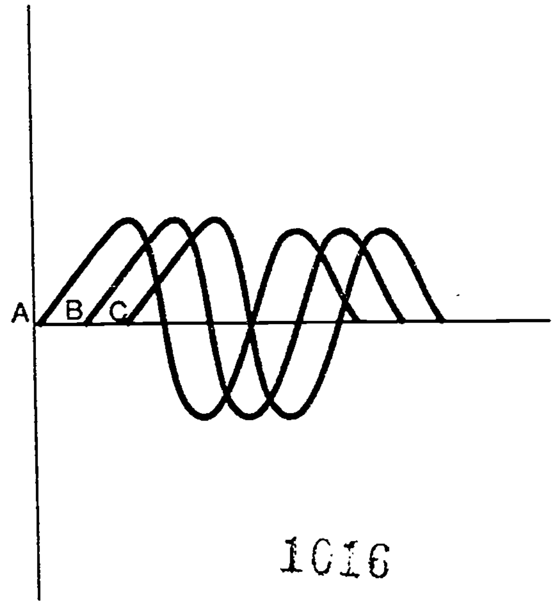
TRANSPARENCY MASTER #16

Three Phase Electricity



A three phase current can be represented as three distinct currents A, B, and C, each starting and peaking one-third of a cycle apart.



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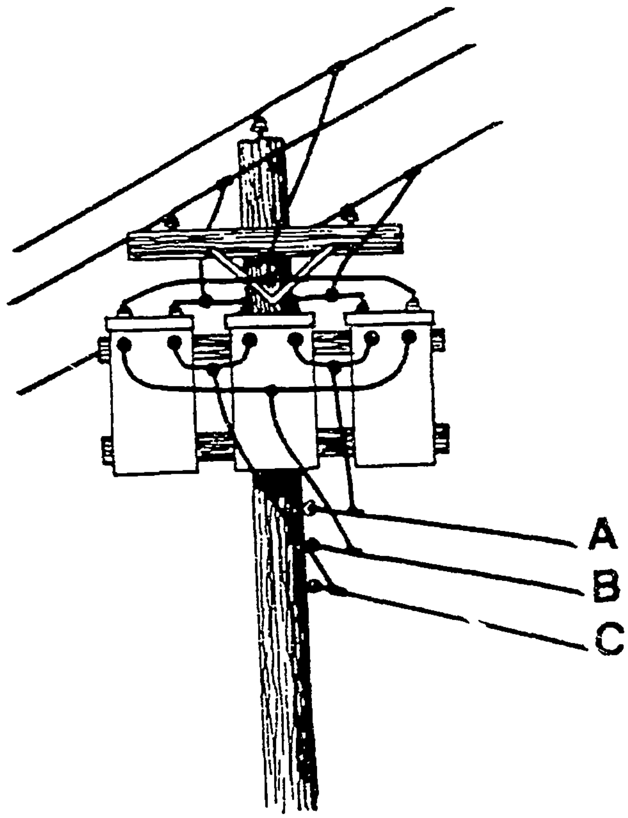
The three phases can be combined together on one time line to show why three phase current is a steady source of power.

TRANSPARENCY MASTER #17

Three Phase Electricity



Three transformers may be mounted on a pole and connected in the delta pattern.

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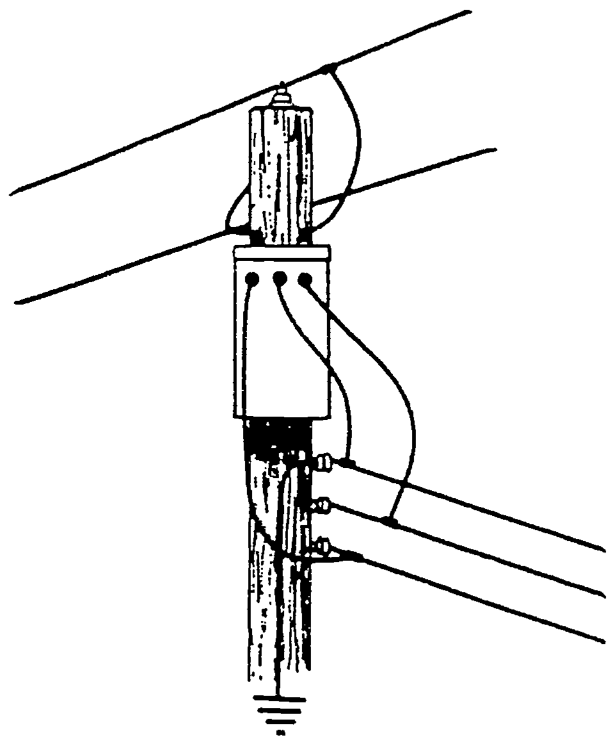
TRANSPARENCY MASTER #18

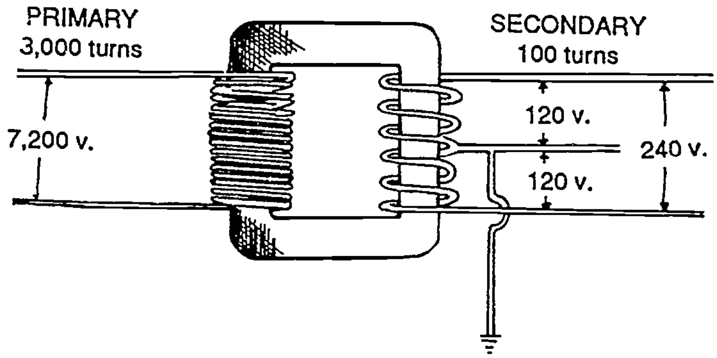
Single Phase Electricity



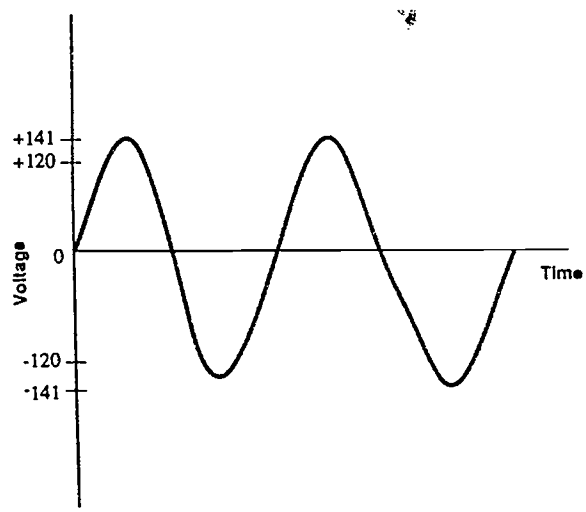
The typical homestead is served by a single phase transformer mounted on a pole.

TRANSPARENCY MASTER #19

Single Phase Electricity



The primary coil of this transformer has 3,000 turns. The secondary coil has 100 turns, with a center tap at the 50th turn. This steps the primary voltage of 7,200 down to 240 between A and B, or to 120 between A and N or B and N.



A single phase current is shown as a sine-wave pattern. The horizontal line represents time. The vertical line represents voltage. Current flow in one direction is above the line while flow in the opposite direction is below the line. To obtain an effective voltage of 120 requires peak voltages of about 141.

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Masters #1 - #3

Every known substance, whether gas, liquid, or solid, is made up of elements. At present there are 106 known elements. Eleven of these elements have been made in the laboratory, with the remainder being found in nature.

It is presently believed that elements have as their smallest particle the atom. The atom of a particular element has all the characteristics of that element. In addition, the atom of a particular element has a unique makeup of protons, neutrons and electrons which will be found only in that element.

There are, however, certain features common to all atoms. All atoms have the nucleus as the innermost part. The nucleus is composed of protons and neutrons. Neutrons don't contain an electric charge. Protons have a positive charge and will be found in a number equal to the number of electrons that the element possesses.

The electrons will be found in orbits around the nucleus and are the smallest part of an atom. The electrons have a negative charge. The negative charge of the electrons and the positive charge of the protons attract each other and account for the electrical balance of the atom as long as the arrangement is not charged. There is however movement within the atom from the attraction of opposite charges and the repulsion of like charges. This movement will allow the outer orbits of different atoms to come in closer than normal contact.

Transparency Masters #4 - #6

Electricity can be defined as a flow of electrons along a conductor. A conductor is a material that has atoms which have "free" electrons. These free electrons are found in the outer orbits of the atom and will exchange at random with proximate atoms with each retaining its electrical balance. Such forces as magnetism, heat, light, or pressure can be applied to a conductor and direct the "free" electrons of the atoms in a given direction with each atom taking an electron from its closest atom to maintain its balance of electrons and protons. This movement of electrons is electricity. As the electrons move along the conductor they will flow through whatever "load" is present. This "load" may be the filament of a light bulb, providing light; the windings of an electric motor, providing mechanical energy; or a coil on an electric range, providing heat for cooking.

Electricity that is delivered to homes, industry, and farms is alternating current. AC is said to complete one "cycle" when it travels in one direction, stops and reverses to flow back in the opposite direction. In the U.S. the AC cycles 60 times per second. A cycle per second may also be termed "hertz." The alternating current is generated by a magnet spinning inside a coil of wire. This rotation of the ends of a magnet causes the electrons to move first in one direction (because of attraction or repulsion), and then in the opposite direction when the opposite end of the magnet moves to that point.

In direct current, the electrons flow only in one direction and are generally considered to move from negative to positive. Direct current can be found in batteries, rectifiers (as in battery chargers), and photonvoltaic cells. These mediums provide a means of converting one form of energy to another.

Transparency Masters #7 - #8

Magnets were discovered more than twenty-five hundred years ago when certain rocks were found to always align themselves in a north-south direction when suspended. This alignment is now known to correspond to the attraction of the earth's magnetic field to the poles located on the opposite ends of the magnetite (magnetic rock). Elemental nickel and cobalt, and certain alloys are also present with the magnetite.

A material that can be magnetized can become a magnet by being stroked in one direction with a piece of magnetite or another magnet. The theory is that the magnet exhibits the outside effect of the alignment of the individual atoms within the material. The attraction and repulsion of the opposite ends of the magnet are similar to the attraction and repulsion of the opposite charges within the atomic structure.

The effects of the alignment of molecules is concentrated at the ends as seen when the magnet is thrust into a pile of iron fillings. The lines of magnetic force are thought to circle the magnet on the outside from the north end of the magnet to the south end and continue through the magnet to form a closed loop. The alignment of molecules may be disrupted by heating.

In addition to like poles repelling and unlike poles attracting, the force of the attraction or repulsion is directly proportional to the strength of the poles and inversely proportional to the distance.

Magnetism can be "induced" by a magnet into other materials by the temporary influence of the magnet on the alignment of molecules in that material. Soft iron, as in nails, will be temporarily magnetized while in contact with the magnet. A chain of nails will ball apart as soon as the closest nail is removed. A piece of hard steel will remain magnetized for a longer period of time after the magnet's removal.

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Transparency Master #9

When a magnetic field such as that found at the end of a horseshoe or C-type magnet is moved across a wire, voltage is produced in that wire. If the wire is a completed circuit then a current will flow in that wire.

As the current flows through the wire a magnetic field is generated around that wire and is considered to be in the opposite direction of the current (electron) flow. This was discovered by a Danish scientist, Oersted.

Transparency Master #10

Electric Generators

The fact that electricity (electron flow) can be caused by moving a magnetic field across a wire is used in simple generators by moving the wire rather than the field.

In a DC generator, a loop of wire has each end attached to one half of a divided commutator. These commutator segments rotate and alternately touch two brushes that are connected to an external circuit through which the electrical energy is used for work.

The commutator segments make contact with only one brush at a time and alternate individually with each brush in order to keep the current flowing in the same direction.

In an AC "alternator," the loop of wire is similar to that in a DC generator with the difference being the connections made at the ends. The ends are attached to individual slip rings which touch brushes that complete the external circuit. During each revolution of the wire loop, each side passes through a magnetic field but first in one direction and then the other direction. Thus the current flows first one direction then the other.

Transparency Master #11

Any wire that has an electric current flowing through it is surrounded by a magnetic field. Under ordinary circumstances this field is weak and unimportant. If we wind a coil of insulated wire around a soft iron core and pass a current through the coil we produce a magnet called an electromagnet. It may be considerably stronger than a permanent magnet. The strength of an electromagnet is determined primarily by the number of turns of wire in the coil and the amount of current flowing through it.

Transparency Master #12

If a coil of wire is placed between the poles of a U-shaped magnet as in the illustration, the field will build up and collapse. When the current begins to flow through the electromagnet winding, a magnetic field is produced. The lines of magnetic force move into position cutting across the coils of wire. When the current flow stops, the magnetic field disappears or collapses, and the lines of force again cut across the coil. No current flows in the coil except at the very instant the lines of force are cutting the coil or when the current starts and stops flowing through the electromagnet, as occurs in the cycles of an AC system.

This effect, discovered by Faraday in England by running a magnet through a coil of wire, can be applied to simple nearby circuits, transformer windings, and the current induced in the rotor of an electric motor by the stator windings.

Transparency Masters #15 - #19

In the United States, alternating current was chosen over direct current for generation and distribution because of its efficiency in transportation. The manner of AC generation provides a wave form (sine wave) that is always changing. This rise, fall, rise in the opposite direction, and fall to the original zero produces much less loss, mostly in the form of heat, when being transported over long distances when compared to the steady voltage of direct current.

All power generation stations generate three single phase currents which are distinct from each other and are combined for transportation to substations. At the substations transformers are used to step up the voltage for more efficient transmission. Nearer to the point of use transformers are again used to step down the voltage in accordance with the overall need. At the point of use transformers are again used to step down to the voltage needed.

The phase available at the point of use can be either single phase or three phase. The three phase which arrives from the generating station can be taken to those situations which warrant it. These situations usually involve the use of motors over 10 HP and were formerly associated with industry. However, the requirements at farms has grown such that many now need three phase power. Three phase is produced such that each phase of current peaks at one-third of a cycle apart from the two other phases and allows for 6 peaks per cycle. This characteristic provides a steadier source of power than single phase current and allows for cheaper construction of large frame motors without the need of starting windings.

Single phase current meets the needs of most homes and small farms and is taken from the primary phase at the substation to these locations. Since the single phase has two peaks per cycle, one in each direction, it is sufficient for motors below 7.5 HP and commonly found lights and appliances.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Electric Charges and Magnets

STUDENT WORKSHEET #2 — Electric Currents

STUDENT WORKSHEET #3 — Induced Currents

STUDENT WORKSHEET #4 — Force in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #5 — Force in Electrical Systems

STUDENT WORKSHEET #6 — Force in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #7 — Work in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #8 — Rate in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #9 — Rate in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #10 — Resistance in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #11 — Energy in Electrical Systems (with discussion guide)

STUDENT WORKSHEET #12 — Power in Electrical Systems (with discussion guide)

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Electric Charges and Magnets

1. What are the poles of a magnet?

2. How do two magnetic poles react to each other?

3. What is a magnetic field?

4. How do positively charged objects differ from negatively charged objects?

5. What is the process of magnetizing a steel bar?

6. How does the force one body exerts on another depend on the circumstances?

7. What is meant by the difference in electrical potential between points in a electrostatic field?

STUDENT WORKSHEET #1 — Key

Electric Charges and Magnets

1. What are the poles of a magnet?

   The points near each end of a magnet where the forces of attraction for other bodies is concentrated.

2. How do two magnetic poles react to each other?

   Unlike poles attract; like poles repel.

3. What is a magnetic field?

   The region near a magnet where its effects are appreciable.

4. How do positively charged objects differ from negatively charged objects?

   A positively charged object has a deficiency of electrons, where as an excess of electrons leads to a negative charge.

5. What is the process of magnetizing a steel bar?

   The lining up of the atomic (elementary) magnetic units which compose the material.

6. How does the force one body exerts on another depend on the circumtsances?

   The force varies inversely to the square of the distance apart and directly to the two amounts of charge.

7. What is meant by the difference in electrical potential between points in a electrostatic field?

   The tendency of a charged object to move from one point to the other.

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STUDENT WORKSHEET #2

Electric Currents

1. What is electric current?

2. What is meant by the strength of an electric current?

3. What makes up the current in a conductor?

4. What are the carriers of current through solutions?

5. What is Ohm's Law?

6. State the formula for computing the amount of power in a circuit where the current is I and the voltage is V.

STUDENT WORKSHEET #2 — Key

Electric Currents

1. What is electric current?

   Flow of electrons.

2. What is meant by the strength of an electric current?

   The amount of electrons passing a point in a unit of time.

3. What makes up the current in a conductor?

   The movement of atomic electrons from one to another in a managed direction.

4. What are the carriers of current through solutions?

   Plus and minus ions formed by the disassociation of molecules of the dissolved substance.

5. What is Ohm's Law?

   $I = V/R$ where I is current, V is the force across the conductor, and R is resistance.

6. State the formula for computing the amount of power in a circuit where the current is I and the voltage is V.

   $$Power_{(watts)} = I_{(amps)} \; x \; V_{(volts)}$$

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STUDENT WORKSHEET #3

Induced Currents

1. What was Oersted's discovery?

2. What was Henry and Faraday's discovery?

3. What is Lenz's Law?

4. What is electromagnetic induction?

5. What type current is produced by a simple coil rotating in a constant magnetic field?

6. Describe the function of a transformer.

STUDENT WORKSHEET #3 — Key

Induced Currents

1. What was Oersted's discovery?

   That an electric current produces magnetism.

2. What was Henry and Faraday's discovery?

   That magnetism can produce an electric current.

3. What is Lenz's Law?

   The direction of an induced current is always such that its magnetic field opposes the operation that causes it.

4. What is electromagnetic induction?

   The production of a current when the magnetic field through the circuit changes.

5. What type current is produced by a simple coil rotating in a constant magnetic field?

   An alternating current.

6. Describe the function of a transformer.

   Pair of coils positioned so that the magnetic flow produced by the current in one sets up a current in the other. The voltage is dependent on the number of windings.

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STUDENT WORKSHEET #4

Force in Electrical Systems

How do you read the scales on a multimeter?

The figure shows a multimeter reading for the output of a 1.5-V battery. The range switch and function switch are set as follows:

Range: 2.5 V
Function: +DC

The DC scale is used because the function switch is set to +DC voltage. The pointer on the figure shows the needle crossing the DC scale where the numbers 150, 30, and 6 are printed. With the range switch set to 2.5 V, the top row of numbers is used (0 to 250 V scale). On this scale, the needle indicates 150. When that value is divided by 100, the actual voltage is 1.5 V. For this example, since the meter is connected to a single cell of a dry cell battery, the 1.5-V reading is reasonable.

State the current readings for the same needle position shown in the figure if the meter settings are as follows:

a. Range: 50 V
Function: -DC
Reading: ________

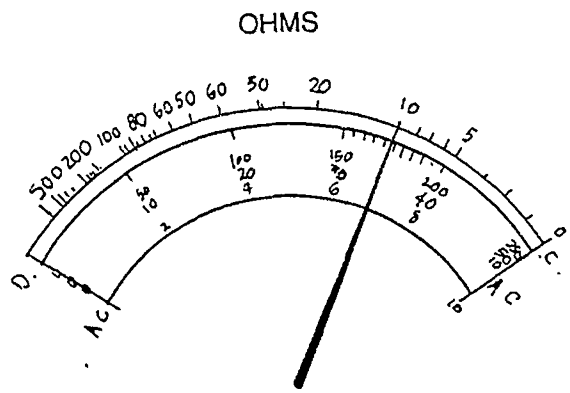
b. Range: 500 V
Function: +DC
Reading: ________

c. Range: 10 V
Function: AC
Reading: ________

d. Range: 2.5 V
Function: AC
Reading: ________

e. Range: 500 V
(Probes connected 1000 V DC terminals)
Function: DC
Reading: ________

f. Range: 250 V
Function: -DC
Reading: ________



Multimeter readings

STUDENT WORKSHEET #4 — Key and Discussion Guide

a. Range: 50 V
Function: -DC
Reading: *-30 volts*

b. Range: 500 V
Function: +DC
Reading: *300 volts*

c. Range: 10 V
Function: AC
Reading: *A little above 6 volts*

d. Range: 2.5 V
Function: AC
Reading: *About 1.57 volts*

e. Range: 500 V
(Probes connected 1000 V DC terminals)
Function: DC
Reading: *A little more than 600 volts*

f. Range: 250 V
Function: -DC
Reading: *-150 volts*

Note: It's important to take time discuss carefully the safety practices required when working with electrical circuits or electricity.

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Force in Electrical Systems - Discussion

Electricity is the movement of electric charge (usually electrons) through metals, gases, and liquids. The energy produced by electrical power can help us heat and light buildings, run machinery with electric motors, prepare food with electric ranges and microwave ovens, run computers, and communicate using radios, televisions, and telephones. Voltage is a forcelike quantity that causes electric charge to move within materials. This movement of charge is electricity.

Review: How are voltage sources measured?

The specific output of a voltage source is measured with an instrument called a "voltmeter." The size of the voltage source, sometimes called the "potential difference," is expressed in units called "volts." Before trying to measure a voltage, you should know about how large the voltage is expected to be. That is, will it be close to 0.1 V, 1 V, 10 V, 100 V or 1000 V? This estimate will be important for the following two reasons:

It'll tell you the correct measurement range to set on the voltmeter.

It'll tell you whether or not the voltage and the measurement procedure pose a potential safety hazard.

If you have no idea how large the voltage is that you're measuring, first set the range switch on the highest available value. Then decrease the range setting until the meter reads the unknown voltage, at a reading somewhat below a full-scale value.

Digital Voltmeter

Digital voltmeters are easier to use than multifunction, needle-indicator voltmeters. The readout, or display, looks similar to a digital clock or calculator display. Voltage measurements are made by using the two probes — wires coming from the meter — labeled "voltage to be measured." The red probe should touch the positive (anode) terminal of the voltage source. The black probe should touch the negative (cathode) terminal. If the meter indicates a negative voltage reading (such as -10.3 V), the probes have been connected backwards. This means the probes should be reversed.

The front panel of the meter has a function switch. When measuring DC voltages, it should be set to "DC Volts." When measuring AC voltages, it should be set to "AC Volts." The meter may also have a range switch. This switch, as explained above, should be turned to the value that's just greater than the voltage you expect to measure — or to the highest value available if you have no idea of the voltage you expect to measure.

Multifunction, Needle-Indicator meters

In this experiment, you'll use an instrument called a "volt-ohm-milliammeter (VOM)," or a "multifunction meter," or just a "multimeter." Figure 1 shows the front of one of these meters. To measure voltages between 0.5 V and 500 V, the following parts of this instrument will be important for you to examine:

Probe Inserts: Plug the black and the red leads into the correct connections on the lower left corner of the meter.

Function Switch: Set to +DC, -DC, or AC, depending on the voltage source to be measured.

Range Switch: Set from 2.5 V to 500 V, depending on estimate of voltage to be measured. The values 2.5, 10, 250, and 500 V indicate what the full-scale (maximum right-side) reading will be. this setting determines which of the scales you'll read on the upper face of the meter.

If you're measuring DC voltages, you'll use one of the three sets of black numbers and the black scale above them. If you set the range switch on 2.5 V, read the 0- to 250-V scale for more accuracy. Then divide your answer by 100. If you set the range switch on 500 V, read the 0- to 50-V scale. Then multiply your answer by 10.

If you're measuring AC voltages, you'll use one of the two red scales and the black numbers (above) for 0-10, 0-50, 0-250, or 0-500 V - and the red numbers (below) for 0-2.5 V.

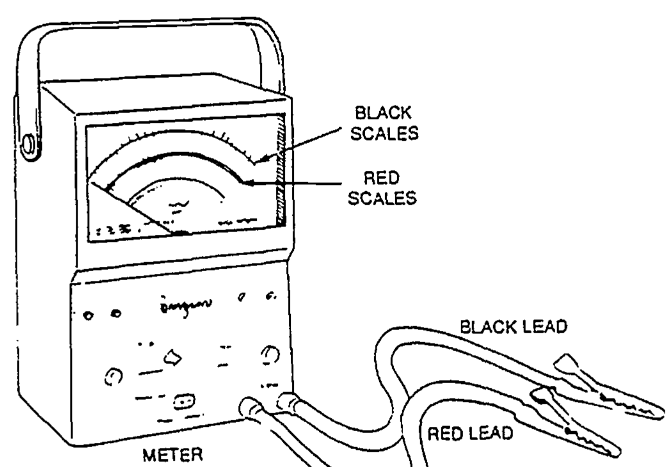


Figure 1. Typical VOM multimeter

Demonstration — Electrical Forces

Purpose:

1. To show that voltage is the prime mover in electrical circuits.
2. To show that voltage causes electrons to flow in a circuit.

Materials:

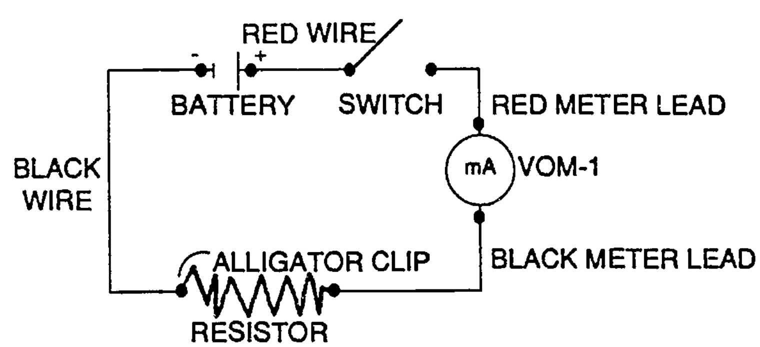
Two lantern-type batteries, 1.5 volts each
Two volt-ohm-milliammeters (VOMs)
Three rolls of hookup wire (1 red, 1 black, and 1 yellow)
Miniature alligator clips
SPST knife switch

Setup:

1. Set out items called for under Materials.
2. Prepare leads for demonstration.
   a. Measure off and cut the following:
      6"-long wire from the black insulation roll.
      4"-long wire from the red insulation roll.
      6"-long wire from the yellow insulation roll.
   b. Strip 1/4" to 3/8" of insulation from the end of each wire lead.
   c. Attach the alligator clip to one end of the black insulation wires.
3. Connect the circuit as shown in the figure.
4. Set the range/function dial on the VOM connected in the circuit. (This VOM will be called VOM-1 from here on.)
   Function: (current) + DC
   Range: 100 mA
5. Set the second VOM (VOM-2) dials.
   Function: (voltage) + DC
   Range: 3 to 5 volts
6. Draw the figure on the blackboard or prepare an overhead transparency before class.

Procedure:

1. Review proper circuit connection procedures with students. Note:
   a. DC circuits often have voltage polarities indicated by color — red for positive, black for negative.
   b. When a circuit is connected properly (according to a schematic), one can trace all wires and connections, starting at one battery terminal, following the entire circuit, and ending at the other battery terminal.
2. Use VOM-2 to measure the battery voltage. This is done by connecting red meter lead to the positive (+) terminal and the black meter lead to the negative (-) terminal.



Note: Be sure switch is open before last wire is in place.

3. Close the switch and measure the voltage with VOM-2 across the resistor. Make sure that VOM-2 leads are connected across resistor to give a positive voltage reading. Compare voltage readings across battery and resistor.

4. Adjust the range of VOM-1 for the maximum upscale indication of the needle. Point out that VOM-1 measures current flow (movement of electrons) in circuit.

5. Open switch. Summarize the demonstration to this point.

   VOM-2 is used as a voltmeter to measure voltage across circuit elements. VOM-1 is used to measure electron flow in the circuit.

   Voltage measurements are made across a voltage source or across a circuit component. (Voltmeters never break a circuit when in use.)

   Current measurements are made in the circuit (meter must be part of circuit — circuit has to be broken to admit meter when current is to be measured).

6. Add a second battery to the circuit as shown in the figure.

7. Read voltage across batteries.
   a. Show that voltage of each battery is 1.5 volts.
   b. Measure total voltage of both batteries. Show that it is 3 volts (twice as much).

8. Close switch and measure voltage across the resistor.

9. Read the current on VOM-1 and compare it to the current obtained with a single battery in the circuit.

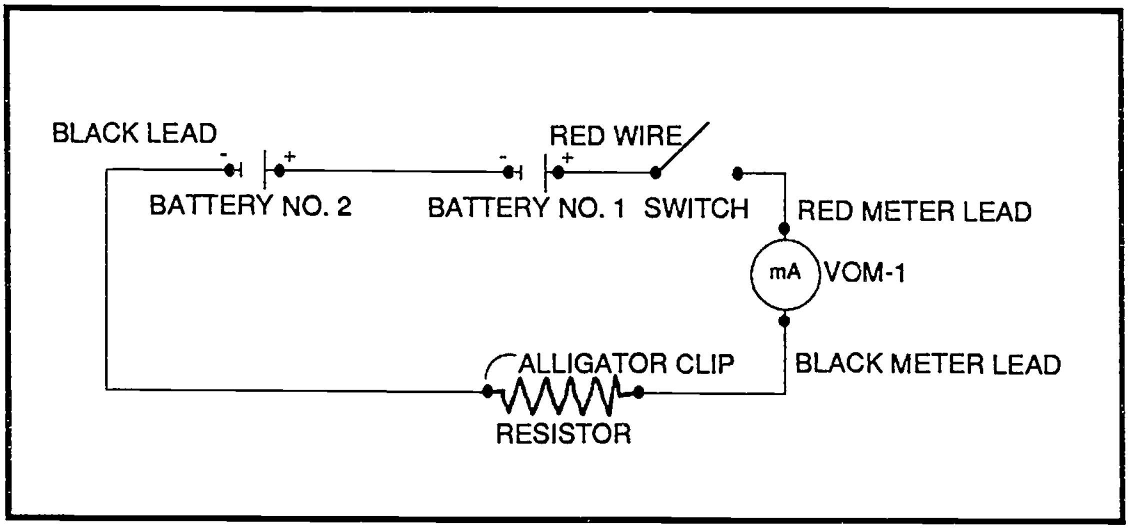
Conclusions:

1. Voltage causes electrons (current) to flow.

2. More voltage means more electrons are flowing.

3. Voltages are measured by voltmeters connected across circuit components.

4. Current (electron flow) is measured by meters placed in the circuits.



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STUDENT WORKSHEET #5

Force in Electrical Systems

Procedure:

1. Connect the probes to the multimeter.

2. Measure the voltage of each voltage source listed under a, b, c, d, e, and f below. Record the meter reading, the setting of the function switch, and the setting of the range switch.

   a. Car battery
   Function: _______
   Range: _______
   Reading: _______

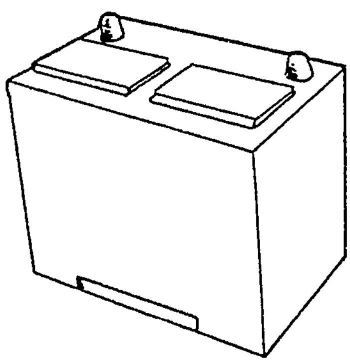
   b. Electrical outlet in wall
   Function: _______
   Range: _______
   Reading: _______

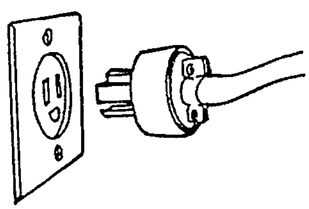
   c. Three 6-volt batteries connected as shown
   Function: _______
   Range: _______
   Reading: _______

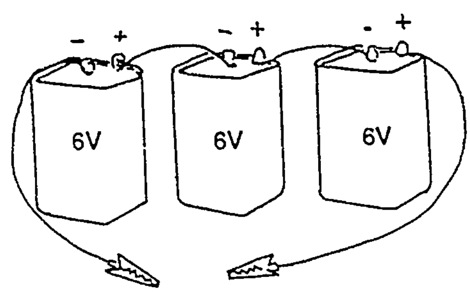
   d. A 9-volt and a 6-volt battery connected as shown
   Function: _______
   Range: _______
   Reading: _______

   e. A 9-volt and a 6-volt battery connected as shown
   Function: _______
   Range: _______
   Reading: _______

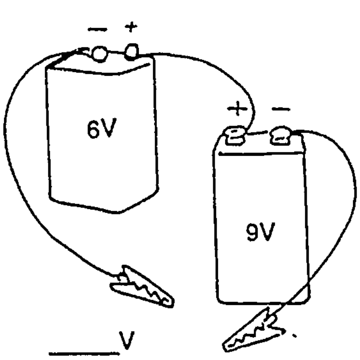
   f. Three 6-volt batteries connected as shown
   Function: _______
   Range: _______
   Reading: _______



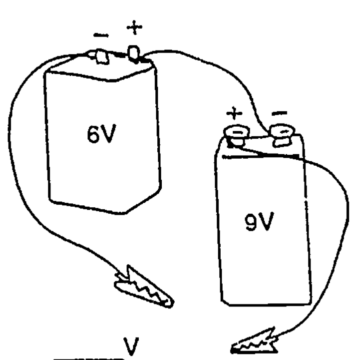




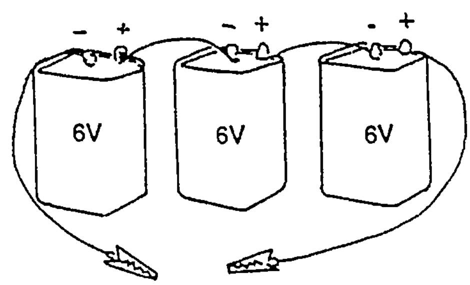
_____V



_____V



_____V



_____V

STUDENT WORKSHEET #5 — Key

Force in Electrical Systems

Note: Closely supervise the student measurement of car battery voltage and electrical wall outlet voltage. You may decide, depending on the experience the class has with electricity, to do the car battery and wall voltage as a teacher demonstration — or with the help of several students who carefully follow your instructions. Parts (c) and (d) pose no particular hazard. Students should complete these as instructed.

a. Car battery
   Function: *Volts, +DC.*
   Range: *0-50 V.*
   Reading: *12.*

b. Electrical outlet in wall
   Function: *Volts, AC.*
   Range: *0-250 V.*
   Reading: *approximately 115.*

c. Three 6-volt batteries connected as shown
   Function: *Volts, +DC.*
   Range: *0-50 V.*
   Reading: *18.*

d. A 9-volt and a 6-volt battery connected as shown
   Function: *Volts, +DC.*
   Range: *0-10 V.*
   Reading: *3.*

e. A 9-volt and a 6-volt battery connected as shown
   Function: *Volts, +DC.*
   Range: *0-50 V.*
   Reading: *15.*

f. Three 6-volt batteries connected as shown
   Function: *Volts, +DC.*
   Range: *0-10 V.*
   Reading: *6.*

Note: Item (f) — On first looking at the battery arrangement, the student might estimate that the proper range would be 0-50 V. However your students should note that one battery opposes the other two batteries, and that the meter could be reduced by one range step to 0-10 V.

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STUDENT WORKSHEET #6

Force in Electrical Systems

Procedure:

1. Parallel Loads: Hooking Up the Circuit.
   a. Hook up the switch, lamps, and battery with the wire segments, as shown in Figure 1. Note that Figures 2 and 3 are other ways to represent the same electrical circuit. The schematic diagram of Figure 3 commonly is used by engineers and technicians. Schematic diagrams always give complete information. Starting with a schematic diagram, you should be able to connect or wire a circuit correctly.

   b. Before proceeding to the next step, be sure that you have connected all parts correctly. To check, start at the negative pole of the battery and "trace" your way through the circuit. Use the schematic diagram as a guide. Be sure that there are wires for each connecting line in the diagram, and that the wires go to the switch, lamps, and battery in the right order.

   c. Close switch S_1.
   What evidence is there that electricity is flowing in the circuit? ________________

   ____

   Identify circuit components by writing the specific "item name" in the blanks below:
   Source ________________________
   Conductors ____________________
   Control Element ________________
   Load __________________________

2. Parallel Loads: Measuring Voltages.
   a. Open switch S_1. Set the multimeter function switch to +DC and the range switch to 10 V. Connect the negative (black) lead of the digital multimeter to the negative terminal of the battery. Use the screw-on alligator clip on the probe to make the connection. Touch the tip of the positive (red) lead of the multimeter to the positive terminal of the battery. Read the multimeter. Record this value as battery voltage (V_s) in the Data Table.

   b. Now move the negative multimeter lead to position d, shown in Figure 3. Close switch S_1. Touch the positive multimeter lead to the opposite terminal (position A) of lamp L_1. Read and record this value in the Data Table as voltage V_1 across lamp L_1. Now move the negative multimeter lead to position C. Touch the positive multimeter lead to the opposite lamp terminal (position B). Read and record value as voltage V_2 across lamp L_2.

   c. Open switch S_1 and disconnect multimeter.

3. Series Loads: Hooking Up the Circuit.
   a. Reconnect circuit as shown in Figure 4. Be sure to check that the circuit is properly wired.

   b. Close switch S_1.
   How does the brightness of the bulbs in this circuit compare with the bulb brightness in the setup for parallel loads? ____________

4. Series Loads: Measuring Voltage.
   a. Open switch S_1. Set the function switch to +DC and the range switch to 10 V. Connect the negative multimeter lead to the negative terminal of the battery. Touch the positive multimeter lead to the positive terminal of the battery. Read and record the value in the Data Table.

   b. Move the negative multimeter lead to terminal D of the lamp socket L_1, shown in Figure 4. Close switch S_1. Touch the positive multimeter lead to the opposite terminal (C) of lamp L_1. Read and record this value in the Data Table as voltage V_1 across lamp L_1.

   c. Move the negative multimeter lead to terminal B of lamp L_2. Touch the positive multimeter lead to terminal A of lamp L_2. Read and record this value in the Data Table as voltage V_2 across lamp L_2.

5. Drawing a Schematic Diagram.

   In the space provided below, draw the schematic diagram for the circuit connecting a table lamp to a wall outlet in your home. Use the symbol (— Ø —) for the AC voltage source from the wall socket.

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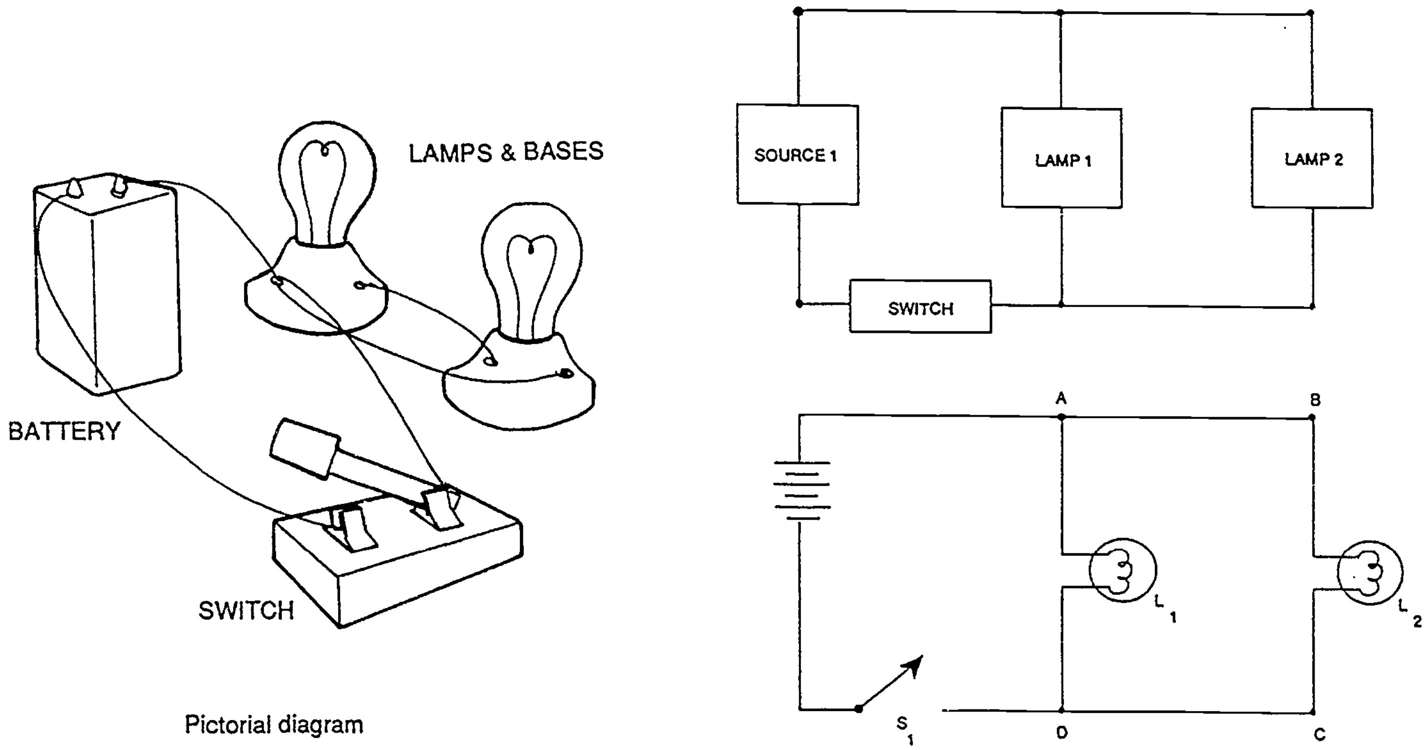
DATA TABLE

	Parallel Loads	Series Loads
Battery Voltage V_s	Volts	Volts
Lamp L_2 Voltage V_1	Volts	Volts
Lamp L_2 Voltage V_2	Volts	Volts



Figures 1, 2, and 3. Circuit for parallel loads.

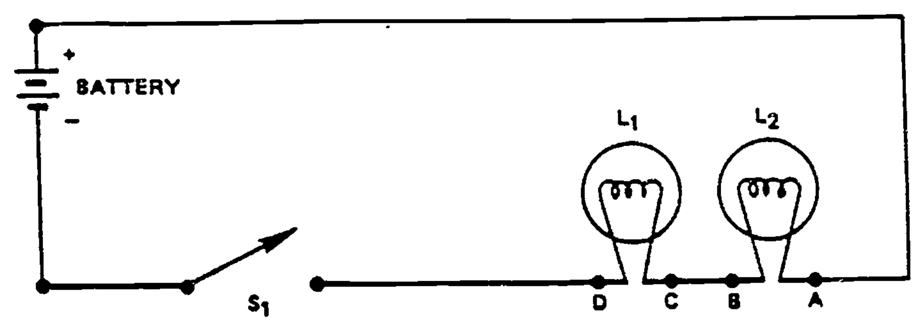


Figure 4. Circuit for series loads.

Wrap-up

1. In the electrical circuit with parallel loads (Figures 1,2, and 3), does battery voltage V_s equal V_1 (voltage across lamp L_1)? Does battery voltage $V_s = V_1 = V_2$? Does this agree with what should happen?

2. In the electrical circuit with series loads (Figure 4), does $V_s = V_1 + V_2$? Does this agree with what should happen?

STUDENT WORKSHEET #6 — Key and Discussion Guide

Force in Electrical Systems

Answers to Wrap-Up:

1. If the students performed the experiment correctly, battery voltage (V_s) should equal V_1 and also V_2.

2. If the students performed the experiment correctly, battery voltage (V_s) should equal $V_1 + V_2$.

Discussion:

Electricity is a clean, efficient source of useful energy. In order to work, electricity must flow from voltage sources into motors or devices that convert it into mechanical energy, heat, or light. Electricity flows through closed paths (circuits) of conducting material For electricity to flow, there has to be an unbroken path of conducting material so that electrical charge can move from the voltage source to the electrical loads and back to the voltage source. The paths through which electricity moves are called "circuits."

Two or more loads can be connected in series or parallel.

Sometimes, a voltage source is used to supply electricity to two or more loads at the same time. The loads can be connected in two different ways, as shown in Figure 1.

Figure 1a shows two loads connected in series. Since the circuit is a single loop, all electrons flow out of the voltage source (V_s) and pass through each load. In the series load condition, the sum of the voltage readings V_1 and V_2 equals the total voltage reading (V_T), or battery voltage (V_s), as follows:

$$V_T = V_1 + V_2 = V_s$$

Therefore, the sum of the voltages around the loop equals zero, as follows:

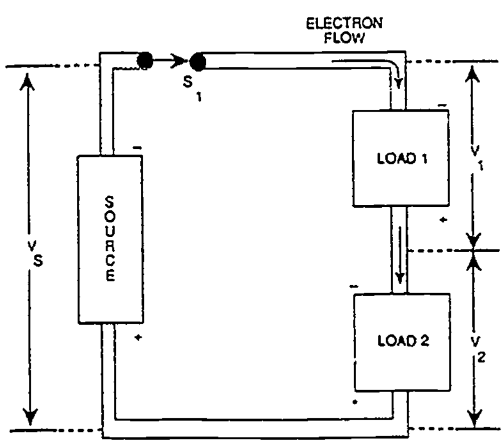
$$V_s - V_1 - V_2 = 0$$

Also, notice that, in a series-connected circuit, all of the electrons leaving the source travel through both loads and back to the source.

Figure 1b shows two loads connected in parallel. Since each load is connected directly across the battery, the voltage reading across each load (V_1 and V_2) is identical and equal to the voltage reading (V_s) of the battery, as shown:

$$V_s = V_1 = V_2$$

The parallel circuit has two loops and can be considered as two circuits connected to a common voltage supply. In a parallel circuit, some of the electrons flow from the source through load 1 and some flow through load 2. After flowing through each load, the electrons recombine and flow back to the source. The number of electrons flowing back to the source is equal to the number of electrons that originally flowed out of the source.



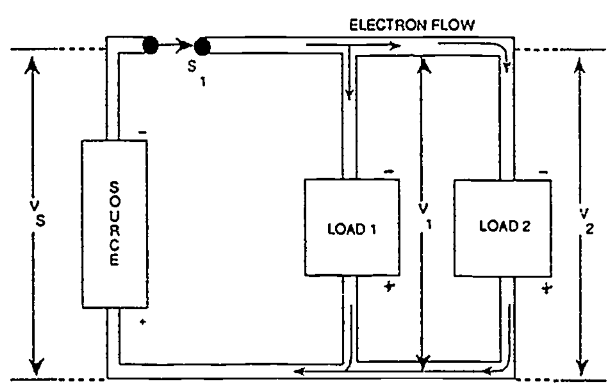


Figure 1. Circuit connections for two or more loads.

STUDENT WORKSHEET #7

Work in Electrical Systems

The following exercises review main ideas and definitions presented in this unit. Complete each question by circling the correct answer.

1. Which of the following equations best defines electrical work?

   a. $W = F \times d$
   b. $W = (\Delta V) \times q$
   c. $W = p \times h$
   d. $W = (\Delta V) \times I$

2. In electrical work, the displacementlike quantity is the charge that's moved. The forcelike quantity is:

   a. the voltage difference.
   b. the product of the current and time.
   c. measured in joules.
   d. measured in newtons.

3. The coulomb is a unit of electrical charge that's made up of:
   a. one ampere.
   b. 6.25×10^{18} electrons.
   c. 60 ampere-seconds.
   d. one ampere-hour.

4. A 1.5-volt battery delivers 6 coulombs of charge. How much work has it done?

   a. 4 ampere-hours
   b. 9 joules
   c. 4 joules
   d. 9 newtons/meter

5. An electrical motor does 800 N-m of useful work while it uses up 1000 joules of electrical energy. The efficiency of this motor is:

   a. 100%.
   b. 125%.
   c. 80%.
   d. None of the above.

6. A 12-volt battery does 180 V C of work. How much charge has it moved? Hint: Rearrange $W = \Delta V \times q$ to isolate q. Then substitute and solve for q.

   a. 2160 coulombs
   b. 7.813×10^{18} coulombs
   c. 9.375×10^{19} coulombs
   d. 15 coulombs

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STUDENT WORKSHEET #7 — Key and Discussion Guide

Work in Electrical Systems

Answers:

1. *B* $W = (\Delta V) \times q$
2. *A* the voltage difference
3. *B* 6.25×10^{18} electrons
4. *B* 9 joules
5. *C* 80%
6. *D* 15 coulombs

Discussion:

How is work done by a voltage?

The definition of work done by voltage difference in an electrical system is:

Work = Voltage difference x Charge Moved

$$W = (\Delta V) \times q$$

where: W = electrical work done by the voltage difference
ΔV = voltage difference that moves charge
q = quantity of charge moved

Electrical charge is measured in units called "coulombs." A coulomb of charge is equal to the charge of 6.25×10^{18} electrons. This means that one coulomb equals the charge on 6.25 billion electrons.

1 Coulomb = Charge of 6,250,000,000,000,000,000 Electrons

Thus, a net charge of one coulomb represents 6,250,000,000,000,000,000 more electrons at the negative plate of a battery than at the positive plate. Since this number is so large, it is usually written in powers of ten, or scientific notation, as 6.25×10^{18}. As we just said, the number of electrons of charge (6.25×10^{18}) is equal to 6.25 billion billion! That's such a large number most of us can't grasp the immensity. But we can develop more of a "feel" for this number by going through the following "thought" exercise.

Think of an electron as a single grain of sand. It would then take about 20,000 rooms, each 12 ft x 12 ft x 10 ft, filled with sand, to equal 6.25×10^{18} grains. That's the same number of electrons that provide the charge equal to one coulomb.

What are the units of electrical work?

In mechanical and fluid systems, work is measured in foot-pounds (ft-lb) or newton-meters (N-m). Both of these units remind us that work involves a force (pounds or newtons) times a distance (feet or meters). In electrical systems, work also involves a force and a distance. The force is an electrical force that moves charge. The distance is the length of path the charge — such as an electron — moves while the force pushes on it. But electrical forces and movements of electrons are both difficult to measure. The unifying equation for work — WORK EQUALS A FORCELIKE QUANTITY TIMES A DISPLACEMENT — gives us an easier way to measure electrical work. Voltage or voltage difference is the forcelike quantity. Therefore, electrical work is also equal to voltage difference (ΔV) times charge (q).

ELECTRICAL WORK = VOLTAGE DIFFERENCE x CHARGE MOVED

$$W = \Delta V \times q$$

where: ΔV is measured in volts.
q is measured in coulombs
W is measured in volts x coulombs, or joules.

In electrical systems, then, we see that the unit of work is equal to one volt-coulomb or one joule. In mechanical and fluid energy systems, the System International (similar to metric) unit of work is one newton-meter, also equal to one joule. So the SI unit of work — the joule — is very useful. The joule is used to measure work, or energy, in mechanical, fluid, electrical and thermal systems.

Batteries store electrical charge

Batteries are portable containers of electricity. We can carry them anywhere: on a boat, in a car, or on a camping trip. Any time we need a little DC electricity, we just "hook up" to the terminal (connectors) and "out comes the juice."

Well, almost anytime. Batteries don't last forever. They run down, or discharge. While they're supplying electricity, a chemical change takes place inside. When the change is almost complete, the battery is "dead." Many batteries — particularly the wet-cell type that we use in cars and industry — can be recharged. We do this by connecting the battery to another DC voltage source so that the current flows through the battery opposite from the way it does during discharge.

This charging process "puts the juice back into the battery." When we use the term "juice," we put it in quotes. This is because "juice" is not a useful, technical term. A better term for "juice" is "coulombs of charge." When we operate a battery, we're discharging, or releasing, coulombs of charge. When we charge a battery, we're restoring (putting back) coulombs of charge.

Example 1 below shows how to use the equation for electrical work ($W = \Delta V \times q$) to calculate work done to charge a battery.

Example 1: Work done to charge a battery.

Given: A "dead," or discharged, 12-volt automobile battery can store 360,000 coulombs of electrical charge.

Find: How much electrical work is done to recharge the battery if a voltage difference of 12 volts moves 360,000 coulombs of charge?

Solution: $W = \Delta V \times q$ $\quad \Delta V = 12$ volts
$q = 360{,}000$ coulombs

$W = (12\text{ V})(3.6 \times 10^5\text{ C})$
$W = (12 \times 3.6 \times 10^5)(\text{V}\bullet\text{C})$
$W = 4.32 \times 10^6\ (\text{V}\bullet\text{C})$
or 4.32×10^6 joules, (since one volt-coulomb = 1 joule)
Therefore, 4.32×10^6 joules (J) or 4.320 kilojoules (kJ) are required to charge the battery. (The prefix "kilo" means 1000.)

How are electrical charge and current related?

Coulombs can't be measured easily. It's more practical to measure the rate at which charge (coulombs) moves through a conductor. This rate is called "electrical current." Electrical current is denoted by the symbol "I."

Current can be measured with an ammeter in units called "amperes." An ampere is the amount of current flowing when one coulomb of charge moves past a point in a conductor in one second.

$$\text{CURRENT} = \frac{\text{CHARGE}}{\text{TIME}}$$

or

$$I = \frac{q}{t}$$

Equation 1

In the previous example, the charge restored to the "dead" battery was given as 8000 coulombs. Batteries are normally rated in charge units of ampere-hours rather than coulombs. But ampere-hours are really units of charge and can be converted to coulombs. Let's see how.

The symbols in Equation 1 can be rearranged to isolate the charge q. If this is done, you get:

$$q = I \times t$$

Equation 2

Equation 2, written in terms of basic units, then becomes.

$$q = I \times t$$

q in coulombs
I in amperes
t in seconds

1 COULOMB = 1 AMPERE-SECOND

So one coulomb equals one ampere-second. That means that if one ampere of current flows for one second, one coulomb of charge is moved. What if the current flows for one hour? One hour equals 3600 seconds There would be 3600 times as many coulombs moved. Thus:

1 AMPERE-HOUR = 3600 COULOMBS

So you can see that ampere-hours are really units of charge. How many ampere-hours of charge does the battery in Example 1 hold? Since it holds 8000 coulombs, and one ampere-hour equals 3600 coulombs, the answer is 2.22 ampere-hours. We found this by a simple division process, as follows:

$$\frac{8000\text{ Coulombs}}{3600\text{ Coulombs/Ampere-Hour}} = 2.22\text{ Ampere-Hours}$$

Batteries are often rated in terms of ampere-hours, rather than coulombs. But don't forget, either unit represents charge.

By using the equation, $q = I \times t$, we also can find the electrical work done on other devices such as motors, lights and heaters. Example 2 shows how to calculate the work done on an electric motor.

Example 2: Work done on an electric motor.

Given: A DC electric motor operates for two minutes on a voltage of 12 volts while drawing a current of 4 amperes (4 A).

Find: The electrical work done to operate this motor for two minutes. (The work done is the same as the electrical energy used.)

Solution: From the equation, Charge = Current x Time, or $q = I \times t$, where $I = 4$ A and $t = 120$ seconds, we have $q = (4\text{ A})(120\text{ sec}) = 480$ (A-sec).

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(Note: One A-sec = 1 C.)
Therefore, q = 480 C.
The charge transferred is 480 coulombs.
Now we can use the equation for electrical work: $W = \Delta V \times q$.

where: $\Delta V = 12$ V
$q = 480$ C
$W = (12\text{ V})(480\text{ C})$
$W = 5760$ V•C or 5760 joules (One V•C = one J.)

Therefore, 5760 J of electrical work was done to run the motor for 2 minutes. This quantity is sometimes referred to as "input energy" or WORK IN.

What are the effects of electrical work?

Electrical work happens when voltage causes a charge to move. Electrical work produces movement, heat, light and/or sound. In your daily life, you're exposed to the effects of electrical work whether you're at home, in school, in an office or in an industrial plant.

Electric motors provide the movement of air in ventilation systems. Electric relays and solenoids open or close switches and valves. Electric motors also move fluids by operating pumps or pushing pistons with the help of mechanical drives. Electric motors also turn wood- and metal-working machines, conveyor belts, and fans.

Another result of charge movement by voltage is the production of heat. Heat may be wanted, such as in electric heaters, clothes dryers, hair dryers, dehydrators, or electric ovens. Or heat may be simply a by-product, such as the heat produced in electric motors or incandescent light bulbs.

Light — whether from an incandescent bulb, fluorescent tube, mercury-discharge lamp, or laser — is produced when a voltage difference causes charge to move. Light is one form of electromagnetic radiation. Other forms of electromagnetic radiation include radio waves, TV waves, and microwaves. These also are produced by electrical work.

Another form of radiation we experience daily is sound radiation from speakers. These speakers may be part of public address systems, radios, TVs, or entertainment systems (such as phonos, tape players, and stereos).

Clearly, we have many examples of the effects of electrical work. From the sound of the buzzer that wakes us up in the morning, to the electric motor in a typewriter or power tool, to the lights of the office, school or plant that are shut off each evening, we have continuing evidence of electrical work around us.

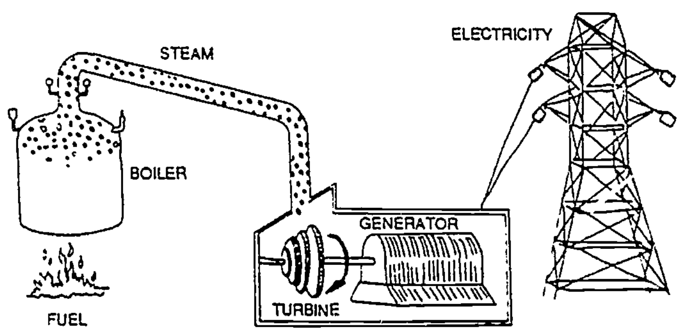
Why use electricity to do work?

Electricity is produced at large electrical generating stations (power plants) by the following process:

1. Coal, gas, or oil is burned to produce heat energy.
2. Heat energy is used to convert water into high pressure steam.
3. Steam pressure is used to drive (rotate) turbines.
4. Turbines drive electrical generators to produce electricity.

The overall efficiency of this conversion process is less than 60%. In the conversion process from raw fuel (coal, gas or oil) to electricity, heat energy, fluid energy, and rotational mechanical energy are all produced. Later, electricity is converted back to useful fluid energy and mechanical energy. The process often generates heat energy. Why go through this long process to produce electricity when we must reverse the process to use it? There are several good reasons:

1. Electricity is an efficient way to transport energy from coal mines (or other fuel sources) to offices, homes and factories. Electricity can move long distances through overhead or underground wires.
2. Electricity is clean. There are no by-products that are dirty or harmful.
3. Electricity operates many machines and electronic devices that are relatively small and take up very little room.
4. Electricity is convenient, easy to use, and provides "fast" work when you want it. That is, you don't have to start a fire and boil water to get electrical energy.



STUDENT WORKSHEET #7 — Demonstration

Electrical Work

Purpose:

1. To show the following:
   a. Electrical work is done when a voltage moves a charge.
   b. Electrical work can be "seen" in terms of its conversion to more visible forms of work — such as mechanical work.
   c. Electrical work done can be calculated from the formula, Work = $(\Delta V) \times q$.

Materials:

1. Slotted-weight set (metric)
2. Two C-clamps
3. Two VOM multimeters
4. Pulley with support stand
5. DC power supply
6. DC motor
7. Stopwatch

Demonstration:

1. Set up the apparatus (prior to class), as shown in Figure 1.

2. Before coming to class, prepare the following calculation table on an overhead transparency or write it on the chalkboard.

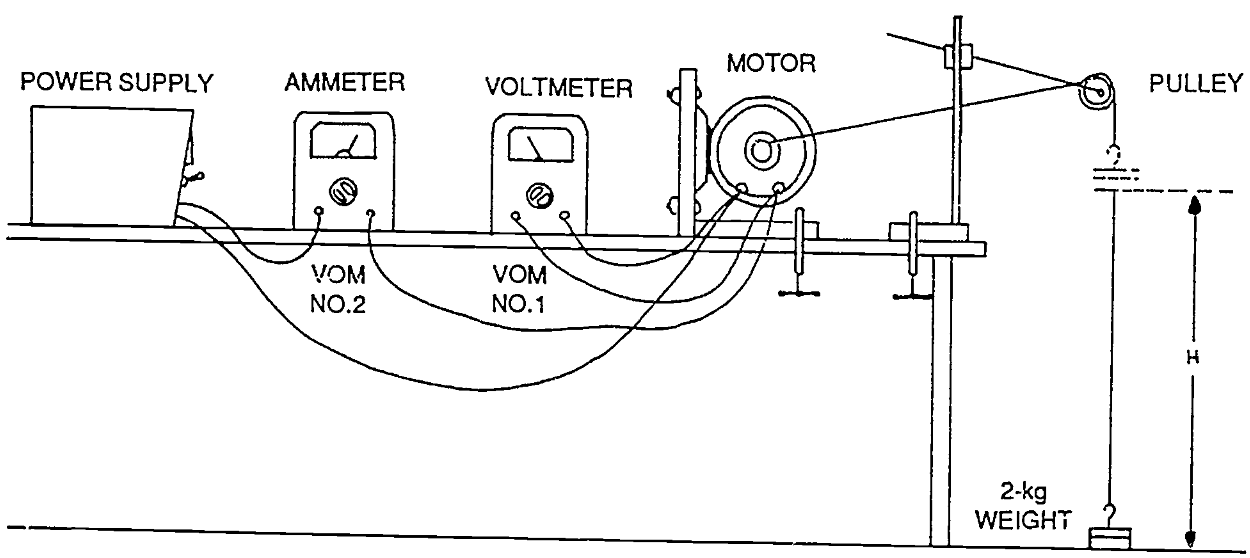


Figure 1.

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Mechanical Work = F x D

where: F = Weight (w) moved = 19.6 N (2 kg)
D = Height (h) lifted = ________ m

Mechanical Work = w x h
=19.6 N x ________ m

Mechanical Work = ________ N-m, or joule (J)

Electrical Work

$W = (\Delta V) \times q$
ΔV measured by VOM #1: _____ V
q calculated from formula $q = I \times t$ (A-sec or coulomb)
I as measured by VOM #2: _________ A
t as measured by stopwatch: ________ sec

Electrical Work = $(\Delta V) \times q$
= $(\Delta V) \times I \times t$
= ________ volts x ________ amps x ________ sec
= ________ volt•coulomb
Electrical Work = ________ V•C, or joule (J)

3. Go through a "practice" run for the class. Turn the power supply ON, and adjust it so that the motor turns at a slow, steady speed while the 2-kilogram weight (19.6 N) rises slowly but steadily. (This procedure should be checked out before class begins.) Explain what's happening to your class and explain what measurements need to be taken. Now ask several students to help you take and record the data.

4. Start with the weight on the floor, string taut, and power supply OFF. Turn power supply ON to predetermined value. Time the movement of 2-kilogram weight from floor to pulley. Be sure the weight moves up at a constant speed. At the same time, read the voltage and current indicated on the meters. Measure the height the weight is raised with a meter stick. Record weight (19.6 N), height (h) in meters, time (t) in seconds, voltage (V) in volts, and current (I) in amperes on the chalkboard.

5. Carry out the calculations for mechanical work and electrical work, as indicated in the table for calculations. both results will come out in joules (J), so they can be compared directly. Electrical work (Work In) should be **larger** than mechanical work (Work Out).

Wrap-Up:

Close the demonstration by reinforcing that electrical work is equal to $(\Delta V) \times q$. Point out that the forcelike quantity (ΔV) moved charge (q) to do electrical work. Point out that students saw the effect of electrical work by observing the motor lift a weight through a distance (h). Ask students to explain why electrical work done was **larger** than mechanical work. Point out how this observation is related to efficiency and energy converted to heat in the motor.

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STUDENT WORKSHEET #8

Rate in Electrical Systems

Before you work the following electrical rate problems, review the units used to describe electrical rates.

Electrical current is measured in amperes.
Electrical charge is measured in coulombs.
The frequency of an electrical signal is measured in cycles/sec or hertz.
The period of an electrical signal is measured in seconds.

Test your understanding by completing the following sentences:

a. The rate unit for electrical current is ____________ .
b. One coulomb per second is equal to ____________ .
c. Ten coulombs of charge flowing through a wire in two seconds is equal to ___________ amperes of current.
d. An electrical frequency of 100 cycles per second is also equal to ________ hertz (Hz).
e. If an electrical signal has a frequency (f) of 10 Hz, it has a period of _________ seconds.

Problem 1: Given: A 110-V heating element in an electrical water heater is rated at 20 amperes.

Find: The charge that passes through the element in 10 seconds. (Hint: Use the equation, $I = q/t$. Rearrange equation to isolate q. Then solve for q in coulombs. Remember that one ampere equals one coulomb per second.)

Solution:

Problem 2: Given: A solid-state device in a hand-calculator display has 3×10^{-2} coulombs of charge pass through it in 10 seconds.

Find: The current used by the calculator in milliamperes. (Hint: Use the equation $I = q/t$. Note that 1 milliampere = 1/1000 ampere = 10^{-3} ampere.)

Solution:

Problem 3: Given: In an electric motor, operating at a constant speed, 3×10^4 coulombs of charge have moved through the motor. The motor is operated at a steady current of 50 amperes during the entire period of time.

Find: The length of time the motor operated at a constant speed. (Hint: Use the equation, $I = q/t$. Rearrange the equation to isolated the time (t). Then substitute values and solve for the time in seconds.)

Solution:

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STUDENT WORKSHEET #8 — Key and Discussion Guide

Rate in Electrical Systems

Anwers:

a. amperes
b. 1 ampere
c. 5 amperes since $I = \frac{q}{t} = \frac{10\text{ coulomb}}{2\text{ sec}} = 5\ \frac{\text{coulomb}}{\text{sec}}$
d. 100 Hz
e. 0.1 sec since $T = \frac{1}{f} = \frac{1}{10\text{ Hz}} = 0.1\ \frac{\text{sec}}{\text{cycle}}$

Problem 1:

$I = q/t$
$q = It$ Where: $I = 20$ amp, $t = 10$ sec

$q = 20\text{ A} \times 10\text{ sec}$
$q = 200$ amp-sec
$q = (200\text{ coulomb})/\text{sec} \times \text{sec}$
$q = 200$ coulomb

Problem 2:

$I = q/t$ Where: $q = 3 \times 10^{-2}$ coulomb, $t = 10$ sec

$I = (3 \times 10^{-2}\text{ coulomb})/(10\text{ sec})$
$I = 3 \times 10^{-2-1}$ coulomb/sec
$I = 3 \times 10^{-3}$ amp
$I = 3$ milliamp
$I = 3$ mA.

Problem 3:

$I = q/t$
$t = q/I$ Where: $q = 3 \times 10^{4}$ coulomb, $I = 50\text{ amp} = 5 \times 10^{1}$ amp

$t = (3 \times 10^{4}\text{ coulomb})/(5 \times 10^{1}\text{ amp})$
$t = 3/5 \times 10^{4-1}$ coulomb/amp
$t = 0.6 \times 10^{3}$ coulomb/amp
$t = 600$ (amp-sec)/amp
$t = 600$ sec or 10 min

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Discussion:

This activity will give you practice in rearranging equations to isolate an unknown. It also gives practice in solving for an unknown quantity by substituting numbers and units in electrical rate equations.

A. The equation for electrical charge flow rate or current is:

$$\text{ELECTRICAL CURRENT} = \frac{\text{CHARGE TRANSFERRED}}{\text{ELAPSED TIME}}$$

To simplify use the symbols: $I = q/t$

Where: I = electrical current (amperes)
q = charge transferred (coulombs)
t = elapsed time (hours, minutes, seconds)

B. The equation for electrical frequency is:

$$\text{ELECTRICAL FREQUENCY} = \frac{\text{NUMBER OF CYCLES}}{\text{ELAPSED TIME IN SECONDS}}$$

To simplify use the symbols: $f = n/t$

Where: f = frequency (cycles/sec) Note: 1 cycle/sec = 1 hertz
n = number of cycles
t = elapsed time (seconds)

C. Period and frequency of a repeating electrical signal are related by an inverse relationship. The equation for the period of an electrical wave with a known frequency is:

$$\text{ELECTRICAL WAVE PERIOD} = \frac{1}{\text{ELECTRICAL WAVE FREQUENCY}}$$

To simplify use the symbols: $T = 1/f$

Where: T = period of electrical signal (usually in seconds)
f = frequency of electrical signal (cycles/sec or hertz)

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STUDENT WORKSHEET #9

Rate in Electrical Systems

Procedure:

Part 1: Measuring Small Currents (Less than 500 mA)

1. Connect the apparatus as shown in Figure 1. Be sure that the switch is open and the DMM is set on OFF.

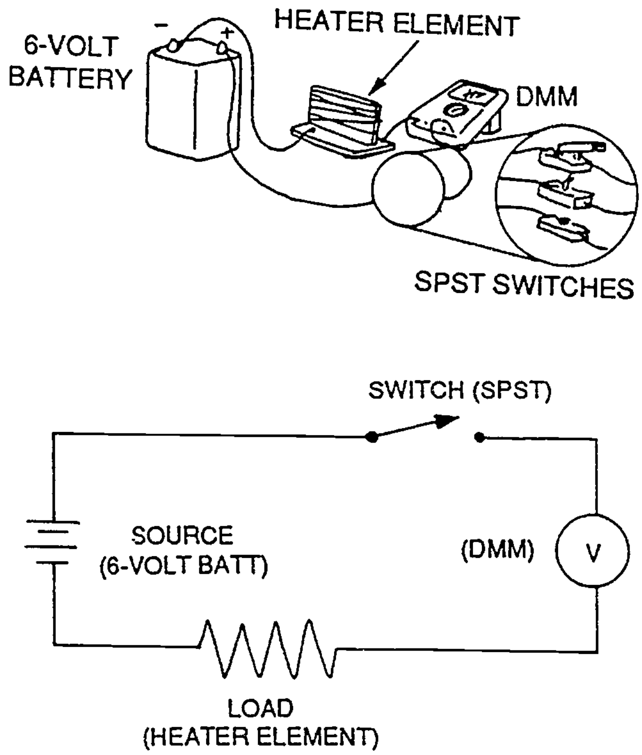


Figure 1. Laboratory setup 1.

2. Examine the meter settings. Be sure the function switch is set to measure DC current. Set the range to the highest possible current-setting value for the "high-current" terminal used. Connect the meter leads to the proper input terminals on the meter. Connect the other ends of the meter leads to the external circuit — positive lead to positive side of circuit, negative lead to negative side of circuit. Before you continue, ask your instructor to check your setup.

3. Turn the meter to ON and close the switch. The meter should register a reading. If the meter has an automatic range-setting capability ("auto ranging"), you can record the reading of the meter here and go to Step 5:

   I_1 = ________ mA.

4. If the meter does not have an "auto-ranging" capability (or you choose the "manual" setting), slowly reduce the range setting switch to its proper value. For example, if the reading indicated on the meter is greater than the next lower-range setting, do not reduce the range setting switch further. With the range switch set at its optimum value, read the current. Record here:
   I_1 = ________ mA.

5. Open the switch. Turn the DMM to OFF and remove it from the circuit. Replace the DMM with the VOM. Repeat steps 2 through 4. Record the VOM readings here:
   I_1 = ________ mA.
   Open switch.

Part 2: Measuring Mid-Value Currents (500 mA to 1 A)

1. Connect a second 6-V, dry-cell battery in series with the first 6-V battery that was used in the lab setup in Figure 1. Be sure to connect the positive electrode of one battery to the negative electrode of the other, as shown. This will give you a total voltage of 12 volts. Schematically, the circuit should now be like that shown in Figure 2.

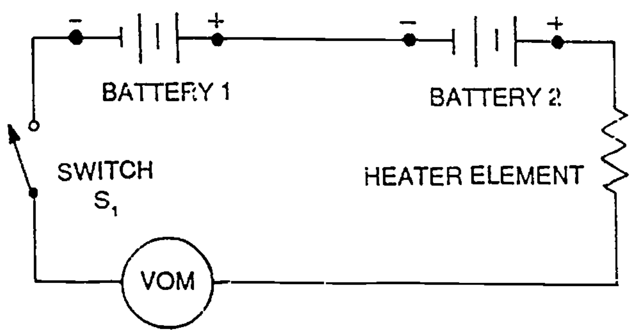


Figure 2. Laboratory setup 2.

2. With switch S_1 open and the VOM in the circuit, as shown in Figure 2, be sure the function switch on the VOM is set for current measurement. Be sure the range switch has been adjusted to the proper value. Be sure the meter terminals are properly connected. Ask your instructor to examine your setup before proceeding to Step 3.

3. Close switch S_1 and read the VOM. Record the reading as:
   I_2 = ________ mA.

4. Open S_1 and disassemble the setup.

Part 3: Measuring Large Currents (Greater than 1 A)

1. Connect the apparatus, as shown in Figure 3. Be sure the power supply is OFF and the switch is "open."

2. Connect the VOM leads to the "high-current" terminals. Set the range switch to the highest possible current setting for the "high current" terminal used. Ask your instructor to examine your setup before proceeding to Step 3.

▲ **Caution:** With large currents, heater element may be hot. Use care to avoid burns.

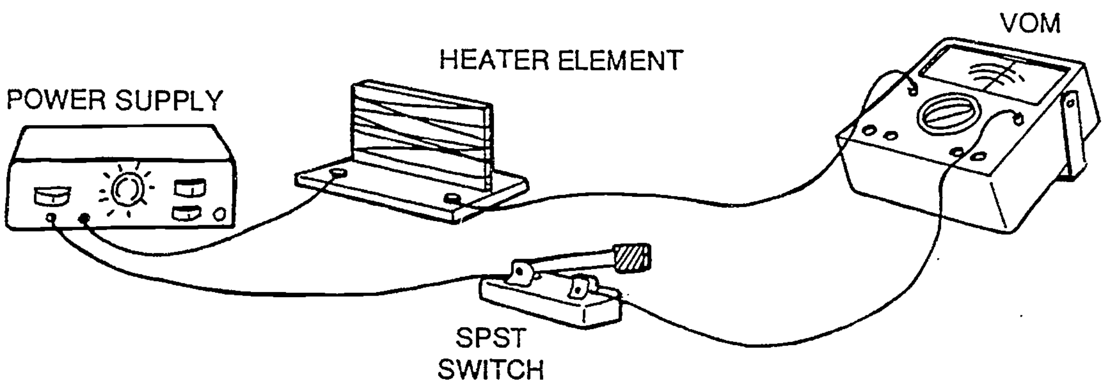
3. Turn the output control of the power supply to minimum and turn the power supply ON. Close the switch. Slowly increase the power supply output until either (1) the meter can read no higher current or (2), the power supply control is at maximum setting. Record the current indicated as I_3 = __________ A. Turn power OFF.

4. Remove the VOM from the circuit and replace with the DMM. Repeat Steps 2 and 3 of Part 3. Record here as I_4 = _________ A. Turn power OFF and disassemble the apparatus.

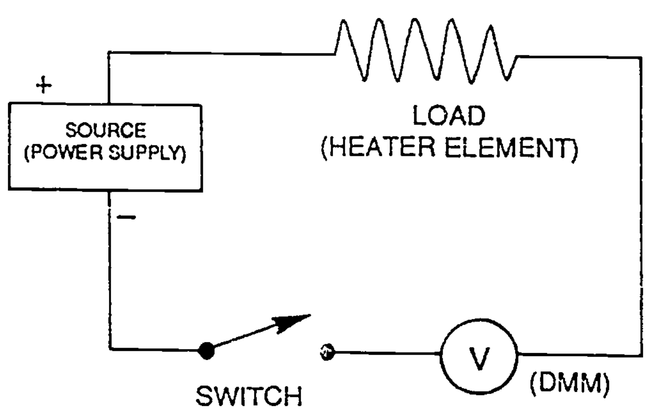
Wrap-Up:

1. If all the components of a circuit remain the same, but the source voltage in the circuit is increased, what happens to the amount of current flowing in the circuit? What parts of your experiment support your answer?

2. Which meter (DMM or VOM) measures current more precisely?



Pictorial diagram



Schematic diagram

Figure 3. Laboratory setup 3.

STUDENT WORKSHEET #9 — Discussion Guide

Rate in Electrical Systems

Introduction:

1. Current flowing in the circuit increases as the voltage increases when the load remains constant. When two batteries were placed in series, the voltage doubled. If the circuit was not changed in any other way, the current flow would also double. The increase in current flow is manifested by the heater element. It glows brighter and gives off more heat.

2. The DMM reads exact values within its range. The VOM requires an interpretation made from the position of a pointer on a scale.

Purpose:

To show the following:
1. Current is proportional to voltage in an electrical circuit.
2. Current flow can take place in one direction (DC) or alternate from one direction to the other (AC).
3. Ammeters must be placed in the circuit — in series — to measure circuit current.

Materials:

1. Two lantern-type batteries, 6-Volt dry-cell.
2. 6-volt lamp with base.
3. Single-pole, single-throw (SPST) switch.
4. VOM.
5. Oscilloscope with a X1 and X10 probe.
6. Function generator.

Procedure:

1. Set up the apparatus, as in Figure 1a. Be careful to make the proper polarity connections between the battery and VOM. Be sure the VOM is set up to measure current, not resistance or voltage. Turn the oscilloscope ON. Allow it to warm up for at least 10 minutes. A longer warm-up time may be needed if the scope you are using is a pre-1975 model. Also turn ON the function generator. Allow it to warm up.

2. Draw a schematic (Figure 1b) of the demonstration setup on the chalkboard. Review the four major parts of a circuit (source, load, conductors, and control device). Emphasize the method of connecting the VOM in the circuit to measure current. Compare this to the method of connecting a VOM to measure voltage across a load.

3. Close the switch. Observe the brightness of the light bulb. Record the value of the current reading on the VOM.

4. Open the switch. Place a second 6-volt battery in series with the first.

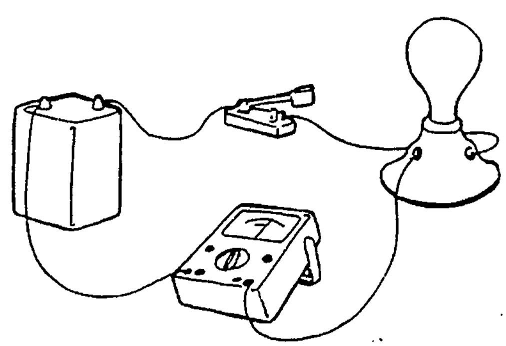
5. Close the switch. Observe the brightness of the light bulb. Record the second value of current on the board.

Questions:

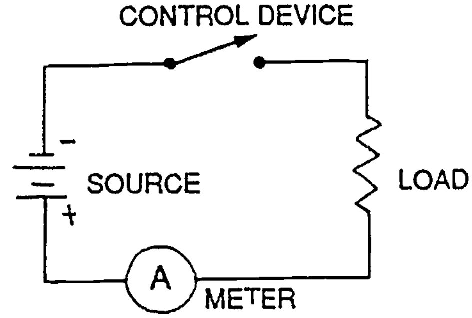
1. Was the lamp brighter with one battery or with two batteries connected in series?

2. What was the total voltage when the batteries were connected in series?

3. What happened to the current when the voltage was doubled?



Pictorial diagram



Schematic diagram

Figure 1. Demonstration setup.

STUDENT WORKSHEET #10

Resistance in Electrical Systems

1. Find the strength of a current through a filament lamp if the resistance of the filament if 220 Ohms and the voltage is 110.

2. What is the resistance of the heating element of an electric toaster that carries a current of 5.0 amps on a 110-volt line?

3. What is the resistance of an electrical heater which draws 8.7 amps and operates on 120 volts?

4. How much current flows through a 100-watt bulb operating at 120 volts if the filament resistance is 144 ohms?

5. What is the current flowing in a series circuit at 120 volt with one light bulb with a resistance of 92 ohms and another light bulb with a resistance of 138 ohms?

6. What is the voltage across a load with a current of .52 amps and a resistance of 72 ohms.

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STUDENT WORKSHEET #10 — Key and Discussion Guide

Resistance in Electrical Systems

1. *I = 110/220 = .5 amp*
2. *R = 110/5 = 22 ohms*
3. *R = 120/8.7 = 13.8 ohms*
4. *I = 120/144 = .83 amps*
5. R_T *= 92 ohms + 138 ohms = 230 ohms*

   I = 120 volts/230 ohms = .52 A
6. *E = .52 A x 72 ohms = 48 V*

Ohm's Law

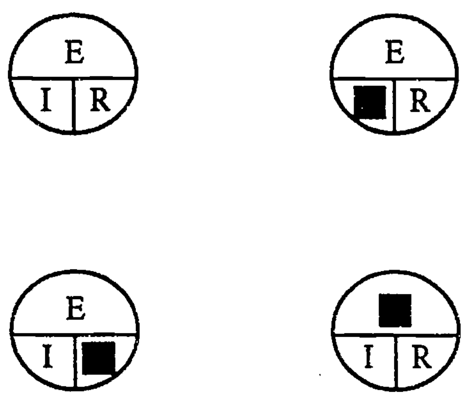
It is easier to work with Ohm's law when it is expressed in a formula. In the formula, E represents emf or voltage; I is the current, or the intensity of electron flow; R stands for resistance. The formula is E = I x R. It is used to find the emf (voltage) when the current and the resistance are known.

To find the current, when the voltage and resistance are known, use I = E/R

To find the resistance, when the voltage and current are known, use R = E/I

Using Ohm's Law

Ohm's law is very useful in electrical and electronics work. You will need it often to determine the missing value. In order to make it easy to remember the formula take a look at the figure. Here the formulas are arrived at by placing your finger on the unknown and the other two have their relationship displayed.



The best way to become accustomed to solving problems is to start with something simple, such as:

1. If the voltage is given as 100 V and the resistance is 25 ohms, it is a simple problem and a practical application of Ohm's law to find the current in the circuit. Use I = E/R.

   Substituting the values in the formula, I = 100/25 means 100 is divided by 25 to produce 4 A for the current.

2. If the current is given as 2 A (you may read it on an ammeter in the circuit), and the voltage (read from the voltmeter) is 100 V, it is easy to find the resistance. Use R = E/I

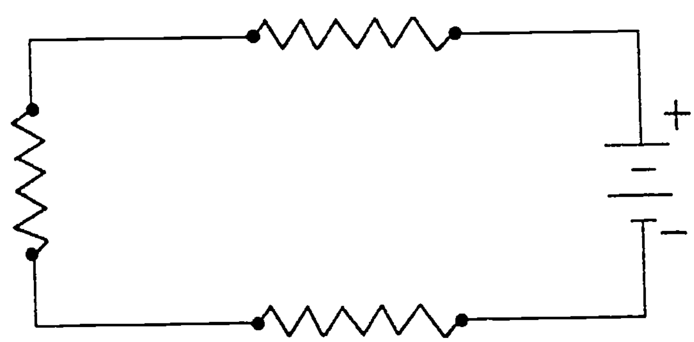
   Substituting the values in the formula, R = 100/2 means 100 divided by 2 equals 50 ohms for the circuit.

3. If the current if known to be 10A, and the resistance is found to be 50 ohms (measured before the circuit is energized), it is then possible to determine how much voltage is needed to cause the circuit to function properly. Use E = I x R

   Substituting the values in the formula, E = 10 x 50 means 10 times 50 produces 500 or that it would take 500 V to push 10 A through 50 ohms of resistance.

Series Circuit

The figure below shows a series circuit. The three resistors are connected in series, or one after the other, to complete the path from one terminal of the battery to the other. The current flows through each of them before returning to the positive terminal of the battery.



There is a law concerning the voltages in a series circuit. Kirchhoff's voltage law states that the sum of all voltages across resistors or loads is equal to the applied voltage. Voltage drop is considered across the resistor. The figure shows the current flow through three resistors. The voltage drop across R_1 is 5 V. Across R_2 the voltage drop is 10 V. And, across R_3 the voltage drop is 15 V. The sum of the individual voltage drops is equal to the total or applied voltage of 30 V. E_T means total voltage. It may also be written as E_A for applied voltage or E_S for source voltage.

To find the total resistance in a series circuit, just add the individual resistances or $R_T = R_1 + R_2 + R_3$. In this instance the total resistance is 5 + 10 + 15, or 30 ohms.

Parallel Circuit

In a parallel circuit each resistance is connected directly across the voltage source or line. There are as many separate paths for current flow as there are branches (see figure below).

The voltage across all branches of a parallel circuit is the same. This is because all branches are connected across the voltage source. Current in a parallel circuit depends on the resistance of the branch. Ohm's law can be used to determine the current in each branch. You can find the total current for a parallel circuit by simply adding the individual currents. When written as a formula it reads

$$I_T = I_1 + I_2 + I_3 + \dots$$

The total resistance of a parallel circuit cannot be found by adding the resistor values. Two formulas are used for finding the total resistance (R_T). If there are only two resistors in parallel, a simple formula can be used:

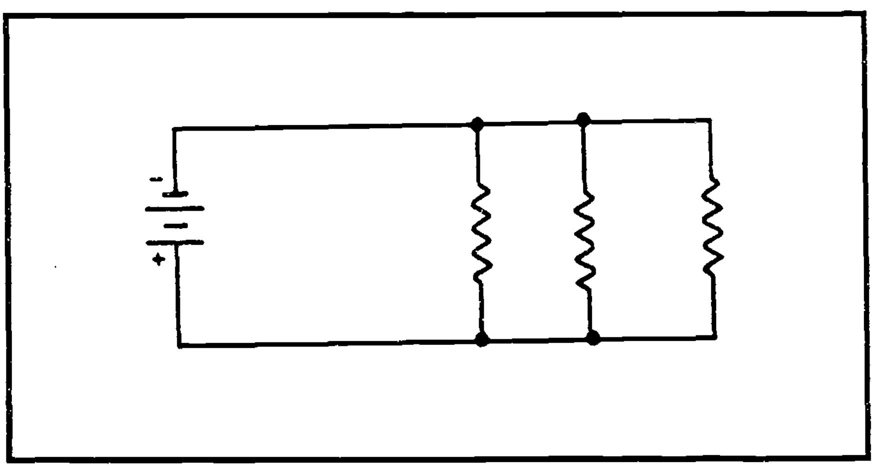
$$R_T = (R_1 \times R_2)/(R_1 + R_2)$$

If there are more than two resistors in parallel, you can use the following formula. This formula may also be used with two resistors in parallel. In fact, it can be used for any number of resistors.

$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + 1/R_4 + \dots$$

One thing should be kept in mind in parallel resistances: The total resistance is always less than the smallest resistance.

As branches are added to a parallel circuit, the voltage across each branch is the same. However, the current divides according to the resistance in the branch. The total current is equal to the sum of the individual currents. Inasmuch as current and resistance are inversely related, that means if the currents are added then the total or equivalent resistance of the parallel circuit decreases with the increase in current. In order to account for this decrease even though more resistance is added to the circuit, the mathematical answer lies in the reciprocal (1/R) formula. The reciprocal of the sum of the reciprocals of the individual resistors in the circuit produces the desired mathematical result and Ohm's law is satisfied when applied to the total circuit values and when used for individual values within the branch circuits.



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STUDENT WORKSHEET #11

Energy in Electrical Systems

Complete each question.

1. What is the function of an electrical capacitor?

2. The quantity of charge that builds up on either plate of a capacitor when the voltage is one volt is called __________ .

3. Electrical __________ (potential energy/kinetic energy) may be stored in a capacitor or an inductor. (Choose the correct answer.)

4. Capacitance can be calculated from the stored charge (q) and the voltage (V) across the capacitor plates. In equation form, capacitance is written as:

   a. $C = 1/2\, qV$
   b. $C = q/V$
   c. $C = 1/2\, qI^2$

5. Capacitance is measured in units called:

   a. ohms
   b. henries
   c. farads
   d. coulombs

6. The potential energy of the charge stored in a capacitor can be found from the following equation:

   a. $E_p = 1/2\, mr^2$
   b. $E_p = 1/2\, CV^2$
   c. $E_p = 1/2\, I\, \omega^2$
   d. $E_p = 1/2\, LI^2$

7. Find the charge (q) stored on the capacitor plates of a capacitor rated at 20 µF (20×10^{-6} F) where the voltage difference is 100 V.

8. In Problem 7, what's the potential energy (E_p) in joules that's stored in the capacitor? (Hint: 1 farad = 1 coulomb/1 volt; and 1 joule = 1 volt•coulomb.)

9. An inductor opposes changes in __________ (current/voltage). (Choose the correct answer.)

10. Inductance is measured in:

    a. ohms
    b. henries
    c. farads
    d. coulombs

11. The value of inductance __________ (increases/decreases) when an iron-core inductor is substituted for a similar air-core inductor. (Choose the correct answer.)

12. Inductance for a given coil depends on:

    a. material of the core.
    b. number of loops in the wire coil.
    c. length and area of the coil.
    d. all of the above.

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STUDENT WORKSHEET #11 — Key and Discussion Guide

Energy in Electrical Systems

1. A capacitor is a device that's used to store electrical energy. It's used in electrical circuits to oppose changes in voltage.
2. capacitance
3. potential energy
4. (b)
5. (c)
6. (b)
7. q = 0.0020 coul
   $C = q/V$
   $q = CV$
   $q = 20 \times 10^{-6} F \times 100\ V$
   $q = 20 \times 10^{-4}$ coul
8. 0.1 joule
   $E_p = 1/2\ CV^2$
   $E_p = 1/2\ (20 \times 10^{-6}\ F)(100\ V)^2$
   $E_p = (10 \times 10^{-6})(10^4)\ F \cdot V^2$ $1\ F = 1\ coul/1\ V$
   $E_p = 0.1\ coul/V \times V^2$
   $E_p = 0.1\ coul \cdot V$ $1\ J = 1\ coul \cdot V$
   $E_p = 0.1\ J$
9. current
10. henries
11. increases
12. (d)

How can potential energy be stored in electrical systems?

Electrical energy can be stored as potential energy in many ways. But almost all of these ways require that the energy be changed to another form.

When electrical energy is stored in a battery, it's changed into chemical energy. Later, when the battery is used, the chemical energy is changed back to electrical energy. Energy stored as water behind a dam can be changed into electrical energy. This happens when the falling water turns a turbine that runs a generator.

There are two common devices that store electrical energy as potential energy. They are a capacitor and an inductor. Capacitors and inductors are found in many electrical circuits.

What's a capacitor?

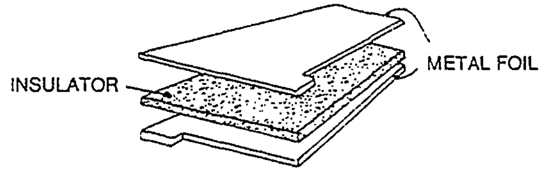
A capacitor is an electrical device that's used to store electrical energy. When placed in electrical circuits, capacitors oppose changes in voltage. (They aren't like resistors. Resistors, you recall, oppose current flow.) A capacitor opposes voltage change. When a capacitor is in a circuit, it smooths out voltage changes that may be occurring.

How is a capacitor made? How does it work?

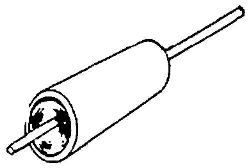
A capacitor usually has two large plates of conducting material separated by a layer of insulating material. (See Figures below)

The second of these figures shows a tubular capacitor. Here the plates are made of metal foil. The insulator is made of wax paper or plastic. Because the metal and insulation plates are flexible materials, the layers can be rolled up into a tube. This provides a small package with a large plate area. This type of capacitor is also called a "fixed capacitor."

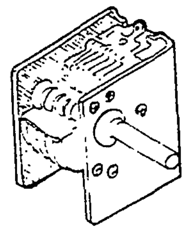
The third figure shows a "variable" capacitor. Here two sets of metal plates mesh. The more the plates mesh, the higher the capacitance. Controlling the amount of mesh varies the capacitance.



Capacitor plates

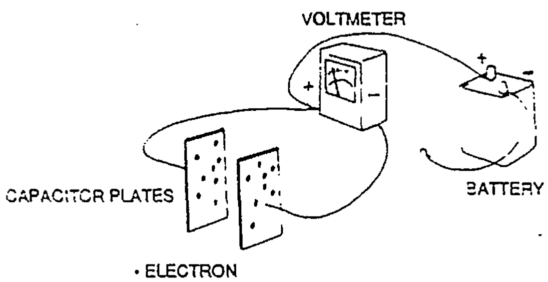


Fixed tubular

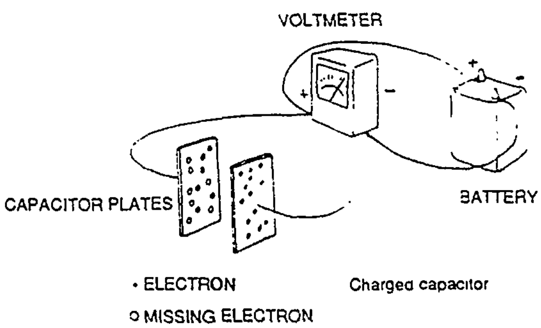


Variable capacitor

Work must be done to separate the positive and negative charges on the capacitor plates. This work is stored in the capacitor as potential energy. As the capacitor is charged by a battery or some other voltage source, the voltage difference between plates builds up. (See Figure below.) As the charge builds up, the voltage difference becomes greater.



Uncharged capacitor



Charged capacitor

What are the units for capacitance?

When there is a voltage difference across the capacitor plates, the ability to hold the charge that builds up on either plate is called "capacitance." Capacitance is said to be equal to one farad (F) when one volt is applied and moves a charge of one coulomb from one capacitor plate to the other.

The farad is a very large unit of capacitance. As a result, most capacitors found in electrical circuits have a small value of capacitance. Values for many capacitors are given in microfarads (written μF), or micro-microfarads (written μμF). The prefix micro (μ) means one-millionth. Therefore, a capacitance of 1μF is equal to one-millionth of a farad.

The formula for capacitance is written as follows:

$C = q/V$

where: C = capacitance in farads
q = charge in coulombs
V = voltage in volts

How much energy is stored in a capacitor?

Energy stored in a capacitor depends on its capacitance rating and how much voltage is used to "charge" the capacitor. The formula for electrical potential energy stored in a capacitor is given by:

$E_p = 1/2\ CV^2$

Where: E_p = stored energy in joules
C = capacitance in farads
V = voltage in volts used to charge capacitor

It's helpful to compare the energy s ored in a capacitor with the energy stored in a stretched spring. Recall that the potential energy stored in a spring is $E_p = 1/2\ kd^2$. Suppose a spring has a large spring constant (k), i.e., a stiff spring. The spring is stretched a large distance (d). The potential energy, $E_p = 1/2\ kd^2$, is large.

In the same way, suppose a capacitor has a large capacitance (C). A large voltage difference (V) is built up across the capacitor. In this case, the potential energy ($E_p = 1/2\ CV^2$) stored in the capacitor is large.

Electrical energy units are the same in both SI and the English system. Thus, capacitance always is measured in farads or fractions of a farad. In SI and the English system, voltages are measured in volts. Charge is measured in coulombs. Electrical energy is measured in joules. So in an equation like $E_p = 1/2\ CV^2$, there's only one set of units to use.

What's an inductor?

An inductor is an electrical device that's used in electrical circuits to oppose changes in current. It isn't like a resistor. A resistor opposes current. An inductor opposes a change in current. An inductor acts something like a huge flywheel. (Flywheels are sometimes used with motors to keep them running smoothly, at constant speed.) In a similar manner, an inductor in a circuit keeps the current flowing at a smooth, constant speed. It "irons out" the increases or decreases in current. Inductors are important in circuits where filtering is needed. In such instances, they're called "chokes" or "filter chokes" because they smooth out — or "filter" — current flow.

How does an inductor smooth out current changes? An inductor builds up voltage in itself to help overcome the circuit voltage that's causing the current to change. If the circuit voltage increases, the inductor develops a voltage in the opposite direction. This helps keep the current from increasing by maintaining a constant voltage across the inductor. If the circuit voltage decreases, the inductor adds voltage to the circuit. This helps keep the current from decreasing.

Energy is stored in an inductor when a current (I) increases from zero to some value as it flows through the coil. When the current in the circuit drops to zero, the energy stored in the inductor is released and used up.

Compare the buildup and release of energy in an inductor with the mechanical act of pushing a wagon or cart up a hill. Suppose you stop at some point along the hill. At this point, a certain amount of work has been done on the cart and stored as potential energy in the cart. As long as you hold the cart at that position, the energy remains stored in the cart. When you remove your hands, the cart rolls back down the hill. The cart uses its stored energy.

Energy stored in an inductor acts much the same way. The stored energy is released and used when the source that causes current to flow in the inductor is disconnected.

STUDENT WORKSHEET #12

Power in Electrical Systems

Computing an Electric Bill by Using Information From Kilowatt-hour Meter Readings

Kilowatt-hour meters measure electrical energy used. That is, they measure the kilowatts of power consumed times the time (hours) of consumption.

The most common meter has a dial register like the one shown in Figure 1. Each dial is driven by a gear that's meshed with a gear on the next dial. Each digit on the register has a value of 10 kilowatt-hours.

When the dial on the right moves clockwise one complete revolution (10 kilowatt-hours), the dial just to its left rotates counterclockwise one digit. The time it takes for the dials further to the left to move depends on the power used over a period of time. Small power uses — hence small movements — can be calculated by a method you'll learn in a future lab exercise.

Figure 1. Kilowatt-hour meter dials.

Electric companies usually offer five classifications of billing rates: residential, farm, commercial, industrial, and special. Kilowatt-hour meters are used to find the amount of energy, and therefore power, that's used in a given time.

For example, if you record the meter readings on the first day of two consecutive months, the difference between them is the kWh of electrical energy used during that month. Figure 2 shows a typical residential-rate electrical bill. Let's examine it.

Account Number 252 62 4915		Cv		Service Period 3/4 to 4/5	
Bill Demand	Master Reading Present	Past	kW used	Rate	Amt.
	30116	29116	1000	1	22.48
Fuel Adjustments: 1000 kWh =0.857					8.57
				4% State Tax	1.24
				Total	32.39

Figure 2. Sample electrical bill.

The meter register reading on March 4 was 29116 kWh. On April 5, it was 30116 kWh. That means 1000 kWh of electrical energy was used during those 32 days. The billing rate schedule for the 1000 kWh was as follows:

1st 650 kWh @ 2.3 cent kWh, so	650 kWh	x	2.3 cents	$14.95
Next 500 kWh @ 2.15 cents kWh, so	350 kWh	x	2.15 cents	7.53
Charge Subtotal	1000 kWh			$22.48
Base Charge (less than 100 kWh $4.00)				0.00
Fuel Adjustment: @ 0.857 cents/kWh	1000 kWh	x	0.857 cents	8.57
Tax @ 4%				1.24
Total Bill				$32.39

The base charge, as an equipment rental fee of $4/month, is applied only if less than 100 kWh is used. Fuel adjustment fees are justified on the basis of the 1970 Clean Air Act that requires utility companies to use high-grade fuel.

Solving Practical Power Problems That Appear in Electrical Energy Systems

Problem 1: Given: The same billing schedule as that in the discussion that follows Figure 2.

Find: The cost of electrical energy in each of the following cases.

a. 82 kWh residential
b. 648 kWh residential
c. 1150 kWh residential
d. Will the schedule work for 1200 kWh?

Solution:

Problem 2: Given: An electric motor does 500,000 joules of work by pumping liquid through a sprayer in 5 minutes.

Find: The power supplied to the motor if the motor is 100% efficient.

Solution:

Problem 3: Given: The conditions of Problem 2.

Find: The rate at which electric energy is used by the motor described, if the voltage source is 120 V AC.

Solution:

Problem 4: Given: An incandescent lamp has a current flow of 625 mA when connected to a 120-volt source.

Find: The power rating stamped on the bulb.

Solution:

Problem 5: Given: Any device that offers resistance to the flow of current changes some electrical energy. This is dissipated as heat energy and is called "power dissipation."

Find:

a. How much power is dissipated by a 5,000-ohm resistor that has 4 mA of current flowing through it?
b. How much power is dissipated by a 300-ohm resistor if the voltage drop across it is 10 V?

Solution:

2059

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STUDENT WORKSHEET #12 — Key and Discussion Guide

Power in Electrical Systems

Problem 1:

A.

82 kWh @ 2.3 cents/kWh	$1.89
Base charge (less than 100 kWh)	4.00
Fuel adjustment @ 0.857 cents/kWh	.70
Charge subtotal	$6.59
State sales tax @ 4%	.26
Total	$6.85

B.

648 kWh @ 2.3 cents/kWh	$14.90
Fuel adjustment @ 0.857 cents/kWh	5.55
Charge subtotal	$20.45
State sales tax @ 4%	.82
Total	$21.27

C.

650 kWh @ 2.3 cents/kWh	$14.95
500 kWh @ 2.15 cents/kWh	10.75
Fuel adjustment @ 0.857 cents/kWh	9.86
Charge subtotal	$35.56
State sales tax @ 4%	1.42
Total	$36.98

D. The rate schedule shown can be used for a maximum of 1150 kWh. Beyond 1150 kWh, a different rate schedule shown *could not* be used to accurately determine the charge for 1200 kWh of energy.

Problem 2: P = Work/Time

$P = 500{,}000\ J \div [5\ \cancel{min} \times (60\ sec/1\ \cancel{min})]$

$P = [500{,}000/(5 \times 60)](J/sec)$;

(1 J/sec = 1 watt)

P = 1666.67 watts

Problem 3: $P = \Delta V \times I$. Therefore, $I = P/\Delta V$

$I = P/\Delta V$

$I = 1666.67\ \cancel{V}{\bullet}A/120\ \cancel{V}$ (watt = V•A)

I = 13.89 A.

Problem 4: $P = \Delta V \times I$

P = 120 V x 0.625 A (625 mA = 0.625 A)

P = 75 watts (1 V•A = 1 watt)

Problem 5: a. $P = \Delta V \times I = I^2 \times R$

$P = I^2R$

$P = (0.004\ A)^2 \times 5000\Omega$ (4 mA = 0.004 A)

P = 0.08 watt. (5 kΩ = 5000Ω)

b. $P = \Delta V \times I = (\Delta V)^2/R$

$P = (\Delta V)^2/R$ where $\Delta V = 10V$; $R = 300\Omega$

$P = (10\ V)^2/300\Omega = 0.333\ V^2/\Omega$;

$(1\ V^2/\Omega = 1\ watt)$

P = 0.333 watt.

How is the consumption of electrical energy measured?

People tend to think of "the electric utility" as the "power" company. But what power companies actually sell us is energy. The cost of electricity is based on a unit of electrical energy called the kilowatt-hour (kWh).

One kilowatt-hour equals the amount of energy consumed by an electrical device that uses 1000 watts of power for one hour. As you know, a watt is the unit for electrical power. Notice that the kilowatt-hour is the unit of power (the watt) multiplied by time.

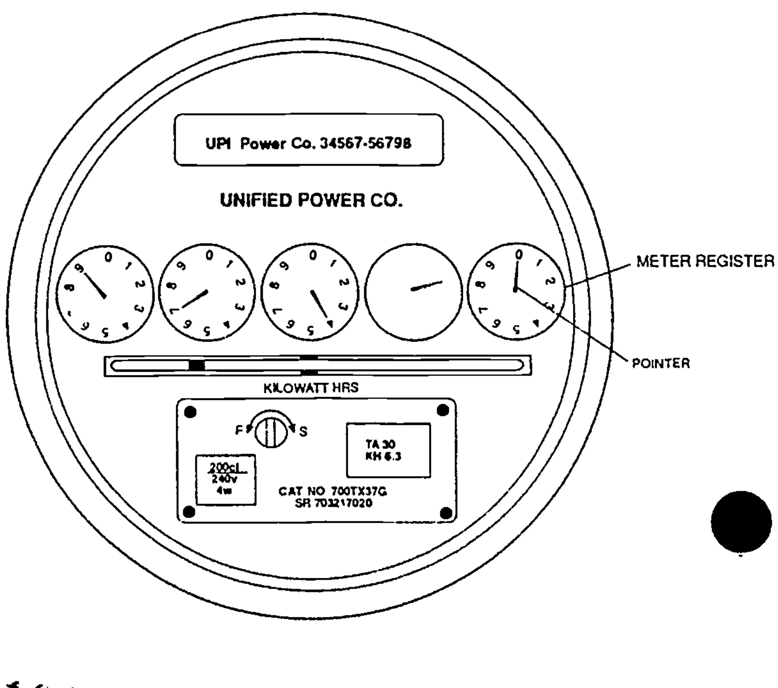
Since power is equal to work/time, you can think of the kilowatt-hour as:

Kilowatt-hour = Work/Time x Time

The time units cancel out. This leaves just "work." work and energy have the same units. Therefore, the kilowatt-hour unit is just another way of writing an energy unit.

The figure shows a common type of electrical "power" meter that measures energy used in kilowatt-hours. This meter is actually a little electric motor whose speed depends on the voltage and current in the circuit it's measuring.

As electrical power is used, the motor spins. As the motor spins, it turns a system of gears. The gears cause the "pointers" to rotate and point to the correct number on the meter registers. You'll learn how to read and use a kilowatt-hour meter in your lab work.



Technicians work with electrical power.

The concept of power is more widely used in the electrical system than in any other area of technology. Millions of today's electrical and electronics parts have a power rating specifying the maximum power that part can take before burning out. Therefore, every circuit is made so that each of its component works below its power rating.

One common problem in electrical circuitry is the overheating and burning out of a component that has been made to work above its power rating. So when technicians work with an electrical system, knowing about electrical power, power rating, and control of power is important.

Technicians must know how to find the power needed in electrical systems. One of the reasons for this is that electrical control systems are used for almost every control application. In fact, it's the ability of electrical power to control all other forms of power that makes most of our modern technology possible. A second reason technicians work with electrical power is that most of the tools used in manufacturing plants run on electrical power.

What are the unifying equations for power in electrical systems?

The table below sums up the physical quantities of force, work, rate and power in electrical systems. This table also shows the units used to measure each quantity. In some cases, more than one unit is shown. That's because the units are equal!

System	Force or Forcelike Quantity	Rate	Work	Power
Electrical	Voltage difference ΔV (volts)	Current $I = q/t$ (amperes)	$W = \Delta V \times q$ joules or n-m	$P = \Delta V \times q/t$ $P = \Delta V \times I$ (N-m/sec, J/sec or watts)

The unifying equations for power are:

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

$$\text{Power} = (\text{Force or Forcelike Quantity}) \times \text{Rate}$$

When applied to electrical systems, the unifying equations for electrical power become:

$$P = (\Delta V \times q)/t$$

$$P = \Delta V \times I$$

1061

Electrical Power Demonstration

Purpose:

To show that:
1. Electrical power depends on the amount of voltage and current used.
2. Kilowatt-hour meters can be read to determine consumption of electricity.

Materials:

1. Power supply
2. Lamp base with bulb
3. Switch, SPST
4. DMM or voltmeter
5. VOM or ammeter
6. Kilowatt-hour transparency
7. Variable resistor

Procedure:

1. Set up the demonstration equipment, as shown by the schematic in Figure 1.

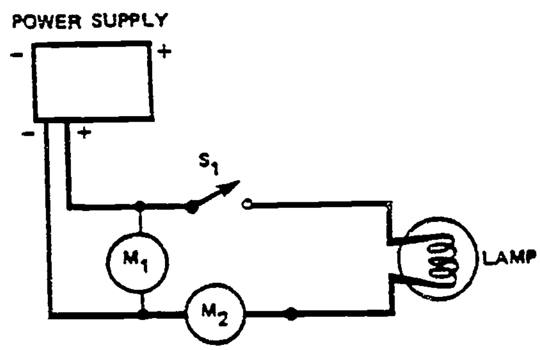


Figure 1. Demonstration setup.

2. Power is defined as the rate of doing work. If you wish to light the lamp, you must do electrical work by moving charge through the lamp filament. That's done by applying voltage across the lamp. The rate of charge movement is current. In electrical systems, power is equal to voltage (V) times current (I). Let's review work in electrical systems. Recall that:

   $W = (\Delta V) \times q$ Where: W = electrical work done
   ΔV = voltage across lamp
   q = charge (in coul) moved through lamp

   Notice that it takes both voltage, the forcelike quantity needed to move charge, and electrical charge moving to accomplish electrical work.

3. Turn the power supply ON. Set the voltage control so that meter M_1 indicates 3 volts. Point out that, with switch S_1 open, meter M_2 reads "0" — no current. This means that no charge is moving; therefore, power is being consumed.

4. Close switch S_1. Note the current reading and the bulb brightness.

5. Next, open switch S_1. Note the current reading and the bulb brightness. Based on these re idings and observations, ask students if increased voltage and increased current mean increased power? (They should answer that more power was delivered to the lamp because the voltage difference across the bulb was increased, and the bulb "burned brighter.")

6. Turn the power supply OFF. Insert a variable resistor in place of the SPST switch (S_1). The resulting schematic is shown in Figure 2.

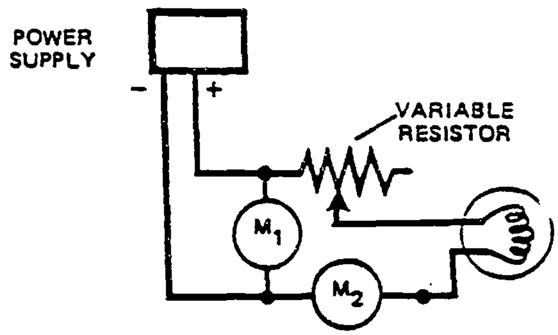


Figure 2. Schematic.

7. Adjust the variable resistor for maximum resistance. Then turn the power supply ON. Adjust the power supply for a meter reading on M_1 of 6 volts. Note the current reading on M_2. Ask students to comment on the brightness of the bulb. How bright is the bulb now compared to the two previous cases? Why is the bulb dimmer? (The bulb is dimmer because the variable resistor reduced the current flow through the bulb.)

8. Reduce the variable resistor setting. Note the bulb brightness and current flow. Ask your students to explain what's happening to the voltage, current, and power to the lamp. (The voltage didn't change, but the current flow increased. Therefore, the power also increased.)

9. Turn the power supply OFF.

10. From the demonstration above, students should see that holding voltage constant and decreasing resistance increases current flow and power used. Ohm's law ($R = V/I$) tells us how voltage, current, and resistance are related. The equation for electrical power, ($P = V \times I$), tells us how power depends on the amount of voltage and current used. Ask students the following questions. (These questions review what you've just shown your students and provide a lead-in to a discussion of "power" meters on houses.)

    a. Does a 60-watt light bulb use (more, less) power than a 40-watt light bulb? (more)
    b. Does a 60-watt light bulb require (more, less) current flow than a 40-watt light bulb? (more)
    c. Will two 40-watt light bulbs in a ceiling light fixture use (more, less) power and require (larger, smaller) overall current flow than a single, 60-watt light bulb? (more; larger)
    d. The answer to question (c) follows from the fact that houses are wired in (series, parallel). (parallel) Note: Remind students that, when adding resistors in parallel, the total resistance decreases, thereby causing an increase in total current and power used.
    e. Is the electrical power you use at your house free? (No, it isn't.)
    f. How does the power company determine how much to bill your family? (The bill is determined by the reading on the power meter.) Explain that what we call a "power meter" is really an "energy" meter, since it measures kilowatt-hours. Kilowatt-hours are energy units, not power units.
    g. Do you know how to read a "power" meter - properly called a "kilowatt-hour" meter?

11. Show a transparency of kilowatt-hour meter face. Point out features of the meter face. (See Figure 3.)

    a. The five dials, beginning on the right, are numbered clockwise, then counterclockwise, then clockwise, and so on. The dial furthermost to the right reads units of kWhs. The next one to the left read tens of kWhs, the next reads hundreds, and so on.
    b. The meter contains a disc that revolves. Lines are painted on the disc. These lines can be used to calculate the fraction of a revolution made by the disc. The "kh" number on the dial face tells how many watt-hours of electrical power are used for every revolution of the disc. Tell students that they'll use this number, and the number of disc revolutions, to measure how much energy is used by various electrical appliances.

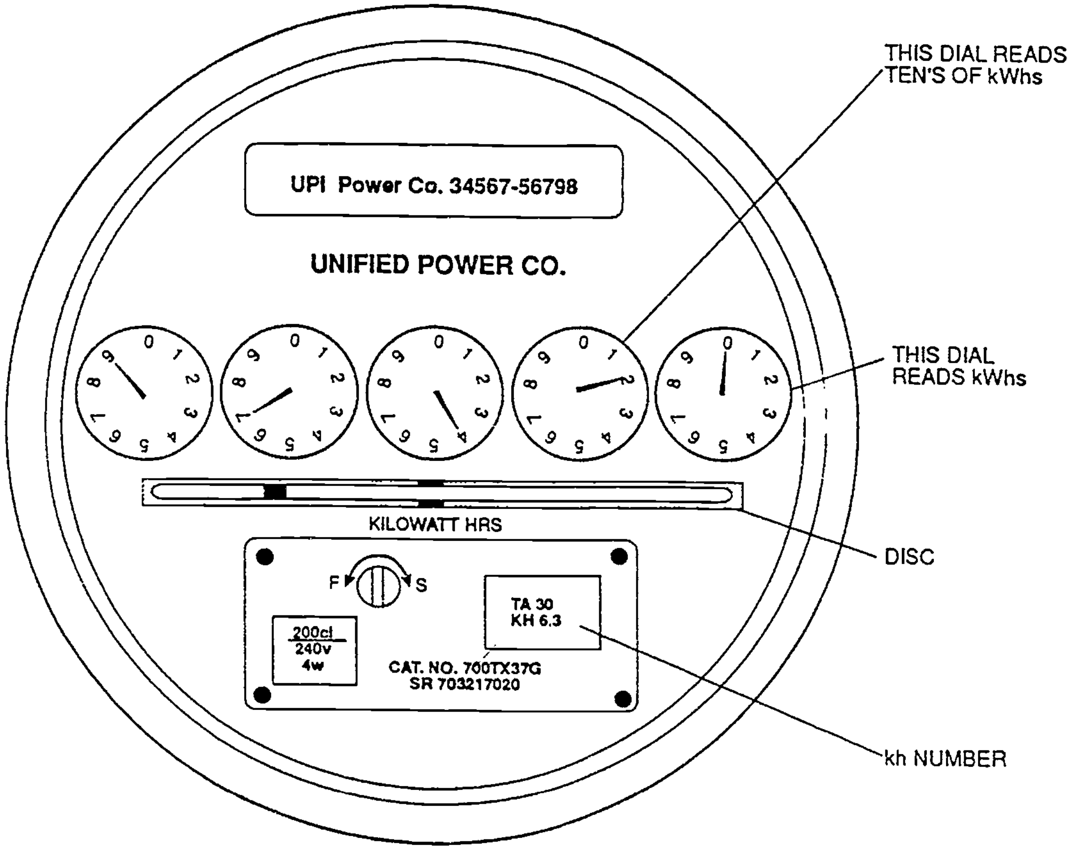
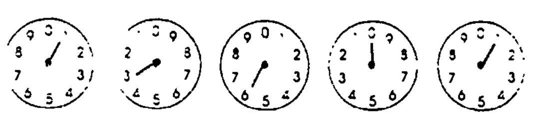
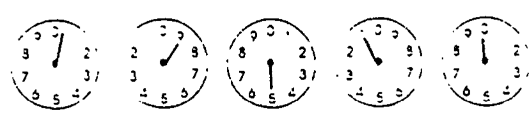


Figure 3. Kilowatt-hour meter face.

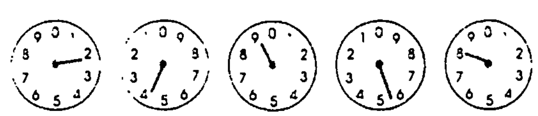
12. Mark the transparency according to the dial-face settings shown in reading A of Figure 4. Teach students how to read the dials in kilowatt-hours, going carefully from the dial on the right to the dials on the left.



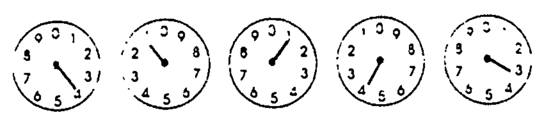
Reading A
(13,601 kWh of energy used)



Reading B
(09,510 kWh of energy used)



Reading C
(24,958 kWh of energy used)



Reading D
41,143 kWh of energy used)

Figure 4. Meter readings.

13. Erase the settings of the dial faces on the transparency. Replace with Reading B. Have students figure out the reading.

14. Repeat the previous step for Readings C and D.

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding and Using Pesticides

RELATED PROBLEM AREAS:

1. Identifying Basic Principles of Plant Science

2. Understanding Basic Soil Science Principles

3. Conserving Agricultural Resources

4. Understanding Plant Germination, Growth, and Development (Agricultural Business and Management Cluster)

5. Controlling Plant Pests (Agricultural Business and Management Cluster)

6. Understanding Plant Germination, Growth, and Development (Horticulture Cluster)

7. Understanding Plant Anatomy and Physiology (Horticulture Cluster)

8. Controlling Plant Pests (Horticulture Cluster)

9. Recognizing the Impact of Technology on Agriculture: Biotechnology

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty I: Assembling, Servicing, and Maintaining Equipment and Facilities

1. Clear and fumigate storage facilities
2. Disinfect pens, cages, and runs

Duty J: Applying Fertilizers and Chemicals

1. Evaluate chemicals applied to test plots
2. Dispose of chemicals and containers according to manufacturer's specifications
3. Map chemical applications
4. Compute chemical costs
5. Time fertilizer and chemical applications
6. Maintain chemical files

Duty L: Growing Corn, Soybeans, Small Grains, or Forage

1. Select pest control program
2. Spray crop for pest control

Duty O: Maintaining Animal Health

1. Disinfect building and equipment

Duty R: Applying Safety Practices

1. Comply with shop and equipment safety rules
2. Correct safety hazards

Horticulture Cluster

Duty A: Propagating Plants, Seeds, and Cuttings

1. Apply rooting hormone

Duty D: Applying Fertilizer and Chemicals

1. Calculate fertilizer and chemical application
2. Mix chemicals
3. Time chemical applications
4. Store chemicals
5. Transport chemicals
6. Map chemical applications
7. Select chemicals for specific problems
8. Maintain chemical inventory files

Duty L: Servicing and Maintaining Equipment and Facilities

1. Clean dusters
2. Clean sprayers
3. Clean and fumigate storage facility
4. Fumigate cold storage facility

Duty R: Applying Safety Practices

1. Comply with laws regarding notices of chemical application
2. Determine safe weather conditions for chemical application

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in the Biological and Physical Sciences and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

1CCG

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

Submission Date ____

☐ Original submission ☐ Revision Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the principles of scientific research and their applications in simple research projects.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Demonstrate the ability to draw conclusions from collected data.					
2. Describe methods and techniques that can be used in applying chemicals and pesticides in experimental settings.					
1067					1068

ISBE 41-70 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
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LEARNING ASSESSMENT PLAN

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Submission Date ____
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA (*check one*)
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the basic concepts and vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (*circle one*) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the interactions among populations of plants, herbivores, and carnivores.					
2. Define terms integral to understanding and using pesticides.					
1069					
					1070

ISBE 41-78 (1/88)

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LEARNING ASSESSMENT PLAN

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Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Recognize that significant technological changes often relate to significant social change.					
*2. Compare the economic interdependence among horticulture, business, government, labor, and consumer.					
3. Distinguish between the benefits and risks of pesticide use.					
4. Identify the major concerns associated with pesticide use.					
1071					1072

ISBE 41-78 (1/88)

Submission Date ____

☐ Original submission ☐ Revision

Page ____ of ____

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

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LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ____
Title: ____
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Identify situations in which moral and technical beliefs have affected the application of science.					
*2. Relate the biological increase of certain toxic substances in a food chain.					
3. Distinguish between the benefits and risks of pesticide use.					
4. Identify major concerns associated with pesticide use.					
5. Describe alternatives available to reduce pesticide use.					
1073					
					1074

ISBE 41-78 (1/88)

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LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY ______ DISTRICT ______ ESC ______

District Name

City

Submission Date ______

☐ Original submission ☐ Revision Page ____ of ____

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes, techniques, methods, equipment, and available technology of science.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze the results of an experiment.					
2. Apply principles of scientific research to simple experiments.					
1075					1076

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding and Using Pesticides

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define terms integral to understanding and using pesticides.
2. Distinguish between the benefits and risks of pesticide use.
3. Identify major concerns associated with pesticide use.
4. Identify and explain safe practices associated with pesticide use.
5. Describe alternatives available to reduce pesticide use.
6. Describe methods and techniques that can be used in applying chemicals and pesticides in experimental settings.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding and Using Pesticides

PROBLEMS AND QUESTIONS FOR STUDY	INSTRUCTOR'S NOTES AND REFERENCES

1. What are pesticides?
2. Why are pesticides used?
3. Which organisms are affected by pesticides?
4. How are organisms affected by pesticides?
5. What are some benefits of pesticides?
6. How is one at risk by using pesticides?
7. What are some environmental concerns of pesticide use?
8. How are pesticides packaged?
9. How should one dispose of the various container materials?
10. How long do pesticides last before breaking down?
11. What are the effects of pesticides that have not broken down?
12. What are the safety concerns of using pesticides?
13. What equipment is necessary to use pesticides safely?
14. How does one use pesticides safely?
15. What information about a pesticide does one need?
16. Where does one find information about a pesticide?
17. What are some alternatives to pesticide use?
18. What is integrated pest management?
19. What agencies control which pesticides can or can not be used?
20. How is a pesticide determined to be safe for one to use?

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding and Using Pesticides

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use other science personnel as resource persons for equipment, materials, and expertise on chemicals, environmental effects, and biological concerns.

2. Use Vocational Agriculture Service subject matter units, film strips, slide sets and transparency sets at appropriate times during instruction and as reference materials for students in completing study guides.

3. Obtain copies of Instructional Materials Service Unit #8415, *Agriculture Chemicals and the Environment*, and Unit #8416, *Proper Use of Agricultural Chemicals,* to use as student reference materials and study guides.

4. Obtain a computer program such as Agri-Quiz *Pest and Pest Control* for use as a student study aid and as an evaluation means.

5. Conduct field trips to commercial enterprises to observe the use of chemicals and pesticides and associated safety procedures and techniques.

6. Use community commercial enterprises as resources for guest speakers such as home pest control applicators, fertilizer and chemical applicators, or industry safety personnel to address the class on storage, mixing, application, cleanup, and container disposal.

7. Use Cooperative Extension Service publications and personnel as resources for class presentations on not only agricultural but also family resources and home economic issues related to chemicals in general and pesticides in particular.

8. Divide the class into groups to study opposite sides of issues such as:

   a. Animal use for testing chemicals.
   b. Alternatives available that can reduce pesticide use.
   c. Social and economic consequences of government regulation and banning of certain pesticides.
   d. Types and quality of foods available if a pesticide-free society is declared.

9. Conduct field trips to research facilities or field trials to observe efforts to reduce pesticide use such as integrated pest management.

10. Use Student Worksheet #1 as an in-class activity or as an assignment to conduct at home.

11. Have students make a list of chemicals contained in foodstuffs eaten during a specified length of time.

12. Use monthly agriculture publications and local and area newspapers for current topics related to pesticide and chemical use.

13. Have students contact government agencies for current information and publications on chemical and pesticide issues. Examples:

    a. Environmental Production Agency, Illinois
       A.G. Taylor, Agricultural Adviser
       2200 Churchill Road
       Springfield, IL 62706
       (217) 782-3960
    b. Hazardous Waste Research and Information Center
       David L. Thomas, Director
       1808 Woodfield Drive
       Savoy, IL 61874
       (217) 333-8940
    c. Illinois Fertilizer and Chemical Association
       Victor Thompson, Containment Regulations and Systems
       P.O. Box 357
       Springfield, IL 62705
       (217) 522-3734

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding and Using Pesticides

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES (Con't)

INSTRUCTOR'S NOTES AND REFERENCES

14. Use the following offices for specific related information to chemicals, pesticides, and integrated pest management:

    a. University of Illinois, Cooperative Extension Service, State Offices.
        1. Agricultural Engineering
           1304 West Pennsylvania Avenue
           Urbana, IL 61801
        2. Entomology
           172 Natural Resources Building
           607 East Peabody Drive
           Champaign, IL 61820
           (217) 333-6650 (51, 52, and 53)
        3. Agronomy
           Turner Hall
           1102 South Goodwin Avenue
           Urbana, IL 61801
           (217) 333-4424
        4. Horticulture
           Plant Sciences Lab
           1201 South Dorner Drive
           Urbana, IL 61801
        5. Plant Pathology
           Turner Hall
           1102 South Goodwin Avenue
           Urbana, IL 61801
           (217) 333-8414 or 333-7515

15. Obtain a copy of the film *Integrated Pest Management* for student viewing. Lead a discussion with students after viewing the film.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding and Using Pesticides

REFERENCES

*1. *Pesticide Use: A Benefit/Risk Analysis* (VAS Unit #U4080); *Reading Chemical Container Labels* (VAS Unit #U4081); *Using Farm Chemicals Safely* (VAS Unit #U4082); *Managing Environmental Impact of Pesticides* (VAS Unit #U4083); *Glossary of Pesticide Terms* (VAS Unit #U4085); *Handling & Using Pesticides Safely* (VAS Unit #U4045A); *Pesticide Use: A Benefit/ Risk Analysis* (VAS Filmstrip #F780); *Reading Chemical Container Labels* (VAS Filmstrip #F781); *Using Farm Chemicals Safely* (VAS Filmstrip #F782); *Managing Environmental Impact of Pesticides* (VAS Filmstrip #F783); *Pesticide Application: Equipment and Calibration* (VAS Filmstrip #F784); *Pesticide Use: A Benefit/Risk Analysis* (VAS Study Guide #G780); *Reading Chemical Container Labels* (VAS Study Guide #G781); *Using Farm Chemicals Safely* (VAS Study Guide #G782); *Managing Environmental Impact of Pesticides* (VAS Study Guide #G783); *Pesticide Application: Equipment and Calibration* (VAS Study Guide #G784); *How Herbicides Work* (VAS Transparency #T700). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*2. *Agricultural Chemicals and the Environment* (Subject Matter Unit #8415); *Proper Use of Agricultural Chemicals* (Subject Matter Unit #8416). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588.

*3. *Illinois Pest Control Handbook.* Cooperative Extension Service, University of Illinois, College of Agriculture, Publication Sales, 69 Mumford, 1301 West Gregory, Urbana, IL 61801. (217) 333-2007.

4. *Illinois Agronomy Handbook 1990-1991.* Circular #1290. Cooperative Extension Service, University of Illinois, College of Agriculture, Publication Sales, 69 Mumford, 1301 West Gregory, Urbana, IL 61801. (217) 333-2007.

5. *The National Conference on Agriscience and Emerging Occupations and Technologies — October 11-16 1988.* The National Council of Vocational and Technical Education in Agriculture.

6. *Agriscience Teacher Inservice Program.* Osborne, Edward W., Project Director, October 1988 - January 1989. Agricultural Education, University of Illinois, 124 Mumford Hall, 1301 West Gregory, Urbana, IL 61801. (217) 333-3166.

*7. *Integrated Pest Management.* Bureau of Audiovisual Instruction. For 16mm or videocassette: Department of Agricultural Journalism, University of Wisconsin, P.O. Box 2093, Madison, WI 53701. For VHS format: Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407. (800) 235-4146.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Integrated Pest Management

TRANSPARENCY MASTER #1 — Classification of Pesticides by Target Species (with dicussion guide)

TRANSPARENCY MASTER #2 — Routes of Pesticide Entry into the Body and Oral, Dermal, and Inhalation Toxicity Ratings of Pesticides (with discussion guide)

TRANSPARENCY MASTER #3 — Schematic View of Water Movement (with discussion guide)

TRANSPARENCY MASTER #4 — Accumulation of Pesticides in the Food Chain and Chemicals in Foods (with discussion guide)

TRANSPARENCY MASTER #5 — A Representative List of Mammalian Laboratory Animal Tests Conducted to Gain Pesticide Registration (with discussion guide)

TRANSPARENCY MASTER #6 — From Lab to Label — Introducing an Agricultural Pesticide (with discussion guide)

TRANSPARENCY MASTER #7 — Sample Pesticide Label (front) (with discussion guide)

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TRANSPARENCY MASTER #10 — Triple-Rinse Method (with discussion guide)

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INFORMATION SHEET #1

Terms to be Defined

Absorb — to take a pesticide or other material into a plant, animal, or the soil.

Acute poisoning — poisoning which occurs after a single exposure to a pesticide.

Agricultural commodity — any plant or plant part, animal or animal product produced by a person.

Antidote — treatment given by a medically trained person to reduce the effects of pesticide poisoning.

Application — process of directing or placing pesticides on or in plants, animals, buildings, soil, air, water, or other site.

Broad spectrum (nonselective) — pesticide which is toxic to a wide range of pests; used when several different pests are a problem. Short-term, residual, and broad spectrum are terms often used in describing insecticides and miticides.

Cannister — metal or plastic container filled with absorbent materials to filter fumes and vapors from the air.

Cartridge — cylinder-shaped part of the respirator which absorbs fumes and vapors from the air.

Certification — recognition by certifying agency that a person is competent and thus authorized to use or supervise the use of restricted use pesticides.

Chronic poisoning — poisoning which occurs as a result of repeated exposures to pesticides over a period of time.

Contact — to touch or be touched by.

Contact poison — pesticide that kills when it touches or is touched by the pest.

Contaminate — pollute or make unfit for use.

Dermal toxicity — how poisonous a pesticide is to man or animal when in contact with the skin.

Diluent — liquid, such as water, kerosene, or alcohol, or a nonliquid such as dust, which "waters down" or weakens a concentrated pesticide.

Dilute — to make a pesticide thinner or weaker by adding water, oil, or other material; to water down.

Disposal — act or process of correctly discarding pesticides and pesticide containers; can include recycling, deposit-return, reuse, or burning.

Dose, Dosage — portion or amount of pesticide mixture which is directed at the target.

Downwind — direction toward which the prevailing wind is blowing.

Drift — movement by wind and air currents of droplets or particles of a pesticide.

Encapsulation — method of disposal of pesticides and pesticide containers by sealing them in sturdy, waterproof, chemical-proof container which is then sealed in thick plastic, steel, or concrete to resist damage or breakage. The whole package is then usually buried in an area where water could not be contaminated even if leakage occurs.

Environment — surroundings, usually water, air, soil, plants, and animals.

EPA — United States Environmental Protection Agency.

Exposure — not protected or shielded; contact with pesticides through mouth, lungs, or skin.

Face shield — piece of protective equipment used by a pesticide applicator to protect face from exposure.

First aid — first effort to help a victim of poisoning while medical help is on the way.

Fume — unpleasant or irritating smoke, vapor, or gas.

Fumigant poison — pesticide which enters the pest in the form of a gas and kills it.

Hazard — risk of danger; chance that injury or harm will come to the applicator, other persons, plants, and animals.

Herbicide — agent that is used to control unwanted weeds.

Incinerator — special high-heat furnace or burner which reduces everything to nontoxic ash and gas.

ERIC

Inhalation — to take air into the lungs; to breath in.

Inhalation toxicity — how poisonous a pesticide is to man or animal when breathed in through the lungs.

LC_{50} — concentration of a pesticide in the air which would kill half of a large number of test animals exposed to it. The lower the LC number value, the more poisonous the pesticide. It is often used as the measure of acute inhalation toxicity. LC stands for lethal concentration.

LD_{50} — dose or amount of a pesticide which would kill half of a large number of test animals if eaten or absorbed through the skin. The lower the LD number value, the more poisonous the pesticide. LD number values are the commonly used measures of acute oral or acute dermal toxicity. LD stands for lethal dose.

Lethal — deadly.

Monitoring system — regular system of keeping track of and checking up on whether or not pesticides are escaping into the environment.

Neoprene — a kind of synthetic rubber.

Nonselective — pesticide which is toxic to all or more plants or animals of a type; usually used to describe a particular type of pesticide. For example, a nonselective herbicide would kill or injure all plants in the application site but not all insects, animals, or other organisms.

Oral — through the mouth.

Original container — package (bag, can, or bottle) in which a pesticide is sold. The package must have a label telling what the pesticide is, how to use it correctly and safely, and how to safely dispose of the empty container.

Pesticide — chemical or other substance that will destroy or control a pest or protect something from a pest.

Phytotoxicity — causing injury to plant life.

Pollute — to make unclean or unsafe.

Private applicator — a certified applicator who uses or supervises the use of any pesticide classified for restricted use for the purpose of producing any agricultural commodity on the property owned or rented by him or his employer or on the property of another person producing any agricultural commodity in exchange for personal services.

Reentry Interval — period of time between a pesticide application and when persons may reenter an area without wearing protective clothing and equipment.

Residual (persistent) — pesticide that remains in the environment for a fairly long time.

Respirator — face mask which filters out poisonous gases and particles. A respirator is used to protect the nose, mouth, and lungs from pesticide injury.

Selective — pesticide which is more toxic to some types of plants or animals than to others; usually used to describe a particular type of pesticide. For example, a selective herbicide would kill crabgrass in a corn field but not injure the corn.

Sensitive — easily injured.

Short-term (nonpersistent) — pesticide that breaks down almost immediately into nontoxic by-products.

Soil injection — method of disposal of pesticides by putting them within the plow layer of soil by usual tillage practices.

Stomach poison — pesticide which kills when swallowed.

Surface spray — pesticide spray which is evenly applied to the outside of the object to be protected.

Systemic — pesticide that is taken up by one part of a plant or animal and moved to another section where it acts against a pest.

Target — pest to be treated with a pesticide.

Tolerance — maximum amount of pesticide which can legally remain on or in any food or feed crop at harvest, or any animal at slaughter.

Vaporize — to form a gas and disappear into the air.

Definitions taken from *Principles of Pesticide Use, Handling, and Application Instructional Modules.*

INFORMATION SHEET #2

Integrated Pest Management

Integrated Pest Management (IPM) is a concept that uses a variety of control measures rather than depending on a single approach. IPM uses biological, cultural, chemical, and mechanical control methods in addition to scouting pests in order to identify and determine if the pest is present in sufficient quantities to justify a specific control. The aim of IPM is to reduce a pest to an acceptable level and maintain that level while keeping the remainder of the ecosystem present in balance.

IPM is flexible in that the effort can be directed towards either preventing, suppressing, or eradicating the pest of concern. When possible, planning may be the best approach by actually preventing a common pest from establishing itself. Specific seeds or varieties that are resistant to common pests can be used. Altering the planting or harvesting date when practical can minimize certain problems. Conservation practices that enhance natural enemies can be beneficial in keeping populations at an acceptable level. Pesticides may be used to prevent a common infestation from occurring or by stopping a known pest before it can increase to a level that competes with the crop.

Suppression of pests refers to reducing the population below that which does economic damage. Among the methods used could be release of natural predators, cultivation of weeds, and screens or netting in certain cases.

Eradication refers to the total elimination of a pest from a particular location. The most common sites where eradication is used are within buildings and confined areas. Eradication efforts in large areas in typically unsuccessful and expensive. Not only is the dollar cost high, but many species not specifically targeted are affected by the program. Large geographical areas that are threatened by exotic or introduced pests may call for large-scale measures.

Identification of the pest that is causing damage is a prerequisite to control. After the pest is positively identified, familiarity with that pest's life cycle, growth, and reproductive habits may indicate techniques of control not readily apparent. Control methods of consideration would be biological, cultural, chemical, and mechanical.

Biological control is one of the oldest methods and depends on the actions of predators, parasites, and pathogens to reduce the population. Although the reduction is not immediate it may be more economical and effective than chemicals. Among the traditional methods are conservation of predators and parasites, introduction of exotic species, and augmentation of pathogens, predators, and parasites. Biological controls also include resistant strains and varieties of seeds and plants. Advantages of biological control include economy, permanence (the effect is persistent, specific, and cumulative), and the overall safety.

Cultural activities are intended to make the environment less favorable for the survival and growth of the pest. A few cultural practices are crop rotation, adjusting planting and harvesting dates, choice of good quality seeds and varieties, and frequent cultivation. Additional cultural practices include leaving land idle (fallow) and water resource management. As with all IPM methods, any single practice rarely gives complete control.

Chemical pesticides have a primary role in IPM. The quality and quantity availability of many crops is heavily dependent on chemicals and without these controls insects and pathogens would simply devastate the crop. Because of the susceptibility problem, chemicals are used even though the dangers of pesticide chemicals to humans, animals, and the environment in general makes it the least desirable method of control to use. Chemical pesticides are effective (initially), easy to apply, fast acting, and reasonable in cost when compared to alternative measures.

Mechanical methods involve the use of machines and equipment to destroy or remove pests. Advantages include the use of available labor and equipment and no chemical residue. Mechanical methods include controlling the environment by raising or lowering temperatures, atmospheric manipulation, or conservation practices; and direct mechanical action such as discing, plowing, cultivating, mowing, shredding, rolling, and recently, vacuuming. Disadvantages include cost of labor and equipment (relative to chemicals) and those environmental concerns associated with tillage practices (sodbusting, soil erosion) and combustion engine pollutants and fossil energy use.

In the final analysis the application of integrated pest management by producers is dependent upon consumer acceptance of a quality of product different than that now present. Weeds, insects, and pathogens all have an effect on the quality of that product. Fruit may be somewhat misshapen and scarred, size and color may be changed, plants may not grow as vigorously causing yellowed leaves and smaller plant parts. While there may be agreement that everything needs to be done to protect ourselves and our environment, producers will be reluctant to offer for sale a product somewhat inferior to that available with current practices until the majority of consumers have shown that this is acceptable.

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TRANSPARENCY MASTER #1

Classification of Pesticides by Target Species

Pesticides	Target Species
acarcide	mites, ticks
algaecide	algae
attractant	insects, birds, other vertebrates
avicide	birds
bactericide	bacteria
defoliant	unwanted plant leaves
desiccant	unwanted plant tops
fungicide	fungi
growth regulator	insect, plant, and animal growth
herbicide	weeds
insecticide	insects
miticide	mites
molluscicide	snails, slugs
nematicide	nematodes
piscicide	fish
predacide	vertebrates
repellents	insects, birds, deer, rodents, other vertebrates
rodenticide	rodents
silvicide	trees and woody vegetation
slimicide	slime molds
sterilants	insects, vertebrates

Source: *The New Pesticide Users' Guide,* by Bert L. Bohmont, 1983.

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TRANSPARENCY MASTER #2

Routes of Pesticide Entry into the Body

Route	Exposure
Oral	Mouth and digestive system
Dermal	Skin
Inhalation	Nose and respiratory system
Eye	Eyes

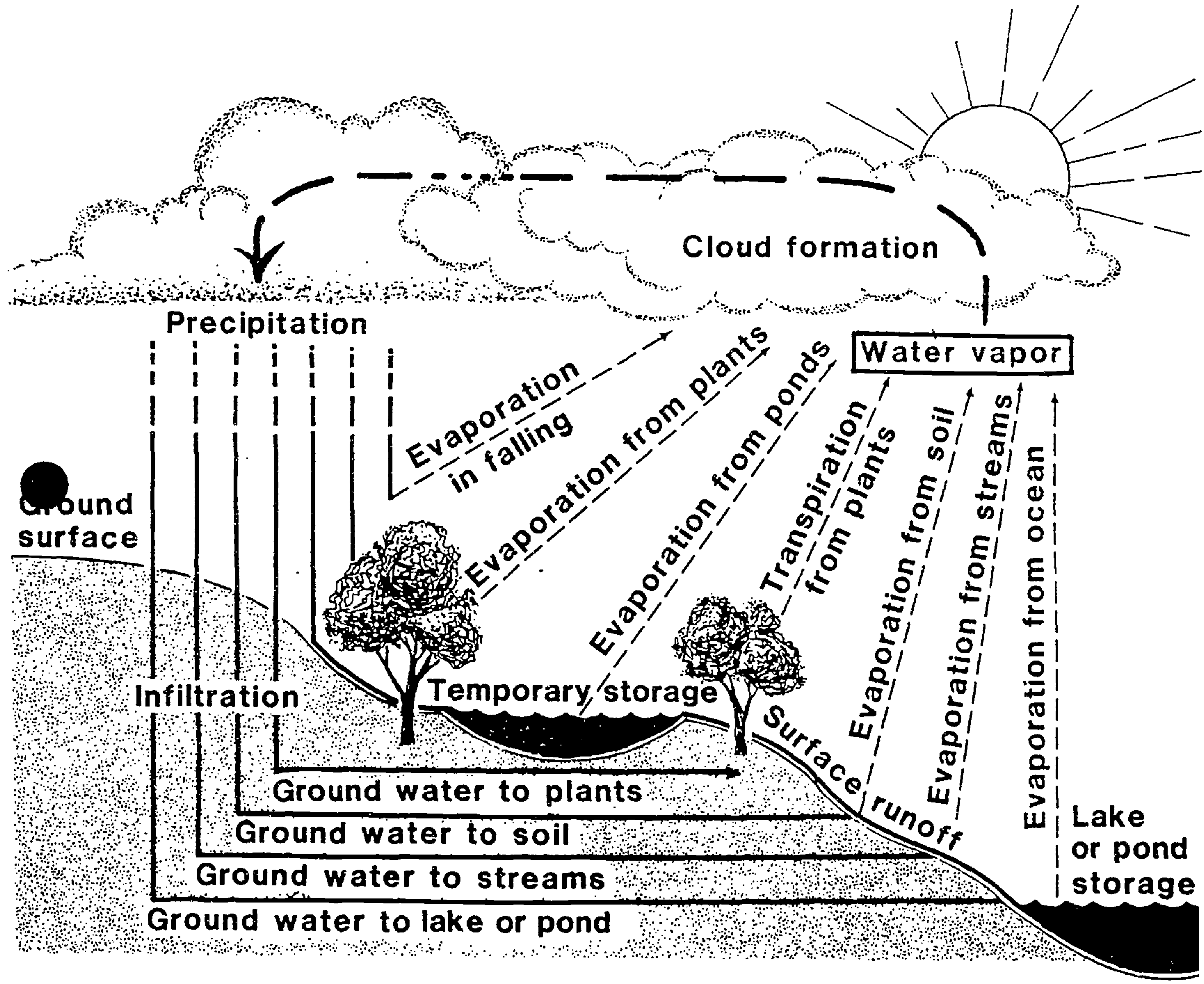
Oral, Dermal, and Inhalation Toxicity Ratings of Pesticides

Toxicity rating	Label signal words	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Inhalation LC_{50} (g/l or ppm)	Lethal oral dose, 150 lb man
high	Danger-Poison	0-50	0-200	0-2,000	few drops to 1 tsp
moderate	Warning	50-500	200-2,000	2,000-20,000	1 tsp to 1 oz (2 tbsp)
low	Caution	500-5,000	2,000-20,000	20,000+	1 oz to 1 pint+ or 2 lb
very low	Caution	5,000+	20,000+	....	1 pint+ or 2 lb+

Source: *Illinois Pesticide Applicator Study Guide (Rev)*, University of Illinois at Urbana-Champaign, College of Agriculture, Cooperative Extension Service in cooperation with the Illinois Natural History Survey.

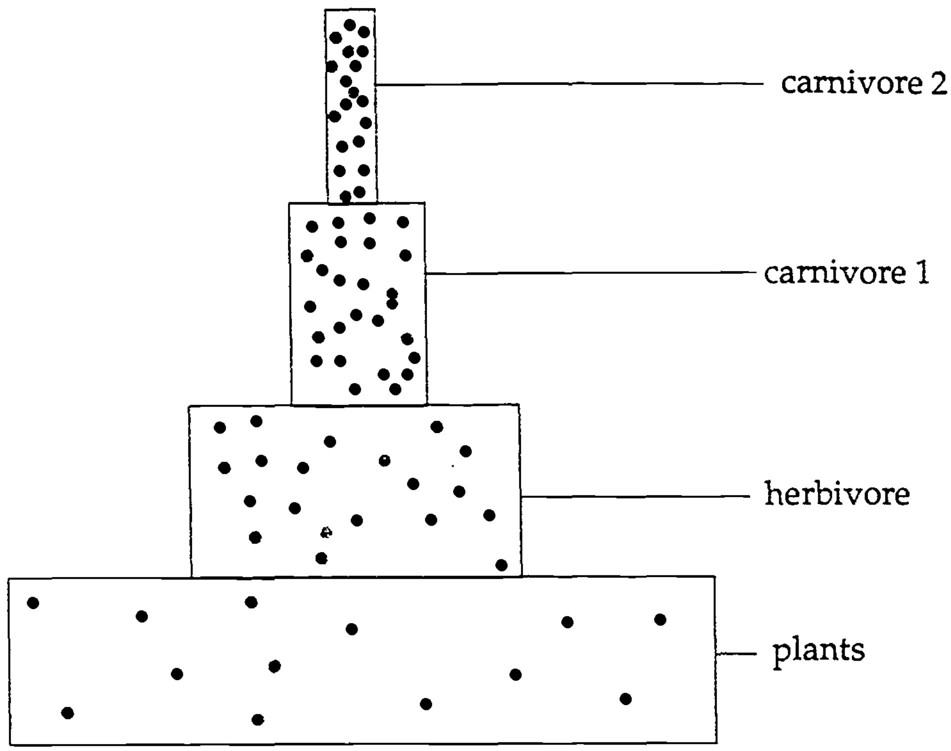
TRANSPARENCY MASTER #3

Schematic View of Water Movement



TRANSPARENCY MASTER #4

Accumulation of Pesticides in the Food Chain and Chemicals in Foods



Accumulation of pesticides in the food chain.

12 alcohols

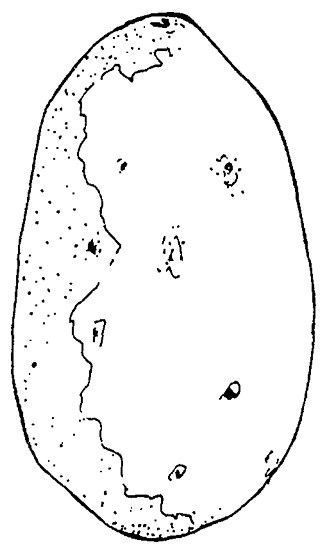
9 aldehydes

2 esters

14 hydrocarbons

4 ketones

109 other chemicals including arsenic



Chemicals in a Potato

TRANSPARENCY MASTER #5

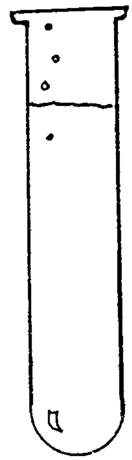
A Representative List of Mammalian Laboratory Animal Tests Conducted to Gain Pesticide Registration

1. Mammalian acute toxicity and irritation studies:
   a. Oral LD_{50} — rats
   b. Dermal LD_{50} — rabbits
   c. Eye irritation — rabbits
   d. Skin irritation — rabbits
2. Mammalian acute inhalation LC_{50} — rats
3. Dermal sensitization LC_{50} — guinea pigs
4. Subchronic feeding (90 days) — rats and dogs
5. Subchronic dermal toxicity (21 days) — rabbits
6. Chronic feeding (2 years) — rats
7. Oncogenicity (18 months) — mice
8. Teratology — rats and rabbits or mice
9. Multigeneration reproduction — rats
10. Feeding (1 year) — dogs

TRANSPARENCY MASTER #6

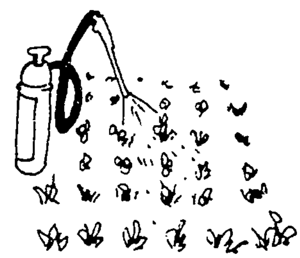
From Lab to Label — Introducing an Agricultural Pesticide

1 to 2 years (minimum)

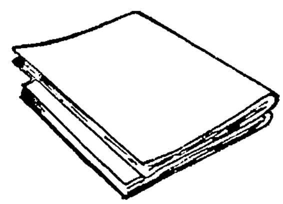


After the development of a potentially new pesticide, initial screening in the lab and greenhouse begins to insure that the chemical is a usable product. Toxicology testing begins on laboratory animals to detect possible short-term human health or environmental problems. Toxicology tests include mortality studies of oral (ingestion) and dermal (skin) exposure. Results of short-term mortality studies are used to assign LD_{50} or LC_{50} values. As studies are in progress, company efforts also turn to patent review and market research to determine if the product will be marketable. This phase takes at least 1 to 2 years.

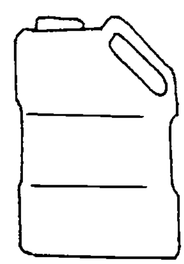
5 to 6 years



If no unreasonable risks are encountered in the initial screening, the potential pesticide undergoes further toxicological studies on both the product and its active ingredient. The toxicology tests are expanded to determine long-term effects of the pesticide on human and animal health and the environment. Environmental studies are expanded and more sophisticated testing is done to evaluate the product's pest-control abilities. The chemical company requests and obtains from the EPA an Experimental Use Permit to conduct field testing. Information on product performance, application methods, residue, and exposure is provided by the field research. This phase takes 5 to 6 years.



1 to 2 years



In the final phase of the registration process, the chemical company submits to the EPA a proposed label and a detailed report of the extensive studies completed on a product. This is referred to as a registration application package. If the product data passes EPA review, the final label is written to show appropriate warnings. After formal tolerance levels are established, full registration is announced. This phase take 1 to 2 years.

TRANSPARENCY MASTER #7

Sample Pesticide Label (front)

Use Classification

Trade (brand) Name

Formulation

Common name

Ingredients (chemical name)

Net Contents of Container

Warning Sign: Stop (read the label)

Child Hazard Warning

Signal Words:
- Danger-Poison (high toxicity)
- Warning (moderate toxicity)
- Caution (low toxicity)
- Caution (slight toxicity)

Precautionary Statements:
- Practical Treatment (first aid)
- Human and Animal Hazards
- Environmental Hazards (toxicity to fish, birds, and bees)
- Physical or Chemical Hazards (flammable)

Establishment Number

EPA Registration Number

Name and Address of Manufacturer

RESTRICTED USE PESTICIDE

For retail sale to and use by certified applicators or persons under their direct supervision and for those areas covered by the certified applicators certification.

TRIPERSAN 1.5 EC

Tripel Insecticide

Active ingredients:
Dimethyl zillate 0,0 dimethyl 2 (N-methyl ethyl propil, carbomyl) carbozillate 22.8%
Inert ingredients 77.2%
100.0%

Contains 1.5 pounds tripel per gallon

Net Contents 5 Gallons Liquid

READ STOP THE LABEL

KEEP OUT OF REACH OF CHILDREN

DANGER - POISON

PRECAUTIONARY STATEMENTS

Practical treatment: If swallowed - induce vomiting by giving a tablespoon of salt in a glass of warm water. Repeat until vomitus is clear. Call a physician immediately. If inhaled - remove to fresh air. Call a physician immediately. If in eyes - flush with plenty of water for 15 minutes. Call a physician immediately. If on the skin - remove contaminated clothing immediately, wash skin with soap and water.

Human and animal hazards: Poisonous by swallowing or inhalation. Wear a mask or respirator of a type passed by the U.S. Bureau of Mines for Tripersan protection. NOTE TO PHYSICIAN: Upon repeated use, Tripersan may cause cholinesterase inhibition. Atropine is antidotal. If in eye, instill one drop of homatrophine.

Environmental hazards: Tripersan is toxic to fish, birds, and other wildlife. Birds feeding on treated areas may die. Keep out of any body of water. Do not apply when weather favors drift. Do not contaminate water by cleaning equipment or disposing of wastes. Tripersan is toxic to bees, and should not be applied when bees are actively visiting the area.

Physical or chemical hazards: Flammable! Keep away from heat or open flame.

ESTABLISHMENT NO. 15359
EPA REG. NO. 832 - 7476 - AA

MFG BY HILLSIDE CHEMICAL COMPANY
Cincinnati, Ohio

TRANSPARENCY MASTER #8

Sample Pesticide Label (rear)

Directions for use

Reentry statement

Storage and Disposal directions

Directions for application

Restrictions on use

Pests controlled
Crop treated
Recommended amount to use
Frequency and time of application

Limitations

DIRECTION FOR USE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS RESTRICTED USE PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING

DO NO ENTER AREA

WITHIN 2 DAYS AFTER APPLICATION

Storage: Store in original container. Do not store near food or other articles intended for consumption by humans or animals. Do not store next to other pesticides in a closed room.

Disposal: Puncture, triple-rinse, and destroy empty container. Bury in a safe place. Never reuse.

or

Contact state or regional federal authority for local instructions on disposal.

This product intended for use by commercial grower or applicator in conventional hydraulic sprayers, ground applicators, or airplane sprayers.

Ground application: Use recommended amount in sufficient water for thorough coverage.

Air application: Use recommended amount in 2 to 10 gallons of water, unless otherwise specified.

Not for use in or around the home.

For use on Corn and Soybeans.

Corn: Corn rootworms - Use 1• to 2 pints per acre. Apply at planting in a 7 inch band over the row. **Soy beans:** Aphids, mites, and thrips - Use • to 1 pint per acre. Apply after soy beans are 6 inches high. Do not apply within 14 days of harvest.

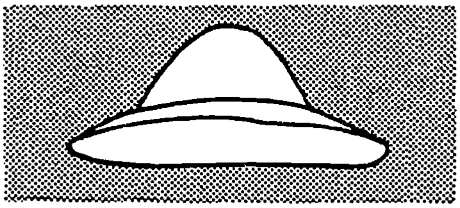
NOTICE OF LIMITATIONS

Hillside warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. Hillside makes no warranties of merchantability or fitness for a particular purpose nor any other express or implied warranty as stated above.

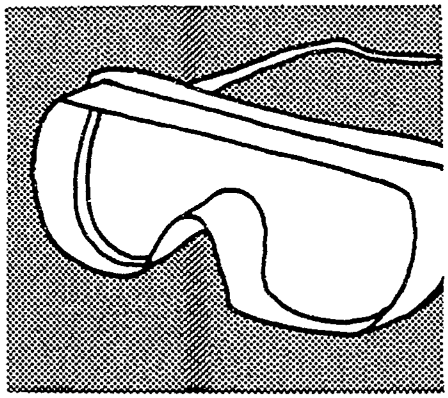
Hillside will not be responsible for losses or damages resulting from use of this product in any manner not specifically recommended by Hillside. User assumes all risks associated with such nonrecommended use.

TRANSPARENCY MASTER #9

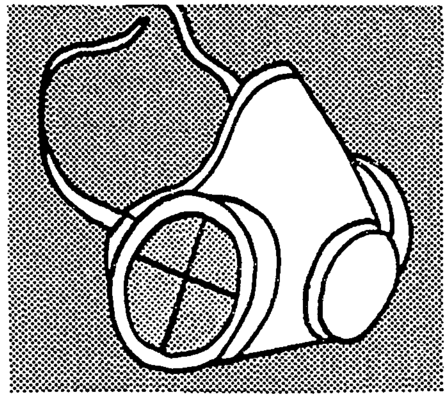
Recommended Protective Clothing and Equipment



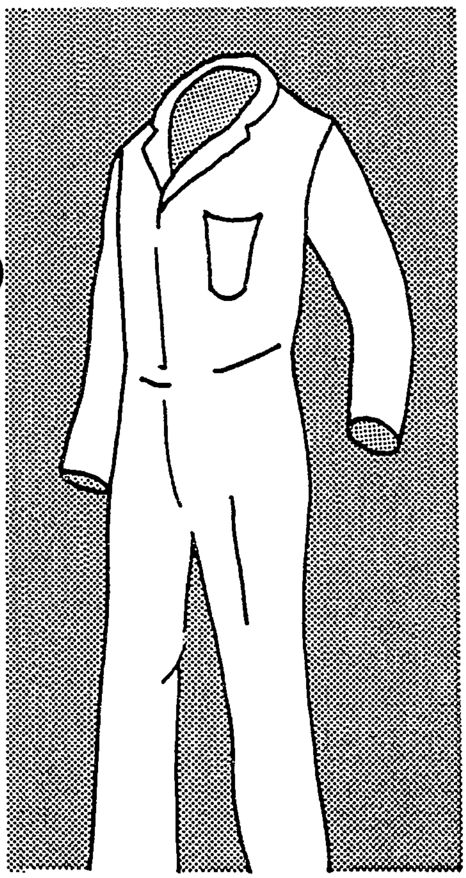
Waterproof Hat



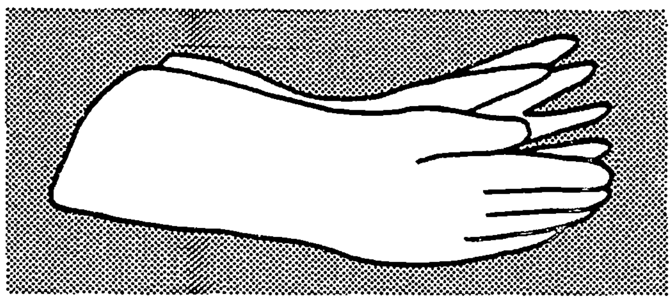
Goggles



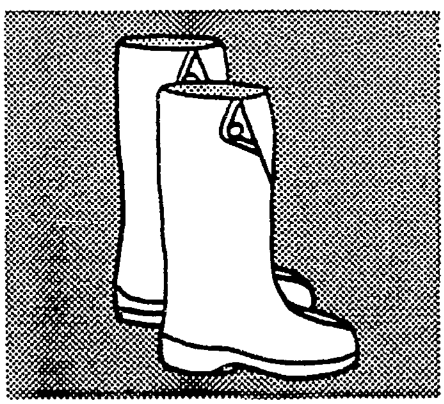
Respirator



Closely Woven Fabric Coveralls



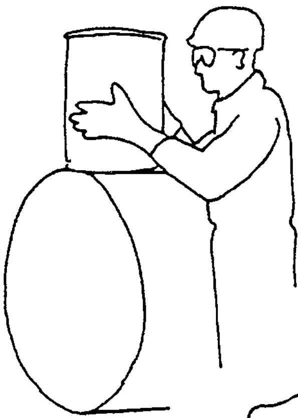
Long Rubber or Neoprene Gloves



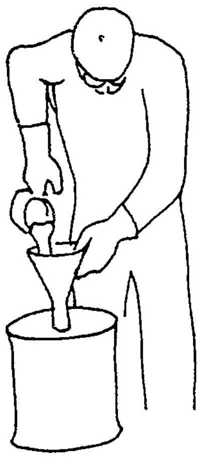
Rubber or Neoprene Boots

TRANSPARENCY MASTER #10

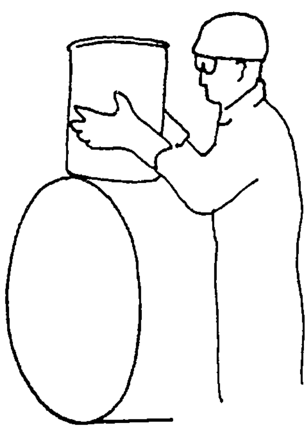
Triple - Rinse Method



Empty container into spray tank. Then drain in vertical position for 30 seconds.



Add a measured amount of rinse water (or other diluent) so container is ¼ to 1/5 full. For example, one quart in a one gallon container.



Rinse container thoroughly, pour into tank, and drain for 30 seconds. Repeat two more times. Puncture container before final drain.

Crush pesticide container immediately. Sell as scrap for recycling or bury. Do not reuse.

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #1

Discuss when and under what circumstances a target species may be a pest and when that species may be beneficial.

Transparency Master #2

1. Discuss the methods of entry of pesticides into the body. Ask the class for examples.

2. Discuss the toxicity ratings of pesticides and why different amounts are lethal according to method of entry and rating.

3. Point out how the same chemical may be used in different concentrations and have different toxicities and target species.

Transparency Master #3

Using the schematic for water, discuss these factors along with others such as wind drift, soil texture, soil permeability, soil organic matter, wildlife, weather conditions and beneficial organisms that may be affected by pesticide use.

Transparency Master #4

1. Lead the class in a discussion on how concentrations may increase as one moves up the food chain. Ask the class for examples.

2. Use the potatoes as an example of how chemicals are present in everyday life. Ask for other examples such as caffeine and common food preservatives.

Transparency Master #5

1. Lead the class in a discussion of why various animals are used for testing of chemicals used everyday. Ask the class for alternatives that could be used.

2. Lead the class in a discussion on the necessity of using animals to test products, such as cosmetics, which may be short-lived in their usefulness.

Transparency Master #6

Lead the class in a discussion of the development phases of pesticides. Point out the cost involved and how that cost is recovered.

Transparency Masters #7 - #8

Lead the class in a discussion of what information is available on pesticide labels and how that information should be used.

Transparency Master #9

1. Lead the class in a discussion of clothing that should be worn when using pesticides.

2. Ask students for examples of chemical use that caused problems and what might have prevented the problems.

Transparency Master #10

1. Lead the class in a discussion of disposal methods including a comparison of burnable and non-burnable containers, and reasons why recycling may be the best method of disposal.

2. Discuss why containers should be triple-rinsed.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Pesticides and Their Use

STUDENT WORKSHEET #2 — Rooting Hormone

STUDENT WORKSHEET #3 — Plants and Gibberellic Acid

STUDENT WORKSHEET #4 — Effect of Herbicides on Plant Growth

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Pesticides and Their Use

Brand Name	Generic Name	Intended Use	Active Ingredient	Inert Ingredient	Signal Word

Select 1 label and list at least 10 diseases that it will control. Fill out the following chart.

Common Disease Name	Affected Host	Class of Organism

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STUDENT WORKSHEET #1 — Key

Pesticides and Their Use

Supply students with five or more chemical labels (preferably on the containers as they are puchased.) Have each student complete the following chart using the provided chemicals, or assign this activity to be done at their home on pesticides found.

Brand Name	Generic Name	Intended Use	Active Ingredient	Inert Ingredient	Signal Word
Example: Ortho Bug-Geta	*Snail & Bug Pellets*	*Kills Snails & Slugs*	*3.25% Metaldehyde*	*96.75%*	*Caution*

Select 1 label and list at least 10 diseases that it will control. Fill out the following chart.

Common Disease Name	Affected Host	Class of Organism
Example: Using Kocide 101 label (an agricultural fungicide)		
Leaf Spots	*Alfalfa*	*Fungus*
Blossom Brown Rot	*Almonds*	*Fungus*
Shot Hole (Coryneum Blight)	*Apricot*	*Fungus*
Scab	*Avacado*	*Fungus*
Bacterial Blight	*Beans*	*Bacteria*
Early Blight	*Tomatoes*	*Fungus*
Downy Mildew	*Broccoli*	*Fungus*
Carrot Blight	*Carrots*	*Fungus*
Walnut Blight	*Walnut*	*Bacteria*
Powdery Mildew	*Grapes*	*Fungus*

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STUDENT WORKSHEET #2

Rooting Hormone

Purpose:

1. To demonstrate the effectiveness of rooting compounds in speeding up the time it takes for terminal cuttings to develop roots.

2. To appreciate the value of rooting compounds to a Nursery operation.

Materials:

1. One flat
2. Vermiculite
3. 30 terminal cutting of chrysanthemums, philodendrons, geraniums, or carnations
4. Different concentrations of a rooting compound (Hormodin 1, 2, or 3 or Cutstart X, XX, or XXX)

Procedure:

1. Thoroughly water the media 24 hours prior to the time the cuttings are to be stuck.

2. Ask your instructor to demonstrate the procedure for making terminal cuttings on one of the following plants: chrysanthemums, philodendrons, geraniums, or carnations.

3. If Hormodin is being used, place concentrations of H_1, H_2, and H_3 powders on separate pieces of paper.

4. Select one of the above plants. Make 10 cuttings. Dip the bases of the cuttings in the H_1 powder. Tap the excess powder off the cuttings as too much powder may retard root formation.

5. Stick the 10 cuttings in vermiculite mix.

6. Repeat the above procedures using H_2 and H_3 powder. You should end up with 10 cuttings of three different Homodin concentrations.

7. If the cuttings are not under a mist, syringe at least once per hour for two days to give the plants a good start.

8. Label each of the cuttings. Include date, name of cutting, and Hormodin concentration.

   NOTE: Have your teacher check to see that you have correctly labeled each set of cuttings.

9. During the second to the fourteenth day, watering methods will vary with weather conditions. During the summer the cuttings should be watered-in well and them misted periodically for several days after planting. This reduces wilting and allows the cuttings to start in growth more rapidly. When planted during the winter the cuttings should be spot-watered, definitely leaving a dry area between plants. This allows the soil to dry more rapidly and root growth will be faster.

Observations:

1. Check for rate of rooting at the end of the first 10 days by carefully removing one or two of the plants from the media. Calloused tissue and a small number of primary roots should have formed.

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2. List the Hormodin concentration that influenced the best root formation.

10-day Hormodin Concentration

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________

3. Check again for the rate of rooting at the end of 14 days. Again list the Hormodin concentration that influenced the best root formation.

14-day Hormodin Concentration

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________

4. At the end of 14 days or at the time most cuttings have completely rooted, remove the cutting and pot up. Record the percent of cuttings that rooted in each Hormodin concentration.

Hormodin Concentration	Percent Cuttings			
	Plant W	Plant X	Plant Y	Plant Z
H_1	____ %	____ %	____ %	____ %
H_2	____ %	____ %	____ %	____ %
H_3	____ %	____ %	____ %	____ %

Discussion:

1. What are the advantages of using rooting compounds in a large-scale plant nursery?
2. Is it important to know where to make a cut in making a cutting?
3. Which method is more effective, powder or liquid spray?
4. Which concentration of rooting compound gave the best results?
5. How did the cuttings treated with a rooting compound compare to the control cuttings?

STUDENT WORKSHEET #3

Plants and Gibberellic Acid

Purpose:

1. To explain the responses of plants to the application of different concentrations of gibberellic acid.
2. To describe the experiment on the effect of gibberellic acid on shoot elongation.

Materials:

1. Concentrations of 5, 10, 100, and 1,000 parts per million of gibberellic acid to use on coleus, chrysanthemums, or geraniums; ten of one kind of the above plants.

2. Concentrations of 0.15%, 0.25%, and 0.5% of B-Nine to use on coleus, chrysanthemums, petunias, poinsettas, or lillies; eight of one kind of the above plants.

Procedure:

1. Buy or mix concentrations of 5, 10, 100, and 1,000 parts per million of gibberellic acid. Tap water may be used to mix concentrations.

2. Select 10 coleus plants. (Chrysanthemums or geraniums may be used as substitutes.)

3. Spray each concentration of gibberellic acid on the crown of the root of the two plants. Do not spray the two remaining plants. They will be maintained as control plants. Keep the control plants out of the area when spraying.

4. Label each pot. Include date of spraying and concentration of gibberellic acid used.

   NOTE: Show your teacher that you have clearly and correctly labeled each pot.

5. Observe at the end of 14 to 20 days to see the extent of elongation of the internodes.

6. Compare the life of buds on the plants.

7. Repeat the above procedures with concentrations of 0.15%, 0.25%, and 0.5% of B-Nine. Also have two control plants. Plants that can be used include coleus, chrysanthemums, petunias, poinsettas, or lillies. Spray on the foliage of plants to the point of runoff.

8. Check the degree of suppression that occurs with different concentrations of B-Nine.

Discussion:

1. Which concentration of gibberellic acid gave the greatest elongation of the internodes? The least?

2. Did the different concentrations of gibberellic acid affect the life of buds on the plants? If so, how?

3. What concentration of B-Nine gave the greatest suppression of plant height? The least?

STUDENT WORKSHEET #4

Effect of Herbicides on Plant Growth

Purpose:

1. To explain the responses of broad-leaved plants to the application of selective weed killers.
2. To discuss the effects of synthetic auxin such as IAA that are present in some herbicides like 2,4-D.

Materials:

1. Selective weed killers such as 2,4-D, MCPA, Silvex, or 2,4,5-T
2. 4 glass rods
3. 4 flower pots
4. 4 broad-leaved plants such as a potted geranium or begonia plant
5. Soil
6. Rubber gloves
7. Safety goggles
8. Respirator

Procedure:

1. Secure four broad-leaved plants and set in pots.
2. Pack plants firm in soil.
3. Water plants as often as needed in order to keep the soil moistened.
4. Allow the plants to establish roots.
5. After the plants have established good root attachment, select an available weed killer from a garden or feed store.

   NOTE: Have your teacher help you with step #6.

6. With a glass rod, apply a drop of the selective weed killer to one side of the stem of the broad-leaved plant.
7. Try different concentrations of the chemical on three other broad-leaved plants.
8. Apply two drops of the selective weed killer to the second pot, three drops to the third pot, and four drops to the fourth pot.

Observations:

Within a few hours the cells on the treated side of the stem will cause the stem to bend in different directions.

Discussion:

1. Why did the cells on the treated side of the stem bend in different directions?
2. Why was an overgrowth of the plants induced by the chemicals?
3. What were the effects of different concentrations of the same chemical on different broad-leaved plants?

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STUDENT WORKSHEETS #2, 3, and 4 — Key

The activities enclosed do not all pertain only to pesticides specifically, but to the larger question of chemical use in agriculture. The activities can be used to represent the use of chemicals to affect plant growth and how those chemicals cause those changes. In addition, the point can be made that chemicals are useful and even necessary to maintain the quality of products we have come to expect. Again, the issue of chemical effects on beneficial species and unintended targets may be addressed.

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Agricultural Mechanics Principles

RELATED PROBLEM AREAS:

1. Identifying and Using Agricultural Tools and Equipment
2. Identifying Basic Principles of Electricity
3. Welding and Metalworking (Agricultural Business and Management Cluster)
4. Designing, Building, and Maintaining Agricultural Structures (Agricultural Business and Management Cluster)
5. Repairing and Maintaining Agricultural Equipment (Agricultural Business and Management Cluster)
6. Understanding and Maintaining Small Engines (Agricultural Business and Management Cluster)
7. Identifying Career Opportunities in Agricultural Engineering/Mechanization (Agricultural Business and Management Cluster)
8. Recognizing the Impact of Technology on Agriculture: Electronics

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D..
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ____ DISTRICT ____ ESC ____
District Name
City

I. LEARNING AREA (*check one*)
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (*circle one*) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understanding the principles and implications of friction.					
2. Describe physical and mechanical principles, concepts, and laws applied in the agricultural mechanics areas					
1107					1108

ISBE 41-78 (1/88)

Submission Date ______

☐ Original submission ☐ Revision

Page ____ of ____

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Evaluate the economic, political, and social implications of scientific and technological developments.					
2. Recognize that technological advances will affect the means available for use in agricultural mechanics.					
1109					
					1110

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Agricultural Mechanics Principles

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Identify the five basic areas of agricultural mechanization.
2. Describe various skills used in each of the basic areas of agricultural mechanization.
3. Describe basic physical concepts and laws applied in the agricultural mechanics areas.
4. Recognize that technological advances will affect the means available for use in agricultural mechanics.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Agricultural Mechanics Principles

PROBLEMS AND QUESTIONS FOR STUDY

1. What is agricultural mechanics?
2. How important is agricultural mechanics?
3. What are the areas of agricultural mechanics?
4. What skills are used in each of the basic areas of agricultural mechanics?
5. What are physical principles?
6. Why are physical principles important?
7. How are physical principles applied in agriculture?
8. What technology is now used in agriculture?
9. How will new technology be used in agriculture?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Agricultural Mechanics Principles

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use other science personnel as resource persons for ideas, techniques, equipment, and materials.

2. Conduct the demonstrations (Student Worksheets #8 - #18) and activities (Student Worksheets #3 - #7) at appropriate times during relevant subject matter units.

3. Use the demonstrations and activities as resources on which to expand to suit the needs of students and classes.

4. Conduct field trips to production facilities, agricultural industries, and local agricultural businesses where everyday application of the identified principles, concepts, and laws can be seen.

5. Use the identified areas of agricultural mechanics as a starting point and lead students in a discussion of career opportunities available in this area.

6. Lead students in a discussion of technology used in agricultural mechanics today that was not available 5 years ago.

7. Lead students in a discussion of new technological breakthroughs and how these advancements may affect agricultural mechanics specifically. (See Problem Area *Recognizing the Impact of Technology on Agriculture: Electronics*)

8. Either use the topical activities as demonstrations or obtain sufficient materials to allow each student or pair of students to perform the activities under supervision.

9. Use the demonstrations as independent activities or to reinforce either the specific function (i.e., Student Worksheet #8 — Torque) or the represented principle (i.e., Student Worksheet #8 — Force).

10. Use the student activities for individuals or pairs of students to construct, assemble, and collect data on the required project.

11. Use the demonstrations simply as demonstrations. Demonstrate and lead a discussion using the discussion questions and included equations for enhanced student learning, or adapt the demonstration to an individual project format to allow further investigation by those students interested and able to conduct the project on an independent basis.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Identifying Basic Agricultural Mechanics Principles

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Agricultural Mechanics.* (Subject Matter Unit #8410). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588.

2. *Mechanics on Agriculture.* (1983). Phipps, L.J. Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

3. *Agricultural Mechanics: Fundamentals and Applications.* Cooper, Elmer. Delmar Publishers, Inc., 2 Computer Drive West, Box 15015, Albany, NY 12212-5015.

*4. *Agriscience Teacher Inservice Program.* Buriak, Philip (Agricultural Engineering, University of Illinois), Trammell, Gary (Chemistry, Sangamon State University), and others. Osborne, Edward W., Project Director. (October 1988 - January 1989). Agricultural Education, 124 Mumford Hall, 1301 W. Gregory, Urbana, IL 61801. (217) 333-3166.

*5. *Principles of Technology, Energy Utilization Technology, and Production Technology.* Illinois State Board of Education (ISBE), DAVTE. Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322-3905. (Also available from Illinois Vocational Curriculum Center. Sangamon State University, Springfield, IL 62794. (800) 252-4822.)

*6. *Basic Principles of Hydraulics.* (VAS Transparency Set # T440). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Agricultural Mechanics

INFORMATION SHEET #2 — Basic Principles of Agricultural Mechanics

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INFORMATION SHEET #1

Agricultural Mechanics

Agricultural mechanics includes all the mechanical activities performed on production facilities and in agriculturally oriented businesses and industries. A majority of the work of these diverse agricultural occupations involve mechanical activity. As the use of technology in agriculture continues to increase, successful employees will necessarily need to possess some mechanical skill and knowledge. Traditionally, agricultural mechanization has been divided into five general areas:

1. Agricultural Construction and Maintenance
    a. repair and maintenance
    b. hot metal work
    c. cold metal work
    d. arc welding
    e. oxy-fuel welding
    f. plumbing
    g. fiberglass and plastic applications

2. Agricultural Power and Machinery
    a. tractor power
    b. small engines
    c. trucks and machines

3. Agricultural Electrification
    a. electrical circuit installation
    b. electrical power
    c. electrical controls and sensing devices

4. Agricultural Structures
    a. elementary planning
    b. basic construction
    c. concrete and blocks

5. Soil and Water Management
    a. land measurement and leveling
    b. conservation practices
    c. drainage and irrigation

As technology continues to have an impact on occupations in agricultural mechanization, successful employees will need knowledge of how the processes work scientifically and mathematically. It is important that students not only understand how to perform occupational tasks but also are able to accurately communicate how the system works.

INFORMATION SHEET #2

Basic Principles of Agricultural Mechanics

One of the reasons for the popularity of agricultural mechanics at the secondary level is the amount of laboratory "hands on" activity available. This fact can be used to one's advantage in the effort to match the basic principles and concepts of the hard sciences to the objectives which currently guide the instruction in agricultural technology.

The following list of basic principles and concepts can be used as a starting point in determining those concepts interacting in the horticultural context and then modifying the instructional plans to at least point out those principles and concepts that are addressed.

Basic principles, concepts, and laws:

Measurement	Energy
Work	Friction
Force	Stress
Motion	Inertia
Pressure	Mass/matter
Power	Torque
Conservation of energy	Conservation of mass
Heat/temperature	Fluid flow
Transfer of energy	Statics
Dynamics	Psychrometics
Gravity	Solids/liquids/gases
Balance	Simple machines
Power transmission	Wave motion
Magnetism	Electricity
Light	Sound

This list, which is incomplete, is adapted from:
Dr. Philip Buriak
Associate Professor
of Agricultural Engineering
University of Illinois

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Bridge Design Project (with discussion guide)

STUDENT WORKSHEET #2 — Passive Solar Project (with discussion guide)

STUDENT WORKSHEET #3 — Types of Forces — Topical Activity

STUDENT WORKSHEET #4 — Hydraulic Lifts — Topical Activity

STUDENT WORKSHEET #5 — Gas Physics — Topical Activity

STUDENT WORKSHEET #6 — Effect of Pressure on the Boiling Point of a Liquid — Topical Activity

STUDENT WORKSHEET #7 — Alcohol Vapor Explosion — Topical Activity

STUDENT WORKSHEET #8 — Torque (Force) — Demonstration

STUDENT WORKSHEET #9 — Fluid Pressure (Force) — Demonstration

STUDENT WORKSHEET #10 — Electrical Forces (Force) — Demonstration

STUDENT WORKSHEET #11 — Fluid Rate (Rate) — Demonstration

STUDENT WORKSHEET #12 — Resistance to Airflow (Resistance) — Demonstration

STUDENT WORKSHEET #13 — Mechanical Friction and Lubrication (Resistance) — Demonstration

STUDENT WORKSHEET #14 — Thermal Resistance (Resistance) — Demonstration

STUDENT WORKSHEET #15 — Fluid Power (Power) — Demonstration

STUDENT WORKSHEET #16 — Mechanical Power (Power) — Demonstration

STUDENT WORKSHEET #17 — Mechanical Force Transformer (Force Transformer) — Demonstration

STUDENT WORKSHEET #18 — Rotational Force Transformer (Force Transformer) — Demonstration

STUDENT WORKSHEET #19 — Momentum and Impulse (Momentum) — Demonstration

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Bridge Design Project

Purpose:

1. To design and construct a model bridge to span an 8-inch-wide void and to hold as great a load as possible.

Considerations:

Your bridge design must conform to the following rules:

1. The bridge can not measure longer than 10" long, 3" wide, and 3 1/2" high.
2. Structural members can not be glued together to increase their cross-sectional area.
3. The bridge must be able to accommodate a 2 1/2-inch-wide roadway.
4. The bridge must have at least a 2-inch vertical clearance between the roadway and any structural members.
5. The bridge must be designed to accommodate the load plate from which the load will be suspended.
6. Glue joints must be clean and not longer than 1/4".

Procedure:

1. Using the bridge design sheet, analyze how you want to distribute the load.
2. Sketch a truss system on your bridge design sheet.
3. Plan, cut, and layout the structural members for your bridge on the design sheet. The amount of material you have to work with is limited, so plan carefully.
4. Make sure each joint is tight and glue the truss system together.
5. When the first truss system is completed, use it as a guide for constructing the second truss system.
6. Install horizontal bracing to fasten the two truss systems together. Make sure you allow for the specified roadway width, vertical clearance, and load plate installation.
7. When you have completed your bridge, place it across the test site. Install the load plate inside of your bridge and suspend the load container from it.
8. Weigh one scoop of sand. Remember to subtract the weight of the scoop.
9. Apply a load to your bridge by pouring one scoop of sand into the container at a time. Add the sand slowly and carefully so as not to cause premature bridge failure. Continue to add scoops of sand until your bridge falls. Keep track of the number of scoops added to the load container.
10. Determine the total load applied to the bridge by multiplying the number of scoops added to the container by the weight of one sand scoop.
11. Determine bridge efficiency using the following formula:

$$\textbf{Efficiency} = \frac{\textbf{Failure Weight}}{\textbf{Amount of Wood Used (in linear inches)}}$$

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Data:

1. The weight of one scoop of sand.
2. The total number of sand scoops added to the load container before bridge failure.
3. The maximum load your bridge was able to hold.
4. The total amount of wood used in linear inches.
5. Bridge efficiency in pounds per linear inch of material.

STUDENT WORKSHEET #1 — Discussion Guide

Introduction:

During this activity students will design, construct, and test a model bridge. Students will have to analyze the forces caused by a load, design the superstructure to withstand the forces, construct the superstructure according to the design, and test the superstructure. During this activity students will further develop their problem-solving group process, communication, and building skills.

Materials:

During this activity, students will work in teams. Assign a workstation to each team. Each work station will need the following materials:

1. seven pieces of bass wood 1/8" x 1/8" x 24"
2. glue
3. one x-acto knife
4. two bridge design sheets
5. eye bolt, washers, and nut
6. wire
7. coffee can
8. sand
9. scoop

Procedure:

1. Obtain the materials needed for this lab activity. Review the recommended references and develop a ten- to fifteen-minute lecture for each production topic. Your lectures should include resources, technical processes, industrial applications, and technological impact (see transparency masters).

2. Explain the concepts of compression and tension. Fasten three narrow boards together in the form of a triangle. Apply a load to one of the points of the triangle. Have students identify which boards are under compression and which are under tension. Apply a load to a horizontal board in the triangle. Have students identify the compression, tension, and triangle. Discuss how compression, tension, and triangular structures are used to construct bridges.

3. Explain the guide lines for constructing the model bridges. Demonstrate how to cut and fasten wood trusses for the bridges. Emphasize the need for accuracy.

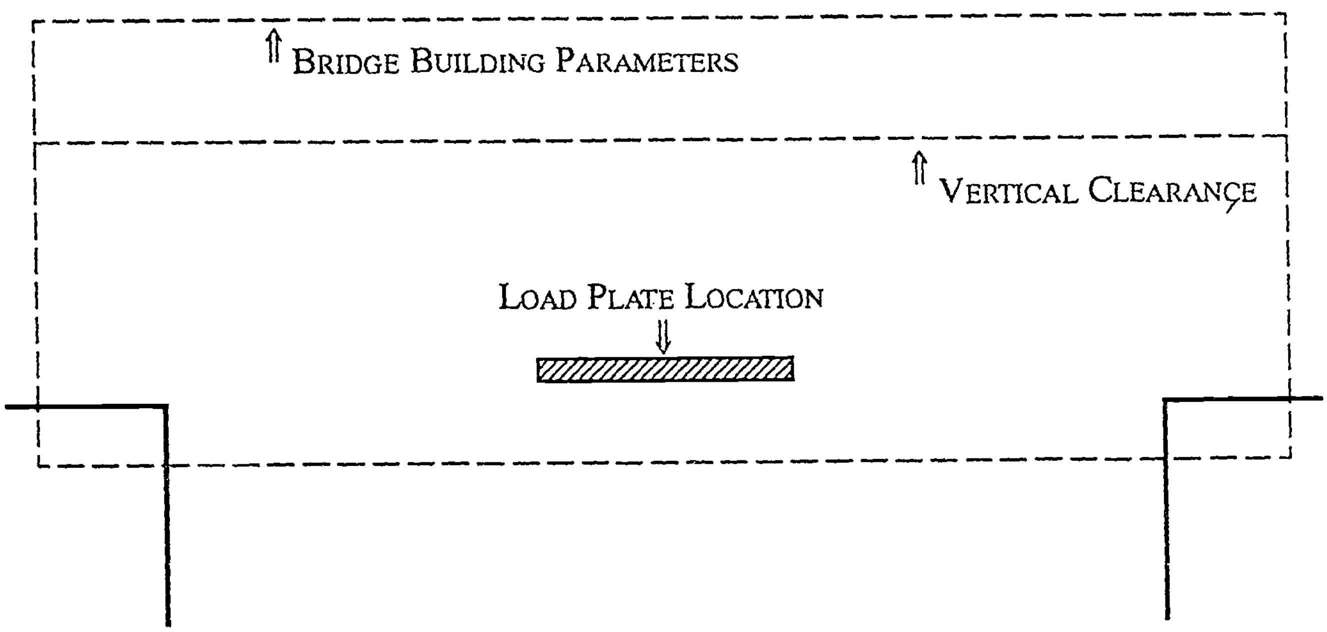
4. Demonstrate how to connect the load to their bridges and how to increase the load with scoops of sand. Students need to determine the weight of one scoop of sand (less the weight of the scoop). During the testing, have students increase the load on the bridge by pouring one scoop of sand into the container at a time. Have students record the number of scoops before failure and multiply the number of scoops by the weight of one sand scoop. Emphasize the need to add the sand slowly and carefully so as not to cause premature bridge failure.

5. Explain and demonstrate how the following formula can be used to determine bridge efficiency.

$$\textbf{Efficiency} = \frac{\textbf{Failure Weight}}{\textbf{Amount of Wood Used (in linear inches)}}$$

6. Divide your class into teams. Assign each team a work station. Have students construct and test model bridges.

7. After the testing has been completed, have students report their results. Display each bridge and the load under which the bridge failed. Discuss the use of compression and tension in each bridge design. Discuss why given bridges failed with a low load and why other bridges held higher loads before failure. Discuss the technological impact of a bridge failure.


⇑ Bridge Building Parameters
⇑ Vertical Clearance
Load Plate Location
⇓

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STUDENT WORKSHEET #2

Passive Solar Project

Name ____________________ Date ___ - ___ - ___

Problems/Questions:

1. What is the relationship between the amount of south-facing glass on a structure and the interior temperature from solar gain?

2. What is the role of the additional mass within a passive solar structure?

3. What role do windows not facing south play in terms of solar energy?

4. In your opinion, which of the passive solar techniques do you think is the best and why?

Hypothesis:

1. If the amount of glass facing south is increased, the heat from solar gain will ______.

   a. decrease
   b. increase
   c. stay the same

2. The additional mass in a passive solar structure will _____.

   a. absorb heat
   b. store heat
   c. release heat
   d. all of the above

3. The east, west, and north windows on the control mock-up will _____.

   a. provide for additional solar gain
   b. will allow heat to escape
   c. not affect its performance

Directions:

1. Divide into groups as directed by your instructor.

2. Make sure your mock-up is made according to the plan and your teacher's instructions.

3. Once outdoors, locate your mock-up so as much sunlight as possible can enter it through the glass.

4. Install a thermometer through the top of the mock-up. Make sure you can still read it easily. Be careful, thermometers break easily.

5. When your teacher tells you it is time to start, read the thermometer and record the temperature on the chart provided. Continue reading and recording your mock-up's temperature every 60 seconds.

6. When your teacher tells you it is time, move your mock-up out of the sun. Continue to read and record your mock-up's temperature every 60 seconds.

7. When your teacher tells you it is time, stop collecting data (temperature), clean up the site, and return to your classroom.

Conclusions:

Plot your data (temperature), along with those of your fellow students, on a large graph. In your groups, discuss how your mock-up performed in comparison to the other mock-ups. During your discussion, answer the following questions:

1. Which mock-up experienced the least amount of solar gain and why?
2. Which mock-up experienced the greatest amount of solar gain and why?
3. Which mock-up was able to stay hot the longest and why?
4. What is the role of the extra mass in the passive solar mock-ups?
5. What role do you think the windows on the east, west, and north sides of the control mock-up have in terms of energy?
6. In your opinion, which passive solar design would be the best house to live in and why?

DATA COLLECTION

TEMPERATURE READINGS

In the Sun	Out of the Sun
1. ______	1. ______
2. ______	2. ______
3. ______	3. ______
4. ______	4. ______
5. ______	5. ______
6. ______	6. ______
7. ______	7. ______
8. ______	8. ______
9. ______	9. ______
10. ______	10. ______
11. ______	11. ______
12. ______	12. ______
13. ______	13. ______
14. ______	14. ______
15. ______	15. ______

STUDENT WORKSHEET #2 — Discussion Guide

Technical System: Energy

Introduction:

Passive solar energy technology takes advantage of the sun's radiant energy for heating and cooling without dependence on energy-consuming devices like fans and pumps. Through the building's design, orientation, and composition, solar energy is collected, distributed, stored, and controlled.

South-facing glass typically provides for collection. Conversion is encouraged by dark-colored surfaces. A thermal mass, typically masonry or water, stores the energy. Vents and large open spaces facilitate energy distribution. Movable insulation and shading (roof overhangs and/or trees) provide control.

Passive solar structures typically employ one of the following techniques:

Direct Gain Systems: These systems use the sunlight directly entering the living space through south-facing glass. Conversion, collection, storage, and distribution of solar energy occurs within the living space.

Indirect Gain Systems: These systems employ a thermal mass between south-facing glass and the living space. Sunlight passes through the glass, is converted to heat, and is absorbed by the thermal mass. Convection currents bring heat into the living space through vents at the top and bottom of the thermal mass. Heat can also enter the living space by passing through the thermal mass.

This technology education activity will provide students with an opportunity to experience each passive solar technique using working mock-ups. The heat gain in the passive solar mock-ups can be compared with that of a control mock-up. The control mock-up is designed to represent a conventional structure.

Concepts Reinforced:

direct gain
indirect gain
collection
conversion
storage
distribution
control
thermal mass

Objectives: After completing this technology education activity, students will be able to:

1. Describe the difference between a conventional structure and a passive solar structure.

2. Differentiate between direct gain and indirect gain passive solar systems.

3. Explain how solar energy is collected, converted, stored, distributed, and controlled in each passive solar technique.

4. Explain the role of thermal mass in a passive solar energy system.

Materials:

1. 3/4" particle board, approximately one-half sheet (4' x 4' x 3/4") per mock-up
2. 4 pieces of single strength glass or acrylic plastic, 6 1/2" x 6 1/2"
3. 3 pieces of single strength glass or acrylic plastic, 11" x 11"
4. 1 piece of single strength glass or acrylic plastic, 11" wide and 13" long
5. 8 pieces of 3/4" pine, 1 1/2" wide and 4" long

6. 1 tube of silicone caulking
7. 5 pieces of 1" copper pipe, 10" long
8. 10 copper caps for the pipe
9. 3 pieces of "Wonder Board" (a concrete material often used as an underlayment for ceramic tile), about 11" x 11"
10. 5 thermometers
11. white glue and 4D finishing nails
12. dark brown or flat black paint

Procedure:

Preparation before introducing the Passing Solar Project:

1. Collect and precut the materials for the solar mock-ups (see Figures 1-5).

2. Duplicate lab sheets and plans for each passive solar mock-up (Figures 1-5).

3. Organize the materials, plan, tool, and fasteners needed to make each mock-up into a workstation. There should be a total of six workstations, one workstation per mock-up.

4. Prepare materials to present an introduction to passive solar energy (i.e., overhead transparencies, slides, brochures on solar homes).

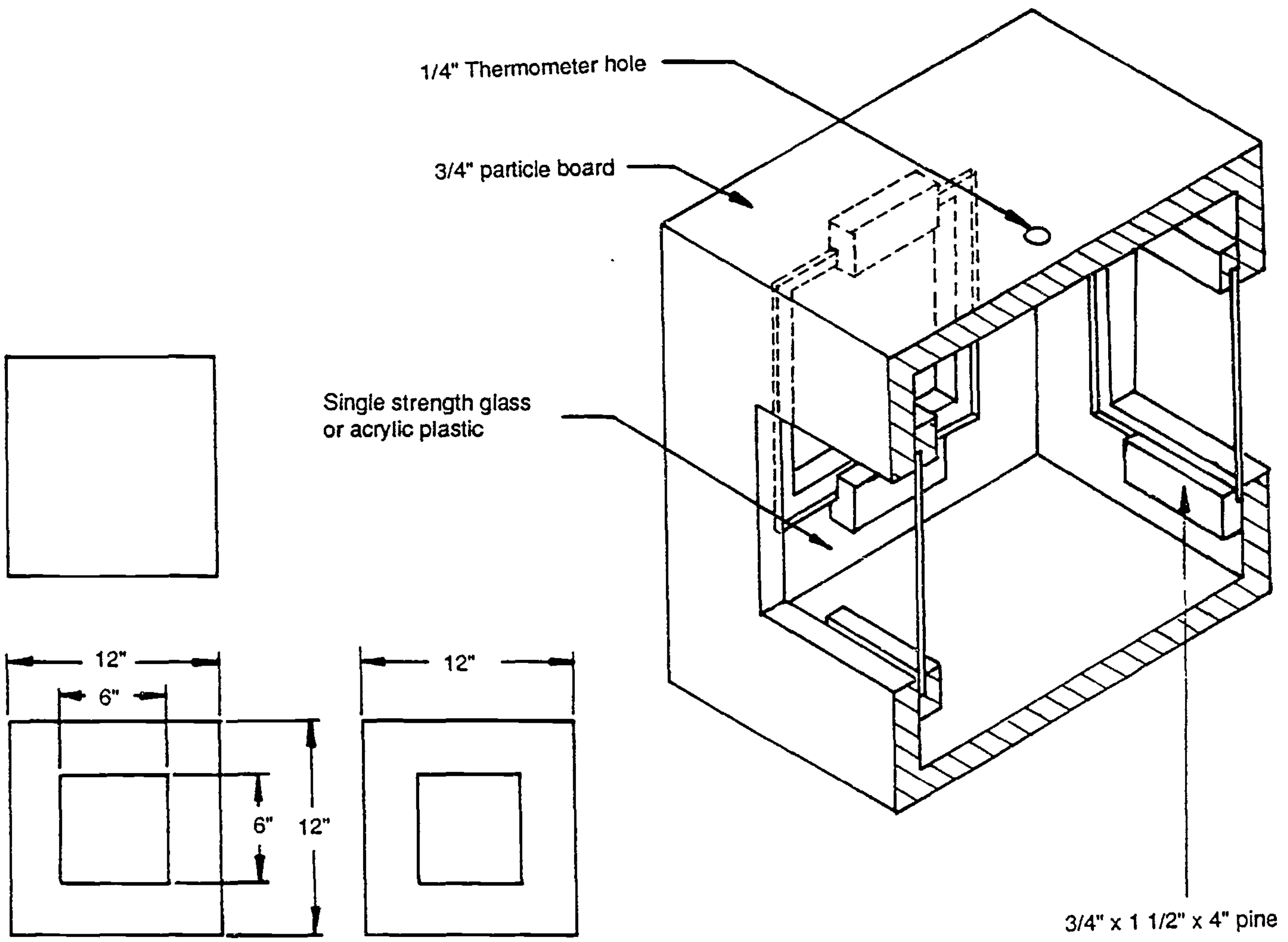


FIGURE 1
CONTROL MOCK-UP

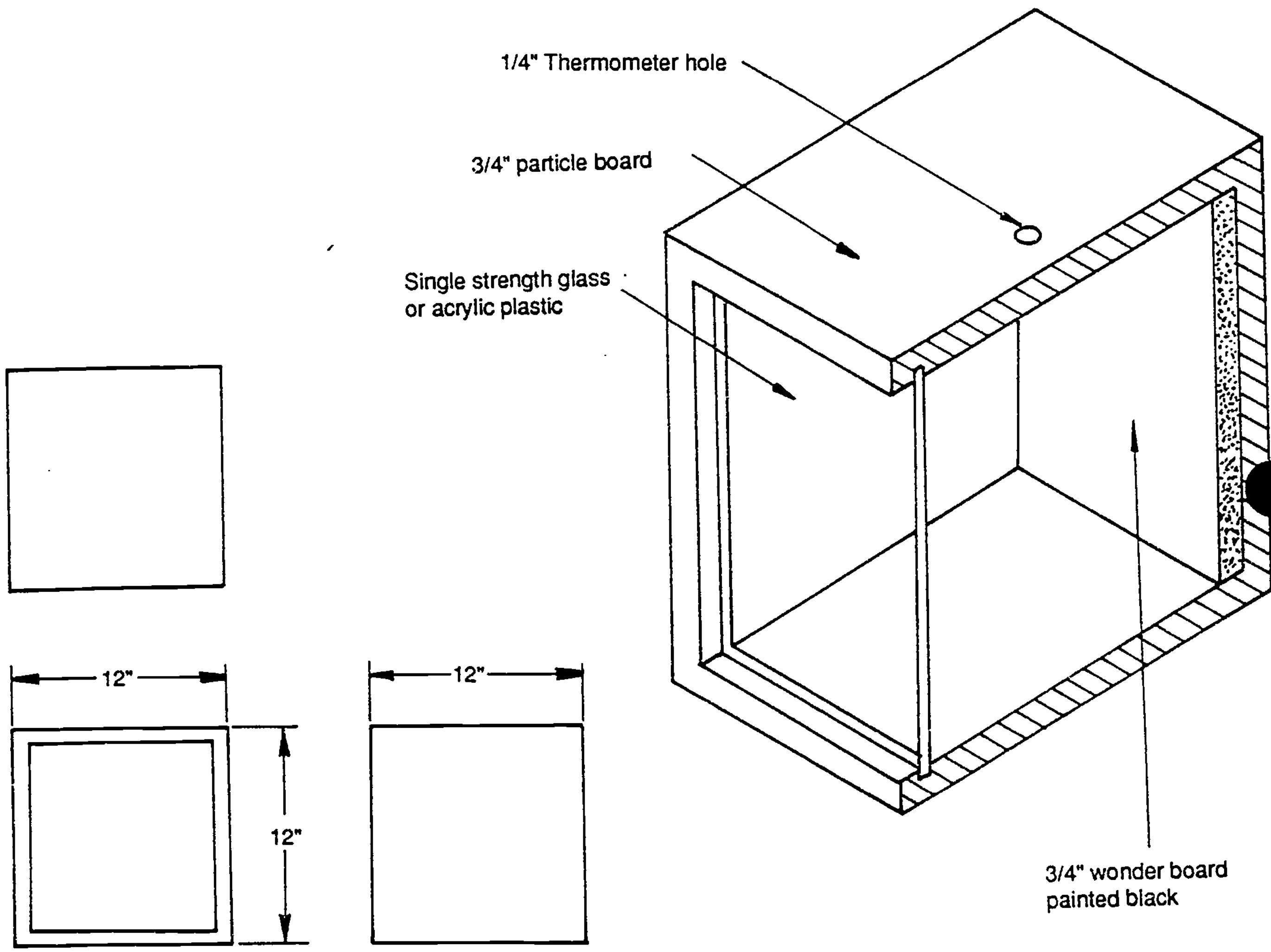


FIGURE 2
DIRECT GAIN MOCK-UP

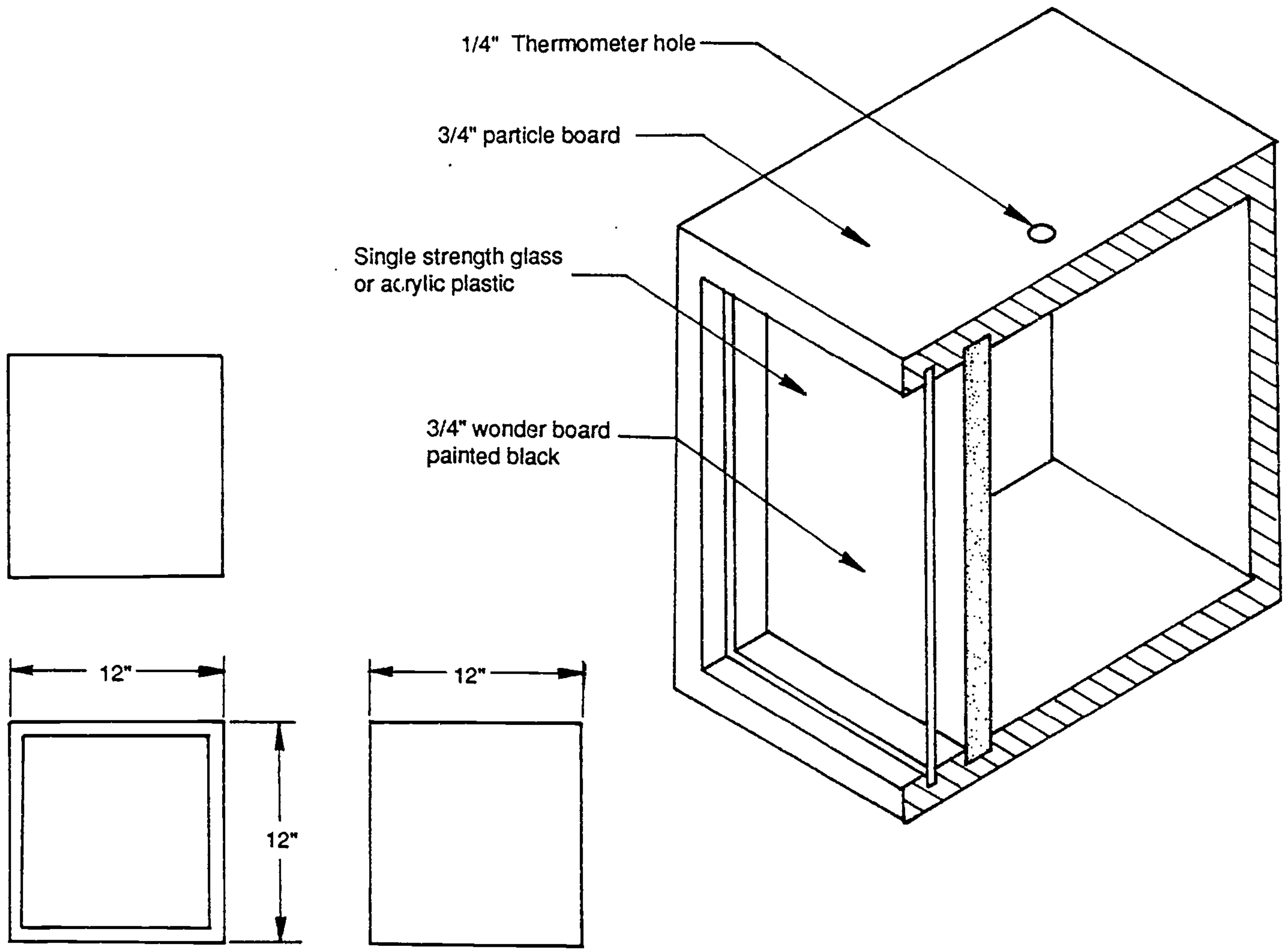


FIGURE 3
TROMBE WALL MOCK-UP

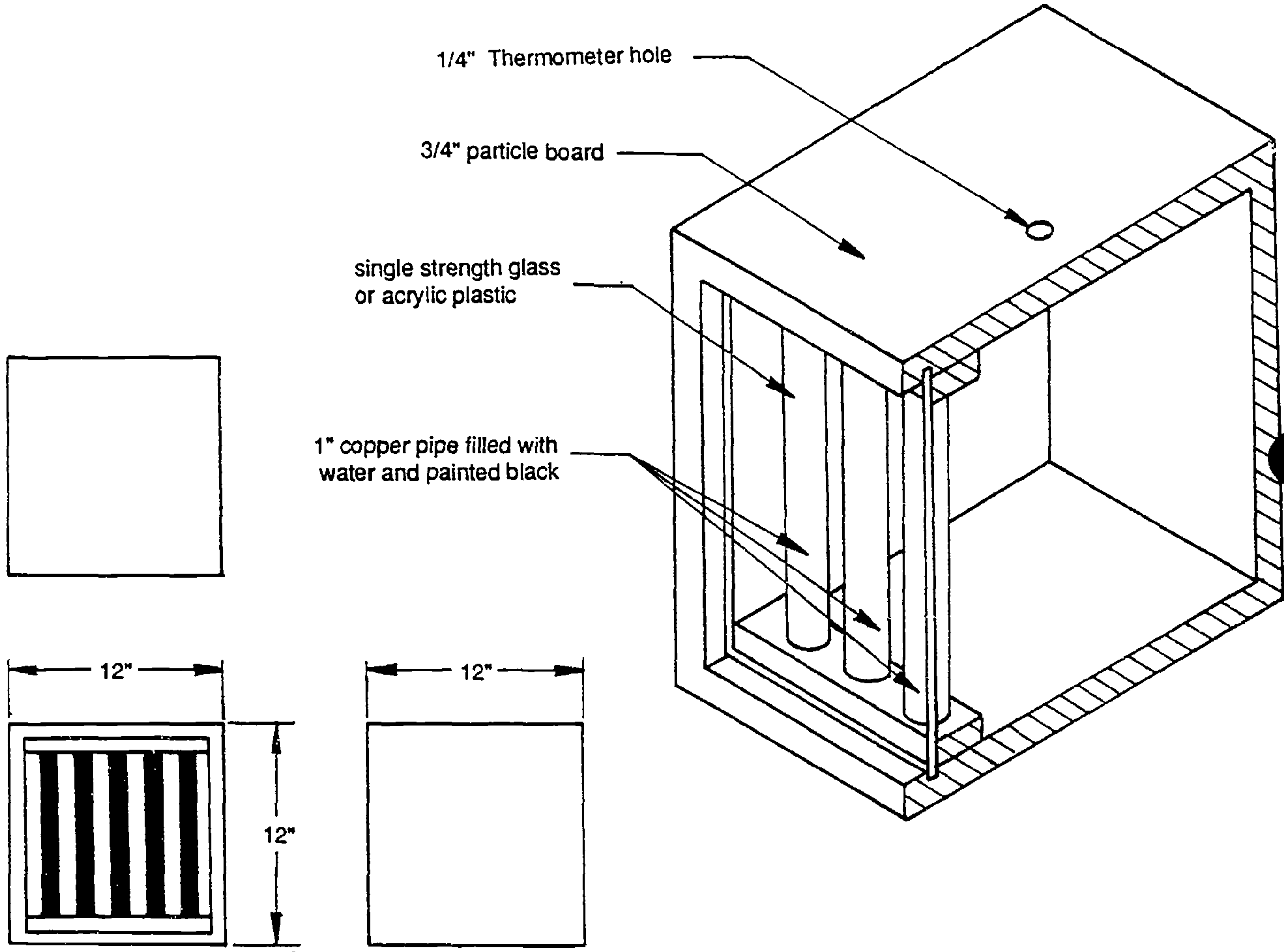


Figure 4
Tube Wall Mock-Up

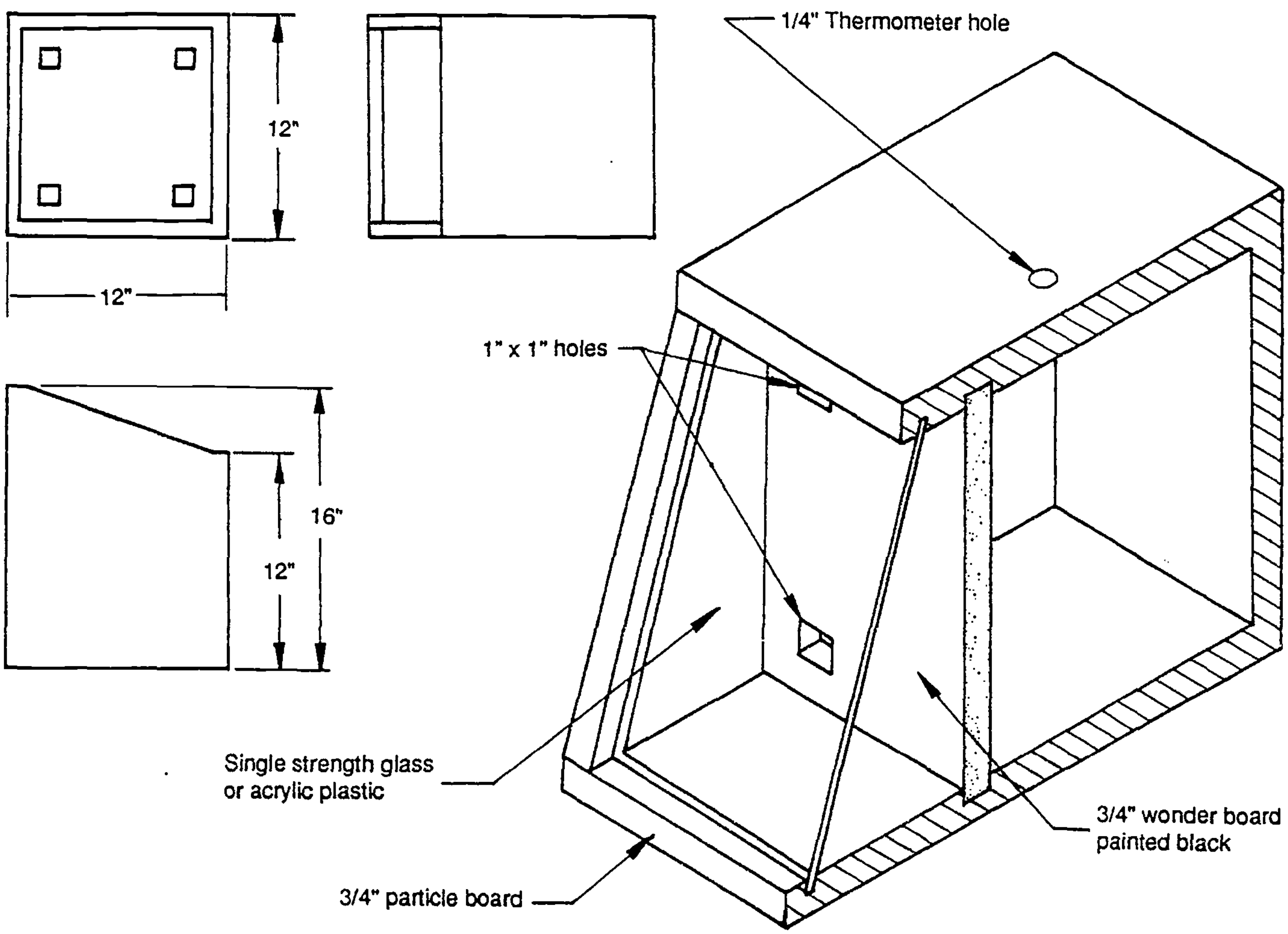
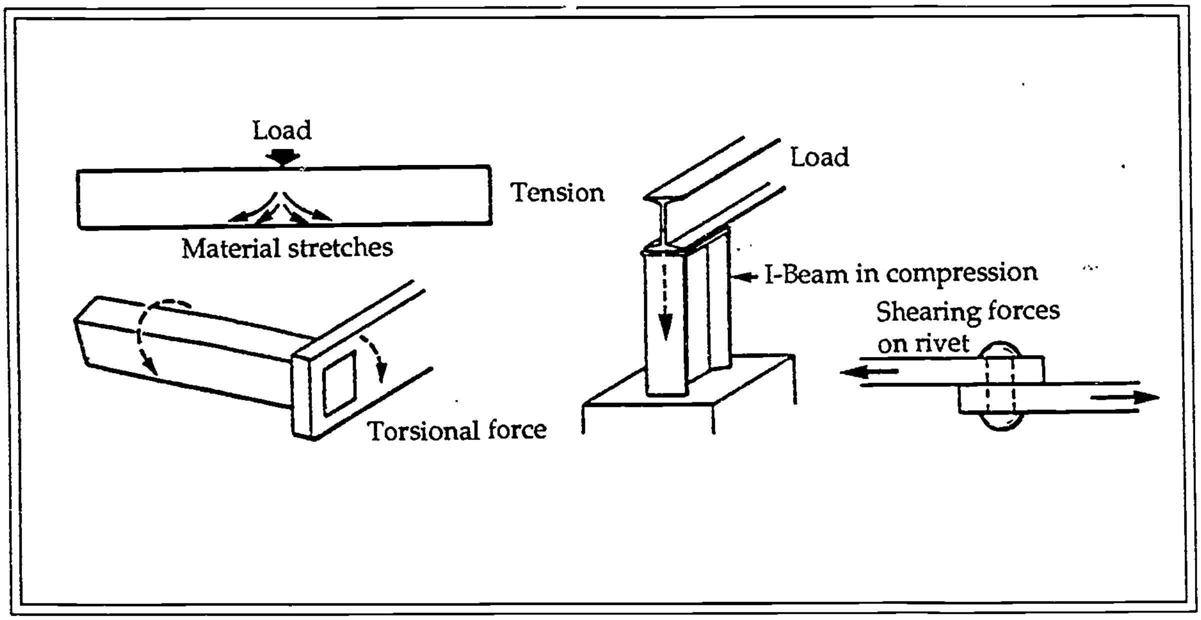


FIGURE 5
GREENHOUSE MOCK-UP

STUDENT WORKSHEET #3

Types of Forces — Topical Activity

A force is a push or a pull, tending to change the shape or position of an object. Every force produces a stress in the object to which it is applied. When a force tends to stretch an object, it is called tensile force. Compressive forces tend to shorten or squeeze an object. Torsion or torque twists an object. When a force is applied similarly to the action of scissors, a shearing force is exerted.



Purpose:

1. To define and identify forces and their resultant actions.

Materials:

1. wooden blocks
2. bench vise
3. wooden strips
4. weights

Procedure (Record observations in the table provided):

1. Place a soft block of wood in a vise and tighten. What force is acting on the block?

2. Support both ends of a thin strip of wood and apply a force near the center. What forces are acting on the top and bottom surfaces of the strip?

3. Hold a thin strip of wood, one end in each hand. Turn one end clockwise, the other counterclockwise. What force is applied?

4. Stack five (5) thin wooden strips (forming a light beam) between supports. Apply a force (weight) to the center of the beam until motion between the strips is observed. What happens? Remove the force and clamp both ends of the stacked beam. Again, apply the force and observe what happens.

Data table:

Observed Action/s	Type of Force
1	
2	
3	
4 Unclamped	
4 Clamped	

Discussion:

Machines are composed of various moving parts. These parts transform motion from one form to another performing work. Work is defined as a motion resulting from the application of force. The study of mechanics deals with many types of forces and their effects.

The effects of tension, compression, shear, and torsion have been demonstrated. Identify areas in agricultural mechanization and systems that are subjected to differing forces or stresses.

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

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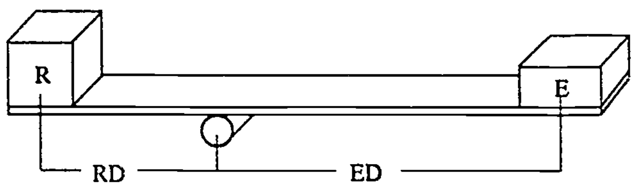
Effort, Resistance, and Mechanical Advantage

An effort force is the force applied to an object. The resistance by the object to the force is the resistance force. If we compare the effort force, effort distance, resistance force, and resistance distance, we learn that the effort force times the distance through which it is applied, equals the resistance force multiplied by its distance.

$$R \times RD = E \times ED$$



This relationship can be demonstrated through the following activity:

Purpose:

1. To define and investigate the relationship between effort forces and resistance forces and their relationship to mechanical advantages.

Materials:

1. weights — 100g, 200g, and 400g
2. yardstick
3. triangular block of wood

Procedure (Record observations in the table provided):

1. Place the 200g weight at one end of the yardstick, with the wooden fulcrum located 12" from the weight. Place the 400g weight to the other side of the fulcrum adjusting it until the beam is balanced. Record the distance from the center of the 400g weight to the center of the fulcrum.

2. Repeat this procedure with the 200g weight 10" from the fulcrum and the 100g weight balanced at the opposite end. Determine and record the effort distance.

Data Table:

	Resistance Force	Effort Force	Resistance Distance	Effort Distance
1	200g	400g	12 in	
2	200g	100g	10 in	

Discussion:

Sketch E, ED, R, and RD for the 200g/400g and 200g/100g combinations. Calculate ED for both combinations. How do they compare with the values observed?

Mechanical advantage is the ratio of the resistance force to the effort force. A gain in mechanical advantage allows us to use a small force to move a larger force. Calculate the mechanical advantage for examples 1 and 2. What do these numbers mean?

The mechanical advantage of speed or distance is the ratio of the resistance distance to the effort distance. Calculate the mechanical advantage of distance for both examples. What do these numbers mean?

Observe the calculated mechanical advantages. How does the mechanical advantage of force relate to the mechanical advantage of distance for example 1? example 2?

Questions:

What implications does this scientific principle have for agriculture?

Give examples of agricultural occupations in which this principle is used.

Mechanical Power Transmission

Purpose:

1. To investigate through inquiry the relationships among diameter, number of teeth of drive, and driven devices with respect to torque and speed (RPM) and the law of conservation of energy.

Materials:

1. ten-speed bicycle
2. clamps
3. 2 torque wrenches (in-lb)
4. rules

Procedure (Record observations in the blanks provided):

1. Measure the diameter of the large pedal sprocket (D1), and the smallest wheel sprocket (D2).

   D1 = ____________________
   D2 = ____________________ Ratio D1/D2 = ____________________

2. Count the number of teeth on the large pedal sprocket (N1), and the smallest wheel sprocket (N2).

   N1 = ____________________
   N2 = ____________________ Ratio N1/N2 = ____________________

3. Count the number of revolutions of the smallest wheel sprocket (RPM2) for one revolution of the large pedal sprocket (RPM1).

   RPM1 = _________1_________
   RPM2 = ____________________

4. Compare D1/D2 to N1/N2. What can you conclude from this comparison?

   ____
   ____
   ____

5. Compare D1/D2 to your answer in item number 3 for RPM2. Is RPM1/RPM2 = D2/D1? YES NO

   Describe this relationship in your own words. ____________________
   ____
   ____

6. Determine *all* possible speed ratios and arrange them in increasing or decreasing order.

1.	N6/N5	= ____________	6.	____________
2.		= ____________	7.	____________
3.		= ____________	8.	____________
4.		= ____________	9.	____________
5.		= ____________	10.	____________

7. Which speed ratio has the greatest wheel speed? ____________________

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8. Using two torque wrenches in opposition, apply a force of 200 in-lb to the pedal sprocket. Measure and record the resultant torque at the wheel sprocket for *all* possible speed ratios.

1. N6/N5 =	________________	6.	________________
2. =	________________	7.	________________
3. =	________________	8.	________________
4. =	________________	9.	________________
5. =	________________	10.	________________

9. Which speed ratio provides the greatest torque? ________________

10. Based on your observation, what can you conclude about the relationship between power, torque, and speed? How does the law of conservation of energy apply to mechanical power transmission?

____

____

____

____

____

NOTE: If equipment is available, conduct similar activities using belts and pulleys and gears.

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

Adapted from: *Agriscience Teacher Inservice Program.* Dr. Philip Buriak, Associate Professor of Agricultural Engineering, University of Illinois

STUDENT WORKSHEET #4

Hydraulic Lifts — Topical Activity

Purpose:

1. To demonstrate how hydraulic lifts operate by application of Pascal's Law.

Materials:

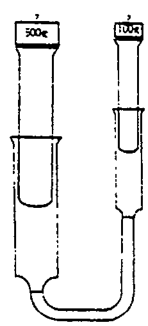
1. 2 plastic syringes of different sizes
2. plastic tubing to connect tips of syringes
3. water
4. food coloring

Procedure:

1. Fill each syringe with colored water and remove any air by holding the syringe vertical with the tip pointing up and pressing the barrel until all the air is removed. Connect the two syringes with about 1 inch of the small diameter plastic tubing.

2. Give the syringes to two students and see who can push his or her syringe in all the way.

3. To quantitate the experiment, mount the two syringes vertically on ring stands and connect them with the plastic tubing. The plungers should be up. Place a weight on the plunger of the large syringe and see how much weight must be placed on the small syringe to support it.



Discussion:

Hydraulic lifts operate by Pascal's Law. In the case of our two syringes, the small syringe and the large syringe balance each other when the pressure on each plunger is equal. The pressure on each plunger is found by dividing the force on the plunger by the area of the plunger. Since the smaller has a smaller area than the larger syringe, it requires a smaller force to exert the same pressure and balance the weight on the large syringe. When you push on the small syringe, you exert a pressure equal to that on the large syringe with a smaller force.

In mathematical terms, Pascal's Law is stated:

$$\frac{F_{ls}}{A_{ls}} = \frac{F_{ss}}{A_{ss}}$$

Where:

F_{ls} = force on the large syringe
A_{ls} = area of large syringe plunger
F_{ss} = force on the small syringe
A_{ss} = area of small plunger

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Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

References:

1. *Using Syringes to Teach Science . . . Or How to Needle Your Students.* Holbrook, Tom. (University High School, Normal IL). (Presented at the Chemical Demonstration Conference, Western Illinois University, Macomb, IL, 1986.).

2. *Idea Bank Collation: A Handbook for Science Teachers.* 1984. Talesnick, Irwin. (ed.). (A collection of items from the Idea Bank Column in *The Science Teacher* [1970-1984]). S17 Science Supplies and Services Co. Ltd., Kingston, Ontario.

3. *A Demonstration Handbook for Physics.* 1981. Freir, G. D., Anderson, F. J. American Association of Physics Teachers, Stony Brook, NY.

4. *A Sourcebook for the Physical Sciences.* 1961. Brandwin, Joseph et al. Harcort, Brace, Jovanovich, NY.

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STUDENT WORKSHEET #5

Gas Physics — Topical Activity

Purpose

1. To demonstrate the relationship between the volume of a gas and its temperature and pressure. These relationships have applications in understanding the operation of internal combustion engines.

Materials:

1. a plastic syringe (25 ml or larger)
2. ring stand and clamp or a 2 x 4 with a hole to fit the syringe
3. heat gun or hair dryer
4. portable bunsen burner

Procedure:

Prepare a syringe cap by heating the needle cap with a match or candle flame until the needle can be pulled out with pliers. Discard the needle. Continue to heat the cap until the plastic seals itself shut. The sealed cap is now an effective gas-tight seal for the syringe.

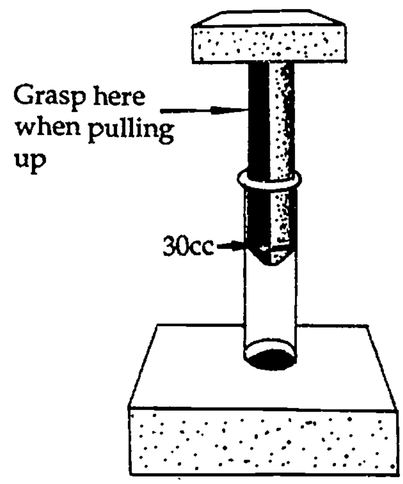
Effect of Pressure on Volume of a Gas (Boyle's Law)

Set the plunger of the syringe to a convenient mark near the top of the syringe. Place the sealed cap tightly on the tip of the syringe. Try pushing in and pulling back on the plunger. What happens to the column of gas inside the syringe when you increase the pressure on the plunger? What happens when you decrease the pressure by pulling out the plunger?

To quantitatively demonstrate Boyle's Law, clamp the syringe to the ring stand or place it in the hole in the 2 x 4. Books of the same size or weights can be placed on the plunger and the volume recorded. Make a chart of weight added versus volume and plot a graph of your results.

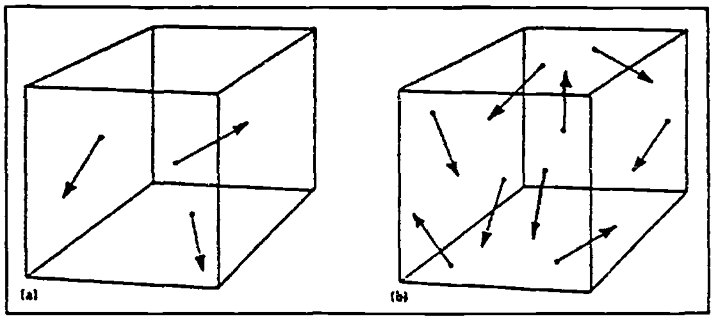
Effect of Temperature on Volume of a Gas (Charles' Law)

To demonstrate the effect of temperature on the volume of gas, set the plunger of the syringe about half way up the barrel. Record the volume and heat the bottle with a heat gun or hair dryer. What happens to the volume of gas? Try placing the syringe in a container of ice. What happens to the volume?



Discussion:

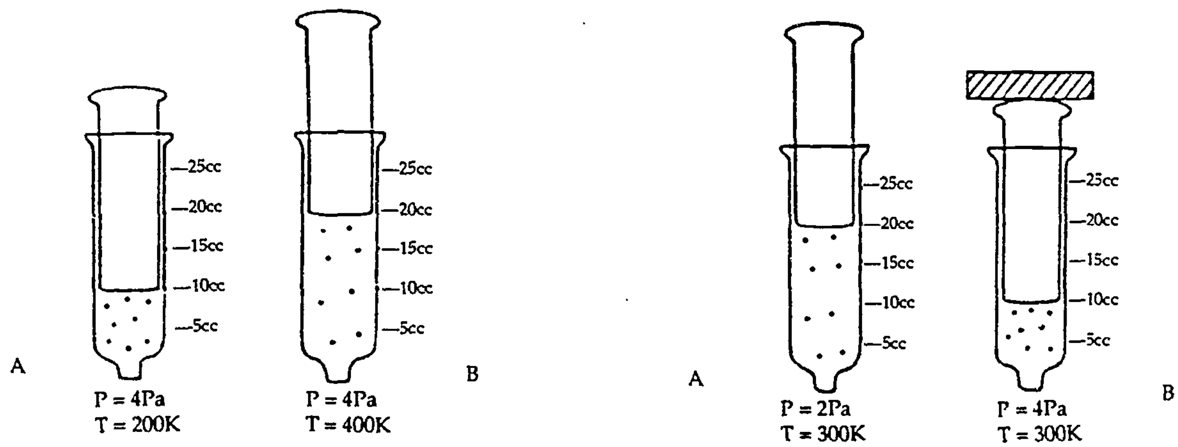
The behavior of gases is easily described on the molecular level. Gases are composed of molecules or atoms that are very far apart and are in constant, random motion. Gases exert a pressure when the molecules collide with the walls of the container. The average speed of the gas molecules is measured by the temperature. As the temperature of the gas increases, the gas molecules move faster and faster; when the temperature is lowered, they slow down.



Gases exert pressure when the molecules collide with the walls of the container. (a) Few molecules produce little pressure. (b) Many molecules produce high pressure.

In the Boyle's Law demonstration, when the volume of gas is decreased, the molecules of gas strike the wall of the container more frequently, and the pressure increases. The volume of gas is inversely proportional to the pressure applied to the gas.

When the gas is heated, the molecules move faster and strike the sides of the container more frequently causing the pressure to increase. If the gas is confined, like in an aerosol can placed in a fire, the pressure increases enough to rupture the can. In the syringe, the plunger inside the syringe is equal to the pressure applied to the plunger.



Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

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STUDENT WORKSHEET #6

Effect of Pressure on the Boiling Point of a Liquid — Topical Activity

Purpose:

1. To demonstrate that the boiling point of a liquid is lowered when the pressure is reduced. This has applications for understanding carburetors in gasoline engines.

Materials:

1. 1 plastic syringe with cap
2. hot water
3. denatured alcohol

Procedure:

Draw some of the hot water into the syringe. Cap the syringe with an airtight cap. Pull back the plunger and observe the water. Repeat this experiment using room temperature alcohol.

Discussion:

All liquids have some vapor above the surface of the liquid, and this vapor exerts a vapor pressure. The boiling point of a liquid is the temperature at which its vapor pressure is equal to the external pressure. When the external pressure above a liquid is reduced, the boiling point of a liquid decreases. This is why water boils at a lower temperature at high altitudes. Also, when a piston in the cylinder of an engine pulls back on the intake stroke, the pressure is lowered in the chamber causing some of the volatile gasoline to fill the cylinder.

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

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STUDENT WORKSHEET #7

Alcohol Vapor Explosion — Topical Activity

Purpose:

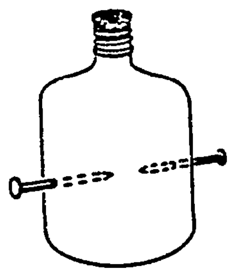
1. To demonstrate the combustion of vapors of a flammable liquid in air. This simulates the combustion process inside a gasoline engine.

Materials:

1. 2 - 3 ml of 95% ethanol
2. 2 nails
3. 250 ml polyethylene bottle
4. cork to fit bottle
5. Tesla coil (try your physics teacher. Sargent-Welch catalog number S-30978, $95.40)

Procedure:

Insert one of the nails through the side of the bottle about half way up. Insert the other nail through the opposite side. Position the tips of the nails so there is a gap of about 1/4 inch (0.5 cm) near the center of the bottle. Pour 2 - 3 ml (a layer about 1/8 in. deep) of 95% alcohol in the bottle and stopper with the cork. Set the bottle in an area free of overhead obstructions.



Turn on the Telsa coil and bring its tip to one of the nails. A spark will jump to the nail and from one nail to the other. This spark inside the bottle detonates the mixture of alcohol vapor and air, causing the cork to shoot out of the bottle. This demonstration cannot be repeated without flushing the bottle with air, presumably, because the explosion consumes all the oxygen in the bottle, replacing it with carbon dioxide.

Discussion:

A small amount of the ethanol liquid in the bottle vaporizes, and the vapor produces an explosive mixture with oxygen in the air. When a spark is created between the electrodes, the mixture detonates, forcing the stopper from the bottle. This discussion emphasizes the fire triangle for fire prevention. Fire requires fuel, oxygen, and heat. Without one of these, no fire will occur. The vapor and oxygen mixture combined with heat in the form of a spark causes detonation. The same process occurs in the cylinder of a gasoline engine.

$$C_2H_5OH + 3\,O_2 > 2\,CO_2 + 3\,H_2O$$

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

Reference:

1. *Chemical Demonstrations: A Handbook for Teachers of Chemistry.* Vol. 2. 216-219. 1985. Shakhashiri, Bassam Z. (ed.). University of Wisconsin Press.

STUDENT WORKSHEET #8

Torque (Force) — Demonstration

Purpose:

1. To show the following:
   a. Torque causes objects to rotate.
   b. Torque is the product of lever arm and applied force.

Materials:

1. sponge, damp
2. meter stick
3. two meter scales, 0 to 72 ounce
4. two vacuum suction cups with hooks
5. two 1-ft lengths of light chain — or strong line
6. gallon paint can (filled with sand)
7. socket fixture
8. two C-clamps
9. torque wrench
10. two hose clamps with hook as shown in Figure 2
11. roll of masking tape

Procedure:

Part one: What causes a door to move?

1. Select two students to help.

2. Give student A two suction cups, damp sponge, and spring scales.

3. Give student B a roll of masking tape and a meter stick.

4. Have student B measure the width of the closed door; mark the center with a piece of masking tape at 40 to 42 inches from the floor.

5. Have student A fasten the suction cup at the edge of the door, at a level even with the height of the piece of masking tape and as near as possible to the door edge. (The damp sponge can be used to wipe the surfaces of the suction cups and the door, thereby assuring a good seal.)

6. Attach a spring scale to the hook on the first suction cup with a length of chain as shown in Figure 1.

7. Make sure the door is slightly ajar. Have student A pull on the spring scale in a straight line — perpendicular to the door surface. Have student B read the scale reading when the door just starts to move. Record this value on the board.

8. Have students A and B exchange places and repeat step 7.

9. Now connect the second suction cup at the same height — but just to the right of the center mark.

10. Repeat steps 7 and 8.

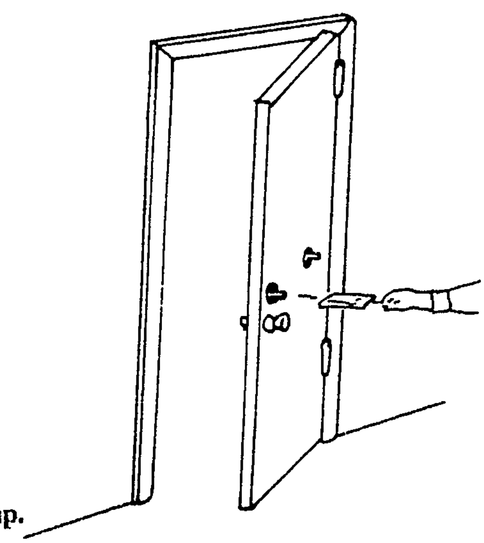


Figure 1. Experimental setup.

Discussion:

1. Did it take more force to open the door with the spring scale pulling at the edge of the door or at the center of the door?

2. Which position had the shorter lever arm?

3. If it takes more force to open the door with the shorter lever arm, would you expect that more or less force would be needed to open the door if the spring scale were connected to the door next to the hinges?

NOTE: To emphasize the point about lever arms and force interaction, you might locate one of the suction cups on the door near the hinges. Attach the spring scale with the chain and try to move the door. More than likely, the force needed will exceed the limits of the spring scale! This will dramatize the dependence of torque on the lever arm.

4. If you were given the job of tightening a bolt with a socket wrench, would you prefer a wrench with a short handle or a wrench with a long handle? Why?

5. What would be the effect of fitting a long pipe over the end of the wrench handle? Why should this practice be avoided?

NOTE: **▲ CAUTION: It's important that you, the instructor, point out the practical danger involved in using a "cheater" or extension bar. There is a possibility of material failure or breakage of the wrench. Consider: If a bolt of 1/2" diameter is the object to which the 190 ft-lb of torque is applied, then 9,120.0 pounds (4.56 tons) of force act on the surface edge of the bolt (1/48 ft x 9120 lb = 190 ft-lb).**

Part Two: How does a torque wrench work?

1. Clamp the socket fixture to the front edge of the demonstration table as shown in Figure 2.

2. Clamp the hook to the torque wrench on the handle.

NOTE: Have students look at the handle of the beam-type torque wrench and see how it is mounted. Notice that the handle pivots from one point; it is near this point the weight must be suspended. When weight is suspended from the handle, the handle will pivot. This will result in a slight measurement error. Emphasize the importance of allowing the handle to "float" on its pivot to make accurate torque measurements with a "beam" type torque wrench.

3. Connect torque wrench as shown in Figure 2.

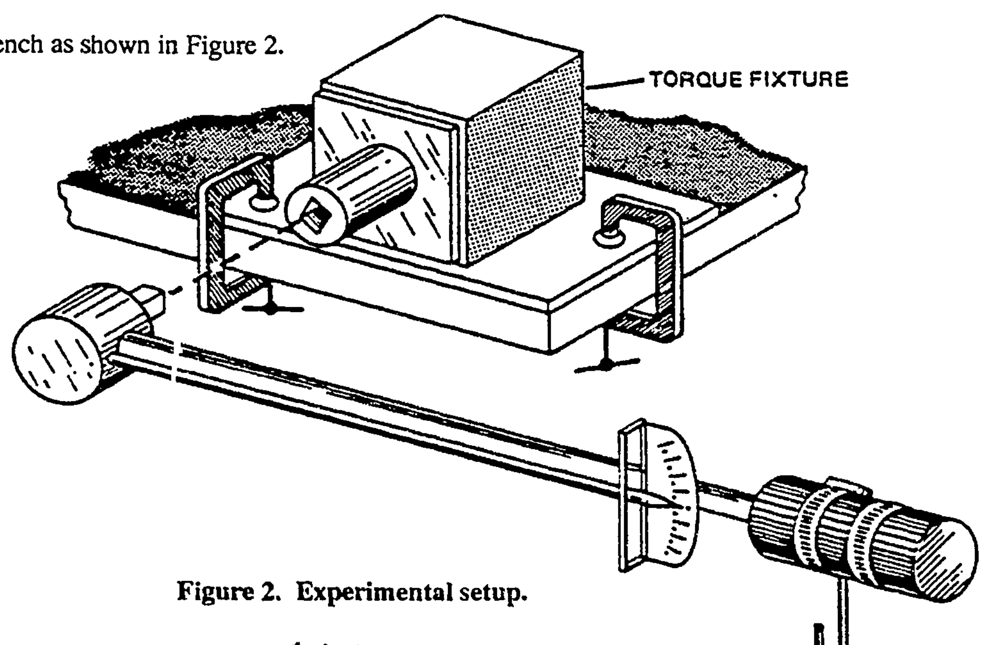


Figure 2. Experimental setup.

4. Hang a gallon can (filled with sand) from the hook at the pivot point on the handle. Have a student read the torque in pound-feet. Record this value on the board.

5. Ask the students to identify clearly the applied force and the lever arm.

6. Ask students how they could check the torque reading recorded in step 4 above.

7. Ask students to give a good reason why the handle on the torque wrench is mounted the way it is. (To have accurate readings, handle should not contact shaft of wrench except at the pivot point.)

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #9

Fluid Pressure (Force) — Demonstration

Purpose:

1. To show the following:
   a. Pressure causes fluids to move.
   b. Pressure increases with depth of fluid.
   c. Pressure and flow rate in a fluid circuit are proportional.

Materials:

1. flow indicator
2. two large liquid containers with outlets
3. two sections of Tygon bubble tubing
4. two to four tubing connector clamps
5. tubing clamp
6. heavy-duty laboratory jack
7. two tubing adapters
8. stopwatch
9. two large beakers

Setup:

1. Connect apparatus, as shown in Figure 1 below.

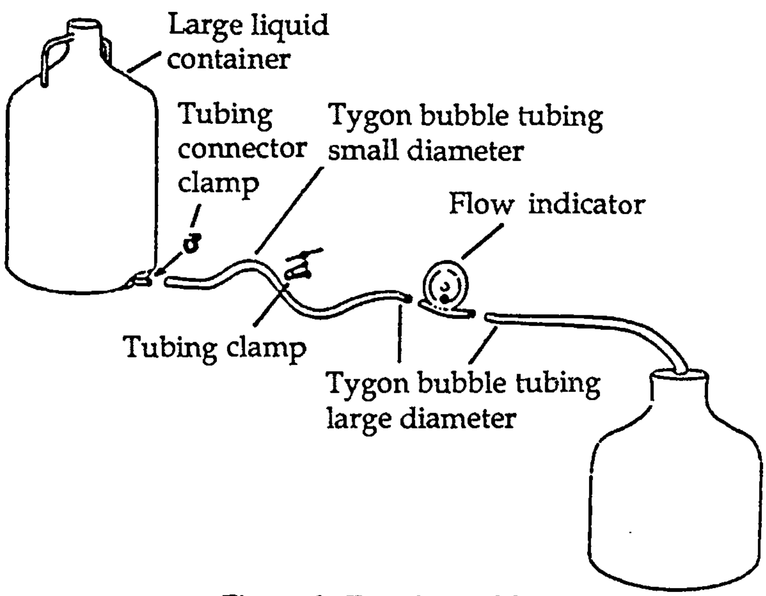


Figure 1. Experimental Setup.

2. Place tubing clamp between the flow indicator and the large liquid containers. Close it to ensure that no flow will occur.

3. Fill the upper container with 4 to 4 1/2 gallons of water and mark level container wall.

4. Adjust laboratory jack so that its upper stage is opposite the water level (mark) on the fluid container. Leave jack at this level throughout demonstration.

5. With the receiving container (or sink) at a level lower than table height, do the following:

   a. Place the laboratory jack next to the filled container.
   b. Be sure the flow indicator is visible to the class.
   c. Be sure the filled container is vented at the top so that water flows freely out of the bottom.

6. Select one student to use stopwatch and one student to count the revolutions of the flow indicator ball. Explain the procedure you'll follow. Do not discuss what outcome you expect.

Procedure:

1. Open the tubing clamp. Allow a good flow through the indicator.

2. Have student with stopwatch *start* timing when the student counting indicator revolutions counts "5" and *stop* timing at a count of "25." Read stopwatch time. Close tubing clamp and record time for 20 indicator revolutions on the board.

3. Refill the liquid container to initial level (at mark). Place the fluid container *on* the laboratory jack. Note that the water level is now twice as high. Repeat step 2. (Increased height of fluid causes greater pressure which in turn causes fluid to move faster. Therefore, time for 20 revolutions should be less with container on jack.)

4. Ask students the following questions:

   a. What did you observe with respect to the flow indicator when the height of the fluid was raised? (Indicator ball moved faster.)
   b. What did raising the height of the water level above the table surface do to the pressure of the fluid at the outflow end of the tube? (Increased the pressure; water came out faster.)
   c. How can we verify that we saw a greater flow rate with an increased height? (Measure how much fluid flows through the tube in each case — for the same time interval — and compare.)

5. Refill liquid container to same level (mark on wall). Place container on table surface.

6. With student help, catch a timed-flow of water in one of the large beakers. Select time interval so that beaker fills to no more than about 1/3 of its height. Be sure water is flowing at start of counting. Use tube clamp to close water flow at end of counting. Record time interval.

7. Refill container to same level (mark on wall). Place container on raised lab jack and repeat step 6, using second beaker to catch flowing water. Be sure to catch the water during the *same* time interval recorded in step 6.

8. Show students the two beakers and allow them to make the comparison. What is their conclusion?

9. Ask students what devices or techniques were used to measure flow rate in this demonstration. Should better devices or techniques be used in an industrial plant? Talk about accurate flow measurement instruments used in industry.

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #10

Electrical Forces (Force) — Demonstration

Purpose:

1. To show the following:
   a. Voltage is the prime mover in electrical systems.
   b. Voltage causes electrons to flow in a circuit.

Materials:

1. two lantern—type batteries, 1.5 volts each
2. two volt-ohm-milliammeters (VOMs)
3. three rolls of hookup wire (1 red, 1 black, and 1 yellow)
4. miniature alligator clips
5. SPST knife switch

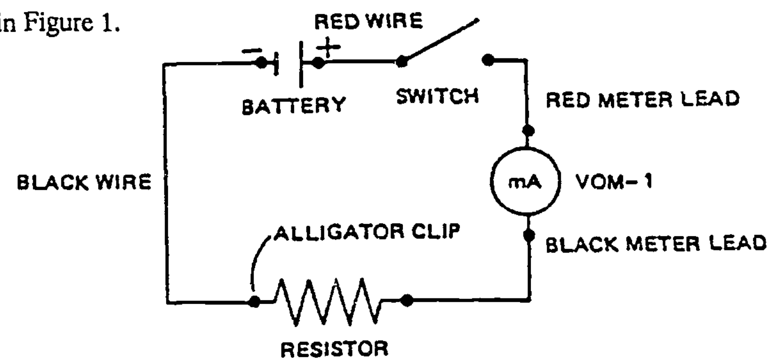
Setup:

1. Set out items called for under *Materials*.

2. Prepare leads for demonstration.

   a. Measure off and cut the following:
      6" wire from the black insulation roll.
      4" wire from the red insulation roll.
      6" wire from the yellow insulation roll.
   b. Strip 1/4" to 3/8" of insulation from the end of each wire lead.
   c. Attach the alligator clip to one end of the black insulation wires.

3. Connect the circuit as shown in Figure 1.



NOTE: Be sure switch is open before last wire is in place.

Figure 1. Laboratory setup.

4. Set the range/function dial on the VOM connected in the circuit. (This VOM will be called VOM - 1 from here on.)
   a. Function: (current) + DC
   b. Range: 100 mA

5. Set the second VOM (VOM - 2) dials.
   a. Function: (voltage) + DC
   b. Range: 3 to 5 volts

6. Draw Figure 1 on the blackboard or prepare an overhead transparency before class.

Procedure:

1. Review proper circuit connection procedures with students.

NOTE:
a. DC circuits often have voltage polarities indicated by color — red for positive, black for negative.
b. When a circuit is connected properly (according to a schematic), one can trace all wires and connections, starting at one battery terminal, following the entire circuit and ending at the other terminal.

2. Use VOM - 2 to measure the battery voltage. (This is done by connecting red meter lead to the positive [+] terminal and the black meter lead to the negative [-] terminal.)

3. Close the switch and measure the voltage with VOM - 2 across the resistor. Make sure that VOM - 2 leads are connected across resistor to give a positive voltage reading. Compare voltage readings across battery and resistor.

4. Adjust the range of VOM - 1 for the maximum upscale indication of the needle. Point out that VOM - 1 measures flow (movement of electrons) in circuit.

5. Open switch.

Discussion:

1. VOM - 2 is used as a voltmeter to measure across circuit elements.

2. VOM - 1 is used to measure electron flow in the circuit.

3. Voltage measurements are made across a voltage source or across a circuit component. (Voltmeters never break a circuit when in use.)

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #11

Fluid Rate (Rate) — Demonstration

Purpose:

1. To show the following:
   a. Fluid-flow rates involve movement of a mass or volume of fluid in a given time interval.
   b. Fluid-flow rates can be measured as either mass-flow rates or volume-flow rates.

Materials:

1. large aspirator bottle
2. 5-gallon bucket
3. triple-beam balance
4. 2 beakers, 1 liter each
5. stopwatch
6. tube clamp

Procedure:

Part one: Volume-flow Rate

1. Set up apparatus, as shown in Figure 1.

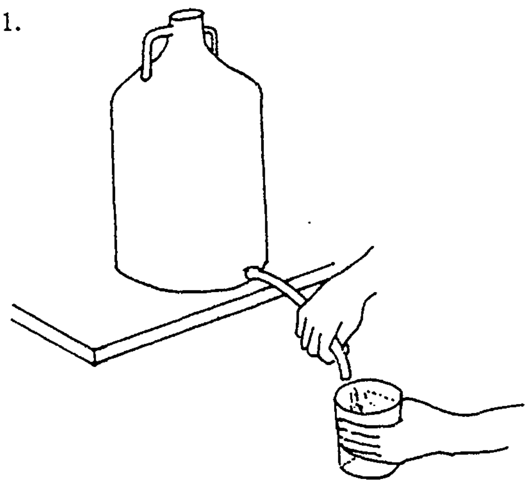


Figure 1. Lab setup.

2. Ask two students to help you conduct this part of the demonstration. One student will operate a stopwatch; the other student will hold the one-liter beaker.

3. Hold your thumb over the end of the outlet tube while you open the tubing clamp. Allow water to begin entering the beaker by removing your thumb.

4. Instruct the student holding the stopwatch to measure the time it takes for a given volume of water — such as 200 milliliters (200 cm^3) — to flow into the beaker. Record this time interval on the chalkboard.

5. Stop the flow with your thumb. Close the tube clamp.

6. Calculate the volume flow rate by:

   Q^v = 200ml/time interval = __________ ml/sec = __________ cm^3/sec.

7. Ask students to explain how a storage tank might be filled by a pump, and how pumps are rated.

8. Point out to students that if *volume*-flow rate is known, the *mass*-flow rate can be calculated by using the fluid mass density (p_m). Write $p_m = m/V$ on board. Then show that $m = p_m \times V$. Then convert reading above (cm^3/sec) to gm/sec. (**NOTE:** For this demonstration, assume that standard temperature and pure water are used. By doing this, one cm^3 converts directly to one gm.)

Part two: Mass-Flow Rate.

1. Fill a beaker full of water. Use a triple-beam balance to weigh it. Record the weight on the chalkboard. Empty the beaker. Weigh the empty beaker. Calculate the weight of the water.

   $$\text{Weight}_{water} = \text{Weight}_{full} - \text{Weight}_{empty}$$

2. Record the weight (mass) of the water on the chalkboard. (**NOTE:** A one gram weight, measured on the balance, is the same as a one gram mass.)

3. Ask two students to help take the following measurements. Give one student the stopwatch. Instruct this student to measure the time it takes the other student to fill a beaker with water. Ask the other student to fill the beaker with water from the container used in Part One. This student will call out "start" and "stop" to the student with the stopwatch. (**NOTE:** This can be messy if water overflows. Be sure to control starting and stopping of water flow with your thumb over tube, as in Part One. Provide for overflow water to fall into bucket.)

4. Repeat step 3 several times, until measurement process is reliable.

5. Calculate mass-flow rate from the equation:

   $O_m = m/t$

   where: m = mass measured in Step 1
   t = time measured in Steps 3 and 4

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

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STUDENT WORKSHEET #12

Resistance to Airflow (Resistance) — Demonstration

Purpose:

1. To show the following:
   a. Pressure drop across an air filter increases as contaminants are collected.
   b. Accumulation of contaminants in an air filter will increase resistance to airflow.

Materials:

1. auto air-filter
2. Mylar ribbon strips (Used C-90 cassette tapes are an excellent source.)
3. flow shroud (enclosed "box" with an open top that air filter just fits in)
4. vacuum cleaner
5. slant-tube manometer
6. confetti

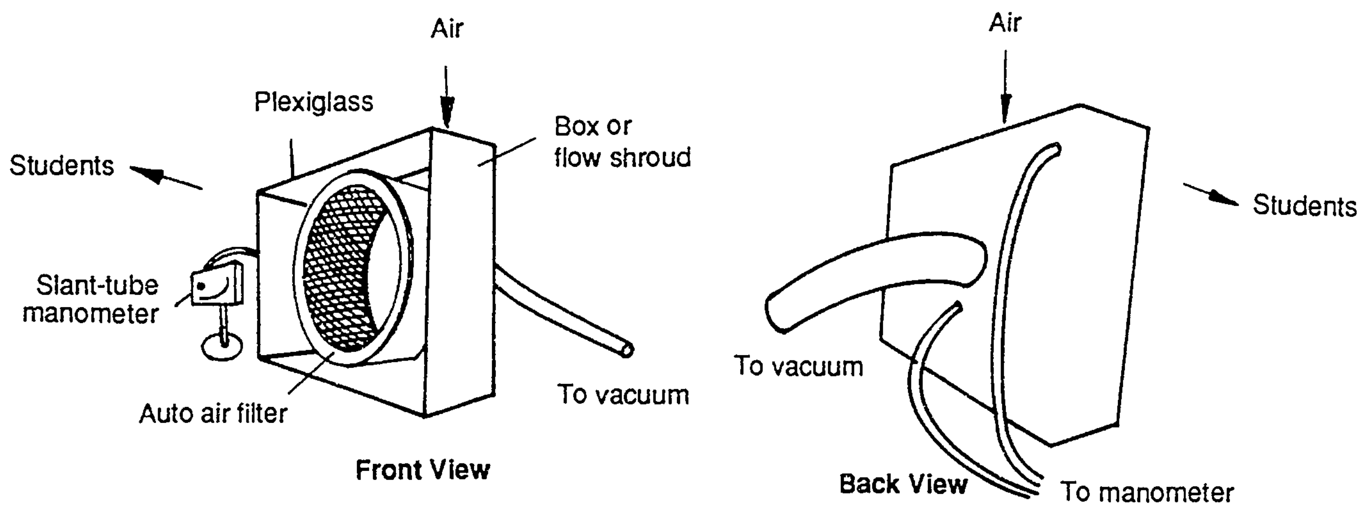


Figure 1. Demonstration apparatus.

About the Flow Shroud

This box should have just enough thickness for the auto air cleaner to fit between the backboard and front Plexiglass sheet. Seal the filters in by using silicon sealant on the top and bottom of the air filter.

The manometer connections should allow you to measure pressure difference across the filter material. One porthole should be inside the filter, the other, should be outside. (See Figure 1.)

Procedure:

Before Class

1. Attach several Mylar strips (each 4" to 6" long) to the inside surface of the air filter.

2. Place filter section in shroud. Secure and seal.

3. Connect the vacuum and manometer lines to the apparatus.

4. Place the apparatus on demonstration table with the plexiglass side of the shroud toward students. The open edge of the shroud should face upward.

Conducting the Demonstration

1. Turn the vacuum **ON.**
2. Have students watch the action of the Mylar strips. Note the pressure drop (Δp) across the filter, as indicated on the slant-tube manometer.
3. Slowly sprinkle pieces of confetti into the air stream so that the pieces will stick to the filter.
4. Have students observe the action of the Mylar and the slant-tube manometer.

Discussion

1. What does the pressure drop across the clean air filter indicate? (Answer: That the filter — even when clean — partially restricts airflow.)
2. What happened to the Mylar strips as the filter became clogged with confetti? (Answer: They are not pulled towards vacuum porthole as hard.)
3. What does this indicate about the flow rate? What happened to the measure of Δp while this happened? (Answer: Flow rate decreases; Δp increases.)
4. What happens to flow rate and pressure drop when fluid resistance increases? (Answer: Q_v decreases; Δp increases.)

Questions:

1. What implications does this scientific principle have for agriculture?
2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #13

Mechanical Friction and Lubrication (Resistance) — Demonstration

Purpose:

1. To show the following:
   a. The force of friction between two moving surfaces depends on the coefficient of friction and the normal force pressing two surfaces together.
   b. The force of friction between two moving surfaces doesn't depend on the area of contact between moving forces.
   c. Lubrication of surfaces significantly reduces friction.

Materials:

1. 18" x 6" aluminum plate, 1/4" thick
2. two smooth-surfaced weights
   a. weight A (one-pound pig lead ingot)
   b. weight B (two-pound pig lead ingot — two 1-lb ingots, one on top of the other "taped" together)
3. one ounce of lubricating oil
4. two cup-hook screws
5. one spring-balance scale

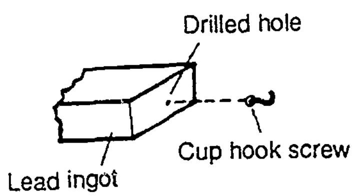
Note: The lead ingots are available from Brodhead-Garrett under catalog number 208349 at a cost of approximately $1.13 per pound.

Procedure:

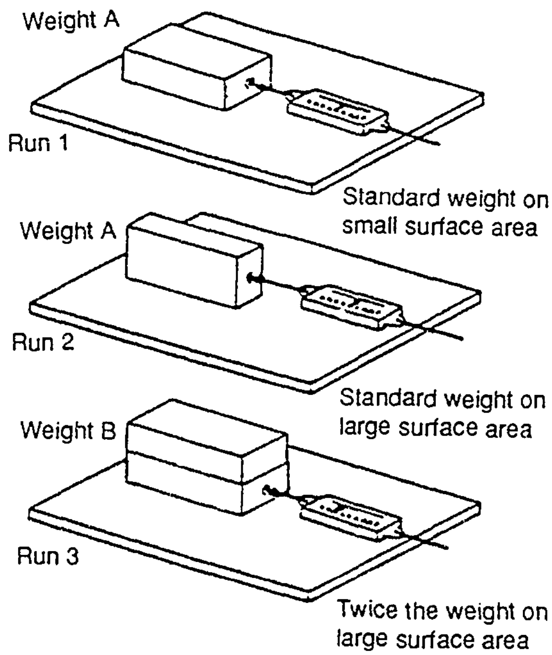
Part A: Friction Without Lubrication.

1. Attach cup-hook screws to ingots, as shown in Figure 1a.

2. Set up apparatus, as shown in Figure 1b.



a. Preparing lead ingot bar



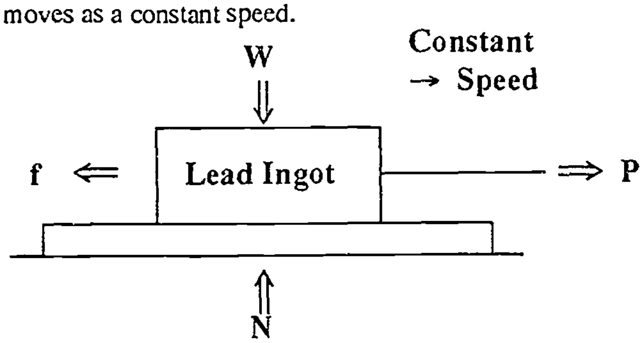
b. Conducting the demo

Figure 1. Demonstration Setup.

3. Ask two students to assist you. One student will pull on spring scale with just enough force to move the ingot across the aluminum plate at a slow, **constant speed.** While ingot is in motion, other student will read pulling force on the spring scale and record on the chalkboard. Do this for three runs, as described below.

   a. Trial 1: Weight A with large surface area in contact with plate.
   b. Trial 2: Weight A with small surface area in contact with plate.
   c. Trial 3: Weight B with large surface area in contact with plate.

4. Place the following drawing on the board. Explain (1) that since the table top is horizontal, the normal force (N) is equal to the ingot weight (W); and (2) pulling force (P) — indicated on spring scale — is equal to frictional force (f), so long as the ingot moves as a constant speed.



5. Write the equation for frictional force(f) and coefficient of friction (μ) on the board. Explain each term:

$$f = \mu \times N \text{ or } \mu = f/N$$

where: f = frictional force between moving surfaces (equal to pulling force [P] in Trials 1, 2, 3)

μ = Coefficient of friction (lead on aluminum)

N = normal force (equal to ingot weight in Trials 1, 2, 3)

6. Discuss the results of the three trials.

   a. Compare Trials 1 and 2 to study the effect of surface area. The frictional force (f) — pull P on spring scale — should be the *same* for Trials 1 and 2. (They may not be exactly the same. That's because pulling on a spring scale to cause constant speed movement, and reading the scale at the same time is not a good way to measure forces accurately. But the readings should be close, anyway.) Ask students what the results of Trials 1 and 2 tell us about the effect of surface area on frictional force.
   b. Compare Trials 1 and 3 to study the effect of normal force. The frictional force for Trial 3 should be about twice that for Trial 1 — if weight B is twice that of weight A. Ask students to describe the effect of normal force on the frictional force, based on the results of Trials 1 and 3.

7. Use the equation, $f = \mu N$, in the form, $\mu = f/N$. Calculate an approximate value for μ for each of the three trials. (For each trial, f is equal to the pulling force [P], and N is equal to the weight of the ingot used.) The results should all be very close, since the coefficient of friction (μ) depends only on the nature of the two moving surfaces (lead on aluminum) and not on the surface area or normal force.

Part B: Friction With Lubrication.

8. Apply a **thin**, uniform coating of oil to the surface of the aluminum plate.

9. Repeat Trials 1, 2, and 3, measuring the required pulling force [P] each time.

10. Discuss the results with your class.

    a. As a result of adding lubricant, what happened to the pulling force required to cause constant speed motion?
    b. What happened to the force of friction?
    c. Did the nature of the moving surfaces change?
    d. Would the coefficient of friction for lead moving on aluminum (with an oil layer in between) be different from that calculated in Step 7?
    e. Is lubrication of moving surfaces important in reducing wear?

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #14

Thermal Resistance (Resistance) — Demonstration

Purpose:

1. To show that various materials have different thermal resistance to the flow of heat.

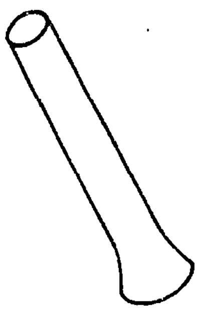
Materials:

1. Bunsen or Fisher burner (or optional butane torch)
2. two strips of insulation, each 2 inches wide x 1/4 inch thick with a length of 3 1/4 inches (We suggest fiberglass and one of the new asbestos replacements.)
3. reversible temperature-indicator strip (This strip is available from Omega Engineering, Inc., catalog number RT-50, at $15.00 for a package of 5 strips 0.8 inches wide x 6.4 inches long — contact phone (203) 359-1660.)
4. copper pipe — 1 inch diameter by 1 foot length
5. aluminum foil — 4 1/2 inches wide x 7 inches long
6. support stand, clamps, and rod
7. double-stick tape
8. temperature crayons (70°-100°C color change)

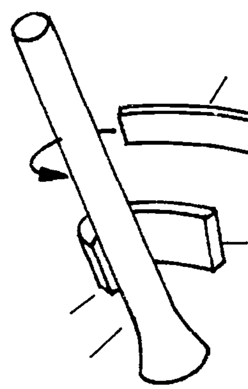
Setup:

Assemble a chimney section of copper pipe with various sections of insulation wrapped around it before class. See Figure 1 for the steps in assembly.

Step 1. Flair one end of the copper pipe.

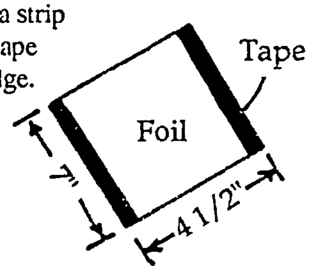


Step 2. At a distance of about 1/2" above the pipe flair, wrap the highest temperature insulation around pipe and secure.

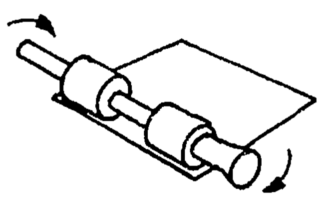


Step 3. At a distance of 2 1/2" above the first wrap of insulation, wrap the second strip of insulation and secure.

Step 4. Lay the aluminum foil sheet down and place a strip of double-stick tape along each 7" edge.

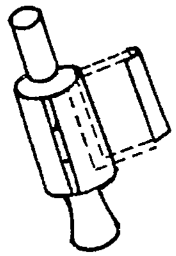


Step 5. Lay the copper pipe with the insulation strips down on the double strip tape as shown.



Step 6. Roll the foil up around the chimney assembly and tape to keep in place.

Step 7. Your chimney assembly should look like this and be ready for the temperature indicator strip.



The indicator strip is adhesive-backed to facilitate its placement.

Figure 1. Steps in assembly of chimney.

Procedure:

1. Set up the apparatus, as shown in Figure 2 below.

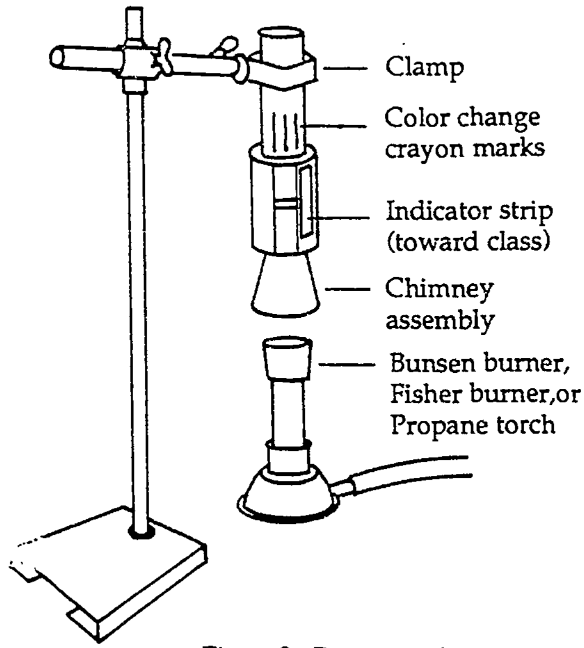


Figure 2. Demonstration setup.

2. Using the open slit in the outer aluminum foil wrap, point out the different types of insulation. Also point out the section of dead air space.
3. Light Bunsen burner. Place under the chimney.
4. Ask students to watch the temperature indicator strips. Students should observe changes in color as time elapses.

Discussion:

1. Which color indicator (crayon or strip) changed color first?
2. List the sections of insulation (#1, #2, or air space) in the order of the color-change appearance. This will help determine which insulation is best and which is worst.
3. Which insulation has the highest thermal resistance?
4. Why would you want to insulate a chimney?

Questions:

1. What implications does this scientific principle have for agriculture?
2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #15

Fluid Power (Power) — Demonstration

Purpose:

1. To show how fluid power developed by a motor depends on pressure difference and flow rate.

Materials:

1. support stands
2. cord
3. small weight set
4. weight hanger, 50-gm
5. air motor
6. air tank
7. pressure regulator, with pressure gauge
8. rotameter
9. stopwatch
10. tape
11. pulley

Setup:

1. Ensure that the air tank is charged to 90 psi minimum for the demonstration.

2. Set up the equipment, as shown in Figure 1.

3. Measure 46 centimeters from the base of the support stand. Wrap a piece of tape around one of the support rods to mark this height. Then measure a distance of 1 meter farther up the support rod. Mark this height with a second piece of tape.

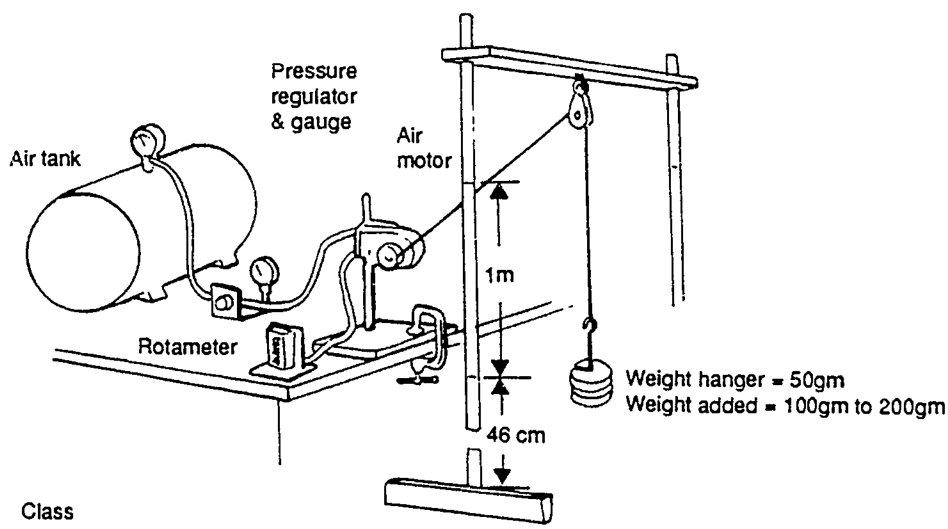


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Figure 1. Demonstration setup.

Procedure:

1. Ask two students to help you do the demonstration. One student will use the stopwatch to time the travel of the weights through the measured 1-meter distance. The other student will read and record the pressure difference across the air motor and the flow rate registered on the rotameter.

2. Pinch the tubing between the pressure gauge and the air motor so that no air can flow. Next, open the flow-control valve on the air tank. Then adjust the pressure regulator for a reading of 12 to 14 psi on the pressure gauge. Close the air tank's flow-control valve. Then release the tubing.

3. Make sure that students know what they're supposed to do for Steps 4 through 6. (They're supposed to measure the lift time through the 1-meter distance with a stopwatch; read the pressure difference [Δp] on the pressure gauge; and then read the flow rate [Q_v] on the rotameter.)

4. Open the air tank's flow control valve. Take readings as the weight moves past the lower mark of the1-meter distance. Close the air flow-control valve as soon as the weight has been moved past the upper mark of the 1-meter distance.

5. Record the flow rate (Q_v), the pressure difference(Δp), and the time of the lift(t) on the chalkboard.

6. Repeat Steps 2 through 6 — with one change in Step 2. Adjust the pressure gauge for a reading of 16 to 18 psi on the pressure gauge.

7. Calculate the fluid power input and the mechanical power output for each trial. Use the equations:

Mechanical Work: W = Weight lifted x height

W = [mass(kg) x 9.8 m/sec^2] x 1 m

W = (______) kg • m/sec^2 x 1 m

W = (______) N • m [Recall, 1 (kg • m)/sec^2 = 1 N)

Mechanical Power: P = W/t = (______)/(______) (N • m)/sec

P_{mech} = (______) N • m sec

Fluid Power: P = Δp x Q_v (Use correct units)

P = (_______N/m^2) x (______m^3/sec)

P_{fluid} = _________(N • m)/sec

8. Record the answers on the chalkboard.

9. Ask students to examine the data on the board. Then ask your students to answer the following questions:
   a. How did the fluid power vary with the pressure difference? (The fluid power increased as the pressure difference increased.)
   b. How did the fluid power vary with the flow rate? (The fluid power increased as the flow rate increased.)
   c. How did the mechanical power output vary with the fluid power? (The mechanical power output increased as the fluid power input increased.)

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #16

Mechanical Power (Power) — Demonstration

Purpose:

1. To show the rate of doing mechanical work — mechanical power.

Materials:

1. large support stand
2. large slotted-weight set
3. weight hanger
4. cord, 8-ft length, 60-lb test
5. pulley
6. meter stick
7. tape
8. stopwatch

Procedure:

1. Ask the students to define work in the mechanical system.

Mechanical Work = Force Applied x Distance Moved

2. Ask a student to help you set up and run this demonstration.

3. a. Set up the equipment, as shown in Figure 1.
   b. Measure 46 centimeters up from the base of the support stand. Wrap a piece of tape around one of the support rods to mark this height. Then measure a distance of 1 meter farther up the support rod. Mark this height with a second piece of tape.

4. Give the student a stopwatch. Have the student stand in a position to observe the rising weight and ALSO see the tape marks on the support rod. (Do not block the class's view of the apparatus.) Ask the student to start the stopwatch when the weight rises past the bottom mark and stop the watch when the weight rises past the top mark.

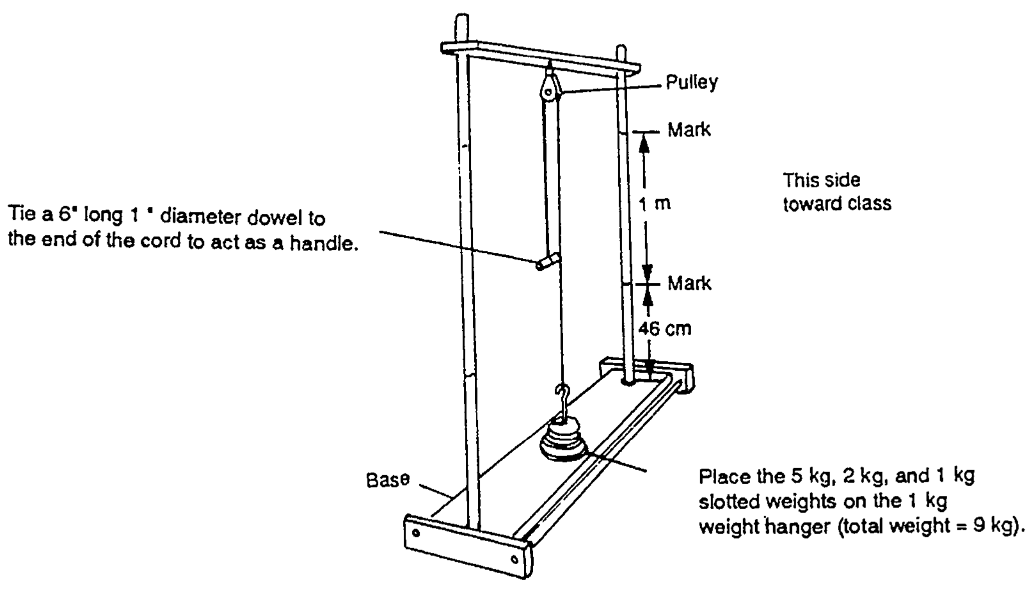

Figure 1. Demonstration setup.

5. Ask the students in class to calculate the amount of work that will be done to move the 9-kg mass through a distance of 1 meter.

$$\text{Work Done} = \text{Weight} \times \text{Height} = mg \times h$$
$$W = [(9\,kg)(9.8\ m/sec^2)] \times (1\,m) = 88.2\ N\cdot m$$

6. Now direct another student to pull on the cord handle and lift the weight through one meter of height. The first trial should be done rather slowly. The second trial should be done much faster. Ask the student with the stopwatch to record the times as indicated in Step 4.

7. Record the amount of time each trial took on the chalkboard.

8. Emphasize to your class that the **same** amount of **work** was done in each of the two trials — but the amount of **time** it took to do the work was different. Point out that **how fast** work is done determines power.

9. Calculate the power for each trial on the chalkboard. Point out the difference. Ask the student lifting the load if he or she exerted more effort (power) while lifting the load faster.

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

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STUDENT WORKSHEET #17

Mechanical Force Transformer (Force Transformer) — Demonstration

Purpose:

1. To show students a variety of mechanical force transformers.
2. To show how using force transformers makes work easier.

Materials:

1. claw hammer
2. nutcracker
3. hydraulic lift
4. paper cutter
5. tongs
6. wheelbarrow
7. windshield wiper system
8. wood screw
9. board (inclined plane)

NOTE: If you don't have these items on hand, you can use overhead transparencies to show each. This will accomplish the same results.

Procedure:

1. Review the three main parts of a lever:

    a. The input — sometimes called "the effort."
    b. The fulcrum or pivot point.
    c. The output — sometimes called "the load."

2. Review the characteristics of each class of lever:

    a. First Class Lever — The fulcrum is always between the effort and the load. The direction of action for the output is opposite to that of the input. Force or displacement is amplified — depending on the position of the fulcrum.
    b. Second-Class Lever — The effort and load are on the same side of the fulcrum, with the load closer to the fulcrum. The direction of action for the output and input is the same. Input force is amplified at the expense of displacement.
    c. Third-Class Lever — The effort and load are on the same side of the fulcrum. However, the effort is closer to the fulcrum. The direction of action is the same for both input and output. Displacement of the load is magnified at the expense of force at the input point.

3. Ask a student to remove two long nails from a board using a claw hammer. (Nails, about 2•" long, should be driven in a 2" x 4" board. About 3/4" of the nail should extend above the board.)

    a. Remove the first nail with a hammer.
    b. Remove the second nail with a small block placed under the pivot of the hammer.

4. Ask questions:

    a. What type of lever is the claw hammer? (first class)
    b. How can you tell? (relative position of input, fulcrum, output)
    c. Which nail was easier to pull: with or without the block? (with)
    d. Why did the block help pull the nail? (The block moves the fulcrum closer to the load thereby increasing the mechanical advantage.)

5. Show actual item or show a transparency of each of the following. Ask students to identify the position of the effort, the fulcrum, and the load. Ask students to identify the direction of action for input and output. Ask students to place the name of the item under its proper class.

   a. Hydraulic jack (handle only) — second class
   b. Paper cutter — second class
   c. Tongs — first class
   d. Windshield wiper system — third class
   e. Person's forearm — third class
   f. Wheelbarrow — second class
   g. Nutcracker — first class

6. Discuss the inclined plane and the screw as linear force transformers. Show examples. Draw a diagram on the board. Identify the pitch of the screw. You may wish to also show the use of vises and jacks. Demonstrate by putting a wood screw in the board. Why would placing soap on the screw threads make the screw easier to drive?

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #18

Rotational Force Transformer (Force Transformer) — Demonstration

Purpose:

1. To show how a multiple-step, wheel-and-axle rotational force transformer can be used to exchange torque for rotational speed.

Materials:

1. DC power supply
2. DC motor with 1•" drive wheel
3. stroboscope
4. multiple-step pulley
5. rubber bands
6. support stand with accessories

Procedure:

1. Set up apparatus, as shown in Figure 1.

   NOTE: Place the rubber bands around each of the stepped pulleys to provide good traction for the motor friction pulley.

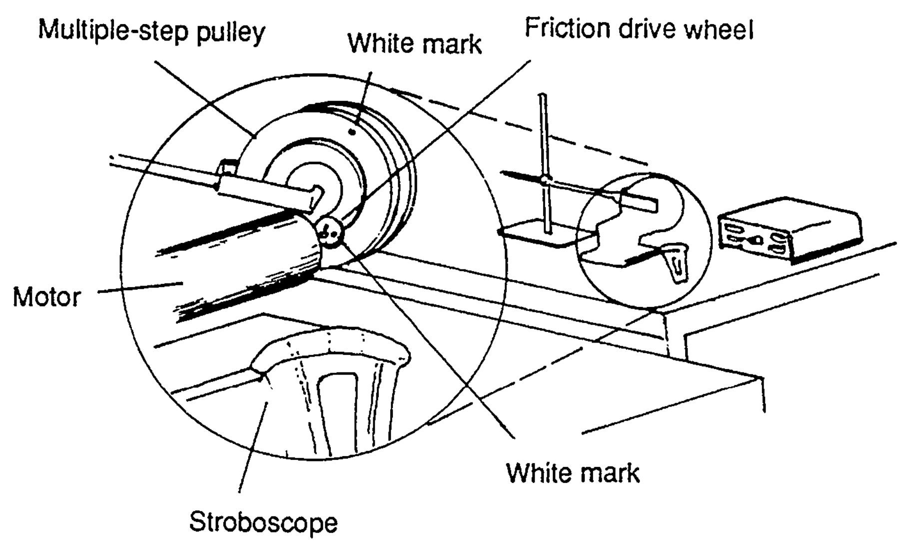

Figure 1. Demonstration setup.

2. Adjust the setup so that the drive wheel will make good contact with the next-to-the-smallest-step radius.

3. Set the strobe to 200 flashes per minute (fpm).

4. Turn the power supply ON. Adjust the voltage until you have the motor turning at approximately 200 fpm, as indicated by the white mark on the drive wheel.

5. Adjust the flash rate on the strobe to stop the white mark on the stepped pulley. Record the fpm measurement on the board.

6. Turn motor and strobe OFF. Discuss the following questions:

   a. Which turned slower, the motor or the stepped pulley?
   b. Which wheel is larger, the friction drive or the wheel step with which it was in contact?

7. Move the motor so that it contacts the smallest-diameter wheel step.

8. Have students predict whether the drive wheel will rotate faster or slower than the stepped wheel (the driven wheel).

9. Repeat steps 3 through 6.

10. Move the motor so that it contacts the largest-diameter wheel step.

11. Again, have the students predict whether the drive wheel will rotate faster or slower than the stepped wheel.

12. Repeat steps 3 through 6.

13. Summarize observations by use of symbols and chart, such as:

    D_m — means "diameter of motor drive wheel"
    D_p — means "diameter of pulley"
    $>$ — means less than
    $<$ — means more than
    ω_m — motor's rotational speed
    ω_p — pulley's rotational speed

    Label each step on the pulley with a number. Start with the smallest step, labeled as #1. Sequentially number the steps up to the largest step.

    Summary chart

    If D_p of step #1 $< D_m$, then $\omega_p > \omega_m$
    If D_p of step #2 $> D_m$, then $\omega_p < \omega_m$
    If D_p of step #3 $< D_m$, then $\omega_p < \omega_m$
    If D_p of step #4 $> D_m$, then $\omega_p > \omega_m$

    Using the summary chart, ask the students to make a general statement about the relationship of wheel sizes and speeds when larger and smaller wheels are in contact.

Discussion:

1. If the amount of force available at the surface of the drive wheel is always the same, and if there's no slippage between the surface of the drive wheel and a step of the multiple-step pulley:

   a. Which pulley step provides the greatest torque about the pulley axis? (The largest pulley, since $T = F \times r$, where "r" is the pulley radius.)

   b. Which pulley step provides the least amount of torque about the pulley axis? (The smallest pulley, since "r" is smallest.)

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

STUDENT WORKSHEET #19

Momentum and Impulse (Momentum) — Demonstration

Purpose:

1. To show the following:
   a. That the momentum in an isolated system is conserved (remains constant) "just before" and "just after" a collision.
   b. That impact forces in a "collision" depend on how fast moving objects are stopped — that is, on how fast or slow the momentum is changed.

Materials:

1. three lumps of modeling clay
2. five glass marbles of the same size and weight
3. two sections of aluminum V-track, one 3 to 4 ft long and one 8 inches long
4. one fresh egg (in shell)
5. hot-water bottle
6. meter stick

Setup:

Part 1: Set the long (3 to 4 ft) V-track section on the demonstration table. Level it and support it with modeling clay. (See Figure 1.)

½ **Part 2:** Partially inflate the hot-water bottle with air so that an egg can be dropped onto it from at least 1 meters and not break.

NOTE: Review the steps in the demonstration for both parts so that you avoid "surprises" during the class demonstration.

Procedure:

Part 1: Conservation of Momentum.

1. The V-track should appear as shown in Figure 1. Have the clay block at one end of track as a brake for the marbles. Always have marbles line up, touching one another, as shown.

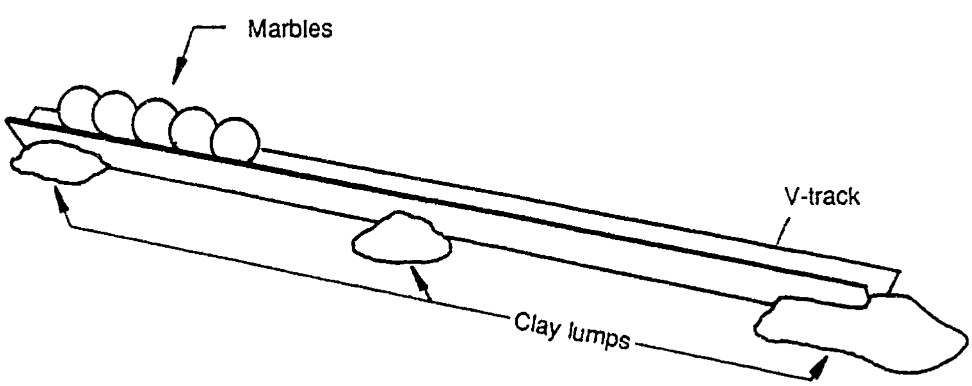

Figure 1. Demo Setup.

2. Leave four of the marbles on the track. Take one marble and the short V-track section and position as shown in Figure 2. With your finger, hold the marble near the top of the short V-track section.

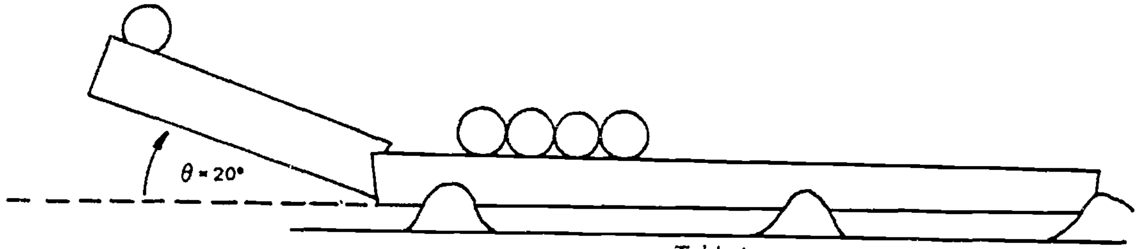

Figure 2. Setup at instant of release.

3. Release the single marble. Let it roll down the short section and onto the long V-track section. Ask a student to describe what happened once the marbles stop moving. Be sure to answer the following questions.

   a. What's the "isolated system"? (The isolated system is the five marbles.)
   b. What's the momentum *just before* impact? (It's the momentum of the single moving marble.)
   c. What is the momentum *just after* impact? (The momentum of the marble moved by impact.)
   d. Was momentum conserved? (Yes it was.)

4. Return the four marbles on the long section to their original position. Remove a marble and move it to the top of the short section.

5. Repeat steps 2 and 3, with two marbles rolling down the short section and striking the three marbles at rest. Discuss what happened. Answer questions 3a through 3d for this demonstration. Be sure to show that *momentum was conserved.*

6. Ask students to predict what will happen if three marbles are rolled down the short section and strike the two remaining marbles on the long section. Then try it. Was the prediction correct? Was momentum conserved *just before* and *just after* impact?

Part 2: Change in Momentum and Impact Force.

1. Hold an egg above the floor (about 1 meter high). Ask students to predict what would happen to the egg if you dropped the egg on the floor. Ask them: When does the egg's momentum change suddenly? Where does the impact force come from? How can the impact force be reduced?

2. Now place a hot-water bottle partially inflated with air on the floor. Hold the egg above the hot-water bottle. Ask students if they think anything different might happen if the egg is dropped.

3. Drop the egg onto the hot-water bottle. (It will not break if you have the proper amount of air in the hot-water bottle.) Ask the following questions:
   a. When does the egg's momentum change suddenly?
   b. Where does the impact come from?
   c. Does it take longer for the egg's momentum to reduce to zero?
   d. Will the impact force be smaller?

4. Now drop the egg from the same height (or slightly lower) onto the hard floor. The egg should break.

Discussion:

1. Point out to the students that the saying "speed kills" might be changed to "sudden stops kill." But do not leave the students with the impression that high speeds are not dangerous! Sudden stops are always more "sudden" when speeds are high. So both "speed" and "sudden stops" are dangerous!

2. It is during the sudden stop that impact forces act and damage is done. The partially inflated air bottle first slowed the egg down, then stopped it. The floor just stopped the egg. This points out the importance of the impulse-momentum equation.

3. Review the equation $\Delta mv = F\Delta t$. Point out that:

   a. When the egg is dropped from the same height, the change in momentum(Δmv) at impact is the same for both trials.
   b. The time interval(Δt) is shorter when the egg is stopped by the floor than when it is stopped by the hot-water bottle. Thus, the impact force (F_{floor}) is much greater than the impact force ($F_{hot\text{ - }water\ bottle}$).
   c. Explain how "air bags" in a collision act like the hot-water bottle to protect passengers from injury.

Questions:

1. What implications does this scientific principle have for agriculture?

2. Give examples of agricultural occupations in which this principle is used.

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CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Conserving Agricultural Resources

RELATED PROBLEM AREAS:

1. Understanding Basic Soil Science Principles
2. Using Energy Efficiently
3. Preventing Soil Erosion and Managing Land (Agricultural Business and Management Cluster)
4. Conserving Wildlife Resources (Agricultural Business and Management Cluster)
5. Conserving Water Resources (Agricultural Resources Cluster)
6. Controlling Water Pollution (Agricultural Resources Cluster)
7. Managing Freshwater (Agricultural Resources Cluster)
8. Managing Forestry Resources (Agricultural Resources Cluster)
9. Maintaining Wildlife Habitat (Agricultural Resources Cluster)
10. Growing Plants Hydroponically (Horticulture Cluster)

PREREQUISITE PROBLEM AREA(S)

1. Understanding the Relationship between Agriculture and the Environment

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty H: Managing the Business

1. Develop land use program

Duty L: Growing Corn, Soybeans, Small Grains, or Forage Crops

1. Select planting method

Horticulture Cluster

Duty C: Controlling the Plant Environment

1. Plan conservation practices
2. Control soil erosion

Duty Q: Managing the Business

1. Develop land use program

Agricultural Resources Cluster

Duty D: Managing Facility Flora and Fauna

1. Identify wildlife species within a selected area
2. Identify plant communities and dominant species within a selected area.

STATE GOALS FOR LEARNING

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in the Biological and Physical Sciences and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______

☐ Original submission ☐ Revision

Page ____ of ____

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to demonstrate a knowledge of world geography with emphasis on the United States.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand how decisions affecting the use of the natural environment can have both positive and negative results.					
*2. Understand the kinds of decisions people must make to determine how to use the natural environment.					
*3. Know the reasons for different kinds of land use.					
4. Describe wildlife benefits and habitat requirements and relate these to current livestock and grain farming practices and private owner use of land.					
5. Describe the impact of private ownership on timberland management and timberland's future potential.					
6. Identify major forest areas of the U.S.					
7. Analyze the properties of water that cause it to be vital to an ecosystem.					
1173					1174

ISBE 41-78 (1/88)

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the concerns and basic vocabulary of biological, physical, and environmental sciences and their application to life work in society.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the interactions among populations of plants, herbivores, and carnivores.					
*2. Recognize that good conservation practices depend on understanding the balance between living things and their environment.					
3. Define agricultural resources and related terms.					
4. Identify functions of soil and describe methods of conserving soil.					
5. Explain the hydrologic cycle and relate the cycle's effects on soil and conservation methods					
6. List and identify popular species of wildlife found in Illinois.					
*7. Examine the dynamics of a freshwater system.					
1175					1176

ISBE 41-76 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of social and environmental implications and limitations of technological development.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand ways that people can minimize the depletion of the earth's resources.					
*2. Evaluate the ways in which natural resources have been allocated, utilized, and conserved in the nation.					
3. Identify functions of soil and describe methods of conserving soil.					
4. Explain the hydrologic cycle and relate the cycles effects on soil and water conservation methods.					
5. Describe wildlife benefits and habitat requirements and relate these to current livestock and grain farming practices and private owner use of land.					
6. Describe the impact of private ownership on timberland management and timberland's future potential.					
					1176
1177					

ISBE 41-78 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the processes, techniques, methods, equipment, and available technology of science.

Contact Person:
Title:
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Analyze the results of an experiment.					
1179					
					1180

ISBE 41-78 (1/88)

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Conserving Agricultural Resources

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define agricultural resources and related terms.
2. Identify functions of soil and describe methods of conserving soil.
3. Explain the hydrologic cycle and relate the cycle's effects on soil and water conservation methods.
4. List and identify popular species of wildlife found in Illinois.
5. Describe wildlife benefits and habitat requirements and relate these to current livestock and grain farming practices and private owner use of land.
6. Identify major forest areas in the United States.
7. Describe the impact of private ownership on timberland management and timberland's future potential.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Conserving Agricultural Resources

PROBLEMS AND QUESTIONS FOR STUDY	INSTRUCTOR'S NOTES AND REFERENCES
1. What is soil erosion?	
2. Why is soil erosion important?	
3. What factors affect erosion?	
4. How can soil erosion be minimized?	
5. What is water conservation?	
6. Why is water conservation important?	
7. What is water pollution?	
8. Why is water pollution important?	
9. How can water conservation be improved?	
10. What types of wildlife are found in Illinois?	
11. Why is wildlife important?	
12. What can one do to conserve wildlife?	
13. What practices are beneficial to wildlife?	
14. How do farming practices affect wildlife?	
15. How should different areas be managed to produce wildlife?	
16. Where are forests found in the United States?	
17. Why is timberland important?	
18. Who owns the timberland in the United States?	
19. How should timberland be managed?	

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Conserving Agricultural Resources

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use other science personnel as resource persons for equipment, materials, and ideas.

2. Use problem area *Conserving Wildlife Resources* (Animal Science Unit, Agricultural Business and Management Cluster) as the resource to meet student learning objectives #4 and #5. The objectives were included to provide a broad definition of agricultural resources and the inclusion of *Conserving Wildlife Resources* will enhance the student's understanding of soil, water, and forest issues.

3. Use local governmental agencies as resources for publications and speakers. Some examples are:
   a. Soil Conservation Service.
   b. Agricultural Stabilization and Conservation Service.
   c. Illinois Department of Conservation.
   d. United States Park Service.

4. Use university departments and affiliated research sites as sources for speakers, publications, materials, and field trip sites. Some examples are:
   a. Sangamon State University.
   b. Southern Illinois University.
   c. Western Illinois University.
   d. Illinois State University.
   e. University of Illinois.
   f. Cooperative Extension Service.
   g. Local Community Colleges.
   h. Forest Preserves and Parks.

5. Conduct field trips to local production enterprises, building locations, experiment station field days, and parks to observe the effects of the operations on soil, water, wildlife, and timber resources and efforts on the part of each operation to conserve and replenish each of the resources.

6. Use the Vocational Agriculture Service and the Instructional Materials Service as sources of student reference and study guide materials.

7. Obtain films such as *Forestry in Illinois: A Resource for Today* and *Forestry in Illinois: A Study in Options* for class viewing and discussion.

8. Secure copies of publications from the Soil Conservation Service for use by students as resources and study guides. Two publications to be available in the summer of 1989 are concerned with utilizing wildlife as an income source and farm practices that affect wildlife habitats.

9. Use Information Sheets #2 and #3 as demonstrations on groundwater pollution and erosion control practices to enhance student understanding of these topics and as a preface for group discussion.

10. Utilize the Student Worksheets at appropriate points during the subject matter presentation as hands-on activities.

11. Use the enclosed Transparency Masters as visual aids to supplement subject matter presentation.

12. Lead the class in discussions of such topics as:
    a. The importance of wildlife and the concern of the general public about preserving our natural wildlife areas compared to a few yaers ago and a hundred years ago.
    b. The impact of new equipment and technologies on how crops are produced and harvested.
    c. Why forest areas are important to life as a whole and the impact of deforestation on all organisms (i.e., Brazilian jungles and Alaskan forests).

13. Introduce or reacquaint students to the universal soil loss equation and its use in both soil and water conservation.

14. Ask students to use periodicals or local newspapers as resources for articles on soil conservation, water conservation, pollution, wildlife, and forest activities.

15. Use VAS #T780 as a component in an objective on forest tree identification. As a follow-up activity have students scout an assigned area and make a list of identified trees.

16. Obtain copies of *Farming your Forest* for use as student references and study guides.

17. Promote agricultural resources as a topic relevant to everyone and suitable for meaningful SAE projects.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Conserving Agricultural Resources

REFERENCES

*1. *Soil Structure* (VAS Unit #U4028); *Soil Color* (VAS Unit #U4029); *Soil Texture* (VAS Unit #U4030); *Nitrates in Water Supplies, Field Crops, and Ruminant Nutrition,* (VAS Unit #U4050); *Understanding Soils* (VAS Unit #U4052); *Using the Universal Soil Loss Equation to Estimate Soil Loss* (VAS Unit #U4054B); *Livestock Waste Management,* (VAS Unit #U1059); *Intro. to Livestock Waste Management* (VAS Filmstrip #F1109); *Agr: Soil Erosion/ Water Quality,* (VAS Filmstrip #F722); *Soil Erosion, The Silent Enemy* (VAS Filmstrip #F723A); *Meet the Speck: The Erosion Crisis,* (VAS Filmstrip #F724); *Forest Tree Identification* (VAS Filmstrips #F725-1, 2, 3, #F726-1, 2, 3, and Transparency Set #T780). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*2. *Water Conservation* (Subject Matter Unit #8419); *Environmental Concerns in Agriculture* (Subject Matter Unit #8358). Instructional Materials Service, Texas A & M University, P.O. Box 2588, College Station, TX 77843-2588. (409) 845-6601.

*3. *Farm your Forests.* (1989). Curtains, T.W. Illinois Cooperative Extension Service, Publication Sales, Room 69, Mumford Hall, 1301 W. Gregory, Urbana, IL 61801. (217) 333-2007.

*4. *Our Natural Resources.* (1982). Kircher, H.B., Wallace, D.L. Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

5. *The National Conference in Agriscience and Emerging Occupations and Technologies Oct. 11-16, 1988.* The National Council for Vocational and Technical Education in Agriculture.

6. *Resource Guide to Educational Materials about Agriculture: A Project of Agriculture in the Classroom.* Agriculture in the Classroom, Room 234-W, U.S. Department of Agriculture, Washington, D.C. 20250.

7. *Environmental Science: The Study of Interrelationships.* (1986). Enger, E.D., Kormelink, J.R., Smith, B.F., Smith, R.J. Wm. C. Brown Publishers, 2460 Kerper Blvd., Dubuque, IA 52001.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — How Groundwater Becomes Polluted — Demonstration

INFORMATION SHEET #3 — Erosion Control Practices — Demonstration

INFORMATION SHEET #4 — Sources of Assistance for Illinois Forest Owners

INFORMATION SHEET #5 — Resources

TRANSPARENCY MASTER #1 — Functions of Soil Water (with discussion guide)

TRANSPARENCY MASTER #2 — The Hydrologic Cycle (with discussion guide)

TRANSPARENCY MASTER #3 — Ways Soils Lose Water (with discussion guide)

TRANSPARENCY MASTER #4 — Erosion Caused by Running Water (with discussion guide)

TRANSPARENCY MASTER #5 — Soil Detachment by Raindrops (with discussion guide)

TRANSPARENCY MASTER #6 — Methods to Control Soil and Water Erosion (with discussion guide)

TRANSPARENCY MASTER #7 — Factors Which Affect Erosion Control Methods (with discussion guide)

TRANSPARENCY MASTER #8 — Water Erosion Control Measures (with discussion guide)

TRANSPARENCY MASTER #9 — Wind Erosion Control Measures (with discussion guide)

TRANSPARENCY MASTER #10 — Generalized Soil Erosion Map of the United States (with discussion guide)

TRANSPARENCY MASTER #11 — Average Slope Range and Slope Limitation (with discussion guide)

TRANSPARENCY MASTER #12 — Drainage Need and Tileability Groups

TRANSPARENCY MASTER #13 — Forest Regions of the United States (with discussion guide)

TRANSPARENCY MASTER #14 — Forest Regions of the United States (with discussion guide)

TRANSPARENCY MASTER #15 — Forest Resources Districts in Illinois

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INFORMATION SHEET #1

Terms to be Defined

Agricultural runoff — surface water that drains from a field and contains both agricultural chemicals and soil particles.

Aquifer — a porous, subsurface layer that accumulates water.

Biological amplification — concentration of a chemical as it passes through a food chain.

Biological control — a method of pest control that uses natural diseases, predators of the pest, or particular species characteristics.

Biome — major regional climax community.

Biotic environment — the living surroundings of an organism that help to determine its survival.

Climax community — a relatively stable, long-lasting interrelated group of plants and animals in an area.

Conservation — the wise use of a commodity so it maintains a maximum sustained yield or a continuous supply of a resource.

Decomposers — microorganisms that cause decay of dead organic matter and recycle nutrients.

Desert — biome characterized by very low rainfall and sparse vegetation.

Ecology — branch of science that deals with the interrelationship between organisms and their environment.

Environment — everything that affects an organism during its lifetime.

Erosion — the wearing away and transportation of soil by water or wind.

Exploitive use — philosophy that supports the belief that enhancing human comfort should be the sole consideration when determining how we should use nature.

Food chain — the series of organisms involved in the passage of energy from one trophic level to the next.

Food web — intersecting and overlapping food chains.

Fossil fuels — organic compounds derived from chemical modification of ancient plant or animal remains.

Groundwater — water that infiltrates the soil and may be stored in ground reservoirs.

Habitat — an identifiable region in which a particular kind of organism lives.

Hazardous waste — substances that could threaten life if they are released into the environment.

Hydrologic cycle — the continual recycling of water from surface water and oceans to atmospheric water vapor to precipitation, powered by energy from the sun.

Integrated pest management — a form of control of unwanted organisms that is harmonious with natural ecosystems because control methods are specifically selected based on the characteristics of the target organisms.

Irrigation — water diverted for agricultural production.

Land — the part of the world that is not covered by oceans.

Leaching — the process of transporting soluble materials downward through the soil.

Migratory — organisms that travel seasonally, usually along traditional routes.

Monoculture — a practice of planting large areas in a single crop.

Natural resources — those structures and processes that can be used by humans but cannot be created by humans.

Nitrogen cycle — the series of stages in the flow of nitrogen in ecosystems.

Outdoor recreation — the use of natural out-of-doors for leisure time activities.

Pollution — waste material that people produce in such large quantities that it interferes with our health or well-being.

Preservation — to keep from harm or damage; to maintain.

Primary consumers — organisms that eat plants (producers) directly.

Primary pollutant — a material released into the environment that can interfere with human well-being.

Public resources — that part of the environment that is owned by everyone.

Resource — a naturally occurring substance that is potentially feasible to extract under prevailing conditions.

Runoff — water that flows over the surface of the earth and enters a river system rather than infiltrating the soil.

Secondary consumers — organisms that eat animals that have eaten plants.

Secondary pollutant — a pollutant that results from the interaction of primary pollutants in the presence of an appropriate energy source.

Selective harvest — cutting only trees of certain ages or species and maintaining other nonharvested organisms.

Stormwater runoff — surface water flow from streets and buildings caused by precipitation.

Strip farming — the alternation of strips of row crops and closely sown crops.

Strip mining — a type of mining in which soil and rock above a mineral deposit is removed to procure the underlying deposit.

Temperate deciduous forest — a biome characterized by a seasonal climate in which trees lose their leaves.

Tundra — a biome characterized by permanently frozen subsoil and the absence of trees.

Water diversion — the physical process of transferring water from one area to another.

Waterways — depressions on sloping land that allow water to flow off the land.

Wilderness — areas that are designated as such cannot be used by humans for any disruptive purposes.

Wildlife — all of the undomesticated animals in an area. This term often refers to game species of fish, birds, and mammals.

Windbreak — any structure or planting that reduces the velocity of the wind.

Wood — central portion of the stem of trees, which is most frequently used for construction or fuel.

Adapted from: *Environmental Science.* 2nd ed. Enger, et al.

INFORMATION SHEET #2

How Groundwater Becomes Polluted — Demonstration

Materials:

1. One large aquarium
2. One large diameter glass tube
3. One small diameter glass tube
4. Several large gravel stones
5. A tin vegetable can with the top removed and 2/3 of the bottom cut away as illustrated
6. Sand to fill half of the aquarium
7. Loosely woven cloth, the size of a large handkerchief
8. String (12 inches long)
9. Air pump (hand or electric)
10. Two 12- to 18-inch sections of rubber hose
11. A two-hole stopper with short pieces of glass tubing in each hole
12. Several Erlenmeyer flasks
13. Red food coloring

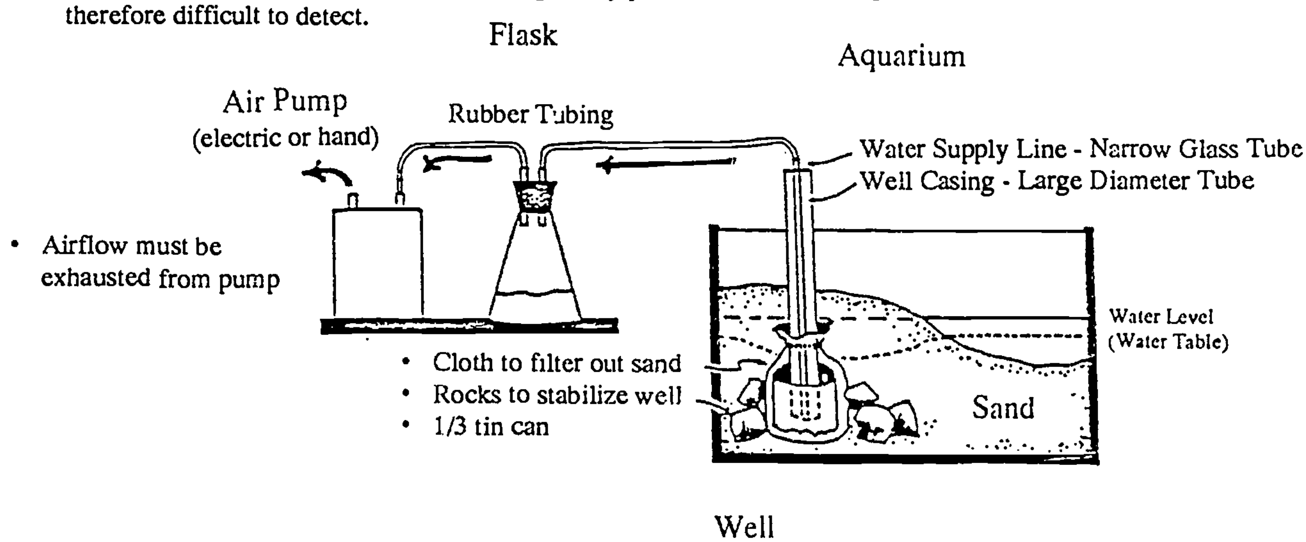
Constructing the Model:

A small group of students might construct the model before the class. Carefully study the diagram. Construct the well by placing the tin can and both pieces of glass tubing in the aquarium. Wrap the cloth around these and tie with a piece of string. Gravel can be placed around the well to hold it into place. Cover the structure with sand but don't get any into your well through the opening in the cloth. The sand should not be higher than where the cloth is tied. Create a depression on one side of the aquarium and a hill on the other. Slowly add water to the aquarium until a pond is formed.

Class Demonstration:

Discuss the model. Identify the groundwater and water table. Begin to slowly pump water from the well. As the surface level of the pond is depleted, water can be added to the pond by simulating rain as a wet sponge is wrung out over the land and water. Watch the infiltration, runoff, and percolation. Pump until flask labeled Number #1 is full.

Install flask labeled Number #2 and continue the demonstration but with polluted water (water with red food coloring added to represent any pollution which is water soluble). Again watch the water percolate through the soil and enter the well. Unlike the red food coloring, many pollutants do not change the color or odor of the water and are therefore difficult to detect.



A model to demonstrate the pollution of groundwater.

INFORMATION SHEET #3

Erosion Control Practices — Demonstration

Purpose:

1. To understand how grasses, shrubs, ground cover, and trees break the force of rainfall with their leaves and stems and hold top soil in place with their roots.
2. To demonstrate the effect of vegetative cover on reducing soil loss by erosion.

Materials:

1. Two seed flats made waterproof by lining with plastic film, tin, or tar paper
2. Two half-gallon sprinkling cans
3. Two half-gallon, wide mouthed jars or other suitable containers
4. One four-foot piece of 1" x 3" lumber

Procedure:

1. Cut a 1" to 1 1/2" V notch at the center of one of the end boards of each seed flat. Fit each notch with a tin spout to draw runoff water into a container.

2. Cut a piece of sod to fit one of the flats. Trim the grass to a height of one inch.

3. Fill the other box with soil from the same area from which the sod was taken. The soil in this flat should have no vegetative cover.

4. Set the flats on a table so that the spouts extend over the edge. Place the 1" x 3" piece of lumber under the other end of the flats to provide slope.

5. Place the empty containers on stools beneath the spouts.

6. Fill the two sprinklers with water and pour the water on both boxes at the same time from a height of about one foot. Pour out steadily and at the same rate for both boxes.

Summary:

The water flowing over the sod will be reasonably clear. It will take longer for the flow to start and it will continue to flow for a longer period of time.

There should be more water in the jar container under the flat of the bare soil than is in the container under the flat of sod.

This demonstration illustrates one of the most fundamental principles of soil and water conservation, that of the protection which grass gives soil against the pounding of raindrops and the movement of running water. The grass breaks the force of the raindrops so that the soil is not pounded and broken apart by the drop impact. The grass roots open up channels to let water get into soil and the grass stems slow down the speed of the running water so that the soil is not disturbed.

Using Good Fertility Programs:

By replenishing the organic matter content of soils with soil-conditioning materials such as manure and peat moss, and by replenishing the nutrient level with lime and fertilizer, plants with large root systems and luxuriant top growth can be produced which are highly effective in reducing soil erosion.

Using Contour Cultivation Practices:

The value of contouring in preventing soil erosion on steep grass areas in the landscape can be shown by using the materials in the previous demonstrations and modifying the procedure to include contouring rather than vegetative cover or mulches.

INFORMATION SHEET #4

Sources of Assistance for Illinois Forest Owners

Extension Forester
110 Mumford Hall
1301 West Gregory Drive
University of Illinois
Urbana, IL 61801
(217) 333-2777

State Forester
524 South Second Street
Springfield, IL 62706
(217) 782-2361

Illinois Consulting Foresters, Inc.
Current addresses and phones can be obtained from the offices listed below.

Forest Resources Districts in Illinois. These districts are shown on the map on Transparency Master #15. District foresters can be contacted at the following addresses and telephone numbers:

1. P.O. Box 6
   Mt. Carrol, IL 61053
   (815) 244-3655
2. Castle Rock
   State Park, R.R. 2
   Oregon, IL 61061
   (815) 732-6184
3. P.O. Box 126
   Cambridge, IL 61238
   (309) 937-2122
4. Randy Timmons
   IVCC East Campus
   Building 11
   2578 East 350th Road
   Oglesby, IL 61348
   (815) 224-4048
5. P.O. Box 335
   Macomb, IL 61455
   (309) 837-1124
6. P.O. Box 795
   Pekin, IL 61554
   (309) 347-5119
7. P.O. Box 472
   Lisle, IL 60532
   (312) 964-8081
8. First National Bank Plaza
   17th and Halsted
   Suite 205
   Chicago Heights, IL 60411
   (312) 754-0945
9. P.O. Box 148
   Shelbyville, IL 62565
   (217) 644-2411
10. P.O. Box 129
    Charleston, IL 61920
    (217) 345-2420
11. P.O. Box 477
    Pittsfield, IL 62363
    (217) 285-2221
12. P.O. Box 401
    Havana, IL 62644
    (309) 543-3401
13. P.O. Box 170
    Carrollton, IL 62016
    (217) 942-3816
14. P.O. Box 603
    Hillsboro, IL 62049
    (217)532-3562
15. P.O. Box 149
    Carlyle, IL 62231
    (618) 594-4475
16. P.O. Box 21
    Sparta, IL 62286
    (618) 443-2925
17. Stephen A. Forbes S.P.
    R.R. 1
    Kinmundy, IL 62854
    (618) 547-3477
18. P.O. Box 313
    Olney, IL 62450
    (618) 393-6732
19. P.O. Box 206
    Fairfield, IL 62837
    (618) 847-3781
20. P.O. Box 188
    Murphysboro, IL 62966
    (618) 687-2522
21. Dixon Springs
    State Park, R.R. 2
    Golconda, IL 62938
    (618) 949-3394
22. P.O. Box 67
    Goreville, IL 62939
    (618) 995-2568

INFORMATION SHEET #5

Resources

1. Cooperative Extension Service
   69 Mumford Hall
   1301 W. Gregory
   Urbana, IL 61801
   (217) 333-2007.

   Videos — *Forestry in Illinois: A Resource for Today* and *Forestry in Illinois: A Study in Options.*

2. Local Soil Conservation Service

   Conservation and the Water Cycle, an eight page leaflet from the USDA.

3. Introducing Agriculture in Curriculum
   Lake Avenue and Second Street
   Duluth, MN, 55802

   Videotapes with teacher's guides on introducing agriculture in curriculums K-12 with science and social studies lessons.

4. Bureau of Audiovisual Instruction
   P.O. Box 2093
   Madison, WI 53701

   Runoff: Land Use and Water Quality, 16mm film #1765 and *Save our Soil . . . Save our Stream,* 16mm film #6460.

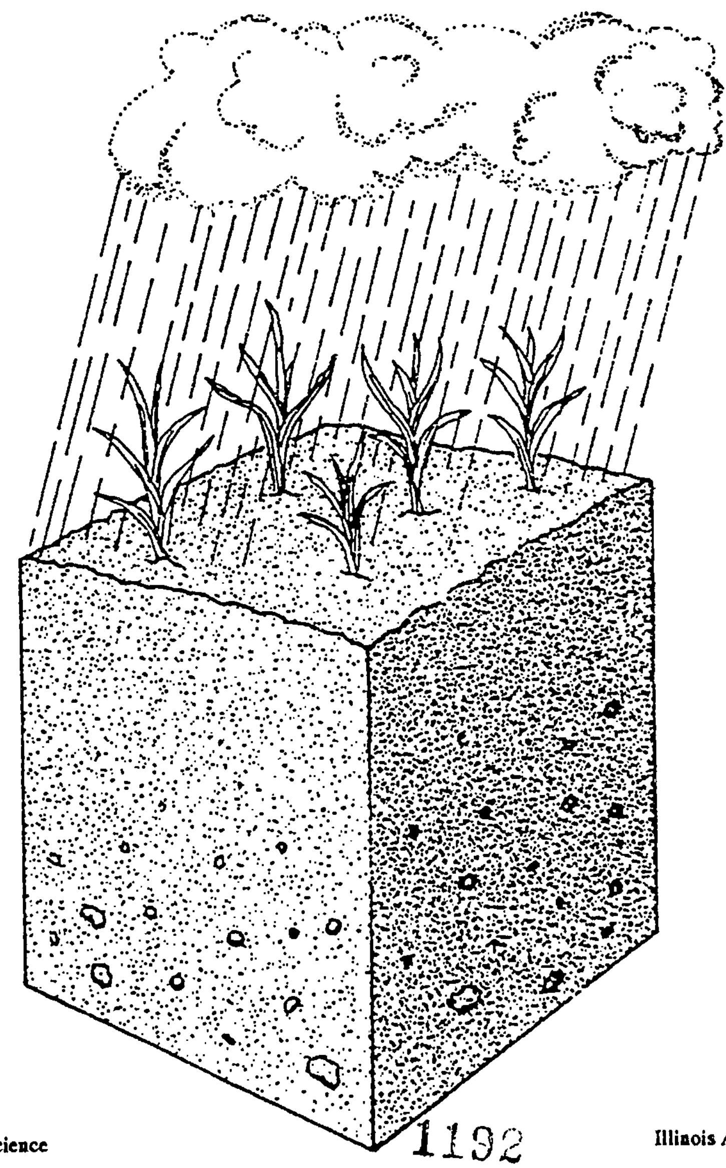
5. Environmental Film Service Catalog
   Maine Department of Agriculture
   Food and Resources
   Public Information Resources
   State House Station 28
   Augusta, ME 04333

   Write for catalog of available-for-rent films and slide presentations.

TRANSPARENCY MASTER #1

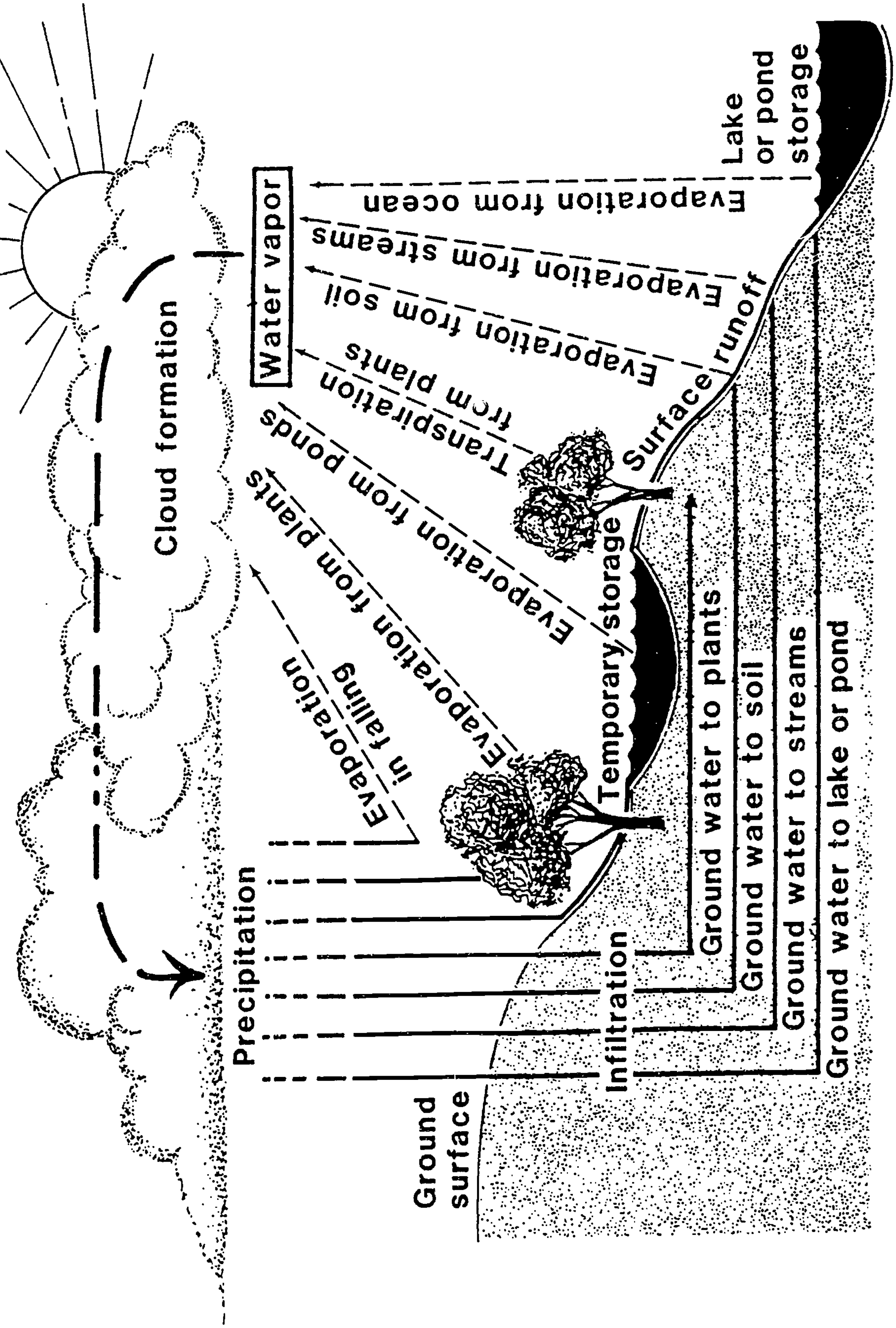
Functions of Soil Water

1. Essential for plant growth
2. Necessary for soil formation
3. Makes nutrients available
4. Influences the physical condition of soil



TRANSPARENCY MASTER #2

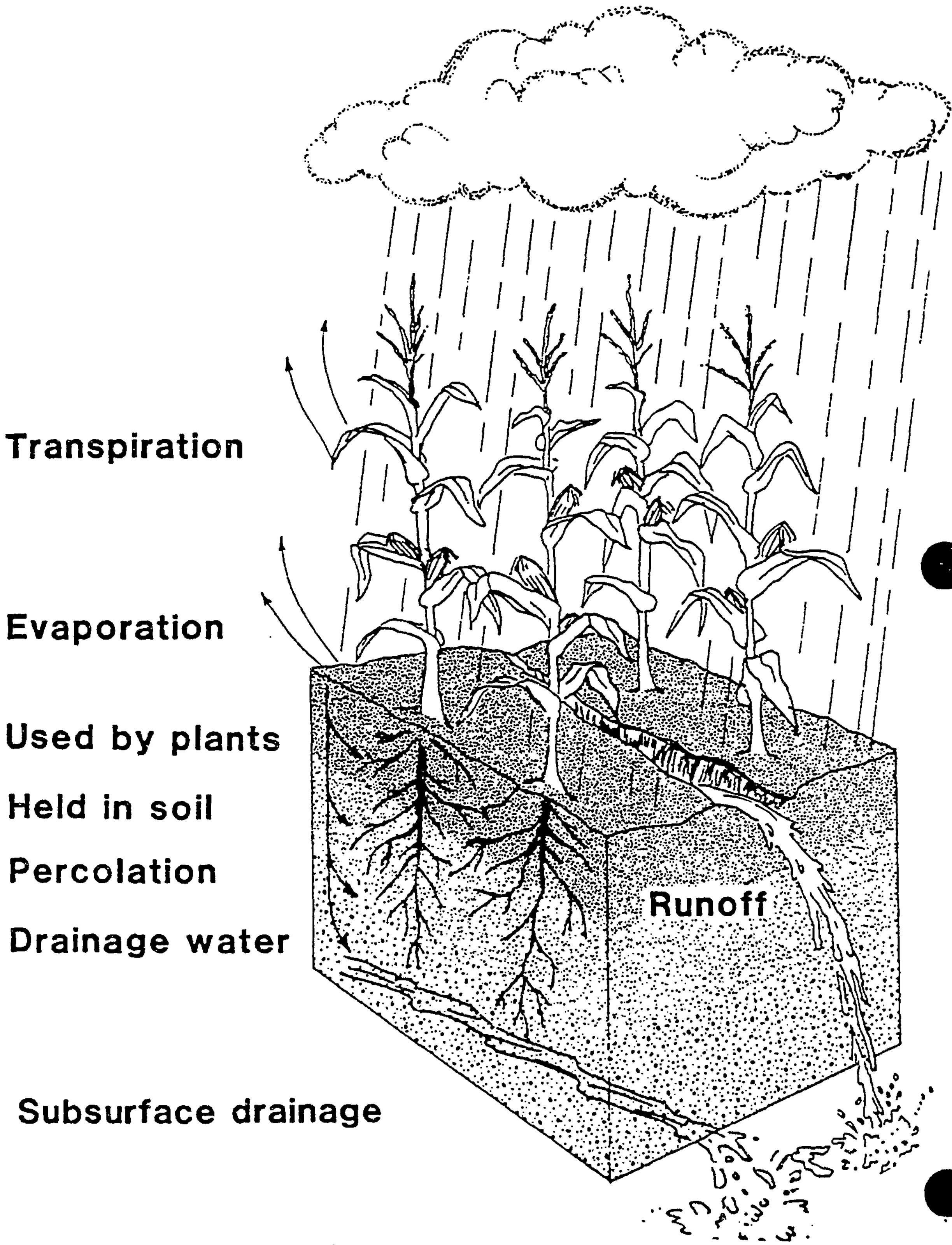
THE HYDROLOGIC CYCLE



The water cycle endlessly repeats itself, as the sun draws water from the earth and the water returns to the earth in the form of rain or snow.

TRANSPARENCY MASTER #3

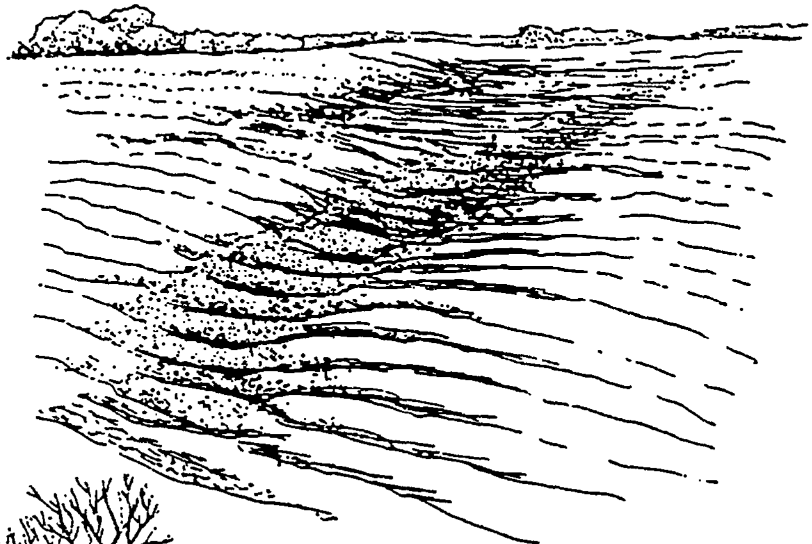
Ways Soils Lose Water



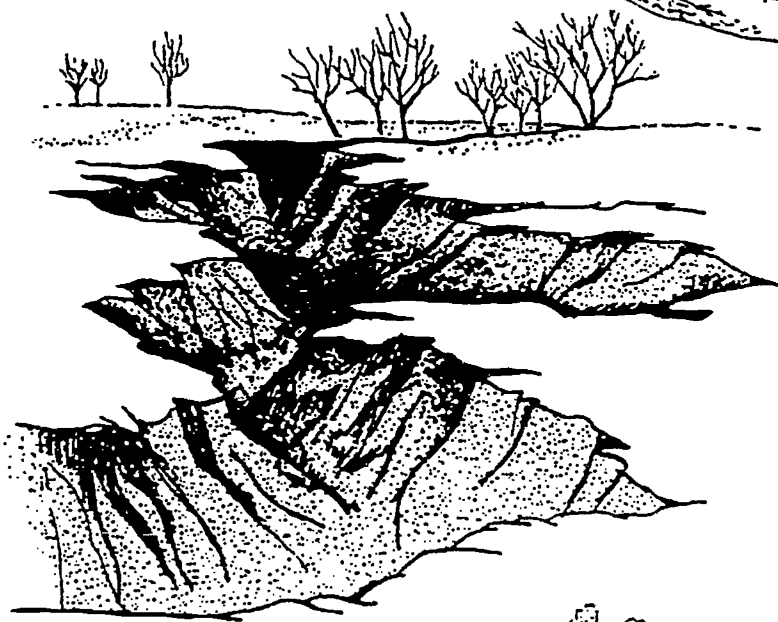
TRANSPARENCY MASTER #4

Erosion Caused by Running Water

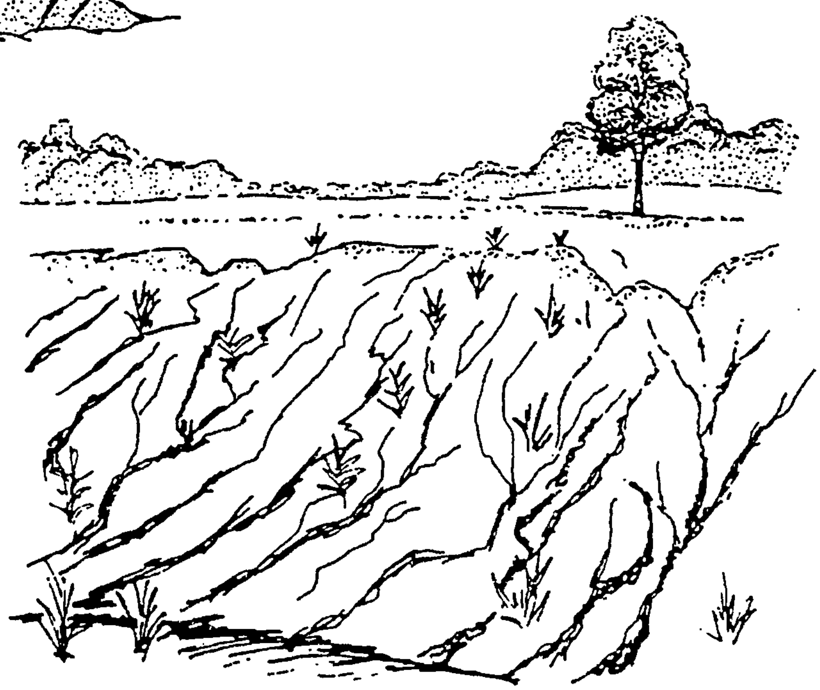
Sheet Erosion



Gully Erosion



Rill Erosion



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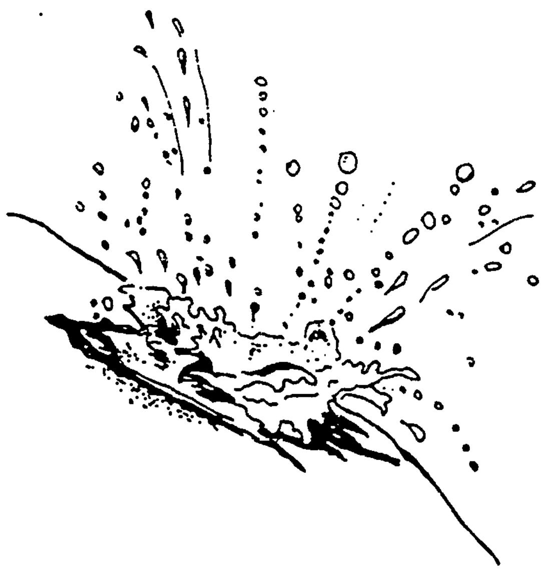
TRANSPARENCY MASTER #5

Soil Detachment by Raindrops

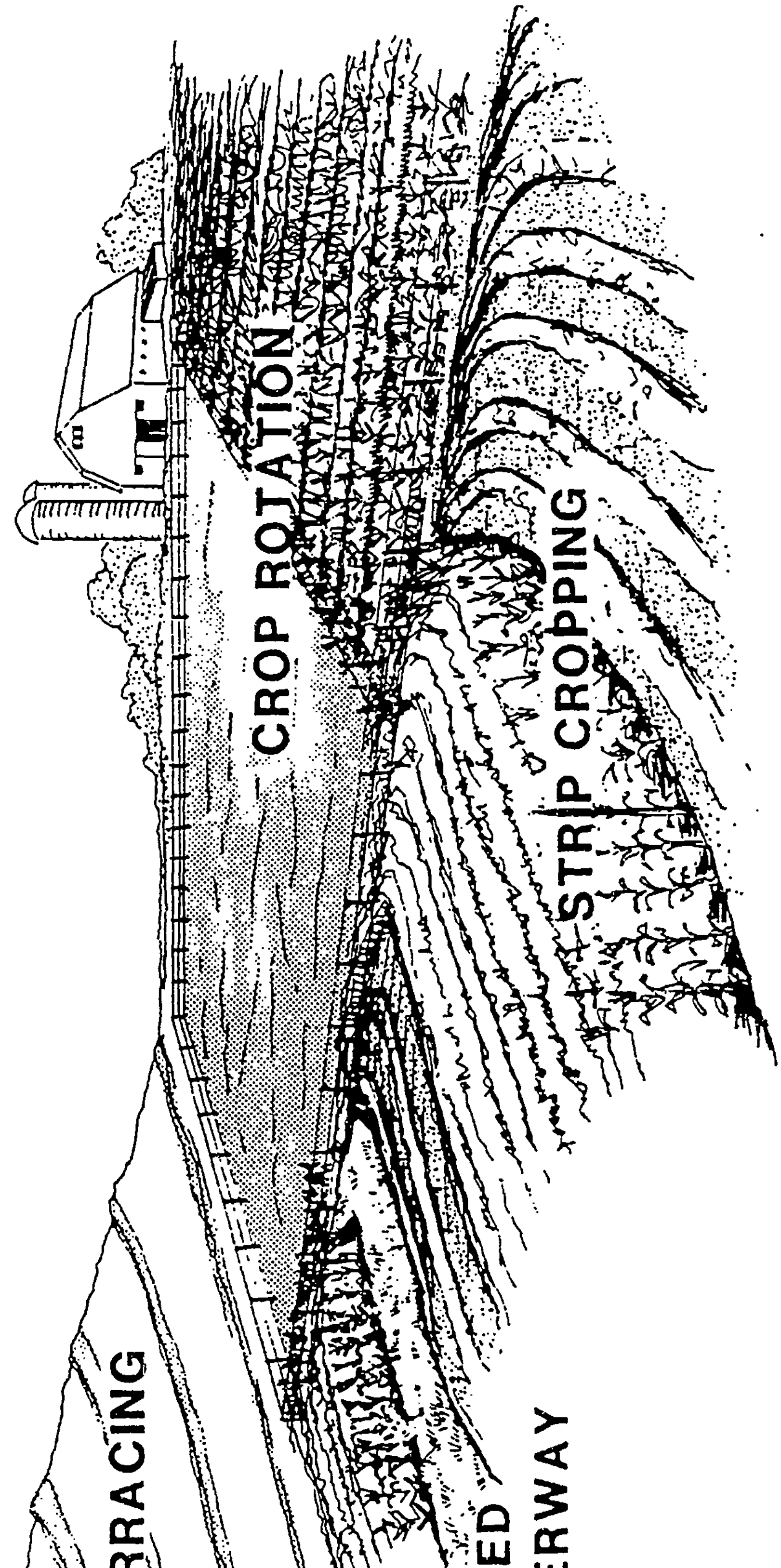


A raindrop may splash soil as far as 5 feet.

One inch of rain may remove one inch of soil per acre (150 tons).

TRANSPARENCY MASTER #6

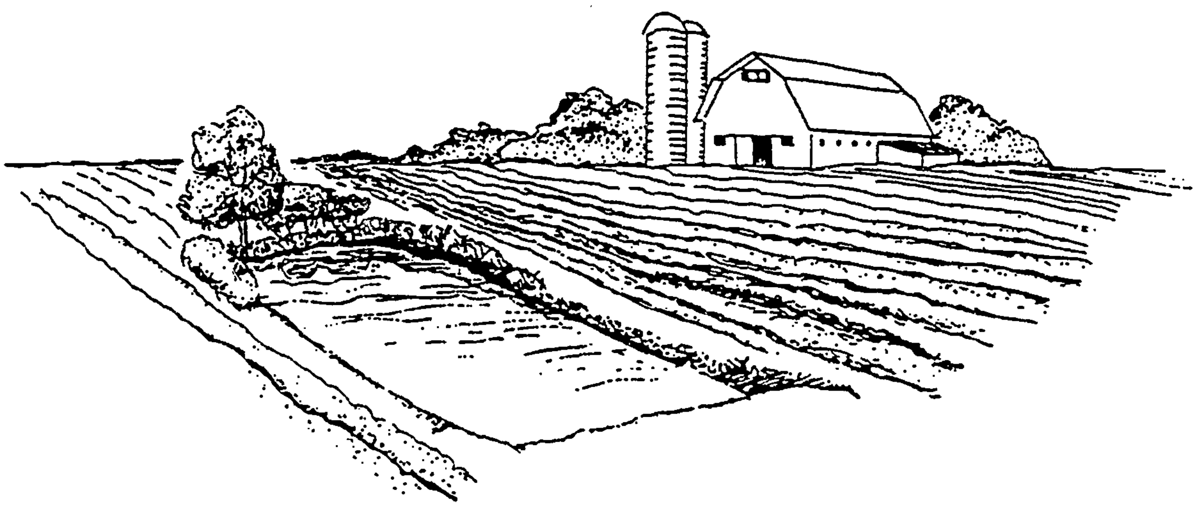
METHODS TO CONTROL SOIL AND WATER EROSION



TRANSPARENCY MASTER #7

Factors Which Affect Erosion Control Methods

1. Effect on the land
2. Effect on the community
3. Effect on farming practices
4. Cost
5. Benefits
6. Time to implement

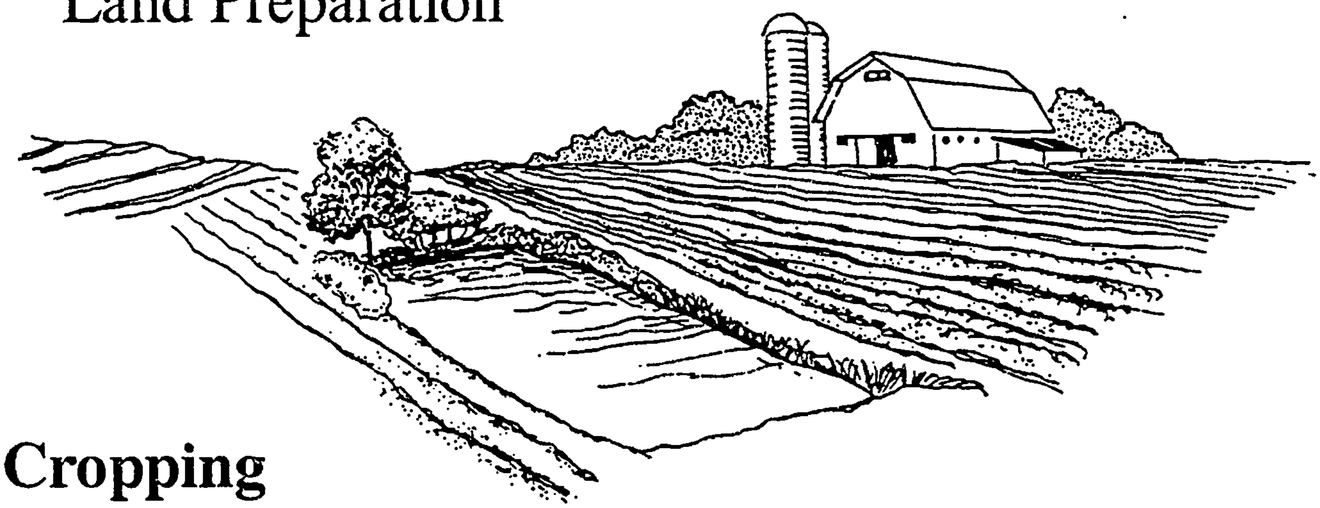


TRANSPARENCY MASTER #8

Water Erosion Control Measures

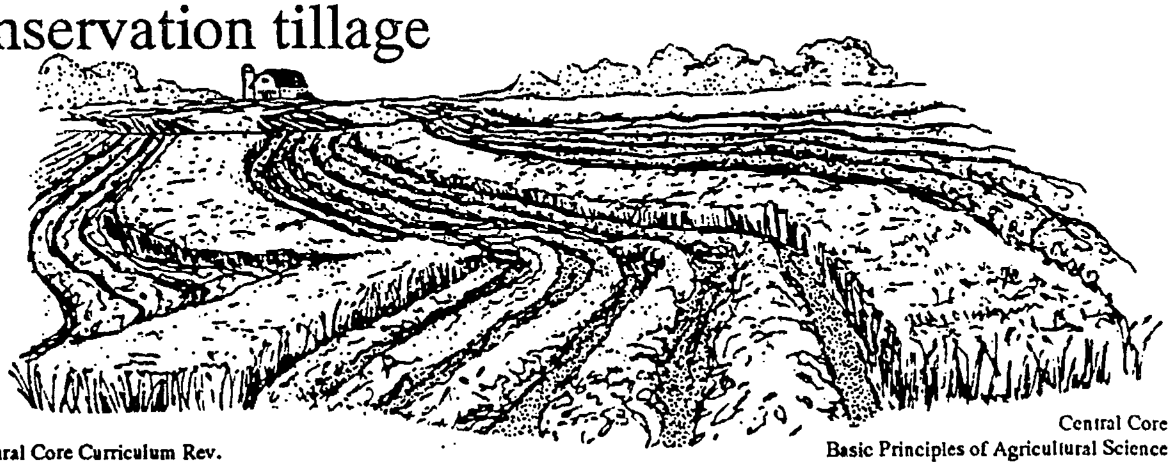
Mechanical

Terracing
Diversions
Grassed waterways
Construction of ponds and dams
Drainage systems (tiling)
Land Preparation



Cropping

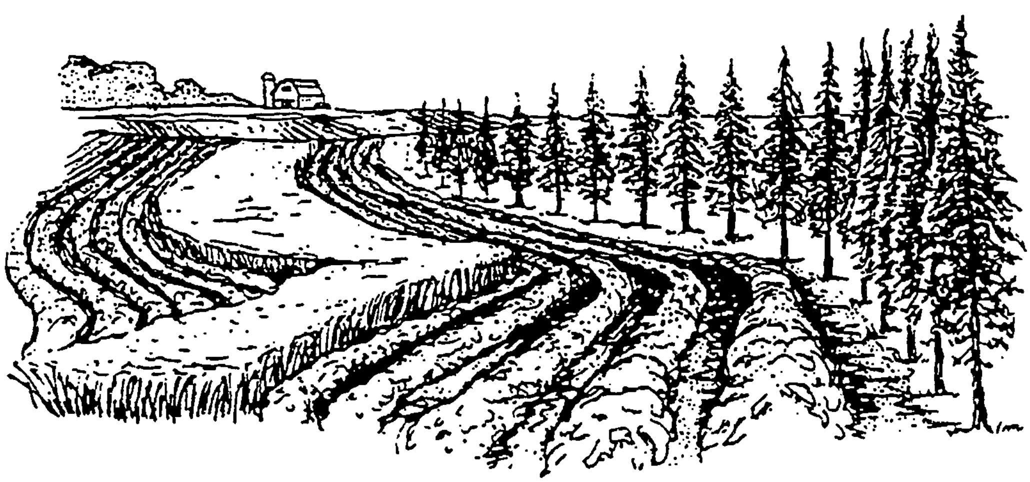
Contour planting
Strip cropping
Conservation tillage



TRANSPARENCY MASTER #9

Wind Erosion Control Measures

1. Strip cropping
2. Prevention of burning
3. Prevention of grazing
4. Moisture conservation
5. Emergency cover crops
6. Emergency tillage operations
7. Windbreak tree planting



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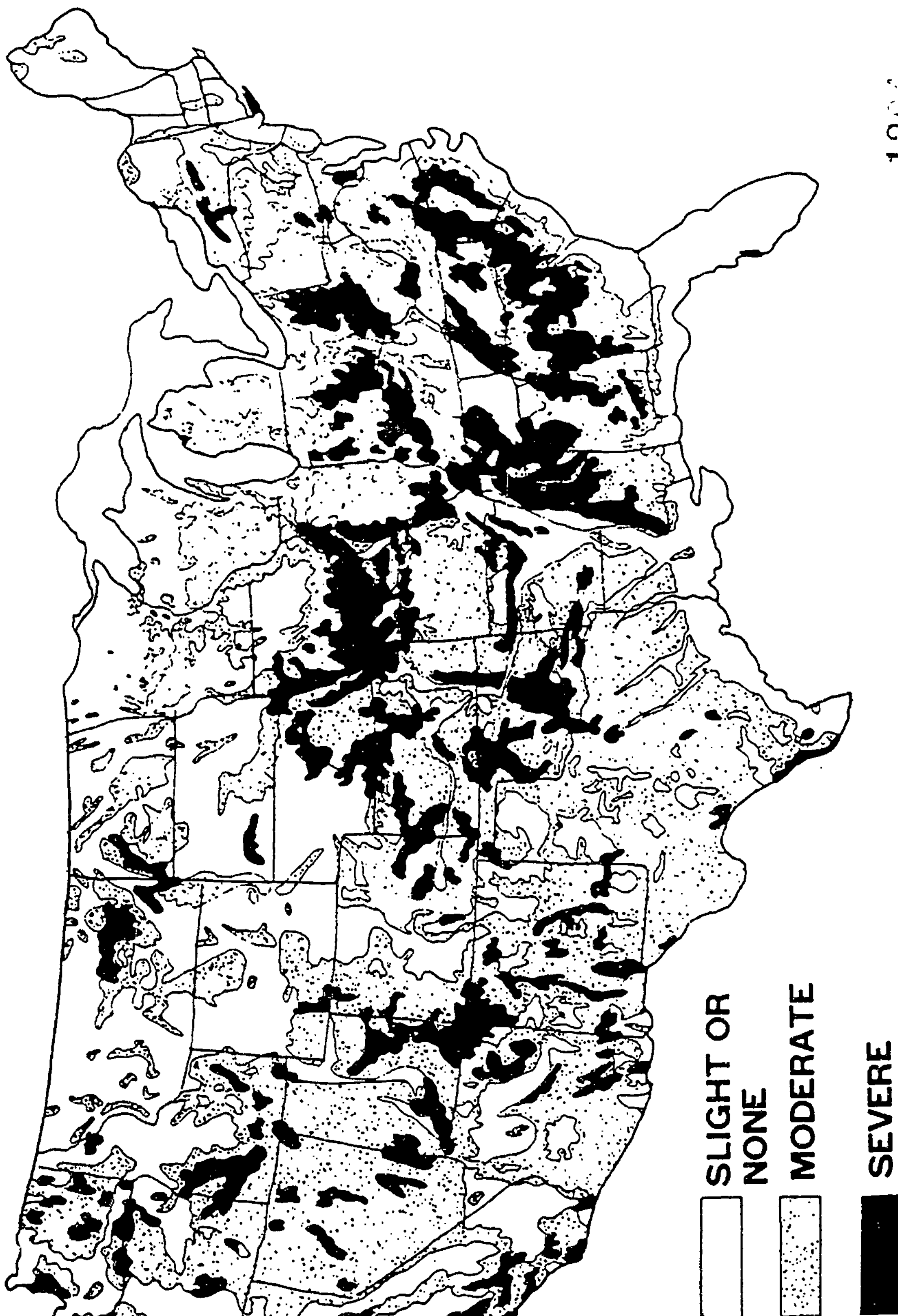
TRANSPARENCY MASTER #10

GENERALIZED SOIL EROSION MAP OF THE UNITED STATES



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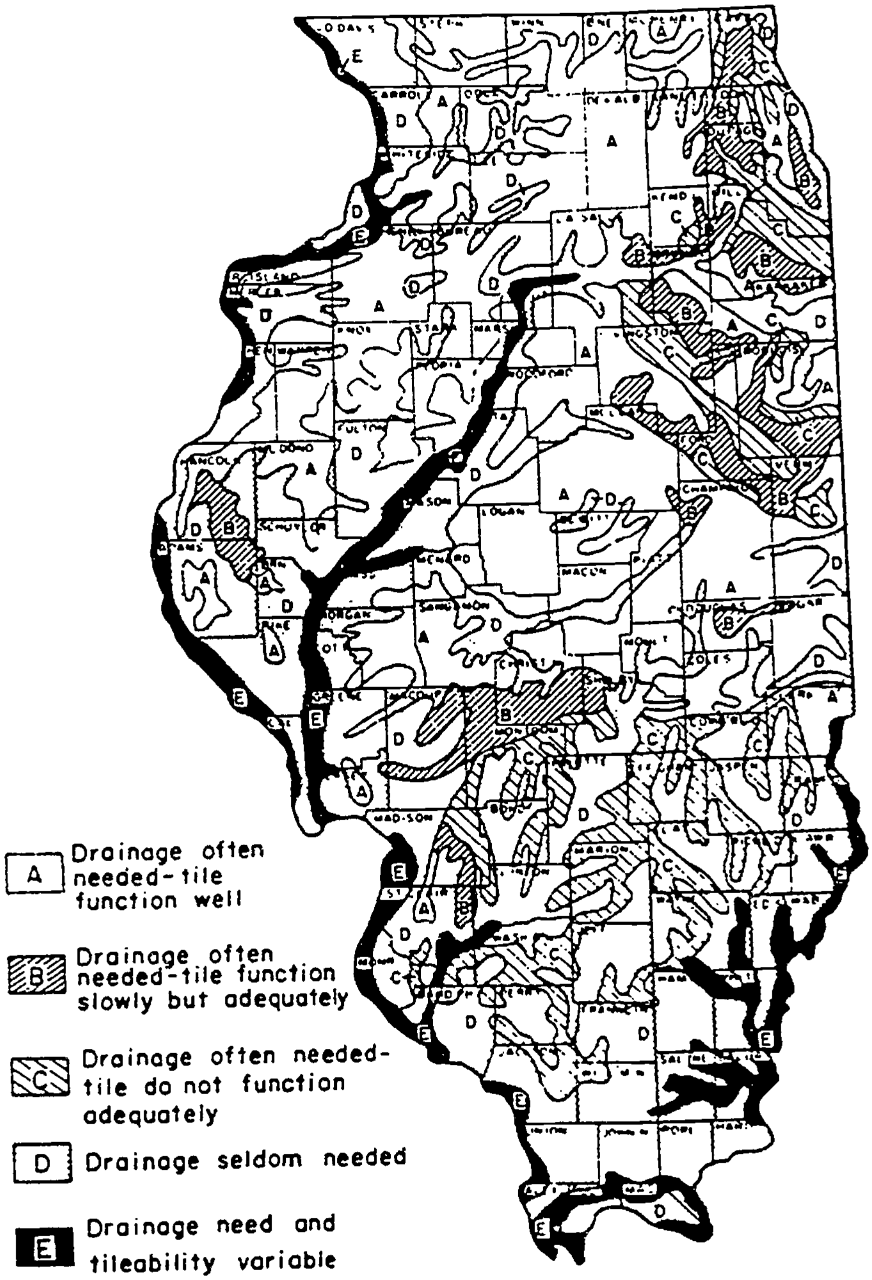
TRANSPARENCY MASTER #11

Average Slope Range and Slope Limitation

1205

TRANSPARENCY MASTER #12

Drainage Need and Tileability Groups



TRANSPARENCY MASTER #13

Forest Regions of the United States

WESTERN

Pacific Coast

Rocky Mountain

EASTERN

Northern

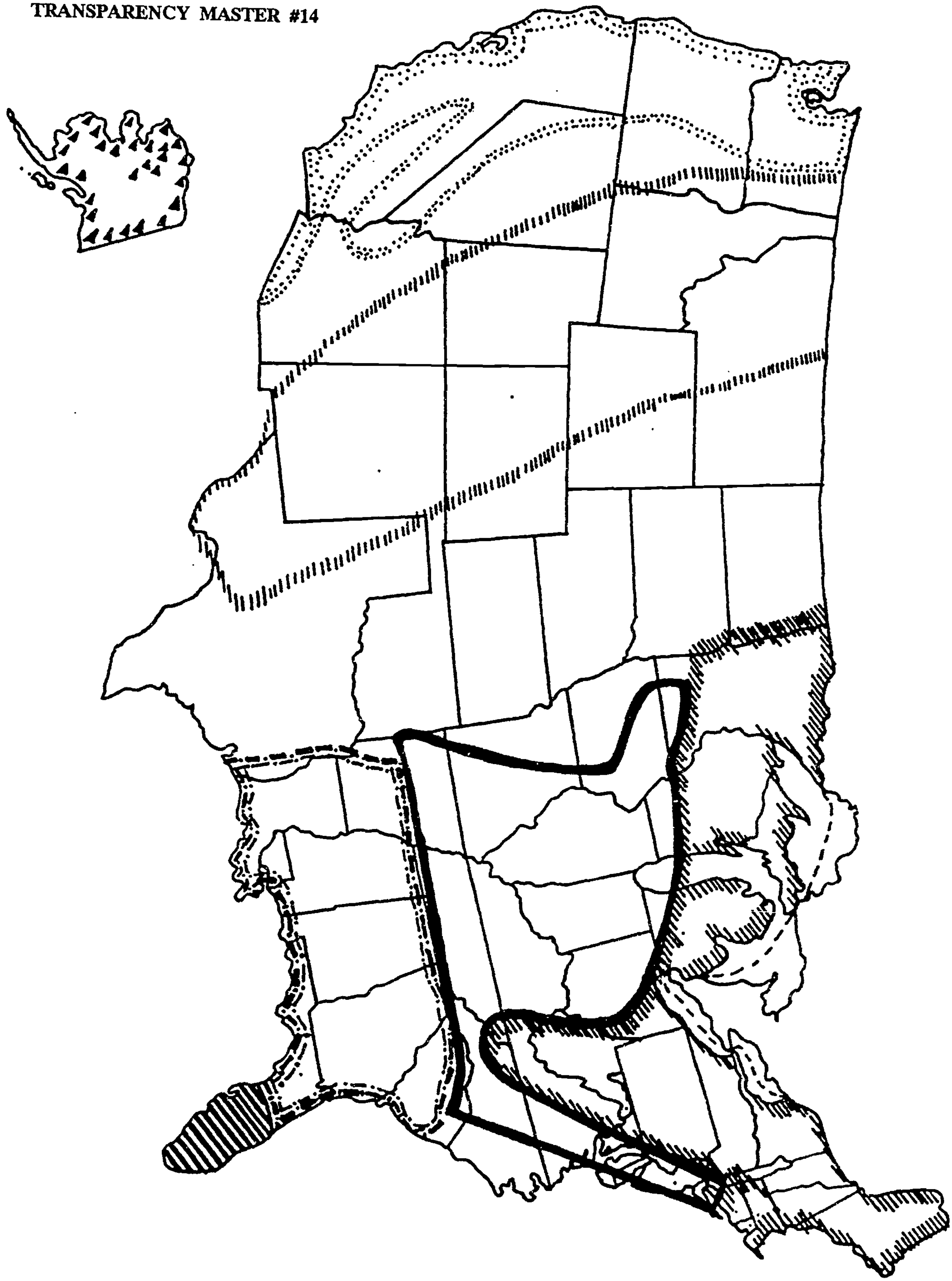
Central

Southern

Tropical

ALASKA

TRANSPARENCY MASTER #14



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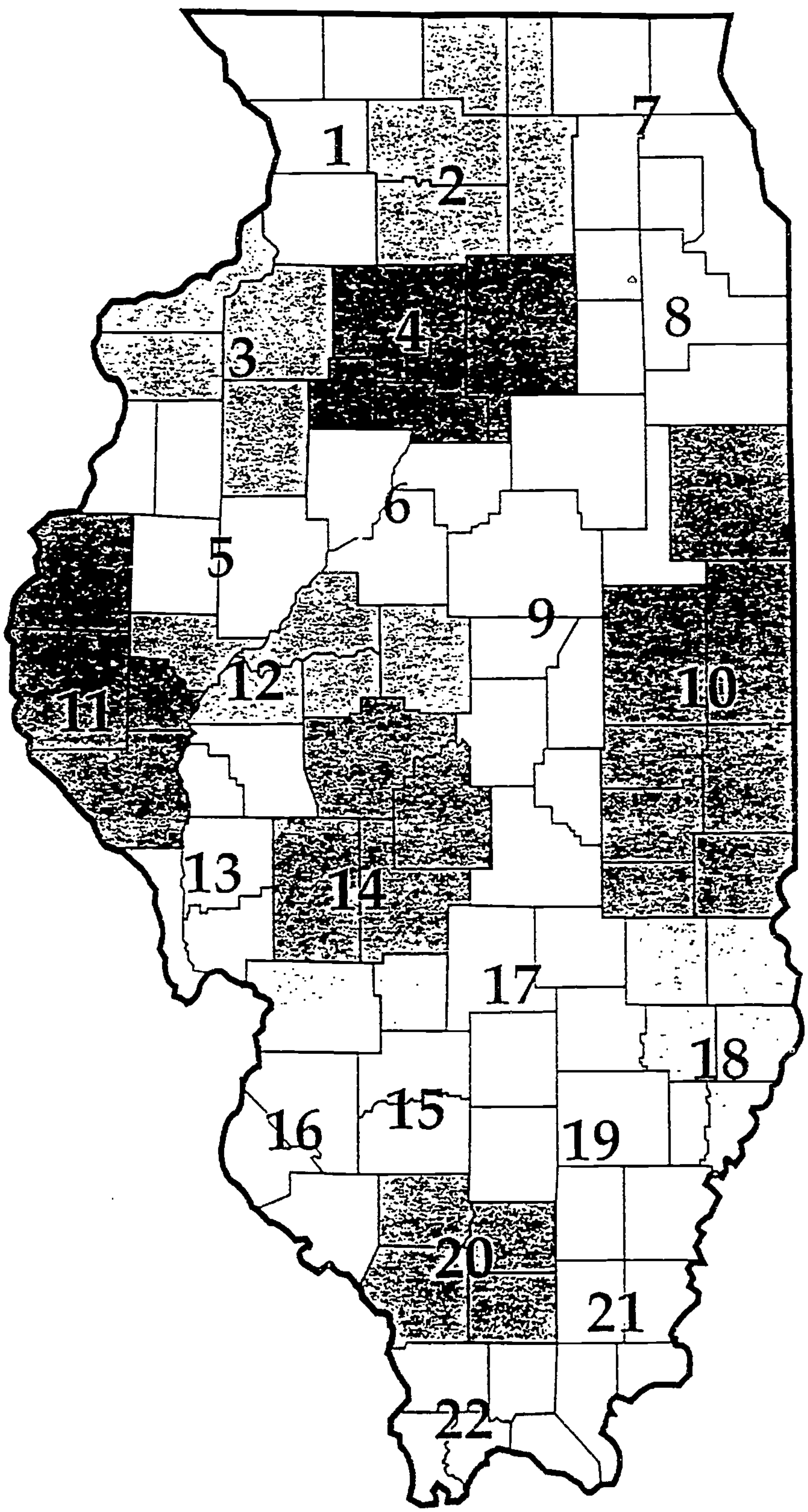
TRANSPARENCY MASTER #15

Forest Resources Districts in Illinois



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TRANSPARENCY MASTER DISCUSSION GUIDE

Transparency Master #1

1. Point out the importance of water to continued growth of Illinois agriculture.

2. Point out that it takes about 1,000 pounds of water to produce one pound of corn.

3. Discuss the fact that corn planted at normal populations on a 40-acre field will use about 18,600,000 gallons of water per year.

4. Corn planted at a population of 14,000 plants per acre will use about 8,750 gallons of water per day per acre.

5. Point out the importance of water in carrying essential nutrients to plants and in forming soil from parent material.

Transparency Masters #2 and #3

I. Discuss the general phases of the hydrologic cycle.

   A. Precipitation phase

      1. Precipitation includes rain, snow, sleet, hail.
      2. A one inch rain on 160 acres is equivalent to about 4,360,000 gallons or 36,300,000 pounds.
      3. To contain this 18,150 tons of water, you would need over 540 railroad tankcars, the equivalent of 4 trains, each over a mile in length.

   B. Infiltration phase

      1. Infiltration makes water available to plants.
      2. Water is stored for later use by plants, man, etc.
      3. Water can move to underground streams and eventually to rivers and the ocean.
      4. Infiltration is the rate water enters the soil.

   C. Surface runoff phase

      1. Surface water causes most of the soil erosion in Illinois.
      2. Runoff moves to temporary storage in lakes, ponds, reservoirs, etc. and other water sheds.

   D. Evaporation phase

      1. Evaporation occurs from water falling as precipitation, and from plants, ponds, soil, ocean, etc.
      2. To evaporate enough water to provide one inch rain over 160 acres requires about one million horsepower of energy.

   E. Condensation phase

      1. Condensation is the changing of water from vapor to mist and moisture droplets which fall as precipitation.
      2. It takes the same amount of energy to condense the moisture as it originally took to evaporate it.

II. Use transparency on soil water to emphasize that nature is not a 100% efficient system.

   A. Point out that water is "lost."
   B. Identify and discuss some good management practices which could increase available water to plants during critical dry periods.

Transparency Master #4

1. Sheet erosion

   a. Is the removal of a thin, fairly uniform layer of surface soil.
   b. Is the most common type of erosion.
   c. Is the most serious type of erosion because it can go unnoticed for a long time.

2. Gully erosion

   a. Is the most noticeable type of erosion.
   b. Is usually found near the bottom of a slope.
   c. Causes severe damage to soil and its productivity.
   d. Reduces field efficiency and damages equipment.

3. Rill erosion

   a. Is noticeable as small ditches between rows of corn and other crops.
   b. Is not as severe as gully erosion.
   c. Carries more soil away as small streams increase in size.

1210

Transparency Master #5

1. Until recently, agriculturists tried to control erosion by concentrating on runoff.

2. Originally it was thought that the raindrops just caused the surface sealing which caused more runoff.

3. Now it is known that the force of the raindrop impact dislodges the soil particles, then the running water can move the soil.

4. It has been estimated that during a hard rain storm, as much as 100 tons of soil may be bouncing up and down on each acre.

Transparency Master #6

1. Point out that gullies, rills, and sheet erosion can be treated and controlled through various conservation techniques.

2. On moderate slopes, erosion can be controlled by planting crops on contour, terracing, or by strip cropping.

3. Strip cropping is more effective on longer slopes.

4. Terracing is the most effective soil conservation practice.

5. Waterways can divert around gullies and spread the flow over a grassed area.

Transparency Master #7

1. *Economic factors* such as low livestock prices have eliminated much pasture and forage crop acreage; therefore farmers are:

   a. Choosing to keep land in row crops.
   b. Unwilling to invest in long-term expensive projects.
   c. Looking for short-term profit.
   d. Not willing to purchase different equipment.

2. *Short term responsibilities* have increased the soil erosion problems by:

   a. Discouraging long-term conservation involvement because of high cash rent on one-year leases.
   b. Desire to maximize returns by absentee landlords who do not see erosion problems.
   c. Deferral of ultimate responsibility to someone else in life estates.

3. *Traditions* of farming practices have increased erosion by:

   a. Planting straight rows.
   b. Clean tillage.
   c. Resistance to change.

Transparency Master #8

1. Point out that a good conservation plan is a combination of many techniques and practices. There is no one answer or solution to controlling erosion.

2. Erosion involves these steps:

   a. *Loosening* of soil particles.
   b. *Moving* of soil particles.
   c. *Deposition* of soil particles.

3. Use this transparency to promote class discussion on local conservation practices being used.

4. Have class identify other erosion control practices which could be listed under these two measures.

Transparency Master #9

1. Point out that wind erosion is not as serious as water erosion in Illinois.

2. Wind erosion causes:

   a. Air pollution.
   b. Highway safety hazards.
   c. Drainage ditches to fill up with soil.
   d. Loss of top soil.

3. Discuss primary factors contributing to wind erosion including:

   a. Frequent, high-velocity winds.
   b. Dry, residue-free soil surface.

4. Point out the methods of soil movement.

   a. *Saltation*
      1) Saltation occurs with medium-sized particles.
      2) Saltation occurs at what is known as *threshhold velocity.*
      3) Small particles don't lift off the ground because the velocity between the top and bottom of the particles is almost equal.
      4) Large particles have too much density to be easily lifted off the surface.

5) Use airplane wing design to help explain the lifting technique involved.

b. *Suspension*
   1) Small particles become dislodged due to surface creep or saltation and are light enough to remain airborne.
   2) Particles can be carried long distances by this means.

c. *Surface creep*
   1) Large particles are too heavy for saltation or suspension.
   2) Particles are moved along the surface by impact of particles moving in saltation.

5. Discuss the steps people can take to protect soil from direct assault by the wind or rain.

Transparency Master #10

1. Crops are grown on a little more than 400 million acres in U.S.

2. About 50 million acres have lost their topsoil.

3. Another 280 million acres are severely eroded and cannot be used for crop land.

4. In areas receiving 30 inches or more of rain annually, most erosion is caused by water.

5. In areas receiving between 20 and 30 inches of rain annually, most erosion is due to both water and wind.

6. In areas receiving less than 20 inches of rain annually, most erosion is caused by wind.

Transparency Master #11

1. Slope influences include:

   a. Height of water table.
   b. Amount of water that enters and passes through the soil.

2. About 60 percent of Illinois has an average slope of less than 4 percent.

3. Color of soil is a reflection of moisture status during soil development.

4. Discuss the average slope and drainage needs in your county or local area.

5. Identify conservation techniques being used locally to counter the soil limitation factors.

Transparency Master #13

1. Forest-producing land — 75% of the forest producing land lies east of the Great Plains (mostly second-growth hardwoods), 25% is in the West.

2. Sawtimber — 75% of forest-producing land is in the East, yet 70% of the sawtimber is in the West.

3. Forest ownership in the United States:
   a. 72% of the forest land is privately owned (84% in Illinois) and 28% is owned by the public government.
   b. Commercial forest-land breakdown:

Government (public)

Federal =	22%	(113 million acres)
State and local =	6%	(29 million acres)
	28%	

Private ownership

Forest industries =	13%	(67 million acres)
Farm =	30%	(151 million acres)
other =	29%	(149 million acres)
	72%	

4. Lead the class in a discussion of why forests are important, and why they are ecologically important to the following:
   a. Wildlife.
   b. Carbon cycle.
   c. Hydrologic cycle.
   d. Nitrogen cycle.
   e. Photosynthesis.

5. Have the class identify current news topics associated with forests.

6. Forestry definitions:
   a. Forest types — natural groups or associations of different species which commonly occur together. They are defined and named after one or more dominant species of trees (example: Douglas fir — redwood forest, etc).
   b. Pure forest — one in which all or nearly all trees are of the same species.
   c. Mixed forest — consists of trees of two or more species.
   d. Even-aged forest — almost all trees are of the same age.
   e. All-aged forest — trees range from seedlings to merchantable timber.
   f. Forest-producing land — any land with forest trees growing on it, whether trees may be harvested or not.
   g. Sawtimber — only that forest land with trees to be harvested.

1212

Transparency Master #14

The seven major forest regions in the United States (by area and predominant species) are:

1. Northern region (primarily hardwoods).

    a. Northern white pine
    b. Red or Norway pine
    c. Eastern Hemlock
    d. Red spruce
    e. White spruce
    f. Birches (all species)
    g. Elm
    h. Beech
    i. Maple
    j. Basswood
    k. Northern red oak
    l. Scarlet oak

2. Central regions (hardwoods).

    a. Oaks (white, black, red, scarlet)
    b. Hickories
    c. Ashes
    d. Elms
    e. Maples
    f. Cherry
    g. Walnut
    h. Sycamore
    i. Beech
    j. Cottonwood

3. Southern region (primarily softwoods). This region contains 30% of all our forest lands.

    a. Longleaf pine
    b. Shortleaf pine
    c. Loblolly pine
    d. Slash pine
    e. Some oaks
    f. Beech
    g. Some sycamores
    h. Some red and white cedars

4. Rocky Mountain region (softwoods). This region contains approximately 12% of our total forest land.

    a. Lodgepole pine
    b. Douglas fir
    c. Western white pine
    d. Limber pine
    e. Ponderosa pine
    f. Western larch
    g. Engelmann spruce
    h. Western red cedar
    i. Western and mountain hemlocks
    j. Some oaks and junipers

5. Pacific region (primarily softwoods). This region contains approximately 12% of our forest land.

    a. Douglas fir
    b. Western hemlock
    c. Ponderosa pine
    d. Sugar pine
    e. Western white pine
    f. Western larch
    g. Coast and giant redwood
    h. Incense and western red cedar

6. Tropical forest region (primarily hardwoods).

    a. Western Indian mahogany
    b. Broadleaf mahogany
    c. Teak
    d. Some southern pines

7. Alaska forest region (Alaska has two major forest regions — the coast and the interior). This may be one region or two separate regions.

    a. Coast region (mainly softwoods) — 75% of this region is western hemlock, the remaining 25% is sitka spruce, western red cedar, and Alaskan cedar.
    b. Interior region (mostly hardwoods) — mainly spruce and birch forest land.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Estimating the Amount of Surface Residue

STUDENT WORKSHEET #2 — How Different Soils Affect the Movement of Water

STUDENT WORKSHEET #3 — Making a Stream Table

STUDENT WORKSHEET #4 — Splash Erosion

STUDENT WORKSHEET #5 — Wildlife Management Inventory

STUDENT WORKSHEET #6 — Wildlife Survey Form

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Estimating the Amount of Surface Residue

Purpose:

1. To develop the ability to estimate the percentage of surface residue on a field.
2. To understand the relationship between surface residue and soil erosion.
3. To identify approved tillage practices which can be used to increase the percentage of surface residue.

Materials:

1. 70 feet of 1/8 or 3/16 inch nylon rope
2. Clipboard, paper, and pencil to record results

Procedure:

1. Tie 100 knots, 6 inches apart, on a rope.

2. Tie a stake to each end of the rope.

3. Stretch the rope diagonally (about 45 degrees) across the crop rows.

4. Adjust the final angle of the rope so that both stakes are placed in a crop row.

5. Stand over the rope and walk toward the other end, count the knots that intersect a piece of crop residue which is large enough to intercept a raindrop (do not count stones or rocks). Ignore small pieces of residue that will decay easily.

6. The number of knots that intersect a piece of crop residue equals the percent of soil surface covered.

7. Record this percentage and then make at least three more checks over randomly selected areas in the field.

8. Calculate the average over the total number of areas checked. This average percentage equals the amount of residue on the surface.

Questions:

1. What would be a definition of conservation tillage?

2. How can conservation tillage help reduce erosion?

3. How does soil roughness affect erosion?

4. Does this field have adequate surface residue? Why?

Conclusions:

1. Identify some tillage methods which could be employed to improve the surface residue.

2. Identify major barriers which cause resistance to adopting approved conservation tillage practices.

STUDENT WORKSHEET #2

How Different Soils Affect the Movement of Water

Purpose:

1. To measure volume accurately.
2. To identify by texture types of soils.
3. To make visual observations about the water movement through the soil.

Materials:

1. 3 large polystyrene cups
2. 3 plastic coffee can lids
3. 3 squares cheese cloth
4. Rubber bands
5. Water
6. Thumbtack
7. Watch or clock
8. Sand
9. Clay
10. Gravel
11. Pencil
12. Four 250ml beakers
13. Scissors

Preparation:

This activity should be preceded by a discussion of types of soils, and how water is absorbed into the soil and moves, with time, around the soil particles.

Procedure:

1. Using the thumbtack, punch several holes in the bottom and around the lower part of each cup. Make sure you punch the same number of holes in each cup.

2. Place a square of cheesecloth over the bottom of each cup so it covers all the holes. Secure the cheesecloth with a rubber band.

3. Using scissors, cut a hole in the plastic coffee can lid so that the cup just fits inside. Place each cup in a lid, and place each lid over a beaker. Label the cups A, B, and C.

4. Fill cup A with half full of dry sand, cup B half full of clay, and cup C half full of a mixture of sand, gravel, and clay.

5. Pour 100ml of water into each cup. Record the time when the water was first poured into each cup

6. Record the time when the water first drips from each cup. Note the physical appearance of the water

7. Allow the water to drip for 25 minutes. At the end of this time, remove the cups from the beakers. Measure and record the amount of water in each beaker.

8. Fill out the following chart with students on the board.

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Data and Observations:

Cup	Time		Observations
	Water In	Water Out	
A			
B			
C			

Questions:

1. Which soil sample is the most permeable?
2. Which soil sample is least permeable?
3. How does the addition of gravel affect the permeability of clay?
4. How does soil type affect the movement of groundwater?
5. Can soil type protect groundwater? Which one? How?

Reference:

Focus on Earth Science, Teachers Resource Manual by Charles E. Merrill Publishing Company. Copyright 1984.

STUDENT WORKSHEET #3

Making a Stream Table

Purpose:

1. To understand the force of moving water.
2. To describe moving water's effect on land forms.

Materials:

1. One cardboard box or metal pan 1' x 2'
2. Tape — masking, cloth, or plastic
3. Water containers
4. Piece of wood to elevate one end of the container
5. Garbage bag or plastic sheeting
6. Several sizes (coarseness) of sand
7. Several types of soil
8. Squeeze bulb such as a large plastic meat baster
9. Small tubing with clothes pins for water control

Procedure:

1. Divide students into groups of 2 to 5 students.

2. Provide students with materials (if cardboard boxes are used have the students score the outside of the sides halfway down and fold the sides in to provide double sides and line them with plastic as in Figures 1 and 2).

3. Use various combinations of sand and dirt to form valleys, slopes, hills, and landforms in the containers.

4. Use the squeeze bulb to act as various intensities of rain and have students observe and record the results. Compare the differences in the effect of water on dry soil and damp soil.

5. Use the tubing as a source of stream water and removal (Figure 3).

   a. Have students observe the differences in straight streams on varying heights of slopes.
   b. Place stones or other obstructions in the stream and observe the results.
   c. Smooth the soil and make S-shaped (meandering) streams and observe the results.

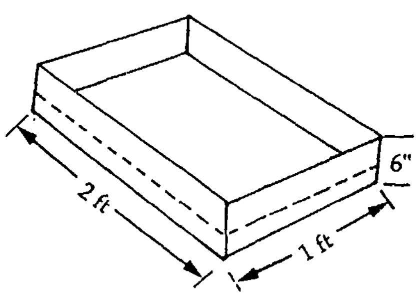


Figure 1.

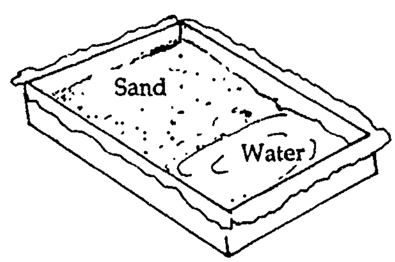


Figure 2.

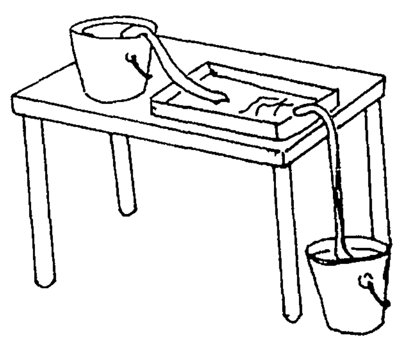


Figure 3.

Discussion:

1. Lead the students in a discussion of the force of water and ask where the power is derived (speed and quantity).

2. Lead the students in a discussion of sedimentation and deposition (heaviest particles first, lightest last).

3. Lead the students in a discussion of minerals and their dissolution by water. Discuss how minerals are both removed and deposited by water.

4. Lead the students in a discussion of man's contribution to erosion through agriculture, building activities such as road and home construction, and urbanization.

STUDENT WORKSHEET #4

Splash Erosion

Purpose:

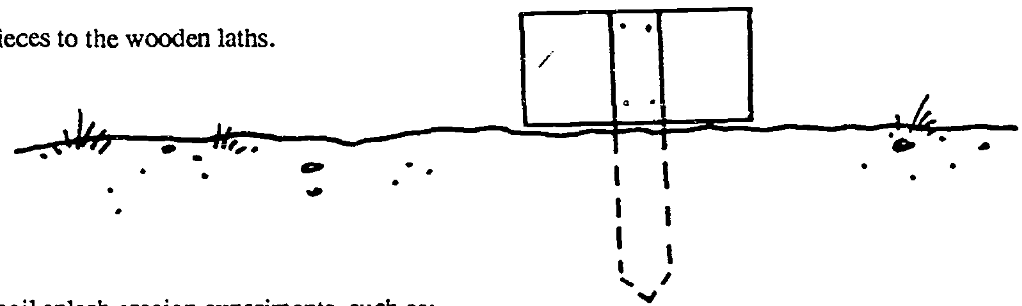
1. To understand the relationship between raindrops and soil erosion.
2. To compare the effects of plant cover on reducing soil erosion caused by raindrops.
3. To understand the effects of slope and soil erosion caused by raindrops.

Materials:

1. 4 boards 1" x 2" x 12" sharpened on one end.
2. 4 plywood boards 3/8" x 4" x 8" painted white.

Procedure:

1. Fasten the painted pieces to the wooden laths.



2. Select locations for soil splash erosion experiments, such as:
   a. Level, grass-sodded area.
   b. Sloping, grass-sodded area.
   c. Level, bare soil area.
   d. Sloping, bare soil area.

3. Drive boards into ground until bottom of plywood is about •" above ground surface.

4. Keep stakes in place until it rains or, if possible, set up a sprinkler system to simulate a •" rain.

5. Have students examine the boards for evidence of soil splash erosion.

6. Promote class discussion on the relationships among rainfall, soil cover, cropping systems, slope of the land, soil type, etc.

7. Complete the following form:

Stake #	Location Characteristics	Results

1220

Questions:

1. Which stake location showed the most erosion or soil movement?

2. What types of tillage practices could be used at each location where erosion was evident to reduce the soil loss?

3. Are there other locations around the local community where splash or sheet erosion is taking place? What conservation practices could reduce the erosion?

4. What effects would this type of erosion have on streams, lakes, ponds, etc.?

5. Calculate the average soil loss using the universal soil loss equation for one or more of the staked areas.

6. Are these areas within soil loss tolerance limits?

STUDENT WORKSHEET #5

Wildlife Management Inventory

Purpose:

1. To understand the relationship between farming techniques and wildlife management.
2. To recognize and map wildlife areas.
3. To compare and contrast two or more farm sites for approved wildlife management practices.

Materials:

1. Plant identification handbook
2. Soil map of area
3. Wildlife identification handbook
4. Two *comparable* field sites

Procedure:

1. Diagram the field site. If possible, obtain aerial photo from local SCS office to help identify field locations.

2. Mark the major natural features of the area such as roads, ditches, waterways, wooded areas, buildings, wet spots, ponds, fences, cropland, etc.

3. Identify potential areas which can provide food and/or shelter for wildlife. Make note of types of ground cover such as grasses (short or tall), shrubs, herbaceous plants, and woody plants.

4. Record any noticeable signs of wildlife such as visible contact, hearing, tracks, droppings, feeding areas, nesting spots, etc.

5. Use symbols to represent items on your map. Use a different symbol for each type of vegetation and animal species.

STUDENT WORKSHEET #6

Wildlife Survey Form

1. Sketch or diagram of wildlife area.

2. Survey observations. Consider the following points about each area:

   a. What are the physical characteristics of the area? (specific plants, topography, animal species, etc.)

   b. How valuable is the area to wildlife? To people?

   c. How could the characteristics of the area be changed or improved for wildlife?

   d. What are some options or recommendations for using this land area? (cropland, nature preserve, public hunting, housing division, public park, etc.)

   e. Try to establish the cause for any differences in wildlife numbers between the sites. (different farming practices, drainage, etc.)

ERIC

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Food Science Technology

RELATED PROBLEM AREAS:

1. Understanding the Role of Research and Development in Agriculture
2. Marketing Agricultural Products and Services (Agricultural Business and Management Cluster)
3. Processing Agricultural Products (Agricultural Business and Management Cluster)
4. Packaging and Distributing Food Products (Agricultural Business and Management Cluster)
5. Processing Fruits and Vegetables (Horticulture Cluster)
6. Adhering to Governmental Regulations (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Biological and Physical Sciences and Physical Development/ Health. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Robert E. Petrea

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

Contact Person: ______
Title: ______
Phone: (   )

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☒ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand principles of consumer health and safety, including environmental health.

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Recognize the impact of government regulation on the food industry.					
*2. Know several local, state, and federal agencies providing consumer fraud information and assistance.					
*3. Know criteria for evaluating foods and their labels.					
1226					1227

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☒ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitations of technological development.

Contact Person:
Title:
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Describe the methods of storing and preserving fish, poultry, and meats.					
2. Describe the methods of storing and preserving cereal grains.					
3. Describe the methods of processing and preserving milk.					
4. Describe the methods of storing and preserving eggs.					
5. Identify food packaging alternatives.					
6. Summarize the trends in food processing for consumer convenience.					
*7. Recognize that controversy exists concerning controls versus noncontrols over the application of technology.					
*8. Evaluate the economic, political, and social implications of scientific and technological developments.					
*9. Understand the impact of technological developments on society.					
*10. Identify future vocations in science.					
*11. Evaluate the need for additives in products used in the home.					
*12. Predict the consequences of technological change.					
1223					1229

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ________

☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

- ☐ Language Arts
- ☐ Mathematics
- ☒ Sciences
- ☐ Fine Arts
- ☐ Social Sciences
- ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in a contemporary technological society.

Contact Person: ________
Title: ________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Define basic terms integral to food science technology.					
*2. Understand the importance of acids, basis, and salts in home and industry.					
*3. Identify examples of simple chemical reactions that occur frequently in our daily lives.					
*4. Understand the effect of various factors on the rate of reaction.					
*5. Relate the processes by which organisms capture, utilize, and release energy.					
*6. Understand how a microorganism moves, obtains food, excretes waste, responds to stimuli, and reproduces in its envoironment.					
123				123	

ISBE 41 78 (1/89)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Food Science Technology

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Define basic terms integral to food science technology.
2. Describe the methods of storing and preserving fish, poultry, and meat.
3. Describe the methods of storing and preserving cereal grains.
4. Describe the methods of storing and preserving fruits and vegetables.
5. Describe the methods of processing and preserving milk.
6. Describe the methods of storing and preserving eggs.
7. Identify food packaging alternatives.
8. Recognize the impact of government regulations on the food industry.
9. Summarize the trends in food processing for consumer convenience.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Food Science Technology

PROBLEMS AND QUESTIONS FOR STUDY

1. What is technology?
2. How does technology differ from science?
3. What is processing?
4. Define and describe the following processes:
   a. freezing
   b. drying (dehydration)
   c. refrigeration
   d. heat sterilization
   e. pasteurization
   f. fermentation
   g. irradiation
   h. pickling
   i. further processing
5. What is storing?
6. What is preservation?
7. What are food additives?
8. Why are food additives used?
9. What are common methods of preserving:
   a. meat
   b. fish
   c. poultry
   d. fruits
   e. vegetables
   f. milk
   g. eggs
10. What are cereal grains?
11. What are common ways of preserving cereal grains?
12. Name specific products that are processed from:
    a. meat
    b. fish
    c. poultry
    d. fruits
    e. vegetables
    f. milk
    g. cereal grains
    h. eggs
13. Name various packaging methods.
14. Why are different methods of packaging necessary?
15. What are different methods of preserving or processing:
    a. meat
    b. fish
    c. poultry
    d. fruit
    e. vegetables
    f. milk
    g. cereal grains
    h. eggs
16. What is government regulation, and how does it apply to the food industry?
17. Name specific examples of governmental requirements which apply to the food industry.
18. Why are governmental regulations necessary?
19. What are convenience foods?
20. Why have convenience foods grown in popularity?
21. Will convenience foods become more popular in the future? Why?
22. Name ways that new convenience foods come about?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Food Science Technology

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Use the food science/home economics instructor as a resource person for ideas, techniques, equipment, and speakers.
2. Have students compare the taste of fresh foods with similar foods processed by various methods.
3. Have students compare length of storage of various preservation and processing methods.
4. Have students compare the taste of fresh foods with similar foods packaged in different containers.
5. Lead students in a discussion on why various methods of preserving food came about.
6. Have students pick a fresh food item and then compile a list of processed foods that contain that item.
7. Have students conduct a survey of the local grocery and compile a list of preservation methods and processing methods found.
8. Conduct field trips to a canning facility, dairy processor, meat packer, slaughtering facility, and local grocery storage facility.
9. Have students use the "home" canning process or make butter, ice cream, yogurt, and jam or jelly.
10. Lead students in a discussion on the inspection processes for different foods.
11. Lead students in a discussion on food labels and what information is required on those labels.
12. Have students compare labels of a specific food item preserved and/or processed by various methods.
13. Lead students in a discussion on additives found in foods consumed daily.
14. Have students keep a diary of foods consumed for a week. Compare the methods of preservation and processing contained in those foods.
15. Lead students in a discussion on the methods of preserving and processing available for "health" foods. Are these different than those available for "normal" foods? Why?
16. Have students compare the packaging methods used for a specific food item. What processing was needed to utilize the different packaging alternatives?
17. Lead students in a discussion on why government regulations in the food industry came about.
18. Lead students in a discussion on the implications and results brought about by government regulations.
19. Have students cite examples of convenience foods.
20. Have students compile a list of convenience foods available at the local grocery store.
21. Have students describe recent changes at "fast food" establishments.
22. Have students keep a diary of purchases at "fast food" establishments for one week. Have students list technologies necessary to make those purchases available.
23. Lead students in a discussion on "convenience" foods and their effects on families.
24. Have students complete Student Worksheet #1.
25. Have students complete Student Worksheet #2.

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Principles of Agricultural Science

PROBLEM AREA: Understanding Food Science Technology

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12. *The World of Nutrition.* (1984). McWilliams, Margaret, Heller, Holly. Ginn and Co., 191 Spring Street, Lexington, MA 02173.

*Indicates highly recommended references

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Food Science Technology

TRANSPARENCY MASTER #1 — The Food Chains of Yesterday and Today

TRANSPARENCY MASTER #2 — Cattle Products

TRANSPARENCY MASTER #3 — Hog Products

TRANSPARENCY MASTER #4 — Principal Types of Aquatic Animals Used as Seafood

TRANSPARENCY MASTER #5 — Schematic Diagram of a Flour-milling Process

TRANSPARENCY MASTER #6 — Schematic Diagram of the Bread-making Process

TRANSPARENCY MASTER #7 — Principal Processed Products From Apples

TRANSPARENCY MASTER #8 — Schematic Diagram of a Dairy Processing Line for the Manufacture of Butter and Non-fat Dry Milk

TRANSPARENCY MASTER #9 — Schematic Illustration of the Butter-making Process

TRANSPARENCY MASTER #10 — Food Packaging Materials

TRANSPARENCY MASTER #11 — Federal Government Agencies with Responsibilities Related to the Processing of Food

TRANSPARENCY MASTER #12 — Categories of Food Additives

TRANSPARENCY MASTER #13 — Preservatives

INFORMATION SHEET #1

Terms to be Defined

Appertizing — canning; named for the french confectioner who won Napoleon's offered prize for a useful food preservation method.

Blanching — inactivation of many enzymes in fruits and vegetables by controlled heating.

Brine — solution of salt and water used to cure (preserve).

Brining — food processing technique that involves storing food in a brine solution, used on foods with juices that are limited or not easily extracted.

Canning — process of preserving food by cooking and then sealing hot foods in airtight containers.

Cereal grains — term generally referring to dry, mature seeds of cultivated grasses; also may include dry, mature seeds of peas and beans.

Controlled atmosphere — technology of food storage, particularly of fresh fruits, whereby temperature, relative humidity, atmospheric pressure, and atmosphere gas composition are manipulated to prolong a "fresh" state.

Convenience foods — processed foods that have had most or all of the preparation completed by food processors.

Cultured — refers to the use of selected microbes to convert lactose to lactic acid while also producing the desired flavoring compound, each requiring a specific incubation temperature.

Curd — semisolid mass of proteins and fats used to make cheese.

Curing — impregnating foods with a strong concentration of salt.

Dry salting — curing foods with a brine consisting of salt and juices drawn from the food by the salt.

Dry storage — storage without extremes in temperature (20°C) and below 50% relative humidity.

Drying — removal of water necessary for growth of microorganisms, thereby preserving the food.

Fermentation — breakdown of complex molecules in organic compounds, generally associated with a lower pH; may refer to food spoilage or the use of microbes in techniques of food processing.

Flash freezing — process for freezing foods in a cyrogenic environment.

Food additive — a substance added to food to produce a desired result; coloring and preservatives are examples.

Food freezing — lowering the temperature of food to a point at which microbes are unable to grow because of either too low temperature or lack of water.

Freeze drying — removal of water content from foods by freezing items in a vacuum.

Freezer burn — dark spots on frozen food, especially meats, due to evaporation of ice during frozen storage.

Freezer storage — stored at temperatures below 0°C and preferably above -23°C.

Freezing — lowering the temperature to a point at which water contained within a substance becomes solid.

Further processing — techniques to convert processed material to products (flour to bread).

GRAS list — generally recognized as safe list of items that can be used in food products without special FDA permission.

Government regulation — in reference to the food industry, governmental involvement by setting standards and procedures to protect the consumer against fraudulent and unacceptable practices and to assure food safety.

Homogenation — use of sound waves or mechanical strainers to break up fat cells in milk.

Humectants — chemical agents added to food to bind water, sugar, and salt.

Hydrogenation — bubbling of hydrogen gas through a liquid or oil to cause solidification.

Irradiation — using γ-rays or β-rays to kill microorganisms present in food; radurization, new term for irradiation to describe its relationship to pasteurization.

Lactose — milk sugar.

Leavening — a natural process in the making of bread or other baked products that generates gases, especially carbon dioxide, that cause the bread to rise.

Margarine — substance made from vegetable oils that is used as a spread on bread or in cooking; looks and tastes like butter.

Microbial food spoilage — spoilage caused by the active growth of vegetative forms of microorganisms.

Mold — parasitic growth that attacks food or other organic materials.

Nutrition label — format of required information to be listed on nutritionally labelled products, including serving size; number of calories; number of servings; calories per serving; amounts of protein, carbohydrate and fat per serving; and percentage of U.S. recommended daily allowance for protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron.

Oil-bearing seeds — term generally referring to those mature seeds crushed for oil; soybean, rareseed, sunflower, cottonseed, peanut, and palm.

Par-fried — refers to foods that have been partially processed, such that reheating at final consumption will not result in overcooking (e.g., frozen french fries).

Pasteurization — heating to a prescribed temperature for a specified period of time to inactivate many viable organisms in the substance.

Pickling — lowering the pH of a food below the growth tolerance limits of microbes.

Preservation — to keep from rotting or spoiling.

Preservation principle — altering the food environment to reduce its suitability for microbial growth, chemical deterioration, or unwanted enzymatic reactions.

Processed foods — foods which have been treated in some way or have undergone some amount of preparation before they are sold to the consumer.

Processing — techniques used to convert resource material to products.

Refrigeration — development of lower than normal temperature.

Science — systematized knowledge derived from observation, study, and experimentation to verify observations.

Smoking — food processing technique that involves curing meats with a combination of salt and smoke (either natural or liquid).

Shelf-life — the length of time, between processing and retail purchase, that a food product remains in a satisfactory state.

Spoilage — degradative changes caused by microbial, chemical, or physical agents making food unappealing or entirely unfit for consumption.

Sterilization — heating to a prescribed temperature for a specified period of time to inactivate all viable organisms in the substance.

Storing — setting aside for future use.

Synthesized — formed by combining chemical elements or compounds found in nature.

Technology — application of scientific knowledge to a specific purpose.

UHT — ultrahigh temperature sterilization of foods, typically 140–144°C for a few seconds.

UPC — universal product code, grid of lines on food product package, allows for computer registry.

Vaporize — to change material into a gas from a liquid.

Vat — a tank or cask that holds liquids used in processing.

Whey — liquid substance of milk after solids are removed.

Yeast — fungus that causes or promotes fermentation; also leavening agent.

INFORMATION SHEET #2

Food Science Technology

Food Science Technology has been defined by the Institute of Food Technologists, the professional society for those disciplines involved, as the application of science and engineering to the production, processing, packaging, distribution, preparation, and utilization of foods.

This diverse discipline may be more specifically divided into food technology and food science. Food technology is generally considered to begin with the raw agriculture products and relates primarily to processing and preserving commercial food products. Food science is generally considered to be the field of fundamental investigation into the basic phenomena of foods and food components. These two broad divisions make up only a part of the continuous spectrum of activities involved in providing to the public those foods available for consumption. The main concern in the realm of food is limiting those degradative changes imposed by our environment, to keep food nutritious and appealing for as long as possible. This concern, then, deals principally with spoilage, which may be caused by microbial, chemical, or physical agents.

The major type of food spoilage is microbial, caused by the growth of bacteria, yeasts, or molds. Chemical spoilage may be from water, oxygen, light, or temperature acting directly on foods or influencing enzymatic reactions within. Physical spoilage refers to mechanical damage that allows degradation to occur that otherwise would be prevented.

The primary objective of food preservation is to stop or retard microbial growth, since these deteriorative changes occur fastest, while at the same time minimizing chances for chemical or physical changes. The three principle food preservation techniques are drying, freezing, and canning.

Drying is by far the oldest and still the most widely used method of food preservation. More fruits are preserved by this means than any other. One of man's first food technologies was the artificial drying of food with heat from fire in his shelter, thus lessening his dependence on weather drying. The art of artificial drying or dehydration began to advance with the invention in 1795 of the hot air room by Masson and Challet in France.

The art of canning came in response to a need, a need that had a prize attached. Napoleon was at war and needed some method besides drying to preserve foods for transportation not only to his people, but more importantly, to his troops. Nicolas Appert, a confectioner, saw that foods heated in a sealed container were preserved if unopened or the seal did not leak. Since the cause of food spoilage was unknown, scientists of the day decided that the air magically combined with the food to prevent spoilage. Though this conclusion was incorrect, the process worked, and Appert modestly called it "appertizing." This was in the late 1790s. The term "can" is assumed to be shortened from the tin-plated containers patented in England by Peter Durand in 1810 called "canisters."

The principle of freezing, of course, could not be used until refrigeration came about. Though a different method, freezing is similar to drying in that it ties up the water needed by microbes for growth. Most microbes cannot use frozen water.

The three principal preservation methods are excellent examples of the application of scientific knowledge to foods in food technology. Drying removes the water microbes need for growth. Canning uses heat to destroy the viability of microorganisms. Freezing in many instances does both. Freezing may destroy the viability of microbes or it may simply make the microbes inactive by tying up their water source until some other method to destroy them is applied. These represent the most common methods; new applications arise daily.

What is not wanted in one place may be wanted in another. Drying removes water that microbes need. In the case of cereal grains, however, not only are they dried for storage, but they are also heated to expand and become our breakfast cereals. Canning, pasteurization, and irradiation are used to destroy microbes in our milk, fruits, vegetables, and meats, but microbes are desirable, even necessary, for the steps needed to make cheese, yogurt, cottage cheese, and sour cream. The scientific knowledge of what specific compound was made by a particular bacteria was necessary for the production of these products.

Consumers have shown a growing interest in "natural" foods without additives, and many foods with a minimum of additives are available. However, the use of additives is sometimes necessary to preserve food in many of the forms we have available. Acetic acid (vinegar) is necessary for pickling. Sorbic acid is used as an antifungicide. The use of sodium chloride (salt) is a major meat preservation method. Benzoic acid is used as an antimicrobial agent. Spices have antibacterial properties. Ethylene gas is applied in controlled atmosphere storage to maintain a "naturally" grown fruit from one season to the next for year-round availability. These are other examples of food technology, of scientific knowledge applied to the processing and preserving of foods.

TRANSPARENCY MASTER #1

The Food Chains of Yesterday and Today

Yesterday	*Today*
Farmer = Processor	**Farmer**
↓	↓
Retailer and/or consumer	**Raw material delivery**
	↓
Immediate family	**Processor**
Neighbors	↓
Village level	**Distributor**
	↓
	Retailer
	↓
	Consumer

Across town, across country, or across the world

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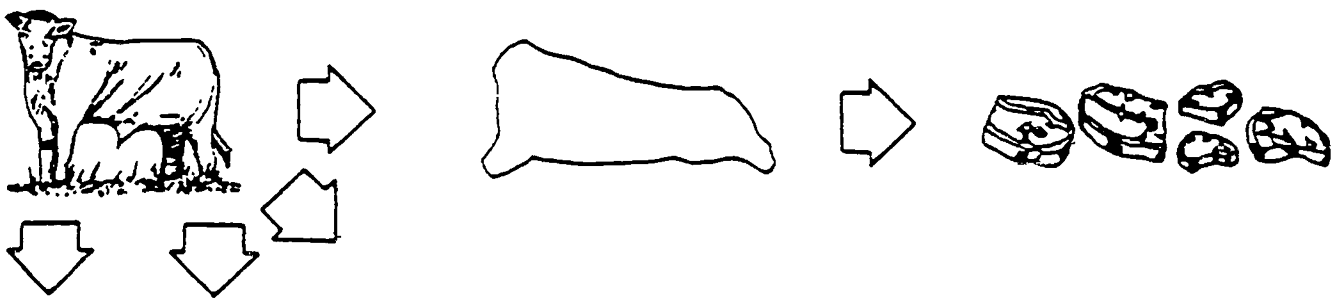
TRANSPARENCY MASTER #2

Cattle Products

1000 lb. Steer **600 lb. Carcass** **440 lb. Retail Meat**

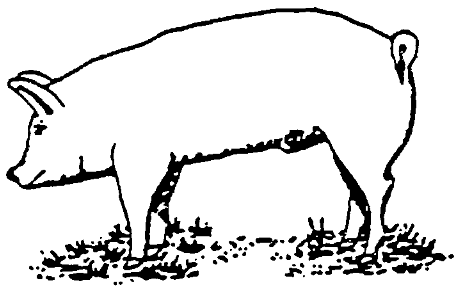


Pharmaceuticals	Inedible By-Products	Edible By-Products
Rennet	Leather	Liver
Epinephrine	Brushes	Tongue
Insulin	Sandpaper	Marshmallows
Thrombin	Soap	Natural Sausage Casings

16 oz. T-bone

TRANSPARENCY MASTER #3

Hog Products



Carcass

Pharmaceuticals

Thyroxin
Estrogen
Relaxin
Insulin
Epinephrine
Cortisone

Bacon Pork Chop Ham

Inedible By-Products

Buttons
Bone China
Fertilizer
Rubber
Leather
Crayons
Plastics

Edible By-Products

Natural Sausage Casings
Chewing Gum
Gelatin
Lard

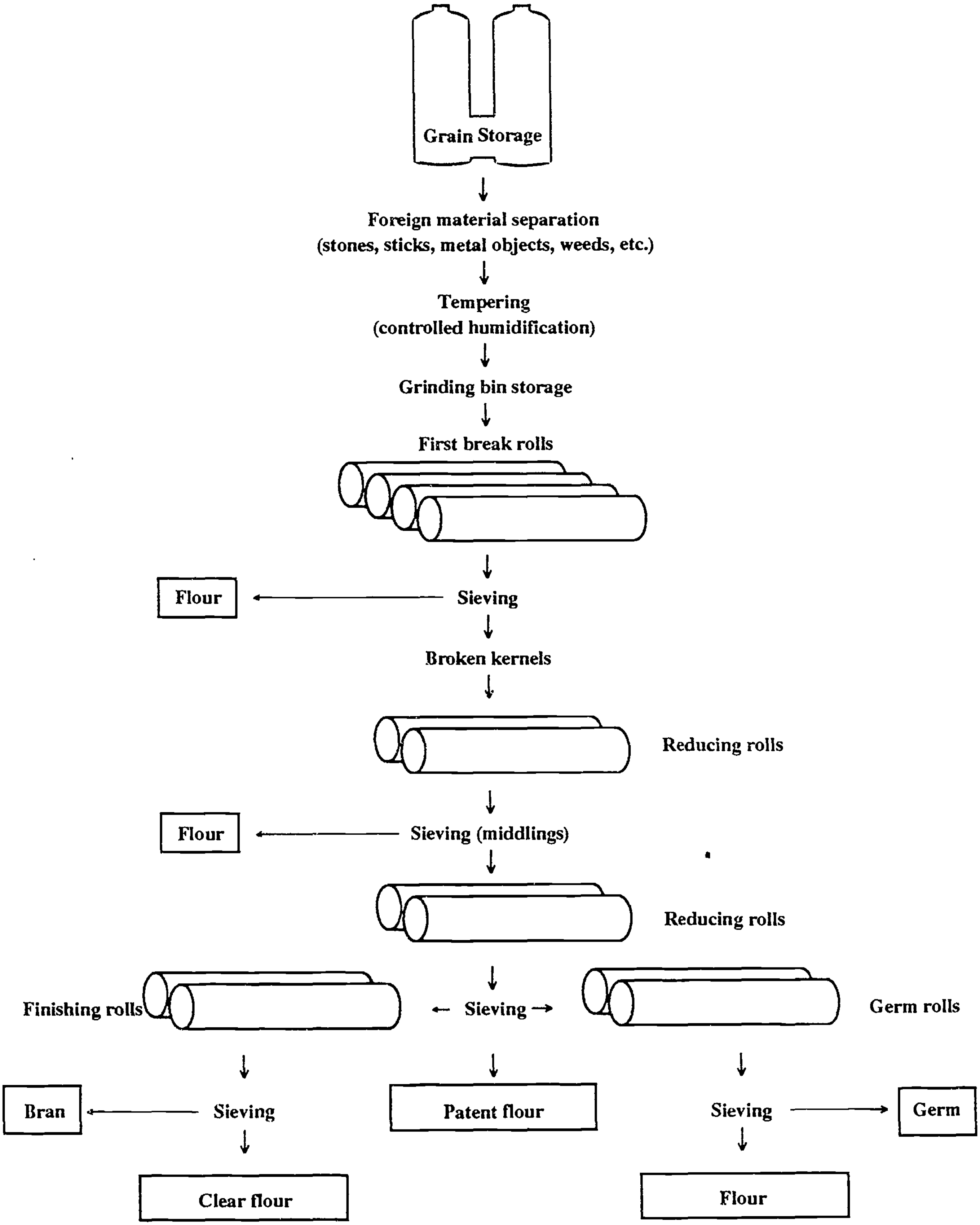
TRANSPARENCY MASTER #4

Principal Types of Aquatic Animals Used as Seafood

Generic Group and Examples	Possible Uses	Typical Producing Country
Fish — General Use:		
Tuna, cod, halibut, salmon, many others	Fresh, frozen, canned, further processed	Norway, Japan, Canada, U.S.A.
Fish — Special Uses:		
Sardine	Canning	Canada, Portugal
Anchovies	Fish protein concentrate	Peru
Fish eggs	Caviar	U.S.S.R.
Fish by-catch	Kamaboko (fish paste)	Japan
Crustaceans:		
Shrimp, lobsters, scallops, prawns, crabs	Fresh, canned, frozen	Canada, South Africa, Japan, U.S.A.
Other Aquatic Life:		
Shark	Fish and chips	New Zealand
Whale	Fresh, canned	U.S.S.R.
Squid, octopus	Fresh, marinated	Japan

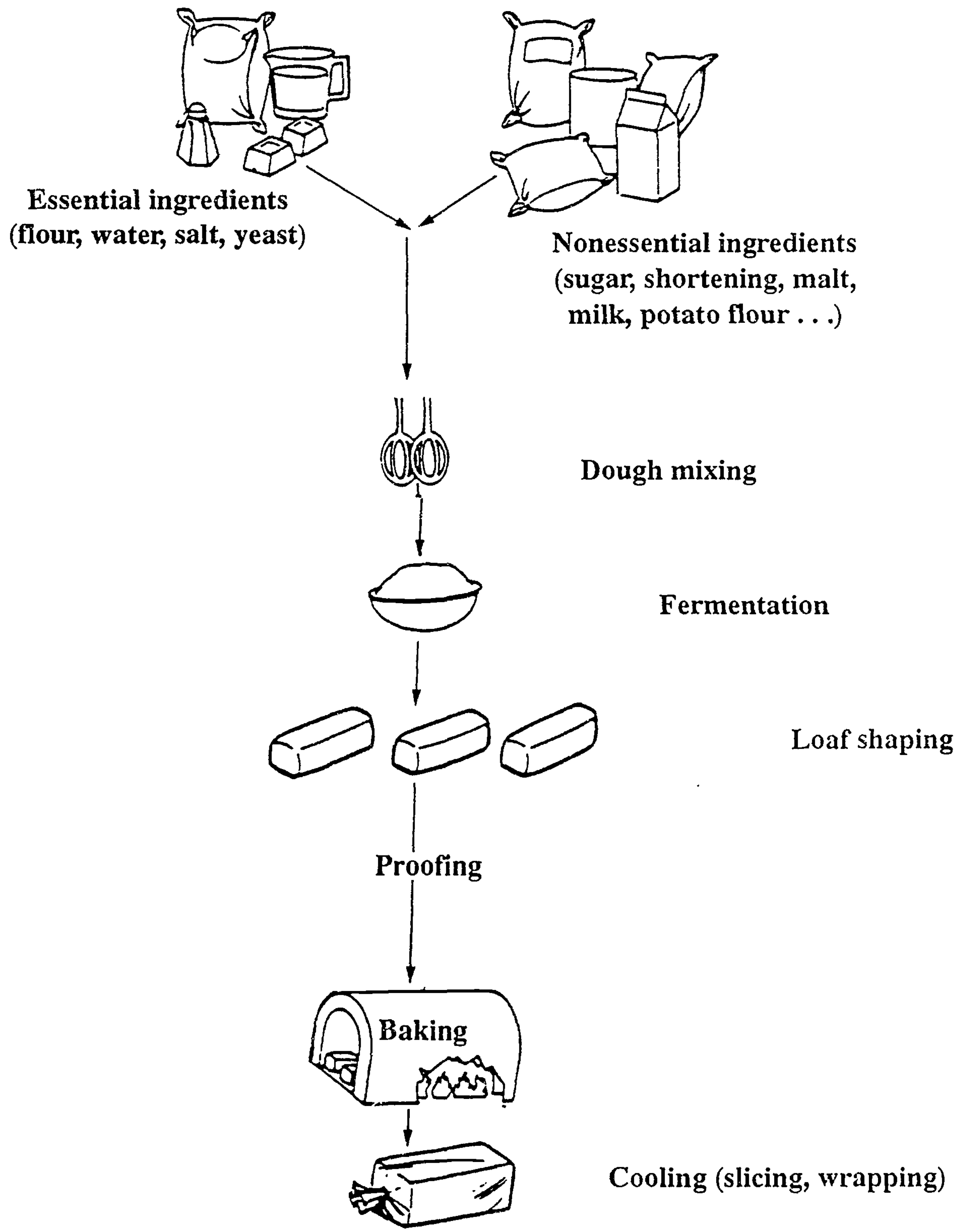
TRANSPARENCY MASTER #5

Schematic Diagram of a Flour-milling Process



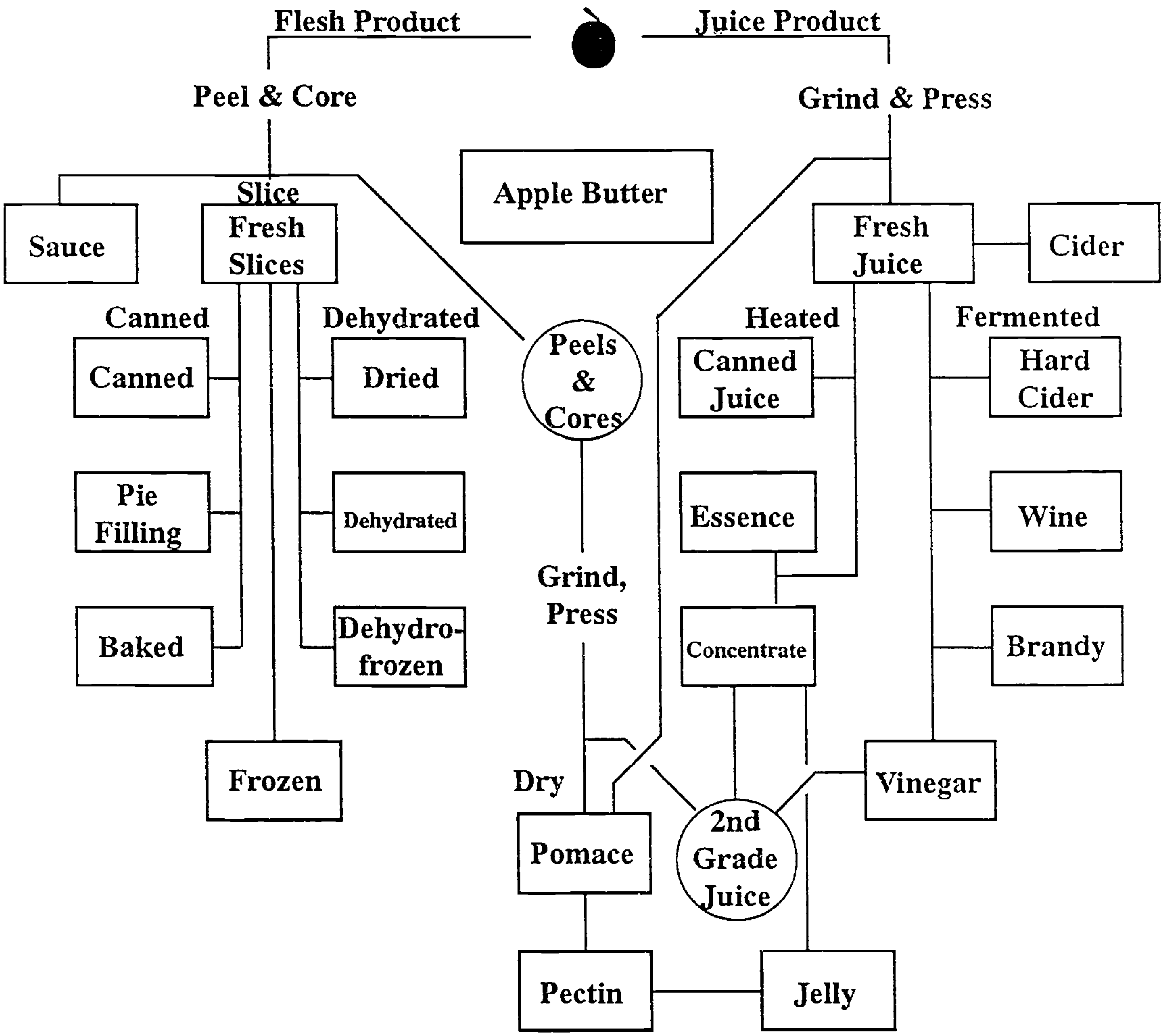
TRANSPARENCY MASTER #6

Schematic Diagram of the Bread-making Process



TRANSPARENCY MASTER #7

Principal Processed Products from Apples



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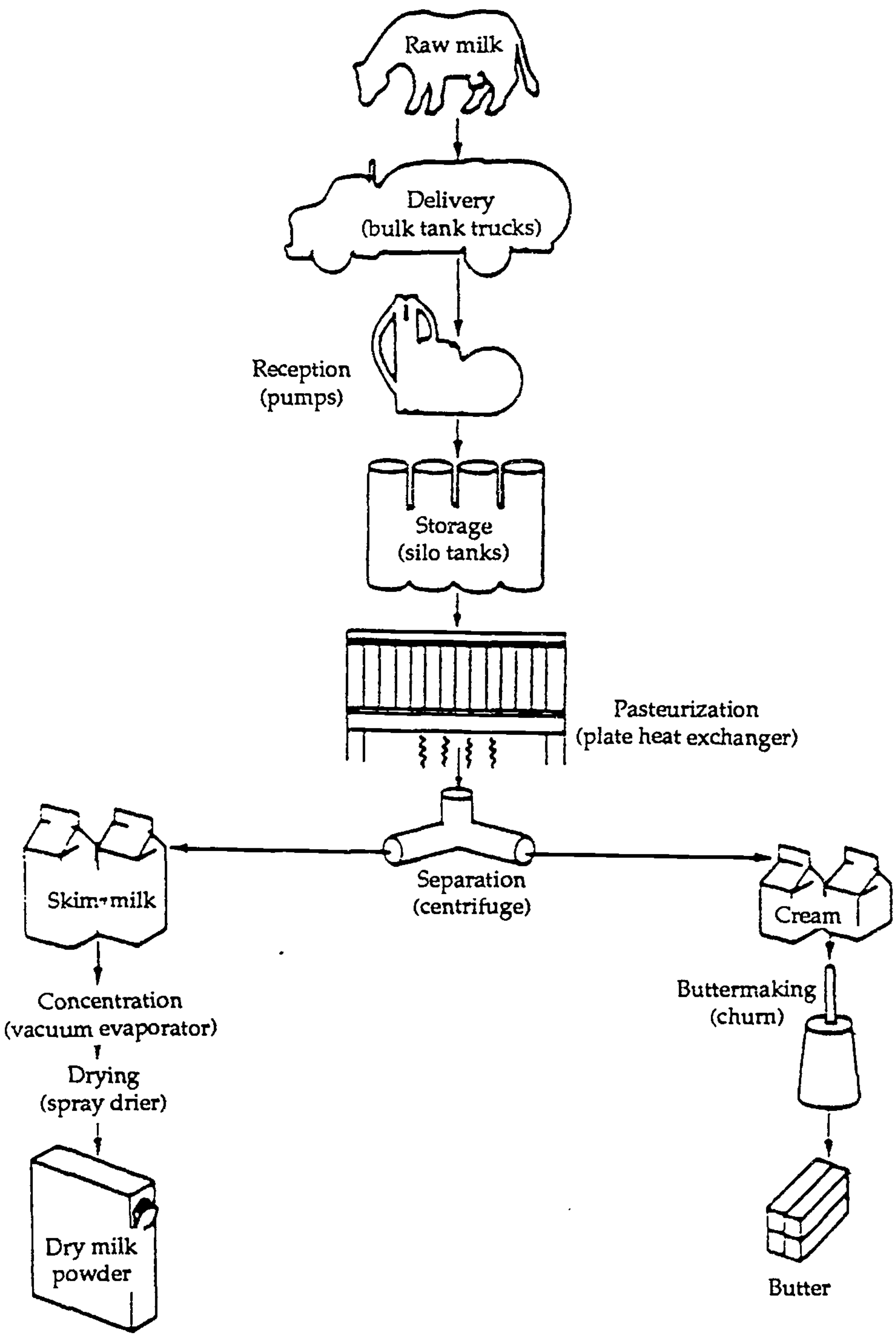
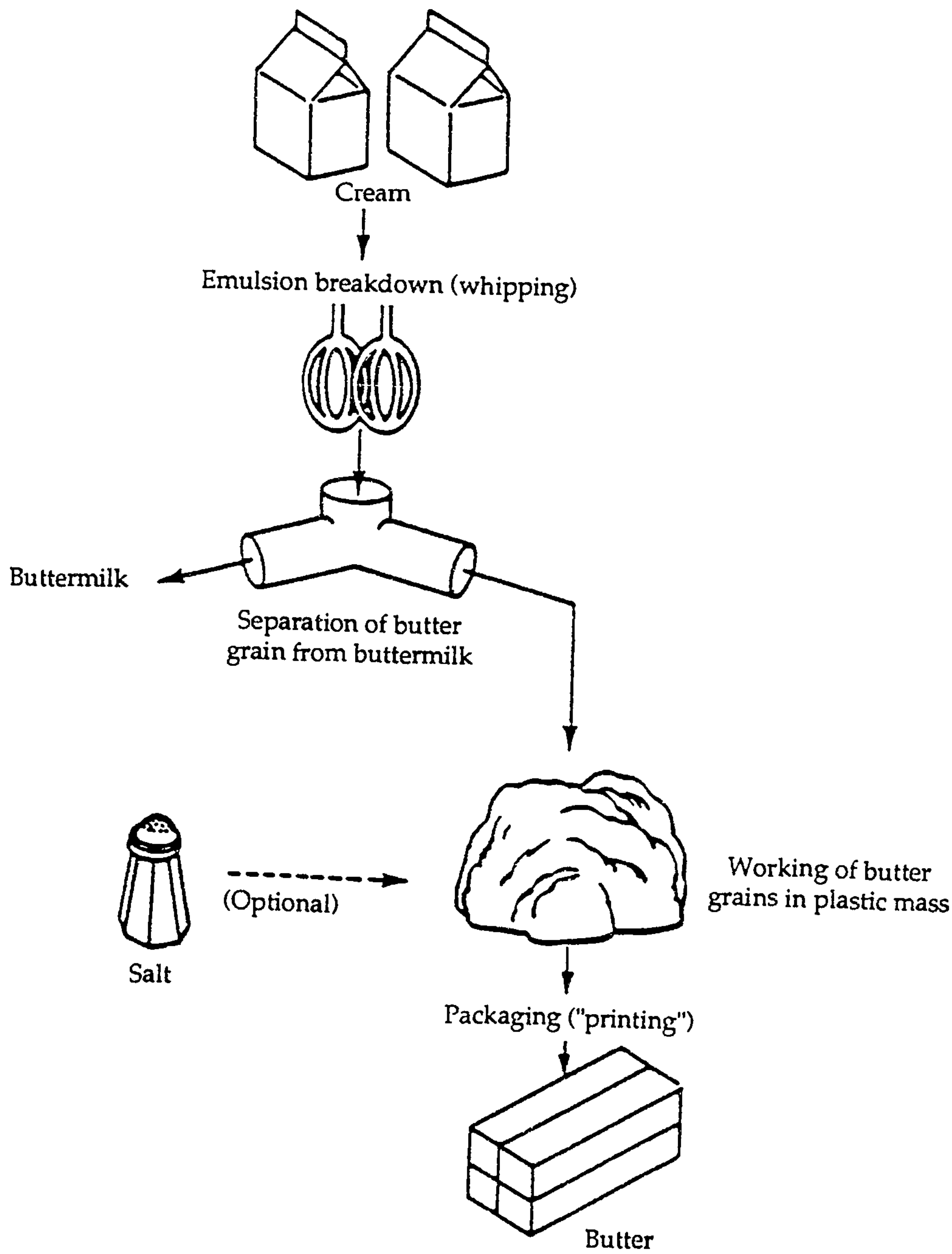
TRANSPARENCY MASTER #8

Schematic Diagram of a Dairy Processing Line for the Manufacture of Butter and Non-fat Dry Milk



TRANSPARENCY MASTER #9

Schematic Illustration of the Butter-making Process



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TRANSPARENCY MASTER #10

Food Packaging Materials

Materials	*Examples of Use*
Cloth	Sacks, special packages
Glass	Bottles, jars
Edible Containers	Cabbage leaves, ice cream cones
Laminates	Cartons for liquids, multilayered plastics
Metal	Aluminum foil, cans
Paper	Bags, boxes, cartons
Plastics	Overwraps, pouches, cups, boxes, bottles
Wax	Coating of cheese, fruits, and vegetables
Wood	Crates, special packages

ERIC

TRANSPARENCY MASTER #11

Federal Government Agencies with Responsibilities Related to the Regulation of the Processing of Food

Governmental Agency	*Responsibility*
Department of Agriculture (USDA)	Acts to enforce standards of plant sanitation and inspection; product identification; grading of meat, vegetables, and fruit; and veterinary inspection of meat.
Department of Commerce (National Marines and Fisheries Bureau)	Acts to enforce regulations on fish catches, imports, and processing.
Department of Commerce and Dept. of Agriculture (USDA)	Acts to regulate participation in the international food trade.
Dept. of Health and Human Service (U.S. Public Health Service–USPHS) (Food and Drug Administration–FDA)	Serves as an advisor concerning the sanitation of food, milk, and shellfish; acts to enforce legislation that sets standards of food wholesomeness, processing, and marketability.
Department of Treasury (Bureau of Alcohol, Tobacco and Firearms–BATF)	Acts to enforce production and sales of all alcoholic beverages.
Environmental Protection Agency (EPA)	Acts to enforce controls of pesticide application; food processing effluviant in water, on land, and in the air; and water supplies.
Federal Trade Commission (FTC)	Acts to enforce legislation concerning food packaging, labeling, and advertising.

TRANSPARENCY MASTER #12

Categories of Food Additives

Category	Example: Additive Name	Example: Uses
Acidulants	Citric acid	Fruit and vegetable products
Anticaking agents	Calcium silicate	Salt mixtures
Carrier or extraction solvents	Ethyl alcohol	Spice extracts
Coloring agents	Annato yellow	Cheddar cheese
Dough conditioners, bleaching and maturation agents	Potassium bromate	Flour, bread
Emulsifiers, gelling and thickening agents	Carrageenan	Ice cream
Firming agents	Calcium chloride	Canned vegetables
Food enzymes	Papain	Meat tenderization
Glazing and polishing agents	Magnesium silicate	Confectionery products
Miscellaneous (antifoaming agents, humectants, pressure-dispensing agents, whipping agents)	Nitrogen, sorbitol	Whipped toppings, marshmallows
Non-nutritive sweeteners	Aspartame	Diet beverages
Preservatives and antioxidants	Sodium nitrite, sorbic acid, butylated hydroxyanisole (BHA)	Prepared meats, jams, fatty foods
Sequestering agents	Calcium phosphate	Ice cream mix
Starch modifying agents	Sodium carbonate	Starch
Yeast foods	Zinc sulphate	Beer

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TRANSPARENCY MASTER #13

Preservatives

Compound	*Used In*	*Effective Against*
Benzoic acid, benzoates	Jams and jellies	All microorganisms
Pimaricin	Surface application on cheese	Molds
Propionic acid, propionates	Bread	Molds
Sodium nitrite	Prepared meats	Bacteria (esp. *C. botulinum*)
Sorbic acid, sorbates	Cheese spread	Molds and yeast

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Food Science Technology Questions

STUDENT WORKSHEET #2 — Food Science Technology Word Search (with solution)

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Food Science Technology Questions

1. Describe two reasons why foods need to be preserved.

    a.

    b.

2. Name the three principal preservation methods.

    a.

    b.

    c.

3. Name the three major types of spoilage which occur in foods.

    a.

    b.

    c.

Use your answers to Questions 2 and 3 to answer the following questions.

4. What is the oldest form of food preservation?

5. Which spoilage is from the growth of bacteria, yeast, and molds?

6. Which spoilage occurs from enzymatic reactions?

7. What is the major type of food spoilage?

8. What food preservation method did Nicolas Appert discover?

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9. Which two preservation methods are similar in action?

10. Describe the action of similarity in Question 9.

11. Which preservation method destroys microbes with heat?

12. What is the most widely used food preservation method?

13. Which spoilage type is related to bruised and cut vegetables?

14. Which governmental agency enforces legislation concerning food wholesomeness?

    a. USPHS   c. FTC

    b. USDA   d. EPA

15. Which governmental agency enforces legislation related to packaging and labeling of food?

    a. BATF   c. FDA

    b. FTC   d. USDA

16. Give four examples of a food-packaging material and a food it might contain.

    a.

    b.

    c.

    d.

17. What is an edible container? Give one example.

18. Name three processed food items.

    a.

    b.

    c.

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19. Describe the processes necessary to make bread from stored wheat.

20. Define the following terms.

    a. technology

    b. sterilization

    c. convenience foods

    d. blanching

    e. GRAS list

    f. freeze drying

STUDENT WORKSHEET #1 — Key

Food Science Technology Questions

1. Describe two reasons why foods need to be preserved.

   a. *The need to prevent spoilage.*

   b. *The need to keep foods in an edible state for extended periods.*

2. Name the three principal preservation methods.

   a. *drying*

   b. *chemical*

   c. *canning*

3. Name the three major types of spoilage which occur in foods.

   a. *microbial*

   b. *chemical*

   c. *physical*

Use your answers to Questions 2 and 3 to answer the following questions.

4. What is the oldest form of food preservation?

   drying

5. Which spoilage is from the growth of bacteria, yeast, and molds?

   microbial

6. Which spoilage occurs from enzymatic reactions?

   chemical

7. What is the major type of food spoilage?

   microbial

8. What food preservation method did Nicolas Appert discover?

   canning

9. Which two preservation methods are similar in action?

   drying and freezing

10. Describe the action of similarity in Question 9.

    Both remove the water needed for microbial growth.

11. Which preservation method destroys microbes with heat?

    canning

12. What is the most widely used food preservation method?

    canning

13. Which spoilage type is related to bruised and cut vegetables?

    drying

14. Which governmental agency enforces legislation concerning food wholesomeness?

    a. *USPHS*

15. Which governmental agency enforces legislation related to packaging and labeling of food?

    b. *FTC*

16. Give four examples of a food-packaging material and a food it might contain.

    See Transparency Master #10.

17. What is an edible container? Give one example.

    See Transparency Master #10.

18. Name three processed food items.

    See Transparency Masters #2 - #9 and Information Sheet #1, Terms to be Defined.

19. Describe the processes necessary to make bread from stored wheat.

    See Transparency Masters #5 - #6.

20. Define the following terms.

    See Terms to be Defined.

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STUDENT WORKSHEET #2

Food Science Technology Word Search

I	N	A	E	W	Q	E	C	N	E	I	C	S	P	V	V	D	A	Z
O	X	H	D	R	Y	I	N	G	U	N	F	S	T	F	K	V	F	L
F	O	C	A	D	N	O	O	G	D	G	I	N	T	D	N	R	U	D
A	G	U	G	S	C	A	T	C	K	G	V	J	G	I	E	J	C	L
X	I	L	G	N	S	F	K	L	N	N	W	J	U	E	V	A	U	I
E	G	T	F	O	I	U	S	I	B	C	M	W	Z	I	P	M	O	E
K	F	U	B	E	B	S	V	Z	Y	Z	C	I	P	D	T	A	V	T
K	S	R	X	I	R	R	S	I	N	G	N	U	Z	I	L	G	C	U
C	F	E	K	H	E	M	L	E	R	G	O	A	R	V	N	J	Q	D
N	U	D	S	S	C	B	E	Q	C	R	Q	L	Y	I	Q	G	L	X
X	O	S	E	P	G	L	L	N	I	O	A	M	O	K	N	M	U	Q
M	S	R	T	X	O	N	J	A	T	K	R	D	R	N	X	G	R	U
X	P	O	B	O	T	I	I	F	N	A	H	P	I	E	H	R	W	J
C	A	R	L	J	R	S	L	N	I	C	T	R	P	A	L	C	Y	M
G	L	F	B	Q	L	I	I	A	N	B	H	I	W	C	T	T	E	L
M	R	Z	H	S	T	L	N	D	G	A	R	I	O	Y	D	I	G	T
V	P	I	P	G	A	Z	B	G	A	E	C	I	N	N	R	R	O	J
E	G	A	D	D	I	T	I	V	E	Z	J	N	N	G	M	T	E	N
Z	S	N	S	D	F	J	I	E	L	V	W	D	M	E	I	Q	B	B

The following words are hidden in the puzzle:

Additive
Blanching
Brine
Canning
Cultured
Curing
Drying
Fermentation

Freezing
Irradiation
Preserving
Processing
Science
Spoilage
Storing
Technology

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STUDENT WORKSHEET #2 — Key

Food Science Technology Word Search

•	•	•	•	•	•	E	C	N	E	I	C	S	•	•	•	•	•	•
•	•	•	D	R	Y	I	N	G	•	•	•	•	•	•	•	•	F	•
•	•	C	•	•	•	•	•	•	•	•	•	•	•	•	•	R	•	•
•	•	U	G	•	•	•	•	•	•	G	•	•	•	•	E	•	•	•
•	•	L	•	N	•	•	•	•	N	•	•	•	•	E	•	•	•	•
•	•	T	F	•	I	•	•	I	•	•	•	•	Z	•	•	•	•	•
•	•	U	•	E	•	S	V	•	Y	•	C	I	•	•	•	•	•	•
•	•	R	•	•	R	R	S	I	•	G	N	U	•	•	•	•	•	•
•	•	E	•	•	E	M	•	E	R	G	O	•	R	•	•	•	•	•
•	•	D	S	S	•	B	E	•	C	R	•	L	•	I	•	•	•	•
•	•	S	E	P	G	•	L	N	•	O	A	•	O	•	N	•	•	•
•	•	R	T	•	O	N	•	A	T	•	R	D	•	N	•	G	•	•
•	P	•	•	O	•	I	I	•	N	A	•	P	I	•	H	•	•	•
•	•	•	•	•	R	•	L	N	•	C	T	•	•	A	•	C	•	•
•	•	•	•	•	•	I	•	A	N	B	H	I	•	•	T	•	E	•
•	•	•	•	•	•	•	N	•	G	A	R	I	O	•	•	I	•	T
•	•	•	•	•	•	•	•	G	•	E	C	I	N	N	•	•	O	•
•	•	A	D	D	I	T	I	V	E	•	•	•	N	G	•	•	•	N
•	•	•	•	•	•	•	•	•	•	•	•	•	•	E	•	•	•	•

The following words are hidden in the puzzle:

Additive
Blanching
Brine
Canning
Cultured
Curing
Drying
Fermentation

Freezing
Irradiation
Preserving
Processing
Science
Spoilage
Storing
Technology

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UNIT D: Basic Agribusiness Principles and Skills

PROBLEM AREAS:

1. Keeping and Using Records in Agricultural Occupations
2. Applying Basic Economic Principles in Agribusiness
3. Developing Basic Microcomputer Skills
4. Understanding Basic Business Organization
5. Managing Personal Finances

ERIC

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Keeping and Using Records in Agricultural Occupations

RELATED PROBLEM AREAS:

1. Applying Mathematics Skills in Agriculture

2. Managing Personal Finances

3. Planning and Organizing the Agribusiness (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty F: Financing the Agribusiness

1. Prepare cash flow projections
2. Prepare financial statements
3. Interpret financial statements
4. Prepare cash flow statements

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Randy J. Bernhardt

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ________
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ________
Title: ________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Understand why records are important for the planning and continuity of an agricultural business.					
2. Identify the two functions of records.					
3. Understand terminology associated with record keeping.					
4. Develop a net worth statement (balance sheet) for an agricultural business.					
5. Develop a profit and loss statement (income statement) for an agricultural business.					
6. Develop a cash flow statement for an agricultural business.					
7. Analyze the financial trend of an agricultural business through financial analysis ratios.					
8. Develop computer record keeping skills.					
9. Prepare unit budgets.					
10. Develop an understanding of enterprise budgets.					
11. Understand how to determine profitability of an investment or change in the business through partial budgeting.					
*12. Evaluate the costs and benefits of a particular course of action.					
*13. Understand the principles of money management including budgeting.					
*14. Apply the principles of money management to financial planning situations.					

ISBE 41-78 (1/88)

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Keeping and Using Records in Agricultural Occupations

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Understand why records are important for the planning and continuity of an agricultural business.
2. Identify the two functions of records.
3. Understand terminology associated with record keeping.
4. Develop a net worth statement (balance sheet) for an agricultural business.
5. Develop a profit and loss statement (income statement) for an agricultural business.
6. Develop a cash flow statement for an agricultural business.
7. Analyze the financial trend of an agricultural business through financial analysis ratios.
8. Develop computer record-keeping skills.
9. Prepare unit budgets.
10. Develop an understanding of enterprise budgets.
11. Understand how to determine profitability of an investment or change in the business through partial budgeting.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Keeping and Using Records in Agricultural Occupations

PROBLEMS AND QUESTIONS FOR STUDY

INSTRUCTOR'S NOTES AND REFERENCES

1. Why are records important for an agricultural business.
2. What are the two major functions of records?
3. What is an asset?
4. What is the difference between current, intermediate, and fixed assets?
5. What is a liability?
6. Can you explain the difference between current, intermediate-term, and long-term liabilities?
7. Define net worth.
8. How do you calculate net worth?
9. What is a net worth statement?
10. What is included on a net worth statement?
11. Can you develop a profit and loss statement?
13. What is a financial ratio?
14. How do we calculate financial ratios?
15. What is the role of computers in agricultural record keeping?
16. What is a unit budget?
17. What is an enterprise budget?
18. What is partial budgeting?

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Keeping and Using Records in Agricultural Occupations

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area with an interest approach which includes an overview of what is to be studied.
2. Using Information Sheet #1, discuss why it is important to keep records.
3. Discuss the two major functions of records using Transparency Master #1.
4. Discuss terminology associated with record keeping. Refer to Information Sheet #2.
5. Using Transparency Master #2, discuss what a net worth statement (balance sheet) measures and how to complete a net worth statement.
6. Have students complete Student Worksheet #1.
7. Using Transparency Master #3, discuss what a profit and loss statement (income statement) measures and how to complete a profit and loss statement.
8. Have students complete Student Worksheet #2.
9. Use Student Worksheet #3 to discuss what a cash flow statement measures and how to complete a cash flow statement.
10. Supply students with financial figures to complete Student Worksheet #3.
11. Use Information Sheet #3 to discuss the importance of financial ratios and to instruct students about how to calculate financial ratios.
12. Have students complete Student Worksheet #4.
13. Assign sections from *Computerized Farm Records* (see references) or another good computerized record-keeping system to give students practical experience using computer record-keeping systems.
14. Assign pages 61-66 of the *Farm Management Guide* for students to read in class as supervised study. Conduct a class discussion on unit budgets and enterprise budgets. Answer student questions.
15. Use Information Sheet #4 to explain partial budgets to students.
16. The instructor should complete Student Worksheet #5 in class and have students fill in partial budget worksheet.
17. Have students complete Student Worksheet #6 as an individual student assignment.
18. Conduct a summary discussion. Ask students "What have you learned about record keeping?" List student responses on the board.
19. Discuss the ethical issues which relate to keeping accurate business records.
20. Use selected Modules from Applied Mathematics to enhance math skills needed in the workplace.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Keeping and Using Records in Agricultural Occupations

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Financial Planning in Agriculture.* Schneeberger, Kenneth C., Osburn, Donald D. (most recent edition). The Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

*2. *Computerized Farm Records.* (1988). Allen, Warren W. South-Western Publishing Co., 355 Conde St., West Chicago, IL 60185. (312) 231-6000.

*3. *Farm Management Guide.* 16th edition. Doane Publishing Company, 11701 Borman Drive, St. Louis, MO 63146.

4. *Business Management for Farmers.* (1983). Looney, J.W. Doane Publishing Company, 11701 Borman Drive, St. Louis, MO 63146.

5. *Century 21 Accounting.* Swanson, Ross, Hanson, Boynton. 3rd Edition. South-Western Publishing Co., 355 Conde Street, West Chicago, IL 60185. (312) 231-6000.

*6. Student SAEP record books available from Vocational Agriculture Service and Interstate Printers and Publishers.

7. *Applied Mathematics.* Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Why Keep Records?

INFORMATION SHEET #2 — Terms to be Defined

INFORMATION SHEET #3 — Financial Analysis Ratios

INFORMATION SHEET #4 — Partial Budget

TRANSPARENCY MASTER #1 — Two Major Functions of Records

TRANSPARENCY MASTER #2 — Net Worth Statement (Balance Sheet)

TRANSPARENCY MASTER #3 — Profit and Loss Statement (Income Statement)

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INFORMATION SHEET #1

Why Keep Records?

1. To determine earnings.
2. To determine profit and loss.
3. To determine financial progress or net worth.
4. To determine the profitability of various enterprises.
5. To determine where improvements can be made.
6. To assist with planning.
7. To provide information needed for income tax reasons.
8. To provide information needed to obtain credit.
9. To preserve information for future reference.

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INFORMATION SHEET #2

Terms to be Defined

Assets — items which have a marketable value.

Current assets — consist of cash or other assets which can be converted to cash through the normal operations of the business during the year, such as cash items (marketable securities, stocks and bonds, and cash values of life insurance).

Current liabilities — those debts due within the operating year, normally a 12-month period, including notes and accounts payable, rents, taxes, interests, and that portion of intermediate or long-term debt (principal) due within the next 12 months.

Intermediate assets — consist of those resources or production items whose useful life is between 1 and 10 years, including equipment, machinery, and livestock.

Intermediate-term liabilities — includes non-real estate debt and contracts written with the purpose of meeting other seasonal needs, over a period greater than 12 months but less than 8-10 years, including notes for improvement to real estate, equipment purchases, and additions to breeding livestock and dairy stock.

Liabilities — all debt obligations.

Long-term liabilities — consist of mortgages and land contracts on real estate, less the principal balance due within 12 months.

Net worth — calculated by subtracting total liabilities from total assets.

INFORMATION SHEET #3

Financial Analysis Ratios

Financial Analysis Ratios can be calculated in a matter of minutes. They provide the needed insight into the financial strengths and weaknesses of your business. They are important to your lender and for obtaining the necessary credit/loans.

Adequacy of capital — reflects financial soundness of the business.

Current ratio — short-run ability of your operation to cover debt. The current ratio equals the total current assets divided by the total current liabilities. 2:1 is considered a good ratio, but nothing lower is acceptable.

Current debt to worth ratio — compares current liabilities to net worth. The current debt to worth ratio equals the total current liabilities divided by net worth. In a secure financial position, net worth is high relative to current debts.

Leverage (debt to worth) ratio — relates total debt to net worth. Leverage equals the total liabilities divided by net worth The higher the ratio, the larger the share creditors have in your business and assets and the greater the risk to both your creditors and you.

Net capital ratio — measures ability of business to pay off all debts. The net capital ratio equals the total assets divided by the total liabilities. This ratio must be greater than 1:1 for the business to be solvent.

Working Capital — gives an indication of ability to pay current debts. Working capital equals the current assets minus the current liabilities. This figure should be positive.

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INFORMATION SHEET #4

Partial Budget

Partial Budget

This budget is used to assess small changes in the business. The partial budget looks at the impacts of one financial decision and assumes no change in other parts of the business. The partial budget is not concerned with the net income total. Rather, what is the net worth change as a result of the financial decision.

Summarize positive and negative impacts = (+) or (-) overall impact.

Record Information

	Old Machine	New Machine
depreciation	$300/yr	10 yr life/$4,000 - salvage
current value	$1,000	$44,000
repairs	$1,000	2% of market value
insurance	$100	$150
field loss	5%	3%
fuel	.7gal/acre	1 gal/acre
misc.	$60	$100
speed	3 acres/hr.	4 acres/hr.

Assumptions	
Labor	$5/hr.
Interest	10%
Fuel	$1/gal
Acres	600 corn
Yield/Acre	120 bu. corn
Price/bu.	$2.40

Positive Impacts
Increased Returns
+ Decreased Costs
Total Positive Impacts

Negative Impacts
Increased Costs
+ Decreased Returns
Total Negative Impacts

Total Positive Impacts
- Total Negative Impacts
Net Impact

Positive Impacts (Purchasing of New Equipment)

Increased Returns 120 bu. x .02 (field loss difference) x 600 (acres) x 2.40 (Price) = $3456.00

Decreased Costs (Elimination of Old Equipment)

Depreciation	300.00	
Interest	100.00	
Repairs	1,000.00	
Insurance	100.00	
	1,500.00	→ 1,500.00
600 (acres) / 3 acres/hour x $5 (labor) =	1,000.00	
600 (acres) x .7 (fuel) x $1 (fuel cost) =	420.00	
Miscellaneous	60.00	
	1480.00	→ 1480.00
Positive Impact		6436.00

Negative Impacts

Increased Cost (Purchase of New Equipment)

Depreciation	(44,000 - 4,000)+10	=		4,000.00
Interest	[44,000 + 4,000 (salvage)]+2 = 24,000 x .10	=		2,400.00
Repairs	44,000 x .02	=		880.00
Insurance		=		150.00
				7430.00
Labor	600 acres/4 acres x $5.00	=	750.00	
Fuel	600 acres x 1 gal/acres x $1.00	=	600.00	
Miscellaneous		=	100.00	
			1450.00	1450.00
		Total Negative Impacts		$8.880.00

Total Positive Impacts	$6436.00
Total Negative Impacts	- 8880.00
Net Impact	-$2,444.00

Note: No decreased returns! Yield doesn't change due to new machine. Only have increased returns due to lower % field loss.

INFORMATION SHEET #4 (cont'd.)

Partial Budget Worksheet (Show all work in area provided)

Positive Impacts

Increased Returns	120 bu. x .02 (field loss difference) x 600 (acres) x 2.40 (price)		3456.00
Decreased Costs			
Depreciation		300.00	
Interest		100.00	
Repairs		1,000.00	
Insurance		100.00	
Labor	600 (acres) + 3 acres/hour x $5.00 (labor)	1,000.00	
Fuel	600 (acres) x .7 (fuel) x $1.00 (fuel cost)	420.00	
Miscellaneous		60.00	
		2,980.00	2,980.00
	Total Positive Impacts		6436.00

Negative Impacts

Increased Costs			
Depreciation	44,000-4,000 + 10	4,000.00	
Interest	(44,000 + 4,000 + 2) x .10	2,400.00	
Repairs	44,000 x .02	880.00	
Insurance		150.00	
Labor	600 acres + 4 acres x $5.00	750.00	
Fuel	600 acres x 1 gal/acre x $1.00	600.00	
Miscellaneous		100.00	
	Total Negative Impacts		8,880.00
	Total Positive Impacts		6436.00
	Total Negative Impacts		-8,880.00
	Net Impact		-2,444.00

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TRANSPARENCY MASTER #1

Two Major Functions of Records

1. To provide a source of information for tax returns.

2. To provide financial and physical information for use in business analysis and decision making.

TRANSPARENCY MASTER #2

Net Worth Statement
(Financial Statement)
(Student's Share)

ITEMS	Beginning of Year ______, 19___		End of Year ______, 19___	
ASSETS				
1. Cash on hand	$		$	
Checking account				
Savings account				
2. Bonds and life insurance (cash value)				
3. Accounts and notes receivable				
4. Harvested crops on hand				
5. Growing crops				
6. Animals, feed, and supplies				
7. Machinery and equipment				
8. Land and buildings				
9. Other assets (List)				
A. TOTAL ASSETS	$		$	
LIABILITIES				
1. Unpaid bills	$		$	
2. Accounts payable				
3. Mortgages				
4. Other liabilities				
B. TOTAL LIABILITIES	$			
C. STUDENT'S NET WORTH (A minus B)	$		$	
D. CHANGE IN NET WORTH (+ or -)	XXXXXXX		$	

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(Balance Sheet)

A net worth statement (balance sheet) is a "snapshot" of an individual's or business's financial picture at a given point in time (date of statement) and is the listing of assets, liabilities, and net worth.

TRANSPARENCY MASTER #3

Profit and Loss Statement

A profit and loss statement (income statement) shows how well the business actually did over a set time period.

	RECEIPTS		
1	Crop Sales	$	
2	Miscellaneous Receipts		
3	Non-Breeding Livestock Sales		
4	Livestock Product Sales		
5	Capital Sales		
A	**Total Farm Receipts (Add lines 1 thru 5)**		$
	EXPENDITURES		
6	Non-Breeding Livestock	$	
7	Operating Expenditures		
8	Breeding Livestock		
9	Machinery and Equipment		
10	Land and Building Improvements		
B	**Total Farm Expenditures (Add lines 6 thru 10)**		$
C	**Gross Cash Income (Line A minus line B)**		$
	CHANGES IN INVENTORIES		
11	Livestock ±	$	
12	Feed, Crops, Supplies ±		
13	Machinery and Equipment ±		
14	Land and Building Improvements ±		
D	**Total Inventory Change (Lines 11 thru 14)**		$
15	Value Home Used Products (Estimate)		$
E	**Net Farm Income (Add lines C,D, and 15)**		$

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Income Statement

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Steps in Preparing a Balance Sheet

STUDENT WORKSHEET #2 — Preparing a Profit and Loss Statement (Income Statement)

STUDENT WORKSHEET #3 — Cash Flow Projection

STUDENT WORKSHEET #4 — Learning Financial Ratios

STUDENT WORKSHEET #5 — Partial Budget Worksheet

STUDENT WORKSHEET #6 — Partial Budget Assignment

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Steps in Preparing a Balance Sheet

Five steps are followed in preparing the balance sheet.

1. Write the heading on three lines. Center each line.

2. Prepare the assets section on the left side.

   - Write the word *Assets* in the center of the first line of the left wide column. List the name and amount of each asset beginning on the next line.

3. Prepare the liabilities section on the right side.

   - Write the word *Liabilities* in the center on the first line of the right wide column. List the name and amount of each liability. Rule a single line across the amount column directly under the last amount. Write the total amount of the liabilities in the amount column. Write the words *Total Liabilities* in the wide column on the same line.

4. Prepare the capital section immediately below the liabilities section on the right side.

   - Write the word *Capital* in the middle of the wide column on the next line. Write the name of the owner and the word *Capital* on the next line. Write the amount of the owner's equity on the same line in the same amount column.

5. Determine that the balance sheet is "in balance" and complete the form.

   - Draw a single line across both the left and right amount columns under the last amount in the right amount column. Add both the left and right amount columns. The two column totals must be the same. Write the words *Total Assets* in the left wide column on the same line as the total. Write the words *Total Liabilities and Capital* in the right wide column. Rule double lines across both amount columns directly under each final amount. The double lines show that the work is completed and the balance sheet is "in balance."

   If necessary to fit the space available, the words written on any line of the balance sheet may be abbreviated. However, if space is available, words are not abbreviated in accounting records. Limited use of abbreviations makes reading easier by other persons.

Problem: Preparing a beginning balance sheet

The following are assets and liabilities of Wilson's Self-Serve Laundry, owned and operated by Walter Wilson.

<u>Assets</u> <u>Liabilities</u>

Cash	$1,100.00	Miller's Repair Shop	$ 85.00
Supplies	320.00	Professional Appliances Company	2,900.00
Drying Equipment	3,000.00	O.K. Supply Company	150.00
Washing Equipment	5,000.00		

Instructions:

1. Prepare a beginning balance sheet for Wilson's Self-Serve Laundry. Use the date September 1 of the current year. Follow the steps in preparing a balance sheet given on Student Worksheet #1.

2. Check the accuracy and completeness of your work with the questions given below.

   a. Is each of the items in the heading centered and on a separate line?

   b. Is each of the sectional headings in the body of the balance sheet centered?

   c. Is each of the assets, liabilities, and capital listed in the correct section of the balance sheet?

   d. Is the amount of total assets on the same line as the amount of total liabilities and capital?

   e. Are the totals at the bottom of the balance sheet the same?

   f. Are the single and double lines drawn across only the amount columns?

   g. Is the work neat? Is the handwriting legible?

STUDENT WORKSHEET #2

Preparing a Profit and Loss Statement (Income Statement)

The ledger accounts and balances for Masterson's Miniature Golf business on December 31 are below.

Cash	$ 2,252.00	Sales	$6,408.18
Supplies	3,009.00	Advertising Expense	149.76
Golf Equipment	45,900.00	Miscellaneous Expense	58.68
Maintenance Equipment	2,278.00	Rent Expense	1,530.00
Allison Company (liability)	2,040.00	Utilities Expense	242.78
Gentry Equipment Co. (liability)	4,622.98		
Uniform Supply co. (liability)	521.82		
Sally Dorton, Capital	42,327.24		
Sally Dorton, Drawing	500.00		
Income Summary	—		

STUDENT WORKSHEET #3

Cash Flow Projection

YEAR ________	Jan.	Feb.	Mar.
INCOME			
Raised livestock sold			
Crops sold			
Other income			
Other income			
Other income			
Purchased livestock sold			
Current income			
Dairy, breeding stock sold			
Capital assets sold			
Asset income			
Total Cash income			
EXPENSES			
Hired labor			
Repairs-machinery			
Repairs-buildings			
Seed, chemicals			
Fertilizer, lime			
Interest			
Other			
Other			
Livestock for resale			
Current expenses			
Dairy, breeding stock			
Other assets			
Asset expenses			
Total expenses			
CASH BALANCE			
Loan payments (Principal)			
Loan payments (Principal)			
Total principal paid			
BUSINESS CASH BALANCE			
CUMULATIVE CASH BALANCE			
Family living needs			
Life insurance payments			
Total family expense			
NET CASH BALANCE			
NET CUMULATIVE BALANCE			

A cash flow statement shows cash inflows/from sales, borrowed money, and withdrawals from savings to meet cash demands.

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STUDENT WORKSHEET #4

Learning Financial Ratios

Records Name ________________________

Learning Ratios by Analyzing Financial Statements

You are a loan officer of a local lending institution. Two couples present you with the following information. Calculate the appropriate ratios from this information and decide whether Farm A (Bob and June) or Farm B (Dan and Cynthia) is a better risk for the loan. Each are asking for $50,000 for additional working capital.

Bob and June are a young husband-wife team who have been operating a general program A since 1977. They are buying 80 acres from June's parents on a 20-year, 10 percent contract. They rent an adjoining 240 acres for $120 per acre. 300 acres of the 320 total acres can be row-cropped, the remainder is in pasture (10 acres), lots, buildings, and roads.

Crop yields have averaged: corn, 125 bushels per acre; soybeans, 45 bushels per acre. They grow 150 acres of corn each year and 150 acres of soybeans.

Bob and June purchase three groups of 500 feeder pigs each year and feed them from 40 lbs. to 230 lbs. They have been averaging 510 lbs. of corn and 90 lbs. of protein supplement per pig to get them to market.

Table 1 will give you the farm A financial statement for January 1, 1981.

Dan and Cynthia are also a young couple who operate a 240-acre farm on which they produce hogs and cattle. They have been paying on the land since 1971 and have 20 years left on the land contract. They raise 100 acres of corn (150 bu/acre), 60 acres of soybeans (45 bu/acre), and the remainder is in hay (20 acres), pasture (40 acres), lots, and buildings. Table 2 will give you the farm B financial statement for January 1, 1981.

Table 1. Bob and June Financial Statement for Farm A
January 1, 1981

ASSETS		LIABILITIES	
Cash on hand	$ 750	Lender	$ 16,000
Savings	2,000	Accrued interest	1,200
500 pigs (40 lbs avg.)	20,000	Feed account	800
Corn (15,000 bu)	37,500	Fuel	1,100
Soybeans (3375 bu)	23,625	Current portion, term loan	4,000
		Current portion, real estate loan	10,000
		Accrued interest, term loan	480
		Accrued interest, real estate	16,000
		Cash rent for 1981	28,800
Subtotal	$ 83,875		$ 78,380
Fall applied fertilizer	$ 10,500	Machinery	$ 18,000
Machinery	68,000	Building	8,000
Pickup truck	6,000		
Subtotal	$ 84,500		$ 26,000
80 acres @ $2500	$ 200,000	Land contract	$ 160,000
TOTAL ASSETS	$ 368,375	TOTAL LIABILITIES	$ 264,380

Table 2. Dan and Cynthia Financial Statement for Farm B
January 1, 1981

ASSETS		LIABILITIES	
Cash on hand	$ 3,500	Note (on Demand)	$ 7,300
Soybeans	6,800		
Corn	19,800		
Feeder pigs	9,500		
Subtotal	$ 39,600		
Beef cows	$ 25,000	Beef cows	$ 17,600
Breeding swine	5,200	Machinery	35,000
Machinery	72,000		
Subtotal	102,200		
Land and buildings	$ 480,000	Land contract	$ 435,000
TOTAL ASSETS	$ 621,800	TOTAL LIABILITIES	$ 494,900

STUDENT WORKSHEET #4 — (cont'd.)

Learning Financial Ratios

Name ______________________

Ratios from Farm Financial Statements

	Farm A (Bob/June)	Farm B (Dan/Cynthia)
1. Current Assets, this farm	$ ________	$ ________
2. Current Liabilities	$ ________	$ ________
3. Total Assets	$ ________	$ ________
4. Total Liabilities	$ ________	$ ________
5. Net Worth	$ ________	$ ________
6. Current Ratio	______ to 1	______ to 1
7. Current Debt to Net Worth Ratio	______ to 1	______ to 1
8. Working Capital Ratio	$ ________	$ ________
9. Net Capital Ratio	______ to 1	______ to 1
10. Leverage	______ to 1	______ to 1
11. For every dollar the operators have invested in their operation others have ______ invested in it.	________	________
12. As loan officer, I would loan the money to:	________	________

13. Explain in the space below why you have selected who receives this loan.

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STUDENT WORKSHEET #4 — KEY

Learning Financial Ratios

Name ____________________

Ratios from Farm Financial Statements

	Farm A (Bob/June)	Farm B (Dan/Cynthia)
1. Current Assets, this farm	$ *83,875*	$ *39,600*
2. Current Liabilities	$ *78,380*	$ *7,300*
3. Total Assets	$ *368,375*	$ *621,800*
4. Total Liabilities	$ *264,380*	$ *494,900*
5. Net Worth	$ *103,995*	$ *126,900*
6. Current Ratio	*1.07* to 1	*5.42* to 1
7. Current Debt to Net Worth Ratio	*.75* to 1	*.06* to 1
8. Working Capital Ratio	$ *5,495*	$ *32,300*
9. Net Capital Ratio	*1.39* to 1	*1.26* to 1
10. Leverage	*2.54* to 1	*3.90* to 1
11. For every dollar the operators have invested in their operation others have _______ invested in it.	*2.54*	*3.90*
12. As loan officer, I would loan the money to:	*x*	

13. Explain in the space below why you have selected who receives this loan.

Farm A is better able to handle a long-term loan. While Farm B is stable in the short run, they would not be able to handle long-term credit.

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STUDENT WORKSHEET #5

Partial Budget Worksheet
(Show all work in area provided)

Positive Impacts

Increased Returns ____________________

Decreased Costs

Depreciation ____________________

Interest ____________________

Repairs ____________________

Insurance ____________________

Labor ____________________

Fuel ____________________

Miscellaneous ____________________ ____________________

____________________ ____________________

Total Positive Impacts ____________________

Negative Impacts

Increased Costs

Depreciation ____________________

Interest ____________________

Repairs ____________________

Insurance ____________________

Labor ____________________

Fuel ____________________

Miscellaneous ____________________ ____________________

Total Negative Impacts ____________________

Total Positive Impacts ____________________

Total Negative Impacts ____________________

Net Impact ____________________

STUDENT WORKSHEET #6

Partial Budget Assignment

The following information is for a partial budget. Complete this budget and calculate whether the purchase of the new machine has a positive or negative impact. SHOW ALL WORK FOR FULL CREDIT!!!

You are a blueberry grower and you are deciding whether to keep your outdated, 15 year-old blueberry picker, or to get a new-fangled one.

Record Information

	Old Machine	New Machine
depreciation	$400/year	10 yr. life/$3,000 salvage
current value	$800.00	$30,000.00
repairs	$1,500.00	1% of market value
insurance	$90.00	$200.00
field loss	9%	5%
fuel	.8 gallons/acre	.9 gallons/acre
miscellaneous	$55.00	$105.00
speed	2 acres/hour	3.5 acres/hour

Other Assumptions	
Labor	$5.00/hour
Interest	9%
Fuel	$1.00/gallon
Acres	600 of blueberries
Yield/Acre	98 pounds
Price/Pound	$1.15

SHOW ALL WORK ON PARTIAL BUDGET WORKSHEET PROVIDED!

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STUDENT WORKSHEET #6 — (cont'd.)

Partial Budget Worksheet (Show all work in area provided)

Positive Impacts

Increased Returns ________________

Decreased Costs

Depreciation ________________

Interest ________________

Repairs ________________

Insurance ________________

Labor ________________

Fuel ________________

Miscellaneous ________________ ________________

________________ ________________

Total Positive Impacts ________________

Negative Impacts

Increased Costs

Depreciation ________________

Interest ________________

Repairs ________________

Insurance ________________

Labor ________________

Fuel ________________

Miscellaneous ________________ ________________

________________ ________________

Total Negative Impacts ________________

Total Positive Impacts ________________

Total Negative Impacts ________________

Net Impact ________________

STUDENT WORKSHEET #6 — Key

Partial Budget Worksheet (Show all work in area provided)

Positive Impacts

Increased Returns	*600 acres x .04 less loss x 98 lbs. acre x $1.15 lb.*		*$2704.80*
Decreased Costs			
Depreciation		*$400.00*	
Interest	*800 current value x .09*	*$72.00*	
Repairs		*$1500.00*	
Insurance		*$90.00*	
Labor	*600 acres + 2 acres/hr. x $5.00*	*$1500.00*	
Fuel	*600 x .8 gal./acre x $1.00/gal.*	*$480.00*	
Miscellaneous		*$55.00*	
		$4097.00	*$4097.00*
		Total Positive Impacts	*$6801.80*

Negative Impacts

Increased Costs			
Depreciation	$\frac{30{,}000 - 3{,}000}{10}$	*$2700.00*	
Interest	$\frac{30{,}000 + 3{,}000}{2} \times .09$	*$1485.00*	
Repairs	*30,000 x .01*	*$300.00*	
Insurance		*$200.00*	
Labor	*600 + 3.5 x 5*	*$857.14*	
Fuel	*600 x .9 x 1*	*$540.00*	
Miscellaneous		*$105.00*	
		$6187.14	*$6187.14*
		Total Negative Impacts	*$6187.14*
		Total Positive Impacts	*$6801.80*
		Total Negative Impacts	*$6187.14*
		Net Impact	*614.66 (+)*

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Applying Basic Economic Principles in Agribusiness

RELATED PROBLEM AREAS:

1. Keeping and Using Records in Agricultural Occupations
2. Marketing Agricultural Products and Services (Agricultural Business and Management Cluster)
3. Planning and Organizing the Agribusiness (Agricultural Business and Management Cluster)
4. Operating the Agribusiness (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty H: Managing the Business

1. Evaluate agribusiness productivity
2. Select computer software for livestock management decisions
3. Select computer software for crop management decisions
4. Select computer software for machinery management decisions
5. Utilize a computerized network on agricultural marketing and management

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Director: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______________
☐ Original submission ☐ Revision
Page _____ of _____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Scienc ☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and analyze comparative political and economic systmes, with an emphasis on the political and economic systems of the United States.

Contact Person: ______________
Title: ______________
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATI
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Stu Expected t Achieve Obje
1. Understand terminology related to basic economic principles. *2. Identify the factors which affect supply and demand.					
3. Identify ownership costs (fixed costs) associated with an agricultural business. 4. Calculate depreciation using straight-line, sum-of-the-years-digits, and double declining balance methods.					
5. Understand costs involved in decision making. 6. Understand that money has increased value over time and to be able to calculate the time value of money.					
7. Calculate fixed and variable costs for an agricultural business activity. 8. Determine feasibility and profitability of an agricultural business purchase.					
*9. Know ways government attempts to stimulate the economy.					
*10. Understand how the factors of production (natural resources, labor, capital, management) affect production.					
*11. Understand the significance of three questions faced by society: What to produce? How to produce it? For whom to produce?					
*12. Demonstrate how the basic principles of economics affect producers and consumers in the public and private sectors.					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Applying Basic Economic Principles in Agribusiness

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Understand terminology related to basic economic principles.
2. Identify ownership costs (fixed costs) associated with an agricultural business.
3. Calculate depreciation using straight-line, sum-of-the-years-digits, and double declining balance methods.
4. Understand costs involved in decision making.
5. Understand that money has increased value over time and to be able to calculate the time value of money.
6. Calculate fixed and variable costs for an agricultural business activity.
7. Determine feasibility and profitability of an agricultural business purchase.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Applying Basic Economic Principles in Agribusiness

PROBLEMS AND QUESTIONS FOR STUDY

1. What is supply?
2. What is demand in a market?
3. What factors affect supply and demand in a market?
4. What are ownership (fixed) costs?
5. What are the DIRTI 5?
6. What is the straight-line depreciation? How is it calculated?
7. What is sum-of-the-years-digits depreciation? How is it calculated?
8. What is double declining balance depreciation? How is it calculated?
9. What costs are involved in decision making?
10. What is time value of money?
11. How is time value of money calculated?
12. What is the difference between fixed and variable costs?
13. Can you calculate fixed and variable costs for an agricultural business activity?
14. What are feasibility and profitability of an agricultural business purchase?
15. How do you calculate feasibility and profitability of an agricultural business purchase?
16. How does government attempt to stimulate the economy?
17. Can you explain the factors of production (natural resources, labor, capital, management) and how they affect production?
18. Do you understand the significance of three questions faced by society: What to produce? How to produce it? For whom to produce?
19. Can you demonstrate how the basic principles of economics affect producers and consumers in the public and private sectors?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Applying Basic Economic Principles in Agribusiness

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area with an interest approach which includes an overview of what is to be studied.
2. Use Information Sheet #1 to discuss terminology related to the problem area.
3. Refer to Information Sheet #2 to explain the concepts of supply and demand.
4. Have students complete Student Worksheets #1 and #2.
5. Assign Chapter 4 of *Modern Agricultural Management*, pp. 66-79 (see reference), as supervised study, or use any good textbook that discusses depreciation, interest, repairs, taxes, and insurance (DIRTI 5, fixed costs).
6. Use Information Sheet #3 to explain how to calculate depreciation using straight-line, sum-of-the-years-digits, and double declining balance methods.
7. Have students complete Student Worksheet #3 and #4.
8. Assign chapter 3 of *Modern Agricultural Management*, pp. 42-65 (see references), as supervised study, or use any good textbook that discusses costs involved in decision making. Refer also to Information Sheet #4.
9. Use Transparency Master #1 to explain the concept of time value of money.
10. Instructor should complete Student Worksheet #5 with the students.
11. Have students complete Student Worksheet #6.
12. Discuss the difference between fixed and variable costs. Using Student Worksheet #7, assist students with calculating fixed and variable costs.
13. Have students complete Student Worksheet #8.
14. Discuss feasibility and profitability of an agricultural purchase.
15. Work through Student Worksheet #9 with students.
16. Have students complete computer activity in *Computerized Farm Records*, Unit 5 (see references), as additional reinforcement of problem area concepts.
17. Assign the three units of *The World of Economics* (see references) as a classroom activity or independent study to reinforce problem area concepts and to cover additional economic concepts.
18. Use selected modules from *Applied Mathematics* to teach math problem-solving skills.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Applying Basic Economic Principles in Agribusiness

REFERENCES	INSTRUCTOR'S NOTES AND REFERENCES

*1. *Financial Planning in Agriculture.* Schneeberger, Kenneth C., Osburn, Donald D. (most recent edition). The Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

*2. *Modern Agricultural Management.* (1983). Osburn, Donald D., Schneeberger, Kenneth C. Reston Publishing Company, Inc., c/o Simon and Schuster, Route 9W, Englewood Cliffs, NY 07532.

3. *Financial Management in Agriculture.* (1983). Barry, Hopkin, Baker, Baker. The Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050.

*4. *Computerized Farm Records.* (1988). Allen, Warren W. South-Western Publishing Co., 355 Conde St., West Chicago, IL 60185. (312) 231-6000.

*5. *The World of Economics.* (1988). Lewis, Senn, Stepien. South-Western Publishing Co., 355 Conde St., West Chicago, IL 60185.

6. *Applied Mathematics.* Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Terms to be Defined

INFORMATION SHEET #2 — Charts for Supply and Demand

INFORMATION SHEET #3 — Depreciation

INFORMATION SHEET #4 — Costs Involved in Decision Making

TRANSPARENCY MASTER #1 — Time Value of Money

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INFORMATION SHEET #1

Terms to be Defined

Depreciation — decrease in the value of an asset due to wear-and-tear or obsolescence.

Law of Demand — when the price of a product is increased with no change in factors other than price, less product will be taken; thus, the lower the price, the more quantity demanded, the higher the price, the less quantity demanded.

Law of Diminishing Returns — states that the addition of a variable input to a set of fixed inputs results in a total product that increases at a decreasing rate, and eventually in a total product that decreases with an increase in the variable input.

Law of Supply — when the price of a product is lowered (assuming no change in factors other than the price), less of the product is supplied; thus, the lower the price, the less product supplied, the higher the price, the more product supplied.

Marginalism — a principle exceedingly important in answering such questions as what amount of an input to use, how to combine inputs, and what products to produce in order to maximize profit. The marginalism principle states that an additional unit of input (output) must be greater than or equal to the increased cost due to the additional input (output).

Market — a place where buying, selling, or trading can take place. Market prices depend on (1) the situation at a given location, (2) a given time for a given quality, and (3) a specified form of a particular commodity.

Substitution:

1. Competitive — most common form of substitution where an increase of consumption or use in one enterprise leads to a decrease in another. Examples are the relative consumptions of beef and pork, or butter and margarine. An increased price of one member of the pair causes an increased consumption of the other.

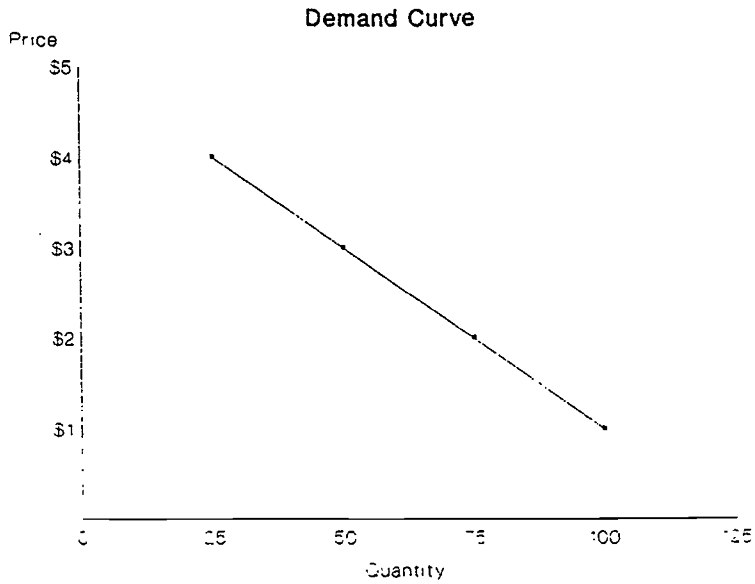
2. Complementary — one enterprise adds to the other when resources are limited.

3. Supplementary — one enterprise does not compete or add to another enterprise.

INFORMATION SHEET #2

Charts for Supply and Demand

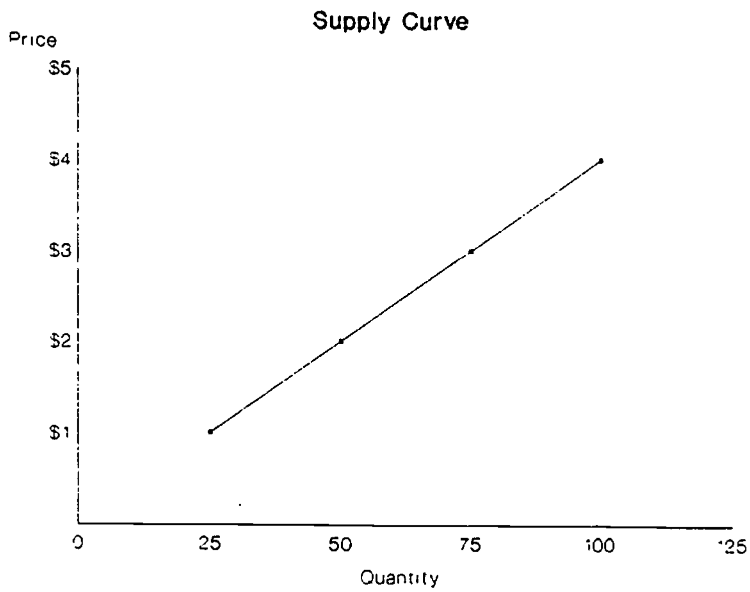
Introduction:



1. Shows the different quantities the consumer will purchase at different prices.

2. Consumer will purchase fewer items at higher prices and purchase more items at lower prices.

3. Normal demand curves will move from left to right and downward.



1. Shows the different amounts producers will offer for sale at different prices.

2. As price increases, in the long run the producers will offer more quantity for sale.

3. As price decreases, in the long run the producers will offer less quantity for sale.

4. Normal supply curves will move from left to right and upward.

INFORMATION SHEET #3

Depreciation

I. Descriptions of methods of computing depreciation for management purposes

A. Straight-line — Method of calculating depreciation in which total depreciation is spread evenly over life of asset.

(NOTE: The salvage value is subtracted from the cost or basis, and the difference is divided by the useful life of the asset. The result is annual depreciation for the life of the asset.)

EXAMPLE: A tractor purchased on January 1, 1979, for $35,000 has an estimated useful life of seven years and a salvage value of $7,000.

Annual Depreciation = (Basis - Salvage Value) + Useful Life of Asset

= $35,000 - 7,000 + 7 years

= $4,000

Year	Annual Depreciation	Accumulated Depreciation	Depreciable Balance
1	$4,000	$4,000	$31,000
2	4,000	8,000	27,000
3	4,000	12,000	23,000
4	4,000	16,000	19,000
5	4,000	20,000	15,000
6	4,000	24,000	11,000
7	4,000	28,000	7,000

This procedure is used for the seven years, with the depreciable balance at the end equal to the salvage value. If the tractor had been purchased at midyear, the first year's depreciation would be 6/12 x $4,000 , or $2,000. Each year thereafter the depreciation would be $4,000, until the last year when it would be $2,000.

B. Declining balance — Method of calculating depreciation in which annual depreciation is taken to be a constant proportion of each year's adjusted basis

(NOTE: Annual depreciation is equal to a constant percentage multiplied by the depreciable balance. The constant percentage is determined by dividing the useful life into 100 percent to arrive at a constant percent per year. Double the straight-line rate is called double declining balance. Salvage value is not used in the computation of depreciation; however, the asset cannot be depreciated below a reasonable salvage value.)

EXAMPLE: A tractor was purchased on January 1, 1979, for $35,000; it has an estimated useful life of seven years; and salvage value if $7,000. Double declining balance method is used.

Straight-Line Rate = 100% + Useful Life of Asset
= 100% + 7 years
= 14.29%
Double Declining Balance Rate = 14.29% x 2
= 28.58%
First Year Depreciation = 28.58% x $35,000
= $10,003

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Year	Yearly Depreciation	Accumulated Depreciation	Depreciable Balance
1	$10,003	$10,003	$24,997
2	7,144	17,147	17,853
3	5,102	22,249	12,751
4	3,644	25,893	9,107
5	2,107	28,000	7,000
6	—	28,000	7,000
7	—	28,000	7,000

Salvage value was reached in the fifth year. If the tractor were purchased at midyear instead of the beginning of the year, the computations would be as follows:

28.58% x $35,000 x (6 ÷ 12) = $5,001.50 First year depreciation

$35,000 - $5,001.50 = $29,998.50 Depreciable balance

28.58% x $29,998.50 = $8,573.57 Second year depreciation

C. Sum-of-the-years digits — Method of calculating depreciation in which the rate of annual depreciation declines as asset becomes older.

(Note: This method allows greater depreciation charges in earlier years than does the straight-line method, but does not allow as great a depreciation as does the declining balance method.)

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INFORMATION SHEET #4

Costs Involved in Decision Making

Opportunity cost — the maximum net return that is sacrificed because the resource is not employed in its next most profitable alternative.

Fixed versus variable cost — fixed costs do not change with the volume of output for a particular enterprise. Fixed costs normally include such items as depreciation, interest on investment, repairs, taxes, and insurance (DIRTI 5). Variable costs, on the other hand, do change with the volume of output.

Operating versus ownership costs — operating and ownership costs are analogous to fixed and variable costs. Operating costs occur only when producing output. Ownership costs are not related to the level of output, but are escapable only if the manager decides to sell out or liquidate the business.

Out-of-pocket versus overhead costs — out-of-pocket costs refer to cash outlays. This normally includes such expenditures as fertilizer purchases, seed, and other items that have to be purchased from off-business sources. Overhead cost is a concept which is often used with varied definitions. Generally speaking, it is used in the same context as fixed costs.

Original versus replacement costs — original cost is the historical cost basis of an asset. This represents the dollars paid plus the undepreciated value of any item traded in when initially purchased. Replacement cost refers to the new cost of a comparable asset that can perform similar tasks.

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TRANSPARENCY MASTER #1

Time Value of Money

Money has value over time: to compare investments or find value of investments, you need to project dollar values to the future or bring value of future dollars back to the present.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Supply and Demand

STUDENT WORKSHEET #2 — Supply and Demand

STUDENT WORKSHEET #3 — Calculating Depreciation

STUDENT WORKSHEET #4 — Depreciation Worksheet

STUDENT WORKSHEET #5 — Time Value of Money

STUDENT WORKSHEET #6 — Time Value of Money Problem

STUDENT WORKSHEET #7 — Fixed-Variable Costs Principle

STUDENT WORKSHEET #8 — Fixed-Variable Cost Problem

STUDENT WORKSHEET #9 — Feasibility-Profitability

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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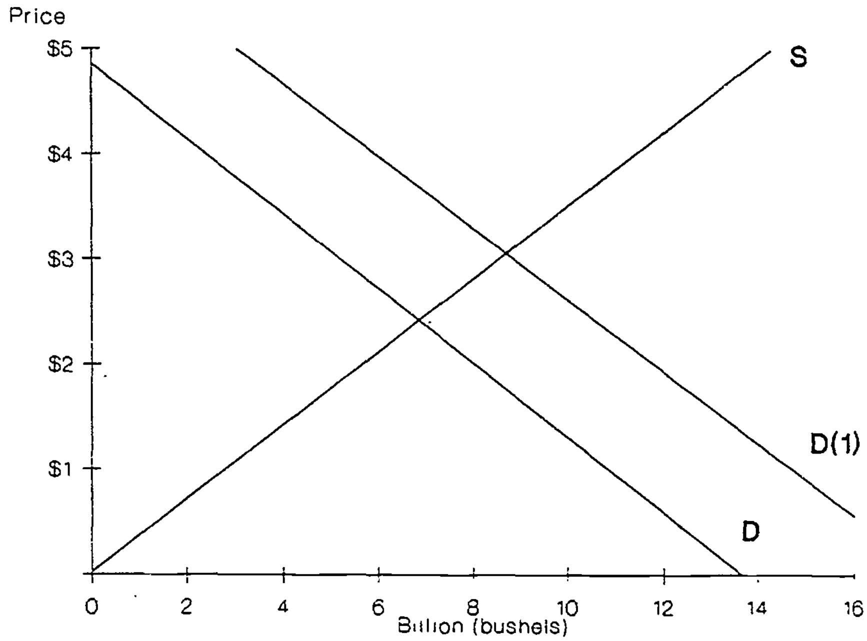
STUDENT WORKSHEET #1

Supply and Demand

Given: Corn production remained constant this year but we had an increase in foreign trade as compared to last year.



1. Was (more or less) of the quantity of corn purchased?
2. Is the new price (higher or lower) than the old price?
3. What are some of the reasons for increases in demand?

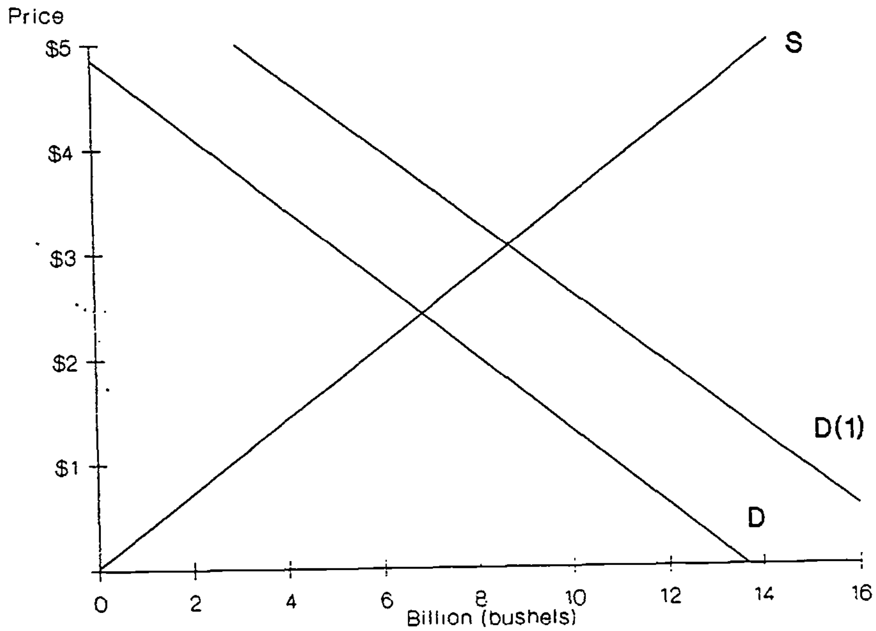
   a.
   b.
   c.
   d.

4. Note! The new demand curve moved to the right which always indicates an increase in demand.

STUDENT WORKSHEET #1 — Key

Supply and Demand

Given: Corn production remained constant this year but we had an increase in foreign trade as compared to last year.



1. *More* of the quantity of corn was purchased.

2. The new price is *higher* than the old price.

3. What are some of the reasons for increases in demand?

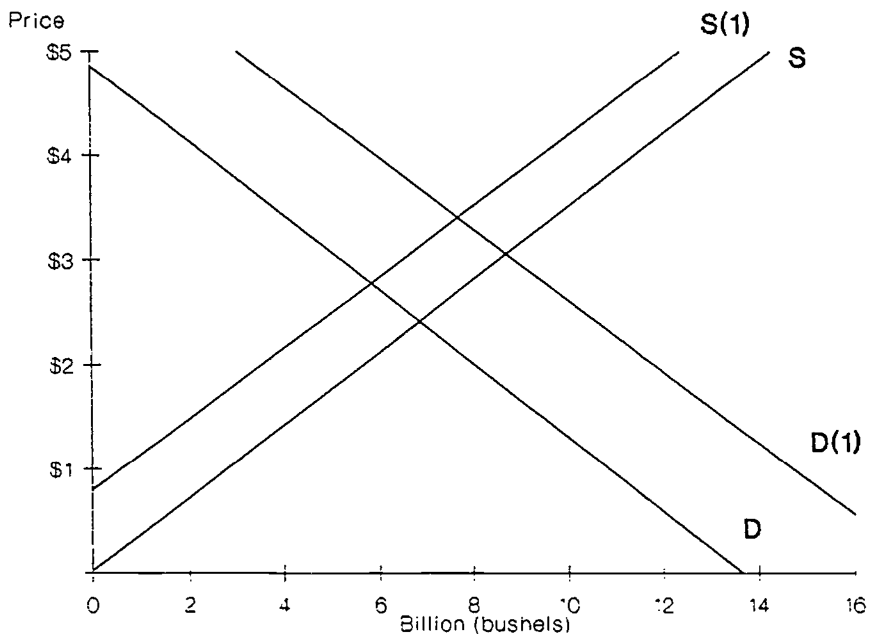
   a. *Increased population*
   b. *Increased income*
   c. *Increased consumer taste and preference*
   d. *Price Substitutes*

4. Note! The new demand curve moved to the right which alwavs indicates an increase in demand.

STUDENT WORKSHEET #2

Supply and Demand

Given: We have a smaller corn crop such as 7 billion in 1980 as compared to 8 billion in 1979 and demand for corn has increased due to more use of corn sweeteners and gasohol. Also we had a carryover of corn from last year.



1. ________ bushels of corn were purchased in 1979 at $ ________ .

2. ________ bushels of corn were purchased in 1980 at $ ________ .

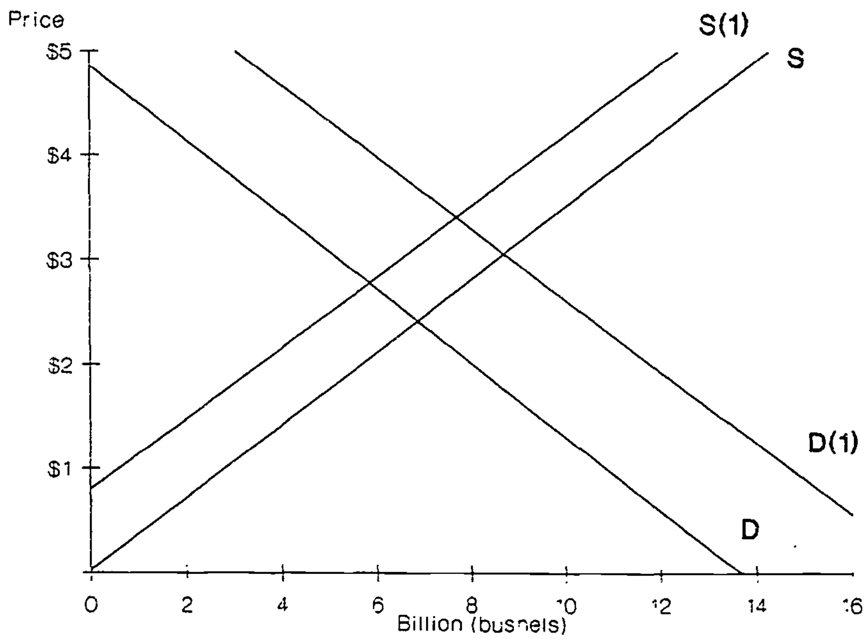
3. Summary: The new demand curve moved to the ________ indicating a(n) (increase or decrease) in demand.

   The new supply curve moved to the ________ indicating a(n) (increase or decrease) in demand.

STUDENT WORKSHEET #2 — Key

Supply and Demand

Given: We have a smaller corn crop such as 7 billion in 1980 as compared to 8 billion in 1979 and demand for corn has increased due to more use of corn sweeteners and gasohol. Also we had a carryover of corn from last year.



1. *7 billion* bushels of corn were purchased in 1979 at $ *2.50* .
2. *8 billion* bushels of corn were purchased in 1980 at $ *3.50* .
3. Summary: The new demand curve moved to the *right* indicating an increase in demand.

   The new supply curve moved to the *left* indicating a decrease in demand.

STUDENT WORKSHEET #3

Calculating Depreciation

Fred Jones is going to buy a new 4-wheel drive pick-up. He will purchase it outright for $15,500 because he wants to keep his old one for work. His salvage value will be computed at 10% of the purchase price. He is purchasing it on October 1, 1989. Fred is a young bachelor. He plans on driving the new pick-up for 6 years.

Using each of the three methods of depreciation determine the amount of depreciation that will be allowed in 1989 and 1990.

Straight-line:

1989 ________

1990 ________

Sum-of-the-years digits:

1989 ________

1990 ________

Double Declining Balance:

1989 ________

1990 ________

STUDENT WORKSHEET #3 — Key

Calculating Depreciation

Fred Jones is going to buy a new 4-wheel drive pick-up. He will purchase it outright for $15,500 because he wants to keep his old one for work. His salvage value will be computed at 10% of the purchase price. He is purchasing it on October 1, 1989. Fred is a young bachelor. He plans on driving the new pick-up for 6 years.

Using each of the three methods of depreciation determine the amount of depreciation that will be allowed in 1989 and 1990.

Straight Line:

5,500 - 1550 = 13,950 + 6 = 2325 — 1989 <u>*2325*</u>

1990 <u>*2325*</u>

Sum-of-the-years digits:

13,950 x (6 + 21) = 3985.71 — 1989 <u>*3985.71*</u>

13,950 x (5 + 21) = 3321.43 — 1990 <u>*3321.43*</u>

Double Declining Balance:

(15,500 + 6) x 2 = 5,166.67 — 1989 <u>*5,166.67*</u>

(10,333.33 + 6) x 2 = 3,444.44 — 1990 <u>*3,444.44*</u>

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STUDENT WORKSHEET #4

Depreciation Worksheet

1. What are the three types of depreciation?

   a.

   b.

   c.

2. What would be the annual depreciation on a truck bought for $4,400 with a $500 salvage value and estimated 10-year life? (Use the Straight-line method.)

3. What would be the depreciation on the truck for the first year if the sum-of-the-years digits method was used?

4. What would be the depreciation on the truck for the first year if the declining balance method was used?

5. Write a couple of sentences and prepare a graph comparing the above three methods of depreciation.

STUDENT WORKSHEET #4 — Key

Depreciation Worksheet

1. What are the three types of depreciation?

   a. *Straight-line*

   b. *Sum-of-the-years digits*

   c. *Declining Balance*

2. What would be the annual depreciation on a truck bought for $4,400 with a $500 salvage value and estimated 10-year life? (Use the Straight-line method.)

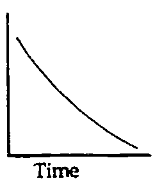
   4,400 - 500 = 3,900
   3900 + 10 = $390

3. What would be the depreciation on the truck for the first year if the sum-of-the-years digits method was used?
   4,400 - 500 = 3,900
   1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55
   10 + 55 x 3,900 = $709.09

4. What would be the depreciation on the truck for the first year if the declining balance method was used?
   Do not deduct salvage value!
   Assume truck is new so use 200% declining balance.
   4,400 x .2 = $880

5. Write a couple of sentences and prepare a graph comparing the above three methods of depreciation.

Straight-line: Most used and easiest method for depreciation. The depreciation is split evenly among all years in the life of the asset.



Sum-of-the-years digits: 2/3 of the value of the asset is depreciated over first half of useful life, and 40% is recovered over the first 1/4 of the useful life.

Declining balance: Allows for fastest depreciation with less depreciation taken each year. 200% is used for new depreciable items. 150% is used for used depreciable items and new real estate.

STUDENT WORKSHEET #5

Time Value of Money

Your neighbor is at retirement age and is talking about renting out or selling his land. He has an 80-acre tract of land which lies next to your land, and which he is pricing at $160,000.

If inflation is running at 6%, what would the cost per acre be for this tract if you waited 4 years to buy?

Compound Interest Factors

No. of Years	Annual Interest Rate											
	6%	8%	10%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	1.060	1.080	1.100	1.120	1.130	1.140	1.150	1.160	1.170	1.180	1.190	1.200
2	1.124	1.166	1.210	1.254	1.277	1.300	1.323	1.346	1.369	1.392	1.416	1.440
3	1.191	1.260	1.331	1.405	1.443	1.482	1.521	1.561	1.602	1.643	1.685	1.728
4	1.263	1.361	1.464	1.574	1.631	1.689	1.749	1.811	1.874	1.939	2.005	2.074
5	1.338	1.469	1.611	1.762	1.842	1.925	2.011	2.100	2.192	2.288	2.386	2.488
6	1.419	1.587	1.772	1.974	2.082	2.195	2.313	2.436	2.565	2.700	2.840	2.986
7	1.504	1.714	1.949	2.211	2.353	2.502	2.660	2.826	3.001	3.186	3.379	3.583
8	1.594	1.851	2.144	2.476	2.658	2.853	3.059	3.278	3.512	3.759	4.021	4.300
9	1.690	1.999	2.358	2.773	3.004	3.252	3.518	3.803	4.108	4.436	4.785	5.160
10	1.791	2.159	2.594	3.106	3.395	3.707	4.046	4.411	4.807	5.234	5.695	6.192
11	1.898	2.332	2.853	3.479	3.836	4.226	4.652	5.117	5.624	6.176	6.777	7.430
12	2.012	2.518	3.138	3.896	4.335	5.818	5.350	5.936	6.580	7.288	8.064	8.916
13	2.133	2.720	3.452	4.364	4.898	5.492	6.153	6.886	7.699	8.599	9.596	10.699
14	2.261	2.937	3.798	4.887	5.535	6.261	7.076	7.988	9.008	10.147	11.420	12.839
15	2.397	3.172	4.177	5.474	6.254	7.138	8.137	9.266	10.539	11.974	13.590	15.407
20	3.207	4.661	6.727	9.646	11.523	13.743	16.366	19.461	23.106	27.393	32.429	38.338
25	4.292	6.848	10.835	17.000	21.230	26.461	32.918	40.874	50.658	62.669	77.388	95.396
30	5.743	10.063	17.449	29.960	39.115	50.949	66.211	85.850	111.065	143.371	184.675	237.376
35	7.686	14.785	28.102	52.799	72.066	98.097	133.172	180.314	243.504	327.997	440.701	590.668
40	10.285	21.724	45.258	93.050	132.776	188.876	267.856	378.721	533.869	750.378	1051.668	1469.772

STUDENT WORKSHEET #5 — Key

Time Value of Money

Your neighbor is at retirement age and is talking about renting out or selling his land. He has an 80-acre tract of land which lies next to your land, and which he is pricing at $160,000.

If inflation is running at 6%, what would the cost per acre be for this tract if you waited 4 years to buy?

160,000 + 80 acres = $2,000 per acre

$2,000 x 1.263 (compound interest chart) = 2,526 per acre in 4 years at 6% inflation rate x 80 acres = $202,080 to purchase 80 acres in 4 years at 6% inflation rate.

STUDENT WORKSHEET #6

Time Value of Money Problem

You are considering whether to buy a house at this time or 2 years from now. The house is being sold for $50,000.00. If inflation is running at 10%, what would the cost of the house be if you waited 2 years to buy?

STUDENT WORKSHEET #6 — Key

Time Value of Money Problem

You are considering whether to buy a house at this time or 2 years from now. The house is being sold for $50,000.00. If inflation is running at 10%, what would the cost of the house be if you waited 2 years to buy?

$50,000 x 1.210 = $60,500

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STUDENT WORKSHEET #7

Fixed-Variable Costs Principle

A central Illinois grain producer is looking for ways to supplement the income from his corn. He has located a feed mill in a livestock feeding area in Missouri that has to bring corn into the area each year to meet the feeding demand. At these times of short supply, this elevator generally offers a cash price that is 35 cents per bushel above the local cash price.

It would be 150 miles each way to make the trip to Missouri. Fully loaded, the truck to be used will make 7.5 miles to a gallon of fuel; unloaded, 10 miles per gallon. Fuel costs 80 cents per gallon. He can haul 800 bushels per trip in his truck.

The producer figures that with the new mileage and the miles driven to deliver his other crops to market, the truck will be driven 8,000 miles per year. Based on his records, the annual overhead costs for the truck are:

Depreciation	$3,000
Insurance	450
Repairs	900
Taxes	300
Interest	780

1. If he makes 10 trips per year during the off-season, what is the fixed cost per mile for hauling corn to Missouri?

2. What is the variable cost per mile for 10 trips?

3. What is the total cost per mile for the 10 trips?

STUDENT WORKSHEET #7 — Key

Fixed-Variable Costs Principle

A central Illinois grain producer is looking for ways to supplement the income from his corn. He has located a feed mill in a livestock feeding area in Missouri that has to bring corn into the area each year to meet the feeding demand. At these times of short supply, this elevator generally offers a cash price that is 35 cents per bushel above the local cash price.

It would be 150 miles each way to make the trip to Missouri. Fully loaded, the truck to be used will make 7.5 miles to a gallon of fuel; unloaded, 10 miles per gallon. Fuel costs 80 cents per gallon. He can haul 800 bushels per trip in his truck.

The producer figures that with the new mileage and the miles driven to deliver his other crops to market, the truck will be driven 8,000 miles per year. Based on his records, the annual overhead costs for the truck are:

Depreciation	$3,000	
Insurance	450	
Repairs	900	
Taxes	300	
Interest	780	
	$5430	*total fixed costs*

1. If he makes 10 trips per year during the off-season, what is the fixed cost per mile for hauling corn to Missouri?

   $5430 ÷ 8,000 miles = $.679 per mile

2. What is the variable cost per mile for 10 trips?

   150 miles ÷ 7.5 miles per gallon = 20 gallons
   150 miles ÷ 10 miles per gallon = 15 gallons
   35 gallons round trip x $.80 per gallon = $28.00
   $28.00 ÷ 300 miles = $.093 per mile

3. What is the total cost per mile for the 10 trips?

   $.679 + $.093 = $.772 per mile

1325

STUDENT WORKSHEET #8

Fixed-Variable Cost Problem

A business person performs a delivery service in Illinois. He does business at a competitive rate of $25.00 per hour. The truck is driven 9,500 miles per year. The truck will make 8.5 miles to a gallon of fuel. Fuel costs 80 cents per gallon. Based on records, the annual overhead costs for the truck are:

Depreciation	$4,500.00
Insurance	520.00
Repairs	860.00
Taxes	420.00
Interest	540.00

1. What is the fixed cost per mile for using the truck for delivery?

2. What is the variable cost per mile for his delivery truck?

3. What is the total cost per mile?

STUDENT WORKSHEET #8 — Key

Fixed-Variable Cost Problem

A business person performs a delivery service in Illinois. He does business at a competitive rate of $25.00 per hour. The truck is driven 9,500 miles per year. The truck will make 8.5 miles to a gallon of fuel. Fuel costs 80 cents per gallon. Based on records, the annual overhead costs for the truck are:

Depreciation	$4,500.00
Insurance	520.00
Repairs	860.00
Taxes	420.00
Interest	540.00
	$6,840

1. What is the fixed cost per mile for using the truck for delivery?

   6,840 + 9,500 = $ 0.72 per mile

2. What is the variable cost per mile for his delivery truck?

   0.80 + 8.5 = $ 0.094 per mile

3. What is the total cost per mile?

   0.72 + .094 = $ 0.814

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STUDENT WORKSHEET #9

Feasibility-Profitability

A part-time farmer is considering purchasing a baler to do custom work for his neighbors. He can purchase a large round baler for $8,000. The baler has an expected life of 10 years with no salvage value. Income over variable costs is expected to be $3.10 per bale. With the amount of labor available during hay season, he can bale 500 large round bales per year.

He can purchase a square baler for $6,000. This baler should last 8 years and have no salvage value. The farmer figures he can make 10 cents per bale over variable costs. In the same number of hours, he can bale 12,000 square bales.

He has a tractor which could operate either machine.

1. If the interest rate is 12%, which investment is more profitable?

2. Are these investments feasible?

Annuity Present Value Factors

Annual contribution of same amount to account each year.

No. of Years	Annual Interest Rate 6%	8%	10%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	.943	.926	.909	.893	.885	.877	.870	.862	.855	.848	.840	.833
2	1.833	1.783	1.736	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.673	2.577	2.487	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.107
4	3.465	3.312	3.170	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.212	3.993	3.790	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.917	4.623	4.355	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	5.582	5.206	4.868	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	6.210	5.747	5.335	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	6.802	6.247	5.759	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	7.360	6.710	6.145	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.193
11	7.887	7.139	6.495	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.487	4.327
12	8.384	7.536	6.814	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	8.853	7.904	7.103	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	9.295	8.244	7.367	6.628	6.303	6.002	5.725	5.468	5.229	5.008	4.802	4.611
15	9.712	8.560	7.606	6.811	6.462	6.142	5.847	5.576	5.324	5.092	4.876	4.676
20	11.470	9.818	8.514	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870
25	12.783	10.675	9.077	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948
30	13.765	11.258	9.427	8.055	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979
35	14.498	11.655	9.644	8.176	7.586	7.070	6.617	6.215	5.858	5.539	5.251	4.992
40	15.046	11.925	9.779	8.244	7.634	7.105	6.642	6.234	5.871	5.548	5.258	4.997

Annual Principal and Interest Payments per $1 Borrowed

Amortization Schedule/Table

Look for monthly payment schedule also

No. of Years	Annual Interest Rate 6%	8%	10%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	1.0600	1.0800	1.1000	1.1200	1.1300	1.1400	1.1500	1.1600	1.1700	1.1800	1.1900	1.2000
2	.5454	.5608	.5762	.5917	.5995	.6073	.6151	.6230	.6308	.6387	.6466	.6545
3	.3741	.3880	.4021	.4164	.4235	.4307	.4380	.4453	.4526	.4599	.4673	.4747
4	.2886	.3019	.3155	.3292	.3362	.3432	.3503	.3574	.3645	.3717	.3790	.3863
5	.2374	.2505	.2638	.2774	.2843	.2913	.2983	.3054	.3126	.3198	.3271	.3344
6	.2034	.2163	.2296	.2432	.2502	.2572	.2642	.2714	.2786	.2859	.2933	.3007
7	.1791	.1921	.2054	.2191	.2261	.2332	.2404	.2476	.2549	.2624	.2699	.2774
8	.1610	.1740	.1874	.2013	.2084	.2156	.2229	.2302	.2377	.2452	.2529	.2606
9	.1470	.1601	.1736	.1877	.1949	.2022	.2096	.2171	.2247	.2324	.2402	.2481
10	.1359	.1490	.1627	.1770	.1843	.1917	.1993	.2069	.2147	.2225	.2305	.2385
11	.1268	.1401	.1540	.1684	.1758	.1834	.1911	.1989	.2068	.2148	.2229	.2311
12	.1193	.1327	.1468	.1614	.1690	.1767	.1845	.1924	.2005	.2086	.2169	.2253
13	.1130	.1265	.1408	.1557	.1634	.1712	.1791	.1872	.1954	.2037	.2121	.2206
14	.1076	.1213	.1357	.1509	.1587	.1666	.1747	.1829	.1912	.1997	.2082	.2169
15	.1030	.1168	.1315	.1468	.1547	.1628	.1710	.1794	.1878	.1964	.2051	.2139
20	.0872	.1019	.1175	.1339	.1424	.1510	.1598	.1687	.1777	.1868	.1960	.2054
25	.0782	.0937	.1102	.1275	.1364	.1455	.1547	.1640	.1734	.1829	.1925	.2021
30	.0726	.0888	.1061	.1241	.1334	.1428	.1523	.1619	.1715	.1813	.1910	.2008
35	.0690	.0858	.1037	.1223	.1318	.1414	.1511	.1609	.1707	.1806	.1904	.2003
40	.0665	.0839	.1023	.1213	.1310	.1407	.1506	.1604	.1703	.1802	.1902	.2001

STUDENT WORKSHEET #9 — Key

Feasibility-Profitability

A part-time farmer is considering purchasing a baler to do custom work for his neighbors. He can purchase a large round baler for $8,000. The baler has an expected life of 10 years with no salvage value. Income over variable costs is expected to be $3.10 per bale. With the amount of labor available during hay season, he can bale 500 large round bales per year.

He can purchase a square baler for $6,000. This baler should last 8 years and have no salvage value. The farmer figures he can make 10 cents per bale over variable costs. In the same number of hours, he can bale 12,000 square bales.

He has a tractor which could operate either machine.

1. If the interest rate is 12%, which investment is more profitable?

Round Baler

500 bales x $3.10 = $1,550.00 annual income

1,550.00 x 5.65 Annuity present value (deposit 1550 each year for 10 years) = $4,757.50

$8,000 x .1770 = $1,416 annual loan payment

1,550 - 1,416 = $134 (feasible)

8,750.50 income/8.000 loan = 1.095 (Profitable)

Square Baler

12,000 bales x .10 = $1,200

$1,200 x 4.968 (Annuity Present Value) = $5.961.60

$5,961.60/6,000 loan = .9936 not profitable

$6,000 x .2013 = $1,207.80 annual loan payment

1,200 income - 1,207.80 annual loan payment = -7.80

Investment must be both feasible and profitable.

2. Are these investments feasible? *See above.*

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CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Developing Basic Microcomputer Skills

RELATED PROBLEM AREAS:

1. Recognizing the Impact of Technology on Agriculture: Electronics
2. Using Microcomputers in Agribusiness Management

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agribusiness and Management Cluster

Duty C: Performing Sales-Related Duties

1. Use computer inventory system to determine part availability

Duty F: Financing the Agribusiness

1. Record accounts payable in computerized bookkeeping system
2. Record accounts receivable in computerized bookkeeping system

Duty H: Managing the Business

1. Select computer software for records and reports
2. Utilize a computerized network on agricultural marketing and management
3. Select computer software for livestock management decisions
4. Select computer software for crop management decisions
5. Utilize computer inventory control systems
6. Establish computerized inventory control system
7. Use computer software for records and reports

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D..
Principal Investigator: Jerry D. Pepple, Ed.D
Research Assistant: Randy J. Bernhardt

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts
☐ Mathematics
☐ Sciences
☐ Fine Arts
☒ Social Sciences
☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the knowledge and skills required for success in selected fields of work.					
*2. Understand the relationships between educational attainment and entry into varied occupational fields.					
*3. Recognize that competence in a field of work entails the development of a side range of skills.					
4. Understand computer terminology.					
5. Explain the uses of computers in agriculture.					
6. Understand the equipment needs for computers.					
7. Develop an understanding of hardware and software options available and how to purchase computer equipment according to need.					
8. Develop keyboarding skills.					
9. Understand computer BASIC.					
10. Develop a sample computer program. 1334					1335

ISBE 41-78 (1/86)

ERIC

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Developing Basic Microcomputer Skills

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Analyze the relationship between skill development and employment opportunities.
2. Identify how common skills and abilities contribute to success across many careers and jobs.
3. Recognize that competence in a field of work entails the development of a wide range of skills.
4. Understand computer terminology.
5. Explain the uses of computers in agriculture.
6. Understand the equipment needs for computers.
7. Develop an understanding of hardware and software options available and how to purchase computer equipment according to need.
8. Develop keyboarding skills.
9. Understand computer BASIC.
10. Develop a sample computer program.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Developing Basic Microcomputer Skills

PROBLEMS AND QUESTIONS FOR STUDY

1. Why is it important to develop computer skills?
2. How will computer skills prove beneficial for most career fields?
3. List some different ways computer literacy will be useful personally and professionally.
4. Define terminology related to computers.
5. Can you describe uses of computers in agriculture?
6. What is computer hardware?
7. What is computer software?
8. What equipment is needed for computer use?
9. How can you suit computer needs to your agricultural business?
10. Develop a sample computer program.
11. What is computer BASIC?
12. How do you use computer BASIC?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Developing Basic Microcomputer Skills

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area with an interest approach that includes a discussion of skills needed for many careers and jobs. Ask the following questions: What are some common skills needed for many careers/jobs? How will computer skills prove beneficial for most careers? Using Student Worksheet #1, have students conduct a brainstorming activity for five minutes with each question. Have students share and explain their ideas in class upon completion of the activity.

2. Have students complete Student Worksheet #2.

3. Have students complete Student Worksheet #3.

4. Conduct a classroom discussion of uses of computers in agriculture. Also, refer to chapters 2 and 3 of *Microcomputing in Agriculture* (see references).

5. Using Transparency Master #1, VAS Unit #U6023, and selected reading from *Microcomputing in Agriculture*, discuss the following: Hardware and Software; Input, Processing, Output; Input, Processing, and Output devices; and Keyboard.

6. Discuss how to purchase computer hardware and software to suit business needs. Refer to VAS Unit #U6025, chapters 6 and 7 of *Microcomputing in Agriculture*, and Transparency Master #2.

7. Have students acquire basic keyboard skills. Refer to *Houghton Mifflin Keyboarding* (see references) or obtain the assistance of a business teacher.

8. Refer to *Microcomputing in Agriculture* and *I speak BASIC to My Apple* (see references) to conduct a thorough discussion on BASIC.

9. Have students develop a sample program of their own on BASIC. Refer to *Microcomputing in Agriculture* and *I Speak BASIC to My Apple*. This student activity could last from one to three weeks.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Developing Basic Microcomputer Skills

REFERENCES

1. *Microcomputing in Agriculture.* (1984). Legacy, Stitt, Reneau. Reston Publishing Company, Inc., c/o Prentice-Hall, Inc., Englewood Cliffs, NJ 07632. (Since a textbook will prove to be almost mandatory for this problem area, *Microcomputing in Agriculture* would be the instructor's best investment.)

*2. *I Speak BASIC to My Apple.* (1982). Jones, Aubrey B., Jr. Hayden Book Company, Inc., Rochelle Park, NJ.

3. *Computer Fundamentals for an Information Age.* (1985). Shelly, Cashman, Forsythe. (textbook and workbook/study guide). Anaheim Publishing Company, Inc., 2632 Saturn Street., P. O. Box 9600, Brea, CA 92622. (714)993-3700.

4. *Houghton Mifflin Keyboarding.* (1987). Chiri, Kutsko, Seraydarian, Stoddard. Houghton Mifflin Company, Geneva, IL.

5. *Introduction to Computers in Agriculture.* (VAS Unit #U6023); *Selecting Agricultural Computer Software.* (VAS Unit #U6025). Vocational Agricultural Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

TRANSPARENCY MASTER #1 — Computer Software and Hardware

TRANSPARENCY MASTER #2 — Selecting Computer Hardware and Software

TRANSPARENCY MASTER #1

Computer Software and Hardware

Complete as each topic as discussed.

1. Input
2. Processing
3. Output
4. Devices for Input, Processing, and Output
5. Hardware
6. Software
7. Keyboard

TRANSPARENCY MASTER #2

Selecting Computer Hardware and Software

1. Computer Purchasing Considerations
2. Choose the Software First
3. Microcomputer Systems
4. Options
   a. Software
   b. Hardware
5. Information Services
6. Software Languages

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Student Brainstorming Activity

STUDENT WORKSHEET #2 — Computer Terminology Word Search

STUDENT WORKSHEET #3 — Computer Terminology Assignment

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Student Brainstorming Activity

Directions: Spend five minutes generating answers to each question. Write all ideas that come to mind. Don't begin until directed by your teacher.

1. What are some common skills needed for many careers and jobs?

2. How will computer skills prove beneficial for most careers?

STUDENT WORKSHEET #2

Computer Terminology Word Search

S	H	I	W	L	Q	E	T	Y	G	M	T	O	A	X
N	D	T	K	G	R	U	E	T	O	R	Y	I	O	I
B	J	U	Q	O	P	R	B	N	F	R	N	L	B	X
L	J	M	T	T	A	A	I	B	O	I	A	Y	G	D
B	Y	S	U	W	U	T	G	M	T	N	T	O	N	T
B	M	O	T	D	O	C	E	I	I	E	F	A	C	E
D	Z	F	F	R	S	M	A	M	C	O	M	I	U	X
N	O	I	M	I	V	L	R	W	O	M	S	R	H	T
S	L	P	D	P	I	E	G	Q	O	A	O	A	Y	C
E	K	I	P	Z	T	P	Y	C	B	S	R	B	V	V
Y	S	K	E	W	R	U	N	P	R	D	L	E	G	X
G	R	A	P	H	I	C	S	U	W	X	B	O	J	K
A	C	I	V	O	Y	O	C	A	M	Z	F	F	A	J
Z	S	S	F	E	M	Y	R	U	X	X	N	Z	Y	D
O	U	L	Q	A	X	E	H	C	A	V	R	Q	K	Z

The following words are hidden in this puzzle:

BASIC
Baud
Byte
Command
Cursor
Disc
File
Graphics
Hardware
Initialize

Load
Memory
Monitor
Output
Run
Save
Software
Store
Terminal
Text

STUDENT WORKSHEET #2 - KEY

Computer Terminology Word Search

•	•	•	•	•	•	E	T	•	•	M	•	•	•	•
•	•	•	•	•	R	U	E	•	O	•	Y	I	•	•
•	•	•	•	O	P	R	B	N	•	R	N	L	B	•
•	•	•	T	T	A	A	I	•	O	I	A	Y	•	D
•	•	S	U	W	U	T	•	M	T	N	T	•	N	T
•	•	O	T	D	O	C	E	I	I	E	•	A	C	E
•	•	F	F	R	S	M	A	M	•	•	M	I	•	X
•	O	I	•	I	•	L	R	•	•	M	S	R	H	T
S	L	•	D	•	I	E	•	•	O	A	O	A	•	•
E	•	•	•	Z	T	•	•	C	B	S	R	•	•	•
•	S	•	E	•	R	U	N	•	R	D	L	•	•	•
G	R	A	P	H	I	C	S	U	W	•	•	O	•	•
•	•	•	V	•	•	•	C	A	•	•	•	•	A	•
•	•	•	•	E	•	•	R	•	•	•	•	•	•	D
•	•	•	•	•	•	E	•	•	•	•	•	•	•	•

The following words are hidden in this puzzle:

BASIC
Baud
Byte
Command
Cursor
Disc
File
Graphics
Hardware
Initialize

Load
Memory
Monitor
Output
Run
Save
Software
Store
Terminal
Text

STUDENT WORKSHEET #3

Computer Terminology Assignment

Match the description in the right column with the correct term in the left column.

1. ______ BASIC
2. ______ Disc
3. ______ Storage Capacity
4. ______ File
5. ______ Chip
6. ______ Modem
7. ______ Initialize
8. ______ Programmer
9. ______ "Bug"
10. ______ Byte
11. ______ Save
12. ______ Dot matrix
13. ______ K
14. ______ Graphics
15. ______ Data

A. A person who understands the meaning of the predetermined commands of a computer language. A BASIC programmer can use the BASIC language to solve problems.

B. A direct instruction to the microprocessor that causes information to be stored on a disk or cassette tape.

C. Abbreviation that represents 1024 bytes of computer memory. A microcomputer with 16K has 16 times 1024 or 16,384 bytes of memory capacity.

D. An indicator of the number of bytes a device can store. If a disk has 400K capacity, it can store 409,600 bytes of information.

E. Information in the form of words, numbers, or other symbols.

F. A process performed on a new disk. This process creates tracks or marks on a new disk. Initialization must be done before a disk can be used to store data.

G. A hardware component that converts the computer's electric signals into high- and low-tone telephone signals. A modem allows the microcomputer's information to be transmitted by telephone.

H. A magnetic-coated piece of recordlike plastic material that can store computer information. The most common disk is the 51/4-inch floppy or flexible disk. Floppy disks usually store 356,000 bytes of information. Disk is the preferred spelling, but either may be used.

I. An acronym for Beginners All-Purpose Symbolic Instruction Code. It is an easy-to-use language that nearly all microcomputers are programmed to accept.

J. Use of symbols or characters to form figures like graphs, buildings, or animals. Graphics may output on a TV screen or on paper.

K. The basic unit of information in a microcomputer. Consists of 8 bits. In the binary system, 8 bits allows one byte to represent at least 128 different combinations.

L. Computer operator slang expression that means something is not working properly. "There is a bug in the system."

M. A portion of a microprocessor, it is a piece of silicon, smaller than a human fingernail. It contains thousands of electronic elements and circuits that provide the computing capacity of a microcomputer.

N. A printing system that uses a sequence of printed dots to create letters and other characters.

O. A list of related information.

STUDENT WORKSHEET #3 — Key

Computer Terminology Assignment

Match the description in the right column with the correct term in the left column.

1. *I* BASIC
2. *H* Disc
3. *D* Storage Capacity
4. *O* File
5. *M* Chip
6. *G* Modem
7. *F* Initialize
8. *A* Programmer
9. *L* "Bug"
10. *K* Byte
11. *B* Save
12. *N* Dot matrix
13. *C* K
14. *J* Graphics
15. *E* Data

A. A person who understands the meaning of the predetermined commands of a computer language. A BASIC programmer can use the BASIC language to solve problems.

B. A direct instruction to the microprocessor that causes information to be stored on a disk or cassette tape.

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M. Also called a microprocessor, it is a piece of silicon, smaller than a human fingernail. It contains thousands of electronic elements and circuits that provide the computing capacity of a microcomputer.

N. A printing system that uses a sequence of printed dots to create letters and other characters.

O. A list of related information.

ERIC

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Understanding Basic Business Organization

RELATED PROBLEM AREAS:

1. Planning and Organizing the Agribusiness (Agricultural Business and Management Cluster)
2. Operating the Agribusiness (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management

Duty H: Managing the Business

1. Determine labor needs
2. Maintain production records
3. Maintain animal records
4. Maintain equipment records

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principle Investigator: Jerry D. Pepple, Ed. D.
Research Assistant: Randy J. Bernhardt

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____________ ☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA (check one)
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and analyze comparative political and economic systems, with an emphasis on the political and economic systems of the United States.

Contact Person: ____________
Title: ____________
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (circle one) 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Understand the basic principles of a good business organization.					
2. Define the term sole proprietorship.					
3. Identify the advantages and disadvantages of a sole proprietorship.					
4. Define the term partnership.					
5. Identify common characteristics of a partnership.					
6. Identify the advantages and disadvantages of a partnership.					
7. Distinguish the difference(s) between a partnership, limited partnership, and a joint venture.					
8. Understand some common problems in a partnership.					
9. Define the term unlimited liability as it relates to a partnership business.					
10. Define the term corporation.					
11. Identify common characteristics of a corporation.					
12. Distinguish the differences between a regular corporation and a sub-chapter S corporation.					
13. Identify the advantages and disadvantages of a corporation business.					
14. Define the term cooperative.					
15. Understand how a cooperative differs from a corporation.					
16. Identify common characteristics of a cooperative.					
17. Develop a further understanding of business organization through the use of computer activities.					
*18. Distinguish between private ownership and collective ownership.					

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ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Understanding Basic Business Organization

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Understand the basic principles of a good business organization.

2. Define the term sole proprietorship.

3. Identify the advantages and disadvantages of a sole proprietorship.

4. Define the term partnership.

5. Identify common characteristics of a partnership.

6. Identify the advantages and disadvantages of a partnership.

7. Distinguish the difference(s) between a partnership, limited partnership, and a joint venture.

8. Understand some common problems in a partnership.

9. Define the term unlimited liability as it relates to a partnership business.

10. Define the term corporation.

11. Distinguish the differences between a regular corporation and a sub-chapter S corporation.

13. Identify the advantages and disadvantages of a corporation business.

14. Define the term cooperative.

15. Understand how a cooperative differs from a corporation

16. Identify common characteristics of a cooperative.

17. Develop a further understanding of business organization through the use of computer activities.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Understanding Basic Business Organization

PROBLEMS AND QUESTIONS FOR STUDY

1. What makes a good business organization?
2. What is a sole proprietorship?
3. What are some advantages of a sole proprietorship?
4. What are disadvantages of a sole proprietorship?
5. Define partnership.
6. List some common characteristics of a partnership.
7. What are some advantages of a partnership?
8. What are some disadvantages of a partnership?
9. Can you compare a partnership, limited partnership, and a joint venture?
10. List some common problems that can occur in a partnership.
11. What is unlimited liability as it relates to a partnership?
12. What is a corporation?
13. List some common characteristics of a corporation?
14. What are some differences between a regular corporation and a sub-chapter S corporation?
15. What are some advantages of a corporation business?
16. What are some disadavantages of a corporation business.
17. What is a cooperative?
18. How does a cooperative differ from a corporation?
19. What are some common characteristics of a cooperative?
20. Perform a computer simulation relating to business organization.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Understanding Basic Business Organization

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area with an interest approach that may include asking students the following questions: Who has heard of agricultural corporations? Can you name any? Do you know of a business run as a partnership? What cooperative businesses exist locally? Why do they exist? What is a sole proprietorship? These questions can be used to overview unit and to stimulate student interest in what is to be studied.

2. Use Information Sheet #1 to discuss the basic principles of a good business organization. Have students supply additional ideas that may be included as good business organization principles.

3. Refer to Information Sheet #2 to describe terminology associated with the problem area.

4. Have students complete Student Worksheet #1.

5. Use Transparency Master #1 to initiate student discussion on the advantages and disadvantages of a sole proprietorship. Encourage students to list additional advantages and disadvantages.

6. Have students interview someone who is a sole proprietor. Have students question the person on the pros and cons of being an individual business owner. Instructor could have students share their findings in class.

7. Use Information Sheet #3 to discuss common characteristics of a partnership.

8. Use Transparency Master #2 to discuss advantages of a partnership. Encourage students to list additional advantages and disadvantages.

9. Transparency Master #3 lists some practical problems that may occur in a partnership. Are there other problems that could occur? Include student ideas along with the list supplied.

10. Assign Student Worksheet #2 as a classroom activity to be completed by 2-3 students in a small group. This project will take students 3-4 class periods to complete. Students will have many questions and will need assistance from the instructor.

11. Use Information Sheet #4 to discuss common characteristics of a corporation.

12. What are the differences between a regular corporation and a sub-chapter S corporation? Use Transparency Master #4 to answer this question.

13. Use Transparency Master #5 to discuss advantages and disadvantages of a corporation. Have students list additional advantages and disadvantages.

14. Use Student Worksheet #3 as an individual student assignment or as a group assignment to be completed in class. This worksheet will assist in drawing comparisons between sole proprietorships, partnerships, and corporations.

15. Use Information sheet #5 to draw further comparisons among different forms of business organizations.

16. Information Sheet #6 discusses how the goals of a cooperative work to the benefit of member users. Have students draw comparisons between a cooperative and a corporation.

17. Refer to Transparency Master #6 to discuss characteristics of a cooperative.

18. As an activity, the instructor could select any one of the business organizations discussed in the problem area and have the class form a business simulation.

19. To further develop student understanding of basic business organization, have students complete computer activity in computerized Farm Records, Unit 6 (see references).

20. To conclude the problem area, have students select a business organization and prepare a presentation stating why they like the specific form of business organization.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Understanding Basic Business Organization

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *Financial Planning in Agriculture.* Schneeberger, Kenneth C., Osburn, Donald D. (most recent edition). The Interstate Printers and Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

*2. *Computerized Farm Records.* (1988). Allen, Warren W. South-Western Publishing Co., 355 Conde St., West Chicago, IL 60185. (312) 231-6000.

*3. *Financial Management in Agriculture.* (1983). Barry, Hopkin, Baker. The Interstate Printers and Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050.

4. *Modern Agricultural Management.* (1983). Osburn, Donald D., Schneeberger, Kenneth C. Reston Publishing Co., Inc., c/o Simon and Schuster, Route 9W, Englewood Cliffs, NJ 07532.

5. *Applied Communications.* Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Principles of a Good Organization

INFORMATION SHEET #2 — Terms to be Defined

INFORMATION SHEET #3 — Characteristics of a Partnership

INFORMATION SHEET #4 — Common Characteristics of a Corporation

INFORMATION SHEET #5 — Comparison of Selected Organizational Alternatives for the Agribusiness Firm

INFORMATION SHEET #6 — Differences Between a Cooperative and a Corporation

TRANSPARENCY MASTER #1 — Sole Proprietorship

TRANSPARENCY MASTER #2 — Partnership Advantages and Disadvantages

TRANSPARENCY MASTER #3 — Practical Problems in a Partnership

TRANSPARENCY MASTER #4 — Comparison of a Regular Corporation and a Sub-chapter S Corporation

TRANSPARENCY MASTER #5 — Agricultural Corporations

TRANSPARENCY MASTER #6 — Characteristics of a Cooperative

INFORMATION SHEET #1

Principles of a Good Organization

1. The organization is simple and the levels of authority are easily understood.

2. Resources, both material and employees, are available for the business to be conducted.

3. Operation of the business is efficient.

4. Employee compensation is fair and provides incentive for worker productivity.

5. Planning is made to initiate the business activity, to help assure success once the business is under way, and to provide for future growth and expansion.

INFORMATION SHEET #2

Terms to be Defined

1. Cooperative — a business that is owned by the members who do business with the cooperative. A cooperative exists to provide needed services for its member owners at better prices. It is not organized to make a profit.

2. Corporation — a business that is treated as a single entity (legal person). Usually there are several owners in the form of stockholders.

3. Joint venture — similar to a partnership, but is usually a single undertaking of fairly short duration. Examples include purchasing a machine together between two people, and jointly purchasing a group of feeder calves and feeding them out.

4. Limited partnership — a special form of partnership. One or more partners are the limited partner(s) and are only investors in the business. A limited partner is often called a "silent partner" because he or she does not participate in the management of the business. Silent partners are liable only to the extent of the money each has invested.

5. Partnership — an association of two or more persons who, as co-owners, carry on a business for a profit.

6. Sole proprietorship — a single owner decides business policy and is solely responsible for management.

7. Unlimited liability — each partner is liable for the partnership's acts, liabilities, debts, and obligations.

INFORMATION SHEET #3

Characteristics of a Partnership

1. There should be a written agreement that specifies terms of the partnership.
2. Each partner has an equal voice.
3. Profits and losses are divided as agreed.
4. The partnership may own property.
5. Each partner is liable for partnership liabilities (unlimited liability).
6. Each partner is liable for partner's wrongful acts as a partner (unlimited liability).
7. Records are a necessity; the partnership files a tax return but taxes are paid individually.
8. Partnership is normally dissolved upon the death of a partner.
9. The courts usually assume control and ownership to be "50-50" between partners unless specified differently in the written contract.

INFORMATION SHEET #4

Common Characteristics of a Corporation

1. A corporation is treated as a single entity (legal person).
2. A corporation can have thousands of stockholders or it can have only a few.
3. Capital is raised by selling shares of stock.
4. The corporation is separate from the operator. The corporation has assets and the operator has his or her own assets.
5. A corporation may have different classes of stock (i.e., common stock, preferred stock).
6. A corporation is taxed as a legal person.

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INFORMATION SHEET #5

Comparison of Selected Organizational Alternatives for the Agribusiness Firm

		Partnerships		Corporations	
Characteristics	Sole Proprietor	General	Limited	Regular	Sub-chapter S
1. Source of Equity Capital	Limited to proprietor's equity: primarily new capital from retained earnings.	Limited to equity capital of partners: new capital from retained earnings and from equity of new partners brought into partnership.	Specifically designed to attract equity capital from limited partners who do not have management responsibility.	From selling equity securities and from retained corporate earnings.	From selling preferred or common stock (not both) to 35 or less persons and from retained earnings.
2. Liability to Owners.	Liability extends to the total assets of the proprietor for obligations of the firm.	Liability extends to total assets of all partners for obligations of the firms and for actions of partners.	Liability of partners limited to amount they invest in partnership. General partners assume major liability.	Liability limited to the assets of the corporation. Liability of stockholders limited to their individual investments in corporation.	
3. Continuity of Owners.	Linked directly to the life cycle of proprietor.	Can be dissolved by any partner. Tends to be associated with life cycle of partners, but need not be.	Can be dissolved by a general partner, but is usually not affected by withdrawal of a limited partner.	Continuity through law is not associated with life cycle of any one person. Instead, the organization is created by law and is terminated by legal action.	
4. Management and Control.	Limited only by the capacity and resources of the proprietor.	Typically, partners share management equally. Each partner has power to bind partnership, thus requiring high level of confidence.	General partners share management, and each has power to bind the partnership. Limited partnership cannot obligate the partnership.	Ultimate power rests with stockholders, who elect board of directors that appoints management.	With fewer stockholders there usually is a close link between stockholders, directors, and management.
5. Income Taxation.	All farm profits are taxable to proprietor. Any salary paid to proprietor as manager is taxable by proprietor.	Partnerships pay no income taxes. All profits as well as losses are allocated directly to partners (both general and limited) for tax accounting. Salaries paid to general partners are taxable to the recipients and are a deductible expense to the partnership.		Corporation pays tax on corporate profits. Salaries to employees are tax deductible to corporation and taxable to employees. Stockholders pay tax on dividends.	Taxed as partnership, i.e., all profits are allocated to stockholders for tax reporting (stockholder could have taxable profits and no dividends with which to pay taxes).
6. Employee Status.	Social security tax stipulated by law on earnings. Restrictions on amount of farm income proprietors can receive without disrupting social security payments after retirement. Cost of employee benefits to proprietor and family not tax deductible to business.	Partnership itself pays no social security tax. Restrictions on amount of partnership income a general partner can receive without disrupting social security benefits. Limitations do not apply to limited partners. Cost of employee benefits to partners and families not tax deductible to business.		Social security tax stipulated by law for salary to each employee, paid by corporation as tax deductible expense. An equal amount paid by each employee is not tax deductible. Only salaries and not dividends diminish social security payments to stockholders. Costs of many employee benefits to the owner-employees and families are tax deductible as expenses to the corporation.	

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Comparison of Selected Organizational Alternatives for the Agribusiness Firm (cont'd.)

Characteristics	Sole Proprietor	Partnerships: General	Partnerships: Limited	Corporations: Regular	Corporations: Sub-chapter S
7. Formalization and Cost of Organization.	No organizational cost. No minimum required records and reports except for income tax, employee withholdings, and workmen's compensation reports.	Can be organized with or without written agreement or contract. Records become more vital than for sole proprietorship.	Must be formally organized with written agreement. Requires official reports to limited partners.	Organization, legal, and filing fees more costly than for partnerships. Franchise tax varies by states.	
8. Intergeneration Transfer and Estate Planning.	Title to actual resources must be transferred on death of proprietor.	Usually difficult to plan for continuity of partnership business beyond first generation. Title to actual resources of partners must be transferred.		At death of stockholder, only the corporation stock owned by decedent is subject to probate (not the underlying assets of that stock). Fractionalization of ownership in undifferentiated assets of firm makes easier transfer possible using tax-exempt gift privileges. 49% of voting stock may be given away without losing control. Regular corporations can have two classes of stock, giving some advantages in estate planning.	

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INFORMATION SHEET #6

Differences Between a Cooperative and a Corporation

Cooperatives differ because of the following cooperative goals:

1. Philosophy
   a. emphasize member control
   b. organized by members with a common interest to obtain better pricing
   c. obtain marketing power for its members

2. Ownership
   a. owned by member users
   b. cooperative is more responsive to its member users

3. Operating Practices
   a. operated on a non-profit basis
   b. any "profits" above expenses and reasonable reserves are returned to members as patronage dividends based upon amount of business conducted by each member at the cooperative

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TRANSPARENCY MASTER #1

Sole Proprietorship

Advantages

1. Your own boss

2. Proprietor owns the assets and runs the business

3. Proprietor receives all profits

4. Business expansion decisions are easy to accomplish

5. Can make quick decisions or change business direction faster

6. Strong incentive by the owner to work hard

Disadvantages

1. May be difficult to raise enough capital to begin business.

2. All assets, business and personal, may be used to meet debts

3. Responsible for entire business.

4. Injury could cause a stop in the business

TRANSPARENCY MASTER #2

Partnership Advantages and Disadvantages

Advantages

1. Combining of capital and knowledge

2. Labor and management responsibilities can be divided amongst the partners

3. Liability is shared

Disadvantages

1. Objectives and opinions of partners may be different

2. Death or illness can cause the organization to dissolve

3. Unlimited liability amongst partners

4. Each partner is liable for business debts

TRANSPARENCY MASTER #3

Practical Problems in a Partnership

1. Tolerance and understanding

2. Partners often have different goals for the business

3. Homes are closely tied to the business

4. Disagreements usually are over trivial things

5. Trust

6. "Unlimited liability"

It is essential that partners understand the problems that can occur prior to beginning a partnership.

TRANSPARENCY MASTER #4

Comparison of a Regular Corporation and a Sub-chapter S Corporation

Regular Corp.	Sub-chapter S Corp.
1. Different stock classes (common, preferred, etc.)	1. Limited to one class of stock
2. Unlimited number of shareholders. (usually specified by board of directors or current shareholders)	2. No more than 15 shareholders
3. Taxed as a single entity (legal person)	3. Taxed as a partnership (taxes are reported by shareholders on their individual tax returns)

Many agricultural corporations are operated as a Sub-chapter S corporation.

TRANSPARENCY MASTER #5

Agricultural Corporations

Advantages

1. Raising of capital
2. There is a separation between ownership and management
3. Business continuation
4. Ownership is easily transferred (stock ownership)
5. Liability is limited to investor's stock purchase
6. Good way to pool resources

ERIC

Agricultural Corporations

Disadvantages

1. Complicated and costly to organize

2. Usually have additional bookkeeping and accounting costs

3. Freedom of actions and changes to the business is limited

4. Expensive to end the business

5. Much "red tape"

6. May result in "double taxation" Corporation's income is taxed: stockholders pay tax on stock dividends.

7. May be less of a personal business.

TRANSPARENCY MASTER #6

Characteristics of a Cooperative

1. Cooperative businesses are owned by member users.

2. Cooperative emphasis is on member control.

3. Cooperatives are organized by members with a mutual interest.

4. Cooperatives are operated on a "non-profit" basis. Profits above reasonable reserves and expenses are returned to the members.

5. Membership is voluntary. This keeps the cooperative more responsive to its members.

6. Many cooperatives operate on "one-member, one vote" basis.

7. The board of directors is elected by the members. The board is comprised of members of the cooperative.

8. Cooperative stock does not increase or decrease in value. Members buy stock for pricing advantages, not for stock dividends.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Business Organization Word Search

STUDENT WORKSHEET #2 — Partnership Agreement Worksheet

STUDENT WORKSHEET #3 — Comparison of Farm Business Organizations

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

Business Organization Word Search

C	R	M	E	V	I	T	A	R	E	P	O	O	C	G	Z	T	S	N	T
W	I	E	X	C	O	R	P	O	R	A	T	I	O	N	S	Y	J	S	H
P	O	J	N	A	M	W	K	N	E	X	K	R	S	I	L	H	I	W	L
Q	Y	O	G	W	T	A	G	O	A	X	N	D	L	T	I	K	G	S	T
R	O	I	I	B	O	O	N	J	U	Q	F	E	X	Y	M	L	J	S	M
B	G	N	B	Y	O	E	G	A	O	B	N	M	T	F	I	D	Z	E	C
O	U	T	R	D	N	M	L	V	G	T	W	I	O	P	T	P	G	N	Q
Y	C	V	S	E	K	R	I	G	P	E	L	P	P	Y	E	B	V	I	V
T	Y	E	K	W	S	P	O	A	N	I	M	E	G	X	D	X	B	S	J
I	K	N	A	P	C	P	R	T	B	I	I	E	M	O	P	Y	O	U	M
F	Z	T	S	F	A	T	O	A	E	F	S	E	N	J	A	Z	S	B	S
O	F	U	M	R	N	R	I	N	S	I	M	Y	U	T	R	X	U	X	N
R	Z	R	X	E	E	L	T	E	S	B	R	O	U	L	T	Q	N	A	X
P	H	E	R	C	A	N	R	N	E	I	V	P	R	Q	N	K	L	Z	T
C	L	W	G	C	D	V	W	R	E	B	B	Y	O	N	E	M	I	H	U
P	O	L	I	C	I	E	S	O	P	R	U	I	C	R	R	Q	M	S	Q
G	F	W	U	C	C	C	H	M	O	I	S	H	L	C	P	B	I	V	S
Q	M	A	E	E	N	N	C	L	K	C	B	F	C	I	S	T	T	M	K
G	Z	S	U	B	C	H	A	P	T	E	R	S	I	N	T	K	E	F	Q
G	L	V	C	I	A	T	J	O	J	U	E	Q	A	P	S	Y	D	G	C

The following words are hidden in the puzzle:

Business
Cooperative
Co-owners
Corporation
Goods
Joint Venture
Liability
Limited Partner
Management
Members
Partnership
Policies
Profit
Proprietor
Responsibility
Services
Silent Partner
Single Owner
Sub-chapter S
Unlimited

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STUDENT WORKSHEET #1 — KEY

Business Organization Word Search

•	R	•	E	V	I	T	A	R	E	P	O	O	C	•	•	•	•	•	•
•	•	E	•	C	O	R	P	O	R	A	T	I	O	N	S	•	•	•	•
•	•	J	N	•	M	•	•	•	•	•	•	•	•	I	L	•	•	•	•
•	•	O	•	W	•	A	G	•	•	•	•	•	L	•	I	•	•	S	•
•	•	I	•	•	O	O	N	•	•	•	•	E	•	Y	M	•	•	S	•
•	•	N	•	•	O	E	•	A	•	•	N	•	T	•	I	•	•	E	•
•	•	T	R	D	•	•	L	•	G	T	•	I	•	•	T	•	•	N	•
•	•	V	S	E	•	R	•	G	P	E	L	•	•	•	E	•	•	I	•
T	•	E	•	•	S	•	O	A	N	I	M	•	•	•	D	•	•	S	•
I	•	N	•	P	•	P	R	T	B	I	•	E	M	•	P	•	•	U	•
F	•	T	S	•	A	T	O	A	E	•	S	E	N	•	A	•	•	B	•
O	•	U	•	R	N	R	I	N	S	I	M	•	•	T	R	•	U	•	•
R	•	R	•	E	E	L	T	E	S	B	R	•	•	•	T	•	N	•	•
P	•	E	R	•	•	N	R	N	E	I	•	P	•	•	N	•	L	•	•
•	•	•	•	•	•	V	W	R	E	•	B	•	O	•	E	•	I	•	•
P	O	L	I	C	I	E	S	O	•	R	•	I	•	R	R	•	M	•	•
•	•	•	•	C	•	•	•	•	O	•	S	•	L	•	P	•	I	•	•
•	•	•	E	•	•	•	•	•	•	C	•	H	•	I	•	•	T	•	•
•	•	S	U	B	C	H	A	P	T	E	R	S	I	•	T	•	E	•	•
•	•	•	•	•	•	•	•	@	•	•	•	•	•	P	•	Y	D	•	•

The following words are hidden in the puzzle:

- Business
- Cooperative
- Co-owners
- Corporation
- Goods
- Joint Venture
- Liability
- Limited Partner
- Management
- Members
- Partnership
- Policies
- Profit
- Proprietor
- Responsibility
- Services
- Silent Partner
- Single Owner
- Sub-chapter S
- Unlimited

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STUDENT WORKSHEET #2

Partnership Agreement Worksheet

I. Preliminary Statements

A. Introduction

1. Names and addresses of the partners: ____
____
____
____
2. What property will be purchased? ____
____
At what price? ____
What are the repayment terms? ____
____

B. Name and Address of Business

1. What name has been selected for the partnership? ____
____
2. What is the address of the principal place of business? ____
____

C. Nature of Business

1. What is to be the principal business activity? ____
____
____
2. What future expansion, especially into other activities, is contemplated? ____________________
____
____
3. Are there any limits on business activities? ____
____

D. Duration

1. On what date will the partnership begin? ____
2. The term of the agreement shall be from ____________________ to ____________________ , and from year to year thereafter unless written notice of termination or change is given by a partner to the others at least ____________ months before the end of the agreement.

II. Contributions

A. Personal Property Contributions

1. What are the personal property contributions by each partner to the partnership?

List Personal Property	Name ________ Market Value	Name ________ Market Value	Name ________ Market Value
Total			

ERIC Full Text Provided by ERIC

2. If any personal property is to be leased to the partnership by a partner, what is the market value of the property, the lease payment, when due, lease period, responsibility for maintenance, who will purchase replacement property and other lease terms? ______

B. Real Property Contributions

1. If any "use only" real property is being contributed to the partnership, what is its description and market value? ______

   a. Fixed real estate expenses are to be paid by whom? ______

2. If any real property is contributed outright to the partnership, what is its description, market value, and income tax cost basis? ______

3. If any real property is leased to the partnership by a partner, what is its description, the lease payment, when due, lease period, responsibility for real estate expenses, and who will purchase new capital improvements?

C. Cash Contributions

1. What outright cash contributions will be made to the partnership, by whom? ______

2. What cash loans will be made to the partnership by a partner? What is the interest rate and repayment terms?

D. Future Capital Contributions

1. Can a partner make additional capital contributions? ______
   Under what conditions? ______

F. Labor Contributions

Name	Proportion of Working Time Devoted to Partnership	If Less Than Full Time in the Partnership, Give Details of Labor Contributions

III. Distribution

A. Salaries

1.

Name	Salary	When Payable

2. Will salary be paid a disabled partner, and for how long? ____________________

3. Are salaries considered a payment to partners and, therefore, an expense to the partnership to be deducted from total partnership income when arriving at partnership ordinary income? ____________________

B. Under what conditions may additional funds be withdrawn during the year as a drawing account or advance on ordinary income? ____________________

C. How will the ordinary income of the business be shared? ____________________

IV. Accounts and Records

1. What accounting system will be utilized? ____________________
   Will records be kept on a cash or accrual basis? ____________________
   Calendar or fiscal year? ____________________
2. Who will be responsible for keeping accounts? ____________________
   When will they be open to inspection? ____________________
3. Will there be a difference between individual partner and firm accounting — fiscal or calendar years, cash or accrual basis? ____________________
4. Where will partnership funds be deposited? ____________________
5. Who will be empowered to sign checks on the partnership account? ____________________

V. Limiting Partners' Power

1. What limitations will be placed on partner's authority to bind the partnership? ____________________

2. What limitations will be placed on a partner's personal activities? ____________________

VI. Management

1. If partners are not to have an equal voice in management, what is the arrangement? ____________________

2. How are management duties to be divided? ____________________

3. How will decisions be settled? By mutual agreement? By majority vote? By arbitration? By one designated partner? ____________________

4. How often and when will partners set time aside for a "business conference" to discuss business progress or problems? ____________________

VII. Dissolution

A. Buy and Well Agreements
   1. Will a buyout arrangement in case of death or voluntary withdrawal of a partner be part of the agreement? ____________________
   2. Will the buyout be mandatory or voluntary upon the remaining partners? ____________________
   3. How will value be established? ____________________

4. How will the departing partner be paid for his interest?
5. Will partnership life insurance be part of the agreement?
6. If life insurance will be used, what are the provisions?

B. Causes of Dissolution
   1. What causes of dissolution other than those included in the Buy and Sell Provisions will be covered in the agreement, such as voluntary dissolution or retirement of a partner?
   2. If the business is liquidated, how should it be handled? (By sale? By distribution of assets?)
   3. What special provisions will guide each cause?

VIII. Miscellaneous

1. How will partners' vacations be handled?
2. Are provisions for admitting a new member desired?
3. Any special provisions for partners' housing?
4. Provisions for the continued participation of an incapacitated partner?

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STUDENT WORKSHEET #3

Comparison of Farm Business Organizations

	Sole Proprietor	*Partnership*	*Corporation*
Nature of entity			
Life of business			
Liability			
Source of capital			
Management decisions			
Limits on business activity			
Transfer of interest			
Effect of death			
Income taxes			

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STUDENT WORKSHEET #3 — Key

Comparison of Farm Business Organizations

	Sole Proprietor	*Partnership*	*Corporation*
Nature of entity	Single individual	Aggregate of two or more individuals	Legal person separate from shareholder-owners
Life of business	Terminates on death	Agreed term; terminates at death of a partner	Perpetual or fixed term of years
Liability	Personally liable	Each partner liable for all partnership obligations	Shareholders not liable for corporate obligations
Source of capital	Personal investment; loans	Partners' contributions; loans	Contributions of shareholders for stock; sale of stock, bonds, and other loans
Management decisions	Proprietor	Agreement of partners	Shareholders elect directors who manage business through officers elected by directors
Limits on business activity	Proprietor's discretion	Partnership agreement	Articles of incorporation and state corporation law
Transfer of interest	Terminates proprietorship	Dissolves partnership; new partnership may be formed if all agree	Transfer of stock does not affect continuity of business — may be transferred to outsiders if no restrictions
Effect of death	Liquidation	Liquidation or sale to surviving partners	No effect on corporation. Stock passes by will or inheritance.
Income taxes	Income taxed to individual; 60% deduction for long-term capital gains	Partnership files an information return but pays no tax. Each partner reports share of income or loss, capital gains and losses as an individual.	*Regular Corporations* Corporation files a tax return and pays tax on income, salaries to shareholder-employees deductible Capital gains offset by capital losses; no 60% deduction for capital gains 17% on first \$25,000, 20% on second \$25,000, 30% on third \$25,000, 40% on fourth \$25,000, and 46% on all over \$100,000 of corporate taxable income (federal rates). Shareholders taxed on dividends paid *Tax-Option Corporation* Corporation files an information return but pays no tax. Each shareholder reports share of income, operating loss, and long-term capital gain.

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CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Managing Personal Finances

RELATED PROBLEM AREAS:

1. Applying Mathematics Skills in Agriculture
2. Keeping and Using Records in Agricultural Occupations

PREREQUISITE PROBLEM AREA(S):

1. Applying Mathematics Skills in Agriculture

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty F: Financing the Agribusiness

1. Prepare budget
2. Develop credit plan
3. Prepare tax statements
4. Calculate operating expenses
5. Prepare cash flow projections
6. Prepare financial statements
7. Interpret financial statements
8. Prepare depreciation schedule
9. Prepare cash flow statements

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principleal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Randy J. Bernhardt

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

(Affix label or complete district information.)

COUNTY	DISTRICT	ESC

District Name

City

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Evaluate the costs and benefits of a particular course of action.					
2. Conduct budgeting of personal finances.					
*3. Understand the principles of money mangement including budgeting.					
4. Develop personal financial goals.					
5. Understand how to use a checking account.					
6. Understand how to reconcile a bank statement.					
*7. Analyze the types and source of consumer credit.					
*8. Evaluate terms of credit agreements.					
9. Calculate the cost of credit.					
10. Understand the characteristics of a good borrower.					
11. Evaluate the characteristics of a good lender.					
12. Understand the concept of repayment capacity as it relates to credit and loans.					
13. Complete a loan application.					
14. Understand the proper use of credit cards.					
15. Prepare tax return forms. 1383					1384
*16. Apply the principles of money management to financial planning situations.					

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Managing Personal Finances

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Conduct budgeting of personal finances.
2. Develop personal financial goals.
3. Understand how to use a checking account.
4. Understand how to reconcile a bank statement.
5. Calculate the cost of credit.
6. Understand the characteristics of a good borrower.
7. Evaluate the characteristics of a good lender.
8. Understand the concept of repayment capacity as it relates to credit and loans.
9. Complete a loan application.
10. Understand the proper use of credit cards.
11. Prepare tax return forms.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Managing Personal Finances

PROBLEMS AND QUESTIONS FOR STUDY

1. Can you evaluate the costs and benefits of a particular course of action?
2. What is budgeting?
3. How do we budget our personal finances?
4. What are the types of financial goals?
5. How do you develop personal financial goals?
6. Can you use a checking account, write checks, make deposits?
7. How do you reconcile or balance a bank statement?
8. What are the types of credit?
9. How do you calculate interest charges on loans?
10. What are the characteristics to look for in a lender?
11. What are good characteristics to look for in a lender?
12. What is repayment capacity?
13. Accurately complete a loan application.
14. How do you use credit cards?
15. Can you complete an application for a credit card?
16. Can you prepare a tax return?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Managing Personal Finances

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area with an interest approach that includes an overview of what is to be studied.

2. Use Transparency Master #1 to disucss why a person should conduct personal budgets.

3. Use Transparency Master #2 to discuss types of personal goals.

4. For a student activity, have students write a letter to themselves. Have them state their personal goals in the letter. They should seal the letters in envelopes addressed to their homes. The instructor would mail the letter to the students anytime in the future. When the students receive the letters, they will remind them of the personal goals they had set for themselves.

5. Refer to Chapter 10 of *Century 21 Accounting* (see references) to discuss checking accounts and reconciling bank statements. Any text from the Business Education teacher could be used to discuss checking accounts and bank statement reconciliation.

6. Give students an opportunity to write checks and balance the checkbook register. Refer to Student Worksheet #1.

7. Have students reconcile a bank statement. Refer to Student Worksheet #2.

8. Refer to Information Sheet #1 to explain the different types of credit.

9. Use Information Sheet #2 to explain how to calculate the cost of credit.

10. Have students complete Student Worksheet #3.

11. Have students conduct a survey of five businesses offering credit in your area to determine interest rates, methods of charging interest, and carrying charges. Have students draw a graph of their findings.

12. Discuss qualities a lender looks for in a borrower. Refer to Transparency Master #4.

13. Use Transparency Master #5 to discuss characteristics of a good lender.

14. Information Sheet #3 explains the concept of repayment capacity.

15. Have students obtain a loan application from a lending institution. Students should complete application and submit it to instructor as if the instructor were the loan officer. Review applications. Point out to students the errors that were made. Instructor may want to have students complete several different types of loan applications

16. Refer to chapter 10 of *Money and Banking* (see references) to conduct a discussion about credit cards.

17. Have students obtain and complete a credit card application from an institution or bank.

18. Use *Understanding Taxes* (see references) to explain how to complete tax forms.

19. Have students identify some of the ethical considerations of using credit.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Basic Agribusiness Principles and Skills

PROBLEM AREA: Managing Personal Finances

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *The Money Encyclopedia.* (1984). Rachlin, Harvey. (ed.) Harper and Row Publishers, Inc., 10 East 53rd Street, New York, NY 10022.

*2. *Money and Banking.* (1984). Cantwell, Lois, Watts, Franklin. A Grolier Company, New York, NY.

*3. *Modern Agricultural Management.* (1983). Osburn, Donald D., Schneeberger, Kenneth C. Reston Publishing Company, Inc., c/o Simon and Shuster, Route 9W, Englewood Cliffs, NJ 07532.

*4. *Century 21 Accounting.* (1982). Swanson, Ross, Hanson, Boynton. South-Western Publishing Company, 355 Conde St., West Chicago, IL 60185.

5. *Business Management for Farmers.* (1983). Looney, J.W. Doane Publishing Company, 11701 Borman Drive, St. Louis, MO 63146.

6. *Understanding Taxes.* (most recent edition). Internal Revenue Service, Attention: Understanding Taxes Coordinator, P.O. Box 398, Springfield, IL 62705. (217) 492-4288 or (800) 424-1040. (Supplied free to high school educators.)

7. *Applied Mathematics.* Curriculum Publications Clearinghouse, Western Illinois Univeristy, Horrabin Hall 46, Macomb, IL 61455.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Types of Credit

INFORMATION SHEET #2 — Cost of Credit

INFORMATION SHEET #3 — Repayment Capacity

TRANSPARENCY MASTER #1 — Why Budget?

TRANSPARENCY MASTER #2 — Types of Goals

TRANSPARENCY MASTER #3 — Three Types of Credit

TRANSPARENCY MASTER #4 — What a Lender Looks For in a Borrower

TRANSPARENCY MASTER #5 — Characteristics of a Good Lender

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INFORMATION SHEET #1

Types of Credit

Agribusiness credit is divided into three classes:

1. Institutional credit — obtained from organizations which are in business to loan money.

   a. Operating Credit

   Short-term credit is that which is used for a relatively short time, normally paid back within a one-year period. Short-term credit can be further broken down into: monthly (20 to 90 days); seasonal (3 to 9 months); and annual (9 months to 1 year).

   Intermediate-term credit is extended for a period of several years, usually one to five.

   b. Real Estate Financing

   Long-term credit normally falls into the classification of real estate mortgage credit. Financing ranges from 5 years up to 35 years. Obvious use is for the purchase of land.

2. Retail and Installment Credit

   This is credit which is extended by retailers in order to make it more convenient for consumers to purchase goods and services. Normally there is no finance or service charge if these purchases are paid for within 30 days. Charge accounts make it convenient for the business people to purchase frequently used goods without paying for each purchase at the time it is made. Charge accounts, improperly handled, can lead a purchaser into a situation of overspending so that he or she is unable to meet the commitment when the time for payment comes. Cash discounts may be lost if goods are bought on installment.

3. Credit from individuals

   A significant portion of total agricultural credit in use today is in the form of money borrowed from individuals. It is important to keep such borrowing on a legal basis. Contracts, notes, and other guarantees should be used just as they would be in institutional financing. The death of either party or a later disagreement can have disastrous results for both the borrower and lender, especially without legal documents in writing. Purchasing of land on contract is a common type of agricultural credit from individuals.

INFORMATION SHEET #2

Cost of Credit

Figuring the Cost of Credit

Truth in lending laws require that anyone who extends credit give a full disclosure of the total finance cost in terms of annual percentage rate (APR). "Shop" for the best credit terms.

The actual annual rate of interest charged can be calculated by using the following formula:

$$\frac{\text{Total Charges}}{\text{1/2 of original loan}} \times \frac{\text{Number of Payments}}{\text{Number of Years}} \times \frac{1}{\text{Number of Payments} + 1} =$$

In addition to interest, there also may be such costs as carrying charges, time differential charges, finance charges, sales commissions, and differences in discounts granted.

When interest alone is charged, the actual cost will depend on whether it is charged on the unpaid balance, on the original or face amount of the loan, or in advance.

Simple Interest

Simple interest is a method of calculating interest charges whereby the actual annual rate of interest is equal to the stated rate. The borrower pays interest only on the actual amount of dollars outstanding for the number of days the money is used.

Add-on interest

Under this method, which is the most common method of charging interest, the borrower pays interest on the full amount of the loan for the entire loan period.

Interest is charged on the face amount of the loan at the time it is made and then added to that amount. This amount (principal plus interest) is then divided equally by the number of payments to be made.

Percent Per Month

Under this method, which has been less widely used in recent years, interest is calculated month by month on the unpaid balance over the full term of repayment. For example, the charge might be 2 1/2 percent per month up to $300, 2 percent over that amount up to $500, 1 1/2 percent on $500 to $1,000, and 1 percent over $1,000.

Interest in Advance

Interest in advance means that the interest is calculated and then subtracted from the principal which the borrower actually receives. For example, if a borrower took a one-year loan for $1,000 at 7 percent interest, he would receive only $930 in proceeds at the start of the loan period.

Carrying Charges

Carrying charges are most frequently used in retail credit, and usually are stated in terms of monthly charge on the unpaid account. They range from 1/2 percent to 1 1/2 percent per month. To arrive at the annual percentage rate, simply multiply the monthly rate by 12. In the case of 1 1/2 percent per month, the APR would be 18 percent.

Be aware of the total cost of using borrowed money. There are differences, and it is wise to "shop around" for the best source of credit.

INFORMATION SHEET #3

Repayment Capacity

Repayment capacity determines how much credit a borrower receives.

Good records are necessary to determine repayment capacity.

Repayment Capacity Answers These Questions:

1. Can the loan be repaid according to the terms?
2. Will the loan be a profitable one?

TRANSPARENCY MASTER #1

Why Budget?

1. Know the useful life of your valuables
2. Device for keeping organized
3. Very helpful when in need of credit
4. Can experiment with possible outcomes
5. Helps to develop a plan

TRANSPARENCY MASTER #2

Types of Goals

Short-Term Goals

1. Achieved in one year or less
2. Assist in providing immediate satisfaction

Intermediate-Term Goals

1. Achieved in one to ten years
2. Helps to achieve long-term goals

Long-Term Goals

1. Achieved in more than ten years
2. Help to develop a life long sense of direction

To achieve intermediate- and long-term goals, we must set and attain short-term goals. This provides the satisfaction of accomplishment as we attempt to reach goals that take many years to achieve.

TRANSPARENCY MASTER #3

Three Types of Credit

1. Institutional Credit: Short, Intermediate, and Long Term

2. Retail and Installment Credit

3. Credit from Individuals

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TRANSPARENCY MASTER #4

What a Lender Looks For in a Borrower

1. Character

2. Managerial Ability

3. Financial Position

4. Repayment Capacity

5. Ability to Set Up a Repayment Plan

6. Purpose of the Loan

7. Security for the Loan

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TRANSPARENCY MASTER #5

Characteristics of a Good Lender

1. Character

2. Lending Policies

3. Permanence and Dependability of Lending Institution

4. Cost of Loan (Interest, Carrying Charges, etc.)

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Preparing Check Stubs and Writing Checks

STUDENT WORKSHEET #2 — Checkbook Balancing

STUDENT WORKSHEET #3 — Calculating the Cost of Credit

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

STUDENT WORKSHEET #1

Preparing Check Stubs and Writing Checks

You are authorized to sign checks for Key Car Wash. The first check is numbered 21. The balance brought forward from Check Stub No. 20 is $389.16. Use the current date on all checks.

Instructions:

1. Write the beginning balance on check Stub No. 21.
2. Prepare check stubs and checks Nos. 21 and 22.

   Check No. 21: $25.00; payee, Waters Supply Company; payment on account.
   Check No. 22: $75.50; payee, Nichols Equipment Company; typewriter repairs.

3. Record a deposit of $126.70 on Check Stub No. 23.
4. Prepare check stubs and checks Nos. 23 and 24.

   Check No. 23: $150.00; payee, Mercer Supply Company; for supplies.
   Check No. 24: $100.00; payee, John Key (owner of Key Car Wash); for personal use.

NO. 21 $ ________

Date ____________ 19 ___

To ____________

For ____________

BAL. BR'T FOR'D		
DEPOSITED Date		
TOTAL		
AM'T THIS CHECK		
BAL. CAR'D FOR'D		

KEY CAR WASH NO. 21
1150 Hinkle Street
Bakersfield, CA 93305-5742

____________ 19 ___

Pay to the Order of ____________ $ ________

____________ Dollars

For ____________

PACIFIC STATE BANK
Bakersfield, CA 93305-5387

1399

NO. 22 $ ______	KEY CAR WASH NO. 22
Date ______ 19 __	1150 Hinkle Street
To ______	Bakersfield, CA 93305-5742
______	______ 19 __
For ______	Pay to the Order of ______ $ ______
______	______ Dollars
BAL. BR'T FOR/D	For ______
DEPOSITED Date	______ ______
TOTAL	
AM'T THIS CHECK	**P** PACIFIC STATE BANK
BAL. CAR'D FOR'D	*Bakersfield, CA 93305-5387*

NO. 23 $ ______	KEY CAR WASH NO. 23
Date ______ 19 __	1150 Hinkle Street
To ______	Bakersfield, CA 93305-5742
______	______ 19 __
For ______	Pay to the Order of ______ $ ______
______	______ Dollars
BAL. BR'T FOR/D	For ______
DEPOSITED Date	______ ______
TOTAL	
AM'T THIS CHECK	**P** PACIFIC STATE BANK
BAL. CAR'D FOR'D	*Bakersfield, CA 93305-5387*

NO. 24 $ ______	KEY CAR WASH NO. 24
Date ______ 19 __	1150 Hinkle Street
To ______	Bakersfield, CA 93305-5742
______	______ 19 __
For ______	Pay to the Order of ______ $ ______
______	______ Dollars
BAL. BR'T FOR/D	For ______
DEPOSITED Date	______ ______
TOTAL	
AM'T THIS CHECK	**P** PACIFIC STATE BANK
BAL. CAR'D FOR'D	*Bakersfield, CA 93305-5387*

STUDENT WORKSHEET #1 — Key

Preparing Check Stubs and Writing Checks

NO. 21 $ 25.00
Date Current 19 --
To Waters Supply Company
For Payment in account

BAL. BR'T FOR'D	389	16
DEPOSITED Date		
TOTAL	389	16
AM'T THIS CHECK	25	00
BAL. CAR'D FOR'D	364	16

KEY CAR WASH NO. 21
1150 Hinkle Street
Bakersfield, CA 93305-5742

Current date 19 --

Pay to the Order of Waters Supply Company $ 25.00

Twenty-five and no/100 Dollars

For Payment on account

Student's Name

PACIFIC STATE BANK
Bakersfield, CA 93305-5387

NO. 22 $ 75.50
Date current 19 --
To Nichols Equipment Company
For Typewriter repairs

BAL. BR'T FOR'D	364	16
DEPOSITED Date		
TOTAL	364	16
AM'T THIS CHECK	75	50
BAL. CAR'D FOR'D	288	66

KEY CAR WASH NO. 22
1150 Hinkle Street
Bakersfield, CA 93305-5742

Current date 19 --

Pay to the Order of Nichols Equipment Company $ 75.50

Seventy-five and 50/100 Dollars

For Typewriter repairs

Student's Name

PACIFIC STATE BANK
Bakersfield, CA 93305-5387

1401

NO. 23 $ 150.00	KEY CAR WASH NO. 23
Date Current 19--	1150 Hinkle Street
To Mercer Supply Company	Bakersfield, CA 93305-5742
For Supplies	Current date 19--
	Pay to the Order of Mercer Supply Company $ 150.00
	One hundred fifty and 00/100 Dollars
	For Supplies Student's Name
	P PACIFIC STATE BANK *Bakersfield, CA 93305-5387*

BAL. BR'T FOR'D	288	66
DEPOSITED (Date: current)	126	70
TOTAL	415	36
AM'T THIS CHECK	150	00
BAL. CAR'D FOR'D	265	36

NO. 24 $ 100.00	KEY CAR WASH NO. 24
Date Current 19--	1150 Hinkle Street
To John Key	Bakersfield, CA 93305-5742
For Personal use	Current date 19--
	Pay to the Order of John Key $ 100.00
	One hundred and 00/100 Dollars
	For Personal use Student's Name
	P PACIFIC STATE BANK *Bakersfield, CA 93305-5387*

BAL. BR'T FOR'D	265	36
DEPOSITED (Date)		
TOTAL	265	36
AM'T THIS CHECK	100	00
BAL. CAR'D FOR'D	165	36

1402

STUDENT WORKSHEET #2

Checkbook Balancing

Use this form, which is similar to a monthly checking account statement, to determine if the checkbook balances with the statement.

Balance shown in checkbook	$3,565.00
Balance shown on bank statement	4,726.00
Paycheck deposited but not on statement	400.00

Checks written but not shown on statement

Gas bill for car (check #202)	$41.00
Animal feed (check #203)	120.00
Cash for a date (check #205)	25.00
Car repairs (check #206)	100.00
FFA convention expenses (check #207)	95.00
Gas for car (check #208)	20.00
Cash for weekend (check #209)	40.00
Payment to haul market animals (check #210)	15.00
Gift for a friend (check #211)	25.00
Rental of animal facilities (check #212)	125.00
Animal feed (check #213)	140.00
Gas for car (check #214)	15.00

Name ______________________________

Balance Sheet

Amount shown in checkbook ____________

Add deposits now shown ____________

A. Subtotal ____________

List of outstanding checks

____
____
____
____
____
____
____
____
____
____
____
____

1403

B. Subtotal ____________

C. Add Subtotal B to Subtotal A = Current Balance ____________

D. Balance on bank statement (should be the same as C) ____________

STUDENT WORKSHEET #2 — Key

Checkbook Balancing

Name ____________________

Balance Sheet

Amount shown in checkbook			3565.00
Add deposits now shown			400.00
		A. Subtotal	3965.00
List of outstanding checks	41.00		
	120.00		
	25.00		
	100.00		
	95.00		
	20.00		
	40.00		
	15.00		
	25.00		
	125.00		
	140.00		
	15.00		
		B. Subtotal	761.00
C. Add Subtotal B to Subtotal A = Current Balance			4726.00
D. Balance on bank statement (should be the same as C)			4726.00

1404

ERIC

STUDENT WORKSHEET #3

Calculating the Cost of Credit

1. Calculate interest on a loan using the *simple interest* method. Be sure to read all information supplied to you.

   A. John Johnson takes out a $15,000.00 loan on July 20,1989 at 12% interest. The loan is due July 20, 1990.

   B. On January 20,1990 (6 months later), John pays back $5,000.00 on the $15,000.00 loan.

   C. Assume the remainder of the loan is repaid on the due date.

2. Using the same information as supplied in question 1A, calculate interest and how much monthly payments will be using the *add-on interest* method. Assume the loan will be paid in 12 equal monthly payments.

3. Credit card companies calculate interest on a "percent per month" basis. If the rate is 1.5% monthly, what percent interest would you be paying annually?

4. Calculate the actual rate of interest charge on a loan using the following formula:

$$\frac{\text{total charges}}{\bullet\ \text{original loan}} \quad x \quad \frac{\text{\# of payments}}{\text{\# of years}} \quad x \quad \frac{1}{\text{\# of payments} + 1} \quad = \quad \text{Actual Interest Rate}$$

Information:	$7,700.00	Loan principal
	$2,200.00	interest and other charges
	4 years	length of loan, payments made monthly

1405

UNIT E: Developing Leadership Capabilities in Agriculture/ Agribusiness

PROBLEM AREAS:

1. Understanding the History and Organization of FFA
   Opportunities in FFA
2. Recognizing Opportunities in FFA
3. Developing Leadership Skills Through Youth Organizations
4. Participating in Community and Government Leadership

ERIC Full Text Provided by ERIC

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Understanding the History and Organization of FFA

RELATED PROBLEM AREAS:

1. Recognizing Opportunities in FFA
2. Developing Leadership Skills Through Youth Organizations

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Randy J. Bernhardt

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will be able to demonstrate a knowledge of the basic concepts of the social sciences and how these help to interpret human behavior.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
1. Explain how, when, and why the FFA was organized.					
2. Know the aims and purposes, colors, motto, parts of emblem, and organizational structure of the FFA.					
3. Recite and understand meaning of the FFA creed.					
4. Describe the role and function of FFA in an agriculture/agribusiness program, the school, and the community.					
5. Name and describe the eleven standing committees of the program of activities.					
*6. Understand the importance of diverse customs and traditions in shaping American history.					
1409					1410

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Understanding the History and Organization of FFA

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Explain how, when, and why the FFA was organized.

2. Know the aims and purposes, colors, motto, parts of the emblem, and organizational structure of the FFA.

3. Recite and understand the meaning of the FFA creed.

4. Describe the role and function of FFA in an agriculture/agribusiness program, the school, and the community.

5. Name and describe the eleven standing committees of the program of activities.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Understanding the History and Organization of FFA

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. When and how was the FFA started?
2. What are the primary aims and purposes of the FFA?
3. Who can be FFA members?
4. How will FFA programs help one in agriculture/ agribusiness courses and SAEP?
5. Explain the meaning or operation of (a) the parts of the FFA emblem, (b) the FFA colors, (c) the FFA motto, (d) the FFA creed, (e) the FFA salute, (f) the proper use of the FFA jacket, (g) the local, state, and national FFA organization, and (h) the FFA foundation.

9. What can members do in the FFA?
10. What are the eleven committees of the program of activities?
11. What contributions does FFA make to the school? To the community?
12. What changes have occurred or are occurring in the FFA?

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Understanding the History and Organization of FFA

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Have chapter officers talk with the class as to why FFA is important.

2. Ask class to name reasons why agriculture/agribusiness students should become active FFA members.

3. Have class research and list well-known Americans who were FFA members.

4. Assign reading assignments:

   Official Manual 5-9, 10-15, 20-55
   Student Handbook 2-27, 38-58, 61-66, 74-80

5. Have a student explain how the jacket is to be worn and used. Explain symbols of emblem using large emblem on the back of the jacket.

6. Provide class an actual copy of the program of activities. Explain its contents and answer student questions.

7. Use Transparency Masters to supplement above activities.

8. Have students complete Student Worksheet #1.

9. Have students complete Student Worksheet #2.

10. Use VAS Materials to supplement classroom instruction, including:

    History of Illinois FFA (VAS Unit #U7001)
    The History of Illinois FFA — History in Making (VAS Slidefilm #MF1007)

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Understanding the History and Organization of FFA

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Student Handbook.* (1985). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

*2. *Official Manual.* (most current). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

3. *History of Illinois FFA* (VAS Unit #U7001); *The History of Illinois FFA — History in Making* (VAS Slidefilm #MF1007). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*4. *The FFA and You.* (1979). Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050. (217) 446-0500.

*Indicates highly recommended reference

1414

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

TRANSPARENCY MASTER #1 — Membership

TRANSPARENCY MASTER #2 — Motto and FFA Colors

TRANSPARENCY MASTER #3 — Program of Activities

TRANSPARENCY MASTER #4 — Aims and Purposes

TRANSPARENCY MASTER #5 — Officer Station Symbols

TRANSPARENCY MASTER #6 — Symbols of the FFA Emblem

TRANSPARENCY MASTER #7 — Proper Use of Jacket

ERIC

TRANSPARENCY MASTER #1

Kinds of FFA Membership

1. Active
2. Alumni
3. Collegiate
4. Honorary

TRANSPARENCY MASTER #2

FFA Motto

Learning to Do
Doing to Learn
Earning to Live
Living to Serve

Colors of the FFA

The colors of the FFA are **National Blue** and **Corn Gold.** Blue reminds us that the FFA is a national organization. Gold reminds us that corn is a native American crop grown in every state.

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TRANSPARENCY MASTER #3

Eleven Standing Committees of a Good Program of Activities

1. Supervised Agricultural Experience
2. Cooperation
3. Community Service
4. Leadership
5. Conduct of Meetings
6. Earnings, Savings, and Investments
7. Scholarship
8. Recreation
9. Public Relations
10. Participation in State and National Activities
11. Alumni Relations

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TRANSPARENCY MASTER #4

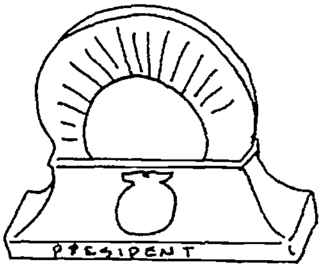
FFA Aims and Purposes

The primary aim of the FFA is the "development of agricultural leadership, cooperation, and citizenship." This includes the need:

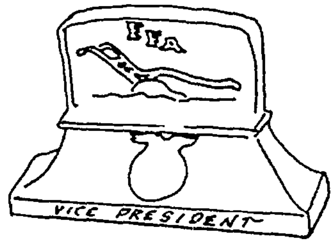
1. To develop competent, aggressive, rural, and agricultural leadership.
2. To create and nurture a love of agricultural life.
3. To strengthen the confidence of students of vocational agriculture in themselves and their work.
4. To create more interest in the intelligent choice of agricultural occupations.
5. To encourage members in the development of individual occupational experience programs in agriculture and establishment in agricultural careers.
6. To encourage members to improve the home and its surroundings.
7. To participate in monthly undertakings for the improvement of the industry of agriculture.
8. To develop character, train for useful citizenship, and foster patriotism.
9. To participate in cooperative effort.
10. To encourage and practice thrift.
11. To encourage improvement in scholarship.
12. To provide and encourage the development of organized recreational activities.

TRANSPARENCY MASTER #5

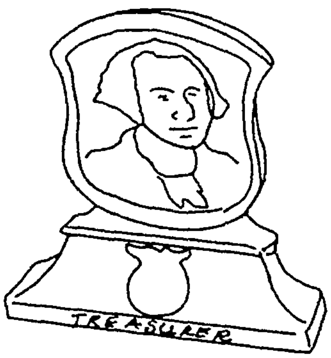
Officer Station Symbols



President—
"Rising Sun"

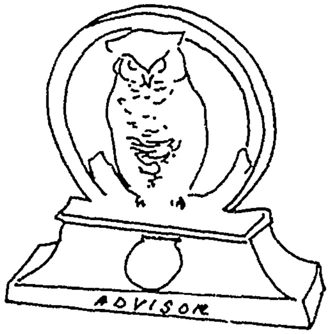


Vice President—
"The Plow"

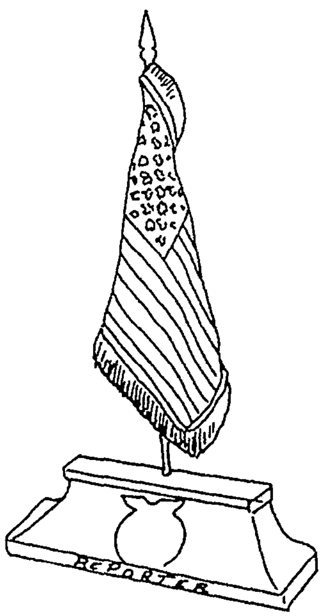


Treasurer—
"Bust of George Washington"

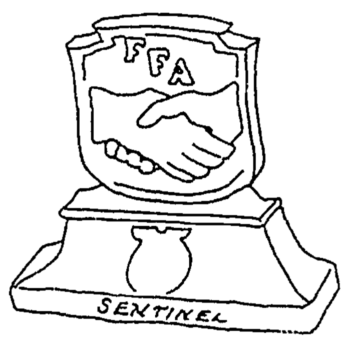
Secretary—
"Ear of Corn"



Advisor—
"Owl"



Reporter—
"United States Flag"

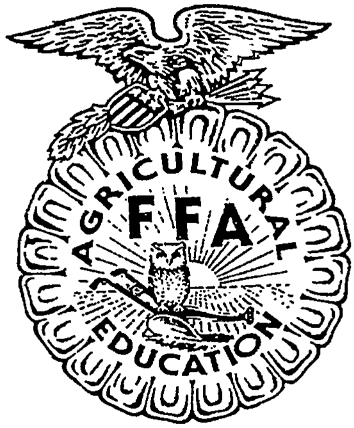


Sentinel—
"Shield of Friendship"

ERIC

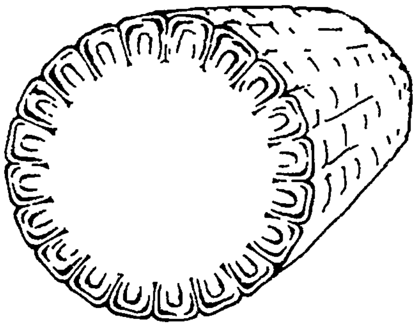
TRANSPARENCY MASTER #6

Symbols of the FFA Emblem

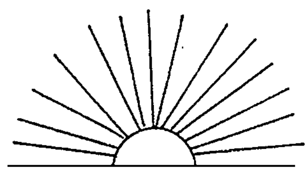


THE EMBLEM

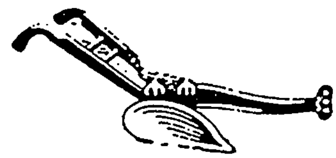
The FFA emblem was designed with much thought and meaning. It is made up of five symbols.



A cross section of an ear of corn. The symbol of corn represents our common agricultural interests, is native to America and is grown in every state.



The rising sun. It symbolizes progress in agriculture and the confidence that FFA members have in the future.



The plow. It is a symbol of labor and tillage of the soil.

The owl. It symbolizes wisdom and knowledge.

The eagle. This is symbolic of the national scope of the FFA.

The words "Agricultural Education" surround the letters "FFA". This tells us that FFA is important part of the agricultu agribusiness program.

TRANSPARENCY MASTER #7

The Proper Use of the Official FFA Jacket

1. The jacket should only be worn by persons who are members of the organization.

2. It should be kept clean and neat at all times.

3. The jacket should have only a large emblem on the back and a small emblem on the front; the name of the State Association and the name of the local chapter on the back; and the name of the individual and one office of honor on the front.

4. For the most attractive appearance, the jacket should be worn on official occasions with the zipper fastened to the top. The collar should be turned down and the cuffs in place and buttoned.

5. The jacket should be worn by officers and members on all official FFA occasions, as well as other occasions where the chapter is represented. It may be worn to school and other appropriate places.

6. The jacket should only be worn to places that are appropriate for members to visit.

7. The jacket should be worn by contestants, at occasions when FFA members are receiving FFA awards.

8. School letters and insignia of other organizations should not be attached to or worn on the jacket.

9. The jacket should not be worn with garments bearing the insignia of other organizations.

10. When the jacket becomes too faded and worn to wear in public, it should be discarded or the emblems and lettering removed.

11. The emblems and lettering should be removed if the jacket is given or sold to a nonmember.

12. A member always acts like a lady or gentleman when wearing the jacket.

13. Members should refrain from smoking while wearing the FFA jacket or officially representing the organization.

14. All chapter degree, officer, and award medals should be worn beneath the name on the right side of the jacket, with the exception that a single State Farmer charm and American Farmer key should be worn above the name or attached to a standard key chain. No more than three medals should be worn on the jacket; these should represent the highest degree earned, the highest office held, and the highest award earned by the member.

ERIC

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #1

1. Active membership — granted to anyone enrolled in vocational agriculture/agribusiness from freshman year of high school to 21 years of age or 3 years out of high school.
2. Alumni membership — granted to anyone who is interested in agriculture/agribusiness and the FFA; the technicality of being a former FFA member is not required.
3. Collegiate membership — granted to anyone who is enrolled in an agricultural degree program in college.
4. Honorary membership — bestowed upon anyone who has made a commitment or contribution to agriculture/agribusiness.

Transparency Master #3

1. Supervised Agricultural Experience (SAE) — organizes activities that encourage FFA members to plan and conduct good experience programs.
2. Cooperation — arranges to cooperate with other groups and organizations.
3. Community Service — plans chapter activities that will benefit the community in areas that relate to agriculture.
4. Leadership — arranges activities that provide opportunities for all members to become better leaders.
5. Conduct of Meetings — arranges for special programs and encourage members to attend meetings.
6. Earnings, Savings, and Investments — earns and manages funds in the best interest of the members.
7. Scholarship — plans incentive programs to encourage members to achieve scholastically.
8. Recreation — plans and carries out recreational activities for FFA members.
9. Public Relations — reports the activities of the chapter and its members to local media.
10. Participation in State and National Activities — encourages members to participate in activities above the local level.
11. Alumni Relations — brings FFA Alumni members into a closer working relationship with the chapter.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — FFA Dates

STUDENT WORKSHEET #2 — FFA Crossword Puzzle

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

FFA Dates

Select the proper date from the following list and enter it in the blanks opposite important events in FFA history at the national and state level.

1917	1931	1944	1952	1957	1968	1976
1928	1933	1947	1953	1960	1969	1979
1929	1939	1948	1955	1965	1973	1988

____________ National FFA organization was started.

____________ First National FFA Convention.

____________ 7th and 8th grade included in the FFA.

____________ Illinois Association of FFA was organized.

____________ President Eisenhower addressed the National Convention.

____________ NFA merged with FFA.

____________ National Future Farmer Magazine first published.

____________ Illinois FFA Foundation established.

____________ State FFA Office established at Roanoke.

____________ President Nixon addressed the National Convention.

____________ FFA constitution was revised to include girls.

____________ First former FFA member elected to U.S. presidency.

____________ First female to win the National Public Speaking Contest.

____________ National FFA Foundation was founded.

STUDENT WORKSHEET #1 — Key

FFA Dates

Select the proper date from the following list and enter it in the blanks opposite important events in FFA history at the national and state level.

1917	1931	1944	1952	1957	1968	1976
1928	1933	1947	1953	1960	1969	1979
1929	1939	1948	1955	1965	1973	1988

1928 National FFA organization was started.

1928 First National FFA Convention.

1988 7th and 8th grade included in the FFA.

1929 Illinois Association of FFA was organized.

1953 President Eisenhower addressed the National Convention.

1965 NFA merged with FFA.

1952 National Future Farmer Magazine first published.

1947 Illinois FFA Foundation established.

1973 State FFA Office established at Roanoke.

1968 President Nixon addressed the National Convention.

1969 FFA constitution was revised to include girls.

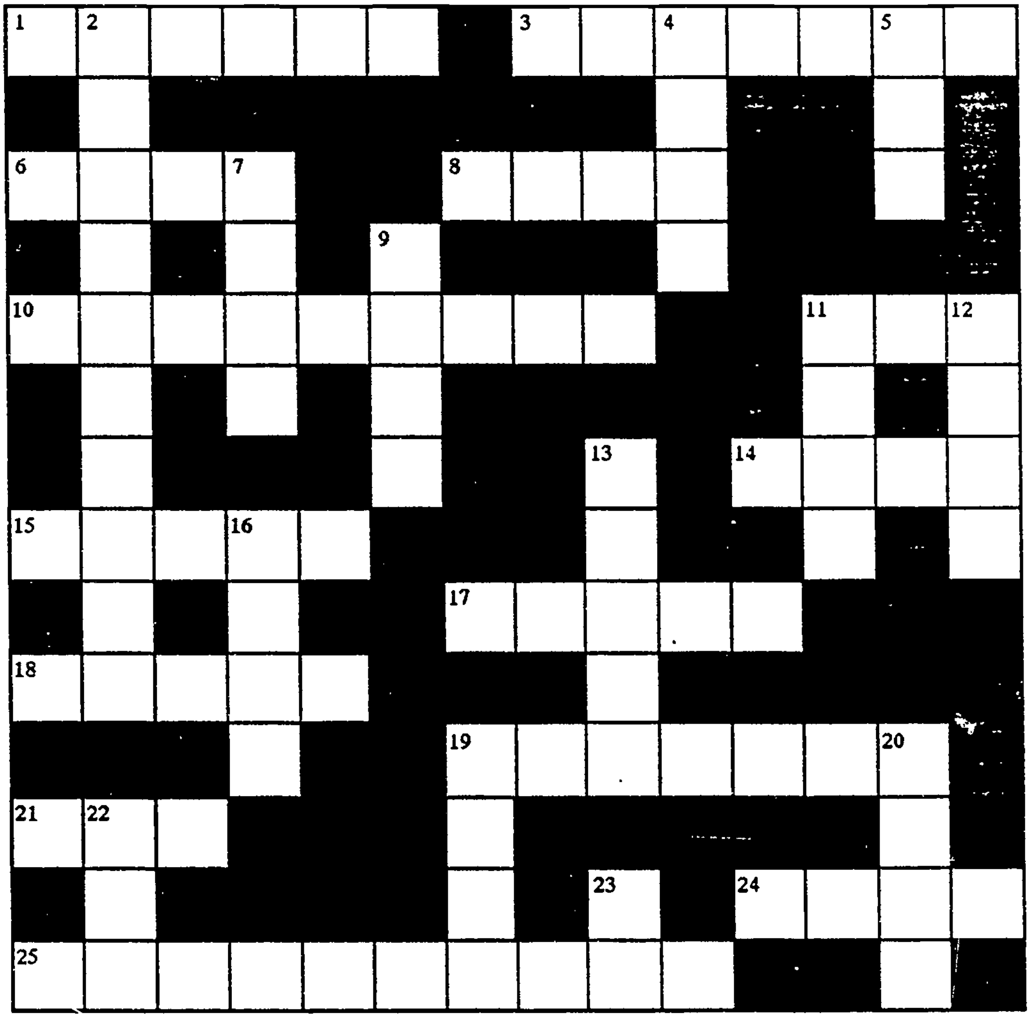
1976 First former FFA member elected to U.S. presidency.

1979 First female to win the National Public Speaking Contest.

1944 National FFA Foundation was founded.

STUDENT WORKSHEET #2

FFA Crossword Puzzle



Across

1. Kind of FFA membership.
3. Person stationed by owl.
6. Symbol at Vice-President's station.
8. Building Our American Communities (Abv.)
10. Keeps minutes of chapter meetings.
11. "One Nation under ________."
14. An FFA color.
15. Is indicative of national scope of FFA organization.
17. __________Hand Degree.
18. Last word of FFA motto.
19. FFA is only youth organization that has such a charter.
21. Abbreviation for Future Farmers of America.
24. Number of symbols that make up FFA emblem.
25. Picture or bust of U.S. President at Treasurer's station.

Down

2. Chapter of college students.
4. Type of president.
5. Symbol of knowledge and wisdom.
7. Program of ________.
9. Regional ________ Farmer/Agribusinessman.
11. An FFA color.
12. Paid by FFA members.
13. It was adopted at the third National FFA Convention.
16. Have a strong affection for FFA.
19. Symbol at Reporter's station.
20. Last word of third line of FFA motto.
22. Federal agency that assists with BOAC activities (Abv.).
23. State where National FFA Convention is held (Abv.).

Used by permission granted by Interstate Publishers, Inc., Danville, IL. Puzzle taken from "Crossword Puzzles for Agriculture and Agribusiness" by Alvin H. Holcomb.

STUDENT WORKSHEET #2 — Key

FFA Crossword Puzzle

1 A	2 C	T	I	V	E		3 A	D	4 V	I	S	5 O	R
	O								I			W	
6 P	L	O	7 W			8 B	O	A	C			L	
	L		O		9 S				E				
10 S	E	C	R	E	T	A	R	Y			11 G	O	12 D
	G		K		A						O		U
	I				R			13 C		14 B	L	U	E
15 E	A	G	16 L	E				R			D		S
	T		O			17 G	R	E	E	N			
18 S	E	R	V	E				E					
			E			19 F	E	D	E	R	A	20 L	
21 F	22 F	A				L						I	
	H					A		23 M		24 F	I	V	E
25 W	A	S	H	I	N	G	T	O	N			E	

Across

1. Kind of FFA membership.
3. Person stationed by owl.
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22. Federal agency that assists with BOAC activities (Abv.).
23. State where National FFA Convention is held (Abv.).

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CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Recognizing Opportunities in FFA

RELATED PROBLEM AREAS:

1. Understanding the History and Organization of FFA

2. Developing Leadership Skills Through Youth Organizations

PREREQUISITE PROBLEM AREA(S):

1. Understanding the History and Organization of FFA

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principle Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Randy J. Bernhardt

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Understand the education and training required to prepare youth and adults for work.					
2. List and describe the four FFA degrees, and the FFA award programs and contests in Illinois.					
3. Become familiarized with FFA camps and leadership conferences.					
4. Be aware of other student opportunities in the FFA.					
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ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Recognizing Opportunities in FFA

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. List and describe the four FFA degrees, and the FFA award programs and contests in Illinois.
2. Become familiarized with FFA camps and leadership conferences.
3. Be aware of other student opportunities in the FFA.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Recognizing Opportunities in FFA

PROBLEMS AND QUESTIONS FOR STUDY

1. In what ways does the FFA and agribusiness class prepare you for the adult world of work?
2. What are the four FFA degrees and what are the requirements for each degree?
3. What individual award programs are available to Illinois FFA members? What team contests are available to Illinois FFA members? What chapter awards are available to Illinois FFA chapters?
4. What leadership conferences and camps may FFA members attend?
5. Wh· · are some other activities that can involve FFA members?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Recognizing Opportunities in FFA

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

INSTRUCTOR'S NOTES AND REFERENCES

1. Show Transparency Master #1. Explain requirements of each degree.

2. For supervised study have students read pages 48-58 of the *Student Handbook.* Distribute Student Worksheet #1. Show Transparency Master #2. Point out levels of competition to students and awards that can be received. Distinguish between which are state and which are national award areas.

3. Show Transparency Masters #3 - #7. Discuss what is involved in each contest. Point out whether a contest is held at section, district, and/ or state levels and which are national contests. Inform students about individual and team awards or recognition.

4. Have students complete Student Worksheet #2.

5. For supervised study have students read pages 74-80 of the *Student Handbook.* Discuss the following student activities (use transparencies provided): Washington Conference; Heritage Tour; Cooperative Tour; Leadership Training School; State and National FFA Conventions; State and National FFA Conventions; State and National FFA Officers; Band, Chorus, and Talent; National FFA Week; Food for America; Work Experience Abroad; Leadership Camp; FFA fairs and Illinois State Fair.

6. For supervised study, have students read about Computers in Agriculture and FFA Scholarship Program on page 47 of the *Student Handbook.* Answer any student questions.

7. Show Transparency Master #10. Discuss why we have committees and what they do. Use selected Modules from Applied Communications.

8. Show Transparency Master #11.

9. Show Transparency Master #12. Discuss and answer student questions.

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Recognizing Opportunities in FFA

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Student Handbook.* (1985). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA. (703) 360-3600.

2. *Official Manual.* (most current). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA. (703) 360-3600.

3. *The FFA and You.* (1979). Bender, Ralph, Taylor, Robert, Hansen, Chester, Newcomb, L.H. Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050.

4. *Food For America — FFA Tells the Story; A Proficiency Award For You; The Game Plan (BOAC).* (Slides and tapes). State Office for FFA, 204 Husseman St., Box 466, Roanoke, IL 61561. (309) 923-7413.

5. *Applied Communications.* Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322-3905.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Degree Requirements

TRANSPARENCY MASTER #1 — FFA Degrees

TRANSPARENCY MASTER #2 — Illinois Foundation Awards

TRANSPARENCY MASTER #3 — Illinois FFA Contests

TRANSPARENCY MASTER #4 — Illinois FFA Contests

TRANSPARENCY MASTER #5 — Illinois FFA Contests

TRANSPARENCY MASTER #6 — Illinois FFA Contests

TRANSPARENCY MASTER #7 — Other FFA Activities

TRANSPARENCY MASTER #8 — Other FFA Activities

TRANSPARENCY MASTER #9 — Other FFA Activities

TRANSPARENCY MASTER #10 — Committees in Action

TRANSPARENCY MASTER #11 — The National Future Farmer Magazine

TRANSPARENCY MASTER #12 — Chapter Award Programs (with discussion guide)

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INFORMATION SHEET #1

Degree Requirements

State FFA Degree Requirements

- have received the Chapter FFA Degree
- have been an active FFA member for at least two years
- while in high school, must be enrolled in at least the second year of instruction in agriculture/ agribusiness
- have earned and productively invested at least $1,000.00 or worked at least 1,000 hours in an SAEP
- demonstrate leadership ability by 1) performing ten parliamentary procedure abilities, 2) giving a five minute speech, and 3) serving as an officer, committee chairperson, or participating member of a major committee
- have satisfactory scholastic record certified by local superintendent or principal

(Note: Only 2% of the state of Illinois FFA membership may receive the State FFA Degree)

American Degree Requirements

- must have State FFA Degree and have been an active member of FFA continuously for at least 36 months
- have record of satisfactory participation in activities of local chapter and state association
- have satisfactorily completed the equivalent of at least three years of secondary schooling in vocational agriculture/agribusiness
- have been out of high school at least twelve months prior to convention at which the degree is granted
- have in operation an outstanding SAEP which shows planning, growth, continuation, and increase in scope with records to substantiate such achievements
- have earned and productively invested at least $5,000.00 by own efforts from your SAEP
- show outstanding ability as evidenced by leadership and cooperation in student, chapter, and community activities
- have satisfactory scholarship record certified by local school superintendent or principal

(Note: Only 1/2 of 1% of the national FFA membership may receive the American Degree)

Greenhand Degree Requirements

- enrolled in vocational agriculture/agribusiness
- have a satisfactory SAEP
- learned and explain the meaning of the creed
- recite FFA motto and salute from memory
- know FFA colors and describe emblem and symbols
- can explain proper use of the FFA jacket
- can identify historical highlights of FFA organization
- know duties and responsibilities of FFA member and have understanding of aim and purposes, proper use of jacket, and code of ethics of the FFA
- own or have access to an Official FFA Manual
- submitted application for the degree

Chapter Degree Requirements

- must have the Greenhand Degree
- completed at least one semester of agriculture/ agribusiness
- must have an improved SAEP
- regularly enrolled in vocational agriculture/ agribusiness
- have knowledge of local constitution and Program of Activities
- participate in at least three local FFA activities
- achieved monetary or hourly requirements from SAEP
- lead a group discussion for 15 minutes
- demonstrate five parliamentary procedure abilities
- demonstrate progress toward an agricultural proficiency award at local level have a satisfactory grade in agricultural class make application for the degree

TRANSPARENCY MASTER #1

FFA Degrees

1. Greenhand Degree

2. Chapter FFA Degree

3. State FFA Degree

4. American FFA Degree

TRANSPARENCY MASTER #2

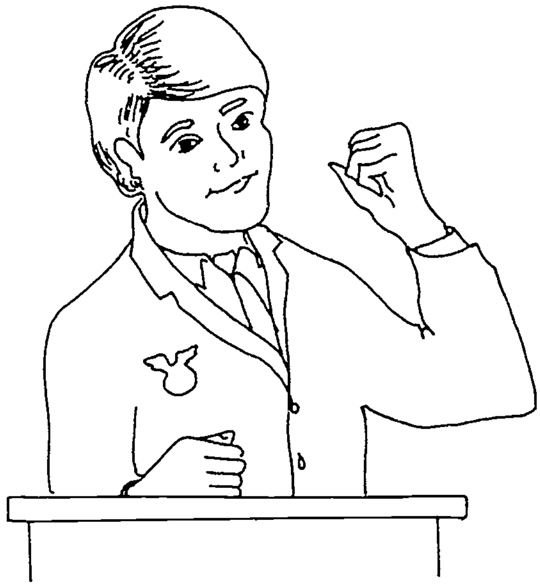
Illinois Foundation Awards

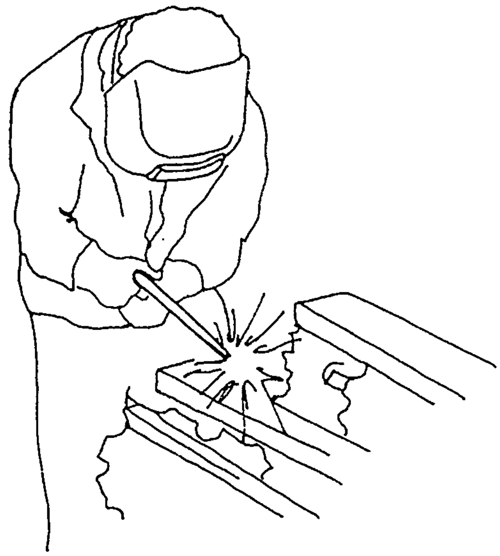
1. Star Farmer of Illinois
2. Star Agribusinessman of Illinois
3. Agricultural Electrification
4. Agricultural Mechanics
5. Agricultural Processing
6. Agricultural Sales and/or Service
7. Beef Production
8. Cereal Grain Production
9. Dairy Production
10. Diversified Crop Production
11. Diversified Livestock Production
12. Feed Grain Production
13. Fiber Crop Production
14. Floriculture
15. Forage Production
16. Forest Management
17. Fruit and/or Vegetable Production
18. Home and/or Farmstead Improvement
19. Horse Proficiency
20. Nursery Operations
21. Oil Crop Production
22. Outdoor Recreation
23. Placement in Agricultural Production
24. Poultry Production
25. Safety
26. Sheep Production
27. Soil and Water Management
28. Specialty Animal Production
29. Specialty Crop Production
30. Swine Production
31. Turf and Landscape Management
32. Wildlife Management

Note: Instructor should refer to pages 48 - 58 of the *Student Handbook*.

TRANSPARENCY MASTER #3

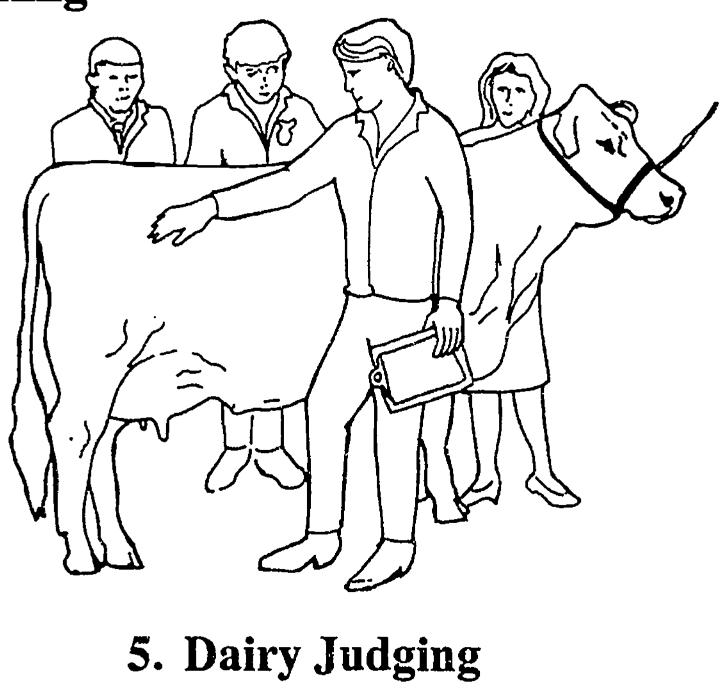
Illinois FFA Contests





1. **Prepared Public Speaking**
2. **Extemporaneous Speaking**
3. **Creed Speaking**

4. **Agricultural Mechanics**



5. **Dairy Judging**

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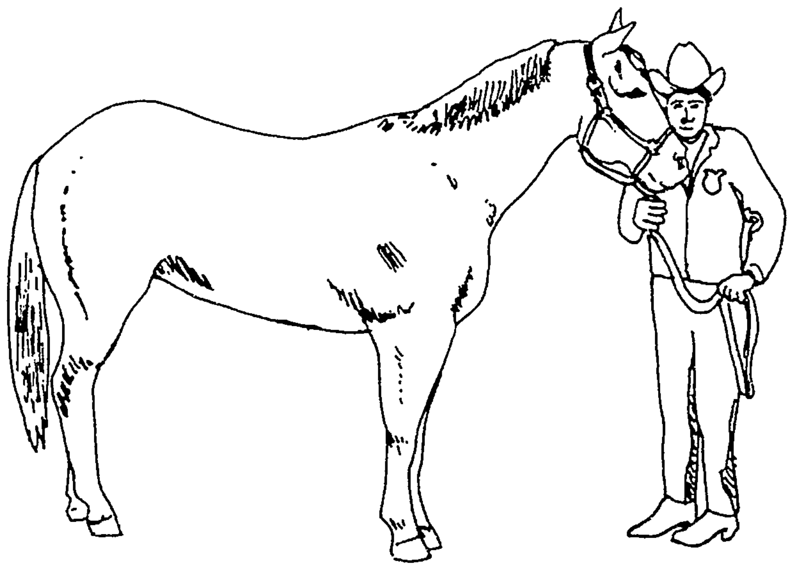
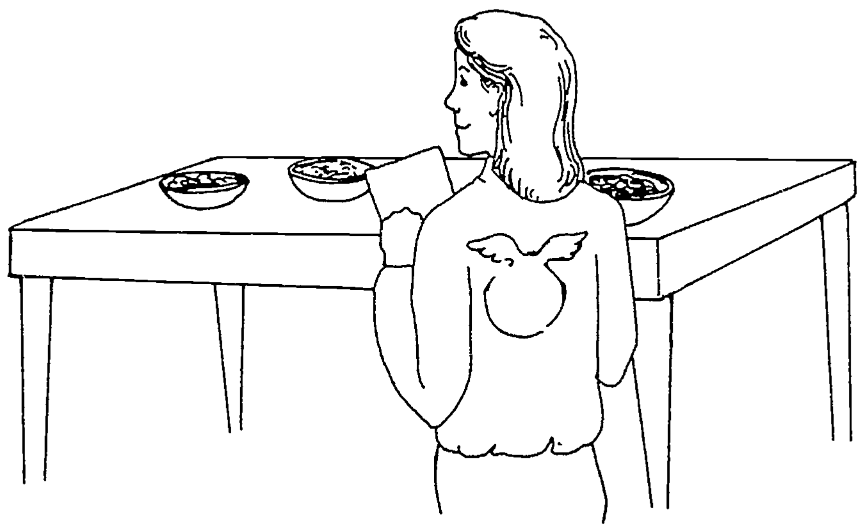
TRANSPARENCY MASTER #4



6. Horse Judging

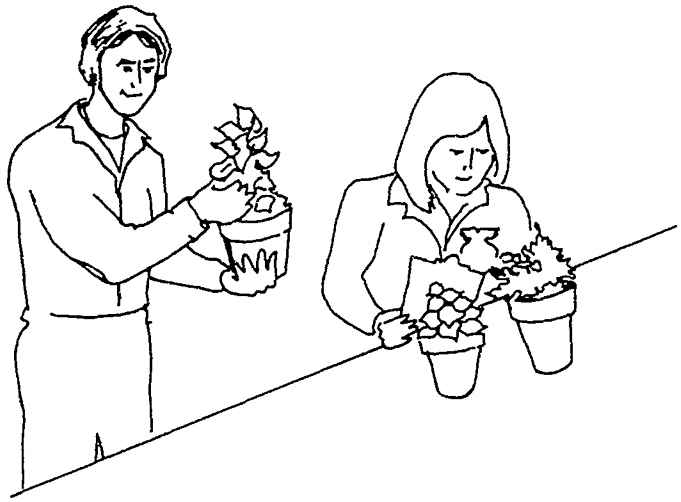
7. Farm Business Management



8. Crops Judging

TRANSPARENCY MASTER #5

9. Poultry Judging



10. Horticulture Judging

11. Livestock Judging

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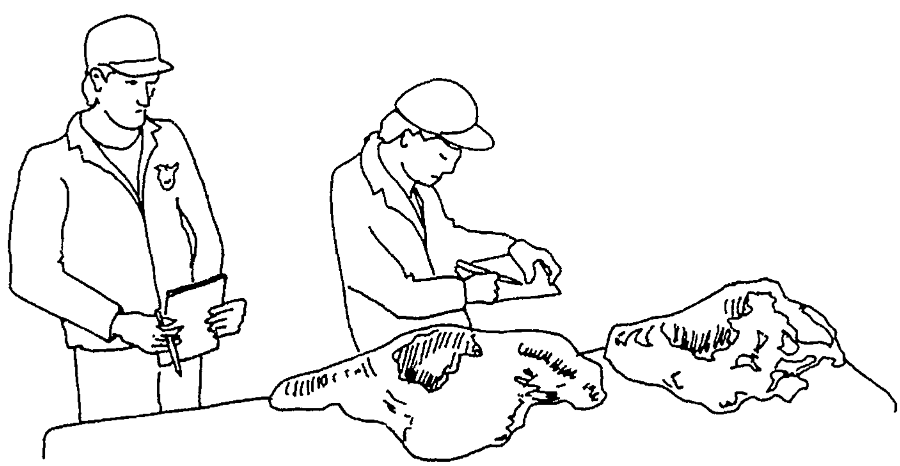
TRANSPARENCY MASTER #6

12. Milk Quality and Dairy Foods Judging



13. Meat Judging

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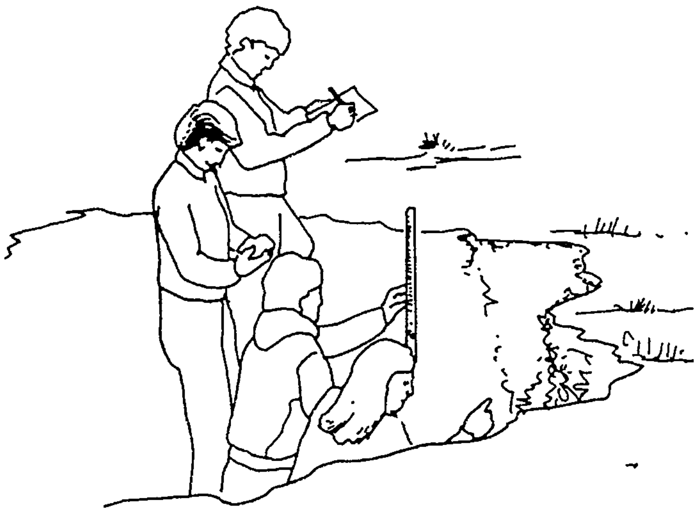
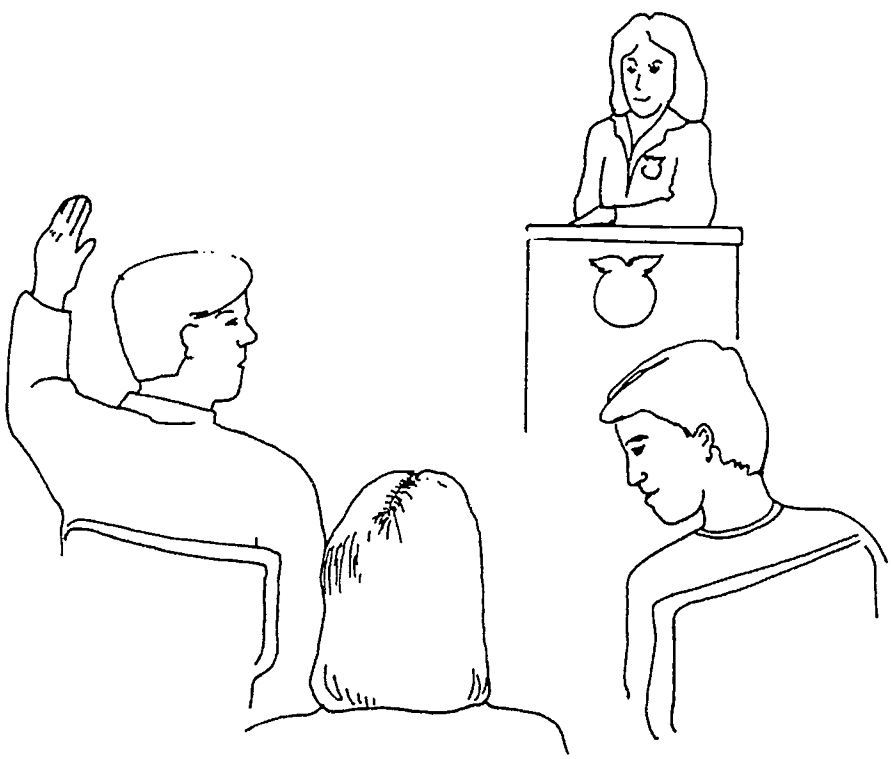
TRANSPARENCY MASTER #7

Other FFA Activities

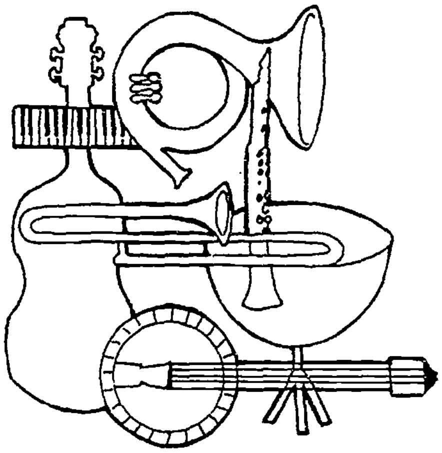


1. Land Use Judging

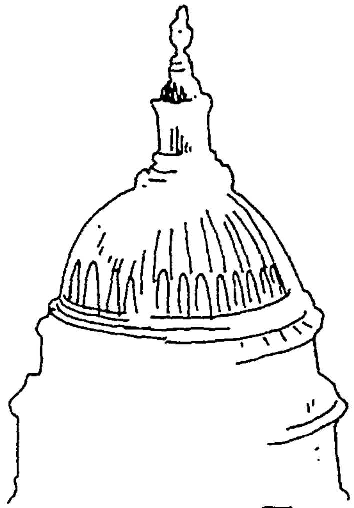


2. Parliamentary Procedure

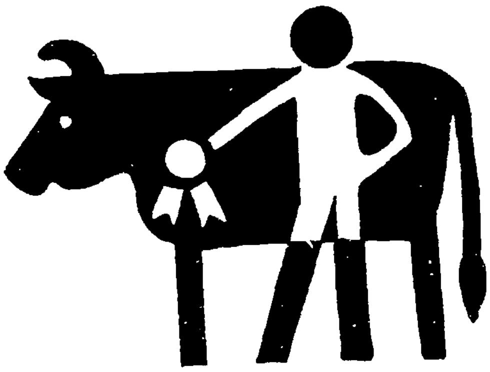
TRANSPARENCY MASTER #8



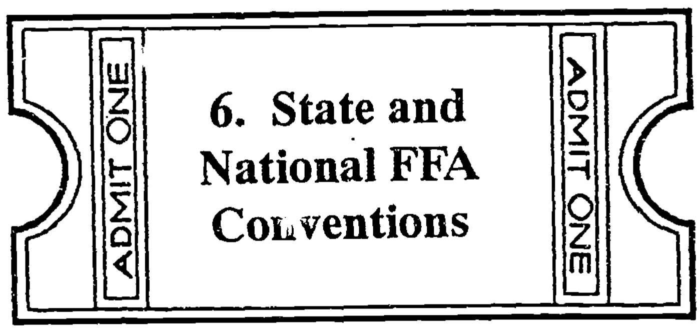
3. Band, Chorus, and Talent



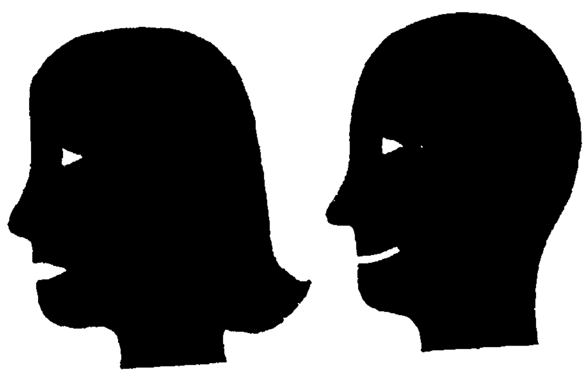
4. Heritage Tour
Washington Conference



5. Fairs and Shows



6. State and National FFA Conventions



7. State and National FFA Officers

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TRANSPARENCY MASTER #9

8. Cooperative Tour

9. National FFA Week

10. Food for America

11. Work Experience Abroad

12. Leadership Camp

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TRANSPARENCY MASTER #10

Committees in Action

A committee is a group of members elected or appointed to consider or make plans for one particular purpose or event. There are three general purposes committees can serve.

I. An investigation committee gathers information and reports its findings back to the group.

II. A planning committee makes recommendations based on information it has gathered. It must submit its plans back to the group for approval.

III. An action committee has permission from the group to take needed action. When its job is done, it reports back on what has been done.

The committee system is used for getting group tasks done for these reasons: It . . .

1. Gets more accomplished.
2. Spreads the work load.
3. Puts a concentrated effort on problem.
4. Gets people who are qualified to work on specific problems together.
5. Develops leadership.

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TRANSPARENCY MASTER #11

The National Future Farmer Magazine

Received by all dues-paying members 6 times per year.

Contents:

50% FFA Information
25% Technical Agriculture/Agribusiness Information
25% General Youth Interest Items

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TRANSPARENCY MASTER #12

Chapter Award Programs

1. National Program of Activities
2. National Safety
3. Building Our American Communities (BOAC)
4. FB-FFA Heritage Program
5. FB-FFA Cooperative Activities Program
6. Sweepstakes
7. Century Challenge
8. Ten Plus

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TRANSPARENCY MASTER #12 — **Discussion Guide**

Chapter Award Programs

1. National Program of Activities — Chapters are recognized for having outstanding Program of Activities.

2. National Safety — Complete a national Safety Award application and compete against other chapters that have conducted safety programs.

3. Building Our American Communities (BOAC) — Submit a BOAC application that explains what the chapter did in the community.

4. FB-FFA Heritage Program (Illinois Only Program) — Conduct a program that relates to the history of our country and the impact of agriculture on American history.

5. FB-FFA Cooperative Activities Program (Illinois Only Program) — Conduct activities that involves FFA with other school organizations, other FFA chapters, or community organizations.

6. Sweepstakes (Illinois Only Program) — Given to those chapters that have participated and filled out an award application in the following areas: Program of Activities, Safety, Building Our American Communities, Heritage, and Cooperative Activities; shows that the chapter is a well-rounded one.

7. Century Challenge (Illinois Only Program) — Given to chapters having 100% of their vocational agriculture/agribusiness enrollment also members of the FFA.

8. Ten Plus — Given to a chapter by the National FFA if your current FFA membership is ten members more than FFA enrollment last year.

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STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Proficiency Awards

STUDENT WORKSHEET #2 — FFA Word Search

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

Proficiency Awards

Match the proficiency award area to its correct description.

1. ______ Agricultural Electrification
2. ______ Wildlife Management
3. ______ Agricultural Mechanics
4. ______ Turf and Landscape Management
5. ______ Swine Production
6. ______ Specialty Crop Production
7. ______ Agricultural Sales and/or Service
8. ______ Agricultural Processing
9. ______ Specialty Animal Production
10. ______ Beef Production
11. ______ Poultry Production
12. ______ Sheep Production
13. ______ Soil and Water Management
14. ______ Dairy Production
15. ______ Cereal Grain Production
16. ______ Fruit and/or Vegetable Production
17. ______ Home and/or Farmstead Improvement
18. ______ Forest Management
19. ______ Horse Proficiency
20. ______ Forage Production
21. ______ Nursery Operations
22. ______ Floriculture
23. ______ Oil Crop Production
24. ______ Fiber Crop Production
25. ______ Outdoor Recreation
26. ______ Feed Grain Production
27. ______ Diversified Crop Production
28. ______ Placement in Agricultural Production
29. ______ Diversified Livestock Production

A. Includes selection, repair, and maintenance of agricultural equipment and structures and observance of safe mechanical practices.

B. Includes job entry level skills in feed, seed, fertilizer, agricultural chemicals, machinery and other farm stores, custom combining, crop spraying, equipment operation and maintenance, small animal and pet services, computer farm analysis, and record keeping.

C. Efficiently produces and markets crops such as wheat, rice, and rye.

D. Employs modern management practices in producing and marketing a combination of two or more crop enterprises.

E. Employs management practices in producing and marketing such crops as barley, millet, buckwheat, oats, corn, and grain sorghum.

F. Includes practical experiences with field or greenhouse production of flowers, foliage, and related plant materials used for ornamental purposes.

G. Uses forestry practices such as thinning, pruning, weeding, planting, re-planting, harvesting, and Christmas tree farming.

H. Encourages members to create better places in which to live, work, and play.

I. Includes job entry level skills in the production of turf, plants, shrubs, and/or trees for sale or propagation.

J. Encourages appreciation of and involvement in picnic areas, fishing and hunting preserves, camping facilities, riding stables, vacation farms and guest ranches, family decks, barbecues, and many more.

K. Employs modern methods in producing, processing, and marketing of turkeys, poultry, and poultry products.

L. Prevents erosion, improves soil productivity, prevents water pollution, and makes efficient use of water resources.

M. Produces and markets such crops as sugar beets, tobacco, popcorn, grass seed, spearmint oil, and hops.

N. Includes planting and maintaining turf, plants, and shrubs; landscaping and outdoor beautification; improvement of recreation areas; and producing sod for sale.

O. Improves the availability of fish and wildlife by using conservation practices, developing land and water habitat, and stocking fish and wild game.

P. Makes use of the latest management practices in efficient hog production and marketing.

Q. Includes producing and marketing honey, rabbits, mink, fish worms, and wildlife as income producing, and marketing sheep and wool.

R. Employs modern methods in producing and marketing sheep and wool.

S. Encourages FFA members to become employed on a farm, ranch, or other agricultural production operation.

T. Includes the producing of flax, mustard, castor beans, sunflowers, peanuts, safflower, and soybeans.

U. Gives FFA members an opportunity to learn about horses and horse-related activities which may result in a career in the horse industry.

V. Uses principles and practices needed for successfully producing and marketing fruit and/or vegetables.

W. Includes producing, utilizing and marketing sorghum (other than grain), alfalfa, clover, brome, native hay, grain forages, corn, and grass silage and pastures.

X. Produces and markets crops such as cotton.

Y. Produces and markets a combination of two or more specific livestock enterprises such as beef, swine, dairy, horses, or sheep.

Z. Employs modern management in producing and marketing dairy cattle and high quality dairy products.

AA. Employs modern management practices in efficient beef production and marketing.

BB. Includes feed manufacturing, meat cutting, fertilizer formulation, grain elevators, cheese plants, and other industries that prepare, package or market agricultural products.

CC. Includes wiring, energy management, electric motors, and safe use of electricity.

ERIC

STUDENT WORKSHEET #1 — Key

Proficiency Awards

Match the proficiency award area to its correct description.

1. CC Agricultural Electrification
2. O Wildlife Management
3. A Agricultural Mechanics
4. N Turf and Landscape Management
5. P Swine Production
6. M Specialty Crop Production
7. B Agricultural Sales and/or Service
8. BB Agricultural Processing
9. Q Specialty Animal Production
10. AA Beef Production
11. K Poultry Production
12. R Sheep Production
13. L Soil and Water Management
14. Z Dairy Production
15. C Cereal Grain Production
16. V Fruit and/or Vegetable Production
17. H Home and/or Farmstead Improvement
18. G Forest Management
19. U Horse Proficiency
20. W Forage Production
21. I Nursery Operations
22. F Floriculture
23. T Oil Crop Production
24. X Fiber Crop Production
25. J Outdoor Recreation
26. E Feed Grain Production
27. D Diversified Crop Production
28. S Placement in Agricultural Production
29. Y Diversified Livestock Production

A. Includes selection, repair, and maintenance of agricultural equipment and structures and observance of safe mechanical practices.

B. Includes job entry level skills in feed, seed, fertilizer, agricultural chemicals, machinery and other farm stores, custom combining, crop spraying, equipment operation and maintenance, small animal and pet services, computer farm analysis, and record keeping.

C. Efficiently produces and markets crops such as wheat, rice, and rye.

D. Employs modern management practices in producing and marketing a combination of two or more crop enterprises.

E. Employs management practices in producing and marketing such crops as barley, millet, buckwheat, oats, corn, and grain sorghum.

F. Includes practical experiences with field or greenhouse production of flowers, foliage, and related plant materials used for ornamental purposes.

G. Uses forestry practices such as thinning, pruning, weeding, planting, re-planting, harvesting, and Christmas tree farming.

H. Encourages members to create better places in which to live, work, and play.

I. Includes job entry level skills in the production of turf, plants, shrubs, and/or trees for sale or propagation.

J. Encourages appreciation of and involvement in picnic areas, fishing and hunting preserves, camping facilities, riding stables, vacation farms and guest ranches, family decks, barbecues, and many more.

K. Employs modern methods in producing, processing, and marketing of turkeys, poultry, and poultry products.

L. Prevents erosion, improves soil productivity, prevents water pollution, and makes efficient use of water resources.

M. Produces and markets such crops as sugar beets, tobacco, popcorn, grass seed, spearmint oil, and hops.

N. Includes planting and maintaining turf, plants, and shrubs; landscaping and outdoor beautification; improvement of recreation areas; and producing sod for sale.

O. Improves the availability of fish and wildlife by using conservation practices, developing land and water habitat, and stocking fish and wild game.

P. Makes use of the latest management practices in efficient hog production and marketing.

Q. Includes producing and marketing honey, rabbits, mink, fish worms, and wildlife as income producing, and marketing sheep and wool.

R. Employs modern methods in producing and marketing sheep and wool.

S. Encourages FFA members to become employed on a farm, ranch, or other agricultural production operation.

T. Includes the producing of flax, mustard, castor beans, sunflowers, peanuts, safflower, and soybeans.

U. Gives FFA members an opportunity to learn about horses and horse-related activities which may result in a career in the horse industry.

V. Uses principles and practices needed for successfully producing and marketing fruit and/or vegetables.

W. Includes producing, utilizing and marketing sorghum (other than grain), alfalfa, clover, brome, native hay, grain forages, corn, and grass silage and pastures.

X. Produces and markets crops such as cotton.

Y. Produces and markets a combination of two or more specific livestock enterprises such as beef, swine, dairy, horses, or sheep.

Z. Employs modern management in producing and marketing dairy cattle and high quality dairy products.

AA. Employs modern management practices in efficient beef production and marketing.

BB. Includes feed manufacturing, meat cutting, fertilizer formulation, grain elevators, cheese plants, and other industries that prepare, package or market agricultural products.

CC. Includes wiring, energy management, electric motors, and safe use of electricity.

STUDENT WORKSHEET #2

FFA Word Search

C	Q	B	V	N	O	I	T	A	E	R	C	E	R	I	T	Z	F	Y	Y
A	T	S	R	C	O	L	L	U	G	I	A	T	E	B	N	X	R	Z	V
W	C	N	N	Y	E	N	M	Q	S	J	E	R	M	O	C	M	Q	N	R
F	G	A	E	U	Q	A	V	E	L	C	C	C	V	H	H	B	U	S	Q
X	F	T	M	Y	S	G	R	E	E	N	H	A	N	D	A	R	M	L	K
C	O	I	W	J	E	G	X	O	M	T	K	O	E	Y	P	Q	H	F	A
X	W	O	A	U	N	V	N	R	F	R	Z	G	L	L	T	M	K	Q	X
U	X	N	A	M	K	P	W	I	H	C	J	B	O	A	E	U	D	J	Y
X	N	A	P	Y	E	F	I	O	S	R	O	W	M	T	R	I	G	H	W
R	M	L	B	I	L	R	N	D	E	I	L	R	U	W	D	S	K	X	R
G	Z	B	E	A	H	O	I	E	L	E	R	U	N	V	E	Q	H	A	J
Y	O	L	M	A	R	S	O	C	D	O	R	J	I	G	G	I	U	I	A
N	U	U	D	A	G	E	R	W	A	V	G	G	D	D	R	I	J	W	P
E	Q	E	R	J	E	L	M	E	M	N	W	N	E	Z	E	R	G	S	F
P	V	Y	O	I	U	D	E	V	D	W	D	E	R	D	E	U	L	Y	I
D	S	O	W	P	N	D	X	V	L	A	T	E	V	O	E	G	L	U	Q
D	A	I	L	U	V	B	F	K	L	I	E	N	G	I	C	T	M	P	Z
L	E	L	W	Z	J	C	Q	R	Q	S	Y	L	M	R	T	E	A	I	M
W	P	C	O	O	P	E	R	A	T	I	O	N	Y	I	E	C	X	T	P
B	H	G	B	P	D	S	C	L	F	V	V	J	F	M	Z	E	A	P	S

The following words are hidden in the puzzle:

Active
Alumni
American Degree
Chapter Degree
Collegiate
Cooperation
Corn Gold
Eagle
Ear of Corn
Green Hand
Honorary
Leadership
National Blue
Owl
Plow
Recreation
Rising Sun
Scholarship
SAEP
State Degree

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STUDENT WORKSHEET #2 — Key

FFA Word Search

•	•	•	•	N	O	I	T	A	E	R	C	E	R	I	•	•	•	•	•
•	•	•	•	C	O	L	L	U	G	I	A	T	E	•	N	•	•	•	•
•	•	N	N	•	E	•	•	•	S	•	•	•	•	•	C	M	•	•	•
•	•	A	•	U	•	A	•	•	•	C	•	•	•	•	H	•	U	•	•
•	•	T	•	•	S	G	R	E	E	N	H	A	N	D	A	•	•	L	•
•	•	I	•	•	•	G	•	O	•	•	•	O	•	•	P	•	•	•	A
•	•	O	A	•	•	•	N	•	F	•	•	•	L	L	T	•	•	•	•
•	•	N	•	M	•	•	•	I	H	C	•	•	O	A	E	•	•	•	•
•	•	A	P	•	E	•	•	O	S	•	O	W	•	•	R	•	•	•	•
•	•	L	•	I	•	R	N	D	E	I	•	R	•	•	D	S	•	•	•
•	•	B	E	•	H	O	I	•	L	E	R	•	N	•	E	•	H	•	•
•	•	L	•	A	R	S	•	C	•	O	R	•	•	•	G	•	•	I	•
•	•	U	•	A	G	•	R	•	A	•	G	G	•	•	R	•	•	•	P
•	•	E	R	•	•	L	•	E	•	N	•	N	E	•	E	•	•	•	•
•	•	Y	O	•	•	•	E	•	D	•	D	E	R	D	E	•	•	•	•
•	S	•	W	•	•	•	•	•	•	A	•	E	V	O	E	•	•	•	•
•	A	•	L	•	•	•	•	•	•	•	E	•	G	I	C	•	•	•	•
•	E	•	•	•	•	•	•	•	•	•	•	L	•	R	T	•	A	•	•
•	P	C	O	O	P	E	R	A	T	I	O	N	•	•	E	C	•	T	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	E	A	•	S

The following words are hidden in the puzzle:

Active
Alumni
American Degree
Chapter Degree
Collegiate
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Rising Sun
Scholarship
SAEP
State Degree

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CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Developing Leadership Skills Through Youth Organizations

RELATED PROBLEM AREAS:

1. Recognizing Opportunities in FFA

2. Participating in Community and Government Leadership

3. Developing Communication Skills in Agriculture

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Orientation

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty H: Managing the Business

1. Evaluate employee performance
2. Supervise agriculture workers
3. Evaluate agribusiness productivity

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Language Arts and Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample list provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Assistant: Randy J. Bernhardt

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ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions.

Contact Person: ____
Title: ____
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Demonstrate flexibility in vocal expression.					
*2. Use physical movements and visual aids in expressive ways appropriate to the situation.					
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ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
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LEARNING ASSESSMENT PLAN

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COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA (*check one*)
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and analyze comparative political and economic systems, with an emphasis on the political and economic systems of the United States.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade (*circle one*) 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Demonstrate the ability to use parliamentary procedure.					
*2. Know how citizens can participate in interest groups.					
3. List duties and responsibilities of all chapter FFA officers.					
4. Plan a meeting					
5. Set up meeting room and paraphernalia.					
6. Recite a part in the opening and closing ceremonies.					
7. List order of business for a chapter meeting.					
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ISBE 41-76 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Developing Leadership Skills Through Youth Organizations

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. List duties and responsibilities of all chapter FFA officers.

2. Plan a meeting.

3. Set up meeting room and paraphenalia.

4. Recite a part in the opening and closing ceremonies.

5. List order of business for a chapter meeting.

6. Demonstrate supervision and evaluation techniques.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Developing Leadership Skills Through Youth Organizations

PROBLEMS AND QUESTIONS FOR STUDY | **INSTRUCTOR'S NOTES AND REFERENCES**

1. Why is it important to be a good communicator?
2. What does it mean to have expression in your voice?
3. What is parliamentary procedure?
4. Why do we use parliamentary procedure during FFA meetings?
5. What is an interest group?
6. Would the FFA be considered an interest group? Why?
7. What are the officers that our local chapter has?
8. What are the names of each respective chapter officer?
9. What is involved in planning a meeting?
10. Where is each officer stationed during a meeting and what symbol is at that station?
11. What is the part played in the opening and closing ceremonies by each officer?
12. What is the order of business for an FFA meeting?
13. What are the characteristics of a good leader?

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Developing Leadership Skills Through Youth Organizations

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Explain the difference between *talking* and *speaking*. Speaking involves the use of effective verbal skills (proper diction, grammar) as well as nonverbal skills (body movements, facial expressions, gestures, and posture).

2. Discuss importance of practice. Practice in front of a mirror and on a tape recorder.

3. Use a VCR to tape student presentations.

4. Ask students if they know about the history of parliamentary procedure and why the FFA organization uses parliamentary procedure. Discuss proper use of gavel. Demonstrate during discussion. Use VAS F1006, *Introduction to Parliamentary Procedure*, as a lead-in as well to this segment. VAS P270, VAS P271, and *The "How" in Parliamentary Procedure* may be used as reference guides to the unit on parliamentary procedure.

5. Using Transparency Master #2 and Information Sheet #1, complete the table for each of the following motions. (Copy table for each student also.)

   Motions:

Main Motion	Refer to a Committee
Amendment	Postpone Indefinitely
Lay on the Table	Point of Order
Previous Question	Appeal
Postpone Definitely	Reconsider
Division	Rescind

Discuss one motion at a time in the following order:

1. Name of motion.
2. Purpose of motion.
3. Method of presenting on floor.
4. Is a second required?
5. Is the motion debatable?
6. Is the motion amendable?
7. Type of vote necessary.
8. Can the motion be reconsidered?

Answer any questions after discussion of motion. After thoroughly discussing motion, instructor or an experienced student will conduct a "mock" meeting. Students receiving the instruction would use the motion learned. Repeat this procedure after each discussion of a motion until all are explained. Discuss precedence. Give students copy of Information Sheet #2, "Parliamentary Procedure Pyramid." Explain how pyramid works. Eventually the students in class may take turns chairing the meeting.

6. Conduct mock meetings daily in class for 1-3 weeks, until you feel students are very comfortable using parliamentary procedure.

7. Have students keep student scores as an incentive for participation. Use the "Suggested Rules for Parliamentary Procedure" from the Illinois FFA Advisors Guide as a guide for awarding points.

8. Ask students what are the six chapter officers of the local FFA, who are the officers, and what are their duties?

9. Have students complete Student Worksheet #1.

10. Have students complete Student Worksheet #2.

11. Show Transparency Master #3.

12. Have students team up in groups of six to learn and perform the opening and closing ceremonies. Remaining students can do the advisor's role. Use the student handbook as a guide.

13. Show and discuss Transparency Masters #4 and #5 .

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ERIC

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Developing Leadership Skills Through Youth Organizations

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

1. *Introduction to Parliamentary Procedure* (VAS Filmstrip #F1006); *A Guide to Parliamentary Procedure* (VAS #P270); *Beginning Steps in Parliamentaty Procedure* (VAS #P271). Vocational Agriculture Service, College of Agriculture, University of Illinos, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

2. *Student Handbook.* (1985). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703)360-3600.

3. *Official Manual.* (most current). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703)360-3600.

4. *The "How" in Parliamentary Procedure.* (1981). Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050.

5. *Applied Communications.* Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322- 3905.

*Indicates highly recommended reference

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Table of Motions

INFORMATION SHEET #2 — Parliamentary Procedure Pyramid

TRANSPARENCY MASTER #1 — Principal Parts of an Outline

TRANSPARENCY MASTER #2 — Blank Table of Motions

TRANSPARENCY MASTER #3 — Order of Business for a Chapter Meeting

TRANSPARENCY MASTER #4 — 10 Ways to Be a Good Leader

TRANSPARENCY MASTER #5 — How to Become A Good Officer

Table of Motions

Motion	Purpose	Method of Presentation on the Floor	Second Required	Debatable	Amendable	Vote Required	Can Be Reconsidered
Main Motion	To introduce new business	Mr./Mdm. Chairperson, I move	yes	yes	yes	Majority	yes
Amendment	To modify, alter, or improve a motion	Mr./Mdm. Chairperson, I move to amend the motion by . . .	yes	yes	yes	Majority	yes
Lay on the Table	To temporarily set aside an item of business.	Mr./Mdm. Chairperson, I move to table the motion . .	yes	no	no	Majority	no
Previous Question	To stop debate immediately	Mr./Mdm. Chairperson, I call for the previous question.	yes	no	no	2/3	yes
Postpone Definitely	To delay action on a motion	Mr./Mdm. Chairperson, I move to postpone this motion until (date).	yes	yes	yes	Majority	yes
Division	To secure an actual (counting) vote	Mr./Mdm. Chairperson, I call for a division of the house.	no	no	no	None	no

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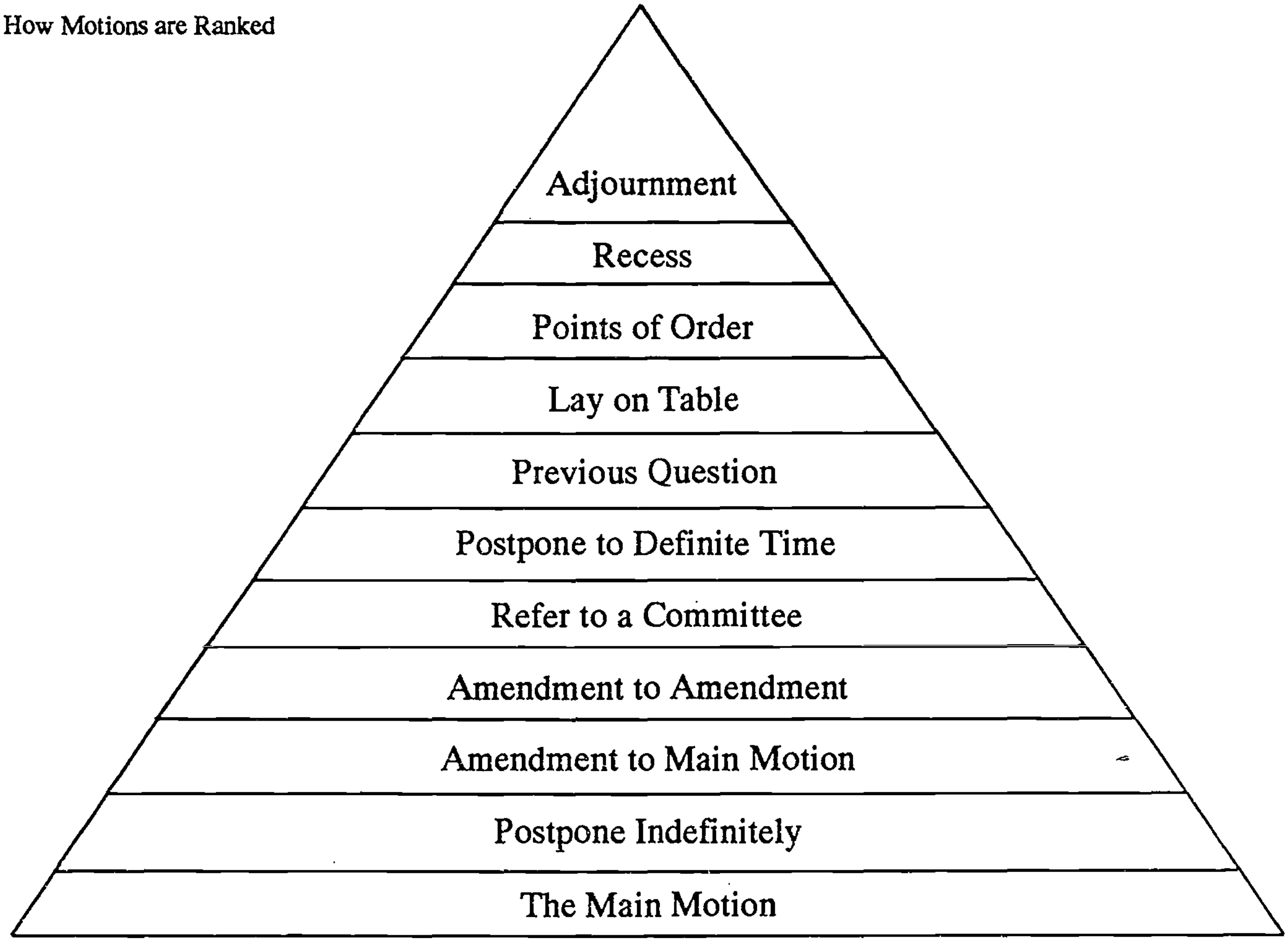
Motion	Purpose	Method of Presentation on the Floor	Second Required	Debatable	Amendable	Vote Required	Can Be Reconsidered
Refer to a Committee	To place motion in the hands of a committee for further research into the matter	Mr./Mdm. Chairperson, I move to refer this to a committee of (#), appointed by (name).	yes	yes	yes	Majority	yes
Postpone Indefinitely	To kill a motion without bringing it to a vote	Mr./Mdm. Chairperson, I move to postpone this motion indefinitely.	yes	yes	no	Majority	yes
Point of Order	To enforce rules, correct parliamentary errors	Mr./Mdm. Chairperson, I rise to a point of order.	no	no	no	None	no
Appeal	To insure majority of group agrees with chair's ruling	Mr./Mdm. Chairperson, I appeal the decision of the chair.	yes	yes	no	Majority	yes
Reconsider	To secure a new vote on a motion previously voted on	Mr./Mdm. Chairperson, I move to reconsider the motion that states . . .	yes	yes	no	Majority	no
Rescind	To void or erase previous actions or serious mistakes of the group	Mr./Mdm. Chairperson, I move to rescind the action of the group . . .	yes	yes	yes	2/3	no

INFORMATION SHEET #2

Parliamentary Procedure Pyramid

How Motions are Ranked



TRANSPARENCY MASTER #1

Principal Parts of an Outline

I. Introduction: Arouses interest in you and indicates your appreciation of the audience.

II. Body: Develops the main idea; lets the audience know what they are to hear and prepares them for good listening.

III. Conclusion: Summarizes, reviews, urges action, or gains respect for ideas expressed.

Table of Motions

Motion	Purpose	Method of Presentation on the Floor	Second Required	Debatable	Amendable	Vote Required	Can Be Reconsidered
	1474						

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ERIC

TRANSPARENCY MASTER #3

Order of Business for a Chapter Meeting

Agenda

1. Opening Ceremony
2. Minutes of the previous meeting
3. Officer reports
4. Report on chapter program of activities
5. Special features
6. Unfinished business
7. Committee reports
   a. Standing
   b. Special
8. New business
9. Degree and installation ceremonies
10. Closing ceremony
11. Entertainment, recreation, refreshments

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TRANSPARENCY MASTER #4

10 Ways to Be a Good Leader

1. The leader fosters active participation by his chapter.
2. The leader promotes group cooperation and a desire to "pull together."
3. The leader obtains essential information for group use.
4. The leader encourages opinions or solution giving by the group members.
5. The leader stimulates critical thinking and evaluation.
6. The leader welcomes all contributions or suggestions.
7. The leader encourages differences as well as agreement on opinions.
8. The leader is personally neutral on issues, and sees that both sides are considered.
9. The leader attempts to change the behavior of "troublesome participants."
10. The leader constantly charts or summarizes the progress of the group.

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TRANSPARENCY MASTER #5

How to Become a Good Officer

1. Study the latest edition of the FFA Manual and Student Handbook.

2. Promote practices that will assist in making a good chapter.

3. Learn your part in the opening and closing ceremonies.

4. Study and practice parliamentary procedure.

5. Devote a part of each school week to your officer duties.

6. Be regular in attendance at all FFA activities.

7. Know your duties and fulfill them.

8. Work hard at having harmonious relationships in your chapter.

9. Be a good salesman. Instill faith in your chapter members.

10. Be neat in your dress and personal appearance.

11. Wear the FFA jacket whenever appropriate.

12. Learn to delegate responsibility wisely.

13. Learn to give credit where credit is due.

14. Be courteous. The words "please" and "thank you" pay big dividends.

15. Use good judgment. Assemble facts and figures before meetings.

16. Read the National and Illinois FFA Magazine.

17. Acknowledge courtesies extended to you or your chapter.

18. Practice good table etiquette on all occasions.

19. Develop good conversational habits.

20. Be careful of what you say and how you say it.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — Chapter Officer Duties

STUDENT WORKSHEET #2 — Room Arrangement for FFA Meetings

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

Chapter Officer Duties

Match chapter officers to their duties.

1. ________ President
2. ________ Vice-President
3. ________ Secretary
4. ________ Treasurer
5. ________ Reporter
6. ________ Sentinel
7. ________ Advisor

A. Prepares the meeting room and cares for chapter equipment and supplies.
B. Receives and deposits chapter funds.
C. Presides over meetings in absence of president.
D. Presides over meetings according to accepted rules of parliamentary procedure.
E. Prepares a chapter newsletter and a scrapbook.
F. Releases news and information to local news media.
G. Prepares meeting minutes.
H. Serves as official representative of the FFA chapter.
I. Keeps the meeting room comfortable.
J. Assumes all duties of the president if necessary.
K. Issues membership cards.
L. Collects dues.
M. Provides guidance for the organization (an adult).
N. Prepares membership roster and submits dues.
O. Supervises all committees.
P. Welcomes guests to FFA meetings.
Q. Coordinates chapter correspondence.
R. Sends articles and pictures to National Future Farmer Magazine.
S. Assists with special features and refreshments.
T. Prepares meeting agenda and minutes.
U. Works with earnings and savings committee.
V. Appoints committees and serves as ex-officio member.
W. Works closely with President in coordinating chapter activities.
X. Prepares a chapter budget.
Y. Works with local media on radio and television.
Z. Keeps member attendance and activity record.

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STUDENT WORKSHEET #1 — Key

Chapter Officer Duties

Match chapter officers to their duties.

1. _D,H,V_ President
2. _C,J,O,W_ Vice-President
3. _G,K,Q,T,Z_ Secretary
4. _B,L,N,U,X_ Treasurer
5. _E,F,R,Y_ Reporter
6. _A,I,P,S_ Sentinel
7. _M_ Advisor

A. Prepares the meeting room and cares for chapter equipment and supplies.
B. Receives and deposits chapter funds.
C. Presides over meetings in absence of president.
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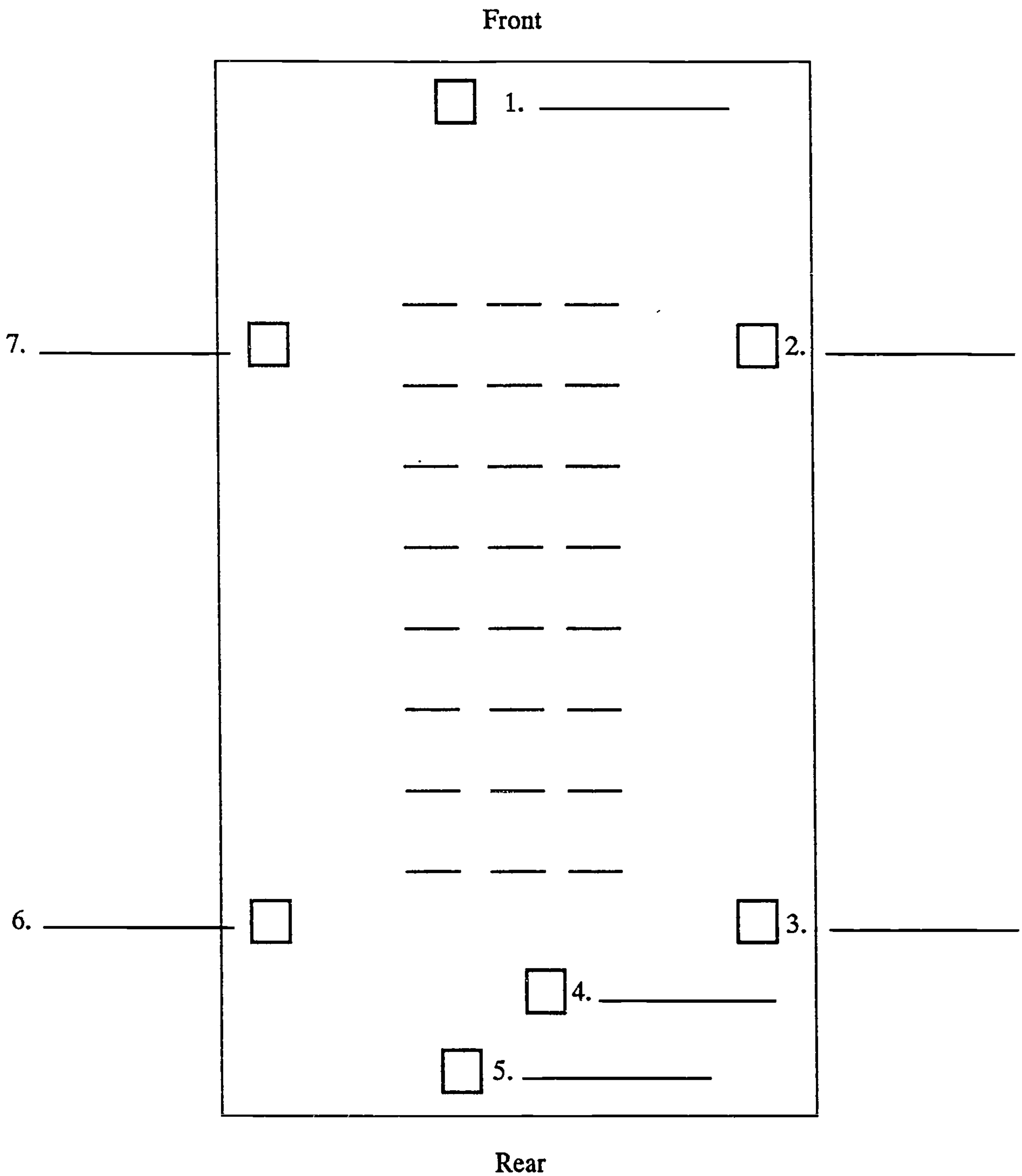
Y. Works with local media on radio and television.
Z. Keeps member attendance and activity record.

STUDENT WORKSHEET #2

Room Arrangement for FFA Meetings

Label the room arrangement illustrated below. Write the correct offices in the blanks.



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ERIC

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Participating in Community and Government Leadership

RELATED PROBLEM AREAS:

1. Developing Leadership Skills Through Youth Organizations
2. Recognizing the Role of Agriculture in Society
3. Understanding Agricultural Law Applications (Agricultural Business and Management)

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED:

Agricultural Business and Management Cluster

Duty B: Performing Sales Duties

1. Inform customers of warranty and guarantee specifications
2. Explain the federal and state laws regarding the grain elevator business
3. Explain the legal responsibilities of business which deal with interstate commerce
4. Explain the relationship of cash grain prices to future markets

Duty E: Performing Promotional Activities

1. Conduct a sales promotion meeting
2. Plan a sales promotion meeting

Duty H: Managing the Business

1. Evaluate agribusiness productivity

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Social Sciences. These objectives are listed on the Learning Assessment Plan forms included on the following pages. Those learning objectives marked with an asterisk (*) are taken from sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☐ Mathematics ☒ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING
As a result of their schooling, students will be able to understand and analyze comparative political and economic systems, with an emphasis on the political and economic systems of the United States.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	IV. ASSESSMENT A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	V. EXPECTATIONS Percent of Students Expected to Achieve Objective
1. Develop an understanding of the importance of being involved with other school activities and organizations.					
2. Become involved with community improvement and community development through the FFA chapter BOAC program.					
3. Develop an awareness of community government and develop the initiative to become involved with community government.					
*4. Know how citizens can participate in interest groups.					
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ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Participating in Community and Government Leadership

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Develop a knowledge of other student organizations.
2. Develop an understanding of the importance of being involved with other school activities and organizations.
3. Become involved with community improvement and community development through the FFA chapter BOAC program.
4. Develop an awareness of community government and develop the initiative to become involved with community government.
5. Develop an awareness of how government impacts local agribusiness operation and management.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Participating in Community and Government Leadership

PROBLEMS AND QUESTIONS FOR STUDY

INSTRUCTOR'S NOTES AND REFERENCES

1. What student clubs or organizations are in the school? (List them on the board.)

2. Have students brainstorm to answer the next question. (Do not reject any possible answer!) What are the ac ntages to joining other organizations while also being an FFA member?

3. What community improvement projects has the FFA done in the past? What about other school organizations? What type of projects should we do in the future?

4. Who are the elected officials in our community? What type of influence can they have on the success of public education and the success of our agriculture/agribusiness program?

5. How can we become involved in community government?

6. What other local organizations provide community leadership?

7. What is an "interest group"?

8. What is a "support group"? Give examples.

9. Discuss how local, state, and federal government regulations impact on agricultural business operation and management.

10. Identify how local agricultural leaders can help influence government policy.

11. Discuss the ethics of governmental control of agricultural production, marketing, and trading.

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Participating in Community and Government Leadership

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Ask students to list all school activities and clubs available in the school as you write them on the board.
2. Show Transparency Masters #1 and #2. Explain about each student organization even though it may not exist at the school. This makes students aware of other vocational student organizations. Use Information Sheet #1 as a guide.
3. Ask students to list as many advantages as they can for joining other organizations while being an FFA member. Write them on the board also.
4. Encourage students to join other youth clubs and organizations to give them a well-rounded background.
5. Have each student complete Student Worksheet #1.
6. Using Student Worksheet #2 , have students list under each category names of groups that may be interested in working with the FFA in the area of community service.
7. Using Student Worksheet #3, have each student survey 5-8 people to find where the most interest lies in the area of community service.
8. Using *Community Development —An FFA Rural Initiative* and the National FFA BOAC information, plan and conduct one quality program based on survey results. It may be wise to create a special committee.
9. Make sure the FFA chapter fills out application for BOAC awards.
10. Show Transparency Master #3. Explain how it is important for young agriculturists to become active in local community interest groups.
11. Copy and handout copies of Information Sheets #2 and #3. Have students read this article as supervised study. Conduct an open discussion with the students about this article. Ask the students "Why did the people in the article organize a support group? What positive results occurred because of the formation of the support group?"
12. Show Transparency Master #4 as a summary or closing for the discussion on interest groups.
13. Handout copies of Student Worksheet #4. Give students 5 minutes to brainstorm answers. List student answers on the board.
14. Using Cooperative Extension Service Circular #1147 *County Government in Illinois* and obtaining assistance form an elected official in county or city government, put together a "mock" government system. Make sure students follow parliamentary procedure in all sessions. Students could create a government, elect and/or appoint officials, conduct business, etc. This activity could go on for several weeks.
15. Have students attend a city, county, or state government meeting.
16. Take students on a field trip to governmental offices. Arrange meetings with elected officials. Have students prepare questions ahead of the visit.
17. Show Transparency Master #5 as a closing of this unit.
18. Use Information Sheet #3 to discuss the 4-H youth organization.
19. Discuss with class about interest and support groups.

ERIC

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Developing Leadership Capabilities in Agriculture/Agribusiness

PROBLEM AREA: Participating in Community and Government Leadership

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6. *The FFA and You*. Bender, Taylor, Hansen, Newcomb. (1979). The Interstate Printers and Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050.

7. *Applied Communications*. Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455. (800) 322-3905.

*Indicates highly recommended reference.

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — Vocational Student Organizations

INFORMATION SHEET #2 — Rural Teens Accentuate the Positive

INFORMATION SHEET #3 — Helping You Help Youth — Introduction to 4-H

TRANSPARENCY MASTER #1 — Vocational Student Organization Emblems

TRANSPARENCY MASTER #2 — Vocational Student Organization Emblems

TRANSPARENCY MASTER #3 — Belonging to Clubs

TRANSPARENCY MASTER #4 — Individual Interests of Group Members

TRANSPARENCY MASTER #5 — Summary on Government

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INFORMATION SHEET #1

Vocational Student Organizations

A. **AIASA** (American Industrial Arts Student Association)

NOTE: This is an organization for students who are enrolled in Technology Education programs.

B. **DECA** (Distributive Education Clubs of America)

NOTE: This is an organization primarily for students who are enrolled or have been enrolled in Marketing Education programs.

C. **FBLA** (Future Business Leaders of America)

NOTE: This is an organization primarily for students who are enrolled or who have been enrolled in Business and Office Education programs.

D. **FFA**

NOTE: This is an organiztion for students enrolled in Agricultural Education programs.

E. **FHA-HERO** (Future Homemakers of America-Home Economics Related Occupations)

NOTE: This is an organization for students who are enrolled in Home Economics programs.

F. **HOSA** (Health Occupations Students of America)

NOTE: This is an organization for students enrolled in Health Occupations programs.

G. **VICA** (Vocational Industrial Clubs of America)

NOTE: This is an organization for students enrolled in Trade and Industrial programs.

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INFORMATION SHEET #2

Rural Teens Accentuate The Positive

Friends, school work, sports, skin problems—these are the issues of highest concern to rural teenagers nowadays, right?

Wrong.

Try bankruptcy, loans, careers, making money, and death.

Surprised? So was the 4-H staff in Gratiot County, Michigan, who surveyed local teenagers to find out what causes stress in their lives.

"Their responses showed us that these teens were dealing with adult problems and issues along with those normally associated with kids their age," says Nicholie Hoffman, Michigan State University Extension specialist and former Gratiot County 4-H youth agent. "We were concerned that they might not be equipped to handle their feelings."

Staying Positive

The teenagers are 4-H and Future Farmers of America members who belong to a Cooperative Extension Service-sponsored group called "Positive Teens for Gratiot County." And though the name sounds out of sync with their current frame of mind, these teens are trying to stay positive as they and their families face the most severe farm crisis in the history of their community.

Gratiot County farmers have been beset with the same challenges as farmers all over the country—dropping land values, high interest rates, and falling prices for crops.

But no one could have been prepared to deal with what happened in Gratiot and many other Michigan counties this fall.

For 26 consecutive days in September the sun did not shine. For 26 days rain fell on ripening fields, devastating what could have been bumper crops for many farmers—washing away hopes that this harvest could help bail them out of already tight financial binds.

"This is the worst the farm situation has ever been, and no one will argue that," says Corey Roslund, Gratiot County 4-H youth agent. "CES, in cooperation with other agencies, has been providing excellent support and information to farmers to help deal with the crisis. But we wanted to make sure that the young people's feelings and fears were not overlooked."

Support Group Helps

"Positive Teens for Gratiot County" bring together students from all the area high schools, to share feelings and provide support for one another. "It's very scary not knowing how the farm year's going to turn out," says 15-year-old Carrie Stoneman of Breckenridge. "It's scary not knowing if we're going to be able to continue farming or if we'll lose our land. It's awfully risky."

The teen years are difficult enough with the pressures of peers, homework, and body changes. But teenagers in farming communities have the added pressures of hard work, long hours, and worry over the viability of their family businesses.

"These kids care very deeply about their parents and about their family farms," says Hoffman. "They have a strong need to feel like they're doing something—helping in some way—and that's what 'Positive Teens' is all about."

"The group started about 2 years ago as an activist group that wanted to make a difference," says 4-H agent Roslund. "But their focus has changed a bit lately."

What started as a group of about 70 teenagers involved in a variety of community service and social activities evolved into a close-knit support group of teens who draw on each other's strengths to get them through the toughest of times.

After only a couple of support group meetings, which included sessions on stress management and coping skills, it was clear that the teens shared similar concerns and feelings. They were scared. They were angry. They felt guilty, helpless, and hopeless.

"But just talking about it with people who understand really helps," says 17-year-old Scott DeVuyst. He is a senior at Ithaca High School, works part time at a farm equipment store, and helps his father farm 500 acres of cash crops. "It helps to know that you're not alone—that some of your friends also feel guilty and somehow responsible that their dads aren't doing so good," DeVuyst says.

Communicating Via Video

The guilt issue is intensified for many of the teenagers because they are so concerned about their parents and the pressures on them that they don't want to burden them with their own concerns. But "Positive Teens for Gratiot County" came up with a positive solution to that problem.

"The kids asked if we could arrange to videotape one of our support sessions," Hoffman says. "They wanted to show the videotape to their parents in hopes that it would help ease open the doors of communication."

A local cable company was hired to videotape an hour-long session of the group; the teens had the option of showing the tape to their parents.

"I'd like Dad to see how this group operates," says Scott DeVuyst. "I'd like him to know how much it has helped me and maybe encourage him to attend adult support groups similar to this."

"Don't give up," is the message Carrie Stoneman wants to convey to her parents. "Sure, this is a bad time right now and it may get worse," she says into the camera. "But I'd rather see you hang onto something that you both love doing."

Communicating their feelings won't solve the serious problems and issues facing farmers and their families. For some, the flood of 1986 will be remembered as the last straw—the final blow that forced them to concede to economic strains, ending generations of tradition, forcing radical changes in lifestyles, and dousing dreams of the future.

But these teenagers believe that isolating oneself and holding in all those feelings can intensify a bad situation, making the problem seem worse and increasing the chance of serious physical and mental health problems.

Positive Changes

"I've seen so many positive changes in these teenagers since we started the support group," says Sharon Fenton, Gratiot County program assistant in charge of teen programming. "Their confidence has increased, they feel better about the whole situation, they seem to have a much better attitude about school, they're exploring all their options, and, overall, they are approaching the future in a very positive way."

Extension Review, Vol. 58, NO.1, USDA, Winter 1987.

INFORMATION SHEET #3

Helping You Help Youth
Introduction to 4-H

What is 4-H

The Cooperative Extension Service 4-H/Youth Program is a voluntary, informal, educational program offered to all boys and girls regardless of race, color, national origin, place of residence, or handicap. The Illinois 4-H program is conducted by the College of Agriculture, University of Illinois at Urbana-Champaign, and the Extension Service, U.S. Department of Agriculture. County and regional 4-H programs are directed by professional Extension staff who train and support the volunteers who work with 4-H members.

Young people in 4-H learn about citizenship, leadership, homemaking, arts and crafts, mechanics, horticulture, agriculture, and other subjects. To teach young people about these subjects, the 4-H educational program uses the learn-by-doing method of instruction. The 4-H project, which each member selects according to interest and ability, is the program's cornerstone. A 4-H project is a practical, but challenging, planned course of activity centered around a specific subject. Projects involve setting goals and evaluating progress, and the skills and knowledge learned help members become more productive individuals and citizens.

Who Develops the Programs?

The 4-H programs in Illinois counties are developed by local adult and youth volunteers who serve on county 4-H and Youth Councils. Clubs and groups, as well as county-wide activities, are conducted by volunteer leaders who are trained and supported by county, regional, and state staff members of the Cooperative Extension Service.

Ways to Participate in 4-H

A 4-H Club

Illinois 4-H policy defines a 4-H club as a group of five or more young people 8-19 years of age who meet in a sustaining, Extension-sponsored educational program for at least six sessions a year and who have a planned program, officers, and one or more projects per member. A 4-H club may explore a single subject or several subjects. In addition, members of a 4-H club will participate in many other activities, such as talks, demonstrations, judging, tours, and county events. A 4-H club may be organized on a community or neighborhood basis and use local facilities or members' homes, or it can be organized within a school using the school's facilities, time, and staff.

A 4-H Special-Interest Group

Sometimes young people want information about a particular subject but do not want to participate in a 4-H club and its many different kinds of activities. These individuals may want to participate in a 4-H special-interest group that studies just that subject — for example, a group that studies just rose culture, model rocketry, or consumer buying. Special-interest groups pursue their subject by using workshops, meetings, simulated experiences, and other similar formats. A group consists of five or more members who meet six or more times and who follow a predetermined educational program under the guidance of a qualified resource person. After learning about other 4-H opportunities, participants may want to join another special-interest group or expand their participation by joining a 4-H club.

A 4-H Short-Term Program

Often young people want to learn about a subject that is specific or limited enough to be explored in depth in a short period of time. These young people may want to participate in a 4-H short-term program, which will inform them about the subject in an evening, an entire day, or a weekend. This short-term method is effective in informing large numbers of youth about subjects such as career choices or fire, water, or bicycle safety. If participants in short-term programs are not already members of a 4-H club or special-interest group, they should be made aware of the other, more sustaining 4-H programs.

Camping

Camping is the most intensive method of working with 4-H boys and girls since it brings volunteers and members into contact with each other for several days. This type of group living, as well as the intensive nature of the activities involved in camping, helps members develop interpersonal skills and self-confidence.

Illinois has five 4-H camps, all developed by a fund-raising program that began in 1948. Each county conducts planned group activities at one of the camps for one week or more each year. In addition, county Extension 4-H and Youth Councils usually establish county camping committees to explore other kinds of camping and outdoor educational opportunities. These opportunities include day camps, naturecraft camps, bike hikes, ski trips, winter weekends, and project camps, and they are held for certain age groups, for all members, or for all members and their families.

What 4-H Does for Boys and Girls

The main purpose of 4-H is to provide opportunities for the mental, physical, and social growth of young people. The informal education offered by the program supplements the training received in the home, at school, and from other youth-serving organizations. Based upon recognized, effective educational concepts, the 4-H program teaches 4-H members skills for living.

Learning How to Learn

The learn-by-doing teaching technique is used in 4-H to help young people learn about practical and technical subjects. This technique requires boys and girls to set their own goals and to plan and conduct programs that will help them accomplish their goals. In planning and conducting a program of activity, 4-H members learn how to obtain information on and assistance with a subject and how to manage their time.

Discovering Interests and Needs

Through their projects an activities, 4-H members have the opportunity to explore a variety of practical and technical subjects in fields such as health, nutrition, textiles, science, agriculture, mechanics, and economics. This exposure helps boys and girls learn early in life about their interests and the world of work, and this information may help them later in life in choosing a vocation or hobby.

The coeducational and intergenerational experiences involved in 4-H help members in their personal growth as well. Boys and girls can develop self-confidence and a sense of a self in 4-H programs, and they learn the importance of an active mind and a healthy body.

Relating to Other Individuals

Young people in 4-H learn not only to express their own ideas but also to listen to, understand, and respect what others have to say. Formal presentations and demonstrations help 4-H boys and girls learn how to convey their ideas to other people. Group discussions and activities and formal club meetings, on the other hand, provide members with the opportunity to practice democratic group action and to become aware of the dynamics of group influence.

Becoming Part of Society

Several aspects of 4-H help young people cope with the changing nature of society and with the changes involved in living as adults. For one, the youth-adult relationships involved in 4-H help integrate young people into society. Other skills necessary for becoming productive members of society are taught directly through 4-H clubs and programs. All 4-H programs teach members about the responsibilities of citizenship in one's community, country, and world. In addition, boys and girls in 4-H are encouraged to become involved in community development. Finally, members also learn to appreciate other cultures and are given the opportunity to experience other cultures through exchange programs.

4-H — A Family Affair

Family involvement is encouraged by 4-H whenever it is practical and possible. What can the 4-H program do for families? Reports from 4-H families indicate that it can

- educate the whole family.
- help family members communicate better as they solve problems by working together toward common goals.
- help families develop a feeling of unity as they work toward project goals.
- provide opportunities to discuss goal-setting, decision-making, and service to others.
- promote family activities such as camping, exchange trips, potlucks, and square dancing.
- provide settings in which family members can share rewards for success and be encouraged during times of disappointment.

Notes on the Origins of 4-H

Early Beginnings

In 1898 a young man in Macoupin County, Illinois, Will B. Otwell, was elected secretary of the newly formed County Farmer's Institute. The first institute meeting was a complete flop: no one came. Otwell felt that the institute needed an activity to capture the interest of farmers, so he decided to work with the boys in the county. He wrote to leading corn growers in Illinois, Indiana, and Iowa to secure high-quality corn seed. He then advertised in local papers for boys under eighteen to send in for a packet of seed corn. The boys were to raise the corn and exhibit a sample of their produce for prizes at the second institute meeting that fall. Five hundred boys sent in for seed, and the fall meeting was a great success. Over 500 people came to see the result of the boys' work.

Over the next few years, Otwell's program continued to grow. By 1901 more than 1,500 boys were enrolled in his program. In 1903 the Governor of Illinois appointed Otwell superintendent of the Illinois agricultural exhibit at the St. Louis World's Fair. That fall, Otwell and his assistants received 1,250 corn exhibits, and the Illinois agriculture exhibit stole the show from the other states' exhibits. In later years, Otwell had annual county meetings for boys participating in his program. Otwell's program was not 4-H as we know it (or even a club), but it was the first organized program for farm youth in Illinois, and many farm youth were inspired by their participation.

Otwell's activities were similar to those being organized in other states around the same time. Educators in rural areas throughout the country were becoming concerned that rural children were not receiving an education that related to rural life and rural living. Liberty Hyde Bailey, an educator at Cornell University, acted on his concern. In the 1890s he prepared leaflets on nature study, and these became widely used by rural school teachers. Other colleges of agriculture prepared similar literature.

Other educators thought boys and girls needed practical experience in agricultural work and homemaking. In Clark County, Ohio, Albert B. Graham was superintendent of the Springfield township schools. He had seen the success of a manual training course in one of the schools in the town ship, so he decided to apply the same idea to agricultural topics. On January 15, 1902, he met with a group of 85 boys and girls, He had them test soil, select corn, and plant experimental plots. Many claim he is the originator of agricultural experiment clubs for boys and girls.

One month later, on February 22, 1902, O.J. Kern, superintendent of schools in Winnebago County, Rockford, Illinois, assembled 37 boys from the rural schools to hear professors from the College of Agriculture, University of Illinois, talk about corn production. From this group Kern formed a boys' experiment club. The members raised corn and sugar beets and took trips to the University's College of Agriculture. So a program similar to Graham's was born, and the new concept quickly spread. The idea of agricultural experiment clubs was alive and growing rapidly.

Origins of the Emblem and Continued Growth

Around 1906 in Wright County, Iowa, Oscar H. Benson, county superintendent of schools, was one of many county superintendents who cooperated with the College of Agriculture at Iowa State University in the development of Boys' and Girls' Corn Clubs. Benson soon became an enthusiastic backer of the program. In 1909, to give some additional recognition to those who took part in the program, Benson made some sketches of a clover leaf pin with an "H" in each of the three leaves. The three "H's" stood for "heart, head, and hands." He had a jewelry company make some of these pins, and they were used to recognize excellence in agricultural and domestic science work.

In 1912, Benson, then working in Washington, D.C., at the Farmer's Cooperative Demonstration Work office, sent a circular to various states that described the clover emblem, which by now had a fourth leaf standing for "health." The circular also showed how the emblem was to be used in connection with the clubs then existing on corn, canning, poultry, and cotton. Although the emblem began appearing on canned products produced by the canning clubs, it wasn't until 1924 that the various agricultural clubs in the national were organized under the name "4-H." Until that date, the name used to encompass all the clubs was "Boys' and Girls' Club Work."

Soon after Benson's circular was issued, other projects were added to the growing program of club work. Members were asked by the Washington office to keep records on their projects. Demonstrations were given in numerous states on improved methods of canning or of growing pigs. However, the basic element in the program remained the learning-by-doing project.

Youth Work — Part of Cooperative Extension

In 1914 the Smith-Lever Act was passed in Congress authorizing a Cooperative Extension Service in each state's land-grant college of agriculture. Extension staff were provided with funds for disseminating useful and practical information on agriculture, home economics, and related subjects to persons not attending college. Extension personnel soon found that one effective way to reach rural men and women was through work with their children. Thus, Boys' and Girls' Club Work soon became an integral part of Extension's programming.

The first state leader of Boys' and Girls' Club Work in Illinois, Dr. James H. Greene, was employed by the University of Illinois, College of Agriculture, on June 1, 1915. The first club organized after Dr. Greene began was Union Pig Club at Palmyra in Macoupin county. The club was led by C.C. Coots and had 14 members, all of whom exhibited their projects, kept records, and received recognition certificates. In 1915, there were 6,032 Illinois boys and girls working independently or in groups on projects, and 487 clubs were organized. The need for volunteers in each community to act as leaders was emphasized, and clubs were asked to de-emphasize "the scramble for large cash prizes."

During World War I, it became important to grow food, and the government made a great effort to get people everywhere to grow their own vegetables. As a result, Boy's and Girls' Club Work was expanded into towns and cities to encourage young people to have garden clubs. The expansion was a great success, and in 1918 Illinois had the largest enrollment to date in the program — 15,290 members. In fact, it would be many years before the 1918 enrollment would be surpassed since, with the coming peace, emphasis was again placed on work with the rural boys and girls.

Illinois 4-H Today

Because of the educational concepts and methods developed by these pioneers, the 4-H program has stood the test of time. The 4-H program continues to grow in Illinois, expanding into villages, towns, cities, and suburbs. The Illinois 4-H program now reaches over 150,000 boys and girls, with about 30,000 adult volunteers helping over 4,000 clubs and groups. The 4-H program has a great history and a great future.

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4-H Symbols and Traditions

The 4-H pledge, motto, and other symbols and traditions have helped identify 4-H work for many years. The songs listed are in the book *Songs of the 4-H Clover*, available from the National 4-H Supply Service, Chicago.

Pledge: I pledge — My Head to clearer thinking,
My Heart to greater loyalty,
My Hands to better service, and
My Health to better living,
For my club, my community, my country
and my world.

Motto: To make the best better.

Colors: Green and white.

Emblem: A four-leaf clover with the letter "H" on each leaf. The leaves of the clover are green and the letters are white.

Songs: A Song of Health, 4-H Field Song, National 4-H Pledge, A Plowing Song, 4-H Chorale, Dreaming, and 4-H Pastoral.

This information was prepared by George L. Daigh and Mary K. Munson, Extension Specialists, 4-H/Youth, Cooperative Extension Service, University of Illinois at Urbana-Champaign.

TRANSPARENCY MASTER #1

Vocational Student Organization Emblems

FBLA

FFA

HOSA

ERIC

TRANSPARENCY MASTER #2

Vocational Student Organization Emblems (cont'd.)

AIASA

DECA

FHA/HERO

ERIC

TRANSPARENCY MASTER #3

Belonging to Clubs

Except for a few intellectuals who don't believe in "joining," and the very, very poor who can't afford to, practically all adult Americans belong to some club or other, and most of them take part in some joint effort to do good. This prodigious army of volunteer citizens, who take time from their jobs and pleasure to work more or less unselfishly for the betterment of the community is unique in the world. It is, in a way, the mainspring as well as the safeguard of democracy. For whatever the silly rituals and absurdities of some of their organizations and the self interest of others, the volunteers are always ready to work and fight for what they think is right.

"The Busy, Busy, Citizen," Fortune Magazine, February 1951, p. 98.

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TRANSPARENCY MASTER #4

Individual Interests of Group Members

"When people get together to form a group to achieve a certain goal or set of goals, it is assumed that they expect to get the active participation of those involved. If members are going to give continued effort to any group, they must feel that through such participation they will be able to satisfy at least those individual interests which are held in common and also that some of their personal needs will be satisfied incidentally and without conflict with others' interests."

Beal, Bohlen, and Raudabaugh, *Leadership and Dynamic Group Action*. The Iowa State University Press, Ames, IA. 1973. p. 75.

TRANSPARENCY MASTER #5

Summary on Government

County government is more than elections and taxes. It is a force for planning, for making decisions about public needs and services, and for finding and expending the revenue that is needed to solve problems and to put plans into action.

Thus county government is local government, and it is local citizens and local elected officials who make it work. Decision making is a complex process, especially today when more than ever "no man is an island." Even the smallest decision may involve all kinds of people in all kinds of places — farmers, businessmen, miners, homeowners, teachers, bankers, construction workers. To the extent that citizens understand and participate in it, county government has the potential to function as an efficient and democratic unit for helping people.

"County Government in Illinois," Circular #1147, Cooperative Extension Service, University of Illinois at Urbana-Champaign, 1972.

ERIC

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — "What's In My Community?" Word Search (with soluction)

STUDENT WORKSHEET #2 — Identifying Cooperative Groups and Organizations

STUDENT WORKSHEET #3 — Community Needs Survey

STUDENT WORKSHEET #4 — Involvement of Agriculturists in Government — Brainstorming Activity

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide

STUDENT WORKSHEET #1

"What's in My Community?" Word Search

C	I	V	I	C	I	R	G	A	N	I	Z	A	T	I	O	N	S	C
H	O	T	E	L	R	E	C	R	E	A	T	I	O	N	Q	H	D	O
U	Y	E	V	Q	G	S	E	G	D	U	J	A	I	L	O	O	A	L
R	R	L	I	L	A	W	Y	E	R	S	K	X	A	P	C	S	O	L
C	T	E	L	E	N	V	I	R	O	N	M	E	N	T	A	P	N	E
H	S	P	L	J	I	H	E	L	P	U	K	R	O	Z	O	I	N	G
I	U	H	A	O	Z	L	E	T	S	A	W	R	A	P	B	T	H	E
G	D	O	G	B	A	L	Z	E	L	D	S	N	Q	F	H	A	R	N
H	N	N	E	S	T	A	U	Q	X	Y	R	A	R	B	I	L	J	E
W	I	E	D	O	I	M	S	T	N	A	R	U	A	T	S	E	R	M
A	X	A	W	P	O	S	T	O	F	F	I	C	E	B	A	N	K	E
Y	O	N	S	A	N	I	T	A	T	I	O	N	O	I	D	A	R	R
R	E	P	A	P	S	W	E	N	S	E	I	T	I	L	I	T	U	I
T	H	E	A	T	E	R	A	N	C	H	Z	L	O	O	H	C	S	F
P	S	K	L	A	N	D	O	O	F	R	K	B	E	C	I	L	O	P

The following words are hidden in the puzzle:

Bank
BOAC
Church
Civic Organizations
College
Doctors
Environment
Farm
Firemen
Food
FHA
Help
Highway
Hospital
Hotel

Industry
Jail
Jobs
Judges
Lake
Land
Lawyers
Library
Mall
Museum
Newspaper
Organizations
Police
Post Office
Radio

Ranch
Recreation
Restaurants
Roads
Sanitation
School
Shop
Telephone
TV
Theater
Town
Utilities
Vet
Village
Waste

1506

STUDENT WORKSHEET #1 — Key

"What's in My Community?" Word Search

C	I	V	I	C	O	R	G	A	N	I	Z	A	T	I	O	N	S	C
H	O	T	E	L	R	E	C	R	E	A	T	I	O	N	Q	H	D	O
U	Y	E	V	•	G	S	E	G	D	U	J	A	I	L	O	O	•	L
R	R	L	I	L	A	W	Y	E	R	S	•	•	•	P	C	S	•	L
C	T	E	L	E	N	V	I	R	O	N	M	E	N	T	A	P	•	E
H	S	P	L	J	I	H	E	L	P	U	K	R	O	•	O	I	•	G
I	U	H	A	O	Z	L	E	T	S	A	W	R	A	•	B	T	•	E
G	D	O	G	B	A	L	•	E	L	•	S	N	Q	F	H	A	•	N
H	N	N	E	S	T	A	U	•	•	Y	R	A	R	B	I	L	•	E
W	I	E	D	O	I	M	S	T	N	A	R	U	A	T	S	E	R	M
A	•	A	W	P	O	S	T	O	F	F	I	C	E	B	A	N	K	E
Y	O	N	S	A	N	I	T	A	T	I	O	N	O	I	D	A	R	R
R	E	P	A	P	S	W	E	N	S	E	I	T	I	L	I	T	U	I
T	H	E	A	T	E	R	A	N	C	H	•	L	O	O	H	C	S	F
•	•	•	L	A	N	D	O	O	F	•	•	•	E	C	I	L	O	P

The following words are hidden in the puzzle:

Bank
BOAC
Church
Civic Organizations
College
Doctors
Environment
Farm
Firemen
Food
FHA
Help
Highway
Hospital
Hotel

Industry
Jail
Jobs
Judges
Lake
Land
Lawyers
Library
Mall
Museum
Newspaper
Organizations
Police
Post Office
Radio

Ranch
Recreation
Restaurants
Roads
Sanitation
School
Shop
Telephone
TV
Theater
Town
Utiliites
Vet
Village
Waste

1507

STUDENT WORKSHEET #2

Identifying Cooperating Groups and Organizations

- Youth Organizations

- Community Civic Groups

- Farm Organizations

- Church Groups

- Recreation Clubs and Organizations

- Business and Professional Groups

- Veterans Organizations

- Women's Clubs and Organizations

- Others

1506

STUDENT WORKSHEET #3

Community Needs Survey

1. What do you think are the important needs of our community? (List up to three.)

   a.

   b.

   c.

2. Can you suggest one or more projects or activities that will help to meet one or more of these needs?

   a.

   b.

   c.

3. Can you name local people who know about these needs?

   a.

   b.

   c.

4. Can you identify any groups and organizations that might help with any of these needs?

   a.

   b.

   c.

5. Do you have other comments or suggestions?

Thank you.

STUDENT WORKSHEET #4

The Involvement of Agriculturists in Government
Brainstorming Activity

Answer the following question by listing as many possible answers as you can come up with (5 minutes).

"Why should agriculturists become involved with community government and/or run for a political office?"

ERIC

UNIT F: Supervised Experience in Agriculture/Horticulture

PROBLEM AREAS:

1. Understanding the Structure and Purposes of SAE

2. Planning and Developing SAE Programs

3. Expanding my SAE

ERIC

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Understanding the Structure and Purposes of SAE

RELATED PROBLEM AREA(S):

1. Identifying Careers in Agriculture/Horticulture (Central Core Cluster)
2. Planning and Developing SAE Programs

PREREQUISITE PROBLEM AREA(S): None

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Language Arts. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with and asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

ERIC

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Associate: Edward W. Osborne, Ph.D.

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ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY | DISTRICT | ESC
District Name
City

I. LEARNING AREA *(check one)*
☒ Language Arts ☐ Fine Arts
☐ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to read, comprehend, interpret, evaluate, and use written material.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Locate information that is explicitly stated in the text.					
*2. Remember the information that is explicitly stated in the text and restate this information in their own words.					
*3. Summarize the important ideas of the text and the important supporting details.					
*4. Use, synthesize, and analyze information from a variety of sources to enhance understanding, e.g., form opinions based upon a variety of information, to compare/contrast, to verify information, and expand knowledge.					
*5. Explain and verify answers to questions about what has been read.					
1514					1515

ISBE 41-78 (1/86)

Submission Date ______

☐ Original submission ☐ Revision | Page ____ of ____

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

(Affix label or complete district information.)

COUNTY	DISTRICT	ESC

District Name

City

I. LEARNING AREA *(check one)*

☒ Language Arts
☐ Mathematics
☐ Sciences
☐ Fine Arts
☐ Social Sciences
☐ Physical Development/Health

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Phrase a problem and follow an agenda for a discussion.					
*2. Distinguish among propositions of fact, policy, and value.					
1516					
				1517	

ISBE 41-78 (1/86)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Understanding the Structure and Purposes of SAE

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Describe the need for supervised experience in agriculture.

2. Compare the major types of SAE programs and the components of each.

3. Describe the nature and purposes of SAE programs.

4. Explain the relationship of SAE programs to the total agricultural program.

5. Describe their responsibilities in planning and conducting an SAE program.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Understanding the Structure and Purposes of SAE

PROBLEMS AND QUESTIONS FOR STUDY

INSTRUCTOR'S NOTES AND REFERENCES

1. What is supervised experience in agriculture?
2. Why do I need supervised experience in agriculture?
3. What is an SAE program?
4. What are the types of SAE programs and how do they compare?
5. What are the components of SAE programs?
6. Why should I develop an SAE program?
7. What are the characteristics of a good SAE program?
8. How are SAE programs related to agricultural class and laboratory activities?
9. How will my SAE program relate to my FFA activities?
10. What groups of people might I work with in my SAE program?
11. What settings might provide opportunities for me to develop an SAE program?
12. When do I begin my SAE program?
13. How long do SAE programs last?
14. What should I try to accomplish with my SAE program?
15. What are my responsibilities with my SAE program?
16. What are the responsibilities of other groups with my SAE program?
17. How will my SAE program be evaluated by the teacher?

15:0

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Understanding the Structure and Purposes of SAE

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin the problem area with an interest approach. An effective strategy would be to stuff a record book full of play money, and while making a few introductory comments, let the money fall out of the book as you thumb through the pages. Then follow this up with specific questions to students about gaining experience, making money, and SAE programs.

2. Show students detailed descriptions of successful SAE programs conducted by current or past students. Use slides and/or videotape as much as possible.

3. Have each student interview recent graduates or older current students to find out how they developed and expanded their SAE program. Have students develop a draft of the interview questions for your review.

4. Show and discuss with students SAE programs that vary in type, setting, scope, and profitability.

5. Take the class on a field trip to observe selected SAE programs being conducted by current students.

6. Invite owners, operators, and/or workers in various agricultural occupations in the community to serve as resource persons in your class. Have them focus on the value of supervised experience in agriculture.

7. Invite students (current or former) with successful SAE programs to describe their programs to your class and answer students' questions. Vary the SAE programs represented in terms of type, setting, scope, and profitability.

8. Provide a variety of reference materials that students may use to read and seek answers to questions they may raise about SAE programs. Be sure that these references contain information about a variety of SAE programs in different agricultural areas.

9. Review recent issues of *The National Future Farmer* to collect feature articles on students' SAE programs. Share these articles with class members.

10. Show audio-visual materials that are designed to introduce students to SAE programs (see reference list).

11. Have each student individually brainstorm and describe possible sites where he or she could obtain supervised experience in agriculture. Conduct a class discussion of these ideas as they pertain to SAE programs.

12. Give students a pretest to determine their awareness of SAE programs (types and purposes).

13. Use a structured overview technique on the chalkboard or on a poster to outline the types of SAE programs and their components. Or better yet, have students develop a "map" of SAE program types and components while reviewing appropriate reference materials that you make available.

14. After students have considered SAE programs conducted by other students, have them work in pairs or small groups to develop a list of characteristics of good SAE programs.

15. Discuss with students the relationship between SAE programs and other components of the agricultural course.

16. Using reference materials you provide and the observed characteristics of other students' SAE programs, have students work in pairs or small groups to develop a list of their responsibilities in planning and conducting an SAE program.

17. Show and discuss transparencies T1 - T9, T21, and T22 from the *SOE Handbook*.

18. Have students read and study VAS Unit #7003 to identify possible solutions to problems and questions.

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Understanding the Structure and Purposes of SAE

REFERENCES

*1. *SOE Handbook.* (1982). National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

2. *New Student Handbook.* (1984). National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-10160. (703) 360-3600.

*3. *SOE Programs in Agriculture.* (VAS Unit #7003). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

4. *SOE Programs.* (A microcomputer program). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

5. *Exploring Supervised Occupational Experience Programs.* (VAS Slidefilm #F1112, or VAS Slideset #S1112). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

6. *SOE Brochure/Mini Poster.* National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

7. *Advisor's Guide to the Student Handbook.* National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

8. *Keeping America on the Grow.* (16mm film, slide show, or filmstrip). National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

9. *SOE Series.* (A set of five filmstrips). National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

10. *SOE — Bridging the Gap.* (1982). National FFA Center, 5632 Mt. Vernon Memorial Hwy., P.O. Box 15160, Alexandria, VA 22309-1060. (703) 360-3600. (Also available on a free loan basis from Vernard Films, Box 1332, Peoria, IL 61654).

11. *SOE Programs in Agriculture.* (1984). Binkley and Byers. The Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050.

*Indicates highly recommended references

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

TRANSPARENCY MASTER #1 — What is an SAE Program? (with discussion guide)

TRANSPARENCY MASTER #2 — Purpose of SAE Programs (with discussion guide)

TRANSPARENCY MASTER #3 — Which Option Looks Good to You?

TRANSPARENCY MASTER #4 — Characteristics of a Good SAE Program

TRANSPARENCY MASTER #5 — Structural Overview (with discussion guide)

TRANSPARENCY MASTER #6 — Student Responsibilities in Conducting SAE Programs

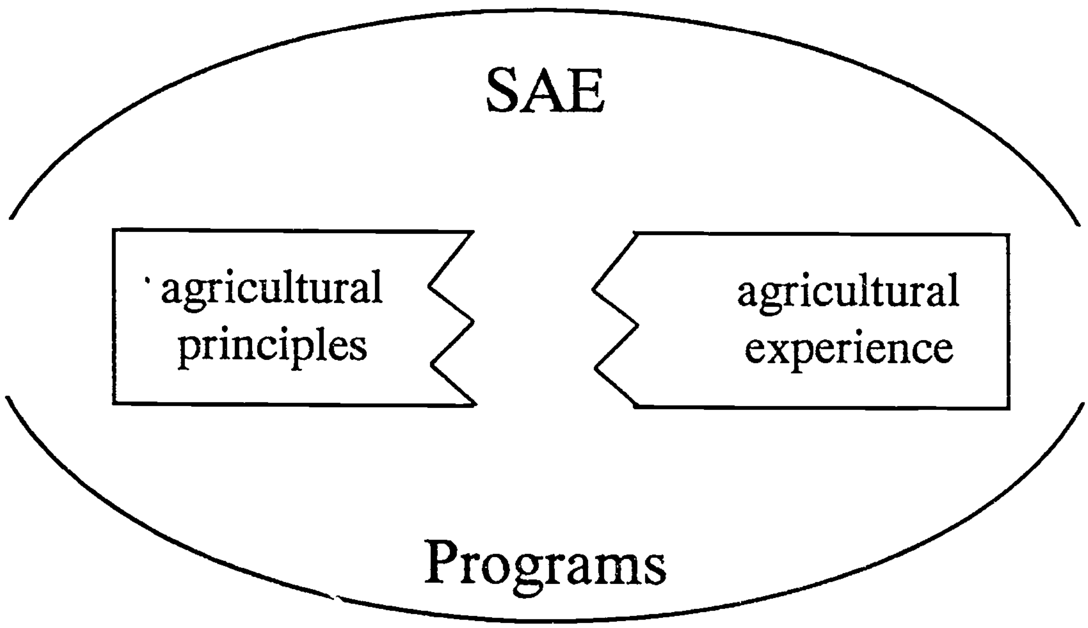
TRANSPARENCY MASTER #1

What is an SAE Program?

Supervised agricultural experience (SAE) programs consist of practical agricultural activities performed by students outside of scheduled classroom and laboratory time. During class and lab periods, students are taught related principles and practices in agriculture. The agricultural teacher, parents, and employer work together to help students gain valuable agricultural experience in their SAE programs.

TRANSPARENCY MASTER #2

Purpose of SAE Programs



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TRANSPARENCY MASTER #3

Which Option Looks Good to You?

SAE Program	General Work Experience	Freddie the Freeloader
1. Get experience in ag	Get experience in whatever	Get no experience
2. Get paid for work you enjoy	Do a job, get a paycheck	Have no bucks
3. Have a planned work experience	Go with the flow	Have no plan
4. Have a variety of job activities	Do the same old thing, day after day	Kill time
5. Obtain long-term experience	Work today, get fired tomorrow	Loaf today, forget about tomorrow
6. Gain valuable experience	Have just a job	Have no experience, no skills, no job, (no money)
7. Receive help/ training	Use trial and error	Do nothing, so no help is needed
8. Discover your interests and talents	Become an expert burger flipper	Watch TV and videos
9. Make opportunities for yourself	Follow the leader	Drop out of the race, watch others succeed

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TRANSPARENCY MASTER #4

Characteristics of a Good SAE Program

1. Based upon the student's interests

2. Has an agricultural focus

3. Provides for the development of a large number of abilities

4. Sufficient in scope to be challenging

5. Contains diversity

6. Provides an opportunity to make management decisions

7. Has the potential for profit

8. Requires student's involvement most of the year

9. Provides opportunities for expansion

10. Can lead to future business ownership or employment in agriculture

TRANSPARENCY MASTER #5

Structural Overview

SAE Programs

Types

- ownership
  - ag business
  - production
- placement
  - farm
  - ag business
- DLE
  - school
  - community

Components

- ownership, placement, and/or DLE improvement projects
- supplementary skills
- exploratory experience

Settings

- agribusiness
- horticultural business
- farms
- other agricultural businesses

Groups

- parents
- teacher
- employer
- student

Student Role

- sole owner
- partner
- corporate owner
- employee

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TRANSPARENCY MASTER #6

Student Responsibilities in Conducting SAE Programs

1. Consider the possibilities.
2. Keep teacher, parents, and employers informed.
3. Set goals for yourself.
4. Keep records of financial concerns and experiences gained.
5. Seek advice/assistance from your teacher.
6. Meet financial obligations.
7. Carry out your SAE program plan.
8. Self-evaluate your progress.
9. Develop an SAE program that will be valuable to you.
10. Give it your best shot!

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ERIC

TRANSPARENCY MASTER DISCUSSION GUIDES

Transparency Master #1

1. Have students identify the key words in this definition, including:

   supervised
   experience
   program
   practical
   agricultural
   students
   outside of scheduled class and lab time
   work together to help
   valuable

2. Discuss several examples of SAE programs to illustrate the significance/meaning of these key words.

Transparency Master #2

1. Agricultural principles are examined/discovered through classroom and lab activities.

2. SAE programs serve as an extended lab to allow students to apply agricultural principles in real settings. Supervised experience in agriculture should clarify understanding of principles.

3. Discuss examples of how principles might be applied in SAE programs (e.g., maintaining soil fertility, pH, etc.)

Transparency Master #5

1. Give students an example of a structured overview on another topic (plant propagation, fertilizers, livestock terms, etc.). Discuss the procedure for building a structured overview.

2. Have students build a structured overview of a familiar, more concrete topic.

3. After reading and studying selected references, have students develop a structured overview for SAE programs. You may want to provide a few key terms to help them get started. When finished, ask students to explain their versions and discuss. Pass out copies of this structured overview with the modifications that you make.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — SAE Programs Pretest

STUDENT WORKSHEET #2 — SAE Quiz Bowl

For additional activities, teachers may refer to the "Suggested Teaching Activites and Procedures" section in the Instructor's Guide

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STUDENT WORKSHEET #1

SAE Programs Pretest

Directions: Let's see how much you already know about SAE programs. Answer each of the following questions by circling the correct answer.

T	F	1.	"SAE" stands for "Students Acquiring Experience."
T	F	2.	SAE programs must deal with some phase of agriculture.
T	F	3.	SAE programs must include paid work experience.
T	F	4.	SAE programs usually begin in the summer months.
T	F	5.	SAE programs must include livestock or crop production activities.
T	F	6.	Students can conduct SAE programs at home, at school, or in the community.
T	F	7.	Group projects are not suitable for SAE programs.
T	F	8.	The primary purpose of SAE programs is to enable students to earn money.
T	F	9.	SAE programs serve as the basis for many FFA awards.
T	F	10.	Students may include several different projects within their SAE program during the year.

STUDENT WORKSHEET #1 — Key

SAE Programs Pretest

Directions: Let's see how much you already know about SAE programs. Answer each of the following questions by circling the correct answer.

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T	F	2.	SAE programs must deal with some phase of agriculture.
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T	F	8.	The primary purpose of SAE programs is to enable students to earn money.
T	F	9.	SAE programs serve as the basis for many FFA awards.
T	F	10.	Students may include several different projects within their SAE program during the year.

STUDENT WORKSHEET #2

SAE Quiz Bowl

Directions: This game can be used near the end of study in this problem area. To play, divide class into teams of three players each. The teacher can serve as the game show host. Draw for playing positions (1, 2, 3, etc.). Begin play by pulling a question from the question bank (use a bag, box, or computer program) and posing to the appropriate team. A timekeeper and scorekeeper should be designated. Teams earn 20 points for each correct answer and 50 points on bonus questions when the correct answer is given. Each team has 10 seconds to answer, with time beginning after the question has been asked. Team members may discuss the question before offering an answer, if they desire. Play continues until each team has been presented with five questions. A bonus round is then played, where each team is asked one question, worth 50 points. Small prizes (FFA pencils, etc.) may be awarded to members of the winning team.

During the game, make note of missed questions. After the game offer further examples and discussion to clarify correct answers.

Sample questions are listed below. More questions can be added as needed.

Game Questions:

1. What groups of people help the student in conducting an SAE program?
2. John works at Mitchell's Nursery and receives $3.50/hour. What type of SAE program does John have?
3. Dana contracts with local residents for landscape installation and maintenance. What type of SAE program does she have?
4. During what month do SAE programs generally begin?
5. How many months during the year should SAE programs last?
6. Can two students work together for their SAE program?
7. What is an improvement project?
8. Gary spends a week observing the operations and activity of a soil testing service. What type of SAE is this?
9. What is the purpose of SAE programs?
10. How do ownership and placement SAE programs differ (give 2 differences)?
11. What are two types of ownership programs?
12. Can directed laboratory SAE programs be ownership or placement programs?
13. With a directed laboratory SAE program, who usually provides the capital?
14. Who assumes the risks in an ownership SAE program that involves a group project?
15. With what types of SAE programs would an employer be involved?
16. Whitney works for a seed corn company as her SAE but also helped prune her neighbor's fruit trees. In her SOE program, the pruning experience would be called ______________ ?
17. Give three examples of improvement projects.
18. What are three different types of ownership SAE programs that a student may have?
19. Who decides what type of SAE program that a student will have?
20. Are SAE programs designed more for individual students or groups of students?

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Planning and Developing SAE Programs

RELATED PROBLEM AREAS(S):

1. Gaining Employment in an Agricultural Occupation
2. Developing Safe Work Habits in Agricultural Occupations
3. Keeping and Using Records in Agricultural Occupations
4. Understanding the Structure and Purposes of SAE
5. Managing Entrepreneurship Opportunities in Agriculture (Agricultural Business and Management Cluster)

PREREQUISITE PROBLEM AREA(S):

1. Understanding the Structure and Purposes of SAE

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Mathematics. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Associate: Edward W. Osborne, Ph.D.

ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

I. LEARNING AREA *(check one)*
☐ Language Arts
☒ Mathematics
☐ Sciences
☐ Fine Arts
☐ Social Sciences
☐ Physical Development/Health

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to perform the computations of addition, subtraction, multiplication, and division using whole numbers, integers, fractions, and decimals.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know the whole number quotient and remainder resulting from the division of two whole numbers on a calculator.					
*2. Translate word problem situations to mathematical expressions or sentences.					
*3. Use computational and problem-solving skills in real-life situations with or without a calculator as appropriate.					
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ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

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Submission Date ____________

☐ Original submission ☐ Revision

Page ____ of ____

I. LEARNING AREA *(check one)*

☐ Language Arts
☒ Mathematics
☐ Sciences
☐ Fine Arts
☐ Social Sciences
☐ Physical Development/Health

(Affix label or complete district information.)

COUNTY ___ DISTRICT ___ ESC ___

District Name

City

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to understand and use ratios and percentages.

Contact Person: ____________
Title: ____________
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Solve problems involving percent of increase, percent of decrease, mark-up, and inflation.					
*2. Apply ratios and proportions in real-life situations.					
*3. Apply rates and percents in real-life situations.					
1539					1540

ISBE 41-78 (1/88)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY | DISTRICT | ESC

District Name

City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to identify and analyze and solve problems using algebraic equations, inequalities, functions, and their graphs.

Contact Person: ______
Title: ______
Phone: (   )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 11 students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know the slope determined by two points or analyze graphs.					
1541					1542

ISBE 41-78 (1/88)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Planning and Developing SAE Programs

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Select one or more career interest areas in agriculture.
2. Identify school, community and home resources/ opportunities for conducting SAE programs.
3. Describe local guidelines for scope and nature of SAE programs.
4. Write a personal annual and long-range SAE program plan.
5. Discuss the potential value of their selected SAE program for their personal and career development.
6. Activate their SAE program plans.
7. Explain the types of financial records needed to support their chosen SAE programs.
8. Keep appropriate records on their SAE program activities.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Planning and Developing SAE Programs

PROBLEMS AND QUESTIONS FOR STUDY

1. What area(s) of agriculture should I select for my SAE program?
2. What opportunities do I have for developing an SAE program?
3. What kind of SAE program should I try to conduct in terms of size and type?
4. How do I plan my SAE program?
5. How do I implement my SAE program plan?
6. What types of records should I keep?
7. Why are records needed?
8. What uses will I make of my SAE program?
9. What are some "approved practices" in keeping records on my SAE program?
10. How do I keep records on my SAE program?
11. What types of SAE programs can be conducted on school grounds?
12. Why are training plans and agreements needed for my SAE program?
13. How should my parents and other people be involved in planning and developing my SAE program?
14. What are some ways that I can finance my SAE program?
15. How do I develop a budget for my SAE program? Why is a budget needed?

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: Central Core

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Planning and Developing SAE Programs

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin this problem area with a provocative interest approach — one that will challenge the students to think about a relevant problem. For example, ask students to individually write out a plan for their SAE program, without providing instruction as to how such a plan should be developed. Respond to questions in a supportive way, without revealing answers. After a few minutes, students will feel a need to know more before they can proceed with planning and developing their own SAE program. Another effective interest approach would involve the teacher role-playing a student, with the students telling the teacher how to plan an SAE program. The financial advantages of planning could also be illustrated in an interest approach.

2. Discuss the case studies contained in the *SOE Handbook*, pages 14-16.

3. Have each student complete the "Personal Resource Inventory" contained in VAS Unit 7003. Discuss potential resources for SAE programs with each student on a one-to-one basis. Make a photocopy of each student's inventory for office records. Take the inventory with you during SAE supervisory visits.

4. Before students start to plan their own SAE program, divide them into small groups and have them develop SAE program plans for hypothetical cases. (See Student Worksheet #3.)

5. Have students read and study VAS Unit 7003 and other resources you may provide to identify tentative answers to their problems and questions.

6. After presenting an interest approach, have students identify questions they have about planning and developing SAE programs. Use the list of "Problems and Questions for Study" contained in this problem area to "round out" the students' list.

7. Discuss examples of past students whose SAE programs were very successful due to good planning, or very unsuccessful due to poor planning.

8. Cite examples from business that illustrate the need/value of good planning for business activities.

9. Use the analogy of holding an FFA banquet to illustrate the importance of planning to project success.

10. Use the example of landscaping a home to illustrate the need for long-range planning. Contrast the results of a well-planned and poorly planned landscape.

11. Other examples may be used to illustrate the need for and nature of planning, such as buying a car, going on a date, starting a small business, and taking a trip.

12. Have each student develop a personal annual and long-range SAE program plan.

13. Conduct SAE supervisory visits to talk to parents to gain their support in helping students plan their SAE programs.

14. Construct a bulletin board (have students help) that illustrates the variety and types of SAE programs conducted by current and former students.

15. Show copies of SAE program plans (annual and long range) from selected SAE programs of current or former students.

16. Show and discuss selected transparencies from the *SOE Handbook* (TM9 -TM18, TM21 - TM24).

INSTRUCTOR'S GUIDE

CLUSTER: Central Core

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Planning and Developing SAE Programs

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES (con't.)

17. Use a progress chart to map the progress of students toward planning and developing their SAE programs. (See Appendix B of the *SOE Handbook*.)

18. Use an SAE program point award system to encourage students to plan and conduct a complete SAE program. (See appendix D of the *SOE Handbook* for an example.)

19. After students have identified their career interest area(s) and possible occupations, have them develop and/or review a list of competencies that people working in these areas would need to possess.

20. Have each student interview one or two people in the community that work in an area of agriculture related to the student's SAE program interests. Students should prepare a brief paper describing the results of the interview.

21. Show students record books kept by selected former students to provide a model for them to follow. Examples of poor record books may also be used to help students understand the desired standard. (Names should be removed from record books before using in class.)

22. Teach all students how to complete the various record books. Focus on principles or common aspects of the various books to make this activity less time consuming. Use sample record book entry problems available from commercial distributors. Also see "Record Book Entry Case Study."

23. Provide special incentives to students to encourage them to keep good records on their SAE programs. Some examples include (1) recognizing the best record book each grading period for each class, (2) providing an extra privilege to all students in each class who meet the accepted standard for SAE program activity and record book quality during each grading period (see Transparency Master #8).

24. After students have developed their own long-range plans, divide the students into groups of three or four and have students critique one another's plans. Challenge them to make positive revisions as a result of the group critiques.

25. Discuss the sample projected budgets (See Transparency Masters #5 and #6) contained in this problem area. Have students develop projected budgets for various SAE programs as a small group activity. See official record books for possible budget outlines.

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Planning and Developing SAE Programs

REFERENCES

*1. *SOE Programs in Agriculture.* (VAS Unit #7003). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*2. *SOE Handbook* (1982). National FFA Center, 5632 Mt. Vernon Highway, P. O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

*3. SOE Record Books. Vocational Agriculture Service, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871. Also available from: The Interstate Printers and Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050.

4. *SOE Programs in Agriculture* (1984). Binkley and Byers. The Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050.

5. *Supervised Occupational Experience Manual for Students of Vocational Agriculture.* Carwin, M. A. The Interstate Printers and Publishers, Inc., P. O. Box 50, Danville, IL 61834-0050.

*6. "Practice Problem" for use with *Records of My Supervised Experience Program.* (Q358, key K358). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*7. *Record Keeping Problem for Agribusiness Placement* (Q398, key K398). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

8. "Practice Problem" for use with *Fruit or Vegetable Production Record Book.* (Q602, key K602). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

*9. *Record Book Student Problems* (For basic, ownership, and placement programs; includes problems, keys, and transparency masters.) National FFA Center, 5632 Mt. Vernon Highway, P. O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

10. *Agricultural Economics.* (CP105). (Computer programs that include crop and livestock budgets). Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (217) 333-3871.

11. *Financial Independence.* (A free annual magazine containing creative business ownership ideas.) Financial Independence, P.O. Box 3395, Champaign, IL 61826-3395.

*Indicates highly recommended reference

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

INFORMATION SHEET #1 — SAE Program Long-Range Plan

TRANSPARENCY MASTER #1 — Steps in Planning Your SAE Program

TRANSPARENCY MASTER #2 — Guidelines for Planning Your SAE Program

TRANSPARENCY MASTER #3 — SAE Program Long-Range Plan

TRANSPARENCY MASTER #4 — Parts of an Annual SAE Program Plan

TRANSPARENCY MASTER #5 — SAE Program Projected Budget (Year 1)

TRANSPARENCY MASTER #6 — SAE Program Projected Budget (Year 2)

TRANSPARENCY MASTER #7 — Why Keep Records on Your SAE Program?

TRANSPARENCY MASTER #8 — Standards for Keeping Records on Your SAE Program

INFORMATION SHEET #1

SAE Program Long-Range Plan

SAMPLE

Date ______________________________

School ______________________________

City or Town ______________________________

Agricultural Career Interest Areas:

1. agribusiness sales
2. tree fruit production
3.

Nonagricultural Career Interest Area:

1. business/sales
2. carpentry work

Major Experiences to be Gained to Support Agricultural Career Interest Areas

Experiences	*IP or SAE	Year to Achieve
Agribusiness Sales		
1. working with customers	SAE	2-4
2. sales techniques	IP, SAE	2-4
3. increasing product knowledge	IP, SAE	2
4. handling customer inquiries	IP, SAE	3
5. servicing products	SAE	3, 4
6. handling customer complaints	IP, SAE	3, 4
7. keeping business records	IP, SAE	3, 4
8. taking inventory	IP, SAE	4
9. identifying business functions	IP, SAE	1, 2
10. observing business operations	SAE	1, 2
Tree Fruit Production		
1. selecting varieties	IP, SAE	1-4
2. controlling diseases	IP, SAE	1-4
3. controlling insects and pests	SAE	2-4
4. growing nursery stock	SAE	3, 4
5. transplanting	IP, SAE	1, 2

ERIC Full Text Provided by ERIC

Experiences (cont'd.)	*IP or SAE	Year to Achieve
Tree Fruit Production (cont'd.)		
6. pruning	IP, SAE	1-4
7. harvesting	SAE	2-4
8. fertilizing	IP, SAE	1-4
9. storing and packaging	SAE	2-4
10. marketing	IP, SAE	3
11. mantaining tree condition	SAE	2-4
12. maintaining fruit quality	IP, SAE	2-4

* IP = instructional program (class and lab instruction)

SAE Projects and Activities*

Year	Ownership	Placement	Improvement Projects	Supplementary Skills
First	• 6 dwarf apple and cherry trees at home	• observation experiences in selected agribusinesses	• prune fruit trees for neighbors • develop a spraying schedule	• sharpen tools • adjust sprayer • plant strawberries
Second	• fruit trees at home • 1/4-acre apple and peach orchard at school	• Anderson Orchards • observation experiences in selected businesses	• rebuild display stand • improve condition and appearance of school orchard	• feed cattle • build livestock fence and gate
Third	• school orchard • 5-acre orchard	• Anderson Orchards	• develop computer records system • develop a marketing plan	• thatch lawn • install landscape materials
Fourth	• school orchard • 10-acre orchard	• Anderson Orchards	• build a cold storage facility • use mechanized equipment	• replace wiring in storage building • service tractor

*List specific projects, experiences, placement sites, etc. DREAM!! What would you *really* like to be able to do in your SAE program?

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TRANSPARENCY MASTER #1

Steps in Planning Your SAE Program

1. Identify one or more career interest areas in agriculture.

2. Review the job activities and responsibilities of people working in your career interest area(s).

3. Complete an SAE program resource inventory to identify possible settings for your SAE program.

4. Select the type(s) of SAE programs that you would like to pursue.

5. Determine what experiences will be completed in each phase of your SAE program.

6. Develop a long-range plan for your SAE program.

7. Develop the first year (annual) plan.

8. Replan the SAE program on a regular basis.

TRANSPARENCY MASTER #2

Guidelines for Planning Your SAE Program

1. Plan for year-round experiences.

2. Include ownership and/or placement projects either at home, school, or in the community.

3. Identify a number of improvement projects and supplementary skills for the year. Gain additional experiences as the opportunity arises.

4. Develop a tentative budget for ownership projects.

5. Plan ownership projects so that some profit is likely.

6. Carefully consider all the possible settings/ locations where you can gain desired experiences.

TRANSPARENCY MASTER #2

Guidelines for Planning Your SAE Program (cont'd.)

7. Discuss your SAE program plan with your parents/guardian.

8. Plan the scope of your SAE program so that you will at least earn enough profit to qualify for advanced FFA degrees and proficiency awards.

9. Provide for a variety of activities and experiences.

10. Increase the scope of your SAE program each year.

11. Plan your SAE program so that experiences gained support your career interest areas in agriculture.

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TRANSPARENCY MASTER #3

SAE Program Long-Range Plan

Date ______________________________

School ______________________________

City or Town ______________________________

Agricultural Career Interest Areas:

1. ______________________________
2. ______________________________
3. ______________________________

Nonagricultural Career Interest Area:

1. ______________________________
2. ______________________________

Major Experiences to be Gained to Support Agricultural Career Interest Areas

Experiences	*IP or SAE	Year to Achieve

*List specific projects, experiences, placement sites, etc. DREAM!! What would you *really* like to be able to do in your SAE program?

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TRANSPARENCY MASTER #3 (con't.)

SAE Projects and Activities*

Year	Ownership	Placement	Improvement Projects	Supplementary Skills
First				
Second				
Third				
Fourth				

*List specific projects, experiences, placement sites, etc. DREAM!! What would you *really* like to be able to do in your SAE program?

TRANSPARENCY MASTER #4

Parts of an Annual SAE Program Plan

1. The calendar year for which the plan is developed

2. Description of ownership projects—include size or scope, location, nature of business or enterprise, partners (if any), marketing (if applicable), facilities needed, and months involved

3. Description of placement projects—include location(s), beginning and ending dates, projected pay

4. A tentative budget showing expected income and receipts

5. Description of improvement projects—include specific activities involved in each project, estimated hours of labor, and estimated cost

6. List of supplementary skills that you hope to obtain—indicate where this experience will be gained

TRANSPARENCY MASTER #5

SAE Program Projected Budget (Year 1)

19___

Name ________________ Year 1 2 3 4
(circle one)

Expenses

Item	Amount
1. apple and cherry trees (6)	$100.00
2. materials to stake trees	15.00
3. hand sprayer	15.00
4. tool purchases	25.00
TOTAL	$155.00

Income

Item	Amount
1. work at school orchard (35 hrs.)	$122.50
2. sale of apples (6 bu.)	70.00
3. miscellaneous work in tree care and landscaping for others	125.00
TOTAL	$317.50

Estimated profit or loss +$162.50

TRANSPARENCY MASTER #6

SAE Program Projected Budget (Year 2)

19___

Name ________________ Year 1 2 3 4 (circle one)

Expenses

Item	Amount
1. purchase of tools	$35.00
2. tree care materials	25.00
3. fruit containers	5.00
4. miscellaneous expenses	20.00
TOTAL	$85.00

Income

Item	Amount
1. sale of apples (12 bu.)	$144.00
2. sale of cherries (10 lbs.)	10.00
3. work at school orchard (50 hrs.)	175.00
4. work at Andersons (200 hrs.)	700.00
5. miscellaneous income	50.00
TOTAL	$1079.00

Estimated Profit or Loss +$994.00

TRANSPARENCY MASTER #7

Why Keep Records on Your SAE Program?

1. To analyze cash flow
2. To stimulate better money management
3. To determine profit or loss of enterprise
4. To observe financial progress over several years
5. To provide a basis for sound management decisions
6. To guide investment and purchasing activity
7. To provide evidence needed for FFA awards and degree programs
8. To furnish information for income tax returns

TRANSPARENCY MASTER #8

Standards for Keeping Records on Your SAE Program

1. Use the appropriate record book for each phase of your SAE program.

2. Use a pencil for entries.

3. Keep records on a calendar year basis (January 1—December 31).

4. Make sure entries are neat, complete, and easy to read.

5. Enter expenses and income as they occur.

6. Review your record book every week to make sure all entries are up to date (including improvement projects, supplementary skills, awards, credits, debits, etc.)

7. Keep your record book in an accessible, protected place.

8. Complete all relevant pages in your record book.

9. Ask your teacher for help as you need it.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — SAE Program Long-Range Plan

STUDENT WORKSHEET #2 — Interviewing Business Owners and Workers in Agriculture

STUDENT WORKSHEET #3 — Case studies for Developing SAE Program Plans (with possible solutions)

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET # 1

SAE Program Long-Range Plan

Date ______________________________

School ______________________________

City or Town ______________________________

Agricultural Career Interest Areas:

1. ______________________________
2. ______________________________
3. ______________________________

Nonagricultural Career Interest Area:

1. ______________________________
2. ______________________________

Major Experiences to be Gained to Support Agricultural Career Interest Areas

Experiences	*IP or SAE	Year to Achieve

* IP = instructional program (class and lab instruction)

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SAE Projects and Activities*

Year	Ownership	Placement	Improvement Projects	Supplementary Skills
First				
Second				
Third				
Fourth				

*List specific projects, experiences, placement sites, etc. DREAM!! What would you *really* like to be able to do in your SAE program?

ERIC

STUDENT WORKSHEET #2

Interviewing Business Owners and Workers in Agriculture

Student's Name ____________________________________

Agricultural Career Interest Areas:

1.

2.

3.

Individuals that you would like to interview:

	Name	Position	Agricultural Business Name or Location
1.			
2.			
3.			
4.			
5.			

Questions That May Be Asked During the Interview

1. What are your day-to-day job responsibilities?
2. How does your business operate in terms of inputs and outputs?
3. What qualifications are needed to work in a position such as yours?
4. What are the sources of employees for your business?
5. Does the supply of qualified employees meet the demand?
6. What are the positive and negative aspects of a position such as yours?
7. What experiences or competencies should a person have who works in a position such as yours?
8. What other positions lead to and lead from a position such as yours?
9. What is the approximate salary range for beginning employees in related positions?
10. How does this agricultural business or industry fit into the total agricultural industry (the overall food and fiber system)?

Other Questions

1.

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2.

3.

STUDENT WORKSHEET #3

Case Studies for Developing SAE Program Plans

Case 1 — Whitney Williams

Whitney is a sophomore enrolled in her first agricultural course. She lives with her parents on four acres of land. Her agricultural career interest areas include animal science, agricultural education, and small animal care. Two 10' x 15' storage sheds are located on the four acres. Whitney would like to plan an SAE program that involves several ownership projects, if possible. She would also like to start a placement program in a related area next year.

Assume that Whitney is a student at your high school and lives in your community. What kind of SAE program could she possibly develop during the next three years?

Case 2 — Susie Matthews

Susie is a freshman enrolled in her first agricultural course. She lives on a 200-acre livestock and grain farm. While she enjoys field crop production activities, she also has a growing interest in vegetable crop production. Her career interest areas in agriculture include agronomy and horticulture. Susie would like to develop several ownership projects for her SAE program that she can expand each year.

What kind of SAE program could Susie possibly develop during the next four years?

Case 3 — Gary Amherst

Gary is a junior enrolled in his first agricultural course. He lives in town with his parents. His agricultural career interest areas include agricultural mechanics and agribusiness. His parents have a small workshop in their home garage, and Gary has also spent some time doing general farm work for several neighbors. He hopes to attend a postsecondary school to study agricultural mechanization and eventually manage his own business.

Assume Gary is a student in your school and lives in your community. What kind of SAE program could he develop over the next two years?

Possible Solutions for SAE Case Studies

Case 1 — Whitney Williams

Whitney could begin her SAE program with several small animal ownership projects. The two storage sheds could be modified to provide housing for rabbits, quail, poultry, or similar animal enterprises. Since very little space is needed for these projects, specialty crops (asparagus/rhubarb, etc.) could also be grown and sold for profit. Her placement experience should involve working with large and/or small animals. Possible settings include farms, veterinarians, kennels, and others. Improvement projects and supplementary skills should also be identified.

Case 2 — Susie Matthews

Since Susie has plenty of land resources available, she can easily initiate and expand a number of field and vegetable crop production enterprises. Her field crop enterprises should probably support the livestock already on the farm. A variety of vegetable crops could be grown, such as cucumbers, sweet corn, tomatoes, squash, or green beans. In addition, she may want to explore several types of small fruit plantings (berries, etc.). The potential market would need to be carefully considered before selecting specific vegetables or fruits to grow. Improvement projects and supplementary skills should also be identified.

Case 3 — Gary Amherst

Gary may want to begin his SAE program with some exploratory or observational experiences in a number of agricultural businesses. The logical SAE program for Gary is placement in an implement dealership, service or repair business, or something similar. The experiences he obtains during this placement should progress toward the managerial aspects of operating such a business, with an annual increase in hours worked. Gary could also be placed at the school in a directed laboratory SAE program. He and the agricultural teacher would determine job responsibilities, pay, working, hours, etc. Appropriate improvement projects and supplementary skills should also be identified.

1585

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Expanding My SAE

RELATED PROBLEM AREA(S):

1. Planning and Developing SAE Programs
2. Managing Entrepreneurship Opportunities in Agriculture (Agribusiness Operation and Management Cluster)
3. Developing Problem Solving Skills in Agriculture

PREREQUISITE PROBLEM AREA(S):

1. Understanding the Structure and Purposes of SAE
2. Planning and Developing SAE Programs

LEVEL: Preparatory

OCCUPATIONAL TASKS ADDRESSED: None

STATE GOALS FOR LEARNING:

In planning the instruction for this problem area, teachers can promote the development of several student learning objectives which are related to the State Goals for Learning in Math and Language Arts. These objectives are listed on the Learning Assessment Plan forms included on the following page(s). Those learning objectives marked with an asterisk (*) are taken from the sample lists provided by the Illinois State Board of Education.

Illinois Agricultural Core Curriculum

Agricultural Education 124 Mumford Hall 1301 W. Gregory Drive University of Illinois Urbana, IL 61801

Directors: Dale A. Law, Ed.D.
Principal Investigator: Jerry D. Pepple, Ed.D.
Research Associate: Edward W. Osborne, Ph.D.

88/89

ERIC

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ____
☐ Original submission ☐ Revision

Page ____ of ____

(Affix label or complete district information.)

COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐

District Name

City

I. LEARNING AREA *(check one)*

☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to perform the computations of addition, subtraction, multiplication, and division using whole numbers, integers, fractions, and decimals.

Contact Person: ____
Title: ____
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Balance a checkbook.					
1568					1569

ISBE 41-78 (1/86)

ILLINOIS STATE BOARD OF EDUCATION
Department of School Improvement Services
100 North First Street
Springfield, Illinois 62777-0001

LEARNING ASSESSMENT PLAN

Instructions and codes for this form are provided on a separate sheet.

Submission Date ______
☐ Original submission ☐ Revision
Page ____ of ____

(Affix label or complete district information.)
COUNTY ☐☐☐ DISTRICT ☐☐☐☐ ESC ☐☐
District Name
City

I. LEARNING AREA *(check one)*
☐ Language Arts ☐ Fine Arts
☒ Mathematics ☐ Social Sciences
☐ Sciences ☐ Physical Development/Health

II. STATE GOAL FOR LEARNING

As a result of their schooling, students will be able to use mathematics skills to estimate, approximate, and predict outcomes, and to judge reasonableness of results.

Contact Person: ______
Title: ______
Phone: ( )

III. LEARNING OBJECTIVES	IV. ASSESSMENT				V. EXPECTATIONS
By the end of grade *(circle one)* 3 6 8 (11) students should be able to:	A Types	B Validity/ Reliability	C Commercial Test(s)	D Evidence of Nondiscrimination	Percent of Students Expected to Achieve Objective
*1. Know whether enough information is presented to arrive at a conclusion.					
*2. Know appropriate justification for a given conclusion.					
1570					1571

ISBE 41-78 (1/86)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Expanding My SAE

STUDENT LEARNING OBJECTIVES

Upon completion of their study of this problem area, students will be able to:

1. Summarize and analyze their SAE program records.
2. Evaluate the costs and benefits of each major component of their SAE program.
3. Evaluate the overall quality and value of their current SAE program.
4. Revise the long range plan for their SAE program on an annual basis.
5. Identify the "problems" or weaknesses in their current SAE program and select possible short range and long range solutions.
6. Make appropriate decisions on expanding and/or diversifying their SAE program.

INSTRUCTOR'S NOTES AND REFERENCES

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Expanding My SAE

PROBLEMS AND QUESTIONS FOR STUDY

1. Why should I summarize my SAE program records?
2. How can I use records to improve/expand my SAE program?
3. What financial information is needed for summarizing my SAE program records?
4. What key summary figures are needed to help me analyze the financial aspects of my SAE program?
5. How do I estimate the efficiency of productive enterprises?
6. What factors should I use to evaluate the quality and value of my total SAE program and its major components?
7. How can I use a records summary to make decisions about revising and/or expanding my SAE program?
8. Why should I try to expand my SAE program from year to year?
9. How can I expand and/or diversify my SAE program?

INSTRUCTOR'S NOTES AND REFERENCES

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INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Expanding My SAE

SUGGESTED TEACHING ACTIVITIES AND PROCEDURES

1. Begin this problem area with an interest approach that causes students to feel a need to gain more information about expanding their SAE programs. For example, have each student write responses on paper to these questions: (1) Should you double your SAE program scope next year? (2) How can you expand your current SAE program? (3) How much will it cost to expand your SAE in this way?

2. Provide several actual examples from among former students and others of how their SAE programs expanded from year to year. Select cases that vary in terms of SAE type, scope, and challenge to the student.

3. Prepare a slide show that depicts the expansion of several current or former students' SAE programs.

4. Invite a former student to speak to your class about how he or she developed and expanded his or her SAE program. Have this guest emphasize how expansion opportunities were identified and chosen. Stress the connection of SAE program expansion to financial records analysis and budget projections.

5. Invite a successful local business person to speak to the class on expanding businesses — ways to expand, the need for expansion, determining when and how to expand, and the risks of expansion.

6. Have students summarize their own SAE program record books.

7. Have each student complete Student Worksheet #1.

8. Plan individual conferences with students to discuss their SAE summary data and analysis and expansion possibilities. These conferences could be held at school or during supervisory visits.

9. Have students discuss Student Worksheet #4 to determine how those SAE programs should be expanded. Divide class into small groups of 3-5 students for this activity. Have each group make an oral report to the class on their decisions and reasoning.

10. Have students play the SAE Game included in this problem area. Use this game as a teaching activity to highlight and discuss the important practices in developing and expanding SAE programs and agricultural businesses.

11. Prepare an annual summary of SAE programs conducted by your students. Have students help in collecting, summarizing, and interpreting the summary results. Use a computer (with students' help) to prepare the summary. Share a copy with school administrators.

12. Encourage (and assist) students to set specific goals for conducting and expanding their SAE programs. Use Student Worksheet #3 included in this problem area.

13. Review teaching plans D and E in the *SOE Handbook* for ideas and activities for teaching students to analyze and expand their SAE programs.

14. Show and discuss selected transparencies from the *SOE Handbook.* (Transparency Masters #17 - #20)

15. Make transparencies of selected pages of SAE record books (e.g., financial statement, enterprise analysis). Provide sample figures for students to use in calculating efficiency factors and analyzing SAE programs.

16. Have students revise their long-term SAE program plan to reflect decisions made about expanding their SAE. Also have students then complete a more detailed annual plan for the upcoming year. (See the problem area *Planning and Developing SAE Programs.*)

INSTRUCTOR'S GUIDE

CLUSTER: CENTRAL CORE

UNIT: Supervised Experience in Agriculture/Horticulture

PROBLEM AREA: Expanding my SAE

REFERENCES

INSTRUCTOR'S NOTES AND REFERENCES

*1. *SOE Handbook.* (1982). National FFA Center, 5632 Mt. Vernon Hwy., P.O. Box 15160, Alexandria, VA 22309-0160. (703) 360-3600.

2. *Standards for Measures of Efficiency.* Cat. No. Z354. Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801. (214) 333-3871.

3. *Checklist for Going Into Business.* U.S. Small Business Administration, Office of Business Development, 1441 L Street, NW, Washington, DC 20416. (800) 368-5855.

*4. *The Creative Young Entrepreneur.* (1988). Doster, Hamilton, Connelly. The Three Entrepreneurs, 111 Circle Lane, West Lafayette, IN 47906.

*Indicates highly recommended reference

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INSTRUCTIONAL RESOURCES

These resources are intended for use by teachers in planning and teaching the materials for this problem area and may be adapted to fit the teaching method(s) used.

TRANSPARENCY MASTER #1 — Factors to Consider in Expanding Your SAE Program

TRANSPARENCY MASTER #2 — Ownership Programs Can Be Expanded By Increasing . . .

TRANSPARENCY MASTER #3 — Placement Programs Can Be Expanded By Increasing . . .

TRANSPARENCY MASTER #1

Factors to Consider in Expanding Your SAE Program

1. Student interests — career and avocational interest areas

2. Overall financial success in previous year

3. Financial profit of each project or activity

4. Efficiency of enterprises

5. Potential for increased profit and efficiency

6. Comparison of current scope with facility and financial limits

7. Match between current scope and challenge provided

8. Student time available

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9. Estimate of financial and other benefits

TRANSPARENCY MASTER #2

Ownership Programs Can Be Expanded by Increasing . . .

1. . . . scope (sales volume, number of head, number of acres, etc.).

2. . . . new products and/or enterprises.

3. . . . capital investments.

4. . . . self-labor.

5. . . . the variety of experiences obtained.

6. . . . knowledge learned.

7. . . . skills developed.

TRANSPARENCY MASTER #3

Placement Programs Can Be Expanded By Increasing . . .

1. . . . hours of experience.
2. . . . variety of experiences.
3. . . . wages earned.
4. . . . knowledge learned.
5. . . . skills developed.

STUDENT ACTIVITIES

STUDENT WORKSHEET #1 — A Summary of My SAE Program

STUDENT WORKSHEET #2 — Self-Evaluation of My SAE Program

STUDENT WORKSHEET #3 — Expanding My SAE Program

STUDENT WORKSHEET #4 — Case Study — Expanding SAE Programs (with solution guide)

STUDENT WORKSHEET #5 — SAE Game — "To the Max"

For additional activities, teachers may refer to the "Suggested Teaching Activities and Procedures" section in the Instructor's Guide.

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STUDENT WORKSHEET #1

A Summary of My SAE Program

Name ______________________ SAE Program for calendar year 19 ___

Brief Description of SAE program ______________________

____

____

I. Ownership Program
   A. Ownership project #1 ______________________

      1. Gross income $________
      2. Hours of self-labor ________ hrs.
      3. Labor expenses $________
      4. Capital expenses ________
      5. Equipment expenses ________
      6. Production expenses ________
      7. Total expenses ________
      8. Net Income $________
      9. Net Income per unit $________

   B. Ownership project #2 ______________________

      1. Gross income $________
      2. Hours of self-labor ________ hrs.
      3. Labor expenses $________
      4. Capital expenses ________
      5. Equipment expenses ________
      6. Production expenses ________
      7. Total expenses ________
      8. Net Income $________
      9. Net Income per unit $________

   C. Ownership project #3 ______________________

      1. Gross income $________
      2. Hours of self-labor ________ hrs.
      3. Labor expenses $________
      4. Capital expenses ________
      5. Equipment expenses ________
      6. Production expenses ________
      7. Total expenses ________
      8. Net Income $________
      9. Net Income per unit $________

II. Placement Program
   Employer(s): ______________________

   1. Hours of paid work experience ________ hrs.
   2. Hours of unpaid work experience ________ hrs.
   3. Gross income $________
   4. Rate of pay $________ /hr
   5. Net income (take home pay) $________

III. Major Improvement Projects

Project	Hrs. Labor

A.

B.

C.

D.

IV. Areas of Supplementary Skills Gained
(e.g., landscaping, beef production, vegetable production, agricultural sales, etc.)

A.

B.

C.

D.

STUDENT WORKSHEET #2

Self-Evaluation of My SAE Program

Student Name ______________________________ Date ______________
SAE Program for 19____

I. Use the checklist below to complete a year-end evaluation of your SAE program. As you rate each item, think about what is possible and desirable for you in your SAE program.

II. Write a one page analysis of your SAE program, using the items listed in the rating scale above (use the back of this sheet). Focus on the strengths and weaknesses of your SAE program.

	Excellent	Good	Fair	Poor
1. Neatness of record book				
2. Completeness of record book				
3. Accuracy of records				
4. Quality of annual plan				
5. Degree to which available opportunities were used				
6. Progress/activity during the year				
7. Skills developed				
8. Knowledge gained				
9. Level of challenge provided				
10. Degree of management responsibility				
11. Efficiency rating of ownership projects				
12. Achievement of personal career goals				
13. Degree of expansion				
14. Use of approved practices				
15. Overall value of SAE program				

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STUDENT WORKSHEET #3

Expanding My SAE Program

Name ______________________ Date __________

My SAE Program now	Goals for expanding my SAE Program	How I will reach my goals for expansion
1. ownership projects (type and scope)	1. ownership projects	1.
		2.
A.		3.
B.		4.
C.		5.
2. placement projects (site[s] and hours)	2. placement projects	6.
A.		7.
B.		8.
3. improvement projects	3. improvement projects	
A.		
B.		
C.		
4. supplementary skills (list areas)	4. supplementary skills	
A.		
B.		
C.		

STUDENT WORKSHEET #4

Case Study — Expanding SAE Programs

Directions: For the two situations described below, identify two options for expanding the SAE program. Then decide upon the "best" option and list several reasons why you would recommend the SAE program be expanded this way.

1. Jeff has just completed his second year of agriculture at Fenway High School. His SAE was essentially the same for the first two years: directed lab experiences at the school (placement) in mechanics and a small number of paid repair jobs for neighbors. His career interest areas include agricultural mechanics and agribusiness. He has one more year of high school left, and he would like to really expand his SAE program for this final year.

2. Karley's SAE program last year consisted primarily of exploratory/observational experiences at six area businesses. She also was a partner in a group livestock ownership project (feeder cattle) set up through an FFA Alumni member. Her career interest areas include animal science and agribusiness. She will be a sophomore next year at Jefferson High School. She would like to expand her activities in both of her career interest areas.

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STUDENT WORKSHEET #4

Case Study — Expanding SAE Programs Solution Guide

1. Jeff has several good options from which to choose in expanding his SAE program. They include: (1) expand the amount and variety of experiences at the school in his directed lab SAE program, (2) seek placement in an agricultural business that includes agricultural mechanics sales and/or service as one of its functions, (3) initiate a small repair or specialty business of his own, (4) undertake a group service, repair, or project construction business with several other students or individuals.

2. Karley's options for expanding her SAE program include: (1) expanded ownership in the feeder cattle enterprise, (2) additional livestock or crop enterprises, (3) placement at a beef cattle farm, (4) continued observational experiences in agribusiness until she turns 16, at which time she could seek placement in an agribusiness that sells animal health and feed products.

STUDENT WORKSHEET #5

SAE Game — "To the Max"

Purpose: To reinforce desirable attitudes and practices in planning, developing, and expanding SAE programs and keeping good records.

Objective: To be the first player to reach the Easy Street space and collect the most money along the way. After all players have reached the Easy Street space the player with the most money wins.

Procedure (rules of play):

1. From 2-5 players can play on one game board.
2. Players roll a die or draw a number to determine starting position. The player with the highest number (1-6) begins play. Play then proceeds to the right.
3. The MAX cards should be shuffled and placed face down near the center of the game board. Players draw one card from this pile when their playing piece lands on a green MAX space. They then follow the directions on the card.
4. Players move their playing pieces around the SAE track by rolling a die and moving a corresponding number of spaces.
5. No more than two players may occupy the same space at a given time. If a third player lands on the same space, then he moves ahead three spaces and follows the instructions on that space.
6. Players collect money as they move along the SAE track by following the directions on each space. The first player to reach Easy Street collects $500. Each player begins with $500.

Tips for Using this Game:

1. Any item can be used as a playing piece, as long as each item is somewhat different. Some ideas include different coins, California raisin miniatures, Monopoly game pieces, etc.
2. Use play money from Monopoly or some other board game.
3. Make game boards out of heavy poster board or matte board. Make enough boards to allow entire class to play at once.
4. After drawing the SAE track layout on the game board, use pictures, models, toys, or illustrations to "spruce up" the board.
5. If the entire class is playing at once on several game boards, then a class champion can be named at the end of play.
6. After play is completed, gather student reactions to the activity, as well as the items printed on the MAX cards.
7. Duplicate a complete set of MAX cards (on colored, heavy paper if possible) for each game board that you make. Cut out and arrange into decks.
8. If you can run computer labels, enter the contents of each MAX card into your computer, and print a set of MAX card labels. Then stick each label on a piece of colored poster board to make your deck of MAX cards.

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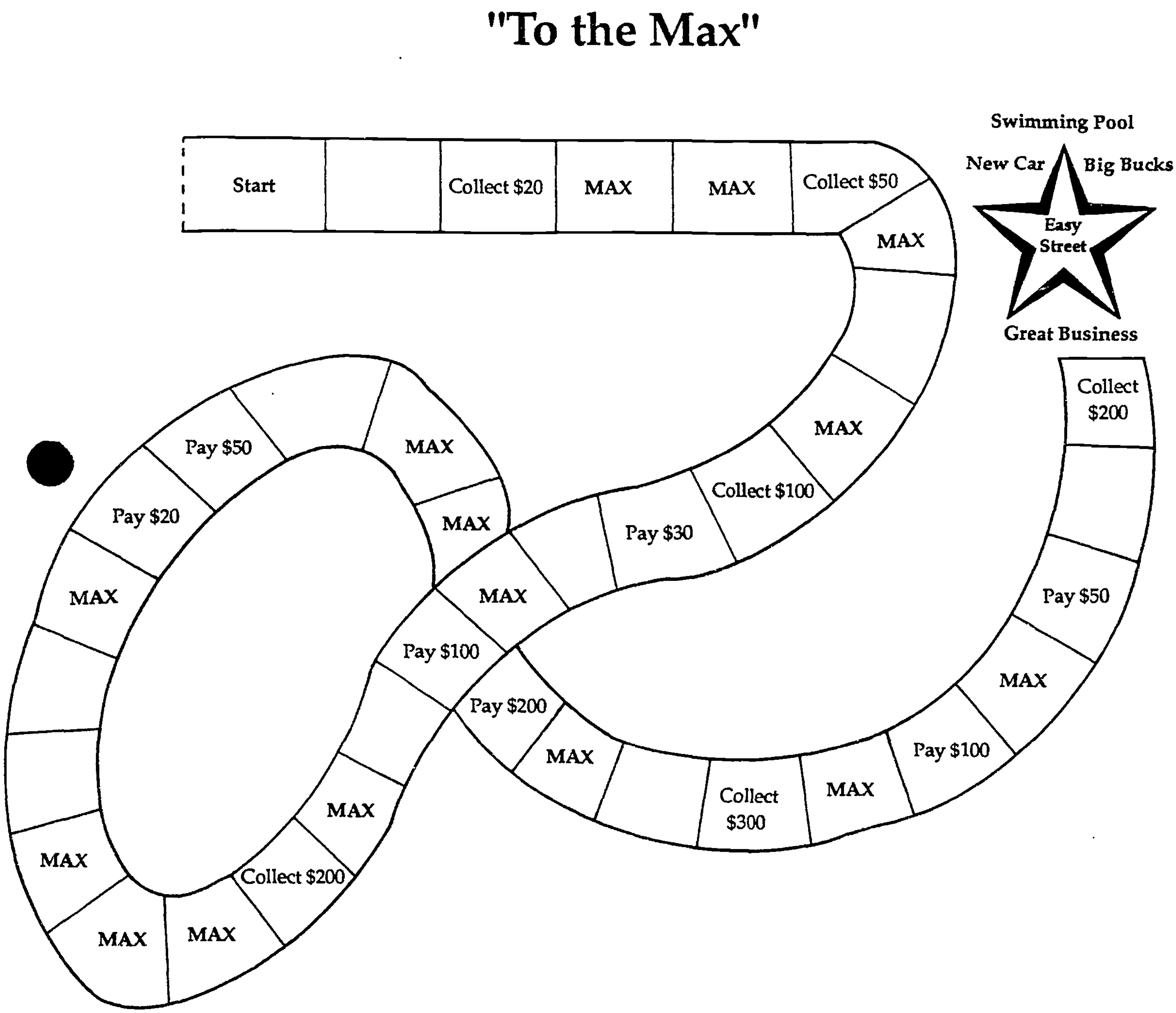
Turned in record book 2 days late — lose turn	Had only 2 goldfish as your SAE for 4 years — pay $100	Set your standards/ goals too low — go back 3 spaces
Entered records in pen — pay $20	Failed to develop a written SAE plan — go back 5 spaces	Did not connect SAE to class and lab activities — pay $50
Lost record book — go back to start	Had a bad attitude — lose turn	Did not set goals for your SAE — pay $100
Lost second record book — lose turn and pay $50	Entered all your records for the year last night — pay $100	Paid your sister to complete your record book for you — lose turn
Took record book to football scrimmage — go back 3 spaces	Did not show up for work last Tuesday — lose turn	Blew all of your SAE earnings on junk food — go back 3 spaces
Failed SAE test — pay $20	Performed no supplementary skills last year — go back 4 spaces	Wasted most of your time this week on videos — pay $50
Asked Jane to fill out your record book for you — lose turn	Passed up good SAE opportunities — lose turn	Forgot to bring your record book to class — pay $50

Did not identify agricultural career interest areas — pay $100	Received state FFA degree — collect $100	Took pictures of your SAE — move ahead 2 spaces
Completed no improvement projects — go back 4 spaces	Won chapter proficiency award — collect $50	Completed some observational experiences in agribusiness — collect $50
Tore out the extra pages in your record book — pay $100	Won state proficiency award — take another turn and collect $100	Invested/saved 50% of your SAE earnings — take another turn
Passed SAE test — Collect $100	Completed an improvement project — move ahead 3 spaces	Adopted 2 approved practices — collect $100
Discussed SAE with parents — move ahead 3 spaces	Performed 2 supplementary skills — move ahead 3 spaces	Summarized and analyzed your SAE records for the year — collect $100
Updated record book — collect $50	Developed a long range plan for your SAE — take another turn	
Expanded ownership program — take another turn	Completed a personal resource inventory — collect $50	

SAE Game - "To the Max"
Board Layout



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