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ABSTRACT

These five environmental education science units are designed for use in the seventh grade. Skills such as note taking, organizing information, critical thinking, analysis of data, and scientific skills, and the correlation between skills and content area are emphasized throughout the units to develop in the student a greater understanding of his role in the environment, and the interdependencies between all living things and the environment. Each unit is developed around long range objectives which reflect and reinforce the objectives of the other four units. Objectives, activities and strategies, materials, and evaluation techniques are identified for each of the five science units. The first unit is basically an introduction to the series, emphasizing skills as well as introducing the student to his environment with an ecology project. Unit 2 discusses the process of photosynthesis and the importance of green plants. Unit 3 centers on animals and their relation to others of the same and different species. Unit 4 stresses the importance of interactions between plants and animals. Human ecology is discussed in Unit 5 in light of pollution and possible solutions. Appendixes and supplementary materials are included. (Author/TK)

4621

EAST SYRACUSE-MINOA SCHOOLS

Environmental Education Materials

Middle School

Science Seven

(1) Techniques of Inquiry

(2) Primary Energy Sources

(3) Animal Niches

(4) Interaction within the Community

(5) Human Ecology

Produced Under USOE Grant OEG-0-71-4621
by East Syracuse-Minoa Central Schools
407 Fremont Road
East Syracuse, N.Y. 13057
Dr. Fritz Hess, Superintendent

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Activity List for Unit One

Activity #		Objectives
1)	Ecology Project	A, B & C
2a)	Identification of Microscope Parts	D & E
2b)	Setting up and caring for the microscope	D & E
3)	Learning to use compound microscope	D & E
optional 3a)	Using compound microscope w/ many objective lenses	D & E
4)	Evaluation of activities 2 & 3	F
5)	Scientific Tools Lab	G
6)	Fun and Games with Scientific Tools	G
7)	Presenting Data	H - M
8)	Quiz for Activity #7	H - M
9)	Checkpoint 6.2 from M & E	N

EAST SYRACUSE-MINOA SCHOOLS

Environmental Education Materials

Grade 7 Science

Unit I Techniques of Inquiry

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INTRODUCTION

Ecology means the interdependence of plants and animals with each other and their physical environment. This is a complex phenomena to understand all at once. If taken apart, however, and studied piece by piece it becomes very logical.

Skills, at this level, are very important. Such things as language skills, note taking, organizing information, critical thinking, analysis of data and scientific skills are only some of the skills that are going to be covered.

The first unit is basically an introduction to the year, emphasizing skills as well as introducing the student to his environment with an ecology project. Unit II discusses the process of photosynthesis and the importance of green plants as producers of food for all other organisms. Unit III centers on animals and their relation to others of the same species and to others of different species.

Unit IV stresses the importance of the interactions between plants and animals within an entire community. And finally in Unit V human ecology is discussed. The different kinds of pollution are examined and possible solutions to the problems are discussed.

Skills are emphasized throughout the whole curriculum. A correlation between content area and skills is of vital importance at this level in education. Through our designed activities the student will become more aware of his role in the environment.

RATIONALE

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In today's dynamic, extremely mechanized world the word pollution is heard and seen at every turn. Repition has created an air of nonchalance about the problem in some cases, while scare tactics have forced individuals to ignore the problem because of lack of understanding. In this curriculum, it is our goal to use neither repetition nor scare tactics but to educate and create an understanding of the way things ought to be in nature.

Nature itself is a complex, fascinating phenomena. There is a delicate balance which must be maintained. Everything depends on something else. Plants and animals depend on each other and they each depend also on such things as sunlight, water, air and soil. Human beings are part of this interdependence. They must, therefore, cooperate and compete in nature but they connot take all and return nothing. It is vital that we understand the intricacies of the natural world in which we live before we can begin to solve the problems we have created and are continuing to create. (Many of the solutions are natural).

It is the goal of this curriculum to teach natural phenomena and create an understanding of the interdependence between all living things and their environment. Then we may begin to find solutions to the problems man has created for himself.

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ENVIRONMENTAL EDUCATION - GRADE 7

I. Unit I Techniques of Inquiry
  A. Ecology project
    1. Quadrant study - to be done at home (micro-ecosystem)
      a. data collection
      b. data analysis
      c. concluding report for investigation
    2. Classroom analysis of quadrant study
      a. student development of format for report of investigation
      b. revision of student development of format

  B. Skills needed for inquiry (in class, simultaneous with project)
    1. Investigations to develop the following:
      a. questioning
      b. observing
      c. classifying and orgainizing
      d. hypothesizing
      e. testing hypothesis (controlled experiments)
      f. summarizing and concluding
    2. Skill development based on: LIFE SCIENCE INVESTIGATION
       MAN AND THE ENVIRONMENT

II. Unit II Primary Energy Sources (producers)
  A. Photosynthesis
    1. Sun
    2. Soil (minerals)
    3. Cycles
      a. water
      b. carbon dioxide/oxygen

  B. Types of plants
    1. algae
    2. non-green (decomposer)
    3. green

III. Unit III Animal niches
  A. Interactions within a population
    1. Definition of species
    2. Competition
      a. Food
        1. carnivore (meat eater)
        2. herbivore (plant eater)
        3. omnivore (plant and meat eater)
      b. space
      c. mate
    3. Cooperation
  B. Interactions between populations in a community
    1. Definition of community
    2. Predator/prey relationships
      a. examples of typical predator/prey relationships
      b. scavangers
      c. saprophytes
    3. Symbiotic Relationships
      a. parasite

III. Unit III Animal niches (cont.)

4. Adaptation for survival
   a. camouflage
   b. extinction-natural (and tentatively man-made)

IV. Unit IV Interactions within the (entire) community

A. Food web (to include man, saprophytes)
   1. Flow of energy
   2. Simple food chain

B. Nature's recyclement
   1. Nitrogen cycle
   2. Review Unit II. A.

C. Changes in the community - succession

D. Ecology project #2 - study of same quadrant (micro-ecosystem)

V. Unit V Human ecology

A. Air
   1. Composition of pure air
   2. Nature of pollution
   3. Collect data - (skill use, discussion)

B. Water
   similar treatment as air

C. Land
   similar treatment as air

D. Noise
   similar treatment as air

E. Living things
   similar treatment as air

F. Population
   similar treatment as air but show how it affects A-E

G. Solutions
   1. Discussion
      a. right vs. responsibility
      b. planning
      c. values
      d. apathy
      e. summary - "an organism cannot live alone" [1]
   2. Project
      to be coordinated with at least two academic areas

[1] New York State Environmental Ed. Syllavus 7-12

LONG RANGE BEHAVIORAL OBJECTIVES

Unit I Techniques of Inquiry

1. Given an ecology project the student will pick a plot of land, determine what variables should be measured, observe these & record data and make a concluding report.

2. Given a group of investigations the student will develop the following skills:
   a) questioning
   b) observing & recording data
   c) hypothesizing
   d) testing the hypothesis
   e) summarizing & concluding

3. Given an assignment to solve a problem the student will design an experiment to solve the problem.

Unit II PRIMARY ENERGY SOURCES

1. Given a series of various activities related to photosynthesis the student will understand the concept (of photosynthesis) as the process by which food and O_2 are produced by green plants: all living things depend on this process for survival.

2. The student will determine that all plants are not the same (some are more complex than others) after making observations of algae, non-green and green plants.

Unit III. Animal Niches

A. The student will hypothesize that the organism within a population interact both cooperatively and competitively after completing a series of various activities.

B. The student will observe that different population within a community interact with each other in a manner that maintains the delicate balance of nature by comleting a series of various activities.

Unit IV Interactions within the community

A. The student should understand through investigations and discussions that all organisms compete with each other for available food in a complex food web and depend on the energy supplied by the environment for survival.

B. The student will interpret illustrations, diagrams and other audio-visual aids to comprehend that there is a continuous, natural recycling of many elements.

C. By analyzing examples of changing land and pond communities the student should internalize the concept that communities change and grow just as an organism does through successive steps until a stable (climax) stage is reached.

UNIT IV

D. The student should apply the skills of inquiry (enumerated in unit 1) as well as the major ecological concepts emphasized throughout this course to plan and carry out a thorough study of a micro-ecosystem and to interpret its biological and physical interrelationships. The student will be investigating the same quadrant as studied in the fall (Unit 1) so that he can compare:
a) seasonal changes a/i an ecosystem
b) his intellectural growth in applying inquiry methods

UNIT V: A-F Human Ecology

By investigating the natural state of the physical environment the student will determine the destructive influences (pollution, etc.) imposed by man and their effects on the web of life.

G. The student through research and discussion should be able to suggest practical solutions, based on ecological principles, to environmental imbalances and take positive action on at at least one of these.

Student should develop an attitude of responsibility to future generations and develop adult life styles consistant with basic laws of nature.

SKILLS

7th grade Science

1. Note taking
2. Locating & gathering information
3. Orgainizing information
4. Critical thinking
5. Scientific thinking - observation, etc.
6. Classification (categorizing)
7. Language skills
8. Mechanical skills - using microscopes, lab equipment, etc.
9. Analysis of data (graphs)
   Interpretation of charts, diagrams, pictures
10. Safety skills (lab)
11. Choosing Main idea.
12. Listening, looking at A-V aids
13. Oral presentation of thoughts & ideas.

ENVIRONMENTAL EDUCATION - GRADE 7

1. <u>Unit I</u> - Techniques of Inquiry
   A. Ecology project
      1. Quadrant study-to be done at home (micro-ecosystem)
         a. data collection
         b. data analysis
         c. concluding report for investigation
      2. Classroom analysis of quadrant study
         a. student development of format for report of investigation
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   B. Skills needed for inquiry (in class, simultaneous with project)
      1. Investigations to develop the following:
         a. questioning
         b. observing
         c. classifying and organizing
         d. hypothesizing
         e. testing hypothesis (controlled experiments)
         f. summarizing and concluding
      2. Skill development based on: LIFE SCIENCE INVESTIGATION
         MAN AND THE ENVIRONMENT

LONG RANGE BEHAVIORAL OBJECTIVES

Unit I

1. The student will pick a plot of land, determine what variables should be measured, observe these, record data and make a concluding report.

2. From a group of investigations supplied by the teacher, the student will develop the following skills:
   a) questioning
   b) observing and recording data
   c) hypothesizing
   d) testing the hypothesis
   e) summarizing and concluding

3. Given an assignment to solve a problem, the student will design an experiment to solve the problem.

Objectives	Strategies / Activities	Evaluation
A. The student will choose a square plot of land six feet by six feet and study it for eight days to make observations of as many different aspects of his environment as he feels necessary. B. The student will make a written report of his observations and his analysis of his observations. C. The student will participate in a group discussion comparing the methods they use to present their observations and as a group derive a logical format for presenting future investigations.	<u>To achieve</u> A, B & C Ecology Project See attached sheet act. #1 p. ___ The students may have many questions. Answer them, but try not to give too much information. This is to be a type of pre-test to see what and how much they observe. They will be doing a much more structured ecology project near the end of the year.	<u>Will be graded by the teacher.</u> Grade will be a satisfactory or unsatisfactory at this time. The project will be kept by the teacher and used at a later date to help measure student growth as the student does a second ecology project.
D. The student will show that he knows the parts of the microscope by filling in the blanks on a ditto as the teacher goes over this with him and by explaining this orally to his lab partner. E. The student will be given several specimens to view under the microscope in order to answer a sheet of questions designed to familiarize him w/ the function of the microscope as a scientific instrument.	<u>To achieve</u> D & E <u>Activity #2</u> p. ___ Learning to use the microscope use blank ditto — attached use transparency — attached 2b). Rules for taking care of microscope (ditto attached). <u>Activity #3</u> (ditto attached) p. ___ note to teacher: suggested specimens include: raw hamburger, banana, tomato skin, apple skin, salt. Teacher may wish to use Act. #3A for more advanced students.	
F. The student will complete a work sheet designed to evaluate his skill at using the microscope.		<u>To Evaluate:</u> Objective D & E Activity #4 (see attached ditto)

Objectives	Strategies / Activities	Evaluation
G. Given a number of scientific tools the student will do two experiments using these tools and successfully complete the experiments at 90% efficiency.	To achieve G Activity #5 p.___ Scientific Tool Lab Part 1 note to the teacher: Put the metric system on the board for the students to put in their notebook, before they do the Lab. See attached ditto on metric system for necessary information. For Lab, see attached ditto ScientificTool Lab Part 2 Activity #6 p.___ See attached ditto.	
H. Given a 100 ml beaker and a bag of kidney beans, the student will count the number of beans required to fill the beaker, collect this data from other students and place it in the prepared data table on his worksheet. I. From a data table which shows the frequency distribution of bean counts the student will prepare a bar graph and after he has answered the questions which follow on his worksheet will observe that there is a variation in the number of beans required to fill a beaker but that some counts occur much more frequently than others.	To achieve H-M Activity #7 p.___ Presenting data page ____ Materials for each student *procedure ditto sheet *answer worksheet 10 ml beaker kidney beans metric rulers triple beam balance Suggestion for the teacher: Give the lab to the student in three separate parts.	

Objectives	Strategies / Activities	Evaluation
J. The student will conclude that data collected by many people is most accurate as it distinguishes common trends from extremes and that this is more easily observed from a graph than a list or table.	Activity #7 -Help student arrange data table #1 in descending order and record the frequency of each piece of data. -Students will need instructions in making bar & line graphs.	
K. After hypothesizing that the variation in bean counts (to fill 100m. beaker) is partly due to the difference in bean size. The student will measure the bean lengths in mm with a metric ruler, collect data from all other students, use it to make a line graph and read the line graph to determine the most accurate data.	-The teacher should review use of triple beam balance. -Encourage honesty in collecting and reporting data. -Emphasize the importance of pooling data for accuracy & common trends. -Emphasize the advantage of presenting data as a graph. -Expect several logical methods for question 22 on worksheet.	
L. Given a triple beam metric balance the student will weigh an empty beaker to the nearest gm., weigh it half full of beans and calculate the weight of the beans needed to half fill the beaker, completely fill the beaker and suggest a method of closely estimating the weight of an average bean.		
M. The student will distinguish the difference between observations (data) and hypotheses and show this by correctly answering the sample questions for activity #7.		To evaluate: Activity #8 Quiz for Act. #7 is attached: These are only sample questions and the teacher is encouraged to write additional ones. This could also be used as worksheet or as extra work for fast students. It is up to the teacher's discretion. The teacher should prepare a student answer sheet which includes graph paper.

Objective	Strategies / Activities	Evaluation
N. Given checkpt. 6-2 from M & E The student will successfully design an experiment as a means of evaluation of Unit 1.	Supplementary material Using visual aids see attached page	Activity #9 Checkpt. 6.2 M & E

Note to the teacher:

ECOLOGY PROJECT

Upon reading the ecology project you may be a bit confused. I hope to be able to alleviate that confusion.

There is very little structure to this first ecology project. I say first project because there is another project near the end of the year. It is hoped that these two projects would act as a pretest and post test of skills as well as environmental concepts. It is also hoped that the student will realize how much he has learned by the time he does the second project. It is important then that the first ecology project have very little structure for the best interest of the student.

Let me then explain how you might best execute the initial project. Give it to the student as written. There will be many questions - but that is the idea. The students should ask questions. Give them enough information so that they can get started but not so much that it ruins the effectiveness of the project. Encourage them to do the project in such a way as to answer their own questions. The point is to see how much they do observe, what they observe and why with very little direction. To avoid confusion it might be a good idea to answer some questions so that they don't feel like giving up or quitting. Also, it is important to see how they write up the report and present it.

The project will be discussed and evaluated together with you and the class. A good format for doing scientific investigations and writing up a report for that investigation should be developed in the discussion.

ECOLOGY PROJECT I (student's copy)
(Activity #1)

There are many things in our world today that we are not aware of. one of our major goals this year will be to become more aware of what what goes on around us. The project you are about to encounter will show you how observant (aware) you are.

You are to pick a plot of land 6' x 6' in your back yard and study it for eight days. You should examine your area and then decide what items you should study. Observe these items over a period of eight days; as often as you think you should. Your observations should be written down so that you don't forget what you see, hear, taste, smell or touch.

At the end of the eight days you should make a report that explains what you have observed and also what you have learned from making these observation. This report should be written in such a way so that someone unfamiliar with what you are doing would understand what you have done and, if possible, why.

Your final report will be collected by your teacher and kept on file.

Activity #2a

Identification of Microscope Parts

a). The teacher will hand out an unlabelled diagram of the 100X compound microscope to the student. The student will label the diagram as the teacher goes over a transparency of the same diagram and identifies the parts as to function.

b). The teacher will go over a set of rules for the proper care of the microscope.

Act. #2 b.

It is suggested that these rules be put on the blackboard for the student to copy into his notebook.

Setting Up the Microscope

1. Turn the focus knob to its lowest position.
2. Move the mirror so that light is reflected upward through the stage.
3. Make certain that the lenses are clean.
4. Place specimen on glass slide, in center of stage.
5. Focus on the specimen by turning the top of the body tube slowly up.

Caring for the Microscope

1. Carry the microscope with TWO hands; one under the base, one on the arm.
2. When setting the microscope on the table, keep it away from the edge.
3. Do not move the microscope when the specimen is on the stage.
4. The lenses should only be cleaned with lens tissue (other paper may scratch the glass or leave lint).
5. Always turn the focus knob down before putting your microscope away.

Act. #3

Problem: To learn to use a compound microscope as a means to observe small objects.

Materials: 100X microscope
2 slides
2 coverslips — each student
4-5 tooth picks
1 medicine dropper
1 container of water — per table
lens tissue

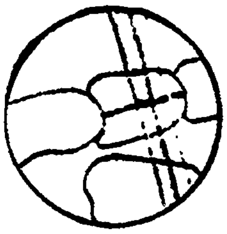
Your teacher will provide several specimens for you to look at under your microscope. Some of the specimens you will cover with a drop of water and a cover slip. For these: take a small amount of the specimen and place it on the slide with the toothpick; add a drop of water; cover with the coverslip and gently press down on it to crush the specimen (Do this while the slide is flat on the table).

Some of the specimens such as salt, you will not cover with water and the coverslip.

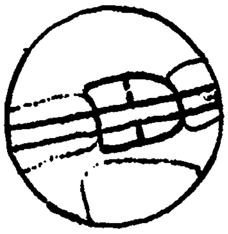
1. Why? ______________________________

As you look at each specimen you will make several observations about it. One of these will be to measure its size. One of your hairs will make an excellent ruler because its width will be similar to all of your other hairs. Place your hair across the specimen and measure the width and length of a unit* of your specimen with the hair.

Example:



and



Specimen is 6 hw long

Specimen is 4 hw wide

*A unit is a small complete part of the entire object.

Choose a specimen and mount it on your slide. (Remember to cover some).

Place the slide on the stage of the microscope. Now, focus on the specimen. When the object is clear carefully pull the slide to the left. 2. Which way did the specimen move? ______________________________

Now, pull the slide slowly to the right.

3. Which way did the specimen move? ______________________________

Push the slide away from you.

4. Which way did the specimen move? ______________________________

For each specimen you observe fill in the following information (data).

1. Specimen ______________________________

2. Does it have units? ____________________

3. Each unit is: ____________________hair widths long

____________________hair widths wide

4. Its color is ____________________________________

5. The shape of the specimen is ______________________

6. The shape of the unit is _________________________

7. In the space below carefully sketch your specimen.

1. Specimen _______________________________________

2. Does it have units? ______________________________

3. Each unit is: _________________________hair widths long.

Optional Act. #3A

The teacher may wish to have students who complete activity 3 ahead of others, proceed to using a compound microscope which has more than one objective lens to view the same specimens again. Some type of direction should be given to the student to start with the lowest power and proceed to the highest.

Act. #4 Evaluation of Act. 2 & 3

Name________________________

Science

Date

After completing your work with the microscope you should be able to fill in the blanks on this paper with no errors.

When you carry the microscope, you hold it in an upright position, with one hand on the (1)__________and one hand under the (2)______________of the microscope. The (3)__________________lens is mounted at the top of the (4)____________________. The (5)___________________lens is at the lower end of the tube and is close to the specimen.

To focus the microscope, move the (6)________________until the image is clear.

To examine a specimen, place the slide on the (7)_________________ where the slide is held in place by the (8)_____________________. The light reflected by the (9)______________________goes through an opening in the stage and onto the specimen.

When you move the slide toward you the specimen moves (10)___________ from you. If you wish to move the slide so that an object in the left field is in the center of the field you would move the slide to your (11)___________.

If you put a slide like this on the stage of the microscope, what would you see?

(12) ?

When you put your microscope away you should clean the lenses with (13)__ ________________and turn the (14)_______________to its (15)_____ ________________position.

Act. #5

Part 1

Scientific Tools Lab

Question: Does the size of the pencil have anything to do with the weight?

Materials: balances
ruler
pencil

Procedure: 1. Using your own pencil, measure it from the point to the end of the eraser with your ruler in centimeters. Record the length of the pencil.
2. Place the pencil on the triple-beam balance and weigh it to the nearest gram. Record this weight.
3. Record both the length of the pencil and the weight of the pencil on the blackboard in the correct column.

Observations:
1. Were all of the pencils the same length?
2. Did all of the pencils have the same weight?

Conclusion: 1 Does the length of the pencil change the weight of the pencil? Why?

Part 2 Fun & Games with Scientific Tools

Materials: balance
beaker (250 ml)
graduated cylinder
thermometer
ice cube

Procedure:
1. Weigh the beaker and record its weight.
2. Using the graduated cylinder measure 100 ml of water into the beaker.
3. Weigh the beaker & 100 ml of water. Record this weight.
4. With the thermometer take the temp. of the water in your beaker in both F° and C°. Record this.
5. Add one ice cube to your beaker of water and allow it to stand for a few minutes until the ice cube has begun to melt.
6. Put the thermometer in the water and record the temperature when it is the lowest. You will have to keep watching your thermometer because it will begin to go back up again. Record the lowest temperature in both F° &C°.
7. Weigh the beaker and water when it is at its lowest temperature. Record the weight to the nearest gram.

Observations:
1. Weight of beaker ______________________
2. Weight of beaker and 100 ml of water ______________
3. Weight of water alone ______________________
4. Temperature of water F° ______________________
   C° ______________________
5. Temperature of water at lowest F° ______________
   C° ______________
6. Weight of beaker and water at its lowest temperature.

   ____
7. Weight of water alone at lowest temperature. __________

Conclusions:
1. Was the weight of the beaker changed when the water was added? Why?
2. Why did the temperature of the water change?
3. Did the beaker of water weigh more or less at the lowest temperature? Why? (there are two possible answers here).

THE METRIC SYSTEM

Standard unit of measurement is a meter.

UNITS OF LENGTH

10 millimeters = 1 centimeter
10 centimeters = 1 decimeter
10 decimeters = 1 meter
100 centimeters = 1 meter
1000 milimeters = 1 meter

UNITS OF VOLUME

1000 milliters - 1 gram
100 centiliters = 1 liter

UNITS OF WEIGHT

1000 milligrams = 1 gram
100 centigrams = 1 gram
1000 grams = 1 kilogram

CONVERSION TABLE

1 meter - 39.37 inches
2.5 centimeters = 1 inch
28.34 grams = 1 ounce
1 liter = 2.11 pints

TEMPERATURE CONVERSION

F°	C°
212°	100°
194	90
185	85
167	75
158	70
140	60
131	55
122	50
104	40
98	36.7
86	30
77	25
68	20
50	10
41	5
32	0

$(C \times 9/5) + 32 = F$

$(F - 32°) \times 5/9 = C$

Students' copy

ACTIVITY #7: PRESENTING DATA

OBJECTIVE: You now see the need for using a standard unit of measurement. In this investigation you will make measurements, compare your data with others & organize it in a graph.

PART A:

1. Fill a 100 ml beaker with beans.
2. Count the number of beans in the beaker & record it. Also put your count on the board.
3. Copy counts for the whole class from the board and place in decreasing order (largest to smallest) in data table #1. After each bean count put a tally mark for the number of times a beaker contained that many beans.

   Example:

Bean Count	Numbers of beakers
10	111
15	1111
17	11

4. Using data table #1 make a bar graph. You must make your own scale for the number of beakers and for the bean count. Remember that each square represents an equal number of beans. Example: 1 square = 5 beans. You choose a scale that will allow the data to fit on the graph.
5. Were there the same number of beans in each beaker?
6. What was the greatest number of beans in a beaker? Least?
7. What is the most common number of beans that it takes to fill a 100ml beaker?
8. How does sharing data with other students help you answer question 7 accurately?
9. Is it easier to read this information from the list on the board or the graph?
10. Explain why did it take more beans to fill some beakers than others? This should be a logical hypothesis.

PART B:

11. Are all the beans the same size? Explain this observation.
12. Measure the length of five bean seeds to the nearest millimeter (mm) and put your data on the board. Fill in data table #2.
13. From data table #2 make a line graph. You will plot each point one at a time, then connect them with a line. Your teacher will assist you.
14. What is the most common length of a bean seed?
15. What is the shortest seed? Longest?
16. What is the advantage of many students putting their data together?

PART C.

17. Using a triple beam balance weigh an empty beaker to the nearest gram and record this data.
18. Fill a beaker half full of beans, weigh it and record.
19. How much do all the beans weigh together?
20. Predict how many grams there would be if the beaker were full of beans.
21. Predict the average weight of one bean.
22. How can you test this prediction? Explain a method you could use to find the average weight of one bean.

STUDENT WORKSHEET
PREDICTING DATA

Activity #7
p. 1

PART A

1. Number of beans in your beaker____________.

2. Data Table #1: Number of beans in a beaker.

Bean Count	Number of Beakers

Number of Beans in a 100 ml Beaker

3. Bar Graph: use 1/4" graph paper for this graph

QUESTIONS

4.

5.

6.

7.

8.

9.

10.

PART B.

Your data

11. Seed 1 mm
Seed 2 mm
Seed 3 mm
Seed 4 mm
Seed 5 mm

Data table #2 Length of Bean Seeds

Length of beans (mm)	Your Count	Total Class Count

12. Line Graph -

Length of Seeds

QUESTIONS
13.

14.

15.

PART C
16. Weight of beaker in gm.

17. Weight of beaker half full of beans

18.

19.

20.

Activity #8

QUIZ FOR ACTIVITY #8

Several students measured the height (tallness) of dandelions in the school lawn and got the following results:

10 cm. tall	- 15 dandelions
15 cm.	- 19
8 cm.	- 10
18 cm.	- 8
7 cm.	- 8
20 cm.	- 4
12 cm.	- 6

1. Arrange the data in a table from tallest to shortest and record the number of dandelions for each height.

2. Make a bar graph of this data. (To the teacher: supply a small piece of graph paper on/with answer sheet).

3. What height is most common for dandelions in the school lawn?
a) 20 cm. b) 15 cm. c) 10 cm. d) 8 cm.

4. The data in the graph is called a) hypothesis, b) conclusions, c) observations, d) a lab report.

5. An explanation for the fact that one dandelion is taller than another is called a) hypothesis, b) data, c) observation, d) graph

6. The best reason why scientists often share their observations is a) they make more money if they do, b) their information is more accurate, c) so they can make a graph, d) to copy others.

7. The least common heights for dandelions are:
a) 8 cm. and 10 cm.
b) 15 cm. and 20 cm.
c) 20 cm. and 7 cm.
d) 18 cm. and 7 cm.

8. A friend picked a dandelion and asked you to predict its height. Which of the following predictions would give you the best chance of being correct?
a) 15 cm. b) 8 cm. c) 20 cm. d) 6 cm.

Supplementary Material

Visual Aids

The teacher may or may not wish to use the following pictures from the text Man and the Environment (see attached sheet) as an aid to stimulate classroom discussion, building of inferences, drawing of conclusions, and creative thinking.

Investigation 1
figure 1.4 page 10

Investigation 2
figure 2.1 page 12
2.3 page 14 making inferences &
2.4 page 16 observations
2.5 page 17
2.6 page 19
figure 2.9 page 23 (Scientific tools)
2.11 page 24 (Scientific tools - graph)

Investigation 3 "Perception"
figures 3.4 & 3.5 pages 38-39
figure 3.12 page 47
figures 3.17, 3.18 & 3.19 pages 52-53
3.21 & 3.22 pages 56-57

EAST SYRACUSE-MINOA SCHOOLS

Environmental Education Materials

Grade 7 Science

Unit II Primary Energy Sources

Produced Under USOE Grant OEG-0-71-4621
by East Syracuse-Minoa Central Schools
407 Fremont Road
East Syracuse, N.Y. 13057
Dr. Fritz Hess, Superintendent

Topic Outline

II. <u>Unit II Primary Energy Sources (producers)</u>

A. Photosynthesis
   1. Sun
   2. Soil (minerals)
   3. Cycles
      a. water
      b. carbon dioxide/oxygen

B. Types of plants
   1. algae
   2. non-green (decomposer)
   3. green

Long Range Behavioral Objectives

<u>Unit II Primary Energy Sources</u>

1. Given a series of activities related to photosynthesis the student will identify the concept of photosynthesis as the process by which food and oxygen are produced by green plants and that all living things depend on this process for survival.

2. The student will determine that some plants are more complex than others after making observations of algae, non-green and green plants.

UNIT II - PRIMARY ENERGY SOURCES (PRODUCERS)

Activity No.		Objectives
1a	Problem 6.1 M & E	A
1b	Does Photosynthesis Produce Any Gas?	B,C,D
2	Problem 6.2 M & E	
3	Mastery Item 6.1 M & E	
4	Mastery Item 6.2 M & E	
5*	Checkpoint 6.1 M & E	
6	Oxygen - Carbon Dioxide Cycle - D	F
7	Problem 10.1 M & E	G
8	Problem 10.2 M & E	
9	Problem 10.3 M & E	
10	Mastery Item 10.1 M & E optional	
11	Mastery Item 10.2 M & E optional	
12*	Checkpoint 10.1 M & E optional	
13*	Checkpoint 10.2 M & E	
14	Ability of Soils to Hold Water - D optional	
15	Soil and Germination - D	
16	Analyzing Soil Sample #1 - D	
17	Analyzing Soil Sample #2 - D	
18	Soil Reading - D	
19	Analyzing Soil Sample #3 - D	
20	Diffusion/Osmosis - D	N
21	Let's Get to the Root of It - D	O
22	Transportation in Plants - D	P
23	Do Leaves Perspire? - D	Q
24	Problem 11.1 M & E - optional	R
25	Problem 11.2 M & E - optional	S
26	Problem 11.3 M & E - optional	
27	Mastery Item 11.1 - optional	
28	Mastery Item 11.2 - optional	
29*	Checkpoint 11.1	
30*	Checkpoint 11.2	
31	The Water Cycle - D	T
32	Problem 9.1 M & E	U & V
33	Problem 9.2 M & E	
34	Mastery Item 9.1 M & E	
35	Mastery Item 9.2 M & E	
36*	Checkpoint 9.1 M & E optional	U-V
37*	Checkpoint 9.2 M & E optional	
38	Phototropism - D	W-Z
39	Is Light Important in Photosynthesis-D	AA
40	Testing For Starch and Sugar - D optional	BB

Activity No.	Objectives
41 - Testing Unknowns - D optional	
42 - The Importance of Being Green - D	CC
43 - Do Leaves Breathe? - D	DD-EE-FF
44 - Photosynthesis	GG
45 - Problem 5.1 M & E	HH-II
46 - Mastery Item 5.1 M & E	
47 - Mastery Item 5.2 M & E	
48* - Checkpoint 5.1 M & E	
49* - Checkpoint 5.2 M & E	
50 - Classification - D	LL
51 - Classification - D optional	
52 - Investigation 4 Classification M&E opt.	MM
53 - Plant Classification - D	NN
54 - Plant Classification -D	OO
55 - Plant Classification - D	PP
56 - Plant Classification - D	QQ

* To be used for evaluation or homework in addition to any other evaluative instruments the teacher may wish to employ.

UNIT II: Materials

Activity #

1a. bromthymol blue (3g)
ammonium hydroxide (10% 100 ml)
test tubes
elodea
pond snails
containers for tubes
bromthymol blue solution
soda straw
plastic bag

1b. elodea plant
large beaker
glass funnel
light source
test tube & stopper
bromthymol blue
straw
splint
matches

2. corn, wheat or kidney beans
food coloring or washable ink
petroleum jelly
balance
potassium hydroxide pellets
string
nylon from stockings
glass bottles
one hole rubber stoppers
rubber tubing
glass tubing
liquid soap
graph paper (1/4")
test animals
soaked seeds
capillary tubing
colored water
clock or watch w/ second hand

3. no materials

4. no materials

5. no materials

6. no materials

7. concentrated sulfuric acid
pyrex beaker (600 ml)
petri dishes
triangular file
scissors
metric ruler
balance
filter paper or white paper towel
small plastics bags
seeds (at least 60)

8. refrigerator
incubators
thermometers
petri dishes
scissors
filter paper
plastic bags (small)
2 kinds of seeds (30 of each

9. lamp (fluorescent)
petri dishes
scissors
filter paper
small plastic bags
black plastic sheeting
tape (either kind)
4 kinds of seeds (20 of each kind)

10. same as materials in the problems

11. no materials

12. no materials

13. no materials

14. funnels
tripods
cotton
beach soil
gravel

14. clay soil
garden soil (loam)
beakers
water

15. paper cups
pre-soaked bean seeds
gravel
sand
organic soil
fertilized soil
water

16. soil
250 ml beaker
oven
scales

17. dehydrated soil
250 ml beaker
oven
scales

18. no materials

19. soil
250 ml beaker
scales
funnel
filter paper
graduated cylinder (10 ml)

20a. concentrated starch solution
thistle tube
cellophane-soaked in alcohol
beaker
ring stand
clamp
rubber band

b. carrot
beaker
one-hole stopper
glass tubing
wax
water

21. 10 seeds (per group)
baby food jars or petri dishes
paper towels
water

22. small jars or beakers
fresh celery stalks (or carnations)
vegetable dye
salt
water

23. candle
matches
jars
leaves
squares of sluminum foil
water

24. cellophane tape
triple beam balances
large & small plastic bags
rubber bands
wilted plants
potted plants

25. plastic dishpans
knife or pruning shears
boiled water
ring stand & clamp
capillary tubing
rubber or plastic tubing
soft wire
short jar or beaker
leafy branches
bright light source
aluminum foil
electric fam
thermometers
humidity indicator cards
sponges
vaseline
dessicant
photographic light meter

26. bubble potometer
leafy branch or top of small plant

27. no materials

28. no materials

29. no materials

30. no materials

31. no materials

32. masking tape
    paper punches
    black construction paper
    scissors
    vial of euglena culture

33. prism or diffraction grating
    slide projector
    euglenas in vials
    wax paper
    black construction paper
    red, blue, green cellophane
    paper punch
    masking tape
    scissors

34. no materials

35. no materials

36. no materials

37. no materials

38. milk cartons
    soaked beans or pea seeds
    peat moss
    vermiculite or potting soil
    powdered agar
    mustard seeds
    shallow square
    clear plastic
    sandwich box

39. plant w/ large leaves
    aluminum foil
    scissors
    heat source (hot plate)
    500 ml beakers
    200 ml beakers
    small dish
    alcohol solution
    IKI solution
    cornstarch
    forceps

40. Benedict's solution
    IKI solution
    500 ml pyrex beaker
    graduated cylinder
    heat source (hot plate)
    test tubes
    test tube holders
    white Karo syrup solution
    various foods (bread, potato, milk)

41. pyrex beakers
    Benedict's solution
    IKI solution
    unknown mixture
    test tubes
    test tube holder
    water bath

42. varigated leaves
    hot plate
    beakers
    test tubes
    water
    alcohol
    iodine

43. plant, vaseline
    hot plate
    beaker
    water
    test tube
    test tube holder
    alcohol
    microscope
    slide
    coverslip
    10% salt solution in dropper bottle
    water in dropper bottle
    leaf

44. no materials

45. fish
    snails
    insect egg
    dried brine shrimp eggs
    chilled earthworm

45. hydra
insects or other arthropods
moth cocoons
praying mantis egg cases
spanish moss
plants - some w/stems and leaves
mosses
potatoes or sweet
large seeds
flower bulbs
algae or mushrooms
bread and fruit mold
lichens
yeast
dried leaves
fossils
spider webs
hair
hen's eggs
rock or glass
empty shells
crystal gardens

46. some materials from act. #45

47. no materials

48. no materials

49. no materials

50. no materials

51. no materials

52. seeds
assorted seedlings
leaves
mealworms
other insects
tropical fish
slides of protists
shells
fossils
aquarium
samples of various woods
bones
hair
furs

52. buttons
coins
laboratory apparatus
paper cutouts
postage stamps
books
pencils
marbles
rulers
calipers
balances
clock or watch w/second hand
stethoscope (optional)
meter stick
scale
caliper

53. prepared mounts of plants

54. plant mounts (20)

55. plant mounts

56. four different kinds of plants (per student)
plant mounts

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
A. By successfully predicting the result of an experiment of a closed biotic system the student learns that the processes of photosynthesis and respiration occur simultaneously and are independent.	<u>To achieve A</u> Activity #1a problem 6.1 M&E. <u>p. 88</u> The conclusion drawn from doing this experiment should be stressed. The importance of the gases exchanged by the plant and snail should be emphasized.	
B. The student will observe that an illuminated plant produces a gas (collected by water displacement) which will cause a glowing splint to burst into flame and conclude that photosynthesis produces oxygen.	<u>To achieve B, C, & D</u> Activity #1b - Does Photosynthesis produce any gas? p. <u>II-18</u> Note to teacher: Activity #1b is an alternate activity. This may be used in place of problem 6.1, or it may be set up by the teacher as a demonstration run concurrently with problem 6.1.	
C. The student will observe that an illuminated plant turns water containing bromthymol blue from yellow to blue and hypothesize that the plants used carbon dioxide for photosynthesis which it removed from the water.	1) This can be done in small student groups or as a demonstration. 2) Part A is set up one day and probably will take less than a period. The transparency and worksheet on the O_2-CO_2 cycle could be introduced the same day and part B done on the following day. 3) Blue water is water containing bromthymol blue. If their breath doesn't turn it yellow, add a pinch of sodium bicarbonate.	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
D. The student will summarize in writing the carbon dioxide-oxygen cycle showing that both plants and animals use O_2 and produce CO_2 during respiration, and that green plants use CO_2 and produce O_2 during photosynthesis.	Activity 1b cont. 4)Use boiled water to make the blue solution so that gases which might obscure the oxygen test will be removed. 5) A 150 watt light bulb can serve as the light source and should be left on all night. If no gas is collected in 24 hrs. leave it one more day. References (1) Interactions of Man, and the Biosphere, Teacher's edition, Abraham et. al., Rand-McNally, Chicago, 1970, p. 38B. (2) Modern Laboratory Program in Biology, C. Harney, Oxford Book Co., N.Y., 1970, p. 79-80.	To Evaluate B,C.D Give a quiz to test the concepts of photosynthesis. It should test inquiry skills as well as knowledge.

OBJECTIVE	STRATEGIES/ACTIVITIES	EVALUATE
E. The student learns that a well designed experiment includes experimental controls. When confronted with two experiments, he expresses more confidence in the data gathered in the experiment with a control.	<u>To achieve E</u> Activity #2 Problem 6.2 M&E p. 91 Teacher demonstration (optional depending upon availability of equipment). Act. #3 Mastery Item 6.1 M&E p. 96 Act. #4 Mastery Item 6.2 M&E p. 97	<u>To Evaluate E</u> Act. #5 Checkpoint 6.1 M&E p. 19
F. The student will complete a worksheet on the CO_2-O_2 cycle, showing that he understands the concepts, at 100% efficiency.	<u>To achieve F:</u> Act. #6 CO_2-O_2 cycle Use transparency Use blank ditto of cycle for students. p.<u>II-20</u> to II-21	
G. The student learns how environmental factors such as water, temperature, and light affect the germination of seeds by designing and carrying out procedures to promote maximum germination of seeds whose germination requirements are unknown to him andby identifying environmental factors that stimulate or inhibit seed germination.	<u>To achieve G:</u> Act. #7 Prob. 10.1 M&E p.<u>137</u> Act. #8 Prob. 10.2 M&E p.<u>142</u> Act. #9 Prob. 10.3 M&E p.<u>145</u> Teacher note: for Act. #7-9 see attached p. <u>II-22</u> Act. #10 Mastery Item 10.1M&E*p.<u>151</u> Act. #11 Mastery Item 10.2 M&E*p.<u>151</u> (above optional) *Teacher note: act. #10 & 11 should be used as supplementary material only if teacher feels reinforcement is needed.	<u>To Evaluate G</u> Act. #12 Checkpoint 10.1 p.<u>29</u> Act. #13 Checkpoint 10.2 p.<u>30</u> (both in M&E) Teacher note: These activities are optional.

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
H. The student will observe a demonstration of: water flowing through different types of soil; water being retained by different types of soil; and answer questions pertaining to this or these demonstrations at 100% efficiency.	<u>To achieve H:</u> Act. #14 Teacher demonstration showing how fast water goes through different types of soil. (or p. 263 in <u>M dern Life Science</u> may be used). p. <u>II-23</u>	
I. The student will make a hypothesis as to the type of soil which best promotes seed germination and healthy plant development and test this hypothesis by a controlled experiment with the type of soil (gravel, sand, muck, fertilized soil) as the only variable.	<u>To achieve I</u>. Act. #15 Soil and Germination p. <u>II-24</u> 1) Students could bring soils 2) Seeds should be soaked overnight. Beans or peas work well. 3) Organic soil could be muck. Garden store fertilizer could be used to prepare the artificially fertilized soil. 4) It would be advisable to start this investigation on a Monday. 5) Milk cartons saved from lunch could be substituted for paper cups. 6) It is suggested that students be placed in groups of 3-5. 7) Be sure to pool data so that students can complete table #2. 8) A class discussion should follow this investigation; 9) Have students save and care for plants. They can be used in later labs. 10) Act. #16 should be set up the same day that activity #15 is started. p. <u>II-26</u>	The student's answer sheets can be marked. However, don't mark his initial prediction wrong.

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
J. Given an investigation on determining the percentage of water in a soil sample the student will complete the investigation and answer the questions at 100% efficiency.	To achieve J: Activity #16 Soil analysis #1 (set up takes 15-30 min.) To bake the soil you will need an oven - those in the home ec room work fine. If the beakers are put on trays they won't spill and there is no mess. To remove the H_2O from the sample the oven should be set at 200° F. The samples should be left in the oven until the next day when the student is ready to weigh them or removed after several hours and dessicated or covered with Saran Wrap. These dehydrated samples should be kept and used in Act. #17 so the student will be weighing just the humus as required by the Activity. p. II-26	To Evaluate J: STudent answer sheets can be graded or a quiz testing comprehension and methods can be given.
K. Given an investigation on determining the percentage of humus in a soil sample the student will complete the investigation and answer the questions at 100% efficiency.	To achieve K: Activity #17 Soil analysis #2 p. II-29 Student will use dehydrated sample from Act. #16. To bake out the humus the oven should be set at 400°F-500°F. Again the sample should be removed from the oven only an hour before weighing and dessicated. While the sample is being baked it is suggested Act. #18 be used and Act. #17 completed the next day. Sample should be kept for Act. #19.	
L. The student will read a few paragraphs on the different types of soil and in his own words explain what the four types of soil described them as: clay, sand gravel, loam.	Act. #18 Soil Reading p. II-31 Modern Life Science p. 192	

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OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
M. Given an investigation to determine the amount of water a soil sample will hold and the pH of that sample the student will complete the investigation and answer the questions at 100% efficiency.	To achieve M: Activity #19 - The students should have no difficulty with the lab. However, the math may present a problem. (Good time for coordination with math classes). p. II-32	
N. The student will observe a demonstration on diffusion and one on osmosis. He will answer a set of questions related to each demonstration.	To achieve N: Activity #20 -"Diffusion demonstration." The teacher may use any of the attached investigations or any other suitable ones which clearly demonstrate the principles of diffusion and osmosis. p. II-34	
O. The student will observe germination in radish seeds to determine how the structure of a young root is related to its function of water absorption.	To achieve O: Activity #21 Let's Get to the Root of It. p. II-36 Suggested seeds: melon, bean, marigold	
P. The student will observe that materials soluble in water are able to move upward through a plant stem. He should conclude that this is a method by which plants obtain much of their nourishment.	To achieve P: Activity #22 Transportation in Plants p. II-37 Teacher note: need potted plants for act. 22-26. Ditto attached. The teacher should sketch the diagram on the blackboard. Question C. Material is transported straight up the stalk. Question E. Wilted appearance caused by damage to the support mechanism provided by the transport system. A stem full of water adds support to the stem as a bicycle tire is firm when filled with air. "Letting water out of a cell is like letting air out of a tire." A stem full of water will	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
	Dehydrate (by osmosis) in the presence of a high salt concentration.[1]	To evaluate N-Q: Student lab reports may be graded.
Q. The student will observe that moisture appears inside the container which was sealed over a plant's leaf. He should conclude that the moisture in the container was transported up the leaf stalk to the leaf and evaporated from the leaf's surface.	To achieve Q: Activity #23 Do Leaves Perspire? p.II-39 To the teacher: A variation of the -- .ie investigation may be used by tightly fastening a small plastic bag over a leaf. The bagshould be tied with a string close to where the petiole is attached to the stem. Similar results should occur.[2]	

1 Abraham Beidleman, Morre, Moores, Utley: Interactions of Man & the Biosphere, 1970, Rand McNally and Co., p. 90

2 Lesser, Life Science Intermediate Level, 1966 AMSCO

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
R. The students learn environmental factors influence the rate at which green plants lose water through their leaves by recognizing that a greenhouse is a system designed to create an optimal environmental for plant growth.	Note to teacher: Activity 24-28 are from Investigation 11 of the text and are totally optional. They should be used only if the teacher needs reinforcement for Act. 20-23. To achieve R, S. Activitv #24 Problem 11.1 M&E optional p.155 Activity #25 Problem 11.2 M&E optional p.158 Activitv #26 Problem 11.3 M&E optional p.164 Activity #27 Mastery Item 11.1 M&E optional p.166 Activity #28 Mastery Item 11.2 M&E p.167	To evaluate P-S' Act. #29-Checkpt. 11.1 M&E p.31 Act. #30-Checkpt. 11.2 M&E p.32
S. The student learns the rate of water loss from plants is related to leaf areas by using leaf area as one of the criteria to predict the natural environment of unknown plants.		
T. The student will complete a worksheet on the water cycle showing that he understands the concept being presented at 100% efficiency.	To achieve T: Activity #31 -The Water Cycle Unlabeled ditto for students; transparency for the teacher to show. Teacher note: start Act. #38 p. II-41	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
U. The student learns that euglena respond to changes in light,	To achieve U-V:	
	Act. #32 Problem 9.1 M&E p. 129 teacher note: Use an appropriate container for the euglenas such as: large test tube, small vials, or baby food jars.	
by predicting the distribution of euglenas in a natural environment with varying light conditions.		
V. The student learns that the light reactions of euglenas and similar organisms are adaptive behavior, which promotes survival by identifying the probable adaptive value of the vertical migrations of marine organisms like euglenas.	Act. #33 Problem 9.2 p. 131 Act. #34 Mastery Item 9-1 p.132 Act. #34-37 Teacher note: Use these activities as you see fit. They don't need to be used exactly as put down in the book. These are good reinforcement activities and may be used if time permits in your classes. Act. #35 Mastery Item 9-2 p.133	To Evaluate U-V: Act. #36 Checkpt. 9.1 M&E p.27 Act. #37 Checkpt. 9.2 M&E p.28
W. Students will plant seeds in boxes.	To achieve W-Z: Act.#38a Phototropism p. II-42 1) This could be done either as a demonstration with one set up per period or in groups of 3-5. 2) Observations won't be made until 3 or 4 days after the experiment is set up. During this time act. 33-37 could be done. 3) Class data should be pooled, discussed and averages or most common observations recorded. 4) This would be a good place for the teacher to introduce graphing to the whole class. Act.#38b-Teacher Demonstration p.II-43	To evaluate W-Z: Through Lab reports
X. After observing these three plants for 10 days the student will conclude that plants grow toward light.		
Z. The student will also conclude that plant coloration (green pigment) is also stimulated by sunlight.		

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
	Reference: Molecules to Man, BSCS Blue Version, Houghton Mifflin, Boston 1968, p-561 Modern Life Science, Holt, Rinehart and Winston, Inc. New York 1966, pp. 115-116	
AA. After observing a teacher demonstration designed to test for the presence of starch in a plant's leaves, the student should be able to determine that light is necessary for photosynthesis.	To achieve AA: Act. #39 Is sunlight Important in Photosynthesis?[1] Ditto attached p. II-44. This activity should be done as a teacher demonstration. IKI solution is prepared by adding 1 g. of iodine crystals; 3.5 g. of KI to about 300 ml. of water.	
BB. Given the procedures and materials required for testing for starch and sugar, the student will test the following: Karo Syrup, bread, potato, milk, cornstarch and etermine if they contain starch and/or sugar at 100% efficiency.	To achieve BB: Act. #40 Testing for starch and sugar -ditto attached p. II-46 To the teacher: 1) To prepare Karo syrup solution, add 100 ml of Karo syrup to 900 ml of water. 2) Benedict's solution may be purchased from scientific supply houses or drug stores. 3) IKI solution may be prepared by adding 1 g. of iodine crystals and 3.5 g. of potassium iodine to about 300 ml of water. This reagent will be used later too. 4) Remind students to clean out glassware thoroughly between each food being tested. Also remind them not to contaminate the standard solutions. (optional lab)	To evaluate BB: Act. #41 Testing Unknowns- ditto attached p. II-48 Evaluate investigation. To the teacher: prepare the unknown mixtures as follows: Mixture X: add 1 g. of cornstarch to 300 ml. of water. Heat until the mixture becomes cloudy and add it to 900 ml. of water. Add 20 ml. of Karo Syrup to this mixture. (optional evaluation)

(1) Abraham, Beidleman, Moore, Moores Utley: Interactions of Man & the Biosphere, Rand McNally & Co., Chicago, 1970, p.25

Activity #40-41: These activities were originally designed to be done by the student to familiarize him with the standard tests for starch and sugar so he could use these new skills in consecutive labs, however, the labs following Act.#40-41 are now designed for the teacher to use as demonstrations so these labs are now optional.

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATIONS
	Act. #40 cont.	Act. #41 cont. Mixture Y: Add 10 g. of table salt to 1 liter of water. Mixture Z: add 1 g. of cornstarch to 300 ml. of water. Heat until cloudy and then dilute up to one liter. The teacher should decide how to evaluate this investigation.
CC. Given the following materials: varegated leaves, hot plate, beakers, test tubes, water, alcohol and iodine the student will write a hypothesis and procedure to test the hypothesis on whether or not the non green parts of plants carry on photosynthesis.	To achieve CC: Activity #42 The Importance of Being Green p. II-49 1) Teacher note: If act. 40-41 are not done (they are optional) the teacher will have to modify the student requirements of Act.42. 2) This lab will probably work best with student groups of 2-3. 3) Any multicolored leaf will work but coleus and silver leaf geranium are recommended. 4) The students' experimental design is somewhat structured by the materials they are limited to. Be careful not to give them too much information unless they draw a blank and have no idea how to start. Reference - Mason, Laboratory Exercises for Life Science, Van Nostrand Co., Princeton, 1965, p. 29	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
DD. The student will observe that plants can not exchange gases when the leaf is coated with vaseline and conclude that it can't carry on photosynthesis or produce starch. EE. The student will hypothesize that the leaf must have some sort of openings or pores through which gases are exchanged and confirm this hypothesis by observing stomates under a microscope. FF. After observing the closing of stomates caused by 10% salt solution the student will conclude that size of the stomate regulates this exchange of gases.	<u>To achieve DD, EE, FF:</u> Act. #43 Note to teacher: <u>p.II-50</u> 1) Part I and II are teacher demonstrations 2) Bean plants from a previous lab can be used. 3) Part I should be set up during the first part of the period and then part III should begin. Part II should be done after a few days, possibly after part III is finished. 4) There is an opportunity to allow students to hypothesize that salt caused osmosis resulting in guard cell collapse but the main concept is the change in stomate size and the presence of stomates. Reference for Part III: Mason, <u>Laboratory Exercises for Life Science</u>, Van Nostrand Company, Inc., Princeton, 1965, P. 33-34	
GG. The students will be involved in a teacher led discussion that will enhance their understanding of the process of photosynthesis.	<u>To achieve GG:</u> <u>Act. #44</u> The teacher should summarize activities 38-43 in a discussion of photosynthesis and the necessary ingredients of that process. In this discussion the students should begin to realize that green plants depend on many things in order for it to make food. In some of your classes you could give the students the formula for photosynthesis if you feel they are capable of understanding it.	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
HH. The student learns that all living things have characteristics in common by classifying specimens as living or non-living and justifying his choices.		
II. The student learns most organisms can be classified as either plants or animals by applying the appropriate criteria for classifying an unfamiliar organism as either a plant or animal.	To achieve HH-II: Act. #45 Problem 5.1 M&E p. 81 Act. #46 Mastery Item 5.1p.84 Act. #47 Mastery Item 5.2 p. 84	To Evaluate HH-II: Act. #48 Checkpt. 5.1 M&E p.17 Act. #49 Checkpt. 5.2 M&E p.18
JJ. The student will be given a group of randomly assorted pictures to organize into similar sets. KK. He will list, on paper, the similar characteristics of each set. LL. The student will present his arrangements of his pictures to the class, defend his arrangement of pictures, and observe that the groups of pictures can be arranged in more than one way.	To achieve JJ-LL: (Classification & hypothesizing) Act. #50 attached p. II-53 to II-55 Act. #51 Classification (opt.) p. II-56	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
MM. The student learns any collection of organisms or things can be classified into two or more groups by classifying an unfamiliar collection into at least two mutually exclusive groups on a logical basis of his own invention.	To achieve MM: Act. #52 Investigation 4 M&E p. 58 This chapter of M & E could be entirely omitted or used only if the teacher feels more reinforcement is needed at this point.	
NN. Given a series of 10 mounts of different kinds of plants the students will explain the differences between these plants in a discussion with the teacher.	To achieve NN-QQ: Act. #53 Classification Teacher preparation required p. II-57	To evaluate NN-QQ Act. #56 Classification p. II-57
OO. Given a series of 20 numbered or lettered mounts of plants the student will put them into groups according to similarities.	Act. #54 Classification p. II-57	
PP. Given a series of 10 mounts of different plants the student will write down on paper a distinguishing characteristic of that specific plant.	Act. #55 Classification p. II-57	
QQ. A student will collect four different kinds of plants, identify them and mount them.		Audio-visual aids p. II-58

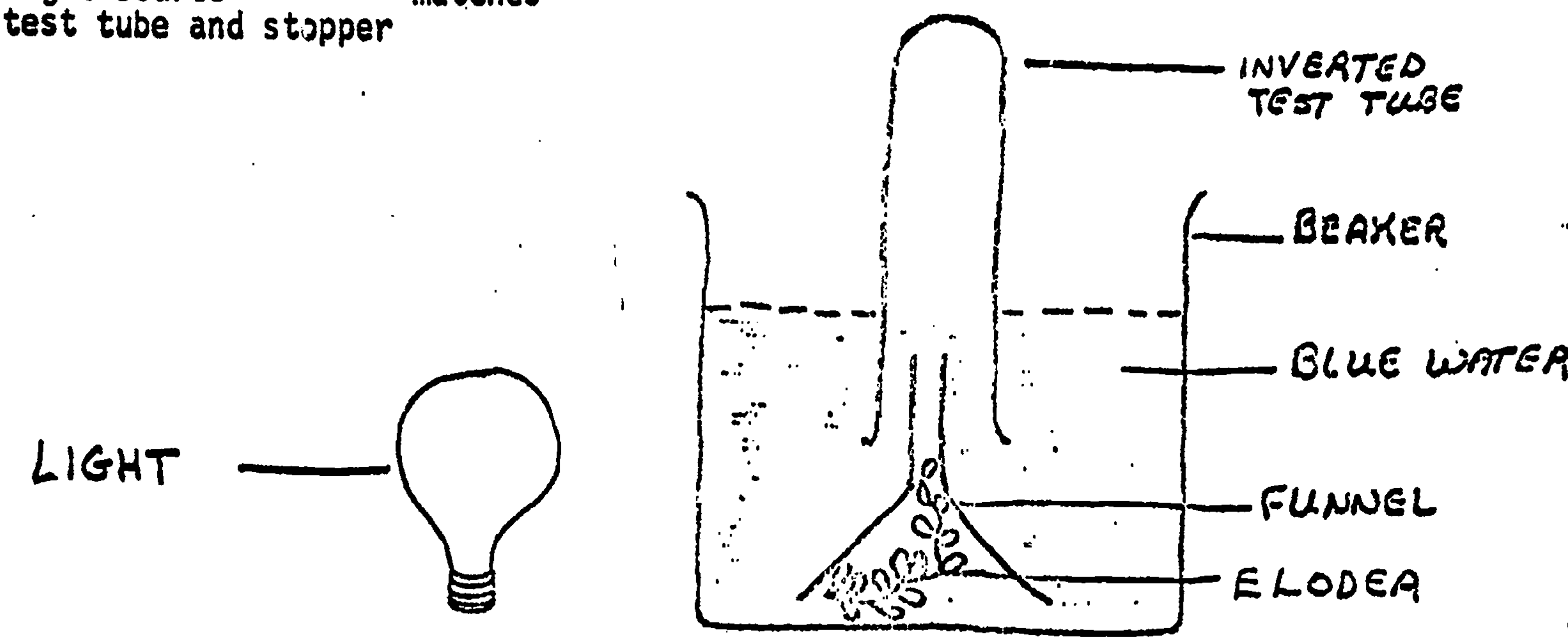
Activity lb. BEST COPY AVAILABLE

Does Photosynthesis Produce any Gas?

Problem: You now know that green plants use carbon dioxide gas from the atmosphere or dissolved in water for the process of photosynthesis. The carbon dioxide was exhaled into the environment by animals as a waste from respiration. In this investigation we will test to see if a waste gas is given off by plants from photosynthesis. If a gas is given off and the plant lives under water we can collect these gas bubbles and identify the gas.

Materials: per lab group

- elodea plant
- large beaker
- glass funnel
- light source
- test tube and stopper
- blue water
- straw
- splint
- matches



Procedure:

1) Fill a beaker 2/3 full of blue water.
2) Blow through a straw into the blue water to saturate it with carbon dioxide. When it has enough carbon dioxide it will turn yellow.
3) Cut several sprigs of elodea, place them in a funnel and place it upside down in the beaker of blue water. The stem of the funnel must be underwater.
4) Fill a small test tube with blue water and add carbon dioxide from your breath until it turns yellow.
5) Stopper the tube, turn it upside down, insert it into the water in the beaker. While it is under water remove the stopper and carefully slip the mouth of the tube over the stem of the funnel. Do not let any air into the test tube.
6) Place the beaker about 20 cm from the light. Turn the light on and allow apparatus to remain in the light for 24 hours.
7) Set up a control by using the same procedure in steps 1-6 but DO NOT put any elodea into the funnel.

Question Group A:

1) Do you hypothesize that any gas will be produced by the plant while it is in light for 24 hours? If so what gas?

2) Do you predict any changes in the color of the water. If so what changes?

3) How will you know if any gas is produced?

4) How can you identify a gas?

Question Group B:

1) What color is the water today? What color was it yesterday? Explain this change.

2) How is the volume in the test tube of water different than yesterday? What does this indicate.

3) Remove the test tube and hold it upside down and insert a glowing splint. If the glowing splint bursts into flame, oxygen is present. If the splint goes out, carbon dioxide is present. What gas is in the tube?

4) Do the results support your original hypothesis? If not modify it.

5) Why did we blow into the blue water and turn it yellow?

6) What gas is used by a plant for photosynthesis? Used for respiration?

7) What gas is given off as a waste from photosynthesis? Waste from respiration?

8) Summarize the oxygen - carbon dioxide cycle.

CO_2 = Carbon dioxide

H_2O = Water

O_2 = Oxygen

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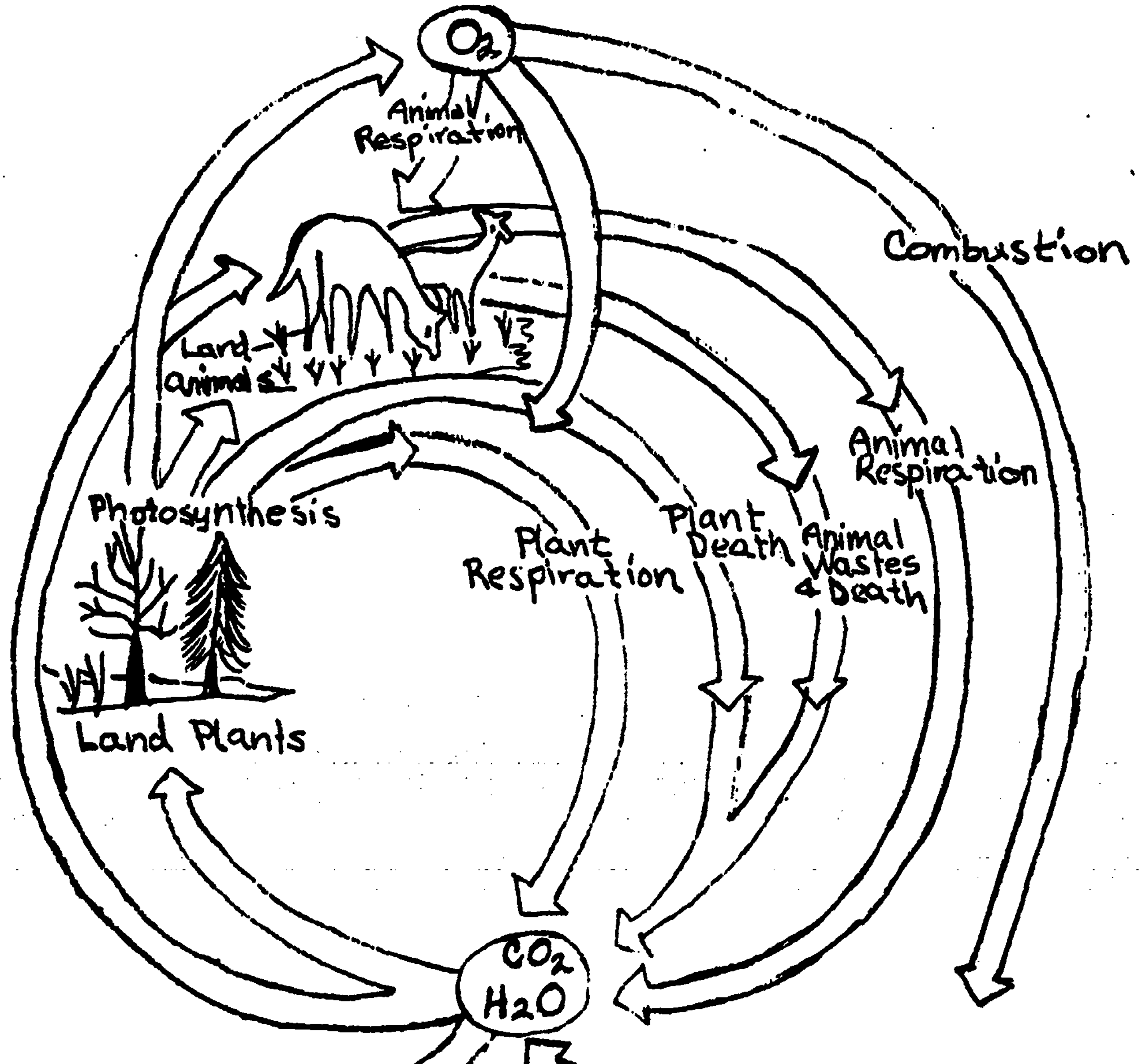


Water is lost by drainage to oceans; carbon dioxide is lost by the washing away of soluble carbonates into the ocean.

Carbon dioxide is added to the cycle by combustion or natural fuels. WATER IS ADDED BY RAINFALL.

The Carbon - Hydrogen - Oxygen Cycle on Land

Activity # 6.

O_2 - CO_2 Cycle (Diagram taken from Modern Life Science)

Class Activity:

use transparency
Give students a ditto without the writing

Go over the diagram with the students explaining where the CO_2 & O_2 come from and where they go.

When you think the students understand the diagram, give them the following work sheet.

1. How is oxygen put back into the atmosphere? ____________________

2. Combustion is one way in which oxygen is used up. What gas is replaced (produced) as a result of combusion? ____________________.

3. Give three ways that O_2 is used up. __________. __________. __________.

4. Water is added to the cycle by what process? ____________________.

5. Give four ways that CO_2 is put back in the system ____________________.

____________________. ____________________.

6. Give two ways the CO_2 is used up ____________________. ____________________.

7. What does photosynthesis mean? ____________________.

8. What living thing carries on photosynthesis? ____________________.

9. What does the word combusion mean? ____________________.

Teacher suggestions for Act. # 7-9

1. Use disposable petri dishes.

2. Use whatever kind of seeds are available if suggested ones cannot be obtained.

3. Have filter cut to size before students use it.

4. Have one set of petri dishes set up for students to use as model.

5. Soak seeds in acid prior to experiment.

It is not necessary for all students to do all three Problems. To save time have separate classes do different problems, and have all students observe the progress of all three Problems.

Activity # 14

Ability of Soils to hold Water

A. Set up three funnels of the same size on tripods. Place a small, loose wad of absorbent cotton in the neck of each funnel. Fill each funnel to within 1 inch from the top with one of the following dry soils: beach soil or gravel; clay soil from an eroded slope or well-worn path; and garden soil (loam). Place a beaker or similar receptacle under each funnel.

B. Pour 150 milliters of water into a container. (More or less water may be used according to the capacity of the funnels.) Slowly pour all of the water into the funnel containing beach soil. Repeat the procedure with the other soils. Wait 5 minutes and measure the amount of water in each beaker. Record the measurements:

Amount of Water Passing Through Soil

Beach soil ________________

Clay soil ________________

Loam ________________

Possible questions for the student to answer after doing the demonstration.

1. Which type of soil allows water to drain most rapidly? least rapidly?
2. Which type of soil holds the most water? least water?
3. What accounts for the capacity of soils to hold water?
4. Which type of soil would best support plant life? Explain.

Life Science: Intermediate Level
Lesser
p. 61

Th above demonstration may be used and/or a demonstration from
Modern Life Science
p. 263
Fitzpatrick and Hole

Activity #15

How does Soil affect Seed Germination and Growth? **BEST COPY AVAILABLE**

Purpose: In this investigation you will make a hypothesis as to the type of soil which is best for seed germination (sprouting) and development and you will test this hypothesis by experimentation.

Materials: per lab group

5 paper cups
5 pre soaked bean seeds
gravel
sand
organic soil
fertilized soil
water

Procedure: 1) Take 5 paper cups and plant a soaked bean seed in each. Label A, B, C, & D. Place your initials on each cup.

In cup A place only the seed.
In cup B plant the seed in gravel
In cup C plant the seed in sand
In cup D plant the seed in organic soil
In cup E plant the seed in fertilized soil

2) Water each seed equally and place near the window. 3) All seeds should be watered daily and treated the same. 4) You will observe these seeds and plants they produce, daily for several weeks and record these observations in a data table.

QUESTION GROUP A (to be answered on the day the experiment is set up.)

1) Which soil types do you predict will produce the quickest seed germination? Explain why.

2) Which soil types do you predict will promote healthy growth of the adult plant? Explain why.

3) What was the purpose of including cup A without any soil?

4) What is this part of an experiment called?

DATA: Some of these days will fall on a weekend when you can't make an observation. Leave these blank. Complete data table #1 with your daily data. Complete data table #2 with class final data.

QUESTION GROUP B: (to be answered at the end of two weeks)

1) Which type soil (s) best support healthy bean growth?

2) Does this data support your hypothesis (prediction)?

3) Whch soils have minerals?

4) Which soils hold water best?

5) Form another hypothesis based on class data to explain why seeds grow better in some soils than others.

6) Why do some people suggest that vegetables be grown organically and that artificial fertilizers be banned (outlawed)?

Student Answer Sheet

Activity #15

How Does Soil Affect Seed Growth?

<u>Question Group A</u>:

1.

2.

3.

4.

DATA Table #1   Personal Data on Seed Growth and Soil Types

DAY	Cup A No soil	Cup B Gravel	Cup C Sand	Cup D Organic Soil	Cup E Fertilized Soil
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Activity #15

DATA TABLE #2 Class Data of Seed Growth and Soil

	Final Observation
Cup A	
Cup B	
Cup C	
Cup D	
Cup E	

QUESTION GROUP B:

1.

2.

3.

4.

5.

6.

Activity #16

Analyzing a Soil Sample #1

I. Question: What percentage of the weight of a soil sample is water?

II. Materials: Soil, 250 ml., beaker, oven, scales

III. Procedure:

A. Collect a sample of soil (1/2 cup)

B. Weigh the empty beaker, record the weight on your answer sheet

C. Put the soil into the beaker

D. Weigh the soil and beaker, record the weight on the blackboard and on your answersheet. Give it to your teacher so that it can be baked.

E. Weigh the soil again (after it has been baked) record this weight on the blackboard and on your answer sheet.

F. Keep your baked soil to use in Activity #17

IV. Observations:

A. How much did the original soil sample weigh?

B. How much did the soil sample weigh after baking?

V. Conclusions:

A. Why was the soil baked?

B. What did this experiment show?

C. Find the percentage of H_2O that was in the soil by using the formula below:

$$\frac{\text{weight lost}}{\text{original weight}} \times 100 = \text{percentage of original weight that was } H_2O$$

Activity #16

Lab Report Sheet #1

1. Weight of empty beaker __________

2. Weight of soil and beaker ___________

3. Name of Student   Weight of soil and beaker

4. Weight of soil and beaker after baking _____________.

5. Name of Student   Weight of soil and beaker after baking

Activity #16

Lab Report Sheet #1

6. Weigh of original soil sample _______________.

7. Weigh of soil after baking _______________.

8. Put your answers for the three questions under conclusions in the space below.

   A.

   B.

   C.

Activity #7

Analysis of soil #2

Question: How much of the weight of soil is humus?

Materials: Dehydrated soil, 250 ml. beaker, oven, scales

Procedure:

A. Weigh the soil and beaker. Record on answer sheet.

B. Bake the sample.

C. Weigh the soil after baking and record the weight on the answer sheet and the blackboard.

D. Keep your sample for Act. 19.

Observations:

A. How much did the soil weigh before baking?

B. How much did the soil weigh after baking?

Conclusions:

A. Calculate the percentage of the weight of the soil that was humus by using the following formula:

$$\frac{\text{wt. last}}{\text{original dry wt.}} \times 100 - \text{percentage of original wt. due to humus}$$

record on B.B. and A.S.

B. Does your soil have more or less humus than the rest of the class.

C. Would your soil be good or bad for growing plants?

Activity #7

Lab Report Sheet #2

1. Weight of soil and beaker ________________.

2. Weight of soil and beaker after baking ___________________.

3. Name of Student Weight

4. Weight of soil before baking ___________.

5. Weight of soil after baking _______________.

6. Weight of the humus ___________.

7. Answers to conclusion questions.

   A.

   B.

   C.

Activity #18

Types of Soil

Read p. 192 in Modern Life Science under the heading types of soils. Then in one or two sentences explain what the four different types of soil described in the reading are.

Activity #19

Analyzing a soil sample #3

I. QUESTION: How much water can your soil sample hold?

II. Materials: Soil, 250 ml, beaker, scales, funnel, filter paper, graduate cylinder (10 ml.)

III. Procedure:

A. Use baked soil sample

B. Weigh the sample

C. Dampen filter paper and place on the funnel.

D. Place soil on top of filter paper in the funnel

E. Using the graduate cylinder, measure out 10 ml. of H_2O.

F. Pour the H_2O onto the soil until the soil is wet and H_2O begins to run through the funnel. (10 ml. may not be enough, you may have to use 20 ml. or 30 ml.)

G. Catch the water that comes through the funnel and return it to the graduate.

IV. Observations:

A. Calculate how many milliters of H_2O was held by the soil in the funnel. Record this on the blackboard.

B. Calculate the milliters of H_2O held by each gram of dry soil by using the following formula:

$$\frac{\text{ml. of } H_2O \text{ held}}{\text{wt. of soil in gm.}} = x \quad \text{of } H_2O\text{/gm. of soil}$$

V. Conclusion:

A. Did your soil sample hold more or less H_2O than the majority of the class.

B. What type of soil do you think your sample is?

C. Would your soil be good for the growth of plants?

D. Give an example of a plant which would grow in water, very damp soil, very dry soil and moderately damp soil.

pH of your soil sample

While your soil is damp, test its pH. Get a piece of pH paper. Put it on the damp soil (you may have to press down on the paper slightly so that it gets damp.) Match the color of the paper with the pH chart and record the corresponding no. on the answer sheet.

Activity #19

Lab report sheet #2

1. Weight of baked soil sample ______________.
2. Number of ml of H_2O used ______________.
3. Number of ml (that did not stay in the soil) collected in the beaker ______________.
4. Number of ml held by the soil ______________.
5. Name of Student . ml held by soil

6. ml of H_2O held by each gm. of dry soil ______________.
7. Put answers to questions under conclusions here:

   A.

   B.

   C.

8. pH of your sample.

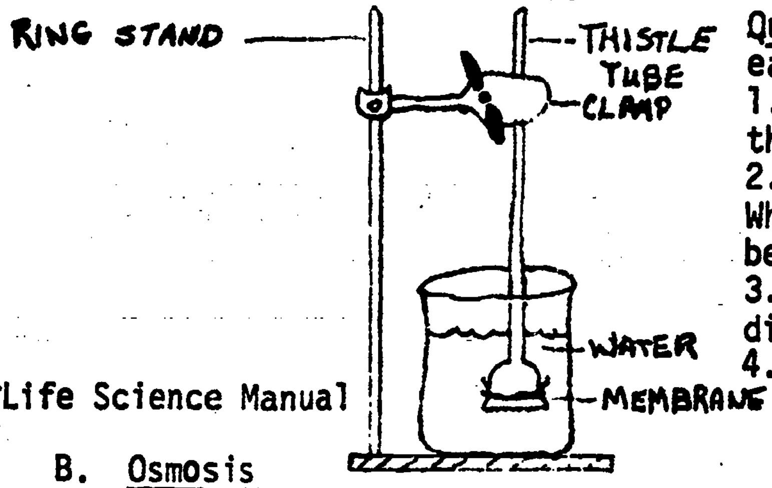
Activity #20 **BEST COPY AVAILABLE**

Diffusion/Osmosis Start Act. #21 beforedoing these demonstrations.

To the teacher: Listed below are a variety of possible demonstrations to show diffusion and osmosis. At least one demonstration for each concept should be chosen to present to the class.

A. Diffusion:
1. Fill a beaker half full with water. Place two drops of food coloring in the water (red or blue would be best). Do not stir. Allow the beaker to stand until the water is the same color from top to bottom.
2. Light a cigarette in the back of the room without the students knowing it. Leave it there until the students in the front of the room smell it.
3. Burn incense in the back of the room - see how long it takes for the students to smell it.
4. Materials: concentrated starch solution*
   thistle tube
   cellophane - soaked in alcohol to remove the protective layer
   beaker
   ring stand
   clamp
   rubber band

Pour some of the starch solution into the mouth of a thistle tube while holding your finger over the end of the tube. Do not completely fill. Cover mouth with a piece of cellophane and fasten with a rubber band. Invert tube and place mouth in a beaker of water. Attach tube by clamps to ring stand. Add dilute iodine solution to the water in the beaker. Observe after 15 minutes and at various times thereafter.



Questions for class discussion or for each student to answer individually:
1. What happened to the liquid in the thistle tube?
2. Iodine will turn starch purple. What happened to the iodine in the beaker?
3. Did the starch in the thistle tube diffuse into the water in the beaker?
4. What is diffusion?

*Life Science Manual

B. Osmosis
1. Materials: carrot, beaker, one-hole stopper, glass tubing, wax, water
   a. Make a hole in the large end of a carrot big enough for a small one-hole stopper to fit into.
   b. Put a piece of glass tubing through the hole in the stopper, then insert the stopper into the carrot.
   c. Seal this by putting wax around the stopper.
   d. Put the carrot in a beaker of water.
   e. Allow to sit for a few days. The water should rise in the tube.
2. The set up for this is the same as for #4 under diffusion. In the thistle tube you put molasses and the beaker has water in it.

A series of questions should be made up to go along with each demonstration. These could be discussed and answered in the classroom or the questions could be put on a ditto for the students to answer and hand in. These questions should be answered while the students observe the demonstrations.

Some activities based on those from:
[1] The Book of Popular Science, N. Y., Grolier, vol. 8, p. 186

Activity #21

Let's Get to the Root of It

Problem:

You already know that a root has a great deal of importance to a plant. Let's see what you may know: Make a list below of the ways a root is valuable to a plant.

You are going to do an investigation that will show you another way that roots are important to plants.

Materials: per group

10 seeds
baby food jar or petri dish
paper towels

Procedures:

A. Place several layers of paper toweling on the bottom of the jar. Moisten the paper so the top is quite wet. (No water should be standing in piles on top of the paper).

B. Spread the seeds out on the paper. Cover the seeds with a layer of paper toweling. Sprinkle the top layer of paper with water. Leave the jar on the counter top.

C. Observe (keep a record) and moisten the seeds each day until they have germinated and the roots are about 3 cm. long.

Questions:

1. Which part of the root (tip, middle, base) do you think will show the fastest growth?

2. How can you prove your answer to question number 1?

3. When your root is 3 cm. long, use your answer to question number 2 to prove which part of the root grows fastest.

4. What does the growing root look like? Be sure to observe it carefully before attempting to describe it. You may want to use a hand lens.

5. a) What major change do you notice after several days? b) Is this change important? c) Why or why not?

Activity #22 Transportation in plants

I. Problem: How are minerals and other water soluble nutrients transported from the soil to the leaves in a plant?

II. Materials: per group of students
4 small jars or beakers
fresh celery stalks (or carnations, Queen Ann's lace)
vegetable dye
salt

III. Procedures:
A. Label the jars A, B, C, and D
1. Pour about 50 ml. of water into each jar.
2. To beaker A, add 3 drops of vegetable dye
3. To beaker B, add 1 teaspoon of salt. Stir.
4. To beaker C, add 3 drops of a different colored vegetable dye
5. Do not add anything to the 50 ml. of water in beaker D.

B. Trim 3 inches off the bottom of 2 stalks of celery (stems of 2 flowers)

Split the cut end of the 2 stalks about one-half to three-quarters of the way up the stalk. Place jars A and B side by side and jars C and D side by side. (See diagram). Take one of the stalks - insert one of the cut sides into jar A and the other cut side into jar B. Follow the same procedure for the second stalk, placing one cut side into jar C and the other side into jar D. Support both stalks loosely and observe.

IV. Observations:
A. Describe the appearance of the stalk and leaves above the water level in each of the four jars A-D.

B. Explain the changes you have observed in each half of both stalks.
1.

2.

3.

4.

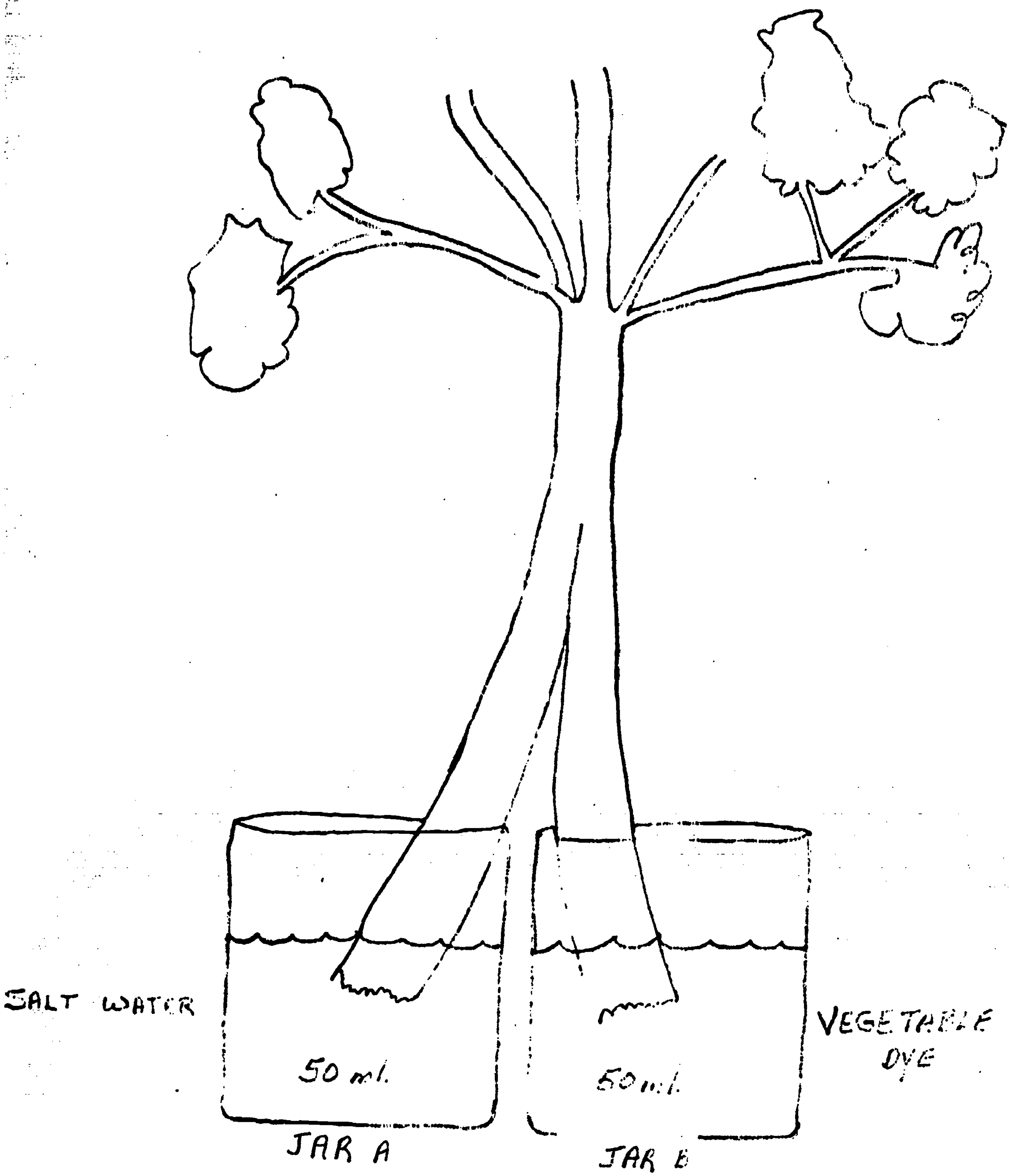
C. Did the same changes occur in both sides of the stalk placed in jars A & B. C & D? Explain your answer.

D. What was the purpose of using jar D, containing only water?

E. What caused the change of appearance in the stalk in jar B? Try to explain this change.

F. What is the importance of watching vegetable dye or salt in solution move up the stem of a plant?

Activity #22



Activity #23

Problem

I. Do leaves perspire?

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II. Materials - per group
candle
matches
2 jars
1 leaf
square of aluminum foil
water

III. Procedure:

A. Break off a leaf from the plant. Be sure to include the leaf stalk or petiole.

B. Cut a square of aluminum foil large enough to completely cover and seal the mouth of one of the jars - (Do not seal the jar at this point.)

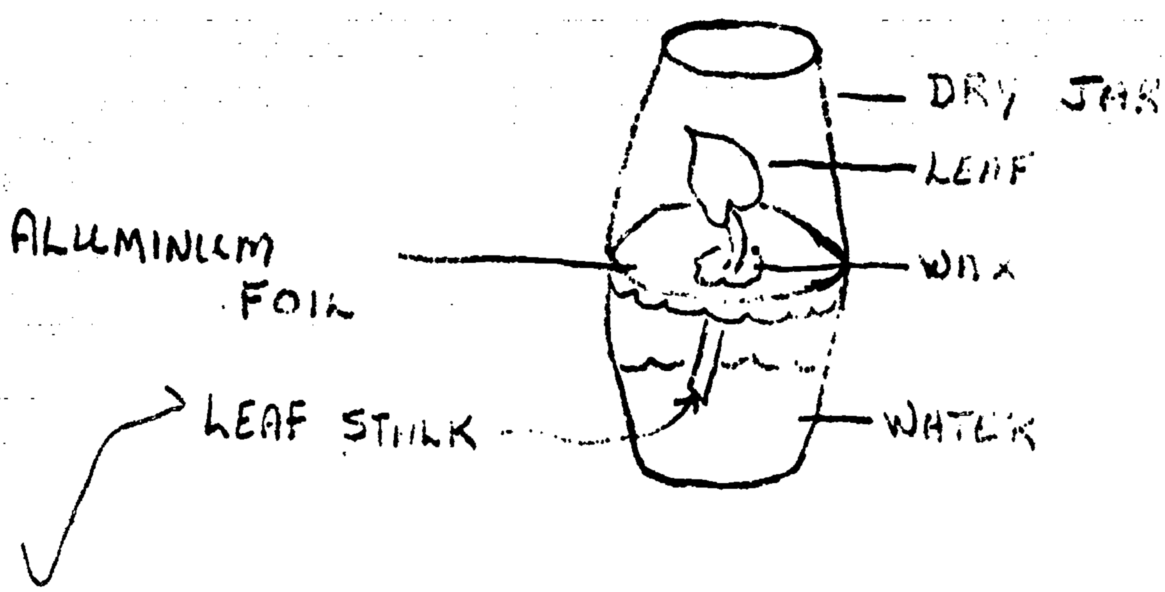
1. In the center of the aluminum foil punch a hole, with a pencil, just large enough for the leaf stalk to fit through.
2. Put the leaf stalk into the hole as far as it will go.
3. Light the candle; tip it so that melted wax will drip down and completely seal the hole around the leaf stalk.

C. Fill one of the jars (glasses) three-quarters full with tap water. Mark a line on the jar where the water reaches.

D. Set the leaf stalk and aluminum foil over the jar with the water. Bend the foil down around the mouth of the jar so that a tight seal is formed.

E. Over the blade of the leaf, place the other jar (up-side down). The jar must be clean and DRY.

F. Make a record of your observations each day that you come to class, for a period of two days.



Activity #23

Do leaves perspire?

IV. Questions:

1. Do you notice any changes in the jar above the leaf? If so, what?

2. Do you notice any changes in the amount of water in the jar below the leaf? If so, what?

3. Circle the best answer. Does a leaf seem to perspire?

   yes no

4. Explain your answer from question number 3.

5. If you choose a light green leaf and did the above experiment only you added red vegetable dye to the water, explain what you think might happen.

Activity # 31

The H_2O Cycle (diagram taken from Modern Life Science p. 185)

Class Activity:

Transparency

Give the ditto to the students. Using the transparency fill in the ditto with the students. Explain the process to the students so that they know where the H_2O comes from and where it goes.

(The CO_2 - O_2 Cycle can be compared here and recycling can be mentioned while natural recycling fresh in their minds).

When you think the student understands the concept, give him the following work sheet to complete.

1. What process is taking place where the no. 1 is on the diagram? ___________
2. What does the word that is the answer to #1 mean? ______________________
3. What one word could you place in the space on the diagram numbered #3.

   ________________________.
4. What is the object numbered #4? Why is this object important to the water cycle? (1)
5. What other word is the word cycle similar to?
6. Why is it important that the water cycles? It is never used up. (1)
7. Why are plants and animals included in the water cycle? (2)

Activity #38

Phototropism

Purpose: To study the effect of light on a young growing plant.

Materials: per lab group of 4 or 5
3 milk cartons (small)
9 - 15 soaked bean or pea seeds
peat moss
vermiculite or potting soil

Procedure:

1. Cut the milk carton down so that the sides are about 3" high.
2. Place peat moss or other planting material in the carton up to within 1" of the top of the carton.
3. Place 3 - 5 of the soaked seeds in the carton.
4. Label the cartons A, B, C.
5. Place carton A on the window sill, carton B on a table that does not get direct sunlight, and carton C in a dark cupboard.
6. Water the cartons equally when the soil seems dry - not too often.
7. Begin observations when plants begin to sprout.

OBSERVATIONS: Fill in the data chart below when you begin your observations. Record data each day.

Date	Height of Plant Length of stem Color of plant	A	B	C

Conclusions:

1. In which carton did the plants grow best?
2. What is the effect of light on the stem?
3. Explain the color of the plant in total darkness.
4. How is sunlight related to the successful growth of a green plant?

Molecules to Man p. 561

Modern Life Science p. 115-116

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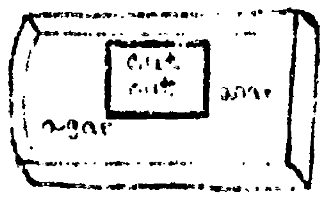
Activity #38 - Teacher Demonstration

To show a plant's response to light and gravity.

Materials: Powdered agar; mustard seeds; shallow square, clear plastic sandwich box

Procedure: Follow the directions on the agar and dissolve enough to fill the sandwich box half full. Pour the melted agar into the box and allow it to harden. When the mixture is hard, cut out an oblong section of the agar just off the center of the box.
like this:



The cut out area forms a little shelf of jelly when the sandwich box is turned on its side as in the diagram. Sprinkle mustard seeds on this shelf, close the box and stand it in an upright position. If the cover causes the box to stand unevenly, place strips of paper or cardboard underneath the box until it is level.

The seeds will germinate and grow into the jelly without adding water. When the seedlings are half an inch above the agar, turn the box on a side edge. The oblong space now goes up and down and the seedlings will be growing sideways.

Have the class observe the changes which take place during the next few days.

Next place the box (you may wish to set up a second box) so plants get strong sunlight from one direction. You should stand the sandwich box in a container to prevent other light from influencing the plant's phototropism.

Activity #39 Teacher Demonstration

Problem: Is light important in photosynthesis?

Materials:

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plant with large leaves, (bean plant, geranium)
aluminum foil
scissors
heat source (preferably a hot plate)
500 ml beaker
2 - 200 ml beakers
small dish
alcohol solution
IKI solution (lugol's iodine solution)
cornstarch
forceps

Procedure:

A. Completely cover one leaf of a plant with aluminum foil. Cover the leaf tightly so that no light can reach its surface.

B. Place the plant about 6 inches from a 150-watt light source. Water the plant for two days.

C. You must now wait two days for results to occur. During this time answer the questions 1-2 below and carry out the investigation which shows you how to test for starch and sugar.

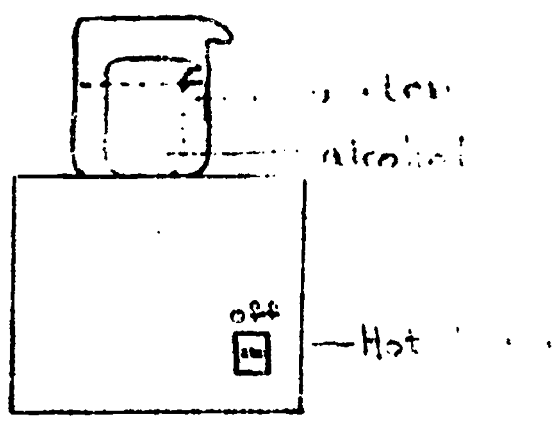
Questions:

1) How can you tell if photosynthesis is occurring in a plant?

2) Do you think question number 1 must be answered before you determine if light is important in photosynthesis?

D. On the third day after covering the leaf, remove from the plant on uncovered leaf. Place the leaf in boiling water for one to two minutes. Remove the leaf from the water with a pair of forceps and place it in a hot alcohol solution. (See precautions and diagram). When the leaf has lost most of its green color, remove it from the solution.

Caution: Alcohol is highly inflammable.



Activity #39 (cont.)

E. Dip the leaf back into the boiling water. Then place the leaf flat in a small dish and flood it with IKI solution. After three minutes, record your observations below.

F. Repeat procedures C and D, using the leaf that was covered with foil.

Observations:

E.

F.

Questions:

1) When you heated the leaf in the alcohol, what color did the alcohol become?

2) What entered the alcohol to cause this color change?

3) What materials is IKI used as a test for?

4) What does the test with IKI indicate is present or not present in the uncovered leaf?

5) Why was one leaf covered with foil?

6) What does the test with IKI on the covered leaf demonstrate to you?

7) Compare the reaction of the IKI on the uncovered leaf to that of the covered leaf.

8) What accounts for this difference between the leaves?

Activity #40

Testing for starch and sugar

Materials:

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Benedict's solution
IKI solution
5000 ml pyrex beaker
graduated cylinder
heat source (preferably a hot plate)
2 - test tubes
test tube holder
white Karo syrup solution (see note)
various foods (bread, potato, milk, cornstarch)

Procedures:

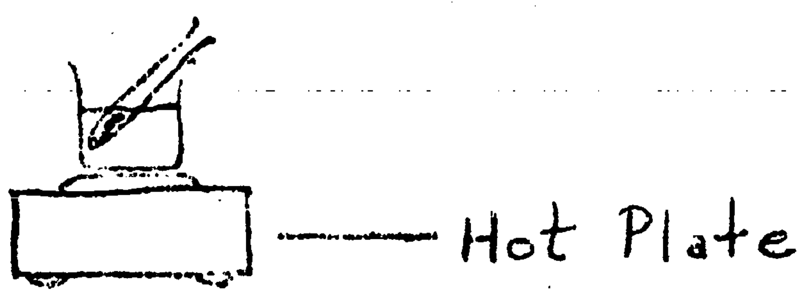
Sugar test -

A. Record your observations in the following chart.

	Sugar test	Starch test
Karo syrup		
bread		
potato		
milk		
cornstarch		

B. Using a graduated cylinder, measure out 5 ml. of white Karo-syrup solution and pour it into a test tube. Add 5 ml. of Benedict's solution.

C. Place the test tube in a boiling water bath.



D. As soon as a definite color change occurs, remove the test tube from the beaker. A color change to green, yellow or red indicates that sugar is present. Test other foods provided by your teacher in the same way, to see if they contain sugar. If a food has sugar, write a plus (+) sign in the proper space under (Sugar test) on your chart. If it does not, write a minus (-) there.

Activity #40

Starch test

E. Place a pinch of cornstarch in a clean test tube. Add water until the test tube is about 1/4 full.

F. Add 4 or 5 drops of IKI solution.

Do you see a color change?________________

If so, what? ________________

A blue-black color indicates the presence of starch.

G. Test for the presence of starch in the other foods listed in your chart. Record the results of the test in the same way you did the sugar test.

Questions:

1) If a water solution containing a food were mixed with Benedict's solution and the mixture turned green, what could you conclude about the food?

2) If a second solution of another food and water were mixed with Benedict's solution and the mixture turned bright orange, what could you conclude about this food?

3) Compare the results of question 1 and question 2.

4) If you added some IKI to raw hamburger and the hamburger turned brown, would you say this is a positive or negative starch test?

Activity 3:

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Evaluative Investigation:*
Testing Unknown Mixtures for Starch and Sugar

Materials: per group

pyrex beaker
Benedict's solution
IKI solution
unknown mixture x,y,z, - provided
2 - test tubes
test tube holder
water bath

Procedures:

A. Set up a data table in your notebook for the tests on the unknowns x,y,z.

B. Obtain a small amount of each of the three unknown mixtures.

Using the materials in your list above determine whether or not your mixtures contain starch or sugar. Keep a record of what you do to each mixture as well as a record of your results as indicated in section A.

C. Your teacher will evaluate your data table when you are finished.

Activity #42 - Teacher Demonstration

The Importance of Being Green

Problem:

Chlorophyll,the green pigment in plants, is necessary for photosynthesis. But all leaves aren't green, some are red or white. In this investigation, you will determine if the non-green parts of leaves carry on photosynthesis.

Hypothesis:

Form a hypothesis to explain whether the non-green parts of plants carry on photosynthesis and design an experiment to test this hypothesis.

Materials: the following materials are available to you:

- variqated leaves with some green parts and some non-green parts
- hot plate
- beakers
- test tubes
- water
- alcohol
- iodine

Procedure: You should outline the procedure you would like to follow to test your hypothesis.

Data: Make a data table and record all your observations and results.

Questions:

1) What is one test you can perform to test to see if photosynthesis has occured in the leaf?

2) If a leaf has produced starch, how can you show this?

3) What parts of the leaf showed evidence of starch? b) What color were these parts before the leaf was bleached in hot alcohol?

4) Do the non-green leaf portions carry on photosynthesis?

5) Does the evidence you collected support your original hypothesis? If not correct it.

Activity #43

How Do Leaves Breathe?

Purpose: In this investigation you will see that leaves must exchange gases with the atmosphere.

Part I Teacher Demonstration

Materials:

plant
vaseline

Procedure:

1) Choose 4 healthy leaves on your plant and prepare them as follows:
 leaf A - coat upper & lower sides with vaseline
 leaf B - coat only lower side with vaseline
 leaf C - coat only upper sides with vaseline
 leaf D - do not coat any sides with vaseline.

Have the students make up a hypothesis for what they think will happen during this experiment.

Activity #43
Part II Teacher Demonstration

Materials:

hot plate
beaker
water
test tube
test tube holder
alcohol

Procedure:

1) Test each leaf (A, B, C, D) to see if starch was produced.

2) Record data on the board and have students record this also.

Questions:

1) Which vaseline treatment allowed starch to be produced?

2) What is the chemical process which produced starch?

3) What gas enters the leaf during this process? What gas leaves?

4) Does the starch test prove the hypothesis you wrote in part one. If not, rewrite your hypothesis.

Activity #43

Purpose: In this investigation you will see that leaves must exchange gases with the atmosphere.

Part III Student Activity

Materials:

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microscope
slide
cover slip
10% salt solution in dropper bottle
water in dropper bottle
leaf

Procedure:

1) Tear the leaf at an angle so that you remove the thin lower membrane. Your teacher will show you how. You may have to try several times.

2) Make a slide of this lower membrane by placing a drop of water on the slide and covering it with a cover slip. Make sure you only get the thin membrane under the cover slip. Observe under low and high power.

3) Locate small openings or pores called stomates. Notice the greenish guard cells which surround this pore.

4) Make a drawing of what you see under high power and label the stomate and the guard cell.

5) Place a drop of 10% salt solution on one side of the cover slip and place a piece of paper towel on the other.

6) Observe and draw under high power.

Questions:

1) What changes do you notice in the guard cell or stomate (Pore)?

2) How could the size of the opening change?

3) Form a hypothesis to explain how the size of the stomate could regulate exchange of gases between the leaf and the air.

4) Do your observations support your original hypothesis?

Activity #50

Teacher direction:

Place the students in groups containing no more than four students each. The students should have a limited amount of time during which they attempt to arrange different groups of pictures (these pictures will be prepared for 2 classes at ESM) into similar sets. The student groups will present their arrangements to the class and defend their arrangement if necessary. The teacher may want to suggest that the students attempt to assign names to their sets-allows for some fun!

Student direction:

You will be given a group of pictures. Try to arrange them into sets that seem to belong together. Be prepared to give an explanation for the groups you have arranged.

Supplement to Activity #50

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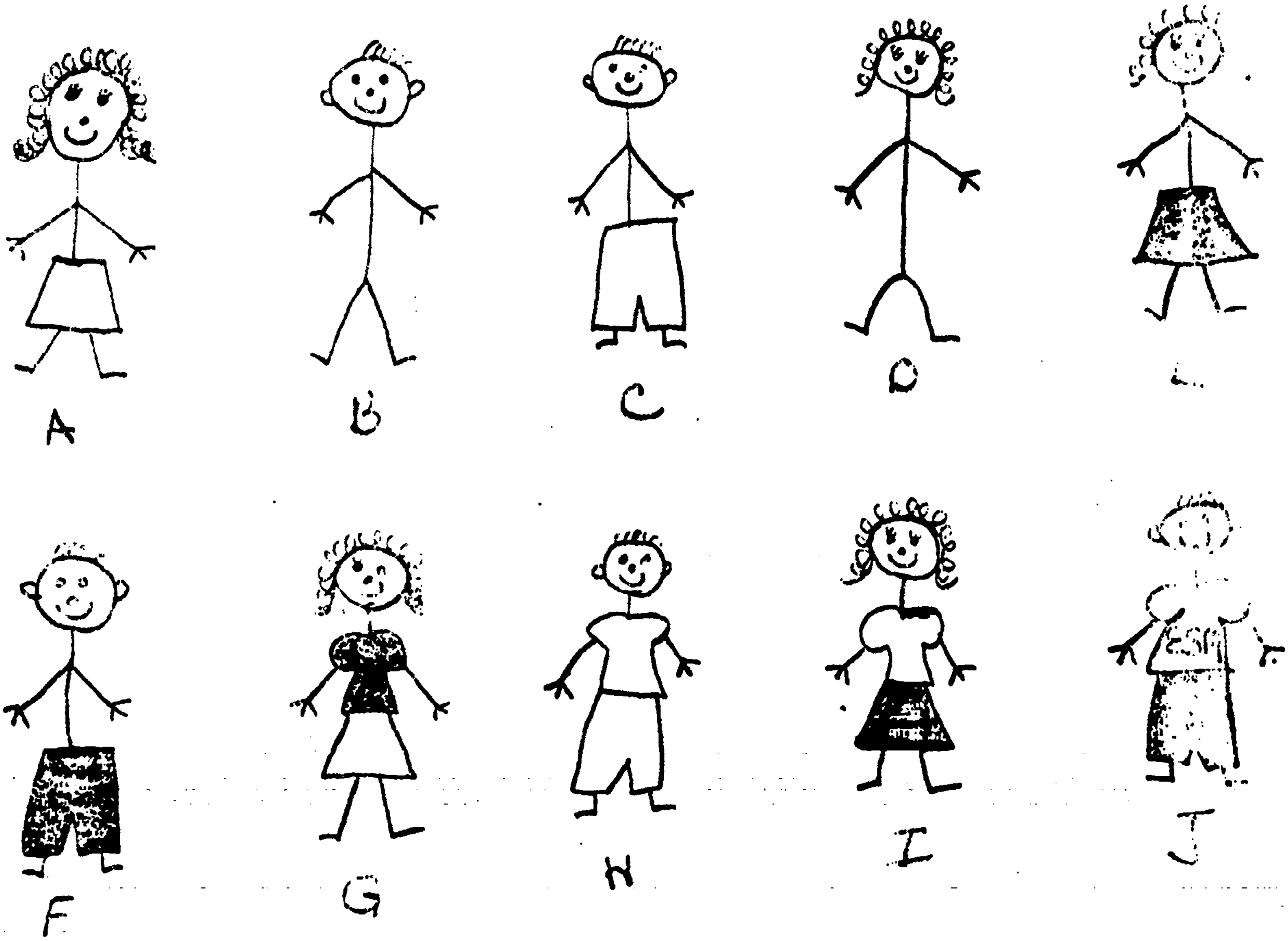
III. This is a classification exercise. Classify the following stick figures so that each is in its own group when you finish. Use the method we went over in class.



Put your answer on a separate sheet of paper!!

Teacher note for Activity #50 supplement (stick figures)

There are many modifications to this classification exercise. The style shown below should be followed because it is the same as most keys that the students might be using at some time during the year.

A. Boys
   C, C, F, H. J
   1. Without clothes
      B
   2. With clothes
      C, F, H. J.
      a. With pants only
         C, F
         1) with white pants
            C
         2) with colored pants
            F
      b. With shirts and pants
         H, J
         1) with white shirt
            H
         2) with white shirt with pattern
            J

B. Girls
   A, D, E, G, I
   1. Without clothes
      D
   2. With clothes
      A, E, G, I
      a. With skirts only
         A, E
         1) with white skirt
            A
         2) with colored skirt
            E
      b. With skirt & blouse
         G, I
         1) with white blouse
            I
         2) with colored blouse
            G

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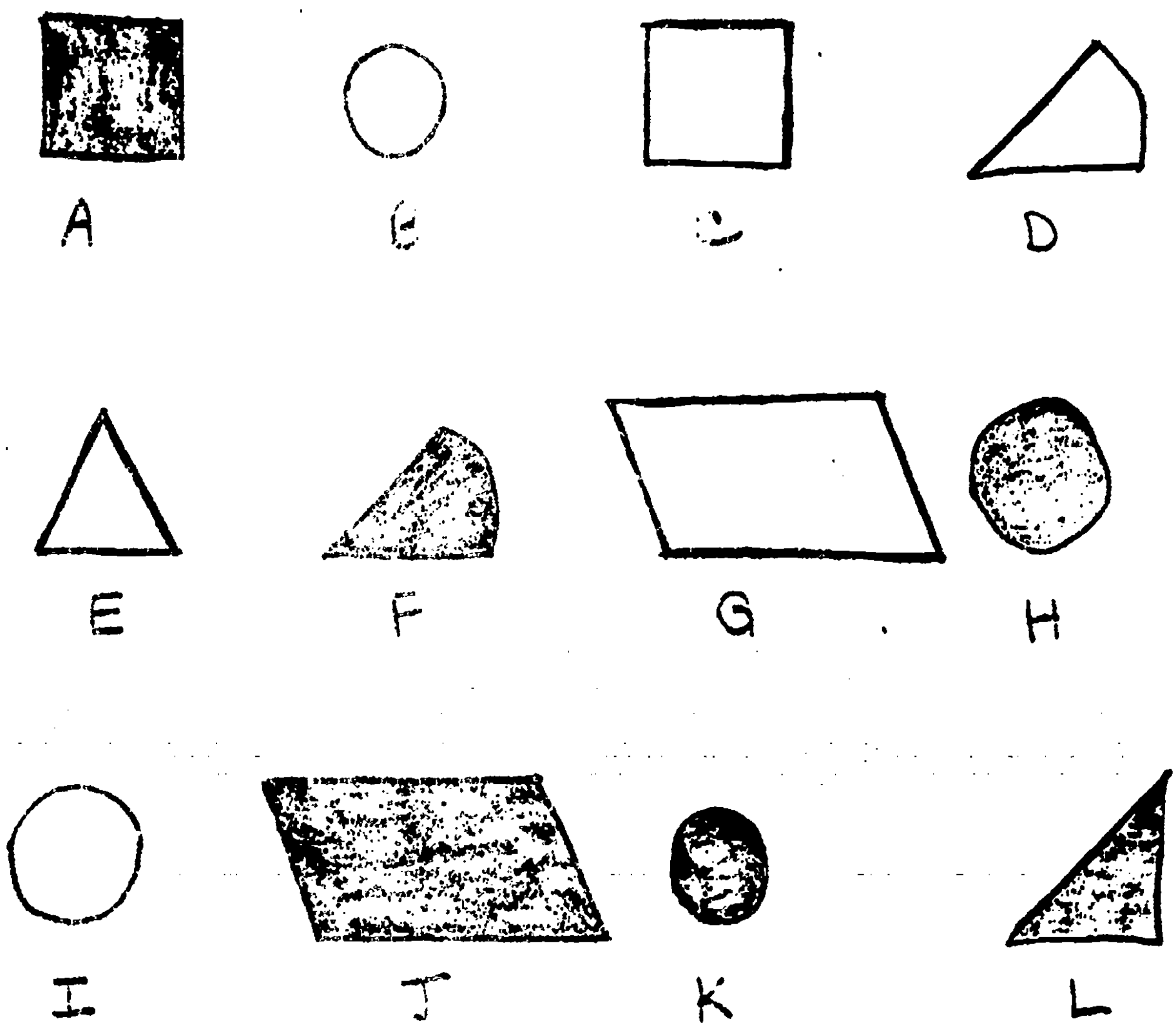
Activity #51 - Classification - supplemental

This activity may be used as enrichment for students who complete the required classification activities.



To the student:

You are to group these figures according to the things they have in common. Remember the least complicated way would be best.

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Plant Classification and Types

Activity #53: Make a number of series of plant mounts (each series consisting of 10 mounts). Label them with numbers or letter, 1-10 or A-J. Display them so that the students can see all of them. Discuss with the student the differences between these plants - first, being general and then getting specific.

Activity #54: Make up a series of 20 plant mounts. Label them somehow. Display them so that the students can see all of them. In groups or individually have the students group the plants according to similarities of individual plants. Discuss the groups they came up with and why - Make sure they have reasons for their groupings.

Activity #55: Using the same series of plants mounts as in activity #55, have the student list specific distinguishing characteristics of each palnt. Go over the list and see if any plants have the same distinguishing characteristics. (This could be a way of grouping these plants).

Activity #56 - Plant Collection

Have the student collect four different plants. Try to have some students collect from the yard, the forest, the field and the swamp. Do this only if feasible for the students. They should collect doubles of each plant - they can press one and use the other for identification. After the plant is pressed, it should be mounted and labeled.

Audiovisual Aids - Optional

Located at Pine Grove

Filmstrips:

Soil Resources	E-42	
Water Resources	E-45	
Plant Factories	H-14 and J-49	
Telling Trees Apart	H-15	
The Kinds of Plants	H-21	

Transparencies:

TR-46 - TR-62 (Includes classification, leaf structure, transpiration, photosynthesis)

TR-103 - TR-107 (Plant systems)

Time required for Unit II - 8 - 10 weeks

The unit should be completed by Christmas vacation.

EAST SYRACUSE-MINOA SCHOOLS

Environmental Education Materials

Grade 7 Science

Unit III Animal Niches

Produced Under USOE Grant OEG-0-71-4621
by East Syracuse-Minoa Central Schools
407 Fremont Road
East Syracuse, N.Y. 13057
Dr. Fritz Hess, Superintendent

TOPIC OUTLINE

III. Unit III Animal niches

A. Interactions within a population
   1. Definition of species
   2. Competition
      a) Food
         1. carnivore (meat eater)
         2. herbivore (plant eater)
         3. omnivore (plant and meat eaters)
      b) Space
      c) Mate
   3. Cooperation

B. Interactions between populations in a community
   1. Definition of community
   2. Predator/prey relationships
      a. examples of typical predator/prey relationships
      b. scavengers
      c. saprophytes
   3. Symbiotic Relationships
      a. parasite
      b. mutualism
      c. commensalism
   4. Adaptation for survival
      a. camouflage
      b. extinction-natural (and tentatively man-made)

Long Range Behavioral Objectives

Unit III.

A. The student will hypothesize that the organisms within a population interact both cooperatively and competitively after completing a series of various activities.

B. The student will observe that different populations within a community interact with each other in a manner that maintains the delicate balance of nature by completing a series of various activities.

Unit III Animal Niches

Activity No.		Objective
1	Environmental Levels - D	A
2	Checkpoint for Activity #1 - D	A
3	Readings - Food Groups - D	B
4	Readings - Food Groups - D	C
5	Checkpoint - D	D
6	Food Group - D - optional	B - D
7	ESS Unit on Crayfish - D	E, F, G
8	Ant Colony - D	H
9	Ant Colony - D	H
10	Bees - D	I
11	Bees - D	I
12	Supplementary Activities - D	I
13	Human Behavior	I
14	Problem 14.1 - M & E	J, K, L
15	Mastery Item 14.1 - M & E	J, K, L
16	Mastery Item 14.2 - M & E	J, K, L
17	Checkpoint 14.1 - M & E	J, K, L
18	Coyote - filmstrip	J, K, L
19	Individualized Study - Communities - D	M
20	Individualized Study - Pond Life - D	N
21	Problem 13.1 M & E	O
22	Mastery Item 13.1 M & E	O
23	Mastery Item 13.2 M & E	O
24	Checkpoint 13.1 M & E - optional	O
25	Filmloop - Hawk, Rattlesnake - D	P
26	Definitions predator/prey - D	Q
27	Predator/prey relationships - D	R
28	Filmloop - Harmful Insects - D	S
29	Supplemental - Shell film - D	S
30	Definitions - D	T
31	Cooperation in Communities	U
32	Special Adaptations - reading - D	V
33	Problem 12.1 M & E	W, X
34	Mastery Item 12.1 M & E	W, X
35	Mastery Item 12.2 M & E	W, X
36	Checkpoint 12.1 M & E	W, X
37	Extinction or Survival? - D	W, X
38	Written Report - D	Y
39	Nature's Disguises #155 FOM - filmstrip - D	Y
40	Nature's Use of Color - filmloop - D	Y
41	Rattlesnake - filmloop - D	Y
42	Little Animals - filmloop - D	Y
43	Adaptation - D	Z
44	Extinction - D	AA
45	Supplemental Activities - D	AA
46	Poisoning of the West Reader's Digest Reprint	AA

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Unit III: MATERIALS

Activity No.

1. no materials

2. no materials

3. no materials

4. no materials

5. no materials

6. no materials

7. medium size crayfish
   6 small crayfish
   2 plastic wading pools
   plastic 3 inch flowerpots
   1 hacksaw or pointed pliers
   aquarium gravel
   clear plastic boxes
   1/2 lb. fresh or frozen fish
   buckets for waste water
   1 pt. rubbing alcohol
   balances or scales
   modeling clay
   low power microscope
   magnifying glasses
   tweezers
   crayons
   drawing paper
   clay
   notebooks

8. ant colony

9. no materials

10. "Life of Honeybee" filmstrip

11. no materials

12. large glass tank
    top soil
    worms
    lettuce
    cereal
    small plants
    fishbowl

12. wire screening
    damp soil
    plants, flower seeds
    lettuce, flower petals
    dead insects, raw hamburg
    dry bread, celery leaves
    snails

13. human subject

14. no materials

15. no materials

16. no materials

17. no materials

18. coyote filmloop

19. Packets on Communities
    Plant & Animal Communities

    The Pond
    The Field
    The Forest
    The City
    Ecology of a Desert
    Ecology of a Forest
    Ecology of a Pond
    Ecology of a Seashore

20. compound microscope
    slides
    cover slips
    medicine droppers
    hand lens
    methyl cellulose or
    clear gelatin
    identification sheets
    jars of pond water, labeled
    beaker of tap water

21. cultures of paramecia
    euglenas
    rotifers and algae
    transparent pint jars
    clear plastic sheets
    rubber bands
    light-tight box

Unit III; Materials cont.

21. Pasteur pipettes
    methyl cellulose 1.5% in
    3 or 4 dropper bottles
    fluorescent light
    microscopes
    slides & coverslips

22. no materials

23. no materials

24. no materials

25. filmloop: Hawk Attacking Rattlesnake

26. no materials

27. no materials

28. Filmloop-Harmful Insects

29. Shell film

30. no materials

31. no materials

32. Book: <u>Modern Life Science</u>

33. plastic petri dishes
    clear tubing
    triangular files
    plastic cement
    test tubes
    cotton
    thermometers
    flashlights
    small paint brushes
    paints
    temperature and humidity gradients
    1/4" plywood sheets
    sand paper
    humidity indicator cards
    5% cobalt chloride solution
    6-8 watt lightbulbs
    pin socket

33. glue
    Saran wrap
    white filter paper
    anhydrous calcium chloride
    ice cubes
    masking or cellophane tape
    colored cellophane
    black plastic sheeting
    whole white potatoes
    vinegar
    vegetable matter
    table sugar
    table salt
    onions

34. no materials

35. several mealworms

36. no materials

37. small glass jars
    teaspoons of:
    lawn fertilizers
    phosphate detergents
    household ammonia
    microscopes
    5 medicine droppers

38. no materials

39. Filmstrip: Nature Disguises

40. Filmloop:Nature's Use of Color

41. Filmloop: Rattlesnake

42. Filmloop: Little Animals

43. ditto listing

44. no materials

45. no materials

46. Reprint from Readers Digest

Objectives	Strategies/Activities	Evaluation
A. After the teacher has defined the levels of organization in the environment, the student will list examples of each and be able to recognize given examples and the levels in which they are included.	To achieve objective A: Act. #1. Environmental levels D - pg. III-12 a) Basic definitions include: species - all organisms of one kind, an interbreeding unit. e.g. wolf, geranium, mountain lion, blue jay, rea maple, Mac Intosh apple, lake trout. population - all the organisms of a single species inhabiting a defined area. e.g. all the Indian elephants of Asia; all the rea pines of the Adirondaks; all the rock bass of Oneida lake; all the algae in an aquarium. community - All the living things (plants & animals) in an area; all species e.g. all plants and animals of New York State. ecosystem - all living things & all non-living elements in an area, includes all the physical factors, e.g. All plants, animals, rain, termperature, minerals, sunlight in a lake. b) Students will complete matching questions 1-10. They may have trouble distinguishing between species & population. A population has a boundary. KEY 1. B 4. B 7. D 10. B 2. A 5. C 8. B 3. C 6. A 9. D	Act. #2 - Checkpoint for activity #1 p. III-13 KEY 1. A (A only) 2. A (F) 3. C (E) 4. A (A)
B. Given three stories the student will read them and pick out the plant eater, the meat eater, and the plant-meat eater in each story at 100% efficiency.	To achieve B. Act. #3 Readings Life in a Field #1 ditto attached p III-14 Pond Life #2 p. III-15 Forest Life #3 p. III-16	

UNIT III: Animal Niches

Objectives	Strategies/Activities	Evaluation
C. Given two reading assignments; Modern Life Science p. 161-163 & Modern Science I, p. 121, the student will read these assignments and gain an understanding of the terms carnivore, herbivore, omnivore, and show that he understands these terms by writing the definitions in his notebook.	To achieve C Act. #4 - ditto attached p. III-17 Note to teacher: Act. #3 and act. #4 are given to the student simultaneously.	
D. Given a ditto sheet on carnivores, herbivores and omnivores, the student will complete the ditto at 100% efficiency.	Supplemental: to achieve D-D Act. #6 - ditto attached p. III-19 to III-22	To achieve D. Act. #5 - Checkpoint p. III-18 ditto attached
E. The student will be given a crayfish to study for a period of time to observe the animal's behavior.	To achieve E, F, G: Act. #7 ESS unit on Crayfish - D p. III-23 The teacher will be supplied with a copy of the teacher's manual for the ESS unit on Crayfish. Further suggestions to guide the teacher are attached to the activity packer.	
F. Given a crayfish, the student will study the external features of the crayfish and label a ditto at 100% efficiency.		
G. The student will contract to do a series of investigations on the crayfish to discover how the crayfish co-operates and competes with other crayfish in his environment.		
H. The student will observe an ant colony and do other activities related to the study of ants, for a period of 4-5 days to see co-operation between members of a species.	To achieve H: Act. #8 - ditto attached p. III-25 Act. #9 - ditto attached may be evaluative p. III-26	

Objectives	Strategies/Activities	Evaluation
I. The student will participate in a series of discussions and activities designed to show him how species other than ants co-operate.	To achieve I: Act. #10 - ditto attached p. III-27 Act. #11 - ditto attached p. III-28 may be evaluative Act. #12 - ditto attached - supplemental III-30 Act. #13 - ditto attached p. III-31	
J. The student learns that ecological problems are often complicated and difficult to manage by predicting the consequences of thoughtlessly tampering with an ecological situation.	To achieve objectives J, K, L, do Act. #14: Problem 14-1 M & E p. 195 The teacher should preview Investigation 14 form M & E and use it in such a way as it would be applicable to the students. The whole thing should be adapted or presented in various ways to various students. The checkpoints that go with this investigation should be used as they are.	
K. The student learns that when drastic actions are taken in managing an ecological situation, they tend to aggravate existing problems by proposing solutions to an ecological problem that reflect compromise between meeting man's needs and the needs of other organisms involved.	Act. #15: Mastery Item 14-1 M & E p. 205 Act. #16: Mastery Item 14-2 M & E p. 207 These activities may be done at this time or later in the year.	
L. Given a group of activities on the coyote, the student will gain an understanding of co-operation and competition between animals of the same species.	Act. #18: filmloop - coyote (on order from Ward's) The teacher should develop a series of questions to aid the student in observing the filmloop.	Act. #17: Checkpoint 14.1 p. 37
M. Given a packet of reading assignments, filmstrips, & worksheets, the student will successfully complete this packet to gain an understanding of the concept of community.	Act. #19 p. III-32 to III-46 There is an attached sheet which explains what the activities are and what has to be done. (dittos attached) During this activity you should start Investigation 13.1 in M & E. p. 179	

Objectives	Strategies/Activities	Evaluation
N. Given an investigation concerning pond life, the student will complete the investigation to gain an understanding of the pond community.	Activity #20: The Pond Community p. III-47 to III-53	
O. The student learns how light plays a crucial role in sustaining a biological community by identifying pathways that energy takes through part of a pond food web and by predicting the effect of variations in light conditions on coral reef communities.	Activity #21: Problem 13-1 (M&E) p.179 Activity #22: Mastery Item 13-1 (M& E) p.188 Activity #23: Mastery Item 13-2 (M&E) p.190	Act. #24: Checkpoint 13-1 p. 35
P. The student will watch a filmloop, "Hawk attacking Rattlesnake" and answer a set of 4 questions at 100% proficiency.	To achieve P. Act. #25: ditto attached p. III-54	
Q. The student will answer a second set of questions based on the filmloop, "Hawk Attacking Rattlesnake" which are designed to guide the student in developing definitions for the terms predator & prey.	To achieve Q: Act. #26 - ditto attached p. III-55	
R. The student will read a ditto of examples of predator/prey relationships and revise his definitions developed in Act.#27.	To achieve R: Act. #27 ditto attached p. III-56	

Objectives	Strategies/Activities	Evaluation
S. The student will watch the filmloop, "Harmful Insects", & list the insects included and how each is potentially harmful to man as a predator.	To achieve S. Act. #28 - ditto attached p. III-60 Act. #29 - supplemental - ditto attached p. III-60	
T. The student will be able to: a) define the terms scavenger. saprophyte, symbiont and parasite; b) complete a set of 10 matching questions designed to reinforce the definitions at 100% proficiency.	To achieve T: Act. #30 - ditto attached Teacher information p. III-61 included p. III-63	
U. The student will read a ditto on co-operation in communities and then complete a research paper for the teacher on at least 3 other co-operative arrangements between animals and/or plants besides the ones in the ditto.	Act. #31 - ditto attached p. III-64 Teacher direction: Either read the examples of co-operation in communities or hand out the sheet and require that the student read it. Then assign the student a research assignment in the school library to look up and report, in written form, at least three good examples of symbiotic relationships other than those which are here included.	
V. The student will do a reading assignment and answer questions to show that he understands the concept of adaptation.	Activity #32 See attached sheet for instructions p. III-66 Also attached is a newspaper article on adaptation which may be read to the class & then posted on the bulletin board.	

Objectives	Strategies/Activities	Evaluation
W. The student learns that changes in a variety of environmental conditions affect the behavior of animals by predicting the responses of familiar organisms when they are subjected to environmental changes.	Act. #33: Problem 12-1 (M&E) p. 171 Act. #34: Mastery Item 12-1 (M&E) p. 174 Act. #35: Mastery Item 12-2 (M&E) p. 176 Act. #33-36 Teacher Note: This investigation is optional but could be a very interesting one. Sow bugs could be collected by students. They are usually found in wooded areas or anywhere there are fallen, decaying, trees. If you lift up the decaying log or pull it apart you could find many of these insects. This particular activity is not necessary, but some students may be interested in it and may benefit from it greatly. It quite possibly could be done as an extra activity for advanced students.	Act. #36: Checkpoint 12-1 (M&E) p.33
X. The student learns that most animal responses to environmental conditions have survival value by identifying the probable survival value that different animals gain from their responses to environmental changes.	Act. #37: ditto attached p. III-67 Teacher: You will need a supply of cured tap water (water that has stood at room temperature, exposed to the air for 24 hours). Remind the students to add cured tap water to the jars to keep the water level close to its original mark.	Act. #38 The written report from Act. #37 may be evaluated for technique as well as content.
Y. The student will view a series of filmstrips and filmloops which show how organisms must be suited to their surrounding in order to survive.	To achieve Y. Act. #39: p. III-69 Have the student view the filmstrip Nature's Disguises and answer the questions in the activity. (ditto attached) (the filmstrip Animal Locomotion may be used here in any way you wish.) Act. #40: p. III-71 Have the student view the filmloop Nature's Use of Color and answer the questions on the attached ditto.	

Objectives	Strategies/Activities	Evaluation
	Act. #41: p. III-72 Have the student view the filmloop Rattlesnake and answer the questions on the attached sheet. Act. #42: p. III-73 Have the student view the filmloop Little Animal's and answer the questions on the attached sheet.	
Z. The student will do a worksheet to help them realize that many animals have peculiar adaptations to the environment and what these adaptations do for the animal.	To achieve Z. Act. #43: p. III-74 - ditto attached	
AA. The student will be involved in a discussion on extinction to understand how man has caused many animals and plants to become extinct or show adaptations in order to avoid extinction.	To achieve AA Act. #44 p. III-76 - ditto attached Act. #45 p. III-77 - ditto attached Act. #46 "Poisoning of the West" Reader's Digest reprint The teacher should use this article as a critical reading assignment.	

Activity #1

ENVIRONMENTAL LEVELS

Definitions: Examples

1) Species

2) Population

3) Community

4) Ecosystem

Matching: Which environmental level is represented by each? Think carefully. Place the letter in front of the question number.

Environmental Levels

A. species

B. population

C. community

D. ecosystem

__1. All the carp in Onondaga Lake

__2. All black squirrels

__3. All the dandelions and honeybees in a field.

__4. All the red clover in the school lawn.

__5. All the birds and trees of a forest

__6. All silver maples

__7. All the bacteria, chemicals & fish in Butternut Creek.

__8. All the racoons in the Adirondack Mountains.

__9. All the rocks & snakes in a stone pile.

__10. All the people of the world.

CHECKPOINT Act. #2

The following are found in a small pond.

A. leopard frogs
B. water lillies
C. pond water
D. sewage water
E. green algae
F. bass & sunfish
G. rain water
H. mud on bottom

(1) Which of the following make up a population in the pond? A) A only, B) F only, C) B & C, D) D only.

(2) The pond community includes A, B, and A) F, B) G, C) C, D) H

(3) A study of this pond's ecosystem must include a study of F as well as A) A, B)B, C) E, D) G

(4) Which of these groups is made up of organisms of only one species? A) A, B) C, C) F, D) H.

Act. #3

Student direction:

1- Read each of these stories through. You should notice the different animals presented in each (remember that man is an animal) and the type of food each one is eating. After reading the stories you are to underline the meat-eating animal once, underline the plant-eating animal with two lines and underline the plant-meat eating animal with three lines.

Life In A Field #1

The small brown mouse huddles under a large rock for protection against the biting rain. As the rain began to decrease in its fury the mouse crept out into the fog. He felt very hungry as the rain had lasted for several hours.

There was a meadow surrounding this very small mouse so his search for food did not take him very far. The sun began to peek through the fog and its warmth made the mouse less cautious than usual. A shadow fell across the little mouse and before he had time to escape to his rock, a red fox gobbled him up.

The fox had been dining not only upon unfortunate field mice but local farmer's hard raised banty chickens as well. It was not long after the furious rain storm when our friend the fox decided to visit the chicken coop again.

The moon was bright that particular night when our fox approached the farmer's yard. No noise came from the chicken coop and all seemed peaceful. The little fox had no difficulty snaring one of the plumpest roosters before the farmer was awakened. However the moonlight gave the farmer an advantage and it wasn't many minutes before the farmer was skinning out the fox.

The farmer asked his wife if she would like to try eating fresh fox as a new gourmet dish. But she answered with an emphatic no!

Pond Life #2

Silence covered the small pond as the hot afternoon sun lulled all life into a state of drowsiness. Large, fluffy clouds hung against the blue sky waiting for a slight breath of air to move them. Reflected in the still water of the pond, hovering against a cloud was an irridescent dragonfly. It lighted gracefully on a bulrush to bask in the sun.

Other members of this pond community were also enjoying the warmth of the sun. Yellow water lilies in full bloom added a delicate fragrance to the air as well as providing a point from which a green frog was able to survey his surroundings. Small schools of pumpkin seeds (sunfish) surfaced occasionally in search of stray insects. Several dead logs jutting out into the pond from its banks allowed a twelve inch long snapping turtle to sun himself.

Suddenly the stillness of the day was broken by much splashing of water. The dragonfly had left the safety of the bulrush to carelessly drift on a whisper of a breeze in front of the little green frog. The frog rolled out his sticky tongue to snare that insect when a very small pumpkinseed surfaced also to obtain the same main course for dinner. Before the fish had a chance to miss catching the dragonfly the snapping turtle slid from his log and clutched him in his powerful jaws.

The splashing stopped. The frog settled back onto his lily pad. The turtle clambered onto his log and the breeze began to create small, glistening ripples in the pond.

Forest Life #3

Bluejays screeching out their warning to the forest community as the group of campers eased their canoes up onto the beach. The mere presence of human beings always brought a sense of timidness to the forest creatures.

The campers unloaded their equipment and established sites for sleeping and cooking. Some of the younger ones located a patch of black berries at the forests edge brought back enough for all. Some of the older ones took time out to go fishing and caught enough fan fish for supper.

While the campers were getting organized to have a restful night's sleep, the forest animals became less timid. Chipmunks skittered across the campsite in search for leftovers. The bluejays were bravely swooped down for the bread crumbs.

As the campfire changed into glowing ashes the nocturnal members of the community began their search for food. A great horned owl slipped by on silent wings looking for a stray creature. As he floated over the campers'dumping area he noted the black bears poking through the debris. It wasn't long before he found what he wanted, a large brown rat. He flew from the dump area with the rat held tightly in his talons.

The owl, the bear, and the rat were not the only ones in search of a good night's meal. A young, inexperienced racoon was also searching for his meal. He carried a piece of orange peel down to the lake and splashed it so vigorously that a bobcat, also in search of food, hearn him. He crept up on the little racoon and pounced only to find himself floundering in water. The racoon peered at the bobcat from under some brush and I'm sure I heard him laugh.

Act. #4

2- When you have completed the above activity, you are to do two reading assignments out of two different textbooks. You might want to take some notes as you read and record them in your science notebook.

Modern Life Science p. 161-163
Modern Science 1 p. 121

Activity #5 Checkpoint

Fill in the blank

1. a- Plant eater means the same as ______________________

   b- A meat eater is also called a ______________________

   c- An animal which eats both plants and animals is an ________

2. List as many examples of animals as possible that fit into each of the columns below. Examples are provided for you.

Carnivore	Herbivore	Omnivore
mountain lion	rabbit	bear

3. Place the following items in the order in which they might be eaten: Japanese beetle, snake, frog, leaf lettuce, praying mantis, hawk.

4. Choose two animals from each of the three group of animals which are classified by what they eat. List them below and next to each give an example of the food they might eat.

Act. #6

Once upon a time, in the quaint land of Nernie, Benjamin Zackery III was strolling happily down the cobbled country road. It was, indeed, a gorgeous day but perhaps even more so for Benjamin. You see, Benjamin Zackery III was a lover of the great forests and meadows that lined the desolate roads. The sunlight, accompanied by a cloudless sky, certainly enhanced the beauty of Benjamin's love for the two.

As he proceeded, he was confronted by a small dwarf-like nernie (for that's what he called the people in nernie-land) who appeared to be rather excited about something. Being very calm, Benjamin listened very attentively to the nernie who had now begun to explain the situation. He informed Benjamin that the king of nernies needed some help in forest and meadow studies, and that Benjamin would be the choice. The nernie continued with instructions.

"Using a trowel, wide mouth jars, hand lens and one collecting can, my dear friend, we would like you to discover examples of the six food groups in both our lovely meadow and deep dark forest and if you possibly could not how each secures its food. Please make note of all fine mosses, fungi, ferns, mammals, reptiles, etc. for the king shall have them all to dinner next week on Thursday. Also take a soil sample and brint it to the gardener of the kingdom. He would like very much to observe it." Benjamin harkened to the instruction and appeared very interested.

"Before I go," explained the nernie, "I would like to remind you of the different food groups. They are food makers, plant eaters, flesh eaters, variety eaters and decomposers. Try to find them all, make complete notes and good luck!" With that he ran speedily down the road and disappeared.

Benjamin pondered his venture a while, gathered his materials, and then, Benjamin Zackery III began his journey through the meadow and forest in the quaint land of Nernie.

Based upon Benjamin Zackery III's adventure, see if you can list what he may have found.

a) food makers ______________________

____

b) plant eaters ______________________

____

c) flesh eaters ______________________

____

d) variety eaters ______________________

____

e) decomposers ______________________

____

f) parasites ______________________

____

g) log decaying organisms ______________________

____

h) soil sample organisms ______________________

____

i) anything else? ______________________

____

After Benjamin's adventure he became even more involved with the different food groups. Write the best answers to the following statements, using the choices listed below.

1) While walking through the forest, Benjamin observed a food chain including a frog, grasshopper, hawk, and green plant and a snake. In order, the hawk eats ______________, the grasshopper eats ______________, the frog eats ______________ and the snake eats ______________.

2) In land communities, such as forests or meadows, the prime food makers are ________.

3) Decomposers act upon plants & animals causing ________.

4) Some plant groups feed on decaying wood. Two of these could be ________ and ________.

5) List three parasites ________, ________, and ________.

6) Parasites feed upon a ________.

7) A variety eater is both ________ and ________.

8) If food were scarce what animal is least likely to suffer?

________.

Some may be used more than once, some not at all!

algae	host	grasshopper
seed plants	enemy	hawk
bacteria	plant	flesh
mosses	variety	lice
fungi	green plant	ticks
snake	frog	ants
fleas	liverwarts	animal
decay	destruction	

Activity #7

To teacher:
ESS unit on crayfish

You will be supplied with the teacher's manual. This will explain the things you need to know to care for the crayfish. The suggested activities in the book are good but we adjusted them somewhat to make them more sophisticated. The unit is an excellent one in showing cooperation and competition between members of the same species.

When the pools are set up and the crayfish are obtained (you should have enough crayfish so that each group of two students have one crayfish. Do this for only one class. Other classes can be assigned the same crayfish as given to other students. You should have a few extra crayfish. 24 would be a good number.) The students should be assigned a crayfish (these should already be marked in some way since more than one class will be using the same crayfish. This is different from the way described in the teacher's manual.). The student should keep a note of his observations and studies of the crayfish. Everything he does about or with his crayfish should be put in the notebook.

One of the first things that should be done is for you and the student to go over the external parts of the crayfish. Using a transparency go over the external structure while the students have their crayfish so that they can look at these parts on the animal. Then hand out an unlabeled ditto for the student to label and put in his notebook. After this much is done you may let the student investigate on his own for a while (1-2 days at the most). Then give him a ditto list of questions that he should answer by designing experiments and doing them. There are ten such questions. The activity will be similar to a contract. If he chooses to do all 10 he will get an "A", if he does 8 he will get a "B", for 5 he will get a "C", for less than that he will get a "D". This contract may be adjusted for different types of students. Each experiment should be designed on paper and shown to the teacher before the students actually do these. A complete and accurate record should be kept by the student. When they have completed the contract the student should hand them all in at once to be graded. The student should be reminded that good quality is expected in order for the experiments to be accepted. The list of questions is attached. Please feel free to add to or change the list in any way.

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Activity #7

To be given to students

Design your own experiments to answer as many of the following questions as possible:

1-What do crayfish eat? If they eat more than one specific thing what do they like best?

2-How does your crayfish react to being touched?

3-How does your crayfish react to one other crayfish? Larger, smaller, or of the same size as your crayfish.

4-How does your crayfish react to a group of other crayfish?

5-How does your crayfish secure a home?

6-What level in the social order is your crayfish at?

7-Does your crayfish have any of the five senses that humans have?

8-Which show's more strength, a male or a female?

9-Do crayfish attack each other? If so, for what reasons do they do this?

10-Do crayfish protect each other from enemies?

Activity #8

Teacher: Put these directions on the blackboard. Also not supplemental Act. #12.

Student directions:

You are to observe the ant colony in the classroom. List all of your observations on a sheet of notebook paper which will be handed in to your teachers. You should plan to observe the colony for ten minutes every day.

TEACHER: Hand out the prepared set of questions approximately 3 days after the student has begun his observations of the ant colony. At this time collect the sheet of observations the student has been working on. See attached.

The teacher should prepare several more questions regarding eggs, etc. if the colony contains such things.

After collecting the series of 6-10 questions the teacher should discuss what the students have seen and then lead a discussion on the ant's life cycle. Use Instructo Transparency Life Cycle: #816-12 The Ant Colony located at Pine Grove Learning Center as Tr 70.

A grade 6 book, Science For Tomorrow's World 6, has an excellent section on animal behavior. The teacher may want to have the class read the following pages during the time they are observing the ant colony. pgs. 307-337. The book is available in both middle schools.

Teacher references:

1. The Story of Ants; Dorothy Shuttlesworth and Su Zan Noguchi Swain 595.7 S Pine Grove

2. The How and Why Wonder Book of Ants and Bees; Merrill 595.7R Pine Grove

3. Filmloop - Ants Tunneling
The teacher should develop a series of questions to aid the student in making observations of ants in the process of tunnel building.

Activity #9

Suggested questions for Act. #9

STudent directions:

Answer the following questions while observing the ant colony. The questions do not have to be answered in order, as long as they are completed at the end of two days.

Questions:

1. Do you see any ants with wings? Look carefully.

2. Are the ants all the same size? Draw two or three ants in the space below. Be careful to show each ant in as much detail as possible.

3. What do your ants eat?

4. What types of work do the ants perform? Do they all do the same work?

5. What color or colors are your ants?

6. Use a hand lens to observe the head region of the ants. Draw what you see in the space provided.

Activity #10

Teacher directions:

Materials: Life of the Honeybee A464-6 SVE filmstrip

*The How and Why Wonder Book of Ants and Bees; Merrill 595.7R Pine Grove

*This Fascinating Animal World; Alan Devoe
Film: The Hidden World -Aetna Life Insurance-free

Instructo Transparency: Life Cycle: #816.13
The Beehive TR 71 Pine Grove

Filmloop: Bees-Pollen & Nectar Dance ICF
#11810 Sharon Smith E. Syracuse Middle

Through the use of audio-visual materials including a filmstrip and transparency the student will observe how bees are social insects which cooperate with each other in order to survive.

1 Introduce the lesson with the transparency of "The Beehive." Follow the approach used with the transparency - be sure to preview it.

*2 The teacher should choose several passages from each of the starred books and read them to the class.

3 Show the filmstrip, "Life of the Honeybee." (location unknown yet-either Pine Grove or East Syracuse) and then hand out the questions that go with it for the student to answer. They may be used as a checkpoint or evaluation. See Activity #12 for questions.

4 Show the filmloop of the pollen and nectar dance. Ask the students to list any changes they can observe in the behavior of the bees who are watching the dance. The filmloop should be run at least two times through. Also note it is a standard 8mm loop - cannot be used in a super 8mm projector. Standard 8mm projectors are available at the Resource Center in Minoa.

5 If possible show the film "The Hidden World:" on loan from Aetna Life Insurance Company as a conclusion to the world of the ant and bee.

Activity #11

Student Questions for the filmstrip, "Life of the Honeybee" SVE

1. The filmstrip uses the word caste. It states that there are three levels of castes.
   a) What is a caste?

   b) List the three castes and next to each the job which it performs.
      1.

      2.

      3.

Fill in the blanks

2. The life cycle of the honeybee goes from the egg to the

_______________, ____________________, and the _______________.

3. The larva is fed a mixture of ____________and_______________.

4. Which larvae are fed royal jelly?

5. How can you tell a queen from the other bees?

6. A young worker cannot fly when born. What does it do while learning to fly?

7. Describe the "defense" of the hive.

Activity #11 (cont.)

8. In addition to making honey, the bee also performs a valuable service to nature. What is it?

9. How does a "scout" clue others in on the location of a new pollen or nectar source?

10. What are some bee products?

Activity #12

Supplemental

In addition to observing the behavior of crayfish and ants there are two other possible animals that may provide interesting behavior in the classroom for children to observe.

Earthworm Farm

You can use a large glass tank, terrarium or any other wide-mouthed glass jar that is large, for the farm. Dig up some top-soil very carefully so you can include all living things which may be present. Place extra worms in your container. The soil should be kept slightly moist but not wet. Bits of lettuce, corn meal or other cereal may be gently mixed into the top layer of soil. You may have to plant some small plants in your farm to make the worms feel at home. Do not disturb the worms until they begin making tunnels.

Do not let the farm become hot or dried out. Always keep some kind of food in the soil.

Snail House

A permanent snail house can be made from a fishbowl or glass jar with a cover of wire screening. Damp soil should cover the bottom to a depth of at least one inch. A few plants or flower seeds may be planted in the soil. The snail house should be kept in a cool, shady place. Snail food can vary from bits of lettuce, flower petals, dead insects, raw hamburg, to dry bread and celery leaves. Try some of the above to find out which the snail likes best and then be sure he has enough to eat.

Activity #13

OBSERVING HUMAN BEHAVIOR

In our study of animals we have ignored the one animal that is most closely related to you - the human being. It is important for us to discover how this animal interacts and reacts with his environment. For this activity we will study only a small portion of the human being's life.

You are to choose a human being that you can observe at least three times a day in many different situations such as eating, working, communicating, and in school. You should plan to observe this individual at the same time every day, three times a day for at least 10 minutes each time. You should record the date and time of each observation and also what you observe. You should look for things such as how they react to other human beings. Do this for one week and then hand in your observations. They will also be discussed in class with the other students.

Activity #19

To the teacher:

Enclosed is a packet of activities which will give a better understanding of different types of communities. Simply give the packet to the student and let him do the activities at his own speed. I would spend about three days of class time on the packet and then let the student finish up in study hall or when he has finished other class activities. Some groups may need more than 3 days of class time. Use your own judgement - only you know your students and their abilities.

The assignments may be handed in as the students finish them or when they are all complete they may hand them in.

Teacher reference: <u>Wildlife Communities, From the Tundra to the Tropics in North America,</u> Clarence J. Hylander. (at Pine Grove 574.9H)

Activity #19

To the Student:

COMMUNITIES

This is a group of activities on communities. Within the packet there should be a page of reading assignments; questions which go with four filmstrips; and a group of worksheets. You are to use the textbook, Life: Its Forms and Changes with worksheets.

You are to do all the activities within this packet in any order and at your own rate of speed. The directions for each activity are with the activity. Read them carefully. If you have any questions ask your teacher before you do the activity. Make sure you have answered each question completely before handing the activity in to the teacher.

READING ASSIGNMENTS:

(1) Life: Its Forms and Changes pp. 44-50

(2) Modern Science 1 a) pp. 233-244
b) pp. 246-252

Read these assignments carefully and write down the main idea--you will be quizzed on the information.

Filmstrips:

View 4 filmstrips (and cassettes)

(1) Ecology of a Desert

(2) Ecology of a Forest

(3) Ecology of a Pond

(4) Ecology of a Seashore

Simply view the filmstrips and listen to the cassettes that go with them. It would be beneficial if you view these before viewing the filmstrips with the questions.

Student direction:

The following set of questions are to be answered after viewing each of the filmstrips:

Plant and Animal Communities: The Pond

Plant and Animal Communities: The Field

Plant and Animal Communities: Forest

Plant and Animal Communities: City

Some of the questions sheets contain vocabulary lists. The words in these lists should be looked up in a dictionary or the glossary of a textbook and the definitions of them written into your science notebook.

PLANT AND ANIMAL COMMUNITIES: THE POND

<u>Vocabulary</u> consume succession terrestrial
submerged emergent variety decrease

<u>Introduction</u>:

There are many different kinds of plants which grow in a pond community. Because of this variety of plants there is also a large variety of animals. You are to observe these plants and the animals which find homes in, on, or near them. To aid you in making these observations, there is a series of questions you are to answer.

Questions:

1. (1) What is meant by the term, "community?"

2. (5) The kinds of plants which exist in any one area are dependent upon the area's ____________ and ________________.

3. (5) True or False: Plants <u>usually</u> control the types of animals which may exist in a community.

4. (6) An animal which may change the plants along a stream is the ________________________.

5. (6,7) When the water level of a pond is decreased, the area may become a ____________________________.

6. (8) The limiting factor for varieties of living things in a pond community is the supply of ____________________.

7. (9) (10) How do the water scorpion and the water beetle live in a low oxygen water environment?

8. (11) List the six plant zones in a pond which determine the types of life present in a pond.

9. What factor is the cause for these 6 zones?

10. (12-17) Next to each zone, list a common plant found in this particular zone.

Zone 1 ______________________________

Zone 2 ______________________________

Zone 3 ______________________________

Zone 4 ______________________________

Zone 5 ______________________________

Zone 6 ______________________________

11. (18-28) In the last column in question 10, list an animal which either feeds ornests in each zone and one which is dependent upon the plant you listed.

12. (29) Pond communities have a food chain. What is the first link in the food chain of a pond?

13. (31) The second link in a food chain is a(n) ____________ which is scientifically called a ____________ ____________.

14. (32) This second link may be eaten by a frog, snake, turtle, or bird and these animals are called ____________ ____________.

15. (37) Are both living and dead animals consumed in a pond community? Explain.

16. (38-43) Why is a pond important for land animals? Give several reasons.

17. (44-48) When has succession in a pond been completed?

Animal and Plant Communities: The Field

Vocabulary: succession, mulch, food chain,

Introduction:

This filmstrip shows the succession of a field to a forest. At each stage of the chang in the field certain plants and animals are characteristic. You are to observe these changes in plant and animal life. The questions which follow will help you do this.

1. (4) A field is usually a ________________ community.

2. (5) A meadow is a field which is used for a ________________ of a ________________.

3. (6) How can man prevent natural succesion?

4. (7) How can a field or meadow loose its ability to produce good crops?

5. (8) Give an example of secondary succession.

6. (10) a-What appears first in an abandoned field?

(11,12) b-Give three ways this is helpful to the field.

7. (13) How do the first plants in an abandoned field help recycle the minerals in the soil?

8. (14) Dead plants help the soil. List two ways.

9. (16) The second type of plant which invades an abandoned field is the ________________.

10. (17-21) At this second stage of succession a typical food chain might be ____________, ______________, ______________, or ______________, ________________, ________________.

11. (22) What is meant by "selective feeding"?

12. (24,25,2?) Give at least two results of "selective feeding".

13. (34) What plants begin to compete with the tall grasses of a field?

14. (36-41) Give three examples of animals that now begin to appear with this third stage of succession.

15. (43) Why does the giant oak replace the shorter junipers and sumacs?

Fact. The closing in of the tops of the large trees which prevents sunlight from reaching the soil which they are rooted in results in a climax forest.

Animal and Plant Communities: Forest

Introduction:

There are two main types of forests in North America deciduous and evergreen but a combination of both types may occur together. Forests are dependent on an annual rainfall of 20 or more inched of rain. Frequently four different layers or levels of vegetation exist in a forest. The questions which follow will aid you in studying these four layers.

1. (7) The first level or layer in the forest is the ________ ________ and is made up of ____________, ______________, and ______________ ____________________.

2. (9) If there is a thin litter layer ____________ may grow several inches tall instead.

3. (10) The beautiful spring wild flowers grow in the next level up, the ______________ ________________.

4. (12) Ferns and club mosses are often found at the second level.

5. (13) The third level or layer which contains even taller plants is the ______________ __________________.

6. (14,15) List two other plants which grow in the third layer.

7. (16) The uppermost layer is the __________ ______________ controls the amount of light reaching the lower levels.

8. (18) What level do earthworms live in?

9. (20) What animals occupy the upper level?

10. (21-29) List six natural ways that a major forest community can change and form several minor communities.

11. (36-37) What organisms can help dead plant matter be recycled?

12. (46-51) List the food link that is mentioned near the end of the filmstrip.

Animals and Plant Communitites: City

Introduction:

The city is a community which has been greatly changed from the natural situation found in a pond, forest, or field. The city has water proofed by man. Thus water disposal and water need are important problems in the city.

1. (5) Why is a city a community?

2. (6) Energy is necessary to run a city. Where does this energy come from?

3. (8) Does anything leave the city which has any value?

4. (9) Why is a city climate like a desert?

5. (11) What type of plant can grow in the city?

6. (13-14) How has man water proofed the city?

7. (14-16) Because man has water proofed the city, he has polluted its water, why?

8. (17) What are the three main environments for the city animals and plants?

9. (18-21) Within a building there may be many types of plants and animals. List some of them.

10. (23) An alley is a temporary ______________________.

11. (26) A semi-natural environment within a city is a ____________

12. (31) Two common city birds are the _______ and the ______________.

13. Three animals which frequent a city or town dump are the ______, ____________________, and ______________________.

14. List several types of plants which are often planted in the city to beautify it and which can survive the city environment.

15. The city provides a biologically-harsh environment and still much life goes on here. Do you feel that it is a good environment for people?

Answer the questions on the following pages from what you have learned from the previous activities (the filmstrips and reading assignments). There are also a couple of pictures on dittoes that may help you.

A. POND COMMUNITY

1. List all of the plants (producers) and animals (consumers) you would find in a pond. Make two separate lists.

   ex. | Plants | Animals |
   |---|---|
   | algae | minnows |

2. How does the sun affect the pond?

3. How would the pond be affected if the producers were removed?

4. How is a pond snail related to a dead fish lying at the bottom of the pond?

5. How would the pond be affected if all the bacteria were removed?

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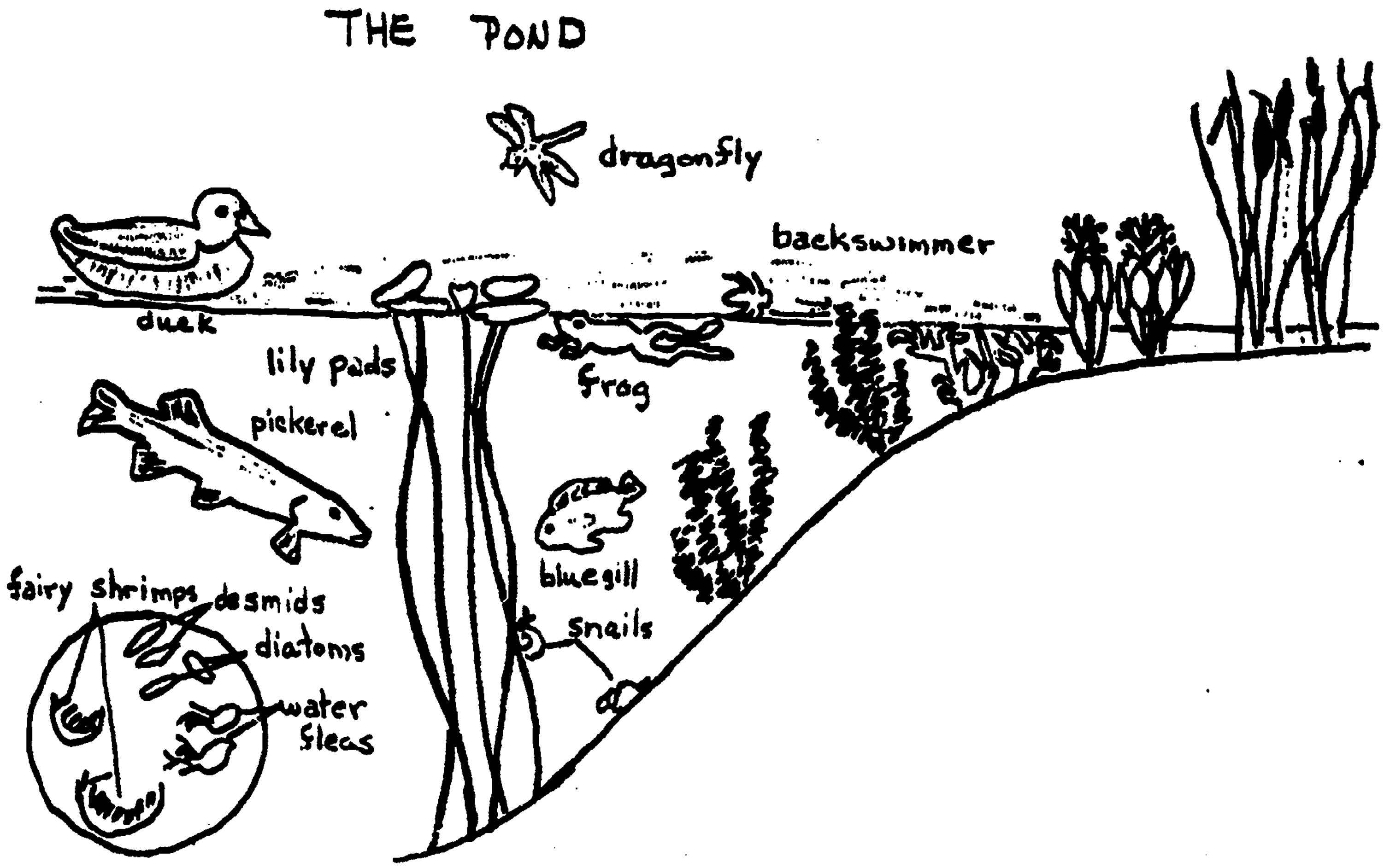


A LAND COMMUNITY: DESERT

1. The cactus is a typical plant of the desert. How does it get the materials it needs to grow?

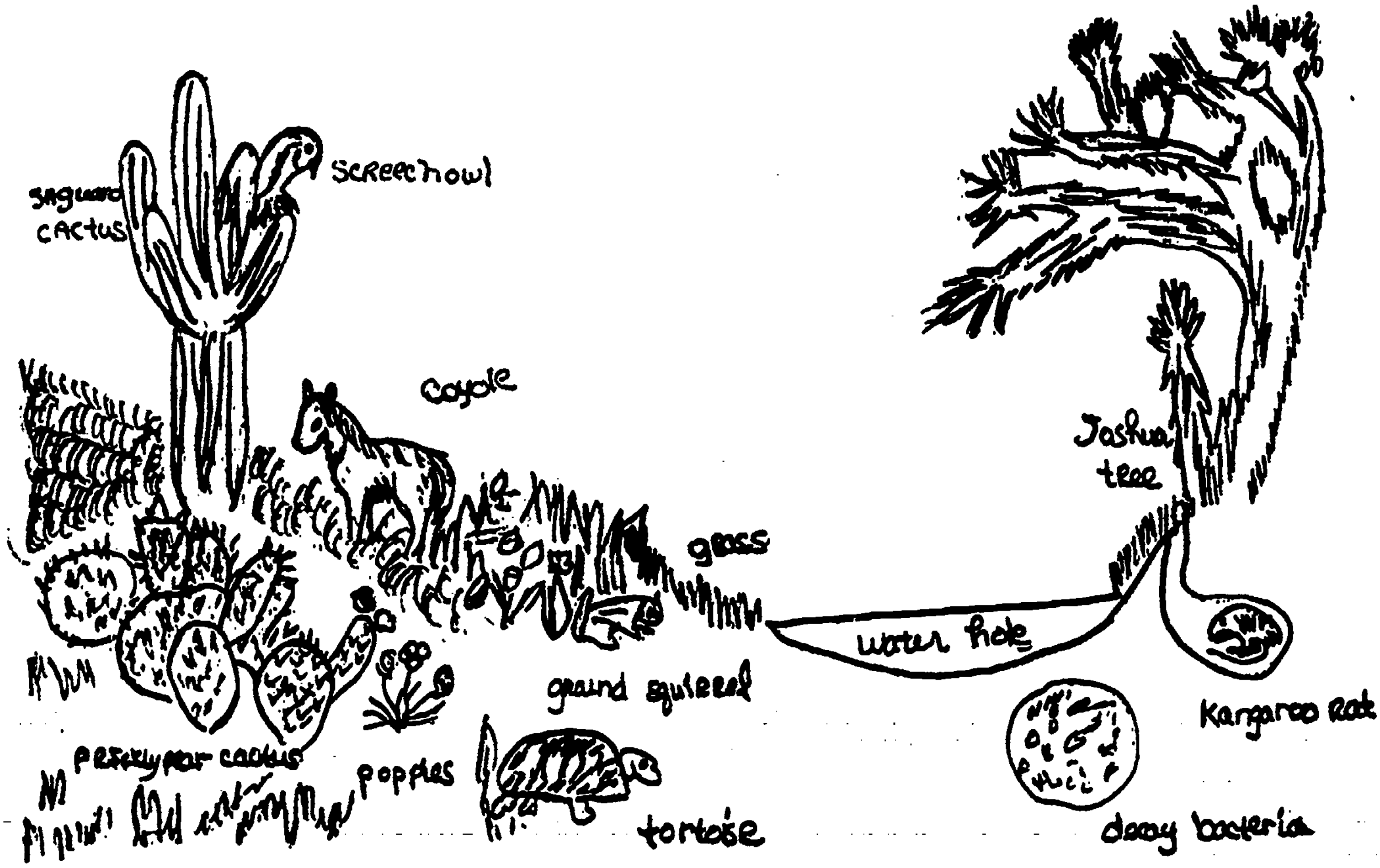
2. Where do different animals make their homes in the desert?

3. What animals might eat the same food a coyote does?

4. How do the plants and animals in the desert survive over long periods of dryness?

5. Are there as many different kinds of plants in a desert as there are in a forest or field?

A LAND COMMUNITY



Act. #20 THE POND COMMUNITY

Introduction:

Many small plants and animals live together in water. In a pond you will find a complicated com-unity which contains representatives of the various food groups as well as examples of primary producers, green plants. Other organisms which feed on decaying plant and animal matter will also be present.

Purpose: To observe and identify microscopic plants and animals as members of a pond community.

Materials:
- compound microscope
- 2 slides
- cover slips
- medicine dropper
- hand lens
- methyl cellulose or clear gelatin dissolved in water
- identification sheets
- jars of pond water, properly labeled, brought in by students
- beaker of tap water

Procedure:

1. As you look at each specimen be sure to put your observations on your data sheet.

2. Draw up a sample of water from the bottom of the pond water jar. Place one drop in the center of a clear slide and put a cover slip on it.

3. Draw up a sample of water from the beaker of tap water. Place it on a slide and cover with a cover slip.

4. Examine each sample with the unaided eye. Do you see anything moving?____ (Remember to use your DATA SHEET)

5. Now examine your samples with a hand lens. Do you see anything moving? ______

6. Place your pond water sample on the stage of the microscope and focus carefully on it with the low power objective.

7. Probably you will see many one-celled plants and animals among fragments of rotting plants. Many of the animals move under their own power but most of the living plants simply float about in the water. Some simple plants form strands as cells join end to end.

8. You should fill in the data sheet for sample number one after observing it carefully for several minutes. Try to identify as many organisms as possible by using they identification sheets which your teacher has.

9. Repeat this procedure by placing samples from the middle of the jar and the top of the jar of pond water on clean slides.

10. After you've observed each specimen you may wish to add some gelatin or methyl cellulose to the sample if you have organisms which move rapidly. The gelatin is a sticky substance which causes the animals to slow down so you can see them better.

11. After you've completed your data sheet wash all glassware with detergent and water, and dry.

Name ____________________

STUDENT DATA SHEET:

Date____________

Sample 1:

Pond Water		Tap Water	
Names of Organisms	Numbers of each	Names of organisms	Numbers of each

SAMPLE 2 | SAMPLE 3

Names of Organisms	Numbers of each	Names of Organisms	Numbers of each

Questions:

1. What is the most common type of plant you found?
2. What level of the jar did this plant come from?
3. What is the most common type of animal you found?
4. What level of the jar did this type of animal come from?
5. How could you tell the plants from the animals?

6. How can you tell the difference between living and non-living matter?

7. In what ways are the organisms you saw wuited to pond life?

8. In which level of the jar did you find the most activity? Why?

After two days you are to again sample the pond water at the three levels and list the kinds and numbers of organisms you see on a sheet of notebook paper.

Conclusions:

1. Which type of plant is now most common?

2. If it's a different plant from the first day why do you suppose there has been a change?

3. Which type of animal is now most common?

4. If it's a different one from the first day why do you suppose there has been a change?

5. Where does the basic food of the animals come from?

6. How do the organisms in the jar depend on each other? (You should have several ways included in your answer)

Thought Questions:

1. Some ponds dry up in the summer. After they are refilled by spring run-off or rain, organisms of many kinds are seen again. How do these organisms survive the dry spells?

2. What effect would there be on the pond water in the jar if several types of organisms were removed?

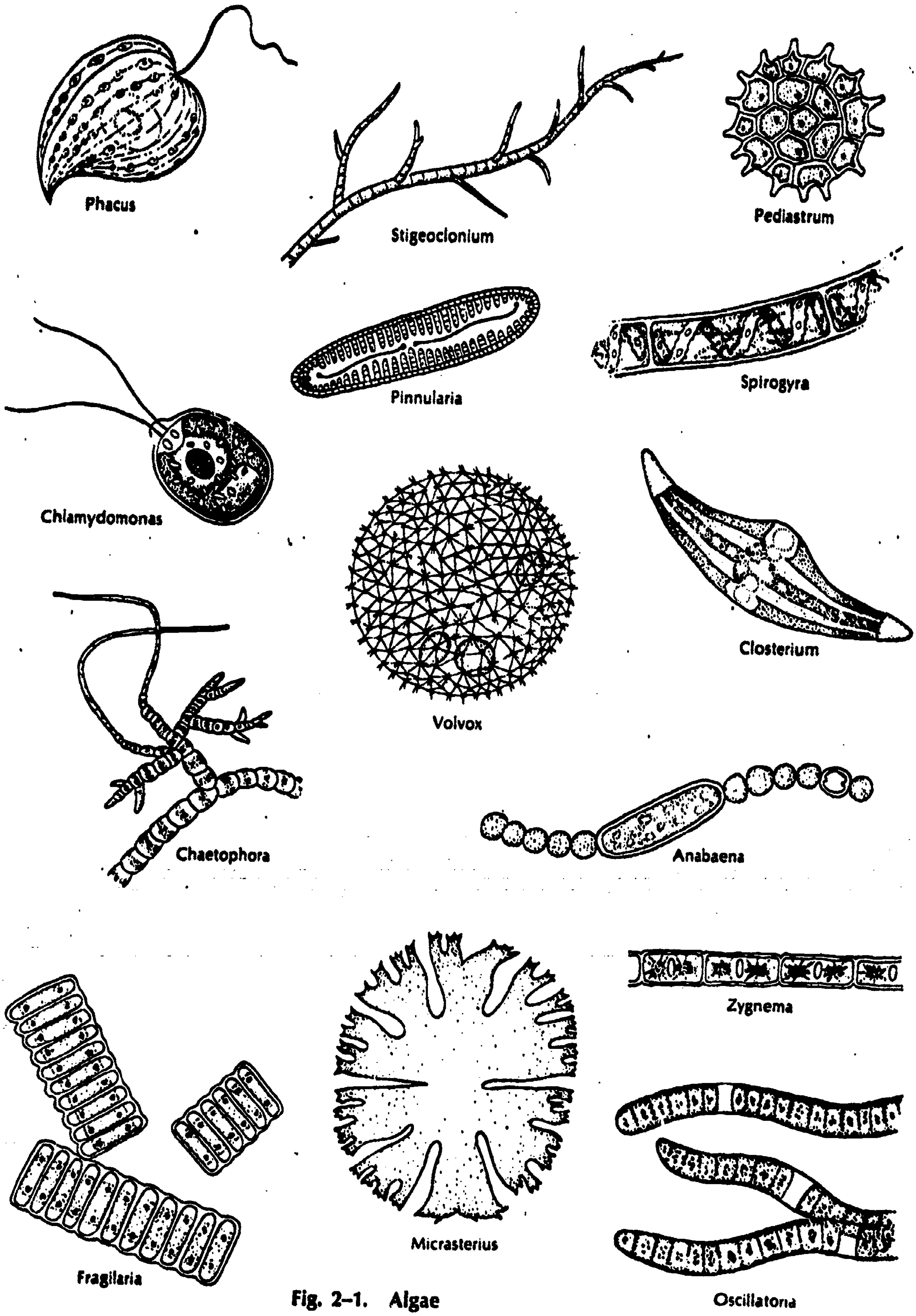

Phacus
Stigeoclonium
Pediastrum
Pinnularia
Spirogyra
Chlamydomonas
Volvox
Closterium
Chaetophora
Anabaena
Zygnema
Fragilaria
Micrasterius
Oscillatoria

Fig. 2-1. Algae

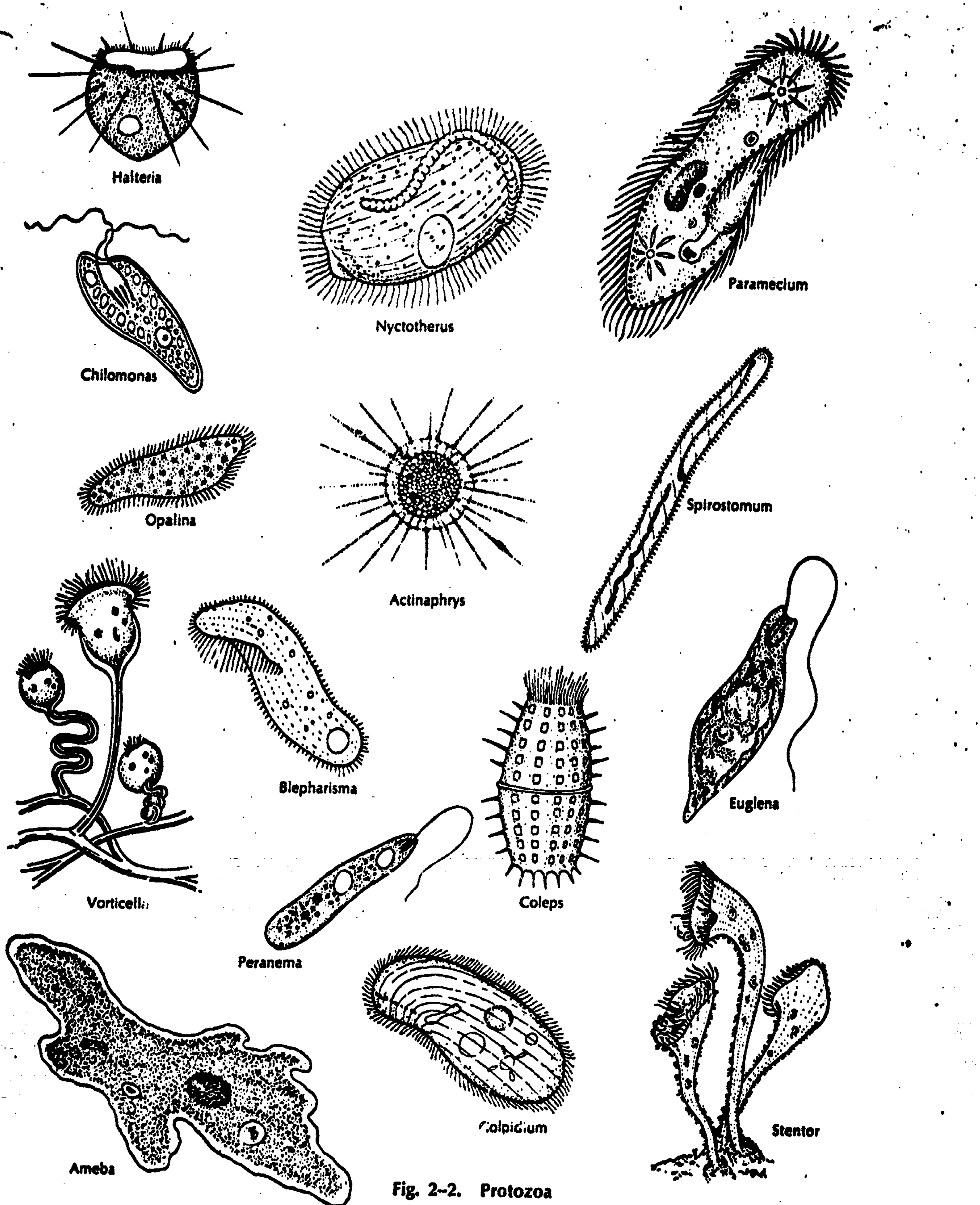
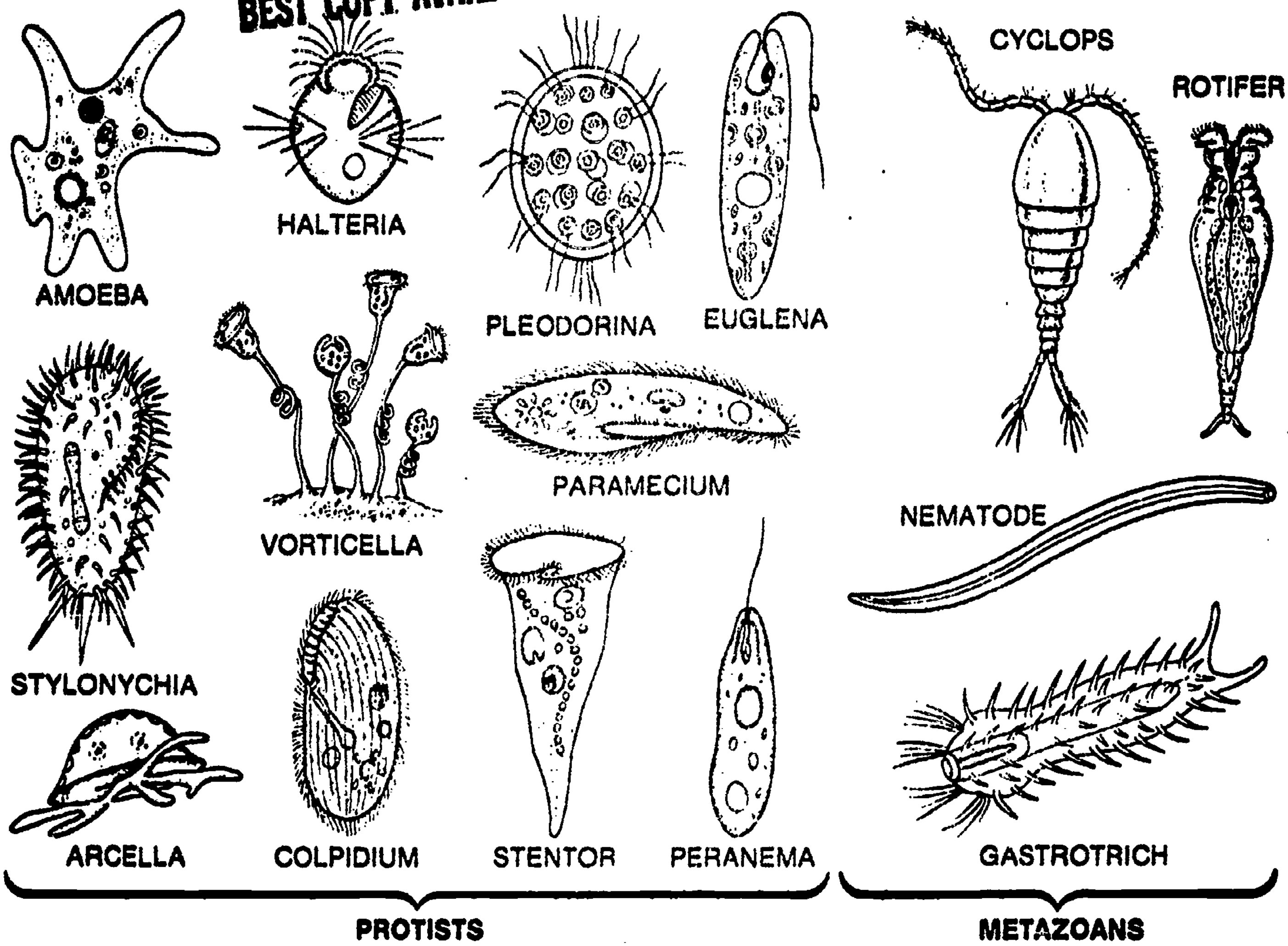
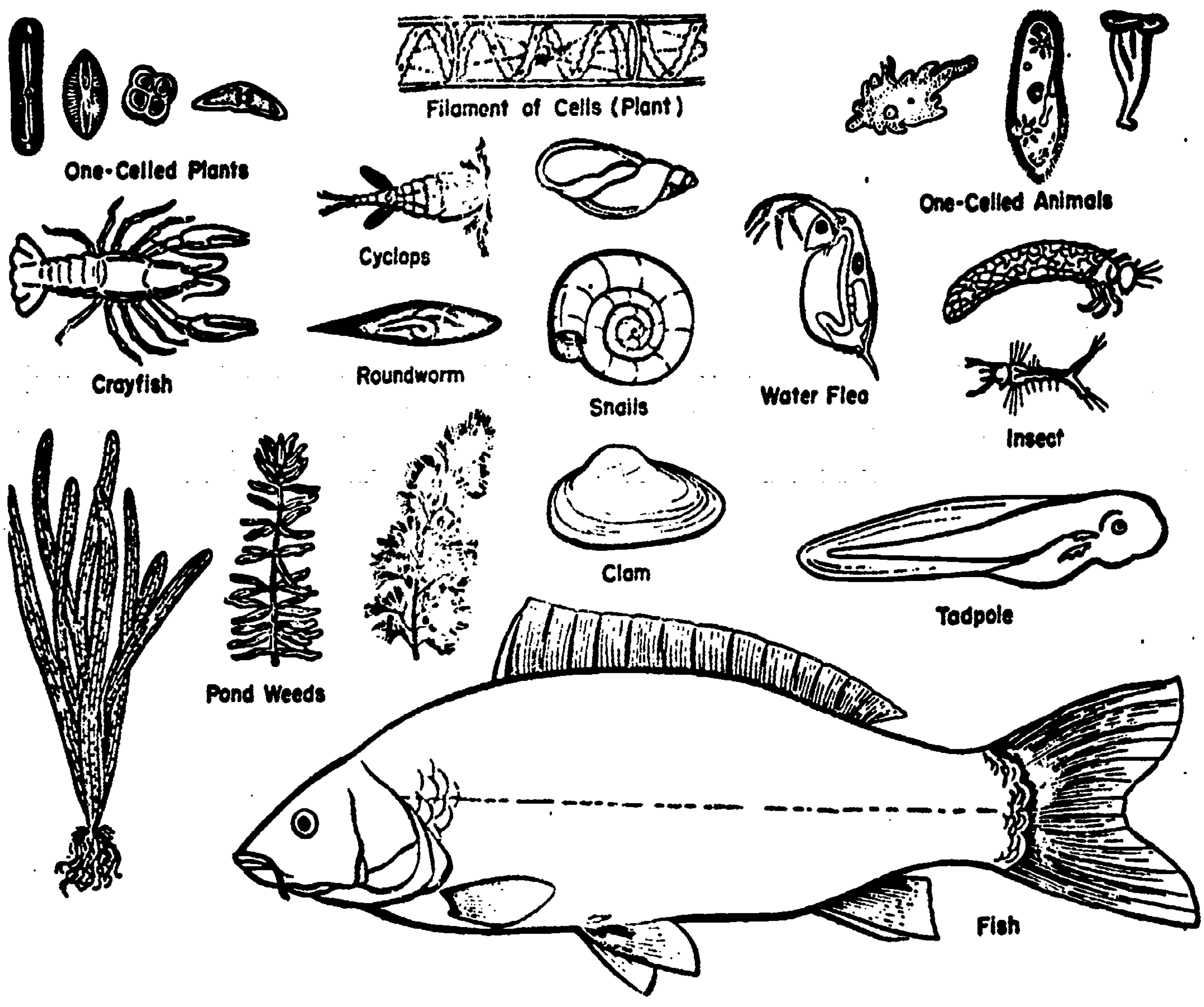


Fig. 2-2. Protozoa



Laboratory Investigations in Biology
p. 60

FIGURE 15·1 Common pond water organisms



Investigating Living Things
p. 50

FIGURE 27

III-53

ACTIVITY # 25

Filmloop: Hawk Attacking Rattlesnake - standard 8mm
Resource Center - Minoa

Questions for students. To be answered after viewing the filmloop.

1. Is it possible that the ground squirrel might have been the hawk's dinner even though the hawk caught the snake? Explain

2. List at least 4 advantages the hawk had over the snake.

3. Did the snake have an advantage in any way over the hawk?

4. As the hawk attacked the snake he seemed to attack the snake in one particular area of his body? Where? Why?

ACTIVITY #26

Student Questions:

1. What food or foods do you suppose the ground squirrel feeds on?

2. Would the hawk eat the same foods as the ground squirrel?

3. What foods does a hawk enjoy?

4. Would the snake enjoy <u>similar</u> foods as the hawk? Think carefully before answering.

5. Do you know which animal (or animals) was the "predator" in the filmloop?

6. Which animal happened to end up being the "prey"?

7. Write what you think <u>might</u> be a definition of: predator; prey. Put these terms in your science notebooks.

Activity #27

PREDATORS AND PARASITES

Predators are insects (or other animals) that catch and devour smaller or more helpless creatures (prey) usually killing them in getting a single meal. The prey is generally either smaller, weaker or less intelligent than the predator.

Parasites are forms of living organisms that make their home on or in the bodies of other living organisms (hosts). The hosts are usually larger, stronger or more intelligent than the parasites and are not killed promptly, but continue to live during the period of their close association with the parasite.

INSECT PARASITES

One of the greatest factors in keeping plant eating insects from overwhelming the world is the fact that they are fed upon by other insects.

The insect killers are divided into two groups (a) predators and (b) parasites.

Examples of insect predators:

Dragon Flies - These insects are harmless to man. They feed on mosquitoes and other insects such as wasps, flies, beetles, etc., some of which are injurious to plants and man.

Ladybird beetle- Feeds on aphids (plant lice), scale insects, and other small insects and their eggs.

An interesting example of the method of insect control by the use of a natural enemy of the insect was the use of the ladybird beetle in controlling the cottony cushion scale insect in California.

The scale insect was introduced into California from Australia in 1869. Having no natural enemies in California the scale spread very rapidly and threatened to destroy the citrus fruit industry. Control was achieved by importing the scales' natural enemy, the Ladybird beetle, from Australia. The beetle was introduced in 1888, and in 18 months had the scale under control.

Praying mantis - Eats a variety of insects, many of which are harmful.

INSECT PARASITES

Tachinid fly- A major enemy of the army worm. This insect feeds on forage crops (corn, alfalfa, clovers, and grasses). The fly lays its eggs on the back of the worm. The eggs hatch and burrow into the worm and kill it.

Chalcid fly- Controls the cabbage worm.

Icheneuman wasp- Control of wood boring insects. This wasp has a long thin ovipositor approximately 3 inches long which it thrusts through the wood until it strikes the burrow of the wood boring larva. The wasp then lays an egg which hatches and kills the larva.

Brachonid wasp- This wasp lays its eggs in the body of the tomato hookworm. This is the large green worm that is found feeding on tomato plants. The eggs hatch off the hosts body which eventually dies.

Animal predators and predator-prey relationship in nature:

Most all scientific investigation of the relationship of predators to other forms of wildlife throws doubt on the idea that if the predator is killed off, the species upon which they prey will automatically increase. Over a wide range, predators generally live on the surplus population of the prey species and their feeding has little effect on the amount of breeding stock needed for the next generation.

The amount of available food and the supply of suitable cover is more important in determining the population of a species in a given area than is the predator.

Predators:

Hawks and Owls- Scientific evidence shows that the hawks and owls are not harmful to man, but by its normal habits of feeding on crop destroying rodents (rats and mice) are actually man's helpers.

Coyote- Feeds mainly on mice and rats, gophers, rabbits, etc. If its natural food is scarce, it will attack poultry, game birds, and the young of domestic animals.

Skunk- The skunk may occasionally kill poultry, but normally it is a consumer of insects.

Wolf- Preys on deer, moose, etc. Its prey is usually the aged or ill animals and in this way helps maintain the vigor of the herd.

Fox - Preys on rabbits, mice, rats and some game birds. Will attack domestic fowl if its food supply is short.

Many of our birds are great eaters of insects.

Woodpecker- devours great numbers of wood boring larva.

Swallows- Feeds on flying insects, are great destroyers of mosquitoes.

Probably the greatest predator is man. Up to date hunting regulations have helped protect most species of game birds and animals, but mans' destruction of the natural habitat and food is one of the main causes of the decline of certain species of animals.

Information from:
Life Nature Library

ACTIVITY #29

Filmloop: Harmful Insects - standard 8mm - available from the Resource Center in Minoa. Should be used to show how insects are predators on man. The suggestions on the filmloop can be followed or the teacher can develop his own questions to accompany it. The teacher might also lead the students into a discussion about insects being man's primary predator.

Activity #29

Supplemental

If possible, the Shell film (rent free) "The Rival World" which shows locusts as a primary predator against man should be shown sometime during Unit III. B.2.

ACTIVITY #30

Teacher information:

Scavenger - an animal, plant or microorganism that feeds on dead or decaying animal matter or carrion. Examples: bears, raccoons, hyenas, scavenger beetle, yellow jackets, soil microorganisms*fungi, vultures, sea gulls.

-Effects: distribution (Scavengers)

Scavengers are usually more wide spread than other animals because of their diet which is less specific.

-Natural pollution controllers

They keep the land free of decaying plant and animal matter.

-Soil microorganisms

are almost exclusively responsible for the removal of dead plant and animal matter from the surface of the earth and its conversion into valuable plant food.

*soil microorganisms most important to man

Saprophytes - Bacteria and fungi that get their food from dead or decaying animal matter.

Parasite - An organism that lives for a longer or shorter period in or on another organism which is the host.

-Parasite obtains nourishment, supplied by the tissues or waste products of the host.

General rule of parasitism is that smaller forms prey upon larger ones. ex.

tape worms	bacterial parasites
round worms	typhoid fever
fleas	lockjaw
	malaria

Symbiosis:

A relationship formed for the mutual benefit of two dissimilar organisms. These may be two different kinds of plants or animals or a plant and an animal.

In many cases the two organisms involved can live independently, although their association brings benefit to them both.

Ex. Lichen
algae and fungi
alga provides food for both
fungi absorbs moisture and minerals for both

Ant Plants

trees that form a symbiotic relationship with ants. The trees provide the ants with nourishment and shelter. The ants protect the plant from invasion by other insects.

Termites

have a bacteria in their stomach which digests cellulose for the termite and themselves.

Teacher reference: The Book of Popular Science Vol. 8 p. 361

ACTIVITY 30

STudent Sheet

Definitions	Examples
1. Scavenger	
2. Parasite	
3. Symbiosis	
4. Saprophytes	

Matching

1.______ Mutual benefit for two different organisms.

2.______ Natural pollution controllers

3.______ Lichens in northern Alaska

4.______ A flea that lives on a dog

5.______ Fungi living on a dead tree

6.______ "Lockjaw"

7.______ Sea gulls feeding on garbage

8.______ Bacteria decaying a dead animal

9.______ "Ant Plants"

10.______ Raccoons feeding on dead fish

A. Scavenger

B. Saprophyte

C. Parasite

D. Symbiosis

ACTIVITY #31

COOPERATION IN COMMUNITIES

Examples of cooperation or "communalism" in which animals live together without serious harm to each other are:

Innkeeper worm lives in the mud flats in a U-shaped burrow with a strange assortment of tenants. The "innkeeper" feeds by trapping, in a bag of mucous, food particles that are washed into the burrow. Small fishes, like the goby, live in the entrance of the burrow, using the burrow only for protection, emerging only to feed. A scale worm lives alongside the innkeeper and robs some food. A pair of pea crabs may also live in the burrow, and sometimes a small clam lives imbedded in the burrow wall.

Worms are not the only marine innkeepers. Several kinds of fishes live with impunity among the stinging tentacles of the Portuguese men-of-war, anemones and medusas. The fish obtain protection and they pay for it by luring larger fishes within range of the tentacles.

Another example is the sea anemone that attaches itself to the shell home of the hermit crab. The anemone gets a free ride and in turn provides camouflaging for the crab.

Here are some examples of mutual association between birds and animals, in which the bird renders a service to its host by ridding them of ticks and other external parasites, and in return for this supply of food the bird serves as sentinels, warning the host of approaching danger. The cowbird with the bison of North America and the oxpecker with the antelope and rhinoceros of Africa represent this type of mutual aid.

An antelope, when visited by an oxpecker, willstand still, spread its legs and raise its tail, apparently to aid the bird in its work.

The osprey, a large fish-eating hawk, builds a permanent nest, usually on an old tree top, and year after year adds new sticks to the top of the nest. A foot or so below the top of the nest a black-crowned heron builds its nest among the sticks and receives protection from the sharp eyed hawk. Other birds - grackles, wrens, sparrows - also build nests in the side of the pile of sticks, receiving the hawk's protection.

A very interesting relationship exists between the sparrow sized African honey guide and the badger-like ratel. Both the bird and the ratel seek beehives - the ratel for the honey and bee larva, the honey guide because it is a wax eater. The bird cannot open the nest, so it needs the help of the ratel, which is practically impervious to the stings because of its tough furry hide, which hangs loosely on its body. The bird by its chattering attracts the attention of the ratel and leads it to the hive. The ratel opens the nest and eats its fill of honey and larva and the honey guide sits on the sideline, content to eat the empty honeycomb after the ratel leaves.

Teacher reference:
Life Nature Library: Ecology
The Book of Popular Science

ACTIVITY #32

To the Teacher:

In the textbook Modern Life Science chapter 9, "Special Adaptations," is concerned basically with adaptations of plants and animals. It is a good chapter and has good activities at the end. There are also useful questions within the chapter.

You may use the whole chapter or only parts of it as you feel is necessary to get the concept of adaptation across to your students. At least part of it should be used at this time. If the reading is too difficult for your students you may wish to give the information to them in some other way.

The reading should be started on one day. Then the other activities following this should be done while the student is doing his reading as homework assignments. A few minutes each day may be used to discuss the reading assignment before starting the activity for the day.

ACTIVITY #37

Pond Water - Extinction or Survival?

Problem: If an environment changes what may happen to the life forms in it?

Materials: per team of 6-10 students
5 small glass jars (baby food jars)
2 teaspoons of each of the following: lawn fertilizer, phosphate detergent, household ammonia, microscopes, 5 medicine droppers, glass slides.

Procedure: (1) On the first day fill each of the small glass jars one half full of pond water. Be certain to include some of the plant material (hay) to maintain a food supply for your five communities. Mark each of the jars with tape, marking pencil, etc., so you will not get them mixed up. Jar #1 is to be set aside for the time. To jar #2 add 2 teaspoons of lawn fertilizer. To jar #3 add 2 teaspoons of any phosphate detergent. To jar #4 add 2 teaspoons of household ammonia. To jar #5 you may add 2 teaspoons of any other material you wish. Mark the water level on each jar.

(2) On the first day you should also look at 6 drops, one at a time, of the water in jar #1. Record the kinds and numbers of organisms you see in each drop. Then get a total number for all 6 drops together. Remember if you cannot identify by name every organism you see you can identify it with a drawing.

(3) Before the second day you are to write hypotheses of what you believe will happen in each of your 5 jars. The hypotheses should be based on what you already know about the materials you are adding to your jars. Be sure to keep the hypotheses.

(4) For the next four days you should look at 6 drops (one at a time) of water from each of the jars. Keep a record of the kinds and numbers of organisms you see in each of the jars.

(5) At the end of a 5-day period you will be expected to write a report on your observations. Be sure to include the following:

a. records or graphs of the species of organisms which you saw in each of the jars;

b. your original hypotheses;

c. additional comments

d. conclusions to the accuracy of your original hypotheses

e. results of the investigation, that is what took place in each of the jars at the end of 5 days.

ACTIVITY #39

Nature's Disguises #155 FOM

Location:
Sharon Smith
East Syracuse
Middle School

Charles Darwin established the idea that animals must be suited to their surroundings in order to survive. Some animals may even change to meet the changes in their surroundings. This filmstrip gives many examples of how animals are adapted to their environment.

The following questions will help you observe these adaptations:

1. (9-16) Give at least 4 examples of how insects are protected in nature.

2. (17) What are at least 3 ways that birds protect themselves?

3. (18-21) Why are male birds more beautiful and colorful than female birds?

4. (22-30) The filmstrip gives 7 examples of sea animals which use protective coloration or mimicry to help them snare food or hide from their enemies. List below at least 4 of them.

5. (3) Why is the alligator a successful hunter?

ACT. #39 (con't.)

6. (33) What is often animals'most dangerous enemy?

7. Why do some animals change colors with the change of seasons?

8. (37) Why is the chameleon so interesting?

9. (38) Is the blowfish really fierce?

10. List at least 5 animals that are protected by what they wear. What were NOT listed in the filmstrip?

ACTIVITY #40

Location: Resource Center

Nature's Use of Color

Bee (1) In the picture of the bee moving across the yellow flower, is the bee's color important or is the flower's color important? Explain

deer (2) What color is a deer? Why is it important for the deer to be this color?

prairie dog (3) Would gray be a better color for a prairie dog? Explain

peacock (4) If you watched closely you saw different peacocks. (a) Can you explain what type each was and (b) why each type was colored as it was?

parrot (5) The parrots were brilliant, gay colors. Wouldn't these colors be harmful to their survival?

polar bear (6) Polar bears are white, why?

zebra (7) Where do zebras live? What are their surroundings like? How does being striped help them?

(8) In class discuss the meaning of camouflage and attraction.

ACTIVITY #41

Location: Resource Center, Minoa

Rattlesnake

(1) Is the rattlesnake well suited to his desert environment? Explain

(2) What are the other two animals shown in the filmloop?

(3) What is the purpose of the snake's tongue?

(4) List the snake's defense against his enemy.

(5) Both the snake and the mouse lost. Why?

(6) Look up information on the tarantula to see if they always demand "squatter's rights".

ACTIVITY 42

Location: Resource Center, Minoa

Little Animals

1. List as many little animals as you can after viewing the filmloop.

2. Next to each write down the type of environment each one was seen in.

3. Did you see any animals preying on any others? If so which ones?

4. Some of the animals you saw were microscopic. Can you identify them?

5. Can you think of any other small animals?

ACTIVITY #43

ADAPTATION IN LIVING ORGANISMS*

CONCEPT: Living things are adapted by structure and function to their environment.

PURPOSE OF LESSON: To help pupils understand that a plant or an animal must be adapted to live under special conditions or it will not survive.

INTRODUCING THE CONCEPT: Distribute to members of the class a mimeographed sheet on which plants and animals are listed such as:

polar bear	lung fish
turtle	cactus
Venus's flytrap	electric eel
porcupine	opossum
angler	chameleon
woodpecker	squirrel
skunk	bat

Ask the pupils to write by each a peculiar characteristic that the organism possesses. Have them read their characteristics to the class.

Ask: 1. Why does this organism have this characteristic?

2. Has it always had this characteristic?

3. Why is it that all the plants and animals that live in this same environment do not have this characteristic?

DEVELOPING THE CONCEPT: Have pupils make a list of ways animals and plants are adapted for:
1. cold conditions
2. dry conditions
3. protection
4. obtaining food
5. light conditions

EXTENDING THE CONCEPT: If the community has a zoo, museum, or botannical garden, take the class to observe special adaptations. Have some pupils prepare a bulletin board display of animal protective coloring and mimicry, while others indicate migratory routes of certain birds on posters. Have pupils discuss ways that man has changed the environment which have resulted in forcing animals to live in new situations.

1. Did the animals adapt successfully?

ACTIVITY #43 (con't.)

2. Has man's change in environment been harmful to man? (man kills too many foxes; therefore the mice and rabbits begin to devour domestic crops.)

3. Have pupils discuss extinct animals, or animals in danger of extinction.

4. What actions can man take to protect scarce plants and animals?

*<u>People & Their Environment</u>
<u>Teacher's Curriculum Guide to Conservation Education</u>
<u>Science 7-8-9</u>

Student Reference:
<u>Modern Life Science</u>
<u>Life: Its Forms & Changes</u>

ACTIVITY #44

EXTINCTION

Teacher direction:

The teacher should lead the students in a discussion of how man has caused or influenced extinction. Even though animals may adapt to their environment in order to survive man may have caused their decrease to the point of endangering the species.

ACTIVITY #45

SUPPLEMENTAL ACTIVITIES

Teacher direction:

The following activities should be used to illustrate man's influence in creating situations where an animal must adapt to a man made environment or not survive. The activities can also be used to show how man has influenced the extinction of certain species of plants and/or animals.

See attached

Science:

Environmental Education Instructional Activities 7-12
University of the State of New York, The State Education Department

Activity #5 p. 35
#6 p. 35-36
#8 p. 36-37 could be coordinated with Social Studies

ACTIVITY #45 (from New York State curriculum)

Man alters the options available to future generations <u>when he unwisely manipulates the natural environment.</u>

Act. #5 Hunting regulations are useful in maintaining and restoring populations as well as in distributing the game harvest. Students should research and record the laws in their community, county, and State that pertain to the killing or capturing of wild animals.

Discuss present day motives for hunting vs. its original purpose.

- Do any of the laws contradict each other? Give examples.
- Are the laws properly enforced? By whom?
- What punishment is meted out to law breakers? Is it severe enough to discourage violations?
- What is the money collected for licenses used for?
- How much money is collected in your area each year?
- Is this money being used for what it is intended?
- Should additional restrictions be placed on the hunting public?
- What natural predators are in your area? Now? In the past?
- Do these natural predators play an effective role today in the control of game?
- Do our present hunting regulations help preserve or maintain balance in the natural community or do they need reexamination with this objective in mind.

Act. #45

#6

Present the following item to the class for thought and discussion on the subject of man's manipulation of the natural environment:

An example of the result of upsetting a natural predator-prey relationship is the Kaibab Plateau near the Grand Canyon. Here, in 1907, there were 4000 deer and a substantial population of their predators, mountain lions and wolves. When an effort was made to protect the deer by eliminating the predators, the deer population increased tremendously. By 1925, there were 100,000 deer on the plateau, far too many for the supply of vegetation. The deer, in their search for food, damaged the vegetation markedly. During the next three winters large numbers of deer starved to death, and in time their numbers declined to about 10,000.

- What was man trying to accomplish?
- Why did his actions seem the most logical ones to take?
- Could you prescribe what should have been done on the Kaibab?
- What is the present situation on the Kaibab Plateau?

Activity #45

#8

Man's efforts at changing the environment to fulfill his needs are often beneficial to him but harmful to the environment.

Divide the class into groups. Using a basic outline map of the community, have one group show the area as it exists today; have a second group show the area as it was 25 years ago; a third group should depict it as it was 50 years ago; and a fourth group, as it was 100 years ago. This information can usually be obtained from town records. To discover whay your local area was like in the eyes of its residents, have one group interview residents of the town who have lived there for 25 years. Have another group interview a 40-to-50 year resident of the community. When all data has been collected and summarized list the changes which have occurred.

- Were these changes helpful or harmful? Explain.
- Looking back, what could have been done to prevent the harmful changes?
- Looking ahead, based on what we now know, what changes do you foresee?
- Will these be helpful or harmful? Explain.
- What can we do to prevent the harmful ones?
- How could this process you have employed be modified for use on a national scale?

EAST SYRACUSE-MINOA SCHOOLS

Environmental Education Materials

Grade 7 Science

Unit IV Interactions Within The Community

Produced Under USOE Grant OEG-0-71-4621
by East Syracuse-Minoa Central Schools
407 Fremont Road
East Syracuse, N.Y. 13057
Dr. Fritz Hess, Superintendent

TOPIC OUTLINE

IV. Unit IV Interactions within the (entire) community

A. Food web (to include man, saprophytes)
  1. Flow of energy
  2. Simple food chain

B. Nature's recyclement
  1. Nitrogen cycle
  2. Review Unit II. A.

C. Changes in the community - succession

D. Ecology project #2 - study of same quadrant (micro-ecosystem)

Long Range Behavioral Objectives

Unit IV

A. The student should understand through investigations and discussions that all organisms compete with each other for available food in a complex food web and depend on the energy supplied by the environment for survival.

B. The student will interpret illustrations, diagrams and other audio-visual aids to comprehend that there is a continuous, natural recycling of many elements.

C. By analyzing examples of changing land and pond communities the student should internalize the concept that communities change and grow just as an organism does through successive steps until a stable (climax) stage is reached.

D. The student should apply the skills of inquiry (enumerated in unit 1) as well as the major ecological concepts emphasized throughout this course to plan and carry out a thorough study of a micro-ecosystem and to interpret its biological and physical interrelationships. The student will be investigating the same quadrant as studied in the fall (Unit 1) so that he can compare:
a) seasonal changes in an ecosystem
b) his intellectual growth in applying inquiry methods

UNIT IV: INTERACTIONS WITHIN A COMMUNITY

Activity No.		Objective
1- Physical Environments	D	A
2- Food Chains	D	B
3- Food Chains	D	
4- Food Chain - Checkpoint	D	
5- Food Web	D; P & P	
6- Energy Chain	D	C-D
7- Efficiency of Energy Chain	D	
8- Food Pyramid	D	
9- Food Pyramid	D	
10-Problem 15.1	M & E	E-G
11-Problem 15.2	M & E	
12-Problem 15.3	M & E	
13-Mastery Item 15.1	M & E	
14-Mastery Item 15.2	M & E	
15-Mastery Item 15.3	M & E	
16-Checkpoint 15.1	optional M&E	
17-Checkpoint 15.2	optional M&E	
18-Checkpoint 15.2	optional M&E	
19-DECOMPOSERS	D	H
20-NITROGEN CYCLE	D	I
21-NITROGEN-FIXING BACTERIA (suggested)	D	
22-Effect of nitrogen-fixing bacteria on plant growth (suggested)		

Act. No.		Objective
23-The Nitrogen Cycle (checkpoint) - D		
24-Nature's Recyclement (discussion)	D	J
25-Phosphate Cycle	D	K
26-Nature's Recyclement -Reading	D	L
27-Succession	D	M
28-Filmstrip- <u>Succession & the Web of Life</u>	D	N
29-Pond Succession	D	O
30-Reading Succession	D	P
31-Plant Successions in the Schoolyard	D	Q
32-Checkpoint	D	
33-Ecology Project #2	D	R

UNIT IV: MATERIALS

Activity #

1. no materials
2. transparency
3. no materials
4. no materials
5. no materials
   (optional transparency)
6. no materials
7. no materials
8. diagrams
9. diagrams
10. fresh hamburger (1/4 lb.)

    test tubes with cotton plugs
    test tube racks
    test tube holders
    Bunsen burners or alcohol
    beakers (500 ml)
    glass marking pencils
    medicine droppers
    microscopes
    coverslips
    microscope slides
11. no materials
12. soil-1/2 bushel
    cardboard boxes or
    plastic dish pans
    aluminum foil or plastic
13. no materials
14. no materials
15. no materials
16. no materials
17. no materials
18. no materials

19a. no materials

19b. no materials

20. textbook
21. uproot leguminous plants
    clover,
    peanuts
    alfalfa or beans
    glass slides
    bunsen burner
    methylene blue
    microscope
22. plants rich in nitrates
    flower pots of soil
    oven
    nitrogen fixing bacteria
    soaked clover seeds
23. no materials
24. no materials
25. no materials
26. no materials
27. no materials
28. filmstrip
29. large cork
    microscope slide
    beaker or jar-250 ml
    grass-water mixture
    pond sample
    aquarium water or culture
    of mixed microorganisms
    (200 ml)
    knife or single edged razor
    blade
    glass plate or aluminum foil

UNIT IV: MATERIALS con't.

Activity #

30. textbook: Modern Life Science

31. plot of land in school yard (optional)

32. no materials

33. no materials

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
A. The student will study three diagrams and write an explanation of these diagrams to show that he understands what makes up the physical part of the environment.	To achieve: A, B Activity #1 (ditto attached) p. IV-10	
B. Given a group of work-sheets on the food chain and the food web the student will complete these work-sheets at 100% efficiency.	Activity #2 (ditto attached) A transparency can be made of the ditto. p. IV-11 Activity #3 (ditto attached) p. IV-12 Activity #5 (ditto attached) p. IV-14	Act. #4 (ditto attached) p. IV-13
C. Given two dittoes on the energy chain the student will answer questions concerning these dittoes at 100% efficiency.	To achieve C,D Act. #6 p. IV-15 Teacher note: Each child may have a copy of the diagrams to go with Act. 6-9	
D. Given examples of the food pyramid and an exercise on the food pyramid the student will complete the exercise, after having gone over the examples at 100% efficiency.	Act. #7 p. IV-16 (ditto attached) Act. #8 p. IV-17 (ditto attached) Act. #9 p. IV-18 (ditto attached)	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
E. The student learns that microbes compete with man for food by recognizing that possible food spoilage was due to improper treatment.	To achieve E,G Act. #10 Prob. 15.1 M&E p. 211 see teacher note attached to back p.IV-19 .	Note: use if time is available Act. #16 Checkpoints 15.1 p. 39 Act. #17 Checkpoints 15.2 p. 40
F. The student learns that microbes cause natural organic materials to rot, but do not attack many man-made materials by identifying a condition which inhibits the growth of microbes and prevents rotting.	Act. #11 Prob. 15.2 (M&E) p. 213 Act. #12 Prob. 15.3 (M&E) p. 216 Act. #13 Mastery Item Item 15.1 (M&E) p. 217	Act.#18 Checkpoints 15.3 p. 41
G. The student learns that microbial decomposition is essential to prevent accumulation of dead organisms by predicting that treating food to prevent decomposition could have undesirable effects.	Act. #14 Mastery Item 15.2 (M&E) p. 218 Act. #15 Mastery Item 15.3 (M&E) p. 219 go back & finish 15.1 Teacher note: If you use Act. #22 it should be set up here.	
H. The student will define decomposer and show by means of a food chain that materials from nature will be used over many times.	To achieve H Activity #19 The Decomposer p.IV-20	
I. The student will read several assignments, answer a set of related questions and observe two activities designed to show him the importance of nitrogen cycle.	To achieve I Act. #20 Nitrogen cycle p. IV-22 Act. #21 Suggested p. IV-24 Act. #22 Suggested p. IV-25	To achieve I Act. #23 Checkpoint p.IV-26 The Nitrogen Cycle

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
J. The student will participate in a discussion of the way nature recycles her materials.	To achieve J Act. #24 Discussion p. IV-27	
K. The student will go over a diagram on the phosphate cycle to reinforce his concepts already developed on nature's recyclement.	To achieve K Act. #25 Phosphate cycle p. IV-28	
L. The student will read a paper on "Nature's Recyclement" and note that energy in a system reaches the terminus.	To achieve L Act. #26 Nature's Recyclement p. IV-29	
M. Given a ditto on succession the students will study it and take notes on succession at 100% efficiency.	To achieve M Act. #27 p. IV-31 (ditto attached)	
N. Given the filmstrip, Succession and the Web of Life, the student will observe the filmstrip and answer the questions at 100% efficiency.	To achieve N Act. #28 p. IV-33 (ditto attached) filmstrip located at East Syracuse Middle School and Pine Grove	
O. The student will do this investigation to discover a better understanding of succession by using the pond as an example.	To achieve O Act. #29 p. IV-35 (ditto attached)	
P. The student will do a reading assignment explaining succession and answer questions on the reading at 100% efficiency.	To achieve P Act. #30 p. IV-37 (ditto attached)	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
Q. The student will make a series of observations and answer questions on these observations at 100% efficiency.	To achieve Q Activity #31 p. IV-38 (ditto attached)	Activity #32 p. IV-40 (ditto attached) Teacher see attached sheet.
R. Given an ecology project the student will do this in order to show that his skills and ability to correlate and present data have improved.	To achieve R Act. #33 p. IV-41 (ditto attached) Teacher: Assign this according to the weather. Preferably in the spring (April, May, June)	

Activity #1

Place the three diagrams (#1, #2, #3) on the bulletin board. Have the student look at these pictures and study them. Then you may make up questions that they can answer by referring to the diagrams. What might be easier and just as effective would be to have the student write a short paragraph explaining the diagram and what it shows, also listing for diagram 1 and 2 the physical parts of the environment shown in the picture. A simple explanation of diagram #3 is sufficient.

This should be done over a two or three day period so that the student has time to observe the pictures.

Activity #2

FOOD CHAINS

To the teacher:

Explain the concept of the food chain and give some examples of simple food chains. Then when the student understands the simple food chain go over a more complex one using an unlabeled ditto and an unlabeled transparency. This particular ditto will show that two food chains can start and end with the same plant and animal. The transparency should be filled in when you go over it with the students so that they can fill in their dittoes.

When the student has completed the ditto on the food chain he should be assigned the following: Read p. 166-167*and note the main idea of each of the three sections.

* Modern Life Science

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Activity #3

FOOD CHAIN

Below is a list of plants and animals. First divide them into three groups: producer, primary consumer, secondary consumer. Then create a number of different food chains each having at least three different organisms in it.

LICHENS	ALGAE	SQUIRRELS
RABBIT	TADPOLES	OWL
FOX	FROGS	CAT
ELODEA	CRAYFISH	MICE
WATER FLIES	SNAKE	HAWK
MINNOWS	TREES	GRASSHOPPER

ACTIVITY #4

In our compact world we find many gains
But the greatest of all is the mighty food chain.

A busy mosquito was eaten by a bat
Just gobbled up at the drop of a hat.
But just one thing that all should note
Our friend the mosquito had bitten a coyote.

An innocent grasshopper was chewing a leaf
There was no DDT, so we need not your grief.
The cute little grasshopper soon had to flee
But the coyote devoured him, and ran away free.

These friends we have do other things
They eat different plants and some animal kings.
Our food chain is growing, from the life within
Before we know it a food web begins.

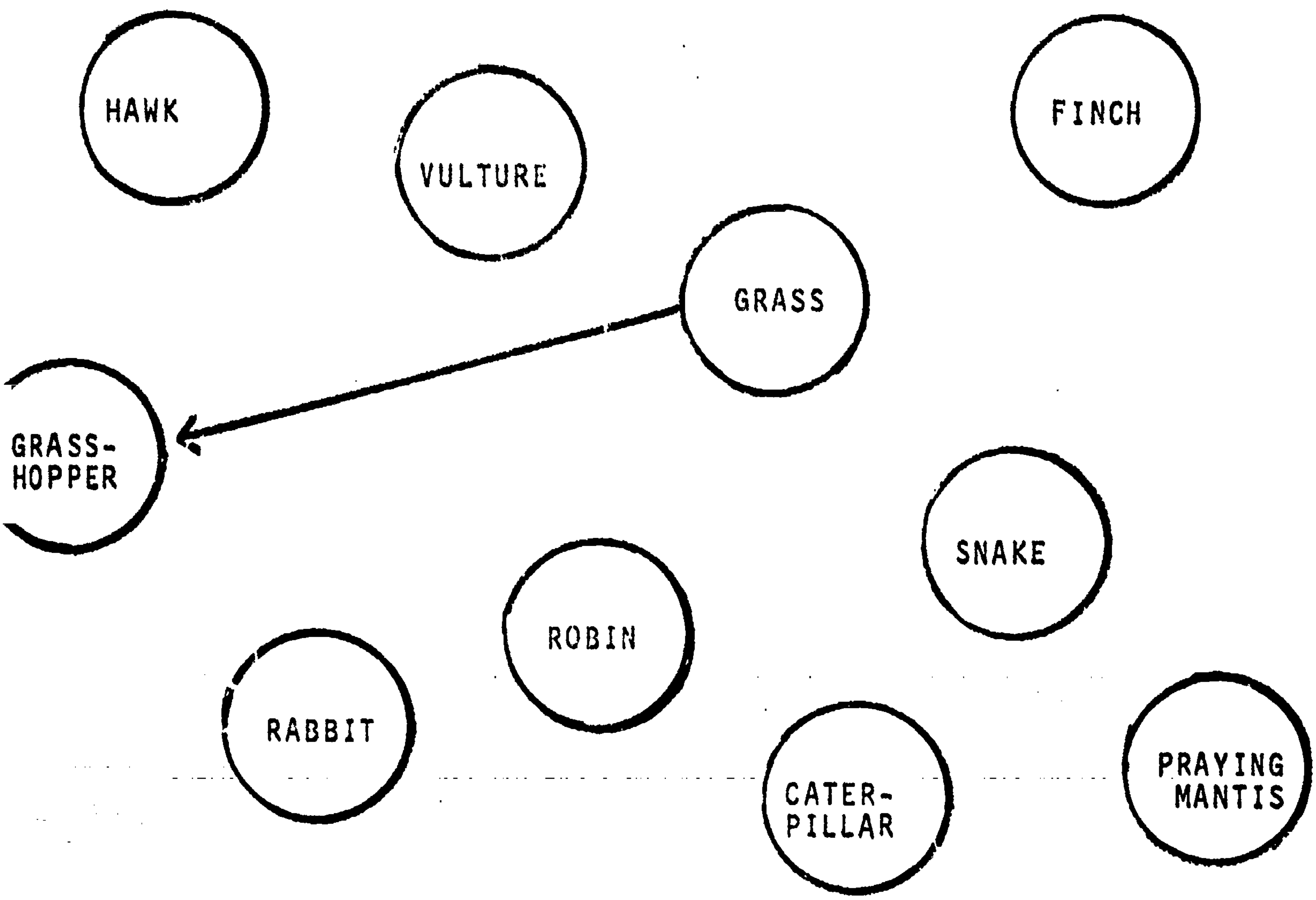
Directions:

From the food web shown on the diagram, see how many different individual food chains you can pick out. Write these on a separate sheet of paper to be handed in.

ACTIVITY #5

TEACHER DIRECTIONS

The basic idea for this activity is to explain the concept of the food web to the students. There are different diagrams and transparencies that can be used for this purpose. The students should understand that a food web is a group of many food chains linked together. The diagram below should be given to the students for them to complete after the concept has been sufficiently explained.



With arrows connect the animals that would eat other animals or plants in the diagram above. An example is done for you. Make sure the arrows go in the right direction: from what is eaten to the eater. ex: grass ⟶ grasshopper
minnow ⟶ large fish

Activity #6

Student Sheet

AN ENERGY CHAIN

1. The energy originally comes from the ______________.

2. Write down the organisms that the energy passes through, in order, beginning with the plant.

3. Does the amount of energy passed from one organism to another get larger or smaller?

4. Fill in the chart below from the information on the diagram. The first one is done for you.

Producer	Plant
	Grasshopper
First order carnivore	
Second order carnivore	
	Bird

5. What do the arrows (↗) show?

Activity #7

Student Sheet

THE EFFICIENCY OF ENERGY IN FOOD CHAINS

1. All the energy comes from the ________________________.

2. Column #1 shows ______________________________________.

3. What does column #2 show you about energy?

4. The diagram shows how much energy is lost when it is transferred. In most of the columns is: half of the energy lost; more than half; or less than half?

____

5. Is the amount of energy <u>used</u> (utilized) more or less than the energy lost?

6. What do the arrows mean?

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Activity 60

To the Teacher:

Using different examples of the food pyramid explain and discuss the transfer of energy from plants to animals. Explain the fact that as you go from the bottom of the pyramid to the top the size of the organism gets larger and the number of organisms needed to transfer the same amount of energy increases. In other words the amount of energy decreases as it passes from one organism to another.

Use dittoes: The efficiency of energy in food chains and an energy chain to show the flow of energy and how energy is lost. Go over the dittoes and then ask questions concerning the diagrams.

Activity #9

In a community you have seen that the organisms living there are classified or grouped, according to certain characteristics. Examples of these characteristics are bone structure, color or size. You may have also observed that some organisms eat plants while others eat animals. Plants and animals are grouped according to these particular traits.

1. Producers - green plants that make their own food using energy from their physical environment. (soil, sun, etc.)

2. First order consumers - animals obtaining energy from producers (plants)

3. Second order consumers - animals obtaining energy from other animals (first order consumers).

In pyramid diagrams 1 and 2, note how the levels of energy decrease as you go to a higher level of the pyramid. Producers contain the most energy and so on up the pyramid. Why do you suppose this flow of energy is needed to maintain this system?

____

____

____

From diagrams 1 and 2 place each of the organisms of the pyramids in the correct columns shown on the ditto sheet. After you have finished, write at the bottom which group contains the most energy and which contains the least. Notice that the last column is left blank. See if you can fill in the proper heading and then complete the entire column.

Activity 10-15

Note to Teacher:

You should set up Act. 10 (problem 15.1 M & E) and then do Act. 11 (prob. 15.2 M & E) and Act. 12 (prob. 15.3 M & E) the same day. It is suggested that only a few students work on Activity 11 and then report their results to the class. Act. 13-15 may be used as they are written but the teacher should work with the class.

Activity 16-18 should only be used if the teacher feels there is enough time to include them.

Activity #19a Teacher Reference Sheet

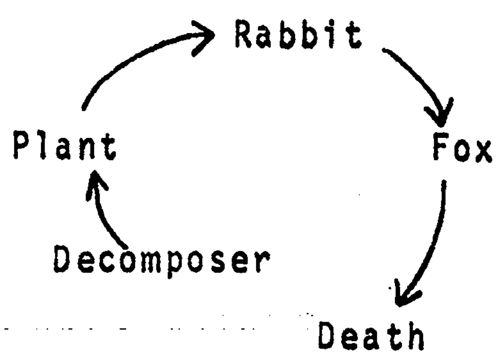
THE DECOMPOSER

Define Decomposer: An organism which breaks down dead plant and animal material into the basic elements.

Example: Bacteria, fungi, scavengers

Explain that without the decomposer, the necessary elements for life would not be returned to the system and therefore, these elements would be use up. The decomposer causes dead material to decay - The elements then go back into the soil and can be used again by plants.

Show this in a food chain in the form of a cycle so that the student realizes that the same elements are used over and over and never used up.



Have the student make up a few food "cycles".

Activity 19b

To the Teacher:

Put the following directions on the board for the student.

Look at the picture and write a short paragraph of 6-8 sentences on what will occur in the little scene. Be certain to use good language skills.

Activity #20

Teacher Direction:

The emphasis of this activity should be on the term cycle. When introducing the activity the teacher should ask the students why this pathway is called the "Nitrogen Cycle".

1. Definition of cycle: A series of events that repeats itself

2. The student is to read assignments from two textbooks and using this information plus the ditto "The Nitrogen Cycle" answer a set of questions.

3. There is a supplemental ditto of the nitrogen cycle which may also be used to further illustrate this cycle.

NITROGEN CYCLE

Reading assignment for student:
<u>Modern Life Science</u> -pg. 247-249
<u>Modern Science</u> 1 pg. 126-127

Definition of <u>Cycle</u>: A series of events that repeats itself

Students should have ditto copy of The "Nitrogen Cycle".

Student questions:
Based on textbook readings and ditto of the "Nitrogen Cycle".

1. Why is the path nitrogen takes called a cycle?

2. What does nitrogen-fixing bacteria produce?

3. Why are nitrogen fixing and nitrate bacteria important to plants and animals?

4. What are two sources of nitrates?

5. What percentage of the air is nitrogen, a) 29%, b) 59%, c) 79%, d) 89%

6. Plants absorb nitrogen in the form of ______________.
a)nitrates, b) free nitrogen c) ammonia d) proteins

7. Plants use the nitrogen they absorb to synthesize* ____________.
a) ammonia b) proteins, c) nitrates, d) free nitrogen

8. Nitrogen from decaying plants and animals is first in the form of ____________.
a) ammonia, b) nitrates, c) free nitrogen d) proteins

9. When lightning strikes the ground it produces ________.

10. Animals get the nitrogen they need from ____________.
a) nitrates, b) other plants and animals, c) decay bacteria, d) free nitrogen

* explain this word and encourage the student to use it.

Suggested Activity #21

Nitrogen-fixing bacteria

Can be used as a student activity or a demonstration. It can also be used as an example of symbiosis.

Activity #21

Nitrogen-fixing Bacteria

Uproot leguminous plants - clover, peanuts, alfalfa or beans

Look for swellings or nodules on the roots.

Each nodule contains thousands of nitrogen fixing bacteria which have invaded the root tissues.

These bacteria do little harm. This is an example of symbiosis.

Wet Mount
Crush a nodule between two glass slides, add a drop of water to each slide and examine.

Mount
Make a thin film of the bacteria by spreading the fluid of a wet mount along the slide.

Fix the bacteria on the slide by warming through a bunsen burner flame.

Flood the slide with methylene blue for one minute. Rinse excess stain with water, let dry and examine.

Suggested Activity #22

Effect of Nitrogen-fixing bacteria on Plant Growth

There is a supplemental ditto of the nitrogen cycle which may also be used to further illustrate this cycle.

Teacher:

The activity can be set up by the students or the teacher, the important point being, the activity should be set up at least one week before the discussion of the nitrogen cycle, this will allow for plant growth.

The plants rich in nitrates will have more luxuriant and greener growth than plants deficient in nitrates.

Teacher direction/student direction

Effect of Nitrogen-fixing Bacteria Plant Growth

A student activity to illustrate the effects of soil deficient in nitrates

1. Sterilize at least four small flower pots of soil in an oven.
2. Add nitrogen-fixing bacteria to half of the flower pots. The nitrogen-fixing bacteria can be purchased from various seed companies.
3. Add an equal quantity of soaked clover seeds to each of the flower pots.

Have students keep a daily record of observations.

Activity #23 Checkpoint

Read the story below and then answer the questions that follow.

In the schoolyard outside your building one of the students found a dead rabbit in a patch of clover. The rabbit was in the clover patch because clover is one of his favorite foods. He had died from old age and was beginning to decay. Many bacteria were attacking the rabbit's body and at the same time putting nitrogen back into the soil. Although it is sad that the rabbit is dead, the soil is being replenished with nitrogen compounds that can be used by green plants. The green plants use these compounds to make protein and pass this nutrient on to other animals, thus completing the cycle.

Some nitrogen is also put back into the air as free nitrogen while the animal is decaying. However, plants cannot use nitrogen from the air;they can only use nitrogen compounds in the soil.

Questions: Using the words listed below complete the following statements.

1. Green plants use ________________ when they make protein.

2. When plants or animals decay, nitrogen compounds are released into the soil by the work of ________________.

3. The clover plant has swollen growths on its roots that are called ________________.

4. Some bacteria in the soil break down nitrogen compounds (nitrates), thus releasing free ________________ into the air.

5. Animals get protein by eating ________________.

nitrogen	tubers
nitrogen compounds	nodules
bacteria	plants
protozoa	animals

Activity #24

Nature's Recyclement

Teacher direction:

Lead the class in a discussion of the following question:

Why don't plants existing in the wild run out of the soil nutrients they need in order to continue living?

Emphasis should be placed on the fact that nature by itself does not run out of materials because everything is re-used. The deficiencies created in nature are those caused by man who is part of a throw-away society.

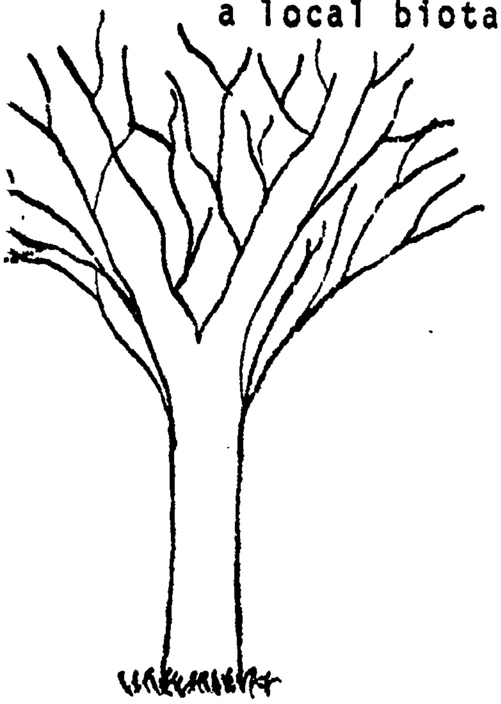
Activity #25

Give the students a copy of the phosphorous cycle. Go over and explain this cycle to the students. The term cycle should be emphasized again. The fact that much of the phosphates are washed to the sea by erosion and lost should be emphasized. The erosion of phosphatic rocks puts phosphorous back into the soil and compensates for this other loss.

Activity #26

Nature's Recyclement

You may have to read this with slower groups so that they will be able to follow its continuity. An important point to emphasize is that, "only part of the energy in a local biota reaches its terminus.



Reading*

The biotic stream (involves all living things) is able to flow in long or short paths, quickly or slowly, uniformly or in spurts, in decreasing or increasing volume. No one understands these variations and changes, but they probably depend on the make up and arrangements of the soils, animals and plants which control this channel of life.

A rock decays and forms soils. In the soil grows a black walnut tree, which produces a walnut, which feeds a squirrel, which feeds a hunter, who eventually lays down to "his last sleep in the great tomb of man - to grow another black walnut tree."

rock → soil → tree → walnut → squirrel → hunter

This series of stages in the transmission of energy in a food chain can be thought of as a pipe line established by time through the process of evolution. Each section in the pipe is adjusted to receive from the section behind it and pass on to the section ahead of it.

The pipe line leaks at every joint between the sections. Not all the rock forms soil. Squirrels do not get all the walnuts, nor do the hunters shoot all the squirrels. Some squirrels die and return directly to the soil. Due to this leakage along the pipeline only part of the energy in any biological community reaches its end. This loss may be shown this way.

rock → soil → tree → walnut → squirrel → hunter

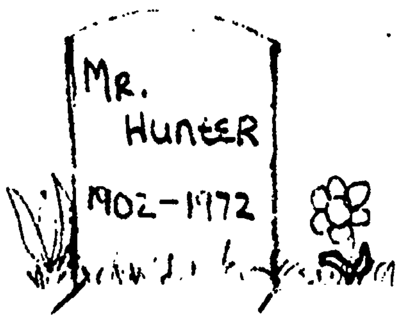
In addition to loss from these leaks in the pipeline, energy is sidetracked into branches. So the squirrel drops a piece of his walnut, which feeds a pheasant, which feeds a fox, which feeds a parasite. The pipeline then, branches

like a tree. The fox eats not only the pheasant but also a mouse which thus forms another link in another pipeline.

rock ⇄ soil ⇄ clover ⇄ rabbit ⇄ fleas

Thus the whole system is interconnected by many pipelines.

Nor is food the only important material passed along the pipeline. The tree grows not only walnuts; it grows wood for furniture; hollow dens for racoons, shade for wild flowers. Its fallen leaves insulate the violets from frost, make mulch for the spring. Its roots are splitting more rocks to make more soil for more trees.



This maze is so complex no one could map the interrelationships found in a single community. It grows more and more complex with time.

* Patterns and Processes p. 70

(Goes with succession ditto)

Activity #27a

Terrestrial Succession

1. Rocks and soil
2. Lichens
3. Mosses and ferns
4. Grasses and Wildflowers
5. Small shrubs
6. Trees
7. Climax forest

Aquatic Succession

1. Algae
2. Floating plants (water lilies)
3. Emergent plants (arrowhead)
4. Cattails
5. Grasses and ferns
6. Shrubs and trees
7. Climax forest

Give the student this ditto and the ditto with the diagram of succession on it. Go over the steps of succession with them. Have them take notes. Discuss this in class with them.

Activity #27b

To the teacher: You may wish to set up a succession plot somewhere near your school at this time. The following Investigation may aid you in your work. (A succession plot will be established behind Pine Grove, October, 1972 as part of the Nature Center).

Investigation

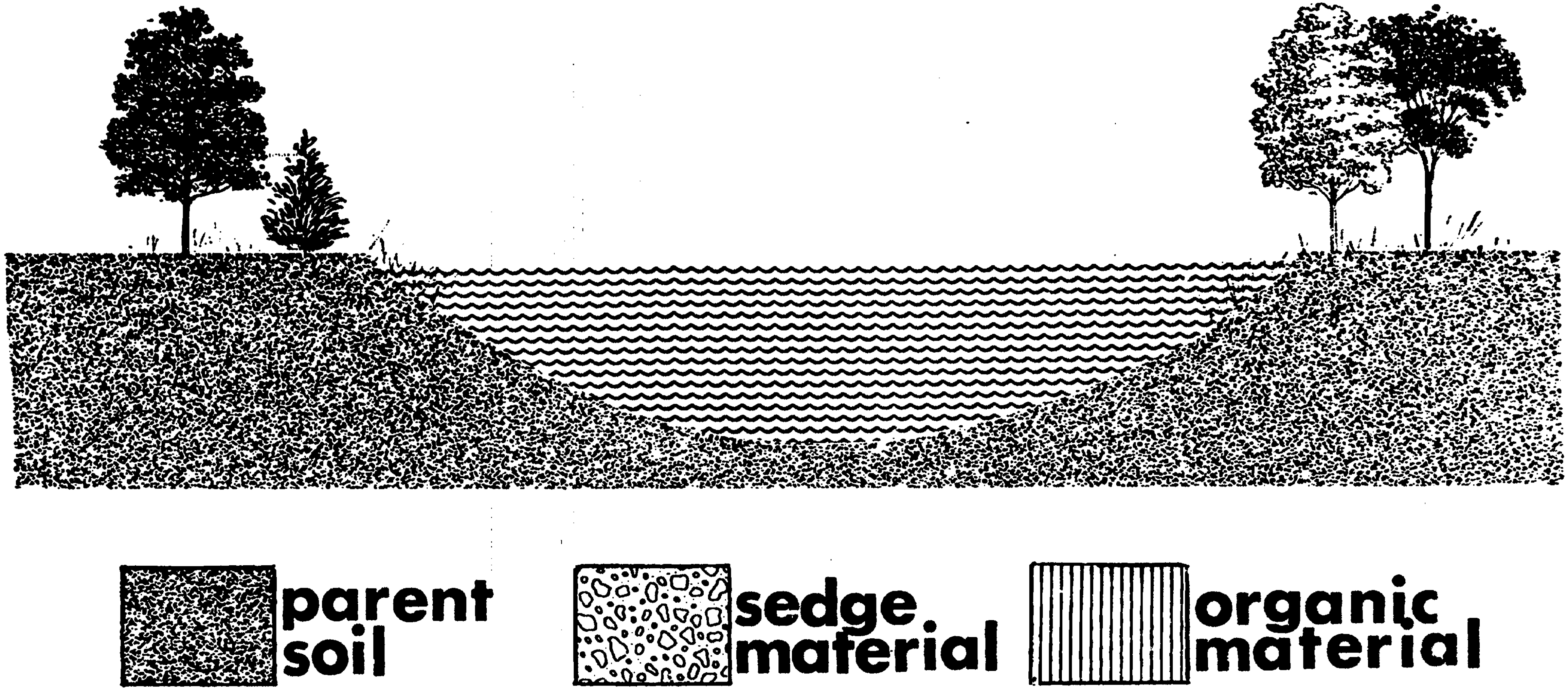
Locate a vacant lot in your community for a study of the ecological event known as succession. If there is no vacant lot, obtain the permission of a landowner to use a plot for your investigation. A three-foot square of ground is all you need. Perhaps you can set aside a portion of the school ground.

Strip your plot of all its vegetation. Remove all the weeds and grass. Use a spade to turn over a few lumps of soil. If there are any rocks in the soil, leave them alone. Do not disturb any tree roots that you might uncover.

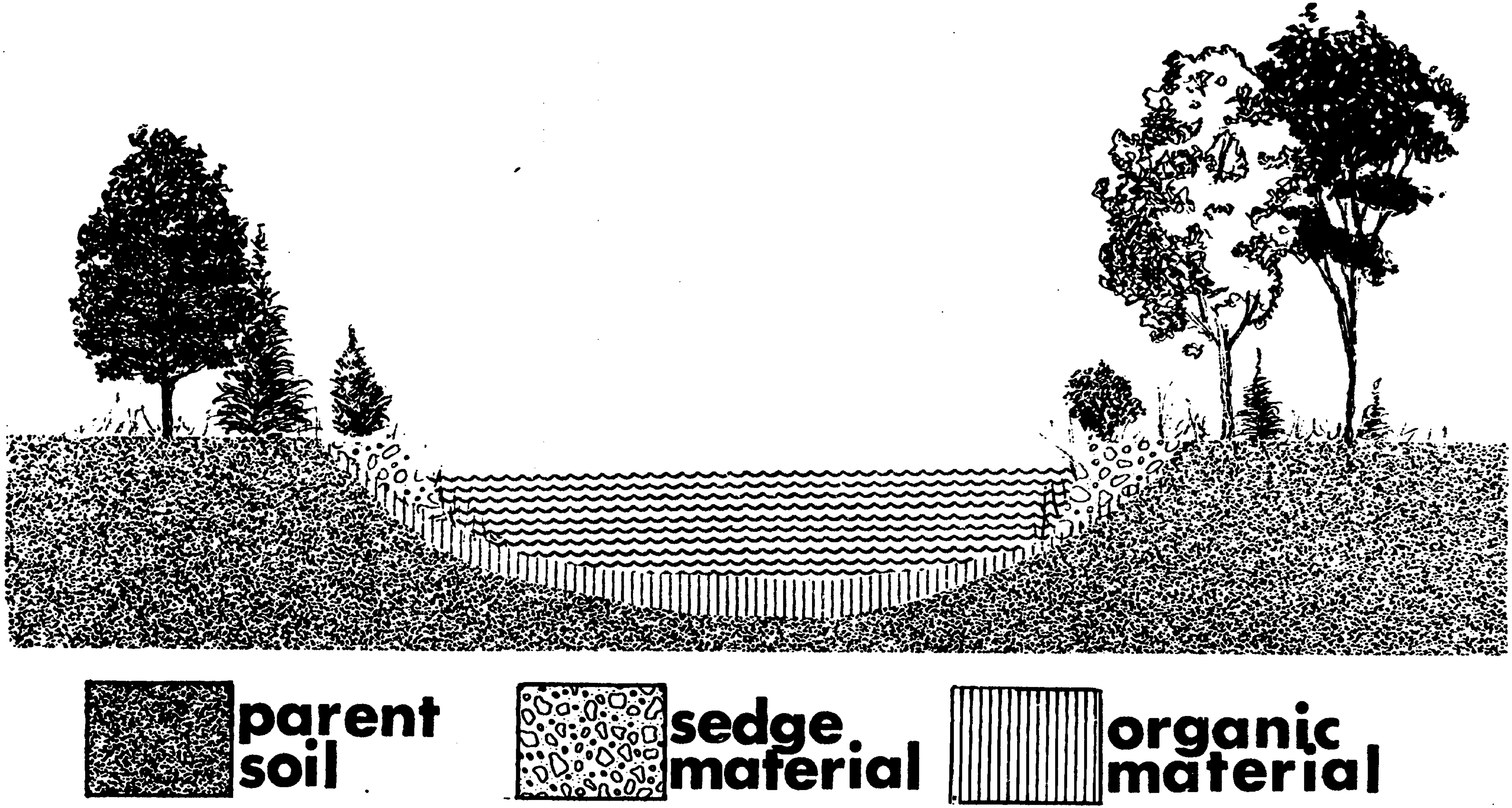
Begin your investigation with a detailed observation of the barren plot. What is the condition of the soil? Is there water nearby? Are animals likely to frequent the area? Is the plot sheltered from squalls and crosswinds? Or is it in an open area? Are there trees and other plants nearby? Record your observations in your science notebook.

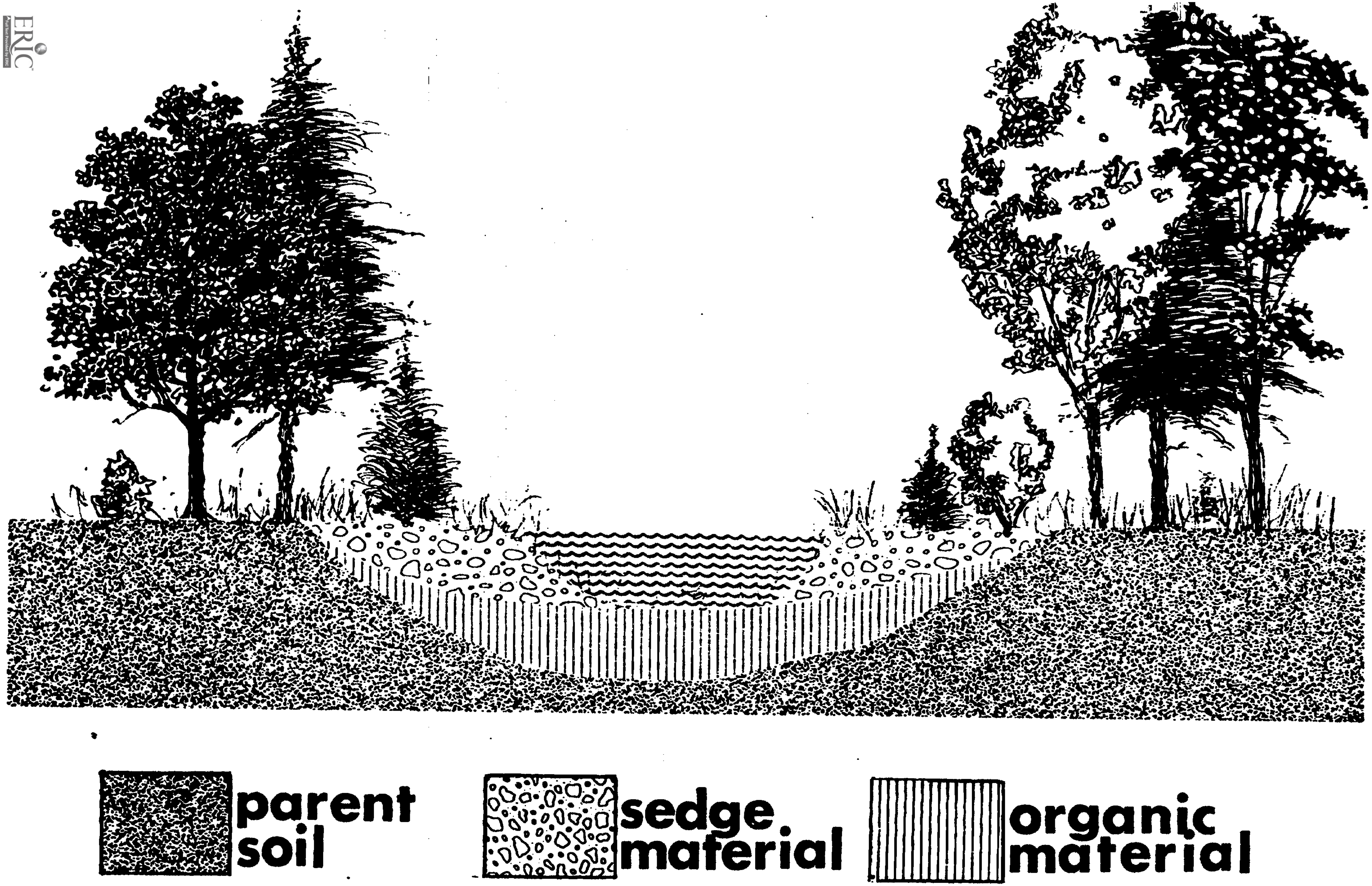
Examine this plot at least once a week throughout the remainder of the school year. Look for changes. Are plants beginning to grow? Are there signs of erosion? Is there a growing population of insects? Are there signs of other animals? Does the weather bring about changes?

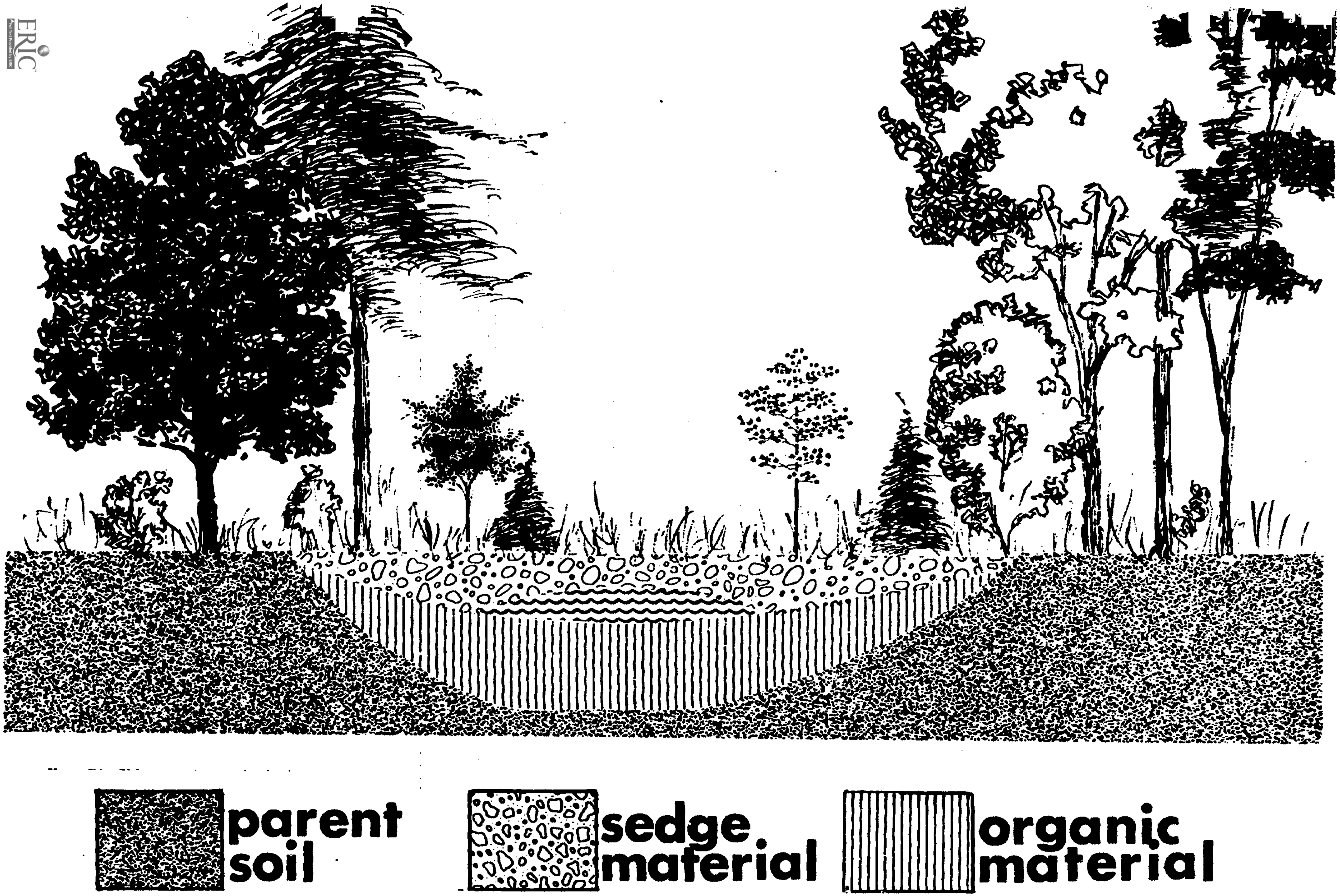
You should have a great deal of data by the time you finish your study. Work carefully and neatly to avoid confusion. Design tables and graphs to record the information that you collect.

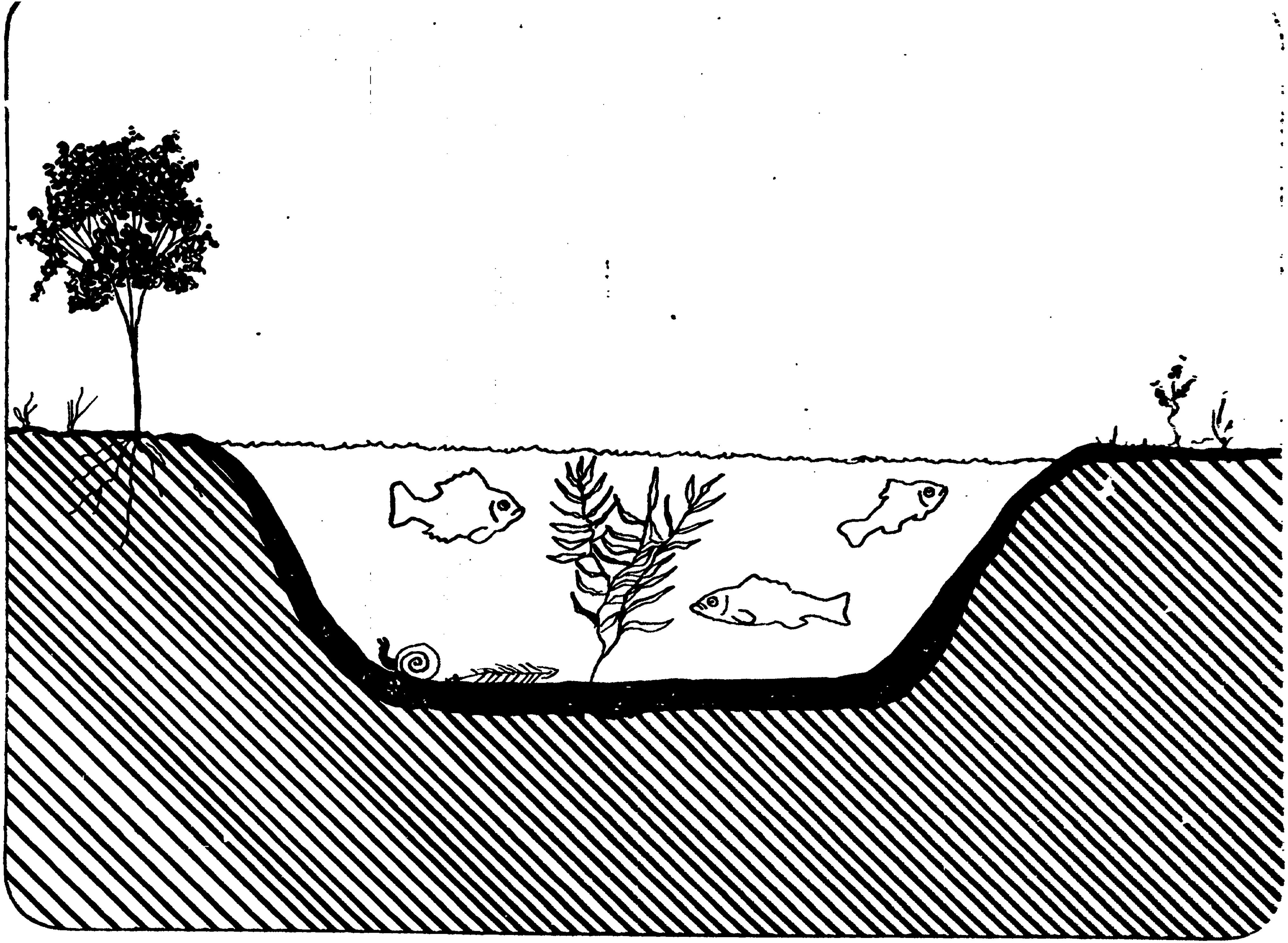


Unit III. OH.#27


parent soil
sedge material
organic material


parent soil
sedge material
organic material


parent soil
sedge material
organic material



Unit III Act. #27

Activity #23

Filmstrip: Succession and Web of Life

Introduction:

You are familiar with the term community. You also know that many types of communities exist in nature. This filmstrip shows you that a community is constantly changing. There is a special term that we use in science when a community changes, this term is; succession. You must be able to define this term and give examples of it after viewing the filmstrip. The questions below will help you understand this new term.

(3)
1. In a changing environment an organism has two chances to survive. What are they?

(4)
2. Give an example of an extreme environment.

(9)
3. Is a community always complex? Explain.

(11)
4. What is succession?

(11)
5. When a bare rock becomes covered with some type of plant material we say the ______________ has begun.

(13)
6. In order for a bare area to be able to support life, plants must invade the area. This occurs in 4 steps:

   a.
   b.
   c.
   d.

7. Take each of the terms from question 6, a-d, and next to each give a simple explanation after viewing frames #13 to #18 of the filmstrip.

8. When does mixed aggregation occur?

(21)
9. Why is a lichen considered a "pioneer plant"?

10. After viewing frames #21 to #28 list in order beginning with a lichen the order of plants which may succeed one another tc produce a stable community.

11. Does the order you listed in question #10 always have to occur this way? Explain.
(33)
12. What factor determines the type of stable community which may be produced after succession?
(35)
13. When does secondary succession occur?

14. Give an example of a major community and then one of a minor community which might be found in it.

15. As a community changes plants change, then the animals. Why?
(49)
16. What is meant by the "carrying capacity" of a community?

17. Read frame #55 carefully then give careful thought to your reply to this statement.

Man's place in nature seems to be that of destroyer of natural balances.

Activity #29

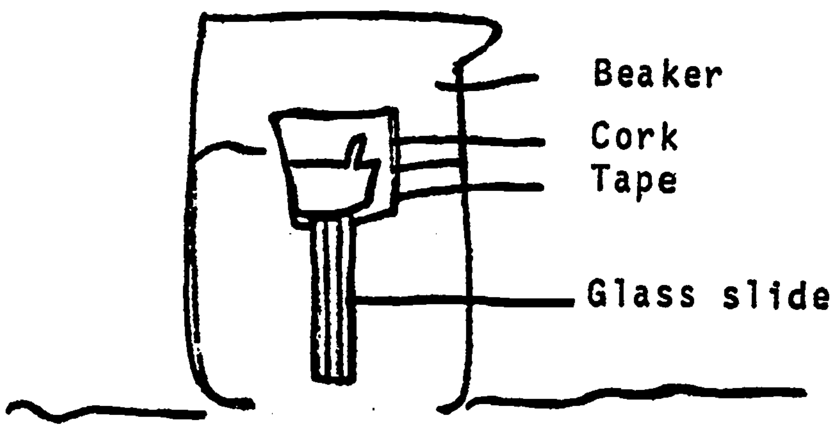
Pond Succession

Materials (per team)

1. Large cork
2. Microscope slide
3. Beaker or jar, 250 ml.
4. Grass-water mixture, pond sample, aquarium water, or culture of mixed microorganisms, 200 ml.
5. Knife or single-edged razor blade
6. Glass plate or aluminum foil.

Procedures

1. Starting midway across the cork's narrower end, cut a slit in it (about halfway). Insert the slide in the cork as shown in the diagram below:



2. Pour the water from your pond sample into the beaker and float the cork and slide in it. Cover loosely and set aside for twenty-four hours.

3. Next day examine the slide, using a microscope. Try to identify any organisms you see, with the aid of Appendix H. Make a list of these pioneers in your data book. Replace the slide in the beaker and set aside again.

4. Two days later, repeat Procedure C.

Interpretations

1. How many kinds of organisms did you see after twenty-four hours? After forty-eight hours?

2. After twenty-four hours, were the organisms mostly of one kind? If so, what kind? After forty-eight hours, had this changed? How?

3. Try to explain what happened in the water sample in the time between your two observations.

<u>Interaction of Man and the Biosphere</u> p. 198-99

Activity #30

Succession

Give the student this reading assignment. Have them answer the questions at the end of the reading. Discuss the reading in class.

Reading: Modern Life Science pp. 169-174

Activity #31

Plant Succession in the Schoolyard

Concept: Areas of the schoolyard which are not cared for will pass through a series of changes known as succession.

Purpose of the Lesson: To study the stages of succession in the limited areas of a schoolyard. Succession can be observed in the corners of fences, fence rows, and hedges.

Introducing the Concept: It is assumed that students have been studying succession.

Developing the Concept: Students are taken to the schoolyard where they observe and make notes on the following as related to succession:

1. Trees
   a) types
   b) size
   c) Compare those planted to ones grown naturally
   d) locations:
      1: Do you see small ones growing in flower beds?
      2. What will happen if not removed?
   e) What do you find growing under trees?

2. Shrubs:
   a) types
   b) size
   c) where growing? why?
   d) Account for growth of those not transplanted

3. Hedge:
   a) type
   b) Do you see plants growing in it? Why? Why not?
   c) How does growth here show succession?

4. Flower beds:
   a) Note growth of small trees, weeds, and grass in beds.
   b) What would happen if growth is not controlled?
   c) Compare uncontrolled growth here to controlling succession in a field.
   d) Relate controlling growth here to controlling succession in forests.

5. Lawn:
   Observe uncontrolled growth here of weeds

6. Asphalt areas: Weeds in cracks and low areas filled with soil.

If desired, students may set up investigations in the schoolyard to measure limiting factors.

Extending the concept

1. Relate succession in the schoolyard to succession on uncultivated fields, sand dunes, bare rocks, or other areas.
2. Relate limiting factors of the environment to succession in the schoolyard.
3. Relate the benefits and problems of succession to a) Plants, b) Animals (Wildlife), c) Man, d) soil, e) Water, f) Minerals.
4. List and discuss the various stages of succession in the schoolyard.
5. How would disasters such as fire and storms affect succession?
6. How could you recognize an area that has reached climax?
7. How does a study of succession in the schoolyard show the importance of controlling succession in a forest?
8. How does succession affect the balance of nature in a community?
9. Is a climax stable, or does it constantly change? Why?

Fixing the Concept: Discuss and justify the following statements:

1. Succession will help to determine the wildlife of a community.
2. An unkept flower bed being overtaken by weeds is one example of succession.
3. Succession is beneficial to plants, soil, water, wildlife, and man. It may also create problems requiring conservation measures. (Individual or group projects may evolve from this study.)

People and Their Environment
Teachers' Curriculum Guide to Conservation
Education, Biology, p. 78, 1969

Activity #32

Teacher Directions:

This activity shows plants and/or animals in their own niches and may be used as an evaluation following Activity 27 to Activity 31.

Hand out p. 75 exercise 32/reading* Ask the student to look at each of the pictures and answer the questions below each one. Then hand out p. 76 and ask them to answer the questions on this page before revising their first set of questions.

* Patterns and Processes, 1970

Activity #33

Ecology Project #2

The first ecology project that you did had very few directions. The object of the project was basically to see how well you could analyze a situation, come up with some logical conclusions and present them logically to the rest of the class.

Now you will be given a second project. You will use the same plot of land as you used for your first project. You have been given a ditto of ten rules you should keep in mind. Read these carefully - now!

You have had some practice in using different scientific equipment and in doing many different kinds of investigations. In doing your second ecology project you should make use of as many of the skills you have developed as possible. The observations you make should be much more far reaching and thorough.

Remember, you are to use the same plot of land. Make sure it is the same size as the original plot of land. Be very exacting and as complete as possible.

Good Luck!!!

BASIC ELEMENTS OF ECOLOGY

In our last investigation we discussed the way in which a scientist - or a good science student - recognizes his problem. Now let's look at the way in which a scientist solves his problem. You already know that in solving a problem a scientist uses process skills such as perception, observation, data analysis, and so forth. But, in addition, he always follows a plan. There is a pattern to his work. You can follow the same procedure.

1. Clearly define your problem. Be sure that you know exactly what you are looking for. Always keep your objectives in mind.

2. Follow a work plan. Keep a calendar. Set a schedule for yourself and try to maintain it. Decide how much time your investigation will require.

3. Keep things as simple as possible. Do not try to make your work look impressive by making everything as complicated as you can. Find the simplest, shortest, and most efficient way of solving the problem.

4. Balance precision with economy. Do not take forever to measure something. Be accurate, but do not split too many hairs. Do not calculate every figure out to the sixth decimal place unless it is absolutely necessary to do so.

5. Keep working. Be a self-starter. Know what you are doing and do it yourself. Do not keep running to other people for advice and directions.

6. Do several experiments. Do not waste time. The more experiments that you can simultaneously, the greater your progress will be. While waiting for one experiment to complete its run, do something else.

7. Work carefully, Weeks of work can be ruined by one careless accident.

8. Finish what you start. If you have planned your problem carefully, you should be able to solve it. Be persistent.

9. Be reliable. Make sure that all your data and conclusions are correct and true. If there is any possibility for error, or if you have any doubts about your results, say so.

10. Cooperate. Share your findings and discoveries with others. If you have found a better method for making an observation or for measuring something, tell others. Be ready to make and to accept constructive suggestions.

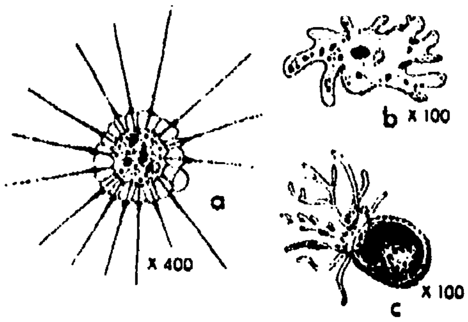
Appendix H

Guide to Some Common Freshwater Organisms

(Courtesy of Biological Sciences Curriculum Study, *BSCS Green Version, High School Biology*.)

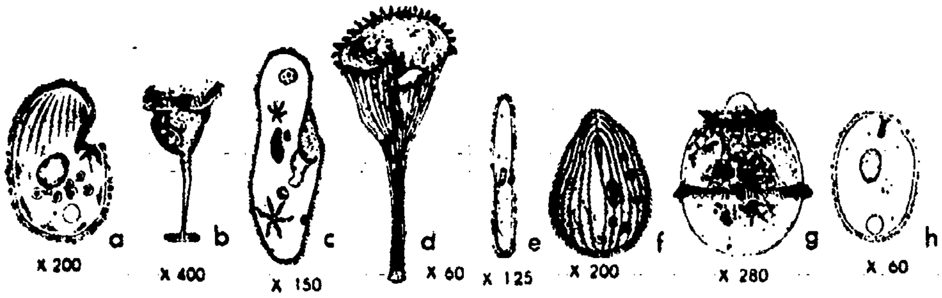
Microscopic Organisms

Amoeboids



AMOEBOIDS: Pseudopods present. (*a*) *Actinosphaerium* (spherical, with stiff, radiating projections); (*b*) *Amoeba* (pseudopods, no shell); (*c*) *Arcella* (shell present)

Ciliates

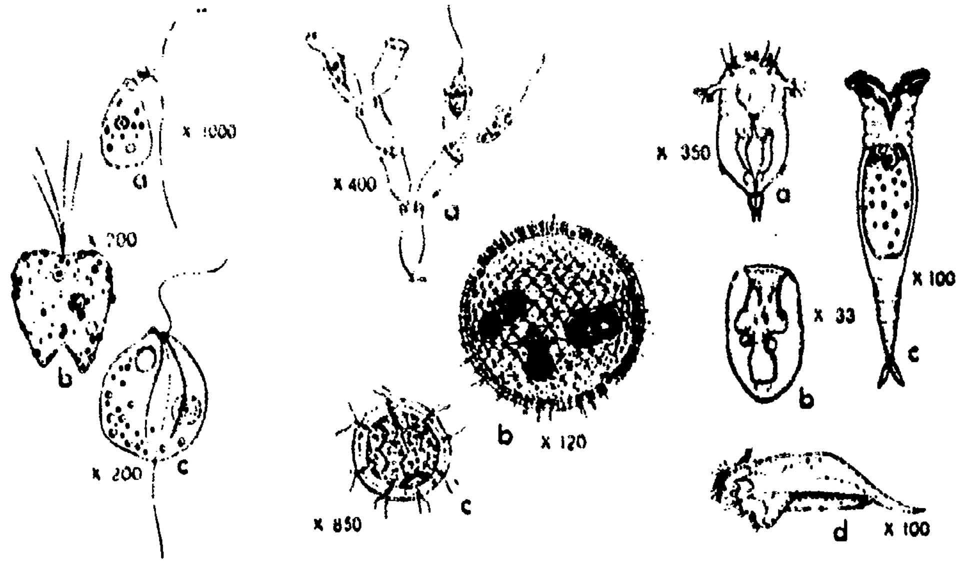


CILIATES: Cilia on all or part of body. No flagella. Some have chlorophyll. (*a*) *Colpoda;* (*b*) *Vorticella;* (*c*) *Paramecium;* (*d*) *Stentor;* (*e*) *Spirostomum;* (*f*) *Tetrahymena;* (*g*) *Didinium;* (*h*) *Prorodon*

Unicellular flagellates (*left*)

Colonial flagellates (*middle*)

Rotifers (*right*)



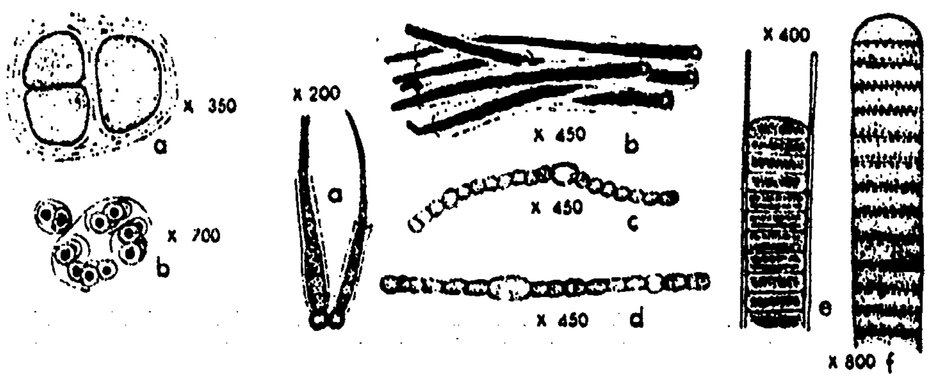
UNICELLULAR FLAGELLATES: One or more long, whiplike flagella. With or without cilia. Colorless. (*a*) *Spironomas;* (*b*) *Collodictyon;* (*c*) *Colponema*

COLONIAL FLAGELLATES: (*a*) *Codonodendron;* (*b*) *Volvox* (constantly rotating); (*c*) *Pandorina*

ROTIFERS: Bands of cilia near mouth. Colorless. (*a*) *Synchaeta;* (*b*) *Asplanchna;* (*c*) *Philodina;* (*d*) *Keratella*

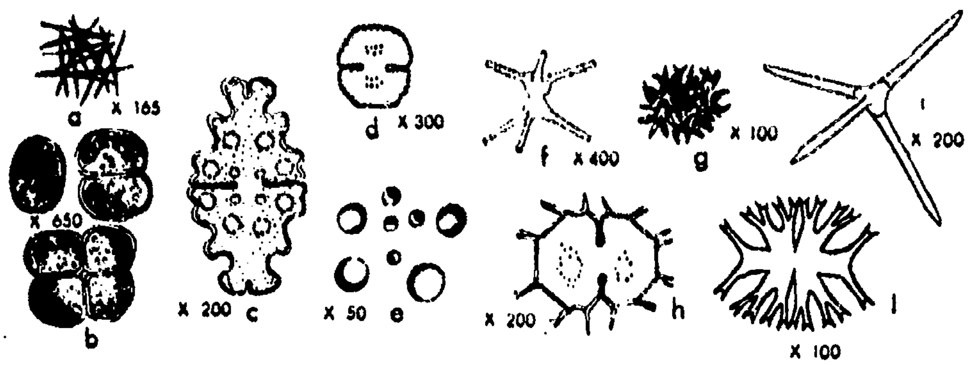
Simple blue-green algae (*left*)

Filamentous blue-green algae (*right*)



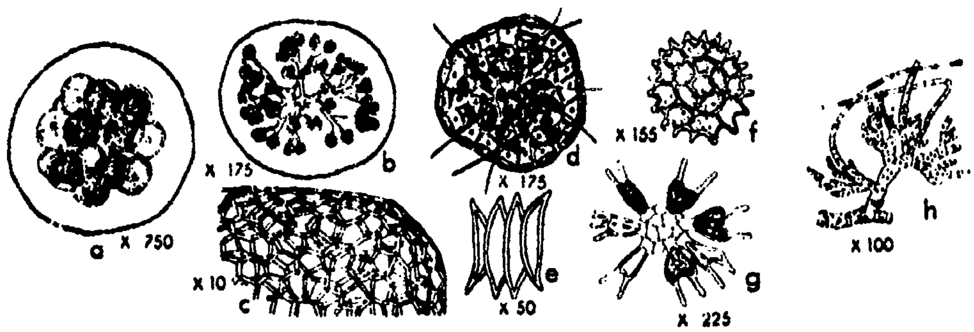
SIMPLE BLUE-GREEN ALGAE: Dark green or blue-green clusters in gelatinous sheaths. (*a*) *Chroococcus;* (*b*) *Gloeocapsa*

FILAMENTOUS BLUE-GREEN ALGAE: (*a*) *Gloeotrichia* (in gelatinous sheaths that often run together); (*b*) *Rivularia* (tapering filaments in sheaths); (*c*) *Nostoc* (firm sheaths); (*d*) *Anabaena* (cells of different sizes, in chains); (*e*) *Lyngbya* (thin sheaths); (*f*) *Oscillatoria* (no sheaths)



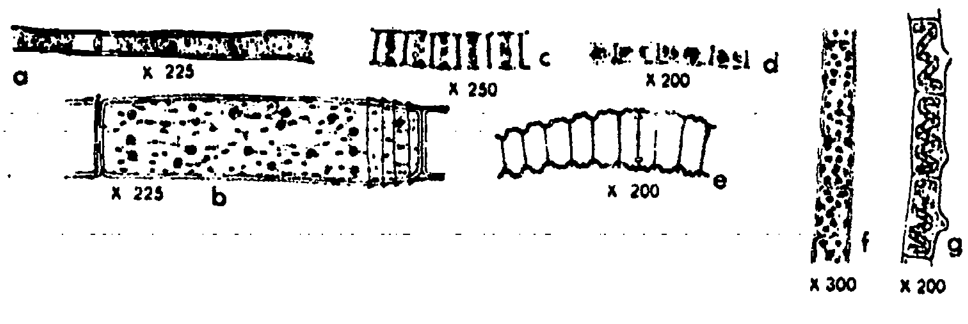
Single-celled green algae

SINGLE-CELLED GREEN ALGAE: (*a*) *Ankistrodesmus;* (*b*) *Protococcus;* (*c*) *Euastrum;* (*d*) *Cosmarium;* (*e*) *Chlorella;* (*f*) *Staurastrum;* (*g*) *Selenastrum;* (*h*) *Xanthidium;* (*i*) *Treubaria;* (*j*) *Micrasterias*



Colonial green algae

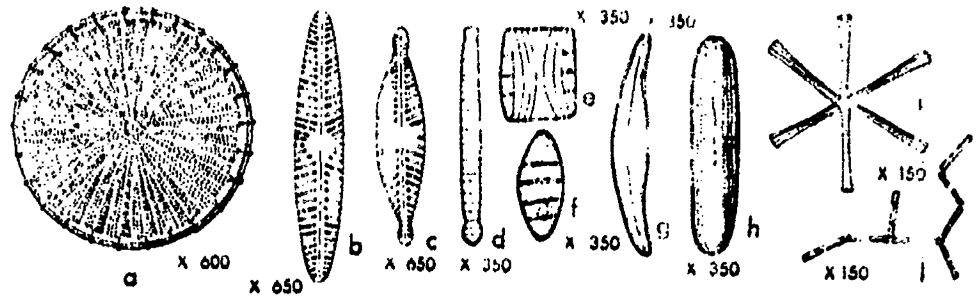
COLONIAL GREEN ALGAE: (*a*) *Sphaerocystis;* (*b*) *Dictyocphaerium;* (*c*) *Hydrodictyon;* (*d*) *Coleochaete;* (*e*) *Scenedesmus;* (*f*) *Pediastrum;* (*g*) *Sorastrum;* (*h*) *Chaetophora*



Filamentous green algae

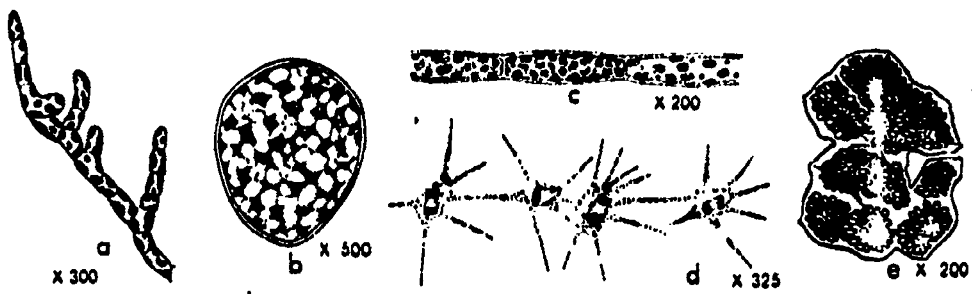
FILAMENTOUS GREEN ALGAE: (*a*) *Mougeotia;* (*b*) *Oedogonium;* (*c*) *Ulothrix;* (*d*) *Zygnemopsis;* (*e*) *Desmidium;* (*f*) *Microspora;* (*g*) *Spirogyra*

Golden algae (diatoms)



GOLDEN ALGAE (DIATOMS): Unicellular or loosely colonial algae. Walls of silica, consisting of two overlapping halves that fit together like the halves of a petri dish. (*a*) *Stephanodiscus;* (*b*) *Navicula gracilis;* (*c*) *Navicula rhynocephala;* (*d*) *Diatoma elongatum;* (*e*) *Diatoma hiemale* (girdle view); (*f*) *Diatoma hiemale* (valve view); (*g*) *Cymbella;* (*h*) *Pinnularia;* (*i*) *Asterionella;* (*j*) *Tabellaria*

Other golden algae



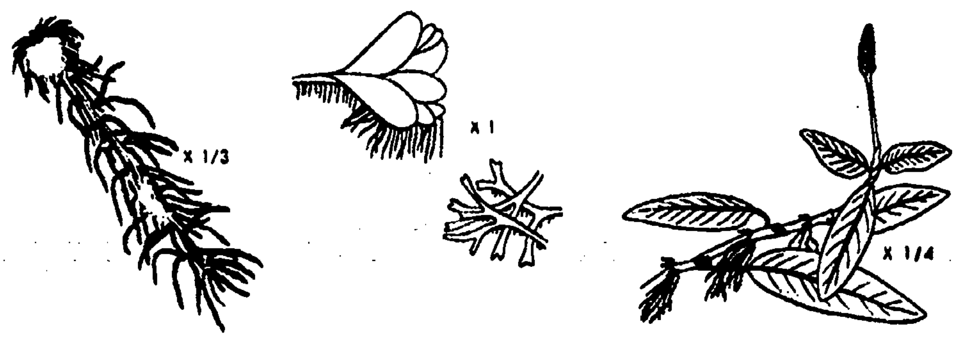
OTHER GOLDEN ALGAE: (*a*) *Monocilia* (branching filaments); (*b*) *Leuvenia* (ovoid or pear-shaped, solitary); (*c*) *Tribone* (cells cylindrical, joined end-to-end); (*d*) *Chrysidiastrum* (amoeboid cells joined in free-floating colonies); (*e*) *Botrycoccus* (compact, irregular, gelatinous, semiopaque masses)

Macroscopic Plants

Moss (*left*)

Liverworts (*middle*)

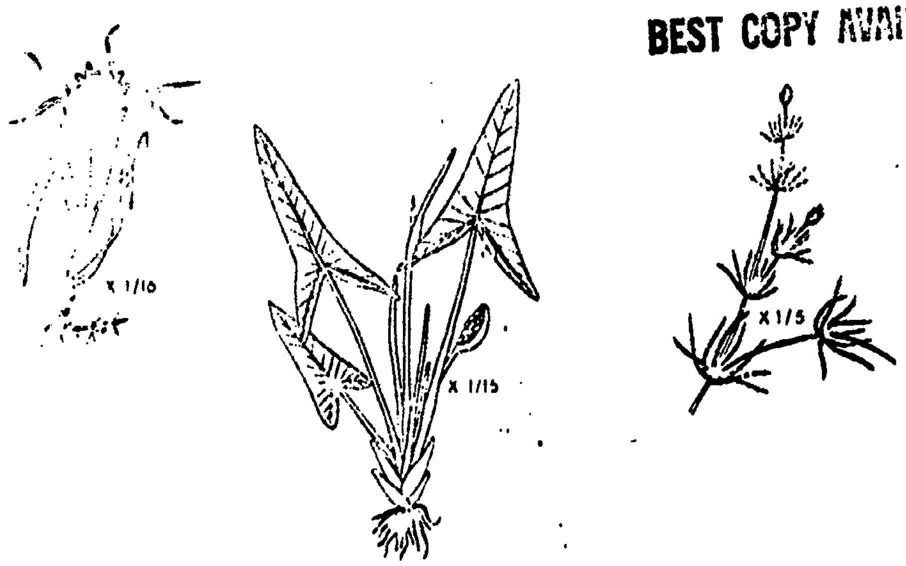
Smartweed (*right*)



MOSSES: Submerged or emergent. Erect, feathery stalks.

LIVERWORTS: Flat and ribbonlike. Rootlike structures on undersurface. Above: *Ricciocarpus;* below: *Riccia*

SMARTWEEDS: Emergent. Small flowers in dense clusters.

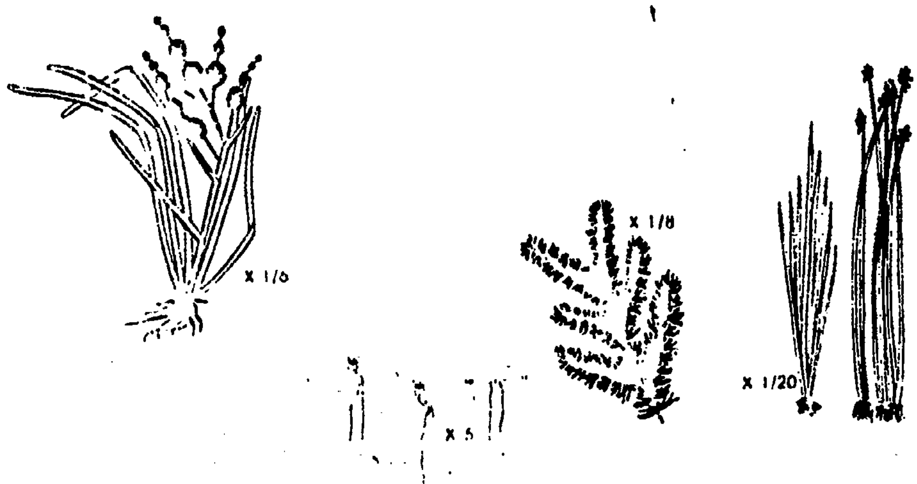


Sedge (*left*)
Arrowhead (*middle*)
Chara (*right*)

SEDGES: Emergent. Stems triangular in cross section.

ARROWHEAD: Emergent. Leaves shaped like broad spearheads.

CHARA: Submerged. An alga with whorled branches.



Bur reed (*left*)
Duckweed (*middle left*)
Coontail (*middle right*)
Rushes (*right*)

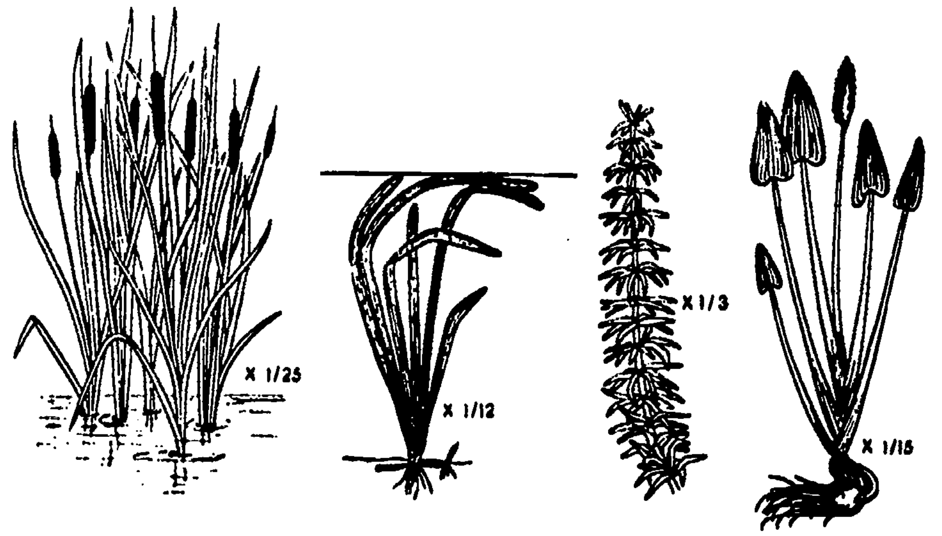
BUR REED: Emergent. Long, grasslike leaves may be submerged.

DUCKWEED: Floating. Roots hang in water. Frequently forms extensive mats.

COONTAIL: Submerged. Leaves stiff, hairlike, branched in whorls. No roots.

RUSHES: Emergent. Leaves grasslike. Clusters of small fruiting structures.

Cattails (*left*)
Tape grass (*middle left*)
Mare's tail (*middle right*)
Pickerelweed (*right*)



CATTAILS: Emergent. Tall, grasslike leaves. Long, brown fruiting structures.

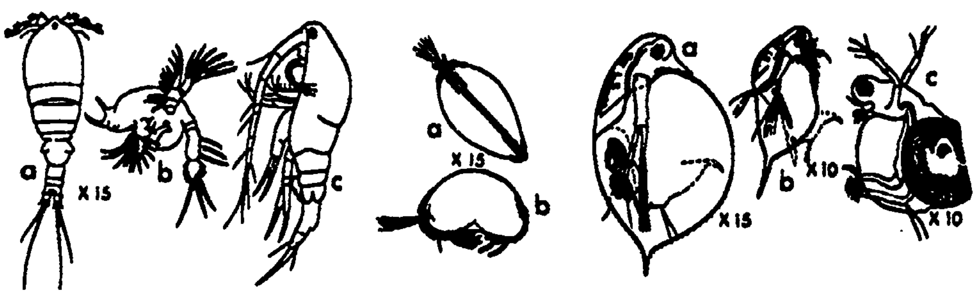
TAPE GRASS: Submerged. Leaves ribbonlike. Plant rooted to bottom. Flowers break off and float to surface.

MARE'S TAILS: Submerged. Leaves small, simple, in whorls.

PICKERELWEED: Emergent. Leaves heart-shaped. Flowers (purple) tightly clustered on slender spike.

Arthropods

Copepods (*left*)
Ostracods (*middle*)
Cladocerans (*right*)



COPEPODS: Small crustaceans with several hairlike spines at tip of abdomen. Body elongated. (*a*) *Halicyclops;* (*b*) *Diaptomus* (a larval stage); (*c*) *Diaptomus* (adult)

OSTRACODS: Small crustaceans with no spines. Body covered by a jointed carapace, somewhat resembling small clamshells.

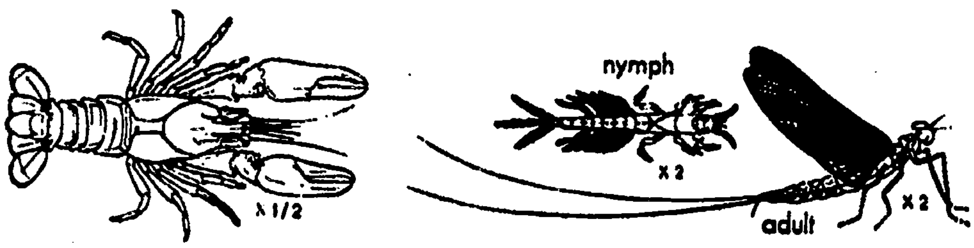
CLADOCERANS: Small crustaceans with no spines at tip of abdomen, or a single spine only. Body short. (*a*) *Daphnia* (female); (*b*) *Daphnia* (male); (*c*) *Ceriodaphnia*

Opossum shrimp (*left*)
Water mite (*middle*)
Scud (*right*)

OPOSSUM SHRIMPS: Carapace covers most of thorax. All limbs of thorax similar. Eyes stalked. No gills in most species.

WATER MITES: Body not jointed. Eight jointed legs.

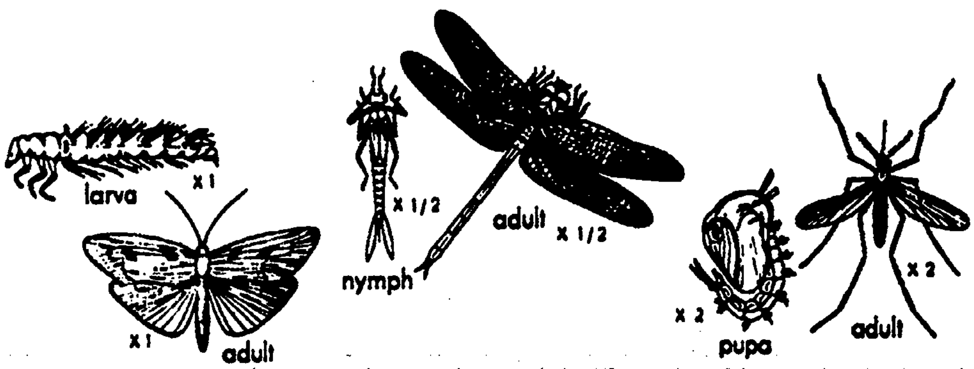
SCUDS: No carapace. Limbs of thorax different from each other. Eyes not stalked. Body compressed laterally. Gills present.



Crayfish (*left*)
Mayfly (*right*)

CRAYFISH: Carapace not jointed. Pincers on anterior legs.

MAYFLIES: Adults usually have clear, narrow wings. Wings usually held vertically when at rest. Larvae aquatic. Adults and larvae with three "hairs" at end of abdomen.



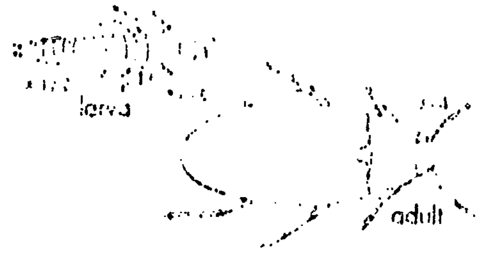
Caddis fly (*left*)
Dragonfly (*middle*)
Mosquito (*right*)

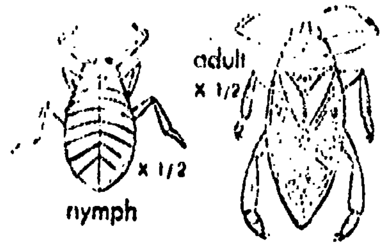
CADDIS FLIES: Adults have clear, broad wings. Larvae aquatic, wingless, and usually live within cases composed of pebbles or debris.

DRAGONFLIES: Adults large, usually clear-winged. Wings extend horizontally when at rest. Large eyes. Larvae aquatic. End of abdomen without "hairs."

MOSQUITOES: Adult has only one pair of wings. Larvae small, without legs, float at surface of water, and breathe air through tubes.

Water scavenger (*left*)





Giant water bug (*right*)

BEETLES: Adult has a pair of hard wing covers, not overlapping. Larvae wingless. Example: water scavenger.

BUGS: Adult has a pair of overlapping wings. No hard wing covers. Larvae wingless. Example: giant water bug.

EAST SYRACUSE-MINOA SCHOOLS

Environmental Education Materials

Grade 7 Science

Unit V Human Ecology

Produced Under USOE Grant OEG-0-71-4621
by East Syracuse-Minoa Central Schools
407 Fremont Road
East Syracuse, N.Y. 13057
Dr. Fritz Hess, Superintendent

TOPIC OUTLINE

V. Unit V Human Ecology

A. Types of Pollution

1. Air
2. Water
   a) conservation
3. Land
   a) conservation
4. Noise
5. Population

B. Pollution Prevention

1. Individual solutions
2. Public and governmental solution

Long Range Behavioral Objectives

Unit V: A - F

By investigating the natural state of the physical environment the student will determine the destructive influences (pollution, etc.) imposed by man and their effects on the web of life.

G. The student through research and discussion should be able to suggest practical solutions, based on ecological principles, to environment imbalances and take positive action on at least one of these.

Student should develop an attitude of responsibility to future generations and develop adult life styles consistant with basic laws of nature.

Activity Number

1. Discussion - D
2. Problem 19.1 M & E optional
3. Mastery Item 19.1 M&E
4. Mastery Item 19.2 M&E
5. Questionnaire
6. Investigation - D
7. What is clean air?
8. Air Cartoons - D
9. Problems 23.1 - 23.5 (teacher note)
10. Mastery Item 23.1 op.
11. Mastery Item 23.2
12. Mastery Item 23.3 op.
13. Mastery Item 23.4
14. Mastery Item 23.5
15. Checkpoint 23.2 (note about other two)
16. Air Pollution - teacher note
17. Investigation - Do cars and truck contribute to air pollution.
18. Is a thermal Inversion a part of air pollution?
19. Investigation - Pesticides - D
20. Clean Water
21. Get to know a pond
22. How Important is Water - D
23. How Much Water do you Use in One Day?
24. Reading - The Only Earth We Have p. 28-42
25. Problem 20.1 M&E op.
26. Problem 20.2 M&R - teacher note - op.
27. Mastery Item 20.1 M& E
28. Mastery Item 20.2 M&E
29. Mastery Item 20.3 M&E
30. Checkpoint 20.1 M&E
31. Water - Distillation of Salt Water
32. How do detergents contribute to water pollution?
33. Sewage Treatment Plants - D

34. Investigation - D
35. Speaker or Field Trip - op.
36. Design the three types of plants - op.
37. Follow the path of local sewage - D
38. Investigation 21 M&E - D
39. Freshwater Pollution - filmstrip
40. Cartoons on Water
41. Garbage Disposal - D
42. Garbage - Solid Waste
43. Investigation - How much garbage is collected in your neighborhood each week? - D
44. Investigation - What does biodegradable mean? - D
45. Investigation - What materials are biodegradable? - D
46. Investigation - Does tissue paper pollute? - D
47. Noise Pollution vs. Sound
48. Sounds of Silence
49. Sounds
50. Noise and your heartbeat
51. Effects of noise
52. Desgin a school
53. Problem 22.1 M&E
54. Mastery Item 22.1 M&E
55. Checkpoint 22.1 - op.
56. The New Me
57. Move over, don't pinch
58. Population study
59. Population
60. Population/Environment
61. Meaning of Recycling
62. Recycling
63. Can paper be recycled?
64. Home-made soap!
65. Composting
66. Problem Situations
67. Tom Lehrer - opt.

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
A. The student will be involved in a discussion to discover what things are needed forthem to survive.	To achieve A: Act. #1. ditto attached, includes teacher information p. V-16	
B. The student learns that many of the substances he and his family add to the environment are harmful to living things by showing an awareness that his everyday life contributes to pollution.	To achieve B: Act. #2 Problem 19.1 M&E optional p. 255 Act. #3 Mastery Item 19.1 M&E p. 262 Act. #4 Mastery Item 19.2 M&E p. 262	
C. The students will complete a questionnaire on environmental behavior and engage in discussion of the results.	To achieve C: Act. #5 Ditto attached p. V-17	
D. The teacher will develop an activity that will introduce the problem of pollution to the students.	To achieve D: Act. #6 Teacher information: from this information develop an activity to introduce the problem of pollution. p. V-20	
E. The student will be informed of the composition of clean air by lecture and discussion.	To achieve E: Act. #7 See attached ditto p. V-22	
F. Given a group of cartoons the student will identify the environmental problem depicted and write a paragraph describing the cartoon and its meaning.	To achieve F & G: Act. #8 ditto attached p. V-23 1. a dittoed sheet of the cartoons should be given to the students and they should write an explanation of each cartoon.	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
G. The students, as a class, will make a collection of ecological cartoons and include some original ones to shouw that they understand the concept.	2. The students should make a collection of ecological cartoons from the local newspaper or magazine and these should be displayed. 3. Some students could make original cartoons and these could be displayed.	
H. The student leans how to gather evidence of local air pollution by describing the procedures necessary for a local air pollution study.	To achieve H - I: Act. #9 Problem 23.1 - 23.5 M&E Teacher note: All of these problems don't have to be done. The ones that you use should be ones that get the point across best with your students. Do at least 2 or 3 problems.	
I. The student leans that the smount of pollution one inhales depends on both the quality of the air andhow much of it one breathes by randing a group of people according to how much air pollution each inhaled.	Act. #10 Mastery Item 23.1 M&E p. 373 Act. #11 Mastery Item 23.2 M&E p. 373' Act. #12 Mastery Item 23.3 M&E p. 376 optional Act. #13 Mastery Item 23.4 M&E p. 376 Act. #14 Mastery Item 23.5 M&E p. 379	
J. The student leans the harmful effects of polluted air on people can be inferred from statistical data by analyzing public health data and inferring from it that smoking is one cause of lung cancer.		

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
K. The student leans that air pollution can damage and destroy plants by designing an experiment to test the effects of automobile exhausts on growing corn.		
L. The student leans to show a concern for the quality of air that people breathe by trying to discourage people he knowns from smoking cigarettes and basing his case on his experiences in this investigation.		Activity #15: Checkpoints 23.2 p. 62 Teacher note: Checkpoints 23.1 and 23.3 are optional
M. After participating in a teacher lead or group discussion the student will make a list of sources of air pollution and keep it in his notebook for future reference.	To achieve M: Act. #16 - #19 See attached ditto p. V-24 The student should come to some kind of conclusion of what might be done to solve the problems of air pollution.	
N. Student will, through research and discussion, derive a definition of clear water and learn the difference between that and pure (distilled) water.	To achieve N: Act. #20 Clean Water The student should do some research in books and find out what clean water is. Then the class, as a whole, should come up with a definition of such. p. V-40	
O. Given three activities the students will learn more about water.	To achieve O: Act. #21 - #23 Dittoes attached	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
P. Students will read a selection on environmental contamination, list the most important points made by the author and organize them into a concise summarizing paragraph.	To achieve P: Act. #24 Reading Assignment in The Only Earth We Have pp. 28-42 This should be given as a class assignment.	
Q. The student leans to deal thoughtfully with masses of data (and not be overwhelmed by data) by finding a pattern in data obtained from a real lake and supporting his conclusions.	To achieve Q-S: Act. #25 Problem 20.1 (optional) p. 265 M&E Act. #26 Problem 20.2 (optional) p. 281 M&E Teacher note: These activities are very difficult. They could be used with an advanced class or upper level students. The information is good but should be changed somewhat to be presented to the student.	
R. The student leans that several measureable factors are useful indicators of water pollution by using some of these factors to evaluate the pollution levels of two of the Great Lakes.	Act. #27 Mastery Item 20.1 M&E p. 281 Act. #28 Mastery Item 20.2 M&E p. 282 Act. #29 Mastery Item 20.3 M&E p. 284	
S. The student learns a working definition of eutrophication or overfertilization by asking relevant questions to determine if a body of water is polluted.		Act. #30 Checkpoint 20.1 M&E p. 53
T. The student learns that compounds which promote algae growth are a major cause of water pollution by recognizing the importance of these compounds when he evaluates proposals for improving the water quality of a lake.	To achieve T: Act. #31 - #32 Dittoes attached	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
U. The student should be able to list the function of primary, secondary, and tertiary treatment processes in the production of clear water.	To achieve U: Act. #33 The teacher should lead the class in a discussion of the three types of treatment plants. Teacher information is attached to the curriculum. Also refer to "A Primer on Waste Water Treatment." p, V-41	
V. The student will be involved in a field trip or listening to a speaker to better understand the treatment of sewage in the local area.	To achieve V: Act. #34 - #35 See attached teacher note p. V-42	
W. The student should be involved in making a model of one of the three types of sewage plants to better understand how they function.	To achieve W: Act. #36 (optional) Models of the three types of sewage plants should be made by different groups of students. Not all of the students should be involved. Only those who are interested in making the models. Then, those students could display and explain the models to the rest of the students. The designs for the models should be found by the students, so a little research would be involved.	
X. The students should trace the path of sewage from his own home to its final stopping point to insure his understanding of how the sewage is treated in our own local area.	To achieve X: Act. #37 (Optional) This activity could be done instead of Act. #27. It also could be done by the students who do not do Act. #27. If you so desire you may have all the student do the activity.	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
Y. The students will observe picture, answer questions about those pictures and come to some conclusions about progress and its affects on pollution.	To achieve Y: Act. #38 Use book M&E Investigation 2p and the attached ditto p. V-43	
Z. The students should observe the filmstrip and come up with some general ideas about water and the pollution of water.	To achieve Z: Act. #39 Filmstrip: Freshwater Pollution The filmstrip should be shown in class and discussed with the students. They should write down generalizations and keep them in their notebooks.	
AA. Given a set of five cartoons the student will write a four sentence paragraph explaining the meaning of three of the cartoons.	To achieve AA: Act. #40 Cartoons on Water To the teacher: The students should be given the series of cartoons on water pollution. Each student should write a four sentence paragraph explaining what three of the five cartoons mean. At this time it might be fun to ask the students to draw some of their own cartoons. p. V-45	
BB. The student will participate in one of two activities designed to show him some of the problems of solid waste disposal.	To achieve BB. Act. #41 Solid Waste Disposal p. V-46	
CC. The student will take part in a classroom collection of paper as solid waste and use the information from the project to participate in a discussion about solid waste as a problem.	To achieve CC: Act. #42 & #43 Garbage-Solid Wastes p. V-47	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
DD. Given three investigations the students will discover which ones are biodegradable.	Activity #44-46	
EE. The student will do an activity and engage in a discussion on the difference between sound the noise.	To achieve EE: Act. #47 Noise Pollution vs. Sound p. V-50	
FF. The student will go outside the classroom at different times during the class and record how long a time interval can be observed when no man-made sounds are heard. The student will also make these observations at home.	To achieve FF: Act. #48 Sounds of Silence p. V-51	
GG. The student will listen to various tape recorded sounds from the community and use his judgement to identify them and determine if they are pleasing, harmful and/or noise polluting.	To achieve GG: Act. #49 Sounds p. V-52 Teacher note: Start activity #49	
HH. The student will do an experiment with plants to find out what effect noise has on the growth of these plants.	To achieve HH: Act. #50&51 Effects of Noise p. V-53	
II. Students will design own school.	To achieve II: Act. #52	
JJ. The student learns that man's applications of some pesticides can poison parts of his environment. He has learned this when asked if he would like various pesticides used in his home and community, he wants to know their character before answering the question.	To achieve JJ: Act. #53 Problem 22.1 p, 328 M&E Teacher Note: Each report on pesticides is excellent but the reading is difficult. Teacher should work closely with the class and cover each report as a separate item, perhaps there could be some sort of break between each.	

OBJECTIVES	STRATEGIES/ACTIVITIES	EVALUATION
KK. The student leans it is more sensible to tolerate some damage from pests than to continue large-scale poisoning of our environment by choosing to bear the presence of insects and to eat damaged foods rather than indiscriminately spray poisons around.	To achieve KK: Act. #54 Mastery Item 22.1 p, 350 M&E Teacher note: This survey could be used as a survey in each student's neighborhood.	Act. #55 Checkpoints 22.1 M&E p. 27
LL. The student should try to live for a time without contaminating the environment and if necessary change his life style so it will be more compatible with the balance of nature.	To achieve LL: Act. #56 The New Me p. V-54	There is no way a teacher can adequately observe changed life styles in a short time but he might observe a new awareness on the part of his students.
MM. Students will be crowded into a small space, experience stress and discuss the behavior of crowded organisms.	To achieve MM: Act. #57 Move over - Don't Pinch p. V-55	
NN. Students will observe growth of both crowded and uncrowded plants and conclude that less crowded plants grow better. Students will observe swelling of beans and conclude that crowding occurs not only when the number if individuals increase within a limited space but also when the size increases within a limited space.	To achieve NN: Act. #58 How does crowding affect beans? p. V-56 Teacher note: This activity should be started at Act. #41 or #42.	

OBJE IVES	STRATEGIE. ,CTIVITIES	EVALUATION
OO. Students will read an article about population problems, participate in a teacher led discussion and hypothesize that most environmental exploitation is a result of an increasing human population.	To achieve OO: Act. #59 Population p. V-59 Readings only worthwhile for top readers. This should be teacher-read and explained (not evaluated) to all but top readers.	
PP. The students will participate in a series of activities designed to show him the effect of population increases on the environment.	To achieve PP: Act. #60 Population/Environmental p. V-63	
QQ. Students will participate in a teacher led discussion, become aware of solid wastes recyclement examples and conclude that man should follow nature's example and recycle his wastes.	To achieve QQ: Act. #61 Recycling p. V-64 Act. #62 Recycling p. V-65 Act. #63 Act. #64 Act. #65	
RR. After discussing a problem situation and answering questions the student will learn to make decisions concerning maintainence of environmental quality.	To achieve RR: Act. #66 Problem Situations p. V-65 Act. #67 Problem Situations p. V-67	

UNIT V - HUMAN ECOLOGY

Act. #1

Begin this unit with an open ended discussion of the necessities of life. The students will come up with many examples which may not be necessary for them to live. The things they should finally come up with are ideas such as: water, air, food, shelter. These are the basic necessities. The other ideas should be taken into account also. Separate class lists should be made of the basic necessities and the other things they believe to be necessary. These lists should be kept for discussion purposes later.

Teacher note: This questionnaire can be used as it is for some students that should be modified for some other students.

Act. #5

Taken from: An Environmental Experience
Barry W. Jamason, Chairman
Environmental Task Force

ENVIRONMENTAL BEHAVIOR PROFILE

Directions: Check the items in both column A and column that apply to you. Total the number of checks in each column. A greater number of checks in column A suggest generally positive environmental behavior; a greater number of checks in column B suggests that improved environmental behavior is desirable.

COLUMN A	COLUMN B
( ) No auto	( ) One auto
( ) One 6-cylinder auto	( ) One 8-cylinder or more than one 6-cylinder auto
( ) No other personal motor vehicle (motor bike, go cart, etc.)	( ) A personal motor vehicle
( ) Hand lawnmower	( ) Power lawnmower
( ) Hoe and shovel	( ) Rototiller or garden tractor
( ) Toboggan or sled	( ) Snowmobile
( ) Shovel	( ) Snowblower
( ) Refuse collected	( ) Refuse burned
( ) ____________	
( ) ____________	
( ) Canoe, rowboat, or inner tube	( ) Outboard motor boat
( ) Sewage treatment system	( ) Septic tank
( ) Nonphosphate lawn and garden fertilizers	( ) Phosphate fertilizers
( ) Nonphosphate detergents	( ) Phosphate detergents
( ) ____________	
( ) ____________	
( ) Returnable containers	( ) Nonreturnable containers
( ) ____________	
( ) ____________	

COLUMN A	COLUMN B
( ) Naturally produced sounds (music)	( ) Electric amplifiers to produce sounds
( ) Properly operating muffler	( ) Defective muffler
( ) Hand operated equipment	( ) Loud power equipment
( ) Moderate speaking voice	( ) Loud speaking voice
( ) ____________________	
( ) ____________________	

List in Column A and check each positive environmental act you perform if you wish to offset the checks in Column B.

( ) ____________________	( ) Air conditioner
( ) ____________________	( ) Electric toothbrush
( ) ____________________	( ) Electric razor
( ) ____________________	( ) Electric carving knives
( ) ____________________	( ) Electric can opener
( ) ____________________	( ) Electric cooking equipment other than basic oven
( ) ____________________	( ) Second TV
( ) ____________________	( ) Electric power mower
( ) ____________________	( ) Electric blanket

I take pride in my home community by	I show a lack of pride in my home and community by
( ) keeping my home neat	( ) not keeping my home neat
( ) respecting grass where planted	( ) not respecting grass where planted
( ) keeping sidewalk and curb-stones neat and clear of refuse	( ) not keeping sidewalk and curb-stones neat and clear of refuse
( ) assisting others who may need help in keeping their home neat	( ) not assisiting others who may need help in keeping their home neat.
( ) respecting the property of others	( ) not respecting the property of others
Total checks _______	Total checks _______

Teacher note: Modify this activity for some of your students. This activitiy could be going on while the other activities are done in class.

Activity #6 - For student

Investigiation: Some Forms of Pollution

Anything added to the environment which causes harm to living things may be called a form of pollution. Some forms of pollution:

1. chemical
2. thermal (heat)
3. noise
4. solid - waste (trash and garbage)

One or more of these forms of pollution may affect parts of the environment, such as: air, water, or soil, in your area.

Procedures:

A. Each of the teams into which your class has been divided should study pollution in one part of the environment. For example, one team might select air pollution.

B. Prepare a list of the different kinds of pollution in your area. For example, the team that selected air pollution might decided that chemical pollution,1 noise pollution, and solid-waste pollution all contribute to air pollution. Their list should include the specific kinds of substances causing air pollution. Chemical pollution may include pollution by lead, sulfur dioxide, carbon monoxide, and smoke. The smoke may also contain solid wastes in the form of small particles. Noise pollution may be caused by noise from jet aircraft at or near an airport, from a construction project, from heavy trucks, from chain sawa or lawn mowers, and even from loud music.

C. Try to determine where the pollution is coming from. The lead, sulfur dioxide, and carbon monoxide may be coming from the engines of cars, buses, trucks, or heating units. The smoke may be coming from a factory or from burning rubbish.

D. Study the local newspapers, and discuss what has been done about pollution in your community. Find out about local or state laws pertaining to local pollution problems which have been enacted in the past three years. Look also for any evidence of changes in the status of the local problems. Are the conditions that cuased the problems improving, remaining the same, or getting worse?

Activity #7

WHAT IS CLEAN AIR?

Teacher notes: The following information on the composition of clean air should be presented to the student in the way that is most beneficial for them. Below is only a brief summary of what can be presented. You may add any information that seems missing.

Give to student:

Clean air is a mixture of colorless, odorless gases. The mixture contains 21% oxygen, 78% nitrogen and 4% of other natural gases. There are also small amounts of particles such as: pollen, spores, dust and bacteria. Pure air is only found in a laboratory! Air that is found in nature has the small particles in it also. Some of these small particles are put into the air by nature (such as pollen) and others are put into the air by man-made things such as factories, automobiles, etc.

This information could be presented to the students. Then in small groups or a class discussion a larger list of more specific things in the air could be made up by the students.

Activity #8 Teacher note in the objectives p. V-5

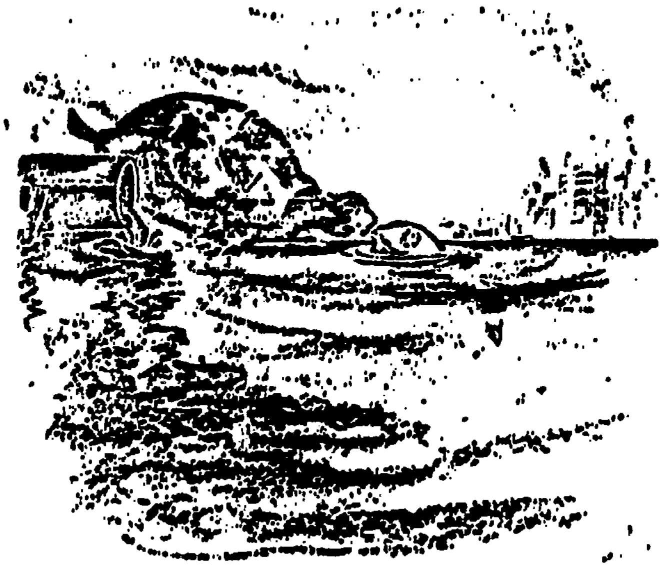


Fig. 1-40. *'If you think the water is bad, you should try the air!'* Reprinted by permission from The Christian Science Monitor. © 1966 The Christian Science Publishing Society. All Rights Reserved

Fig. 1-45. © 1968 Reproduced by courtesy of Wil-Jo Associates, Inc. and Bill Mauldin

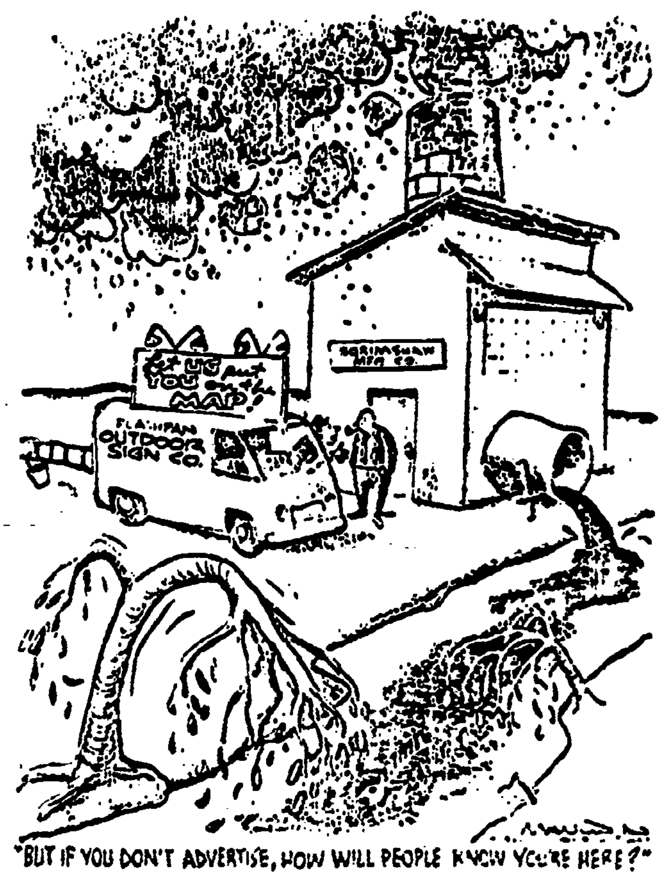


Fig. 1-46. © 1966 Reproduced by courtesy of Wil-Jo Associates, Inc. and Bill Mauldin

Activity #9-15

These activities are from the text M&E, Investigation 23. The problem that seem to work most effectively with most of the students are problems 23-2 and 23-3. Problems 23-4 is a good one to use also. Any of the problems can be used. These are just the ones that seem to work the best.

The Mastery Items and checkpoints can be used in the way you feel would be best for your students. Many times the diagrams and pictures are a good way to bring the point home to those who have difficulty reading.

Activity #16

Teacher notes: A teacher led discussion should follow these activities. It should bring out the scope of the air pollution problem and relate it to over-population if possible. As many different examples of air contamination as possible should be discussed and listed. These should be in the county of Onondaga.

The teacher should refer to the ditto copies of "How to Live with Air Pollution" and "The Modern Miasmas." The teacher and students should also find out facts about air pollution in the immediate area.

The chart on the next page could be presented to the students and explained. The teacher should read the two above mentioned articles and share this information with the students but not expect them to read it. The students could make a similar chart that is relative to their own immediate environment.

Fig. 7-6

AIR POLLUTION

	Type of Pollution	Source	Community or State Action	Status of Problem
CHEMICAL	Lead	Cars, trucks, and buses	State law requiring anti-smog devices.	No change or uncertain
CHEMICAL	Sulfur dioxide	Cars, trucks, and buses	State law requiring anti-smog devices.	No change or Uncertain
CHEMICAL	Carbon monoxide	Cars, trucks, and buses	State law requiring anti-smog devices	No change or uncertain
CHEMICAL AND SOLID WASTES	Smoke	Factories, rubbish burning	Laws regulating burning	Improving
NOISE		Jets, local airports	None	Worse
NOISE		Downtown construction projects	None	No change until projects are completed
NOISE		Chain saws, Lawn mowers	None	Worse
NOISE		Loud music	None	Worse

E. Compile all your information in a table similar to the example in Figure 7-6.

F. The teams studying water pollution or soil pollution should prepare similar charts.

G. Later in the unit oral reports will be given.

Interpretation:

Compare team reports. Which pollution problem seems to be most serious in your area? In what respects has there been improvement? Which problems seem to be most neglected?

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HOW TO LIVE WITH AIR POLLUTION

by Elliott McCleary

Spewing from smokestacks and highways, from jetports and rail yards, a cloud of harmful haze engulfs us. Here are ways you can personally cope with its dangers.

Coughing and gasping, a Chicago couple awake at dawn to slam down the windows of their bedroom and shut out a plume of black smoke wafted downwind from a hospital chimney a block away. They call the police. Minutes later, the smoke has stopped, but still the couple struggle for a breath of clean fresh air.

In an underground garage in Boston, some 1,500 after-concert patrons start their cars almost simultaneously. Fumes fill the air. Dozens collapse at their wheels. A quick-thinking attendant averts disaster by waving cars out of the garage without collecting their parking charges.

In New York, a cabdriver gets frequent headaches while driving his cab when exhaust fumes from heavy daytime traffic make the air "unfavorable." "So," he says, "I've sooner risk getting shot or stabbed after dark than be poisoned by pollution during the daytime."

Most days of the year, most Americans-certainly the 150 million urban residents-have to live with air pollution, have to breathe polluted air into their lungs. Until something is done about it, air pollution will continue to endanger the well-being of the healthy, aggravate the condition of those already suffering from a wide variety of respiratory and other ailments, and actually imperil the lives of thousands of others, particularly the elderly and infants.

A Maryland study, for instance, reveals more colds among people living in heavily polluted areas, as does a nationwide review of absenteeism among industrial workers. Doctors have linked air pollution with sharp increases in eczema, allergic reactions, and sinusitis. Emphysema (which has doubled every five years since World War II), bronchitis, and other respiratory ailments flourish in areas of high pollution. So do many forms of cancer, heart disease, and hardening of the arteries.

"When I drive to work in the morning and can't see the top of the John Hancock building through the haze," says the admitting director of a large Chicago hospital, "our respiratory unit is already busy with half a dozen new asthma patients who have suffered attacks during the night." Dr. Russell P. Sherwin, a Los Angeles pathologist who has examined thousands of lungs, says that he has yet to find lungs in a person over 12 that have not, in some way, been damaged.

We shouldn't be too surprised by all this. What goes up must come down, and each year in America we waft into the air we breathe a sickening one ton of pollutants per person - about 215 million tons in all. Some 90 million tons come from vehicles, mostly our autos, and 46 million tons from smokestacks, chiefly those of electric power plants. Industrial processes release another 30 million tons, solid-waste disposal 11 million tons, and miscellaneous sources (including forest fires) 37 million tons.

Five major villains lurk in dirty air, to harm our health:

-Carbon monoxide - (CO), produced by the incomplete burning of carbon, chiefly in gasoline engines. By displacing oxygen in red blood corpuscles, it reduces the supply of oxygen delivered to body tissues. This is especially hard on cigarette smokers, who already inhale at least as much CO from their tobacco smoke, and puts an extra burden on those who suffer from diseases of the heart, lungs, and blood vessels, or from anemia or even simple fever.

Studies in California have shown that highway accidents increase when drivers'reaction time is slowed by high carbon monoxide levels; their brains don't get enough oxygen to function well. A level common in city air, 10 parts of CO per million parts of air, dulls mental performance after constant exposure for eight hours. At a high concentration, as in a garage with a car motor running, carbon monoxide kills.

-Particulates, solid particles, some visible as soot and smoke and some microscopic and invisible. These come mainly from fuel combustion in power plants and heating units, but also from incinerators and industrial processes. Particulates can multiply the dangerous effects of other pollutants, for poisonous gases, acids, and cancer-causing chemicals clinging to particulates can penetrate to the innermost recesses of the lungs.

The death rate increases when annual average particulate levels pass 80 or 100 micrograms per cubic meter - a level common even in smaller industrial cities.

-Foul-smelling sulfur oxides, in company with particulates, form a deadly brew over many northern cities. Sulfur dioxide (SO_2) and sulfur trioxide(SO_3) are produced by the burning of sulfur containing coal and oil in electric power plants, industrial plants, and space heating furnaces. Sulfur dioxide causes stress by constricting the airways and thus making breathing more difficult. Also, it irritates mucous membranes of the nose and throat, contributes to heart and lung diseases, and can also cause headache and vomiting. Sulfur trioxide combines with water to form sulfuric acid that is carried deep into the lungs on specks of soot. A companion of the oxides, hydrogen sulfice (H_2S) burns the eyes and throat and smells like rotten eggs.

-Nitrogen oxides, produced by high temperature combustion, as in electric utility plants and auto engines. They inhibit the cilia, tiny hairlike projections that propel a purifying flow of mucus out of the respiratory system. Without their action, pollutants, germs, and viruses remain to damage the lungs and breathing passages. A recent Chattanooga, Tennessee, study indicates that even low levels of nitrogen oxides, render schoolchildren more susceptible to Asian flu.

-Photochemical oxidants, the result of auto fumes acted upon by sunlight, create the notorious Los Angeles-type smog that makes eyes smart, irritates lungs, and obscures vision with a thick reddish haze. Outside of California, the condition occurs above auto-jammed northern cities on sunny summer days-in concentrations sometimes strong enough to irritate the eyes. Under the influence of sunshine, nitrogen oxides and gaseous hydrocarbons (HC) combine to form a smelly new soup of chemicals including peroxacyl nitrates and - believed to be the most dangerous - ozone, a highly toxic form of oxygen.

When the oxidant level reaches .06 parts of oxidant per million parts of air, asthma attacks increase. Eye irritation begins at 10 parts per hundred million. At higher levels, oxidants (chiefly ozone) cause coughing, choking, and extreme fatigue, restrict airways, and make breathing more difficult, sometimes enough to make one's chest sore.

Except in a few places, such as Los Angeles, monitoring of the air and air pollution health warnings to the public are inadequate or missing. Even in Chicago, where you can telephone to hear tape-recorded hour-by-hour reports on air pollution, no health advice is given to the public. Codes and terms for describing air pollution vary from city tc city and even within the same city, depending upon what TV station or newspaper you're watching. Usually, only a citywide average is given; but even if pollution levels are "satisfactory," you may be downwind from a power station or in a valley where pollution greatly exceeds the citywide average.

It's not difficult to tell when air pollution has reached a level harmful to your health. One simple, infallible test: if you can smell or taste air pollution, it's already at a potentially dangerous level for most people.

Frequently, local weather forecasts will contain pollution predictions. Forecasters know that certain weather conditions such as a "lul" of warmer air above stagnant surface air, promote smog buildup.

On those days when air pollution becomes intense, everyone should consider the following precautions:

-If you smoke cigarettes, smoke less or not at all. The average cigarette smoker pollutes his air at least as much again as it is polluted from other sources (pipes and cigars are harmful to a lesser degree). Nearly as important is to stay out of smoke-filled rooms, smoking sections of trains and planes, and away from others who are smoking.

-Don't raise dust. Vacuuming the entire house isn't a good idea on a high-pollution day, nor is extensive dusting, starting a bonfire, or using the fireplace or incinerator.

-Restrict activity. The more active you are, the more breaths you take and the more pollution enters your system. If possible postpone shopping trips, hard cleaning jobs, ambitious cooking projects. Forget the daily jog around the block. Avoid stimulating medicines, drinks, and food. Take a nap in the afternoon or go to bed early, In Riverside, California, all children in public schools are excused from strenuous indoor and outdoor activities when the level of ozone reaches .25 parts per million-as happened last August on more than half the summer-school days. All

Los Angeles public school children are excused from strenuous activities at the.35 mark.

-Stay indoors as much as possible. Says Dr. John R. Goldsmith, epidemiologist of California's air-pollution program.

"The levels of oxidants indoors are generally half or less that of outdoor air. The same thing is probably true of sulfur-oxide coated particles. The irritants are absorbed by ordinary fabrics, carpets, drapes. The building itself acts as a kind of filter." Where nighttime smog levels are low, as in California, you can air out the house at night and close it up in the morning.

-Avoid cold. Cold air seems to exaggerate the effects of air pollution. It's another reason to avoid the outdoor air on a smoggy winter day - and also to keep the house or the place where you work comfortably warm.

-Control humidity. Outdoors, humidity makes heavy air pollution worse. It helps turn sulfur oxides into sulfuric acid mists, for example, and helps retain poisonous gases at breathing level. But inside, high humidity with clean air is so beneficial it is used to promote better and easier breathing in lung patients.

Even if a home is not filtered, but only closed during an air-pollution episode, it's desirable to use a humidifier or room vaporizer to raise humidity in dry winter months. In the summer, too much humidity may be a problem: an air conditioner or dehumidifier can lower it to an ideal level.

-If you have to drive, avoid busy streets and expressways, where most smog begins. This is especially important if you're using a depressant, tranquilizer, or sedative drug (including alcohol) pollutants may increase the drug's tendency to slow your thinking and reflexes. If you have to drive, take a bridge instead of a fume-laden tunnel whenever you have a choice. Before entering a tunnel or heavy traffic, close car windows and ventilators but remember to open them again in a short time. Adjust the air conditioner to recirculate. Be sure your car's exhaust system doesn't leak fumes into the passenger compartment. When walking downtown, keep away from curbs and hold your breath when a passing bus blasts you with a cloud of exhaust.

For those especially vulnerable to heavy air pollution-the heart or lung patient, the chronically ill, particularly the aged, the very young, the asthmatic and those suffering from other respiratory ailments-additional precautions are usually advisable. (In fact, every urban American - says Dr. Bertram W. Carnow, professor of preventive medicine, chief of environmental health at the University of Illinois School of Medicine - should get a personal air pollution prescription from his doctor, telling him how to protect his health on smoggy days.)

If you're in one of these categories, and haven't already received emergency instructions in advance, by all means call your doctor at the first sign of breathing distress. He may want you to increase the dosage of the medication he's prescribed for you.

Some heart patients, for example, should seriously curtail activity when sulfur dioxide or ozone levels hit .1 parts per million; they should probably stop working and stay at home at the .2 ppm level, and go to bed at the .3 ppm stage. "When smog is heavy," says Dr. Carnow, "rest can save lives. In 1952 London smog caused 4,500 excess deaths. Ten years later, during a period of the same smog levels, there were only 700 excess deaths. Why? Doctors, meanwhile, had learned the importancr of rest during smog attacks. They told their patients to stay in bed, where they would put the least stress on their vital organs."

One thing not to do: don't take medicine or drugs for smog-aggravated respiratory conditions unless they are recommended by your doctor. A person with severe bronchitis, for example, might try to subdue his cough with cough suppressants, antihistamines, or sedatives. By permitting secretions to build up in air passages, such medication could have harmful effects. And be careful about self-administration of oxygen. Make sure you're following doctor's orders, and that you know what you're doing.

But even the most vigorous and healthy of us worry about what we're inhaling into our lungs when the air reeks of smog. Questions arise.

What, for instance, about home filter systems? Superfiltration-removing up to 99 percent of most pollutants-is achieved by a system until recently reserved for industry, NASA "clean rooms," and a few hospital smog-treatment centers like the Cardiopulmonary Laboratory at St. Vincent's Hospital, New York City. Basically, a unit consists of a blower, an activated-charcoal filter to remove most noxious gases, and chemically treated HEPA (high-efficiency particulate air) filters to remove particles. Eventually, such a system may become available at a reasonable price as a "clean-air" package" with home air conditioners.

Electrostatic precipitators are generally available and highly efficient in removing soot and dust, but they do not remove particles below a certain size. For example, particulates between 1 and 2 microns are 100 percent breathable and are the most dangerous. Precipitators also create some harmful ozone, especially when the electrically charged plates become dirty. If used, a precipitator should be backed up by activated-charcoal filters to remove ozone and other gases.

Should you change your job? In one month, more than half of 22 men manning Brooklyn-Battery Tunnel toll booths suffered dizzy spells from auto fumes; five experienced blackouts. You may not work under such polluted conditions, but if you do, it might be wise to look for a job with fresher air. Or you may decide to spare yourself a daily carbon monoxide headache by taking the train, instead of driving to work on fume-laden expressways.

What about moving to an area with cleaner air? Before deciding, check out the neighborhood with the nearest air-pollution control agency, or the air-pollution enforcement officer of the local health department. A good general rule is to move toward the prevailing wind. Stay away, if possible, from power plants, industry, heavy auto traffic, jet airports, and buildings heated by coal or oil.

If smog's threat to health stimulates you to work in your present community for cleaner air, more power to you! As taxpayers and voters, it's up to each of us to make sure that antipollution laws are strong enough, and more important, that they are enforced.

Until the air is pure, for your health's sake, be on guard.

Teacher Reference: "Air"

THE MODERN MIASMAS

Man and His Changing Environment

Air pollution and its possible effects upon man's health has increasingly become a topic for concern and has been reviewed in newspapers, popular magazines, and other forms of mass media. This has been due in great part to recent studies, research and reports of environmental health specialists - physicians, engineers, biochemists, meteorologists, epidemiologists, and others. There are however, many unknown or little understood factors about the precise relationship of air pollution to health. For teachers, the following article summarizes progress being made and indicates some of the efforts of individuals, government and private organizations to control known hazards and to investigate others. It also suggests several high school projects and activities designed to stimulate student interest in air pollution and to increase student understanding of this important health problem.

We live at the bottom of an atmospheric ocean whose vastness would seem to insure an inexhaustible supply of fresh, clean air for all forms of life dwelling on the earth's surface. However, ever since man began to breathe, he has apparently been concerned about how the air may harm his health.

This was evident throughout the early days of medical history when most epidemics and many diseases were blamed on "miasmatic influences." According to this ancient theory, the air harbored many miasmas - or pollutions - conducive to "the plagues, the fevers, the distempers and the infirmities." Indeed the word malaria, which in Italian means "bad air," is a modern-day reminder of this ancient belief.

Not until the emergence of the sciences of bacteriology and sanitation did the role of the air in the spread of disease become clear. Interest then shifted to the part played by air in the transmission of the causative agents of infection. But history repeats itself and the pollution of the air by noxious materials, or miasmas, is once again of concern to man. These pollutants include an almost infinite variety of chemical compounds - solids, liquids and gases-which are discharged into the skies as by-products of our crowded, industrialized environment.

There is every reason for us to be as concerned about the purity of the air we inhale as we are about the safety of the water and milk we drink and the cleanliness of the food we eat. For of all the basic physical necessities of life, air assumes top priority.

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Man needs an average of only four and one-half pounds of water and two and three-fourths pounds of food to sustain him daily. But to keep the flame of life burning, he must have at least 30 pounds of air, day in and day out. While it is sometimes possible to detect and reject contaminated food and water by its odor or appearance, we have no choice about the air. Although it may be laden with "aerial garbage," we must inhale it as it comes to us.

We have known for a long time that the myriad of waste products spewed forth by modern industrial processes and from other sources threatened the purity of the air we breathe. Yet it has taken a number of air pollution disasters to convince us that pure air is by no means a limitless resource and that its continuing cleanliness cannot be taken for granted.

The first recorded air-pollution disaster in the United States occurred in Donora, Pennsylvania in 1948, when a heavy fog settled over that small city and did not lift. The atmosphere became so befouled with industrial waste that day was turned into night. Some 5,000 people became ill and 17 died. Tragic as this disaster was, the experience of London, England, has been even worse. That city has experienced at least four episodes when it was blanketed by grime and soot, the sort of "pea-souper" familiar to every reader of Sherlock Holmes. The most recent of these episodes occurred in December 1962, and although the smog lasted only a few days, the number of deaths attributed to it totaled 750. And as recently as November 1960, New Orleans, Louisiana, was the scene of an "asthma epidemic" triggered by polluted air. Within a 24-hour period, hundreds of the city's people were treated for labored breathing, coughing, wheezing and other symptoms of acute respiratory distress.

Aside from these and other serious episodes, many cities and towns throughout the United States have experienced the annoyances and blight caused by contaminated air. In Los Angeles, the city most frequently affected, residents have come to expect many days when smog will irritate the eyes and respiratory passages and play havoc with nylon hose. Other cities, of which Pittsburgh was until recently the prime example, have been noted for the accumulation of soot on their buildings--as well as in the lungs of their residents. And there is hardly a community in the entire nation that doesn't awake from time to time to "another murky day" when the air hardly seems fit to breathe. Frequently the affected localities are not responsible for the condition of the air hovering over them. The smoke, dust, smog, soot and unpleasant odors often come on winds blown from neighboring towns or cities of states. This points up the fact that polluted air respects no geographical boundaries and that only through the closest cooperation among many governing bodies will the air be made safer for everyone, everywhere.

There is, of course, one threat to the purity of the atmosphere that has caused worldwide concern--radioactive fallout. However, studies which American, and British scientists made during periods when the air was polluted by relatively high concentrations of radioactive substances showed that inhalation accounts for only a small percent of the total amount of these substances absorbed by the human body. It is to be hoped that the possibility of increased hazards from nuclear contamination of the air has been reduced by the International Test Ban Treaty of July 1963 outlawing atmospheric nuclear explosions.

Air--Pure and Impure. Fresh air is a mixture. About 78 percent of it is nitrogen, about 21 percent oxygen, with small amounts of other gases to make up the remainder. Today, however, we are taking into our bodies a vastly more complex mixture which, as one authority says, "includes a bit of almost everything." Some of the contaminants are visible, including smoke, soot and dust. But these visible offenders are only a part of the problem. Less obvious, and far more damaging to health, are the atmospheric polluters that are not emitted by the combustion of gasoline. Within the atmosphere, these chemicals and, in the presence of sunlight, interact to form substances of unknown identity, some of which take the form of aerosols. It is this complex chemical mixture, sometimes referred to as synthetic or photochemical smog, that seems to pose a menace to health.

The volume of man-made pollutants released into the atmosphere has reached astounding proportions in some localities. For example, the Department of Air Pollution Control of the City of New York reported that during 1961, the soot that filtered down upon the city amounted to 68.4 tons per square mile per month. And the Air Pollution Control District of Los Angeles, California, estimates that gasoline-driven vehicles in the county pollute the air daily with 1,180 tons of hydrocarbons, 300 tons of nitrogen oxides and 8,950 tons of carbon monoxide-to say nothing of lesser amounts of other compounds. The volume of pollutants from this source may increase, as it is expected that nearly 90 million motor vehicles will be registered in the U.S.A. in 1970, compared with about 70 million today.

Over the years, the type of air pollutants has changed because times and technology have changed. Not too long ago, our economy was based largely on coal. Since billows of smoke from factories were proud symbols of our industrial progress, not too much thought was given to the effect of smoke on our health. Today, in addition to coal, oil and gas are burned enormous quantities by practically all industries. Moreover, the increased burning of garbage by homeowners and on city dumps adds appreciably to our open air "sewage." Then, too, large amounts of chemical vapors and gases seep into the air from a variety of sources. For the most part, however, burning-whether it be gasoline or garbage-is responsible for the great rise in air pollution. The trouble is that burning is seldom, if ever, a complete process. If it were, the by-products or debris liberated would be almost negligible and certainly of little or no threat to health.

As would be expected, the organs of respiration suffer most of the insults of air pollution. A brief review of certain structures and functions of the respiratory tract will explain why this is so.

For instance, the larger airways of the lungs are lined with mucus-secreting cells and cilia. The latter are tiny hair-like projections which are always in motion. When any of the larger irritants-particles or droplets-are caught in the mucus of the airways, the cilia, with their ship-like motion, sweep them out of the lungs. It is estimated that at least 90 percent of the larger irritants are thus removed. This lung cleansing system, however, may be damaged. For example, sulfur dioxide and synthetic smog can change the rate at which mucus is produced and slow down the action of the cilia. Thus, when a sufficient concentration of irritants builds up in the larger air passages, coughing and other symptoms of respiratory difficulty usually follow quickly.

As the conducting airways branch and divide, their diameters decrease. They eventually end in millions of tiny air sacs, called alvcoli, where the exchange of oxygen and carbon dioxide between the air and the blood takes place. These tiny units, smaller than the head of a pin, lack the protective mucus and cilia. They are therefore subject to damage by pollutants or irritants reaching them. Here again continued irritation may cause either functional or organic changes. This has been most impressively documented by studies made in Great Britain which correlate high bronchitis rates with high air pollution levels. There is also some evidence that certain pollutants either through their interference with the excretory mechanism of the lungs or by other means, increase susceptibility to cancer of the lung.

According to a report from the Metropolitan Life Insurance Company, the incidence of chronic respiratory diseases is rising in the United States and death rates from them have shown a sizeable increase in the past decade. Among these chronic conditions, the one that has shown the greatest increase in mortality is emphysema. This disease primarily involves the alvcoli, which becomes abnormally enlarged. Since the larger air sacs have less surface area for the exchange of oxygen and carbon dioxide, breathing may become severely impaired as the disease progresses. This, in turn, throws a heavier load on the heart. The lungs also become more susceptible to infection.

Although the exact cause of emphysema is unknown, it is believed that air pollution may have something to do with its onset. There is no doubt that some of the impurities in the air aggravate the disease. It has been shown, for example, that patients breathing air from which pollutants have been removed by charcoal filters show a striking improvement in lung function.

The Economics of Air Pollution. In addition to the health hazards of air pollution, the economic losses charged against it are estimated to be more than $11 billion annually. It is impossible to assess how many extra hours are spent by housewives and school custodians, for that matter-scrubbing, sweeping, dusting, and cleaning to keep the grime away.

Losses elsewhere, however, are plain to see-in soot-blackened buildings, peeling paint, corroded metals and leather, textile and rubber goods that wear out before their time. The damage also extends to plants, crops, and livestock. For example, lettuce, spinach and other leafy vegetables are especially sensitive to contaminated air. So are some fruits, notably those of the citrus variety. In fact, many forms of vegetation in seriously polluted areas develop a characteristic "smog blight." And in some localities, livestock are showing the ill effects of chemical pollutants that seep into the soil.

When we see that the air contains substances potent enough to eat away paint, corrode metals and stunt the growht of plants, there is certainly cause for mounting concern about what the air's noxious contents may be doing to our bodies.

The Drive for Cleaner Air. Eceryone is in favor of clean air and it will take the interest and effort of everyone-from the individual citizen to top governmental health agencies-to solve the gigantic problem of air pollution. Fortunately, despite the expense and complexities of the situation, the drive for cleaner air is under way on many fronts. Here, in broad outline, are a few examples of what is being done.

Automobile manufacturers have developed devices that decrease some of the harmful emissions from the combustion of gasoline. One of them, the crankcase blow-by device, is now factory-installed on all cars for domestic use in the United States. Meantime, this source of air pollution could be further minimized by proper automobile maintenance. Prompt repair of worn or defective parts can significantly reduce the exhaust emissions. This is a point worth emphasizing in all driver education programs.

Industry alone is spending $300 million annually on research to develop and install dquipment to reduce air pollution and control offensive odors given off during manufacturing processes.

More than 236 air sampling stations, operated by the U.S. Public Health Service, are studying levels of air pollution over the country. Specimens for analysis are forwarded to the Robert A. Taft Engineering Center, a facility of the Public Health Service in Cincinnati, where basic research into air pollution is conducted on a continuing basis.

More and more communities are recognizing the gravity of the air pollution problem. This has resulted in local ordinances to prohibit open burning of garbage and refuse.

An aroused public opinion has also brought about the establishment of air pollution control boards in many communities across the nation, some of them interstate.

The U. S. Public Health Service, through its Division of Air Pollution, is increasing its research on all aspects of this problem and will promulgate measures necessary to curb it.

TEACHING GUIDE

To help implement this issue of the BULLETIN in social studies, science and health education classes, the following student activities are suggested. Some may be undertaken as group or class projects, others as individual investigations, papers, oral reports, school newspaper articles, and so on.

Polluted or Clean Air? What can you observe and learn about the air we breathe?

1. Use a tank type vacuum sweeper. Place a piece of filter paper (one thickness of a paper facial tissue can be substituted) over the end of the hose. Turn the switch on and allow the sweeper to run for several minutes while the hose is held in mid-air. Examine the filter in a bright light and compare it with an unused filter.

2. Coat one side of a microscope slide or a glass plate with a sticky substance (e.g., petroleum jelly) and by means of an ordinary spring-type clothes pin, attach the treated slide to an outdoor wire, clothesline or other suitable structure. Several of these might be placed at different locations around the community. After a specific length of time (2 to 24 hours) collect the slides and label as to exposure time and location. Place slides on a sheet of white paper and under a bright light observe any change in the color of the slides and the variety of types and amounts of particles. If possible, use a microscope to examine the slides more closely. Record your observations on an outline mape of your community that charts industrial sites, residential areas, transportation systems, refuse disposal areas, and other factors that contribute to air pollution.

   From your observations, do you think that the air in your community is polluted? Do the particles you have observed and their location on your map give you any clues as to the possible sources of pollution?

   Not all pollutants are visible particles. What can you find out about those that cannot be seen?

3. Contact your nearest health department, weather station or air pollution center to find out what information is available about air pollution in your community. How does this information compare with your observations? If air pollution is a problem, find out what you can do to help fight or control it.

Fog and Smog. What is fog and how is it formed? The word smog referred originally to a combination of smoke and fog, such as is frequently encountered in communites where coal is widely used for domestic heating and industrial purposes. Today, in areas where neither smoke nor fog is prevalent, but smog exists, smog is due to a series of chemical reactions, caused by solar energy, among the pollutants in the atmosphere. Find out more about photochemical smog. Why are fog and smog considered severe accident hazards as well as possible health hazards? What roles are played by weather, topography, industry, transportation, refuse disposal, population density, etc.?

Air and Health. Air is necessary for human life. What are the gases that make up the air? How does the body make use of oxygen? What happens when the oxygen supply is not sufficient? With the help of your teacher, plan a class demonstration to show how oxygen can be produced.

What other substances may be normally found in the air? Are any of these known to be injurious to man's health. How does man's respiratory system help to protect him against invading microorganisms, dust and other particles?

In addition to substances normally found in the air, other substances may be found in different localities as a result of man's activities in the area. Some of these substances may be visible particles; others may be invisible chemicals. Current evidence suggests that these "pollutants" do pose health problems. Find out about asthma, emphysema, lung cancer, chronic bronchitis and other respiratory illnesses to learn what role air pollution may play.

Radioactive fallout continues as a threat to the purity of the air and man's health. How does radioactive fallout differ from other forms of air pollutants? How is it detected and measured? What national and international programs exist to control radioactive fallout?

Effective Air Pollution Control. Statesmanship-scientific, industrial and political-has been viewed as a major need for effective air pollution control. What should be the differing responsibilities of scientists, industrialists, legislators and public officials? What cooperative efforts are currently being carried out among scientific groups, industrial organizations, cities and states? What are the responsibilities of individual citizens? Find out more about:

1. Your community's regulations regarding the control of air pollution.
2. Proper functioning of home heating equipment.
3. Proper functioning of engines in automobiles, trucks, buses, boats, etc.
4. Efficient disposal of leaves, garden debris and other kinds of trash.
5. How to report air-pollution violations observed in your neighborhood.
6. Federal legislation. Write to your local Congressman for current information.

Economic Implications. The latest figures suggest that air pollution may be costing the nation more than $11 billion each year. Why? Find out about its effects on crops, livestock, building materials and structures, and property values. If possible, talk to a farmer, rancher, representative of a real estate agency, member of a chamber of commerce, etc. Observe the outsides of your school, home, and other buildings in your area. Are there visible signs of damage possibly due to air pollution?

Impact of Technology and Population. An airline pilot has said: Millions of people have now flown who have never seen the earth as they ought to see it. In the 1930's,...our country was a joy to behold. Today, if you wish to see this earth as it truly is, you must be within one hour behind a wet cold front and at a comparatively low altitude." How has the air pollution problem changed since the 1930's? What factors in our way of life have made it a problem today? With the help of your teacher, find out why flying behind a wet cold front increases visibility of the earth. What devices have been developed to aid pilots when flying through densely polluted air?

SOURCES

Information on these problems may be found in recent newspapers, magazines, and other references available in most libraries. The Reader's Guide will help you find magazine articles. Your local and state health departments and weather bureaus, local industries, tuberculosis and health associations, and the Information and Education Office, Division of Air Pollution, U.S. Public Health Service, Washington 25, D.C., are also valuable sources. In Canada, information on air pollution can be obtained by writing to the Occupational Health Division, Department of National Health and Welfare., Ottawa, Canada.

(METROPOLITAN LIFE INSURANCE COMPANY)

Activity #17

Problem: Do cars and trucks contribute to air pollution?

Materials:

clean white cloths, collection papers smeared with petroleum jelly, or facial tissues or waxed paper attached to cardboard
cates, trucks lawnmowers, or any internal combustion engine
timing device
meter stick
magnifying glass
poster paper and cardboard
angel hair, glass wool, or fiber glass (aquarium use)

Procedure:

1. Using about a dozen of any of the above collection papers or cloths, hold them parallel to the mouth of the exhaust pipe of a running vehicle. Keep it at a distance of about 15 cm from the mouth of the exhaust for about two minutes. Keep you face as far from the exhaust as possible while working and be sure not to touch the hot exhaust pipe.

2. Test several cars, trucks, lawnmowers, etc. (such as from the teachers' parking lot). Label each collector paper as the engine year, type, number of cylinders, type of fuel burned, etc. Record all observations of the particles such as color, size, texture, etc. and attach to the collector paper.

Observations:

Mount the collector papers and observations on posters in order from the exhaust with the most particulate matter to the least.

Conclusions:

1. What variables were kept constant in the experiment?

2. Would better results be obtained using a different type of collector paper? Why or why not?

3. Have you discovered any important relationships - such as the amount of particulate matter and the age of the engine? What other relationships might there be? How can you test to see if you are right?

4. Can you made an air filter from the cardboard tubing and angel hair? How can you test how well it works?

Activity #18

Problem: Is a thermal inversion a part of air pollution?

Materials:

- hot plate
- pan of water
- ink or food coloring
- 5 or 10 gallon aquarium
- cold water
- ice
- plastic bags

Procedure:

A. Under normal atmospheric conditions, a cool air mass is located above a warm one -

1) Show this by first heating a pan of water and adding several drops of coloring.

2) Now fill a small aquarium or container about three-fourths full of cold water and chill the water by adding ice cubes.

3) Half-fill a plastic bag with the warm colored water. Carefully close and seal the bag, allowing no air to remain inside.

4) Remove the ice cubes from the cold water. Lower the bag filled with the warm colored water into the cold colorless water and puncture it with a pin. Observe the interaction between the warm and cold water masses and describe the results, including a drawing.

B. In a thermal inversion, a warm air mass is located above a cold air mass.

1) Show this situation by first adding ice cubes to chill a small pan of water and adding several drops of ink or food coloring.

2) Heat several gallons of water and fill the small aquarium about three-fourths full.

3) Half fill the plastic bag with the colored cold water and fasten it allowing no air to remain inside.

4) Lower this bag into the container of warm, colorless water and puncture it with a pin. Observe the results and describe them, including a drawing.

Conclusions:

1) State as many comparisons as you can between normal atmospheric conditions and thermal inversion conditions.

2) What conditions will cause thermal inversions?

3) Can thermal conditions be predicted? What would you look for?

4) Can you tell if thermal inversions may be considered a type of air pollution? Why of why not?

Activity #19

An egg without calcium or poison in the food chain.

When pesticides are used they accumelate in the food chain. Predacious birds such as the eagle and osprey are often the top consumer in such a food chain. The pesticides, expecially DDT and DDD interfere with the birds ability to produce calcium. What affect will this have on the eggs?

Instead of using dangerous pesticides we will soak an egg in acid to see what an egg without calcium looks like.

Materials:

two hard boiled eggs
two beakers
vinegar

Procedure:

1. Place a hard boiled egg in each beaker.

2. Fill one beaker with water. Lavel it "A".

3. Fill the other beaker with vinegar. Label it "B".

4. Make observations after 24 and 48 hours.

Observations:

Touch the egg shell, Describe how it looks and feels.

Questions:

1. Do you think an egg without calcium is strong?

2. What will happen if a bird sits onthis kind of egg?

3. Is there anything we can do about this problem?

Activity #20

Teacher notes:

A. Clean water criterion

1) safe
2) inviting for drinking
   clear
   ordorless
   no objectional taste
   no excessive amount of dissolved solids
   cool

B. Pure water cirterion

1) contains no dissolved impurities - 100% H_2O ex.
   chemical reagents and distilled water for flat irons

C. N.Y.S. Water Classificaton
1) AA - drinking (chlorination)
2) A - drinking (chlorination & filtration)
3) B - bathing
4) C - fishing
5) D - industrial, agricultural, navigational and waste disposal

D. Use of water

drinking	irrigation
cooking	electrical power
bathing	industrial processes
fishing	naviagation
boating	waste conveyance

This information should be given to the students and then they could add to it; or through inquiry you could have the students develop the information themselves. Then you could add any information that you feel is necessary.

Activity #21

Get to Know a Pond

Teacher note: This is an appreciation exercise to be done before the lab "Who Lives in the Pond". It may be optional. Read this to the students.

Go to the pond edge and observe it for five min utes. This is the whole world to many creatures. Notice what plants grow in the pond and around it. Touch them. Do they look alike? Feel the temperature of the water. Feel the bottom of the pond. Lie in the grass and close your eyes. Feel the sun and the wind just as if you were floating on the pond. S-M-E-L-L the air. LISTEN?

Look at the pond water. Can you see anything moving? Write your observations of a pond habitat on apiece of paper.

Optional: Draw a picture of what you see.

Who Lives in This Pond

You will be examining pond samples and identifying what lives there. We will then study the affects of thermal pollution and toxic pollution.

Procedure:

1. You will be given an aquatic net to get your sample.
2. Sweep the net through the water collecting water, plants, and animals (Remember the animals are being preyed upon. They like to hide in plants.)
3. Dump you collection into a lab tray.
4. Examine what you have found.
   a) Do the plants have roots?
   b) Do the animals have shells?
   c) Do you see any fish or insect eggs?
5. Record your observations below.
6. In the lab use the microscope to examine your sample. Identify as many plants and animals as you can.

Observations:

Record your observations made in the field. Draw and label what you see with the microscope.

* Thermal Pollution - Power companies often dump hot water into the surface water. Is this harmful? (Teacher note - take one of the pond samples and place it in a glass dish. Place this on an opaque projector. Have students notice the activity. Then add 5-6 oz. of hot water.)

Questions:

1) What happened?

2) Were the plants and animals both effected?

3) What affect does thermal pollution have on the food chain?

* Toxic Pollution - Man industries empty dangerous toxic waste into the water. What affect does thish have? (Teacher note: same procedure as before only add 3-4 drops of ammonia.)

Questions:

1) What happened?

2) Were the plants and animals both affected?

3) How do toxic pollutants affect the food chain?

Activity #22

How important is water?

We know that 65% of our body is water. We must drink five pints of water a day. How about other living things? Is water important to them?

Materials:

potato
cucumber
tomato

Procedure:

1. Slice the fruit
2. Weigh the slices.
3. Dry by a sunny window several days.
4. Reweigh the slices.

Observations:

Describe the color and texture of the slices before and after drying. Record the weigh.

Questions:

1. Compute what percentage of each fruit is water.
2. Which contained the most water? the least?
3. What happens when crops don't get enough water?

Food for Thought

You use about 70 gallons of water a day. How many gallons do you use in a month? ______ A year? ______ If you had to carry that much water from a well maybe you would think twic about how you use it!

Activity #23

Problem: How much water do you use in one day?

Materials: any materials required

Procedure:

Try to determine how much water you use during one typical day. Spend one day deciding what activities you do that involve water and list them*. Also determine what measuring devices you might need in your investigation. You will convert all your data to liters after all your data has been collected.

Prepare a data table listing the activity performed, volume of water used, frequency of the activity, and total volume of water used.

On a blackboard or transparency, place the total volume of water you use in one day on a class chart.

Conclusions:

1. How much water would your entire class use? The school? The community?

2. Would you infer that an older person would use more or less water than you do? What about a housewift compared to a teacher?

3. What could you recommend to people who wanted to conserve water and use less each day?

* See (Domestic Oases : A Study of Household Water Use", by Michael B. Leyden in Jan.-Feb. 1973 issue of Science and Children

Activity #25 - #30

Good activities. They should be used at the teachers disgression.

Activity #31

Teacher note: Give the students the introduction and materials. See if they can design the experiement.

Materials:

- teakettle with spout
- 3" rubber tubing
- glass
- large deep bowl with ice
- 2 tsp. salt
- hot plate
- pint of water

By the year 2000 our need for water will double. Where will it come from? One possible source is the ocean. Using these materials see if you can design a way to de-salt water.

Activity #32

Problem: How do detergents contribute to water pollution?

Materials:

paper and pencil
different brands of detergents
empty babyfood jars
eyedropper

Procedure:

A. 1) Select five homes in your community and interview the residents concerning the following data:

a. brand(s) of detergent used
b. number of boxes per month
c. size of box used usually
d. amount of phosphate in detergent used (from charts in grocery sores, Consumer Reports, etc.)

2) Make a chart summarizing your data and pool your data with others on a class chart.

3) How does your data compare to other class data? What conclusions can you draw concerning your community?

B. 1) Obtain small amounts of many different brands of detergents. Half-fill each babyfood jar with tap water. Mix up soap solutions which contain the same proportions of detergent to water. Put a certain number of drops of each soap solution into the jars and cap them securely, being sure to label each jar.

2) Shake the jars a certain number of times that you decide. Measure the height of the suds that form on top of the water and put the results in a chart. Record the order in which the suds disappear. Make a bar or line graph to show your results.

Conclusions:

1) Which brand or brands of detergent would your recommend be purchased for less water pollution problems?

2) How does your recommendation compare with the amount of phosphate present in the detergent? Is the order the same? Why or why not? How does it compare with others' recommendations?

3) Are these water areas in your community where soap suds are present? What can you infer about these areas? Try to determine if suds are trouble for sewage treatment plants.

Activity #33

Teacher notes:

Summary of sewage treatment plants:

1. Primary treatment plants utilize a device that screens out large debris.

2. Secondary treatment plants screen out all large solid debris but also remove organic materials.

3. Tertiary plants combine the effects of the above two but use blue green algae to remove phosphates and nitrates. The effluent from a secondary type plant is pumped into large nats which contain this algae. The algae utilize the phosphates and nitrates from the effluent as fertilizer and reproduce hundreds of time increasing their mass. This hude algae growth is then harvested by separating it from the effluent. The remaining effluent is treated with clorine and is then ready to enter a body of water. The harvested algae is dried and can be used as fertilizer.

Give the students a brief overview of sewage treatment plants. Then have volunteers find out what type of treatment plant is found in their village. Where does their sewage go?

Activity #34

Primary Sewage Treatment Demonstration D

Primary sewage treatment is largely a straining process. Let's see what it does.

Materials:

flour sifter
absorbent cotton
fine sand
coarse sand
gravel

Procedure:

1. Line the sifter with cotton; a one inch layer of find sand, a one inch layer of coarse sand, a one inch layer of gravel.
2. Place the sifter over a large mouth jar.
3. Slowly pour muddy water into the strainer.

Observations:

Describe what the water looked like before and after treatment.

Questions:

1. Where did the dirt go?
2. Is this water safe to drink as is? (pesticides, phosphates, bacteria still present?)
3. Why do we chlorinate water?

Activity #35

Teacher notes:

There are two activities that can be done here: 1) a speaker can be asked to come in, 2) a field trip could be taken.

1. A speaker could come in to speak to the students on the sewage treatment facilities in the local area. Before the speaker comes the students should make up questions to ask him during a question and answer period after the speech.

2. A field trip could be taken to a sewage treatment plant in the local area (Onondaga Counth). This would familiarize the students with their own sewage treatment systems. There should be some follow-up activity after the field trip is taken to discuss the efficiency of the treatment plant and possible changes that should be changed.

Activity #36

Investigation 21 Book M&E

Facts about the city 1885 (picture p. 289, fig. 21.2)
heavily populated
dirty and noisy
railroad outside of city
horse drawn buggies inside city
majority people walk
rivers widely used (as in industry, people's needs, etc.)

Facts about city - 1905 (picture p. 295, fig. 21.6)
growing industries
better railroads
invention and use of cars
electricity
hot water into rivers
steam into air

Facts about city - 1945 (picture p. 297, fig. 21.8)
more people use cars and city transportation
bridges
population grows rapidly
depression

Facts about the city now (picture p. 299, fig. 21.10)
population decreases (people move to suburbs)
farmland decreases
more cities
more industry
smoky air
polluted rivers

This activity seems to work well. The students could gain observation skills from this. They could make a list of all the tings they see in each picture then they could categorize the list by labeling which of the things are harmful to the environment and which things do not harm the environment. The questions on the next page can be used also or instead of the above.

Use this set of questions for each of the four picture and their facts.

1. a) What can you gather about the pollution situation?

   Is there any pollution problem at all?

   b) What can you gather about the progress situation?

   Is progress helping or hindering the city?

   the people?

2. During this time period, which idea, "a", or "b", do you feel is most important?

   Why?

After applying 1 and 2 to each picture, answer the following.

Do any of the final ideas of the four picture differ?

Why do you suppose they do?

Does this lead to any conclusions about progress and pollution?

Is so, what?

Activity #37

Project 1

You will be responsible for finding out about solid waste disposal in your area. You can do this by any methods available - asking people, inspecting your area by walking, by bicycle, by your parents transportation, reading, television news, etc. What you should be looking for are the following types of situations: auto graveyards, public dumps and land fills, private dumps, illegal dumping areas, construction sites, sewage disposal sites, oil dumps, or any other examples of solid waste mismanagement.

For each such situation you discover, mark its location on the map of the school district that you will be given and indicate the following:

1) the type ofmismanagement (dump, land fill, construction, etc.)
2) the degree of mismanagement (slight, great, growing, etc.)
3) the ways that it upsets the environment (oil covering water and cutting off oxygen to water organisms, etc.)

Finally, bring your results to class and work your data on transparency or large map of the school district along with your classmates, using the key or legend that the class has decided to use. This should give you an idea of the general condition of your school district concerning solid waste disposal.

Activity 38

Sources of Solid Waste

2,000,000,000

1,700,000,000

1,500,000,000

1,200,000,000

1,000,000,000

800,000,000

600,000,000

400,000,000

200,000,000

TONS

Agricultual crop and animal wastes	Mineral	Other	Residental (homes) commerical (business) Institutional (school, churches, etc.)	Industrial

1. List the amount of solid waste that each of the above sources produce in one year:

   Source #1:

   Source #2:

   Source #3:

   Source #4:

   Source #5:

2. What is the main source of solid waste? Smallest source? What is the difference between the main and smallest sources as far as the amount of solid waste produced?

3. Why do you think there is so much mineral solid waste?

4. What types of sources might be included under "thers"?

5. How can it be tha t source #4 contributes more than #5, when industries are always being blamed for easte?

6. What is the total amount of solid waste produced in one year? Would you consider solid waste a serious threat to your environment? Why or why not?

Typical Accumulation of Refuse by Weight

59% papers

10% wood and lawn and garden waste

9% food waste

8.5% glass, other ceramics and ash

7.5% metal

6% clothes, rags, plastic rubber, leather, dirt

About 20% of residential waste is composed of package and packaging materials.

Everyone produces trash. The affluent produce more waste than the poor, thus the average U.S. citizen produces about 1,800 pounds of solid waste a year and the average citizen from India produces about 200 pounds.

The sudden crisis has arisen for several reasons. The population explosion has produced more people thus more refuse and less space to put the refuse. Affluence has created the idea that everything goes out. More disposable items are used. Technology has created more goods for consumers to turn into wastes. The type of solid waste is changing. It takes longer for a plastic bottle to decay than an apply core.

Have your students discuss the following questions and/or have them gather information about each.

1) What are present waste disposal methods?
2) Are there any dangers involved in these methods?
3) Must we "waste" waste?
4) What are some solutions to the solid waste problem?
5) Who is seeking the solution?

Activity #40

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Interpret the following cartoons. What effect will each of the situations pictured have on you personally?

Fig. 1-39. *'Help'*. Reprinted by permission from The Christian Science Monitor. © 1967 The Christian Science Publishing Society. All Rights Reserved

Fig. 1-41. *'My dad says he used to swim here, but I think he's kidding.'* Reprinted by permission from The Christian Science Monitor. · 1966 The Christian Science Publishing Society. All Rights Reserved

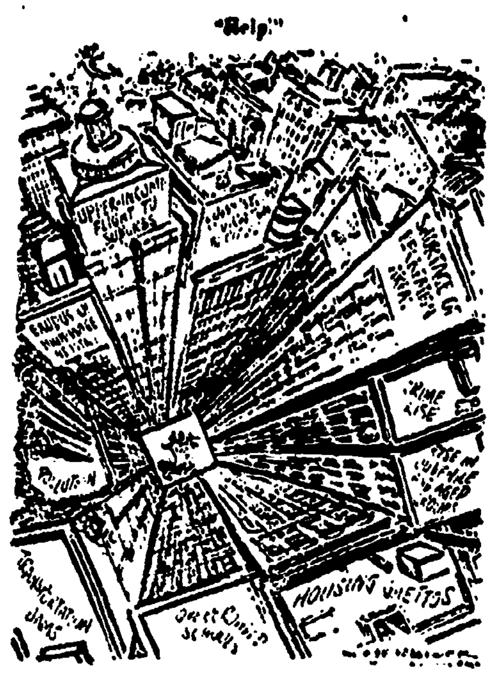
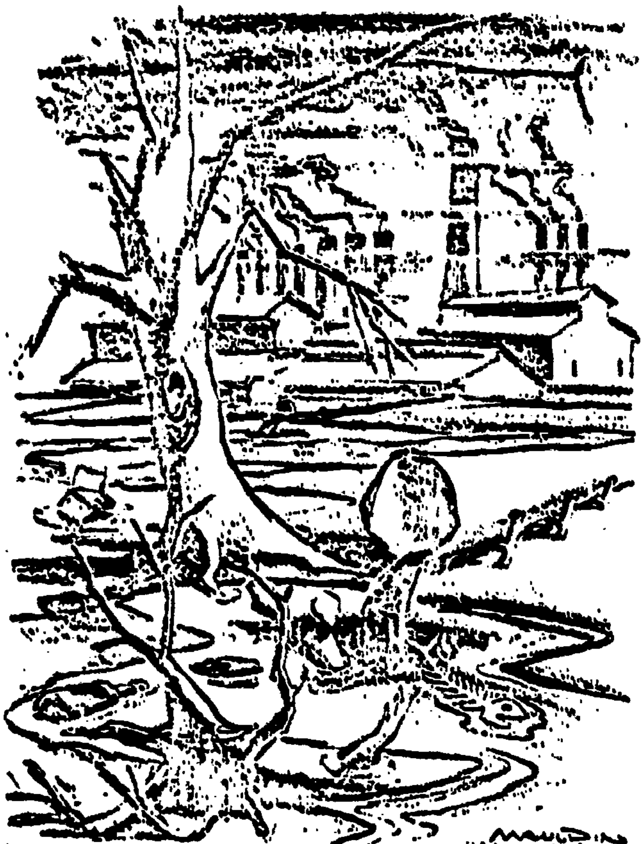


Fig. 1-42. "*Help!*" From *The Herblock Gallery* (Simon and Schuster, 1968)

Activity #40



"THE VAST LONELINESS UP HERE OF THE MOON IS AWE-INSPIRING, AND IT MAKES YOU REALIZE JUST WHAT YOU HAVE BACK THERE ON EARTH." (James Lovell)

Fig. 1-43. © 1968 Reproduced by courtesy of Wil-Jo Associates, Inc. and Bill Mauldin

"IT'S TOO THICK TO DRINK AND TOO THIN TO CHEW."

Fig. 1-44. © 1969 Reproduced by courtesy of Wil-Jo Associates, Inc. and Bill Mauldin

Activity #41

Solid Waste Disposal

To the teacher: There are two activities for Activity #41 which can be used at this time to illustrate the solid waste disposal problem. You should choose one or the other or both.

Directions: A. Ask your students to bring in items which would normally be thrown away. (ex: soap bottles, cottage cheese cartons, cereleal boxes, tin cans, etc.) After each student has an item to work with supply them with scissors, tape, glue, string, etc. Ask them to create something useful from our throw away items. Emphasis should be placed on the fact that many of the items which we normally throw away can be re-used.

Unit V

Activity 41A

Student Directions:

Problem: Are there any solid waste disposal problems in the Syracuse area? To answer this question do one of the following projedts. You will be working in groups.

Project 1:

Problem: Which kinds of buried garbage takes the longest to become recycled naturally?

Materials:

cardboard carton
plastic garbage bag
soil
garbage samples
tape
paper and pencil

Procedure:

Line the cardboard carton with the plastic bag and add about 10 cm of soil. Collect different types of garbage and bury them in the soil, taping another sample of each buried type to the outside of the box as a reference. Add water to the soil each day. After one week with those taped to the outside. Record your observations in a data table. Then rebury the sample and repeat your observations at the end of the second and third weeks. Record your observations in the same manner.

Conclusions:

1) What types of materials has changed the most often one week, two weeks, three weeks?
2) What materials have not changed at all? Will they ever change?
3) Which materials showed signs of being recycled naturally into the soil?
4) In what kinds of materials should products be packaged for most efficient recycling?
5) Why aren't more products packaged this way?

Project 2:

1) Construct a questionnaire (survey) to determine public feeling about solid waste disposal. Make a list of questions to determine if people feel that present laws are doing the job or if new ones should be made, if science and technology will find solutions, if they think the problem is serious or a hazard yet, or when in the future it will become one, ways in which they think living habits should be changed to cope with the problem.

2) For each person surveyed find out his age, sex, occupation and the village in which he lives. Do not take his name and inform him that his opinion will remain anonymous.

3) Try to include a cross-section of many different kinds of people.

Activity #42

Garbage - Solid Waste

These two activities illustrate the solid waste problem and may be used simultaneously.

A. Set up a box in your classroom and mark in "Paper Only". Have your students deposit all their paper waste in the box. At the end of each day push the paper down and mark the level on the box. All other trash should be deposited in the waste basket. At the end of a week compare the amounts in each basket. At the end of a week cotainer or simply notice how much paper has accumulated.

Additional Activity

Activity #43

Problem: How much garbage is collected in your neighborhood each week?

Materials:

garbage
board
scale
meter stick
paper and pencil

Procedure:

1) On garbage collection day, observe the containers on your block. Select several that are average in size and shape. After obtaining the residents' permission, weigh these on bathroom scale that you have brought along. Using boards to help hold the container on the scale, find the average weight of these containers.

2) Count the number of containers on your block and multiply this number by the weight of an average container. This gives the approximate weight of garbage collected on your block that week.

3) If garbage is collected once per week, how much garbage would be produced by your block in one month? One year?

4) Find how much garbage is produced by the neighborhood of you and your classmates in one week. In one month? In one year?

5) Where does the garbage from your neighborhood go? Where will it be put in fifty or one hundred years? Is garbage a problem as far as environmental pollution is concerned?

Activity #44

Problem: What does biodegradable mean?

Sometimes we read and hear things without really understanding them. Let's see if we can find out what biodegradable means.

Materials:

graduated cylinder
2 test tubes
wisk
Ivory liquid

Procedure:

1) Measure 5 ml. of water for each test tube.
2) Add 3 drops of wisk to one test tube.
3) Label it "A"
4) Add 3 drops of Ivory liquid to the other test tube. Label it "B".
5) Observe after 24 hours.

Observations:

Notice how much suds was made by each detergent. Describe what each looks like after 24 hours.

Questions:

1) Which detergent made more suds?
2) Which suds lasted longer?
3) Can you tell what biodegradable means?
4) Was either of these biodegradable.

Activity #45

Problem: What materials are biodegradable?

Materials:

4 slices of bread
cellophane
aluminum foil
waxpaper
brown bag paper

Procedure:

1) Wrap a slice of bread in each kind of paper.
2) Bury each sample at least a foot underground.
3) Record the location or mark with a stake.
4) Leave bury for one month. Then dig up and examine.

Observations:

Draw what you see. Describe the texture and color of the wrapping and bread.

Questions:

1) Which sample is most decomposed? Least decomposed?
2) Which material would be easiest for nature to recycle?
3) Which material would add to our solid waste problem?

Additional Activity

Activity #46

Problem: Does tissue paper pollute?

Materials:

samples of toilet tissue or facial tissue
wide mouthed glass jars with lids
tape
water
paper and pencil

Procedure:

1) Gather as many brands of tissue as possible.
2) Tear or cut several pieces of each brand that are all the same size.
3) Put the same amount of water in each jar and label each as to the type of tissue placed inside by a sample outside (same amount in each jar.) Put the lids on and shake each a certain number of times (that you decide).
4) Compare the paper inside with that outside each jar and write down your observations. Compare different brands of tissue also.
5) Let the jars stand for one or two weeks. Then shake again. Write down all observations.

Conclusions:

1) Which brands disintegrated the most? Least? No change?
2) Which brands would be the worst polluters of all?
3) State which variables were controlled and why/

Activity #47

Noise Pollution vs. Sound

Teacher notes: Have the student make two columns on a sheet of notebook paper and label the columns Sound and Noise. Have the students list in each column what they believe is Sound and what is Noise. After they have done this, discuss the lists with the students. Then give the student a definition of sound and of noise to be placed in their notebook.

Sound - a form of energy, that your ear picks up from sources that are vibrating or trembling.

The First Book of Sound
by David C. Knight
Franklin Watts, Inc. New York

Noise - offensive or painful sound which interferes with a person's concentration, physical well-being, and mental attitude.

Our Noisy World
John Gabriel Navarra
Doubleday & Co., Inc.
Garden City, N.Y.

A noise level chart can be found in the above mentioned book - Our Noisy World on page 48. This chart might be interesting for the students to see.

Activity #48

Sounds of Silence

Have various students go outside the classroom at various times of the day and record how long a time interval can be observed when no man-made noises are observed. Record all observations.

Have students make the same observations at their homes for given time periods. Record data and have students compare their data in relationship to the location of their home.

Conclusion The short time interval most students will observe should help students to realize that we live in a very noisy world.

Activity #49

Sounds

Teacher Direction:

Take a tape recorder to different places in the community and records a variety of different sounds. This tape will be the basis for a student discussion.

In the class the sounds should be played back one at a time. Following each sound the students should be asked these questions:

1) Is this sound pleasing?

2) Is this sound harmful?

3) Would you consider this sound to be noise pollution?

4) What is this sound?

Activity #50

Noise and Your Heartbeat

Teacher note: As an arrisgnment have your students design an experiment to see if noise affects the heart-beat. If they do not come up with anything do the following.

Procedure:

1) Show students how to find their pulse in their wrist or neck.
2) Signal "Begin". Student should count heartbeats in a quiet room. After 30 seconds signal "stop". Record the rate.
3) Ask three volunteers to make noise in the back of the room. The noise should be erratic not rhythmic. Again count heartbeats for 30 seconds.
4) Compare class data by a show of hands.

Questions:

1) Did the noise bother your?
2) Do you think it would disturb your concentration?
3) Do you think it causes tension? headaches? i.e. excederine.

Activity #51

Effects of Noise

Problem: How does noise affect one's disposition?

There are two approaches which are suggested for the teacher to follow. Either one or both may be chosen as a way to solve the problem.

A. Obtain two plants. They should be the same kind, size and in the same relative good health, if possible. Place each plant in separate locations, where lighting and ventilation are the same. One room should be fairly quiet and one room should have a radio in it tuned to a station with popular music playing at a volume above normal intensity. The plants should be watered equal amounts every two to three days. They should be observed daily for any growth change.

B. For several days in each class the teacher should play a tape of noises such as a lawnmower or airplanes (not popular music) which would be at a high volume. After a few days time your students should react to the noise in the classroom.

Activity #52

Design a School

Keeping in mind noise level, design a school to scale. It must have:

10 classrooms
1 cafeteria
1 gym
labatories
library
playing fields
landscaping
office
nurse
parking lot

* Teacher note: Let students add any additional features to the school. They can prove quite interesting. Be sure students don't put noisy rooms such as shop next to the library. Also they tend to forget doors. Let the students do a rough draft on scrap paper.

Activity #56

The New Me

Part I. Suggest to students that over a period ranging from one to several days they must plan their own personal living patterns in such a way that each will in no way contribute to further degradation of the environment. The student must function "normally," yet must live within the particular framework he establishes for himself over this given period of time without damaging the environment. Imaginative students should be able to find ways to meet most of their needs.

Perhaps this activity should be one of graduated difficulty moving from the least difficult to the most difficult. For example, begin by pledging that no student participating will in any way use a vehicle powered by an internal combustion engine, or use food which comes in nondegradable containers, or wrappers. A more difficult project might be to function for a day without using any electrical energy. In order not to make this activity into an experience likely to be ridiculed, care should be taken that students try to develop practical alternatives to what they are giving up or not doing.

A film on new developments in transportation which are less harmful to the environment might be good to show in conjunction with this activity.

- What one thing you "gave up" did you miss the most? Why?
- Did you find your pattern of life hampered by inconveniences during this period? In what way?
- Would you be willing to learn to live differently in an effort to preserve our environment? Why, or why not?

Part II Ask the students to make a shopping trip and note the kinds of containers used for soft drinks, Also, have them count the number of different types of soft drinks. (This could be committee work.) In the classroom, make two charts and put all the soft drink brands available in returnable containers and all those available only in disposable containers. Have some students interview store managers about why so few returnable bottles are stocked.

- Why have disposable bottles become so popular?
- How are they presently disposed of? Is this wasteful?
- What problems does this create?
- Would it be possible for us to have only reusable containers for beverages? Would it be very inconvenient?
- Why is it worth some inconvenience to eliminate this problem?

Activity #57

"Move Over, Don't Pinch!"

Teacher Direction:

Sometime during this unit the teacher should arrange the class so that each student is sitting very close to the next student. The one lab table could have 6-8 students around it or the student's chairs could be pushed very close together so that there is much crowding. The rest of the classroom should remain as usual for a control.

This seating arrangement should last for as many days as necessary for the students to become aggressive, nervious, or unmanageable toward each other.

A discussion should follow from this including the concept that overcrowding among people as well as other animals and plants may produce neurotic behaviors.

Activity #58

Population Study

Problem: How does crowding affect Beans?
Part A - Should start before Activity 49 (Inv. #22 M&E)
Materials: 1. half gallon milk cartons cut down to one-third their original height
2. soil
3. bean seeds

The class may be divided into groups. Each group will plant seeds in the labeled milk cartons as follows:

Carton A - 2 seeds
Carton B - 5 seeds
Carton C - 10 seeds
Carton D - 15 seeds

Each carton of seeds should be placed where it will receive light and warmth. The containers should be watered every other day. Caution the students to give each carton an equal amount of water. Every attempt should be made to control the growing conditions so that the only variable will be the number of seeds per carton.

Part B.
Materials: beans
100 ml. beaker
water

The group which finishes part A questions first will prepare a demonstration for the class.

Take a 100 ml. beaker;fill it about half full of beans. Mark the level of beans with a wax pencil. Add water to the beaker containing the beans so that the beans are just covered with water. Again mark the water level on the beaker with a wax pencil.

The beans should be left overnight. The next day the student should answer the attached questions.

Student Lab Sheet

Problem: How does crowding affect plants?

Procedure: Part A
1. Cut 4 milk cartons in half and fill them with soil.
2. In carton A plant 2 bean seeds, plant 5 seeds in carton B, plant 10 in carton C and 15 in carton D.
3. Label each carton and write your initials on it.

Activity #58 (con't.)

4. Each carton should be watered equally every other day and placed in a warm, lighted place.
5. Observe at the end of 2 weeks.

Data Table A Carton	Number of Seeds Planted	Number of seeds growing	Observations
A			
B			
C			
D			

Questions: Part A - After two weeks

1) Did all the planted seeds germinate?
2) What % of seeds germinated in each carton? In which carton did the greatest percent of seeds germ-nate? Explain these results with a temporary hypothesis.
3) Which carton contains plants which are healthiest? List the characteristics of the healthy plants.
4) What do you hypothesize will happen to the plants in each carton if they are treated in the same way for 2 more weeks?

Questions: Part B (for discussion)

1) How did the volumes of water and beans change overnight? What caused this change?
2) Predict the outcome in each situation below:
   a) A man plants 5 maple seedlings each one foot apart in his yard. What will result after 15 years?

   b) A student fills an empty mayonnaise jar with beans and covers them with water and places the top on tightly. What may result in several days?

   c) A litter of St. Bernard puppies are born and housed in a one car garage. What will result after 10 years?
3) In each example in question 2, what same factor has caused your predicted results?

4) What are two ways in which overcrowding may occur?

Activity #58 (con't.)

5) What happens when a definite number of organisms are allowed to grow (increase in size) within a limited area?
6) What results when organisms are placed in a limited area and allowed to reproduce (increase in numbers)?
7) After answering the above questions can you think of other behaviors which might result from overcrowding other than those which you have already discussed?

Part A Questions after 4 weeks

1) Have any new bean sprouts appeared since you made your first observations? Explain.

2) Which carton now contains the healthiest plants? Why?

3) What results have occurred in the other cartons (do not include your answer to question 2.)

4) Look back at your former hypothesis. You may need to make some changes. Do so in the space below.

Carton A

Carton B

Carton C

Carton D

5) What conclusions can you reach about the differences between the plants in each carton? Be sure to compare CArton A to Carton B.

Activity #59

Teacher Direction:

Part 1 - The teacher will lead a discussion on factors influenced by over-population.

Questions the students should be asked:

As population increases what effect do you think it will have on:

- the amount of cars in use
- the amount of solid and liquid waste
- the amount of power used (electrical, fuel oil, natural gas, etc.)
- land use (housing, recreational areas, etc.)

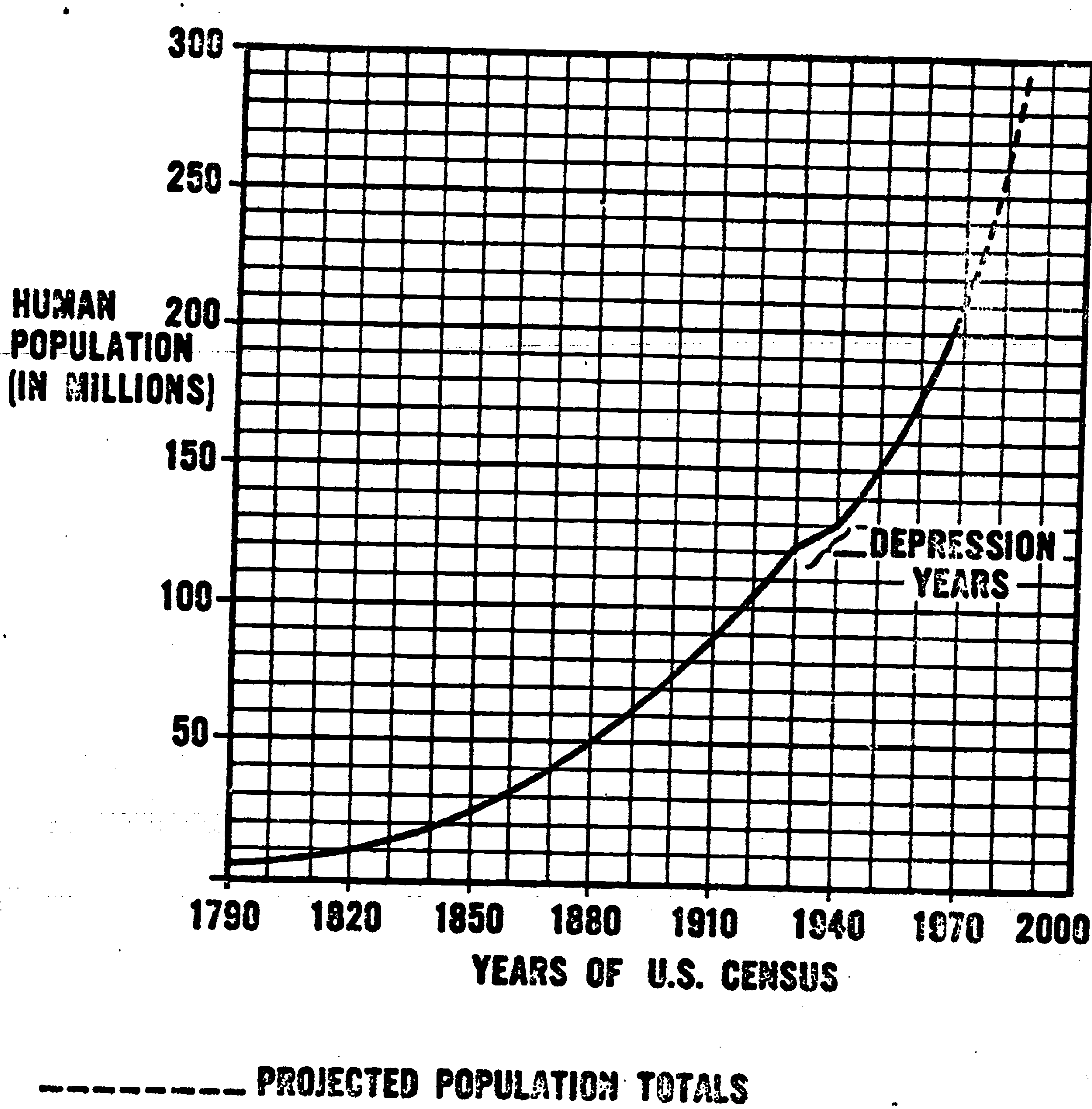
Part B - After discussing the questions in Part 1, pass out the ditto sheets for each student. Have the students read the ditto then ask the following question:

How would you suggest over population problems can be solved?

This activity should be used as a lead in for the activities on solutions which follow.

Activity #59

U.S. POPULATION GROWTH CURVE



NOTES

Activity #59 Teacher use or any interested student.

JUST TOO MANY PASSENGERS FOR THE SPACESHIP EARTH

by Isaac Asimov

The first mistake is to think of mankind as a thing in itself.

It isn't.

It is part of an intricate web of life. And we can't think even of life as a thing in itself. It isn't. It is part of the intricate structure of a planet bathed by energy from a sun.

The Earth, in the nearly five billion years since it assumed approximately its present form, has undergone a vast evolution.

When it first came into being, it very likely lacked what we would today call an ocean and an atmosphere. These were formed by the gradual outward movement of material as the solid interior settled together.

Nor were ocean, atmosphere and solid crust independent of each other after formation. There is interaction always: evaporation, condensation, solution, weathering. Far within the solid crust there are slow continuing changes, too, of which hotsprings, volcanoes and earthquakes are the more noticeable manifestations here on the surface.

Between two and three billion years ago, portions of the surface water, bathed by the energetic radiation from the Sun, developed complicated compounds in organization sufficiently versatile to qualify as what we call "life."

Life-forms have become more complex and more various ever since.

But the life-forms are as much part of the structure of the Earth as any inanimate portion is. It is all an inseparable part of a whole.

If any animal is isolated totally from other forms of life, then death by starvation will surely follow.

If isolated from water, death by hydration will follow even faster.

If isolated from air, whether free or dissolved in water, death by asphyxiation will follow still faster.

If isolated from the Sun, animals would survive for a time, but plants would die, and if all plants died, all life would cease.

It works in reverse, too, for the inanimate portion of Earth is shaped and molded by life. The nature of the atmosphere has been changed by plant activity (which adds to the air the free oxygen it could not otherwise retain). The soil is turned by earthworms, while enormous ocean reefs are formed by coral.

The entire planet, plus solar energy, is one enormous intricately interrelated system. The entire planet is a life-form made up of non-living portions and a large variety of living portions (as our own body is made up of non-living crystals in bones and non-living water in blood, as well as of a large variety of living portions).

In fact, we can pursue the analogy. A man is composed of 50 trillion cells of a variety of types, all interrelated and interdependent. Loss of some of those cells, such as those making up an entire leg, will seriously handicap all the rest of the organism; serious damage to a relatively few cells in an organ such as the heart or kidneys may end by killing all 50 trillion.

In the same way, on a planetary scale, the chopping down of an entire forest may not threaten Earth's life in general, but it will produce serious changes in the life forms of the region and even in the nature of the water run-off and therefore in the details of geological structure.

A serious decline in the bee population will affect the numbers of those plants that depend on bees for fertilization, then the numbers of those animals that depend on those particular bee-fertilized plants and so on.

Or consider cell growth. Cells in those organs that suffer constant wear and tear - as in the skin or in the intestinal lining - grow and multiply all life long. Other cells, not so exposed, as in nerve andmuscle, do not multiply at all in the adult, under any circumstances. Still other organs, ordinarily quiescent, as liver and bone, stand ready to grow if that is necessary to replace damage. When the proper repairs are made, growth stops.

In a much looser and more flexible way, the same is true of the "planet-organism" (which we study in the science called ecology). If cougars grow too numerous, the deer they live on are decimated and some of the cougars die of starvation so that their "proper number" is restored. If too many cougars die, then the deer multiply with particular rapidity and cougars multiply "quickly in turn, till the additional predators bring down the number of deer again.

Barring interference from outside, the eaters and the eaten retain their proper numbers and both are the better for it.

If the cougars were all killed off, deer would multiply to the point where they destroy the plants they live off, and more would then die of starvation than would have died of cougars.

The neat economy of growth within an organism such as a human being is sometimes - for what reason, we know not - disrupted, and a group of cells begin growing without limit. This is the dread disease of cancer, and unless htat growing group of cells is somehow stopped, the wild growth will throw all the body structure out of true and end by killing the organism itself.

In ecology, the same would happen, if, for some reason, one particular type of organism began to multiply without limit, killing its competitors and increasing its own food supply at the expense of that of others. That, too, could end only in the destruction of the larger system - most or all of life and even of certain aspects of the inanimate environment.

And this is exactly what is happening at this moment.

For thousands of years, the single species, Homo sapiens, to which you and I have the dubious honor of belonging, has been increasing in numbers. In the last couple of centuries, the rate of increase has itself increased explosively.

At the rate we are going, without birth control, then even if science serves us in an absolutely ideal way, we will reach the planetary high-rise with no animals but man, with no plants but algae with no room for even one more person, by 2430 A.D.

And if science serves us in less than an ideal way (as it certainly will) the end will come sooner, much sooner, and mankind will start fading, long, long before he is forced to construct that building that will cover all the Earth's surface.

So, if birth control must come by 2430 A.D. at the very latest, even in an ideal world of advancing science, let it come now in Heaven's name; while there are still oak trees in the world and daisies and tigers and butterflies; and while there is still open land and space; and before the cancer called Man proves fatal to life and the planet.

Activity #60

Population/Environment

Each seventh grade teacher will have access to a packet called Investigations in Ecology, Looking Into Earth's Life Systems and Man's Impacts on Environment published by the Charles E. Merrill Publishing Co., Ohio. In the packet under "People and Environment" the cards #1-13 contain several activities and discussion oriented questions which will provide the teacher with material for the class on population's effect on the environment.

Activity #61

Lead a discussion of the meaning recyclement. Ask students to bring to class articles, pictures, or models of things in our environment which can be and have been recycled. Some examples are:

- junked cars - scrap steel
- used newspapers - clean newsprint
- bottles - returned for reuse
- cans - reprocessed tin and aluminum
- trash - glass tubing, building tiles

1. Why do both rich and poor societies need to recycle the results of their technology?

2. What is "planned obsolescence?"

3. How can we encourage and take advantage of our "trade-in" practices (e.g., used cars for new ones, etc.) with retailers as a means of promoting one form of recyclement?

Activity #62

Display in the classroom examples of our modern, throw-away containers,* a soft drink can, a soda bottle, and a cardboard milk container. Have the students discuss what happens to these articles after they are discarded. Emphasize for the class that nature has its own recyclement process in that materials, in one form or another, are used over and over again. Man uses many things only once and then discards them, often in a nondegradable form.

1. Why do our products seldom come in reusable containers any more?

2. Of what materials are reusable containers <u>and</u> discards made?

3. Do these materials readily return to their sources?

4. How are we hindering nature's process of recyclement?

5. How can man reduce the amount of waste he produces?

6. What can individuals do to limit waste?

(* A collection could be made by the students.)

Additional Activity

Activity #63

Problem: Can paper be recycled?

Materials:

- newspaper
- chlorine bleach and container
- solvent (from paper company)
- blender
- measuring instruments
- rubber spatula
- sauce pan
- wooden spoon
- tablespoon
- hot plate
- glass container
- screen sieve (100 mesh wire)
- can mold
- roller
- blotter paper

Procedure:

1) Tear up about 8 sheets of newspaper in squares about the size of the palm of your hand. Place this in a blender and fill with water. Grind this very fine (about one minute). Pour into a saucepan and heat to about 85°F. Add about one tablespoon solvent to the solution. Continue to heat and stir for about 15 minutes.

2) Pour the solution into a can mold through a screen and wash with water by pouring additional water through the screen. Press out the water with a blotter, put the mixture back in the blender, add more water and grind again. Add two tablespoons of chlorine bleach and stir. Pour the solution through the screen and wash with water. Press out the excess water to produce a harder paper and finally allow the paper to thoroughly dry.

3) If possible, repeat the above procedure with other types of papers besides newspapers.

Observations:

Compare the recycled materials with a piece of original newspaper in as many aspects as possible - texture, color, strength, durability, etc.

Conclusions:

1) Which types of paper are hardest to recycle? Eastiest? What about colored paper compared to white paper? What about the tickness of paper? What other aspects can you think of for comparison?

2) What are the advantages and disadvantages of using recycled paper?

3) What wastes did you produce in recycling paper? What will you do with them?

4) Try to determine how many businesses actually use recycled paper.

Act. #64

HOMEMADE SOAP RECIPE

1. Pour 1c. of cold water into a container.

2. Add 5tbs. of lye. Be very careful to prevent spillage. Use gloves or cover hands with vaseline. When purchasing lye, don't buy too much at once since it will lose potency quickly, once opened.

3. Mix over a sink until dissolved and clear, then let it set for a few minutes.

4. Put 3c. of any lard, animal fat, bacon drippings, or candle stubs into a blender (or you may stir by hand).

5. Pour the lye over the fat and mix. If you are using a blender, start on low for a short time, then continue on fast speed.

6. Blend well until thickened.

7. Pour into a pyrex cake pan or a wooden mold. Use cheesecloth or old nylons to strain the chunks out. Let is set for several days. The secret is slow setting up.

8. Cut into bars. This is best done by suspending a strong, thin wire between two sticks and pulling this through the soap.

9. Store in airtight containers.

The soap made in this fashion can be used as hand soap or can be flaked for use in dishwashing and laundry.

If you become proficient in the above techniques, then you can get a bit fancier and add accessory ingredients to make your soap softer, more colorful, and sweetly scented. Ingredients such as glycerine and alcohol, vegetable coloring powders, and essential oil perfumes will do the job when added during the melted stage in preparation of soaps.

Activity 57 & 58 taken from Everyman's Guide to Ecological Living by Greg Cailliet, Paulette Setzer, Milton Love, The Macmillan Co., N.Y. copyright 1971.

TEACHER REFERENCE: COMPOSTING

Compost is the basic tool of organic gardening, and is the natural step in the biological cycle between dead or unused organic matter and growing plants. It returns to the ground the nutrients removed during plant growth and maintains the tilth of the soil. Compost is the most complete and revitalizing and the least expensive form of soil additive a garden can receive.

The production of compost is very easy and can be carried out at various levels of sophostication and time-space-energy requirements. The simplest approach to composting is the heap. One simply piles, preferably in layers, straw, weeds, or lawn clippings; manure and pet deposits; kitchen refuse (organic); seaweed (preferably with the salt washed off); and any other organic material he comes by.

The bin is preferable to the heap because it keeps out dogs and provides better exposure of the decaying material to the air. This means that both aerobic and anerobic bacteria can be at work, causing faster decomposition and eliminating any odors. (If a layer of grass clippings and/or soil is kept on the top of the pile and odoriferous materials are sunk in below this layer, odor isn't much of a problem anyway.) Compost bins can easily be constructed of rocks, stones, or broken bricks, leaving spaces for air to enter. Or you can simply sink four corner posts and stretch picket fencing or poultry wire around them to form the sides. You may want to construct a more elaborate wooden bin with slotted sides, including perhaps a drainage system whereby you can retrieve water which has perculated down through the pile. This "compost water" is useful for treating sick plants or encouraging young ones to grow faster. If you have very limited yard space, you may want to try a round metal container that can be partially buried in the ground (e.g., the Bard-Matic Garbage Eliminator or a rusty metal garbage can). Household vegetable and meat wastes put into this container will provide humus for potted plants and window boxes.

The amount of time it takes to produce compost or humus, by any of these methods varies with moisture, season, and the types of materials present in the pile. Usually the compost is ready in three to six months. Addition of such materials as kitchen scraps, pet wastes, and manure speeds up decomposition because of their relatively high nitrogen content. Occasional turning of the pile also speeds decomposition. The compost pile should be kept about as moist as a damp sponge, which means uncovering it in wet weather and watering it in very dry weather.

Plastic bags of the type sold for lining trash cans can be used as mini-compost bins. Material to be composted should be moistened slightly and put in the bag. Then close the bag, fasten the top, and place it in a shady spot. In warm weather, humus should be ready in a few weeks, and the bag can be filled with new material for composting.

pg. 59-60.

Activity #66

Present students with the following situation based upon an actual occurrence.

The residents of a badly eroded hill-country area, where most of the forest had been completely lumbered 25 years previously found that they had to drill their wells deeper in order to maintain their water supplies. They also discovered that during periods of drought their crops were more likely to fail than had been the case prior to the lumbering operations. An organization of sportsmen in a nearby city formed a corporation to buy the land and build a dam on a small spring-fed stream in order to provide fishing and other recreational facilities. The local property owners disapproved the proposed project on the basis that it would tend to spoil farm land and would have the undesirable effect on bringing large numbers of sportsmen and vacationers into the area.

1. Why had the land owners not objected to the lumbering operations 25 years ago?

2. Does construction of the dam present a more serious threat to their land than the lumbering operations did long ago? Explain.

3. What is the relationship between the lumbering of the forests and the erosion now being experienced?

4. What is the relationship between the lumbering of the forests and the erosion now being experienced?

5. Are the objections of the land owners to construction of the dam valid?

6. What might be the arguments for and against construction of the dam?

7. What alternatives did the land owners have 25 years ago?

8. What alternatives do they have now?

9. How might these people arrive at a sound decision with respect to their problems?

Activity #67

Optional

Free Record - "Tom Lehrer Sings Pollution" (3 min. 3/W. Free Public Health Service, Audio Visual Facility, Atlanta, Georgia 30333)

Preview this film which vividly portrays the various forms of pollution in our environment. Jot down the lyrics for students and ask for a reaction to them. Show the film.

1. What is Tom Lehrer's attitude toward the pollution problem?

2. How does Tom Lehrer feel about the way the country is moving to correct the problem?

3. To whom is he directing his music?

4. Give students an opportunity to write their own lyrics about the pollution problem.

5. Consider how Tom Lehrer might react to a community allowing a major producers of industrial waste to locate in that community.

6. Is this a convincing way to present a problem or issue for discussion?

7. What are the advantages and disadvantages of such a presentation?

8. What should be our attitude toward the pollution?

SUPPLEMENTARY TEACHER INFORMATION

A- Air Pollution

1. Sources of Air Pollution
   automobiles and buses, and motorcycles
   coal, oil, and heating fuels
   radioactivity
   ozone from lightning
   erosion of soils - dust) natural
   pollens
   industrial smoke
   cigarette smoking - personal pollution
   trains
   planes
   aerosols

2. Types of Air Pollutants
   sulfur oxides - industrial smoke (coal and oil combustion)
   Carbon monoxide - car exhaust
   nitrous ozide - engines
   particulates - steel, cement and asphalt factories

3. Diseases Related to Air Pollution
   asthma - swollen bronchial tubes
   emphysema - stretched and ruptured air sacs
   lung cancer - abnormal growth of cells
   black lung - prevalent among coal miners
   tuberculosis - bacterial infection of lung
   chronic bronchitis - consistent infection of bronchial tubes

B- Water Pollution

1. Sources
   land erosion
   dissolved minerals salts
   fertilizers
   pesticides
   residential sewage
   oil slick from tankers
   thermal pollution by atomic plants
   paper mills
   slaughter houses
   cheese factories
   canneries
   hospitals
   chemical industries
   mining acids
   sewage from ships
   phosphates from detergents

lead from gasoline
silo and barnyard drainage
stormcellar overflow
lack of proper sewage treatment (no tertiary step)
citrus processing industry
tanning factories

2. Types of Water Pollutants

sediments
mineral salts
acids
mercury
lead nitrates
phosphates
toxic organic chemicals (most synthetics)
disease causing organisms
sewage
radioactive substances
oil
heat

3. Diseases Related to Water Pollution

typhoid fever - intestinal bacteria, carried by contaminated people, food or water, vaccination available
cholera - intestinal bacteria, carried by flies and contaminated food and water
dysentery - caused by amoeba (protzoan) or a bacterium, infects intestine, causes diarrhea and dehydration, carried by flies and contaminated food and water
polio - virus infection of motor nerves, may result in paralysis, vaccination available, transmitted by contaminated water.

Noise Pollution

A. Sources of Noise Pollution

construction
planes
motorcycles
cars, buses, trucks
*snowmibiles
live rock bands
stereos, TV, radio
sirens
motor boats
trains
"kids"

Noise Pollution (con't.)

B. Diseases Related to Noise Pollution
neuroses - emotional upsets
impaired hearing

Land Pollution

A. Sources

overgrazing of animals
poor farming practices
fire
land fill sites
pesticides and fertilizers
weed killers
strip mining
dumps and land fills
garbage and trash
auto graveyards

B. Diseases

plagues associated with vermin

Teacher Supplement

Natural History, August - September 1970, Vol. LXXIX, No. 7,
("An Environmental Lawyer Urges: Plead the Ninth Amendment!)
E.F. Roberts, p. 26

"At this point s-me lawyers, including myself, conclude that the only answer to this conundrum lies in the Bill of Rights. To put it bluntly, there exists a constitutional right to a decent environment, which mandates that every government agency -be it federal, state, or local - cast its decisions so as not to contribute further to the decline of today's environmental status quo. This decision would only operate prospectively and would not extend retroactively. The harm that has already been done can only be undone by legislative action and not by words alone; words alone, however, when they are constitutional law words, are able to ensure that past mistakes will not be repeated.

From whence can this right be derived? This is a horse soon curried. In "Griswald V. Connecticut," for example, the Supreme Court discovered a "right of privacy" inherent in the Bill of Rights, even though that right was not there in so many words. In fact, the long ignored Ninth Amendment warns us that the listing of rights in the other amendments, such as those guaranteeing freedom of religion and speech, does not eliminate other rights retained by the people. Manifestly, if the people have the freedom to exercise free speech and to enjoy their provacy, they must also have the right to a decent environment, the rest of our rights will prove illusory. We cannot enjoy our other rights if we are all dead. True, this right has never been articulated before, but until the advent of a potentially lethal technological society, there was no need to insist upon such a right. Now that there is a potential for environmental disaster, the time has become propitious for the Supreme Court, sensing the felt needs of the time, to implement within the system this fundamental right held by the people."

UNIT V

Supplementary Teacher Information

Solutions to Pollution Problems

AIR:
- underground atomic testing
- more efficient engines
- more electric vehicles
- new fuel to replace coal and oil
- more green plants (reforestation)
- less use of aerosol pesticides
- air conditioners in buildings of high contamination areas
- exhaust and smoke stack filters
- prohibition of open burning
- electrostatic precipitator
- weather control
- enforcement of present legislation

WATER:
- sedimentation
- disinfection
- removal of minerals especially toxic ones and phosphates
- proper sewage treatment and recycling
- limited use of fertilizers and pesticides
- detergents without phosphates
- prohibition of inhabited waters for atomic reactor coolants
- blanketing reservoirs to prevent evaporation
- distillation of effluents from industry
- careful oil drilling and storage
- proper industrial waste disposal or recycling
- enforcement of present legislation
- water zoning laws to prevent contamination in recreational and navigational areas
- storage of underground water
- desalination
- aeration of waterways

LAND:
- recycling of glass, metals, trash, paper
- incineration of wastes
- sanitary land fills
- Crop rotation to prevent soil mineral depletion
- prohibition of strip mining
- prevent over-grazing
- limited pesticide and fertilizer use
- cover crops to prevent run off leaching
- limited availability of disposable products
- research to produce more biodegradable products
- study of food webs and dependence on plant species

Note to Teacher

The Pollution Game could and should be played many times throughout this unit. The game is very good for the students and the more they learn about pollution and the environment, the better they will play the game. By the end of the unit they should be very competitive and play the game very well.

Hach Kits are on order. If they come in there will probably be a set for each school. They should be used in Unit V to do water quality tests. Water should be collected from different areas of the county to do these tests on. Some of these tests have to be done right on the sight, therefore, if a field trip is convenient it would be good to take one so that the student could do the tests themselves.

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