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ABSTRACT

The career exploration program for grades 9 through 10, as part of a comprehensive K through 10 career development program, attempts to develop an awareness of and appreciation for work, extend knowledge of the variety of career opportunities, and provide experiences in career areas of individual interest. The document, a collection of materials consisting of a teacher's guide, student learning experience packets, and a resource list, is designed to introduce the students to occupations in electricity and electronics. The learning activities are organized to explore different categories within electricity and electronics and include teaching strategies such as interest inventory, field trips, occupational classification, skill tests, career investigation, simulation, roleplaying, individual investigation, job analysis, career evaluation, and the compilation of a job list. A suggested course format and introduction discuss objectives and procedures. The teacher's guide is coordinated with the learning experience packets and is organized into objectives and suggested procedures, with fact sheets and illustrations supplementing the teacher's information. The multimedia resource list is coordinated with the individual learning experiences. (JB)

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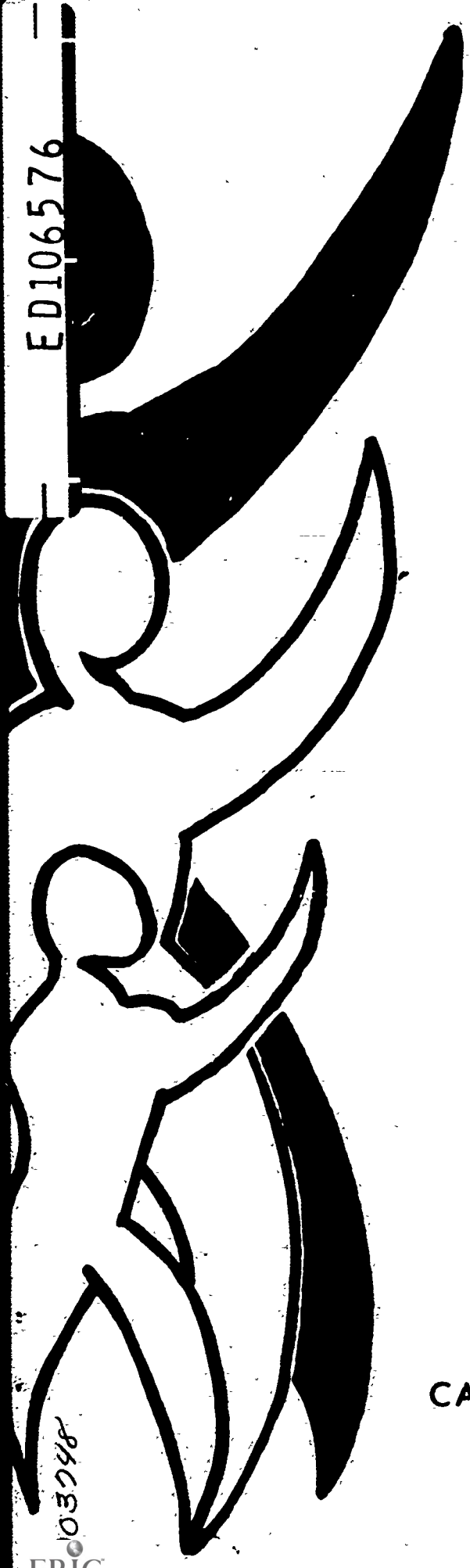

CAREER EXPLORATION 9 - 10

EXPLORING CAREERS

IN

ELECTRICITY-ELECTRONICS

First Edition
1972

CAREER DEVELOPMENT K - 10

CINCINNATI PUBLIC SCHOOLS

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CAREER EXPLORATION

Grades 9-10

CINCINNATI PUBLIC SCHOOLS

Career Exploration in

ELECTRICAL-ELECTRONIC OCCUPATIONS

(Tentative)

1st Edition
1972

CAREER DEVELOPMENT

The Career Development Program responds to the needs of students, taxpayers, and employers for the public schools to provide personal, social, and economic relevance in the educational process. It is an integral part of the educational process essential to the development of all students.

The Career Development components, which are Career Motivation (K-6), Career Orientation (7-8) and Career Exploration (9-10), develop an awareness and appreciation for work, extend knowledge of the variety of career opportunities, and provide experiences in career areas of individual interest. These goals are accomplished through a curriculum based on pupil activities involving simulation, role playing, and individual investigation. These activities require that administrators and teachers develop a new level of working relationships with community resources such as public institutions, business, labor, and industry.

Every individual's right to learn what he or she needs in order to be a producing, participating member of society is a fundamental responsibility of education. Each individual also has a right to self-fulfillment. Career Development, presented as inseparable elements inherent within every level and subject area of the school curriculum, provides each student with the skills and insights to recognize and pursue goals of personal significance. As a result of this program students will increase their abilities to make well-informed and experience-based decisions related to their personal life, school program, and career selection.

Donald R. Waldrip, Superintendent
Cincinnati Public Schools

CAREER EXPLORATION

Career Exploration is the 9th and 10th grade component of the Career Development Program. Its primary goal is to provide experiences related to career areas chosen by the student. Focus is on the student's perception of himself or herself in relation to the real world of career opportunities. Emphasis is on individualized and personalized activities and experiences.

The student chooses and studies a specific career area using skills and insights gained in earlier parts of the Career Development Program. Students explore occupations within the chosen area with particular attention to those most closely related to their own needs, interests, and abilities. They will experience some of the satisfactions, opportunities, limitations and frustrations peculiar to the various occupations.

Career Exploration is planned as the culmination of the Career Development Program. Successful exploratory experiences will enable the student to formulate and refine realistic and personally meaningful career goals. These experiences will also provide a basis for planning a course of studies in the 11th and 12th grades (and beyond) pursuing career goals.

Stanley A. Marsh
Administrative Assistant to
the Superintendent

FOREWORD

This manual is one of a series produced by the Cincinnati Public Schools as a part of a project designed to provide Career Exploration for students in grades 9 and 10.

It is designed to provide activities and information about a Group Work Trait that will provide a more in depth study than presented in Career Orientation in grades 7 and 8.

This is a tentative guide and has been developed for the purpose of field testing and revising based upon feedback from participating teachers.

ACKNOWLEDGEMENTS

This manual was developed by Katherine Flottman, a mathematics teacher at Aiken High School, and Wayne Minnick, a mathematics teacher at Schwab Junior High School. Jerome Braun, Supervisor, Secondary School Science, conducted the curriculum development under the general supervision of Mr. Ralph E. Shauck, Director of Instructional Services.

TABLE OF CONTENTS

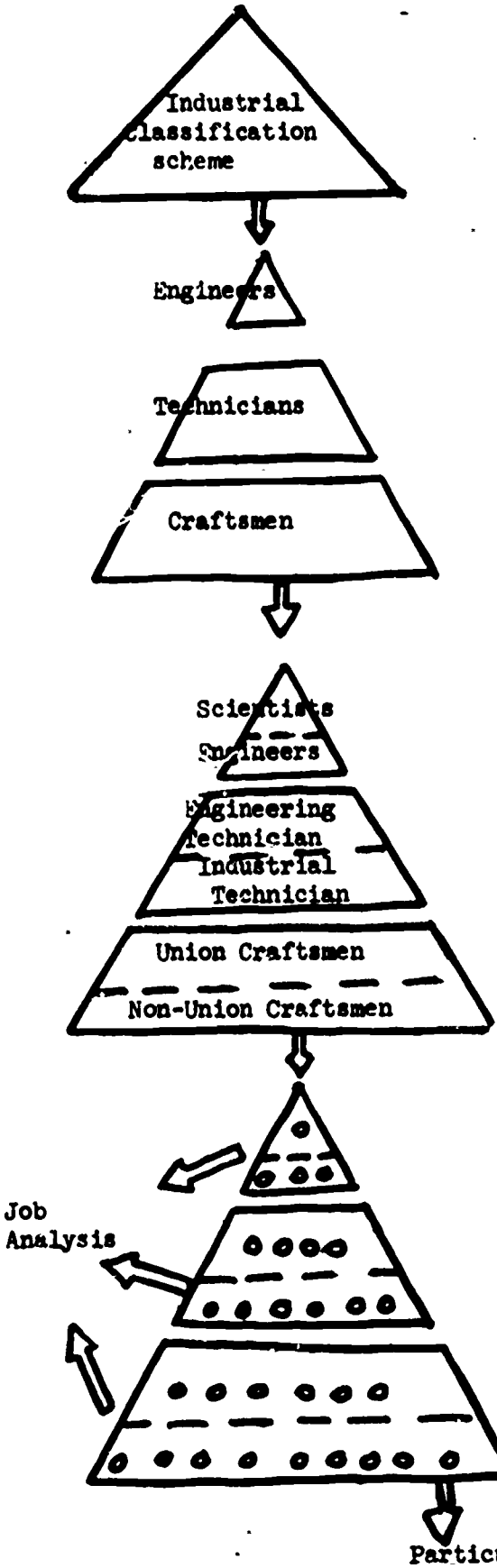
I. INTRODUCTION

INTENT: This course is designed to introduce the students to occupations in the electrical and electronic fields. The students will explore the two areas, the types of jobs in both, and a few specific jobs in one or several categories. As a result of this exploration, the pupil should become more interested or less interested in this occupational area.

STRATEGY: The student will proceed through a sequence of learning experiences. These include field trip(s), class lectures, on-the-job activities, simulation skills, aptitude tests, and job analysis. The student will be provided with some individualized studies in job investigation based on his interest through some of the preceding. At the conclusion of these learning experiences the pupil should be able to make career decisions.

PROCEDURE: This course relies heavily on teaching aids, pupil activity materials, films, and field trips. You are cautioned to review these requirements prior to the start of the school year and to review these requirements on a weekly basis throughout the school year. The second day's activity is a field trip or alternatively a film. Plan for this activity NOW!

FORMAT OF COURSE



L. E. I - II - III
(overview of field)

L. E. IV
(3 main categories of field)

L.E. IV
(Divisions of the Categories)

L.E. V - VI - VII
(Specific jobs in each area)

II. TEACHER'S GUIDE

TEACHER'S GUIDE

A. LEARNING EXPERIENCE I

Suggested Time: 1 day

Objective: To create interest in the course.

Suggested Procedure:

1. Let students read their student learning experience sheet and perform Activity 1.
2. Check with students as to possibility of using one of their parents, neighbors, friends, etc., as resource people.
3. Discuss student interest in places for field trips.
4. Discuss why student chose this course and what he expects from it.
5. Ask students to fill out the interest inventory then save this material for their use in comparison at the end of the course and for use in Learning Experience II.
6. This course format illustrates the general direction this course will take. Don't feed too much information to the student now.

B. LEARNING EXPERIENCE II Suggested Time: 4 days

Objective: To familiarize students with the types of jobs in the electricity-electronic field and with the industrial classification scheme.

Suggested Procedure:

1. Use the student L.E. sheet as your guide to each day's activities.

2. Use the resource sheet to select appropriate field trip and/or films relevant to this section. This activity is designed to show people at work in the electricity-electronic field. Explain to the class that they will be asked to list and group the jobs they are seeing on basis of skill required. Three groups are suggested: High Skill, Some Skill, Little or No Skill.

3. Pass out the inventory interest sheet to be used in activity 2 of the student L.E. sheet, but be sure to re-collect it as it is used again later.

4. The fact sheet provided will help you explain the industrial classification scheme used in activity 3 of this section.

5. Activity 4 is essentially a repetition of activities 1 and 2 now in the more sophisticated framework. (Industrial Classification Scheme)

6. Until one general purpose film is available, you might have to use the interview tapes listed on the resource sheet.

FACT SHEET FOR THE INDUSTRIAL CLASSIFICATION SCHEME

The following observations have been made about the Industrial Classification Scheme:

1. Scientists typically complete approximately eight years college education and work with discovering new facts and theories.

2. Engineers typically have four to six years college education and ordinarily work with developed ideas and theories to improve the quality and reduce the cost of consumer goods.

3. Both engineering and industrial technicians require some education beyond high school.

4. The important distinction between engineering and industrial technicians is that engineering technicians are more likely to have completed a prescribed two year college level program and have a more highly developed ability and interest in mathematical abstractions.

5. Apprenticed Craftsmen are usually associated with recognized union trades such as electricians.

6. Non-apprenticed craftsmen can be illustrated by appliance repairmen and some TV repairmen performing the more routine tasks in larger TV repair shops. The person doing more difficult TV repair work would ordinarily be classified as an industrial technician.

C. LEARNING EXPERIENCE III SUGGESTED TIME: 5 days (2 days of options are included)

OBJECTIVES

To acquaint the student to some job-related hardware.
To continue exploration of student's tentative attitudes and aptitudes.
To provide activities which may permit the pupil to infer future success in this occupational area by acquainting the student with some of the psychomotor skills required.

PROCEDURE

1. Note that the option activities 3 and 4 are preferred activities.

2. For activity one:

   A. Be sure that each student works in both fields. Note the pupil's activities on the last day to be sure of this caution.

   B. Some kits may require soldering and you might consider sending small groups to the industrial arts area in your school.

   C. Refrain from giving group instruction on kit details. Students should work individually.

3. For activity two: Explain that the limitation of this test is that it is not an absolute prediction of success.

4. Use the resource list to co-ordinate activities 3 and 4.

5. For activity 4 you might find it necessary to make phone calls to verify student's presence at the job site.

   You might want to enlarge the scope of this activity to include classroom pupil reports and role playing.

   This activity could be accomplished by student's part time job or in the businesses owned or operated by student's parents or relatives.

   An additional method to accomplish this activity is for the pupil to work or observe vocational education upper-classmen in your school or other student's at technical institutes.

6. Kits, tests and simulation apparatus will contain operational instructions and teacher guides. Consult these in advance.

D. LEARNING EXPERIENCE IV SUGGESTED TIME: 11 days

OBJECTIVE

To specify duties, opportunities, and requirements of jobs in each of the industrial classification categories requiring training or education beyond high school.

PROCEDURE

1. For activity one:

   A. Consult resource sheet for resource people. Be sure to contact people in each of the 3 categories; i.e., at least 3 people will be required.

   B. You will probably want to use 6 days for this activity because the pupil should complete a worksheet after each speaker.

   C. You will probably want to allow time for pupils to interchange ideas after completing worksheets.

   D. These worksheets may be prepared individually or in small groups.

2. For activity two:

   A. Pamphlets used for this activity should be local companies only to enhance the relevancy of this activity.

   B. You might let class generate a good sample letter and write on blackboard for their assistance.

   C. Be sure to let pupil request information about a category which is of particular interest to him.

   D. Don't let pupils request pamphlets, which are already in the classroom.

   E. You will need to make telephone books available to the students to obtain addresses.

   F. Stamps should be obtained from the school office or are enclosed with course materials.

3. For activity three:

   A. Use resource sheet to choose film.

   B. This activity reinforces the concepts in Learning Experience II.

   C. Classification worksheets can be compiled individually or as a group activity.

E. LEARNING EXPERIENCE V SUGGESTED TIME: 6-8 days

OBJECTIVE:

To refine pupil's understanding of the industrial classification scheme so that he can learn what he must do to perform and obtain specific jobs associated with his occupational interest.

PROCEDURE:

1. For activity one:

   A. You will need to have several copies of the "Yellow pages" of the phone book available, as well as copies of current want-ad sections of newspapers. However, the list will primarily be generated from the student's knowledge.

   B. Consult the resource sheet for field trip information and films available.

   C. You will have to begin activity 2 relying on a homework assignment:

      1. Explain to pupils that the Job Analysis Worksheet may be completed by telephone, but personal interview is preferred.

      2. Be sure to hand out the Job Analysis Worksheet at the conclusion of Activity one.

2. For activity two:

   A. Group the students by the category which they have selected.

   B. Role-playing can be done like this: One pupil assumes the role of an employer and a second pupil assumes the role of the applicant for a particular job. The interview takes place.

   C. This activity should be repeated at your discretion.

F. LEARNING EXPERIENCE VI SUGGESTED TIME: 3 days

OBJECTIVE: To show the significance of school subject content in relation to the electricity-electronic occupations.

PROCEDURE:

1. You will want to spend 1 day on problems from each of the 3 categories, i.e., craftsman, technician, and engineer.

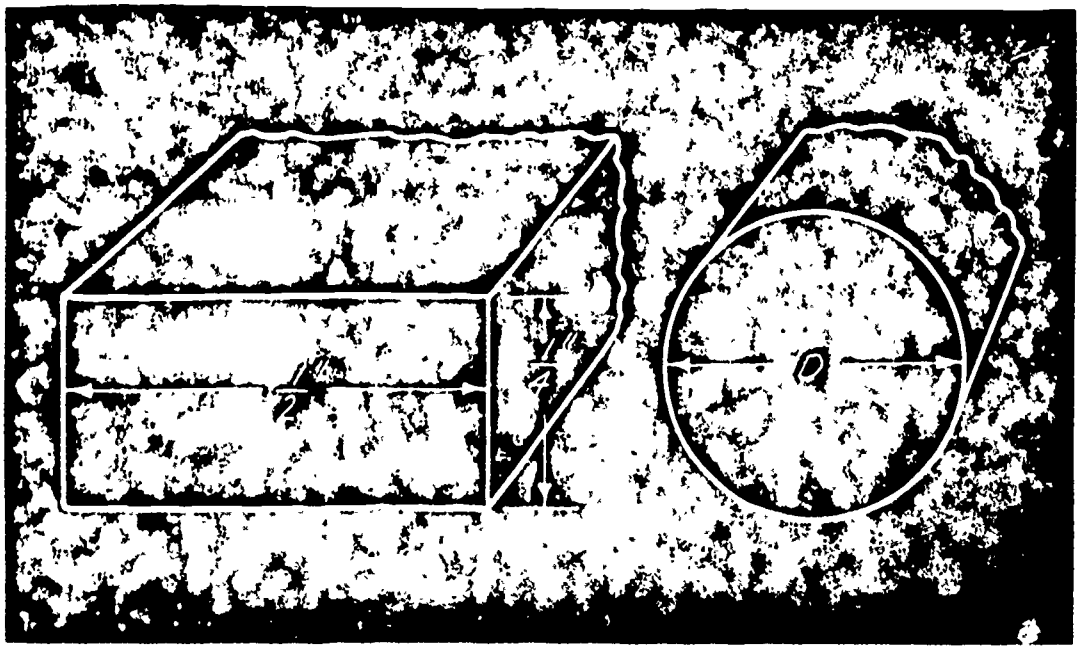
2. The Job Related Problems Worksheet is an open-ended assignment and it is not required that even the most capable students complete all of the problems.

3. Feel no obligation to explain the technical content or procedural methods used in solving the problems on the Industrial Problems Reference Sheet. These illustration problems are typical ones arising in routine work situations. The intent is to point out to the students the types of problems they will solve if they work at the job level described.

4. For part B of this activity, refer to Sample Problems Worksheet, and demonstrate the sample for the students. Work with the students on problem of their Job Related Problems Worksheet. Then ask the students to solve as many of the remaining problems as they can.

5. You might need to help individual pupils with their work or assign a student helper to them.

6. Students should prepare vocabulary list of unfamiliar words to ask the resource people in L.E. VII.



A copper bus bar, a large size conductor for heavy electrical current, must sometimes be replaced by copper wire. In order to carry the current safely, the wire must have the same cross-sectional area as the bus bar it replaces. The problem here is to determine the proper diameter in standard mils for this wire.

The following information will be helpful:

Square mils $= 1{,}000{,}000 \times$ Area of bar

Circular mils $= \frac{\text{Square Mils}}{.7854}$

The diameter in mils equals the square root of the number of circular mils.

A standard mil is 1/1000th of an inch.

Solid copper conductors of larger cross sections and greater current-carrying capacity, such as are required for bus bars, are usually of rectangular cross section, because of the greater ease with which they may be bent, bolted, and soldered.

Calculation:

1st step - Calculate cross section area of bus bar in "Square Mils."

Area in "Square Mils" = 1,000,000 x Area of Bar

= 1,000,000 x $\frac{1}{2}$" x $\frac{1}{4}$"

Area = 125,000 Sq. Mils.

2nd step - Calculate "Circular Mils" Equivalent to the "Square Mils," area of the bus bar.

Circular Mils = $\frac{\text{Square Mils}}{.7854}$ = $\frac{125,000}{.7854}$ =

Required area of round conductor expressed in "Circular Mils" is = 159,409.22

3rd step - Calculate the diameter of the round conductor in mils. This is done by taking the square root of the cross section area which is expressed in circular mils.

Diameter of round conductor in mils =

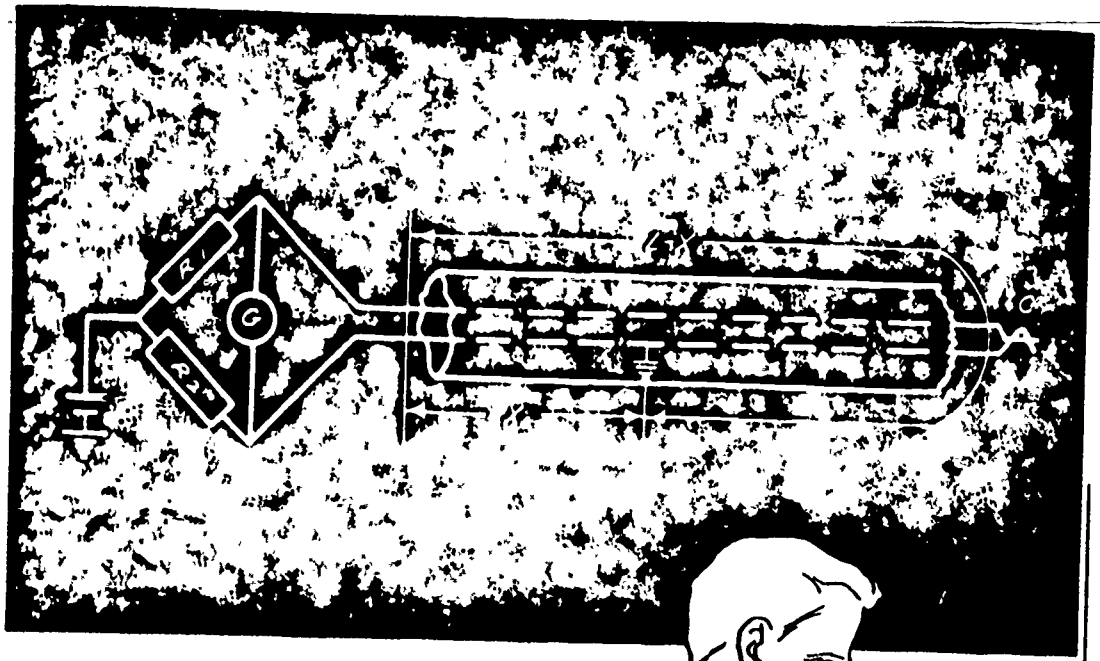
$\sqrt{\text{Circular Mils area}}$ = $\sqrt{159,409.22}$

Required Dia. in mils = 399.2 (ANSWER TO PROBLEM)

Note: The required wire is between 1/3 and 1/2 inch in Diameter. It is exactly .3992 inch in diameter.

CRAFTSMAN WORKSHEET ANSWERS

1. Gauge #13 rubber insulated or #14 other insulated.
2. Gauge #4 rubber insulated or #6 other insulated.
3. Gauge #14 rubber insulated.
4. Gauge #0000 rubber insulated.
5. Gauge #18 other insulated.
6. 90
7. 50
8. 6
9. 35
10. 175



A few computations will enable the technician to locate a ground in an underground cable which may be several miles long. Using the bridge circuit in the above problem, if R_2 equals 250 ohms, and the total length (L) of the cable in the entire loop is 4,000 feet, he can readily determine the distance X.

FORMULA: $\frac{R}{L-X} = \frac{R_2}{X^2}$

Calculation:

1st step - The formula must be rearranged so that it is more convenient to solve for X.

$$\frac{R_1}{L-X} = \frac{R_2}{X} \quad , \quad R_1X = R_2(L-X) \quad , \quad R_1X = R_2L - R_2X$$

$$R_1X + R_2X = R_2L \quad , \quad X(R_1 + R_2) = R_2L$$

$$X = \frac{R_2L}{R_1 + R_2}$$

2nd step - Substitute the observed values of R_1 , R_2 and L into the rearranged formula and solve.

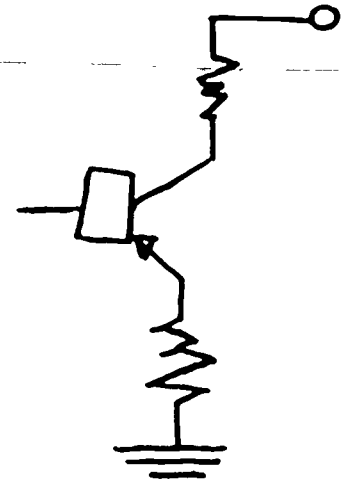
Given: $R_1 = 750$ ohms, $R_2 = 250$ ohms, $L = 4000$ ft.

$$X \text{ in feet} = \frac{R_2L}{R_1 + R_2} = \frac{250 \times 4000}{750 + 250}$$

$$X \text{ in feet} = \frac{250 \times 4000}{1000} = \boxed{1000 \text{ feet}}$$ (ANSWER TO PROBLEM)

TECHNICIAL SAMPLE PROBLEMS WORKSHEET

1.



There are 2 milliamps (.002) of current (I) which flows through R. If R = 1 ohm, what is the voltage E across R?

E = I x R
E = .002 x 1
E = .002 ampheres.

2. $I = \frac{E}{R}$ If E = 925 V and R = 5 Ω then I = _____

$I = \frac{925\ V}{5} = 185$ amp.

3. $R = \frac{E}{I}$ If E = 75 V and I = 5 amp then R = _____

$R = \frac{75\ V}{5\ amp} = 15\ \Omega$

4. E = I x R If I = .026 and R = 33 ohms then E = _____

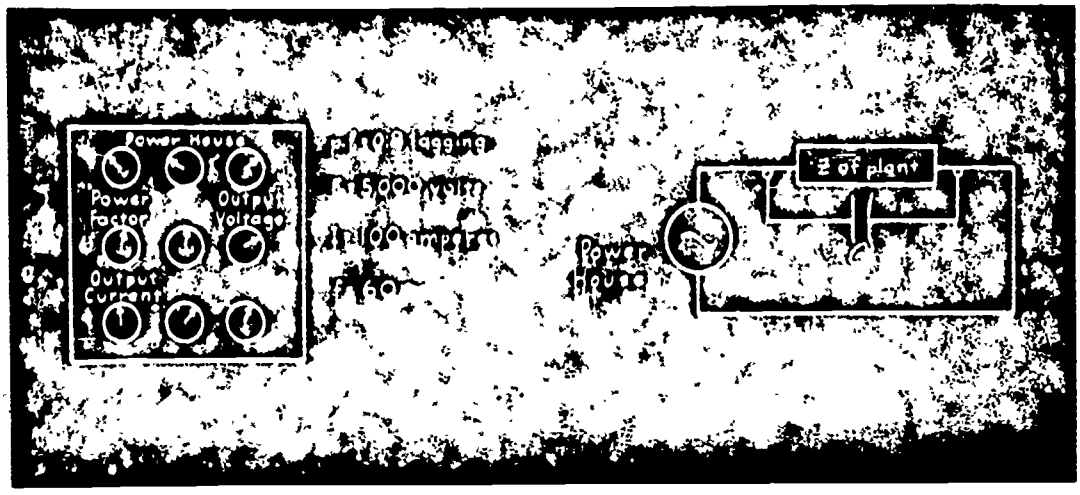
E = .026 x 33 = .858 V

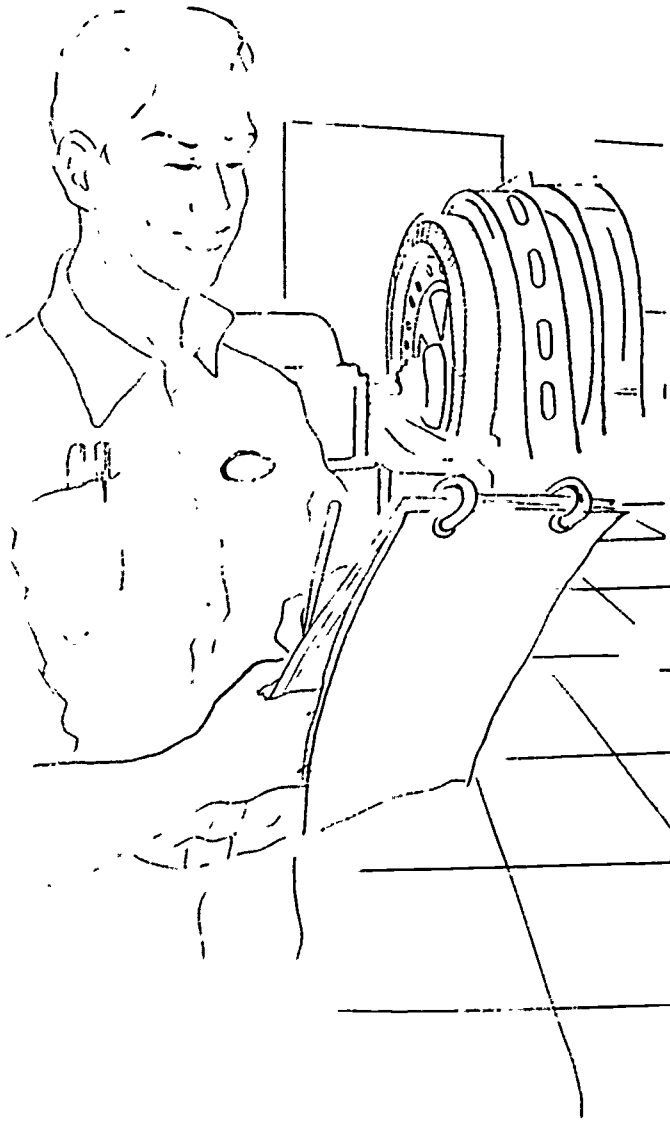
TECHNICIAN WORKSHEET ANSWERS

1. 2 amp.
2. .6 amp.
3. 23 amp.
4. 50 amp.
5. 2 amp.

6. 25 olims
7. 2 olims
8. 106 olims
9. 11 olims
10. 134 olims

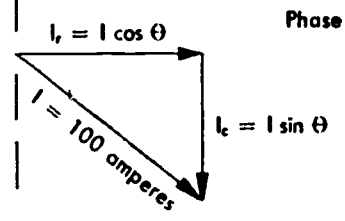
11. .075 V
12. .090 V
13. .156 V
14. .459 V
15. .252 V





The study of electrical distribution requires a knowledge of power factor correction. In the illustration below, it would be necessary for the engineer to find: (1) The amount of capacitance, C, required to produce unity power factor at a frequency, F, of 60 cycles; and (2) The amount of current, I_r, which would be required at a power factor of 100%.

The following information will be helpful:



Phase Angle $\theta = 36° 52'$

$I_c = I \sin 36° 52'$

$X_c = \frac{E}{I_c}$

$C = \frac{1}{2\pi f X_c}$

$I_r = I \cos 36° 52'$

$\bar{Z}$ = represents the total impedance of the plant's electrical equipment.

ENGINEER SAMPLE PROBLEMS WORKSHEET

What is the true power in an A.C. Circuit if

E = 100 V, I = 1 amp, and the phase angle (θ) = 10° ?

TRUE POWER (watts) = E I cos θ

True Power = 100 V x 1 amp x .9848

True Power = 100 x .9848

True Power = 98.4800 watts

ENGINEER WORKSHEET ANSWERS

1. 1069.20 WATTS
2. 1469.15 WATTS
3. 2593.572 WATTS
4. 6993.9 WATTS
5. 20071.9440 WATTS
6. 5919.48 WATTS
7. 4748.8 WATTS
8. 4341.0 WATTS

G. LEARNING EXPERIENCE VII SUGGESTED TIME: 6 days

Objective: To further increase student's ability to relate the "World of Work" to his own interests.

To provide student an opportunity for self-discovery about his growth in knowledge of the "World of Work".

To be able to evaluate the success of course.

Procedure: For activity one:

1. a. Refer to the resource list to obtain speakers in a particular job from each of the five areas.

   b. Be sure that the speakers can give information about their daily activities on the job.

   c. As an alternative to speakers, you could use interview tapes.

For activity two:

2. a. Pass out the job list.

   b. Caution the students to make this as realistic as possible, i.e., they should list the jobs that they expect to some day obtain.

   c. Advise students that this information is personal and need not be shared with anyone else.

   d. The file number on the Job List refers to the SRA Career Kit available in most libraries.

For activity three:

3. a. Distribute Career Evaluation Worksheet.

   b. Advise the pupils that this worksheet will be collected.

   c. After the students have completed the Career Evaluation Worksheet, hand out to each student his Interest Inventory.

   d. Have students compare their responses on items 2, 4 and 5 of the Career Evaluation Worksheet with items 1, 2 and3 on the Interest Inventory.

   e. Collect these worksheets and make a similar comparison as one method for evaluating the success of this course.

III. STUDENT INSTRUCTION PACKETS

STUDENT LEARNING EXPERIENCE SHEET

A. LEARNING EXPERIENCE I

OBJECTIVE: Understand how the course will be conducted.

Begin to explore your understanding of electricity and electronics.

ACTIVITY:

1. Read Introduction sheet.
2. Answer the Interest Inventory Sheet.

RESOURCES:

1. Introduction
2. Interest-Inventory

INTRODUCTION - What are we going to do in this course?

You have expressed a desire to explore the career of electricity-electronics. This is the first of seven learning experiences designed to help you make the best possible career decision. The purpose of this first learning experience is to describe briefly how the course will be conducted.

By field trips and films you will see people working in a wide variety of jobs involved in electricity and electronics. You will participate in laboratory exercises and self-interest tests. Pamphlets from local businesses will allow you to investigate the wide variety of job opportunities. After identifying and grouping jobs into their proper categories, you will analyze several specific jobs of your choice. Whenever possible you will be encouraged and assisted in observing and helping people performing these jobs. You will become aware of needed scholastic skills by performing job related tasks and problems. Skilled workers will share their information and feelings about job opportunities and requirements for each of the job categories you have identified. At the conclusion of the course you will be asked to describe your ideas toward the electricity-electronics fields as your career.

INTEREST INVENTORY

1. Why do you think that you might be interested in an electricity-electronic occupation?

2. How many jobs can you name in the electricity-electronic fields? List them.

3. What kind of job do you think would make you happy?

4. List questions which you would like answered while exploring this career?

STUDENT LEARNING EXPERIENCE SHEET

B. LEARNING EXPERIENCE II

OBJECTIVE: Acquaint yourself with and identify the jobs in the field.

Discriminate between jobs on basis of skill.

Examine industries' pyramid.

Test your ability to use the industrial classification pyramid.

ACTIVITY:

1. Field trip or film.

2. a. Add to the inventory interest list the jobs you saw.
   b. Sort by skill these jobs into several categories.
   c. Compare and contrast with four or five other students and agree on one listing.
   d. Present to the class your group's list.
   e. Compile one classification.

3. a. Examine industries' classification pyramid.
   b. Compare and contrast this industrial classification to that compiled by class.

4. a. Film
   b. Generate list of jobs seen in film.
   c. Locate these jobs in pyramid on sheet provided.

RESOURCES:

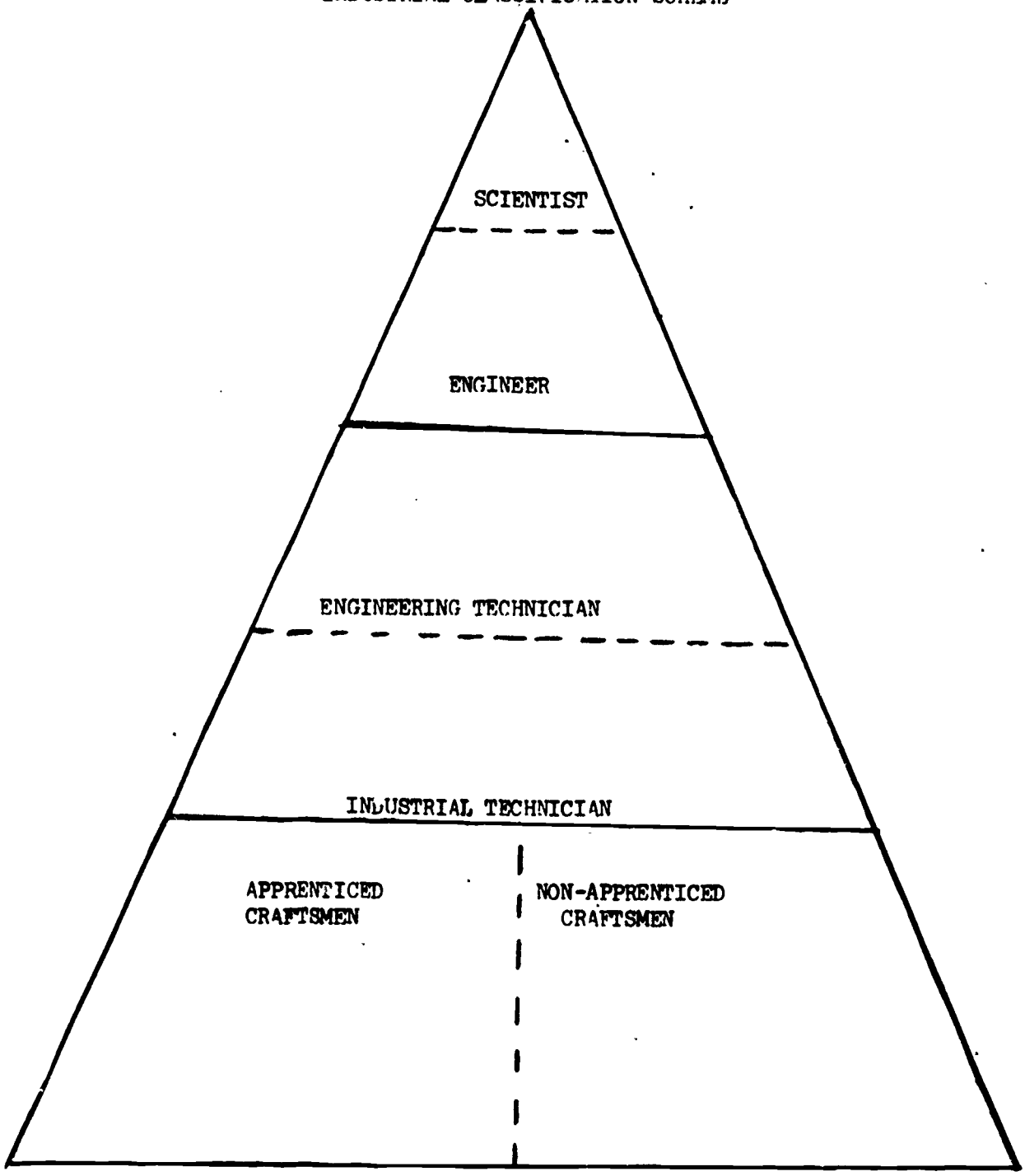
1. Field trip or film.

2. Pupil's Inventory Interest Sheet from Learning Experience I.

3. Industrial classification scheme.

4. Worksheet
   Film

INDUSTRIAL CLASSIFICATION SCHEME



Industrial Classification Worksheet

SCIENTIST AND ENGINEER	TECHNICIAN		CRAFTSMAN
	ENGINEERING	INDUSTRIAL	

STUDENT LEARNING EXPERIENCE SHEET

C. LEARNING EXPERIENCE III

OBJECTIVE: Investigate some of the skills necessary to perform in the electricity field and some skills necessary in the electronics field.

Evaluate your probability for success and your interest in the electricity-electronics field.

Compare your mechanical and reasoning ability to those which may be required in this occupation.

Observe and gain experience about daily work activities of people employed in this field.

ACTIVITY:

1. a. Decide whether you want to work with the electricity or electronic kits first.
   b. Begin with kit one in your chosen field and work in sequence as many kits as you can.
   c. Change over to the other field.
   d. Begin with kit one and work in sequence as many kits as you can.

2. a. Answer the test questions on your interest survey test.
   b. Measure yourself against the norms given by the teacher.

OPTIONS

3. a. Perform the task on the apparatus provided.
   b. Compare your skill with others in the class.
   c. Relate the results to your success in the electricity or electronics occupations.

4. a. Report to a work site.
   b. Observe and assist (if possible) the particular worker to whom you are assigned.
   c. Write a brief paragraph describing what you did and what you saw (include name of worker, what his job was, and whether or not you would like his job).

RESOURCES:

1. a. _____kits in electricity field
   b. _____kits in electronics field.

2. Interest Survey Test

3. Apparatus

4. Work Sites

STUDENT LEARNING EXPERIENCE SHEET

D . LEARNING EXPERIENCE IV

OBJECTIVE:

1. a. Recognize the educational preparation, other entrance requirements, and training needed for jobs in each category of the Industrial Classification scheme.
   b. Consult resource people about employment opportunities.

2. Consult company literature to research jobs available in the electricity-electronics field.

3. Classify jobs in the categories of the industrial classification scheme.

ACTIVITY:

1. a. Consult resource people.
   b. Answer the questions on the Career Investigation Worksheet.

2. a. Select pamphlets from 4 different companies for a particular category of work. Study these pamphlets for answers to questions on the Company Employment Description Worksheet.
   b. List the names and addresses of 3 companies for which you might want to work.
   c. Send letters to these 3 companies requesting literature about job opportunities.

3. a. Observe film
   b. Differentiate jobs in the film by listing them.
   c. Separate the jobs listed according to the headings on the worksheet.
   d. Discuss critically with the class your list.

RESOURCES:

1. Career Investigation Worksheet.

2. Company Employment Description Worksheet.

3. a. Envelopes
   b. Telephone Book

4. Industrial Classification Worksheet.

CAREER INVESTIGATION WORKSHEET

1. Industrial category represented by resource person:

2. Nature of duties performed as described by resource person:

3. Job entrance requirements described to you:

4. Requirements for entering training program:

5. What high school courses should you take to prepare for this kind of job?

6. Job salary range:

7. Potential openings:

8. What are opportunities for advancement in this area?

COMPANY EMPLOYMENT DESCRIPTION WORKSHEET

1. Company name _____

2. Company location _____

3. Products or services _____

_____

4. Company size. Explain. _____

_____

_____

5. Positions described in pamphlet. _____

_____

_____

_____

6. Job benefits: _____

_____

_____

_____

7. Job requirements: _____

_____

_____

_____

Industrial Classification Worksheet

SCIENTIST AND ENGINEER	TECHNICIAN		CRAFTSMAN
	ENGINEERING	INDUSTRIAL	

STUDENT LEARNING EXPERIENCE SHEET

E. LEARNING EXPERIENCE V

OBJECTIVE: 1. Discriminate between jobs in various categories.

2. Analyze a job in detail.

ACTIVITY:

1. a. Based on your present knowledge of the categories in the electricity-electronic area and the resources provided list many jobs which fall in the particular category which is of most interest to you.
   b. You will go on a field trip and see a film in order to observe some of the jobs you have listed and to look for additional jobs to add to your list.

2. a. Pick one job of special interest to you.
   b. Obtain answers to questions on Job Analysis Worksheet by talking to someone employed at that job.
   c. Share the information you obtain with others in your class interested in that category.
   d. Each group will develop a role-playing interview using the information from Job Analysis Worksheets.
   e. Repeat d as time permits.

RESOURCES:

1. a. Yellow pages of phone book.
   b. Want-ads of newspapers
   c. Field Trip
   d. Film

2. Job Analysis Worksheet

JOB ANALYSIS WORKSHEET

1. Category of job _____

2. Name of job _____

3. Name of person contacted _____

4. Name of firm for which he or she works _____

5. Briefly describe the main duties of the job.

6. What school subjects are most important to this job? _____

_____

7. How many years of schooling does the job require? _____

8. Is union membership required? _____

9. Is on-the-job training or apprenticeship required? _____
How long? _____

10. How many hours per week does job require? _____ _____

11. How many days per week does job require? _____

12. What is usual starting salary? _____
Maximum salary? _____

13. How long does it usually take to receive maximum salary? (Years of experience) _____

14. Are job openings in this job increasing, decreasing, or remaining the same?

_____

15. Does this job require supervision of others? _____

16. What part of the job is most pleasing to worker? _____

_____

17. How does a person apply for this job? _____

_____

F. LEARNING EXPERIENCE VI

OBJECTIVE: Perform simplified mathematics problems illustrative of those solved by the craftsman, the technician, and the engineer.

ACTIVITY:

1. a. Examine a routine problem solved by the worker performing his job.
   b. With the teacher's help, solve examples of simplified problems similar to those performed by workers.
   c. Work as many problems as possible from those on the Job Related Problems Worksheet.

RESOURCES:

1. Job Related Problems Worksheet.

JOB RELATED PROBLEMS
WORKSHEET (CRAFTSMAN)

Use the American Wire Gauge Table to solve the following problems. (Some problems have 2 answers.)

1. An electric motor requires a current (I) of 20 amperes (A) in order to do a certain job.

What wire size is required to hook-up this motor to the electric power? _____

2. If I = 70 A? _____
3. If I = 15 A? _____
4. If I = 225 A? _____
5. If I = 5 A? _____

6. What is the capacity of the current allowable to flow effectively through rubber insulated wire gauge no. 2? _____

7. Gauge no. 6? _____
8. Gauge no. 16? _____
9. Gauge no. 8? _____
10. Gauge no. 000? _____

AMERICAN WIRE GAUGE (B&S) FOR ANNEALED COPPER WIRE

Gauge No.	Diameter in Mils at 20°C	Cross Section	Allowable Current Capacity	
		Circular Mils	Rubber Insulation	Other Insulation
0000	460.0	211,600.0	225	325
000	409.6	167,800.0	175	275
00	364.8	133,100.0	150	225
0	324.9	105,500.0	125	200
1	289.3	83,690.0	100	150
2	257.6	66,370.0	90	125
3	229.4	52,640.0		
4	204.3	41,740.0	70	90
5	181.9	33,100.0		
6	162.0	26,250.0	50	70
7	144.3	20,820.0		
8	128.5	16,510.0	35	50
9	114.4	13,090.0		
10	101.9	10,380.0	25	30
11	90.74	8,234.0		
12	80.81	6,530.0	20	25
13	71.96	5,178.0		
14	64.08	4,107.0	15	20
15	57.07	3,257.0		
16	50.82	2,583.0	6	10
17	45.26	2,048.0		
18	40.30	1,624.0	3	5
19	35.89	1,288.0		
20	31.96	1,022.0		
21	28.45	810.1		
[illegible]	25.35	642.4		
[illegible]	22.57	509.5		
24	20.10	404.0		
25	17.90	320.4		
26	15.94	254.1		
27	14.20	201.5		
28	12.64	159.8		
29	11.26	126.7		
30	10.03	100.5		
31	8.928	79.70		
32	7.950	63.21		
33	7.080	50.13		
34	6.305	39.75		
35	5.615	31.52		
36	5.000	25.00		
37	4.453	19.83		
38	3.965	15.72		
39	3.531	12.47		
40	3.145	9.888		

JOB RELATED PROBLEMS
WORKSHEET (TECHNICIAN)

Ohm's law is one of the most important laws of electricity - electronics and is used often in the field.

It states:

The current flowing in an electrical circuit is directly proportional to the voltage and inversely proportional to the resistance.

OR

$I = \frac{E}{R}$ where I = current in ampheres
E = voltage in volts
R = resistance in ohms Ω

---

1. If E = 200 V and R = 100 Ω then I = ____________
2. If E = 300 V and R = 50 Ω then I = ____________
3. If E = 690 V and R = 30 Ω then I = ____________
4. If E = 1000 V and R = 20 Ω then I = ____________
5. If E = 500 V and R = 250 Ω then I = ____________

6. If E = 50 V and I = 2 amp then R = ____________
7. If E = 24 V and I = 12 amp then R = ____________
8. If E = 636 V and I = 6 amp then R = ____________
9. If E = 110 V and I = 10 amp then R = ____________
10. If E = 670 V and I = 5 amp then R = ____________

11. If I = .003 amp and R = 25 ohms then E = ____________
12. If I = .006 amp and R = 15 ohms then E = ____________
13. If I = .013 amp and R = 12 ohms then E = ____________
14. If I = .027 amp and R = 17 ohms then E = ____________
15. If I = .009 amp and R = 28 ohms then E = ____________

JOB RELATED PROBLEMS
WORKSHEET (ENGINEER)

True Power = E I cos θ
(watts)

	E	I	θ	True Power
1	200 V	6 amp	27°	
2	150 V	10 amp	12°	
3	230 V	12 amp	20°	
4	600 V	15 amp	39°	
5	720 V	29 amp	16°	
6	360 V	18 amp	24°	
7	700 V	8 amp	32°	
8	500 V	27 amp	40°	

TABLE OF SINES, COSINES, AND TANGENTS

Angle	Sine	Cosine	Tangent
1°	.0175	.9998	.0175
2°	.0349	.9994	.0349
3°	.0523	.9986	.0524
4°	.0698	.9976	.0699
5°	.0872	.9962	.0875
6°	.1045	.9945	.1051
7°	.1219	.9925	.1228
8°	.1392	.9903	.1405
9°	.1564	.9877	.1584
10°	.1736	.9848	.1763
11°	.1908	.9816	.1944
12°	.2079	.9781	.2126
13°	.2250	.9744	.2309
14°	.2419	.9703	.2493
15	.2588	.9659	.2679
16°	.2756	.9613	.2867
17°	.2924	.9563	.3057
18°	.3090	.9511	.3249
19°	.3256	.9455	.3443
20°	.3420	.9397	.3640

STUDENT LEARNING EXPERIENCE SHEET

G. LEARNING EXPERIENCE VII

OBJECTIVE: 1. Interpret specific job information in relation to yourself.

2. Integrate your feelings toward the electricity or electronics field as your occupation.

ACTIVITIES:

1. Question the resource people about their specific jobs being sure to discuss any conflicting information about job details.

2. a. Imagine that you have completed all education and training necessary for a job in the field of electricity-electronics.

   b. Mark 1, 2, 3 on the Job List the jobs for which you would apply if this training and education are within your abilities and interests.

3. a. Answer briefly the questions on the Career Evaluation Worksheet.

   b. Compare your answers on the Career Evaluation Worksheet to those that you answered at the beginning of the course on the Interest Inventory.

RESOURCES:

1. Resource people

2. Job List

3. Career Evaluation Worksheet

JOB LIST

	JOB TITLE	FILE NO.
_____	Electric Power and Light Worker	604
_____	Electric Appliance Repairman	
_____	Elecreical Engineer	108 F
_____	Electrical Goods Manufacturing Worker	605
_____	Electrician, Construction	601 C
_____	Electrician, Maintenance	601 C
_____	Electronic computing Worker	107
_____	Electronics Engineer	108 F
_____	Electronics Equipment Manufacturing Worker	605
_____	Electronics Serviceman	610
_____	Electronics Technician	610
_____	Radar Technician	610
_____	Radio Serviceman	610 1 (?)
_____	Telephone Technician	604
_____	Telegraph Industry Worker	604
_____	Telephone and Telegraph Lineman	604
_____	Telephone Industry Worker	604
_____	Telephone Serviceman	604

Career Evaluation Worksheet

1 Did you enjoy this course? _____ Comments?
yes / no

_____

_____

2. Do you think that you might be interested in an electricity or electronic occupation?

_____ Why or why not? _____
Yes / no

_____

_____

3. Do you know more about this area now than when you started the course? _____
Yes / No

Comments: _____

_____

_____

4. How many jobs can you name in the electricity-electronic fields? List them _____

_____

_____

_____

_____

_____

5. What kind of job do you think would make you happy ? _____

_____

_____

IV. APPENDIX

A. RESOURCE LIST

1. General Resource:

Each student requires a "Student Learning Experiences Booklet". This booklet is to be distributed to the students one page at a time as indicated in the Teachers' Guide.

2. Learning Experience II

a. Films:

1. Jobs in Small and Major Electric Appliance Repair
1970 Color $90.00 7 min.
Sterling Educational Films
241 East 34th Street
New York, New York 10016 Phone 212 (683)-6300

2. Electronics #9819
Cincinnati Public School
Visual Aid Dept.

3. Federal Aviation Administration
Air Traffic Control Tower
Greater Cincinnati Airport
George W. Hessler 371-5924

4. Cincinnati Gas & Electric Company

a. The Constant Miracle
b. Principles of Electricity
c. Atom Power Today: Service & Safety
d. A is for Atom
e. Danger: High Voltage
f. Nuclear Power and Environment
g. A Boiling Water Reactor
h. The Light of Your Life
i. The Mighty Atom

b. Field Trips

1. Western Union - Dixie Terminal - G. M. Garies - 361-4321

2. United Radio - 7713 Reinhold Dr. - Irvin Horwitz 761-4030 ext. 208

3. A T & T - 15 W. 6th Street, 6th floor - W. Hengstebeck 352-7000

4. Cincinnati Technical College - 3520 Central Parkway
Fred Schlimm - 681-3320

*5. Bell Telephone - Mrs. Phyllis Heizer - 397-4522

*Preferred

c. Interview Tapes

1. Your Future in Electronics D8-121

2. Your Future as a T.V. & Radio Service Technician D8-119

3. Your Future as a Telephone Operator & Supervisor D8-122

4. Your Future as a Telephone Installer & Repairman D8-131

$7.50 each

Guidance Associates
Harcourt Brace & World
Pleasantville, N. Y. 10570

3. Learning Experience III

a. Kits or Lab Equipment

1. Ed Simms
Freeman Supply Company
Dayton, Ohio 513-426-3310

2. Al Fritz
Heath Kit
Woodlawn

b. Aptitude and Interest Test

1. Obtain from counselor and/or coordinator

c. One-on-one Experience

1. United Radio Inc. - 7713 Reinhold Dr. - Mr. Irvin Horwitz 761-4030
2. Cincinnati Bell Telephone Co. - Mrs. Phyllis Heizer 397-4522
3. Cincinnati Technical College - 3520 Central Parkway
Mr. James Howard - 681-3320
4. Proctor & Gamble - Mr. O. L. Bond - 6th & Sycamore
5. Sears, Roebuck & Co. - 660 Lincoln Ave. - 961-4857
Mr. Paul Graw

4. Learning Experience IV

a. Resource People for Topic of Training:

1. Mr. James Howard - Cincinnati Technical College
3520 Central Parkway - 681-3320

2. Roy Vandegrift - Ohio College of Applied Science
100 East Central Parkway 45210

b. Pamphlets:

1. Supplied by: 1) Coordinator, 2) in response to students' requests, 3) training institutions(Resource People), 4) cooperating industries, 5) Vocational Guidance Counselor.

c. Student Materials:

1. Three of each below for every student:

a) Envelopes with stamps

b) "Career Investigation Worksheet"

2. Four "Company Employment Description Worksheets" required for each students.

d. Film:

1. Films listed for L.E.II are appropriate for L.E.IV.

5. Learning Experience V

a. Films:

1. Films listed for L.E.II are appropriate for L.E.V.

b. Field Trips

1. Field trips listed for L.E.II are appropriate for L.E.V

c. Student Materials:

1. Each student will need three copies of the "Job Analysis Worksheet" (90 per class if 30 needed).

d Reference Materials:

1. Newspaper want ads are to be supplied by students.

2. Telephone Yellow Pages - six sets per class is suggested - obtain through your school office.

6. Learning Experience VII

a. Resource People for Topic of Job Description

1. United Radio Inc. - 7713 Reinhold Dr. - Mr. Irvin Horwitz 761-4030

2. Federal Aviation Administration - Air Traffic Control Tower Greater Cincinnati Airport - Mr. George W. Hessler 371-5924

3. Bell Telephone Co. - Mrs. Phyllis Heizer - 397-4522

4. Proctor & Gamble - Mr. O. L. Bond - 6th & Sycamore Sts.

5. Roy Vandegrift - Ohio College of Applied Science
100 East Central Parkway 45210

B. ITEMS REQUIRING ACTION AND SUGGESTED COMMENTS

1. General Requirements:

a. Reproduce, assemble, and distribute for each student a "Student Learning Experiences Booklet". This booklet is to be distributed by the teacher one page at a time as indicated in the Teachers Guide.

b. Reproduce assemble and distribute to each teacher a "Teachers Guide" and all related student materials and supplies.

2. Learning Experience I - Complete

3. Learning Experience II

a. An adequate film has not been identified. One general purpose film is needed. Films related to two portions of the occupational area are identified on the Resource List.

b. F.A.A. has indicated that they have films but the content and availability must be checked.

4. Learning Experience III

a. Mr. Sims of Freeman Supply Co. (Dayton) has been contacted and is preparing a proposed series of classroom activities (Lab Experiments and/or kit building).

b. Self interest and simple self-conducted aptitude tests must be obtained from the guidance counselor in each school or from Bell Telephone Co. The availability of these has not been confirmed.

c. Proctor & Gamble, United Radio, Cincinnati Technical College, Cincinnati Public Schools and Bell Telephone have indicated the possibility of one-on-one observation but the working details of this arrangement have not been resolved.

d. A skill testing apparatus or manipulatory test has not been identified. School psychologists and industrial sources should be queried(especially Cincinnati Milacron).

5. Learning Experience IV

a. Find resource persons to represent training programs for

each of the following categories: a.) Engineers & Scientists and b.)Craftsman

b. A large number of pamphlets relating to careers as a technician have been supplied by O.C.A.S. These should be distributed to teachers.

c. Additional pamphlets should be solicited with emphasis on careers as Engineers and Craftsman. The following organizations have indicated that they could supply pamphlets:

1) A.T.&T. Operations
6th Floor 15 W. 6th St.
Mr. W. Hengstebeck
352-7000

2) Greater Cincinnati Airport
Public Relations Dept.
Box 7500 Airport Branch
Post Office 45275
371-6162

d. Each student "Learning Experience Packet" will need three "Career Investigation Worksheets". i.e. 3 x 30 = 90 for a class set.

e. Also needed -- four "Company Employment Description" work sheet for each student packet (120 per class).

f. Three envelopes with stamps/student (90 req.).

g. A second general purpose film is required. See comments related to Learning Experience II.

6. Learning Experience V

a. Each class will need 90 "Job Analysis" worksheets (3 per student).

7. Learning Experience VI - Complete

8. Learning Experience VII - Complete