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ABSTRACT

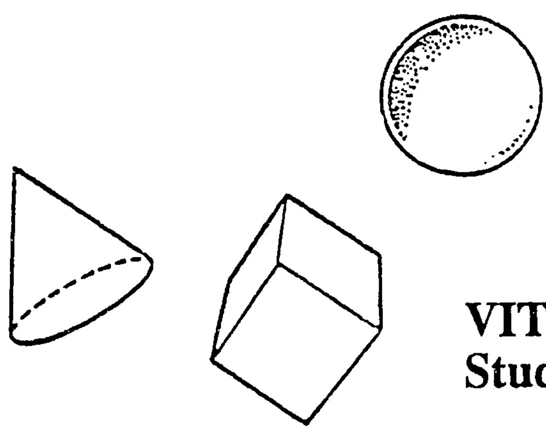
This student workbook and teacher's guide are for a vocational English-as-a-Second-Languge (VESL) course designed to prepare limited-English-speaking students for vocational training programs in industrial and technical fields. The curriculum focuses on the general technical English most critical in making the transition from English-as-a-Second-Language (ESL) courses to vocational courses in which English is the language of instruction. Study skills and test-taking skills are also emphasized. The student workbook contains eight instructional units on the following topics: definitions and classifications; physical and spatial descriptions; functional descriptions; process descriptions; definitions, examples, and classifications; comparative descriptions; non-sequential instructions; and sequential instructions. Each unit contains a list of skill objectives, visual aids, an outline of the lecture to accompany the unit, readings, and worksheets. Notes on test-taking strategies are appended. The instructor's guide begins with an overview of the curriculum and offers suggestions for organization of materials, classroom instruction, and student evaluation. The core of the guide includes specific guidelines for classroom activities, language use, vocabulary, and use of corresponding student worksheets, lecture texts, readings, and answer keys to student worksheets for each of the eight units. Test-taking strategy notes are also appended here. (MSE) (Adjunct ERIC Clearinghouse on Literacy Education)

VESL for Industrial and Technical Training (VITT) Curriculum:

Student Materials

Illinois State Board of Education

Adult, Vocational and Technical Education



VITT
Student Materials

VESL for Industrial and Technical Training (VITT) Curriculum: Student Materials

Illinois State Board of Education

Adult, Vocational and Technical Education

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June, 1989

KTI 471

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ILLINOIS STATE BOARD OF EDUCATION
DEPARTMENT OF ADULT, VOCATIONAL AND TECHNICAL EDUCATION
VOCATIONAL EDUCATION PROGRAM IMPROVEMENT SECTION

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   Address: 1855 Mt. Prospect Rd. Des Plaines, IL Zip Code 60018

6. Developed pursuant to Contract Number: KTI 471

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   ___ 04 Distributive Education
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   ___ 09 Home Economics Education
   ___ 10 Industrial Technology
   X 16 Technical Education
   X 17 Trade & Industrial Educ.
   ___ 22 Cooperative Education
   X Career Education
   X Other (Specify) VESL

8. Education Level

   ___ Pre-K Thru 6 ___ 7-8 ___ 9-10 X 11-12
   X Post-Secondary X Adult ___ Tchr. (Inservice)
   ___ Adm. (Pre Service) ___ Other (Specify) ___

9. Intended for Use By:

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   ___ Teacher Ed. ___ Guidance Staff ___ State Personnel
   ___ Other (Specify) ___

10. Student Type:

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    X Limited-English Profic. ___ Other (Specify) ___

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16. General Description

These revised student materials are to be used by students in a cour~e requiring approximately 64 instructional hours to teach limited English proficient (LEP) students language and study skills for transition into mainstream vocational education programs or employment in any occupational area in the industrial/technical cluster.
A separate product, VESL for Industrial and Techncial Training (VITT) Curriculum: Instructor's Guide, includes information on implementation and answer keys.

17. Person Completing this Abstract David Pankratz

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FORWARD

The VITT Student Materials are designed to help you prepare for vocational training programs or jobs in technical fields. You can apply the skills that you will learn in this course to any technical or industrial occupation.

It is not the objective of the VITT materials to teach you specific technical information. Rather, they present general technical topics to help you practice and improve your English. In all technical training or work situations, you need to know how to speak, read, and write about technical subjects. You also need to be able to follow technical discussions and understand the main points.

Furthermore, this course will help you develop the study skills and test-taking skills that are important in most technical education programs.

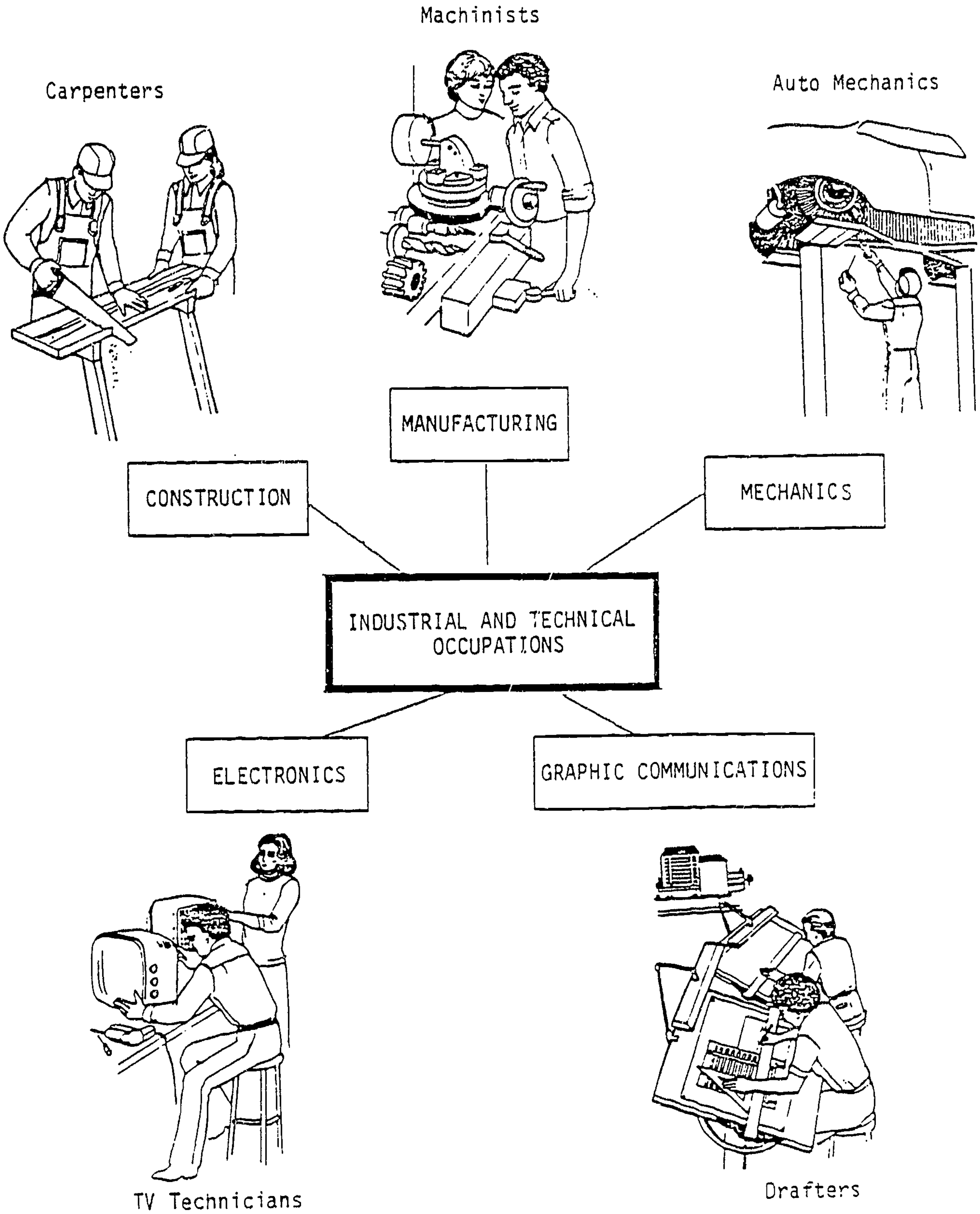
Good luck in your efforts to improve your "technical English"!

UNIT ONE: DEFINITIONS AND CLASSIFICATIONS

TOPICS: Technical Occupations, Vocational Training

SKILL OBJECTIVES:
- Comprehend a lecture
- Follow an outline
- Ask for and give definitions
- Classify information
- Refer to, read, and construct graphs and charts
- Take multiple choice tests

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate directly to the overall skills of being able to define important terms and classify information, which are important in all technical fields. This unit will also expose you to several different technical and industrial fields which you may want to pursue in the future.



Illustrations from the WRIOT Test (Wide Range Interest-Opinion Test), Jastak Associates, Inc.

Outline of Lecture

Follow along with this outline as you hear the lecture.

TOPIC: INDUSTRIAL AND TECHNICAL OCCUPATIONS

I. Introduction
   A. Industries - Products
      1. Automobile Industry
      2. Electronics Industry
   B. Technical Occupations
   C. Five Groups of Occupations
II. Construction
   A. Building
   B. Repair Work
   C. Jobs
III. Manufacturing
   A. Production
   B. Math
   C. Jobs
IV. Electronics
   A. Equipment
   B. Construction, Testing, Repair
   C. Jobs
V. Mechanical
   A. Jobs
   B. Working with Machines, Repair
VI. Graphic Communications
   A. Drafting
   B. CAD
   C. Math Skills
VII. Summary
   A. Training Opportunities

Definitions

A. For this exercise you will need a partner.
Study the following sentences.

1. A vocation is a profession or a trade which requires special training.
2. Many students are enrolled in vocational training.
3. An industry involves the production of goods.
4. The United States is an industrial country.
5. Technology is the science related to developing products and using them.
6. Computer electronics is a technical field.
7. An occupation is an activity or a job that someone has been trained for.
8. There are many occupational opportunities in the construction field.

B. Ask your partner to define the following words:
vocation, industry, technology, occupation

Examples: What does __________ mean?
What is the definition of __________?

Your partner will say a definition for each word, using the sentences in Part A above as a guide. When you have finished, switch roles and repeat the exercise.

C. Now, take turns making sentences using these words:
vocational, industrial, technical, occupational
Use the sentences in Part A above to help you.

D. Finally, interview your partner about his/her experience with technology in school or at work. Use the words above in your questions.

Word Forms

Fill in the missing words.

Noun	Adjective	Verb
technology		X
		industrialize
vocation		X
	occupational	X

Write one sentence for each of the words you have added to the chart.

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

Planning for the world of work

As you read this, you're probably still in school. But you're thinking more and more about the day when you'll go to work. . . .

. . . And since work is going to be your main activity during your adult years, it's a subject worth careful planning.

Perhaps you're not sure just what you can do. Or what you want to do. But you do know you want a job — a paying job that will bring you many of the good things of life.

Well, now is the best time to be exploring the types of occupations that interest you. Keep in mind, of course, that there is probably no one job that's perfect in all respects. The jobs that you'll have (no doubt you'll try more than one) should be determined by your own needs and goals. And you can get a job that fits you if you know yourself.

There are many questions to consider besides money and job availability. What about job security? Length of work hours? Vacations? Early retirement? Working conditions? Is the work indoors or outdoors? Is there a variety of duties or one set routine? Is the work done alone or with people? These are some of the questions that you might want to ask when talking with your counselor or future employer.

A. Discuss this reading with your teacher and classmates.

B. Which occupation are you interested in? Outside of class, conduct research to find out about this occupation. Get information which answers the questions in the last paragraph of this reading. Give a 3-5 minute oral report to the class.

Reading, slightly adapted, courtesy of General Electric Company from the brochure "So you want to go to work", 1983.

VOCATIONAL PROGRAMS AT MONROE TECHNICAL COLLEGE

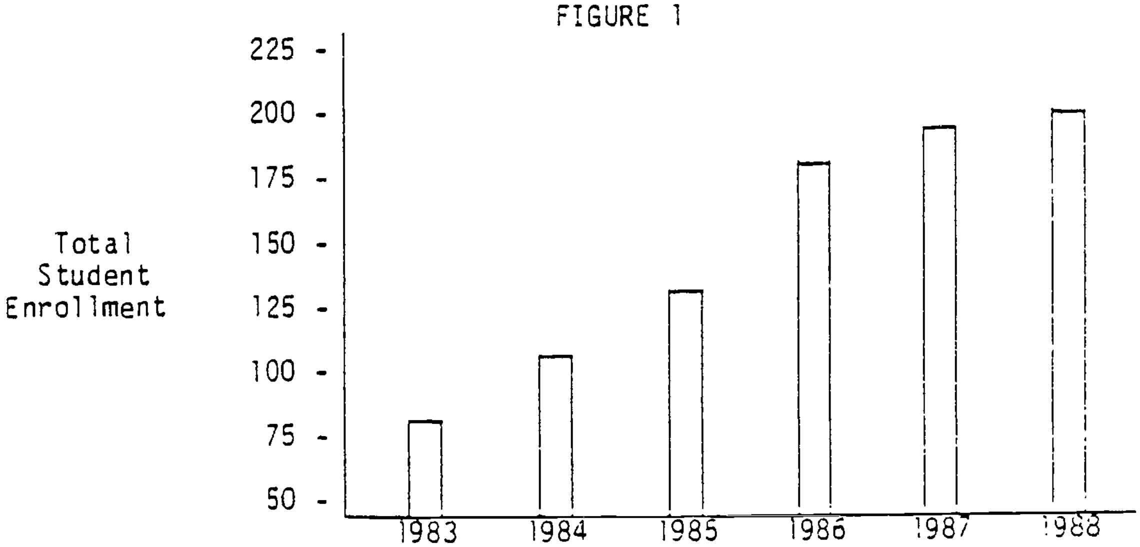
Monroe Technical College has been offering certificate and degree programs in vocational education since 1958. It has become widely known for practical training programs which prepare students for employment. Students at Monroe can choose from a variety of programs leading to jobs in technical and industrial occupations.

Monroe College offers training opportunities in the following programs: Automobile Mechanics, Electronics, Building Engineering, Climate Control Technology, Building Construction and Manufacturing Technology. The first four programs consist of two years of coursework and lab work leading to an associate degree. The last two are one-year programs leading to certification.

The programs at Monroe are very job-oriented. The Auto Mechanics and Building Construction programs include on-the-job training. The other four programs familiarize students with future workplace conditions by inviting guest speakers to visit classes and taking students on field trips to company sites. All of the programs offer classes during the week. Building Engineering also offers courses on weekends. All programs include job placement services for graduates.

Total student enrollment has increased rapidly in recent years from 80 students in 1983 to 200 in 1988 (see Figure 1).

FIGURE 1



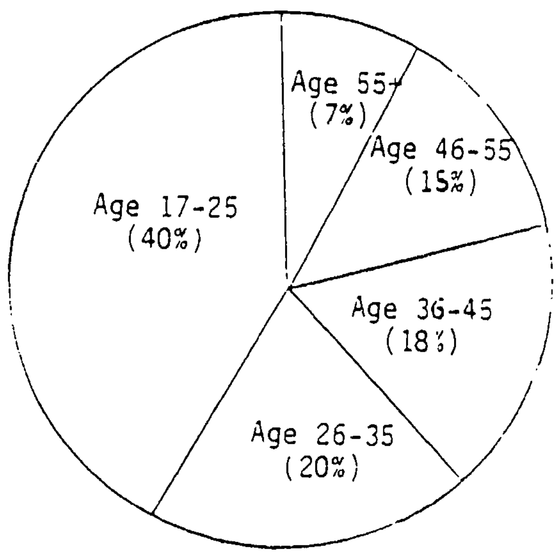
ENROLLMENT AT MONROE TECHNICAL COLLEGE

For the year 1988, enrollment in each program was as follows:

Automobile Mechanics	42
Electronics	60
Building Engineering	25
Climate Control Technology	25
Building Construction	34
Manufacturing Technology	14
Total	200

Monroe serves all different types of student. The student body is racially mixed. Approximately 25% of Monroe students are female. All age groups are represented by the students. For a breakdown of the age distribution of students for the year 1988, see Figure 2.

FIGURE 2



AGE DISTRIBUTION AT MONROE TECHNICAL COLLEGE
1988

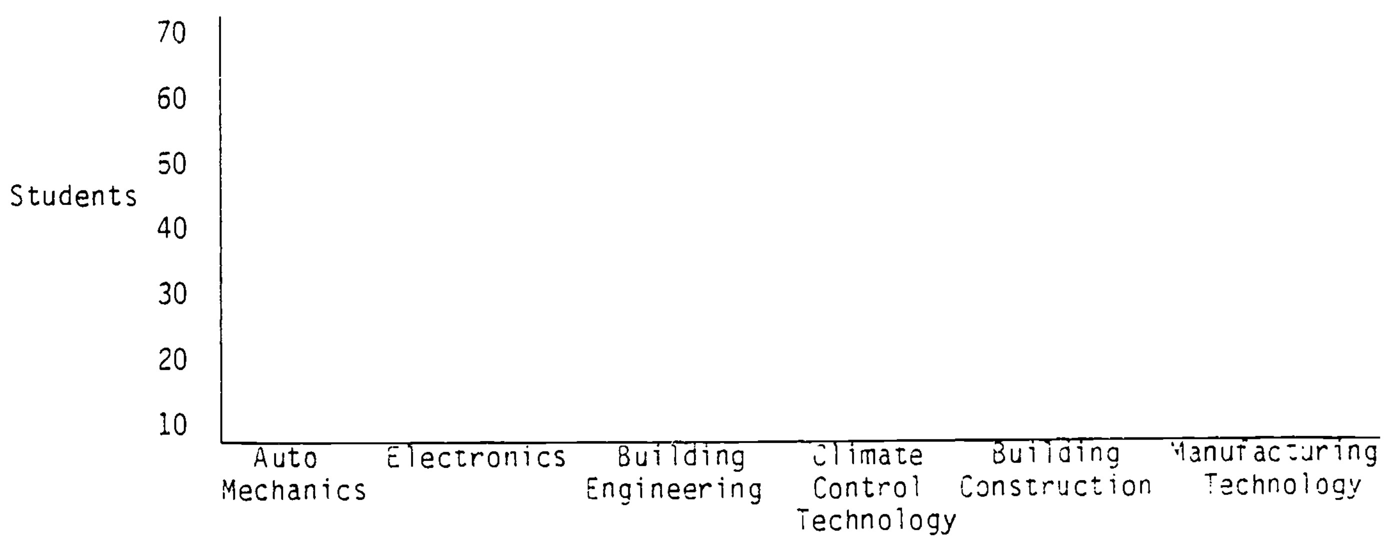
The growing and diverse student body in Monroe's vocational programs reflects the changing times. Technical and industrial occupations are requiring that workers have more and more skills. Monroe is keeping up with these demands by teaching not only technical skills, but also the language, math and problem-solving skills which workers need in today's job market.

Graphs and Charts

A. Complete the chart on the basis of the information given in the reading. Use an "X" to mark the appropriate boxes.

	Associate Degree	Certificate	On-the-Job Training	Job Placement	Weekend Courses
Auto Mechanics					
Electronics					
Building Engineering					
Climate Control Technol.					
Building Construction					
Manufacturing Technology					

B. Based on the information in the reading, make a bar graph which shows the enrollment for each program in the year 1988. The bar for "Auto Mechanics" has been done for you.



PROGRAM ENROLLMENT AT MONROE TECHNICAL COLLEGE FOR 1988

Computer Technicians

Computer technicians are basically troubleshooters. They enjoy installing and testing new computer systems so they'll run trouble-free for the customer. However, they spend most of their time helping to maintain customer equipment — routinely adjusting, oiling and cleaning mechanical, electromechanical and electronic parts and checking for loose connections and defective components or circuits.

Usually called field engineers or customer engineers, computer technicians are employed by computer manufacturers or firms that hold long-term contracts to service computer equipment. These technicians routinely use tools such as voltammeters, ohmmeters and oscilloscopes. And they run diagnostic programs to help pinpoint certain malfunctions.

Because they service computer systems that work twenty-four hours a day, technicians must be on call at odd hours, and available to rotate shifts so they can be available to fix computers. Overtime, often more than eight hours a week, is common.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. Others decide to concentrate on helping other technicians with difficult problems. A few become supervisors or move into equipment or service sales. This is a field where opportunities will continue to grow for years to come.

Reading courtesy of General Electric from the brochure, "What's it like to be a technician?", 1985.

Reading Comprehension

On the basis of the information in the reading, discuss the answers to the questions and then write them.

1. What are some of the things that a computor technician must do?

   a) ____________________

   b) ____________________

   c) ____________________

   d) ____________________

   e) ____________________

2. Who do computer technicians work for?

   ____

   ____

3. When do computer technicians work?

   ____

   ____

4. Look at the last paragraph. Do all technicians have the same job?

   ____

   ____

5. If you were a computer technician what would you like to soecialize in?

   ____

   ____

A. Matching

The words in the left column are found in your reading. Match them to the words on the right with similar meanings and write the letters in the blanks.

1. ______	install	a. fix
2. ______	maintain	b. kind
3. ______	defective	c. change
4. ______	routinely	d. without difficulties
5. ______	pinpoint	e. broken
6. ______	repair	f. keep in good condition
7. ______	type	g. put in
8. ______	overtime	h. extra hours
9. ______	rotate	i. locate
10. ______	trouble-free	j. regularly

B. Definitions

Complete the following definitions:

1. A computer technician is a person who ______________________________

____

2. A computer manufacturer is a company that ______________________

____

3. Diagnostic programs are programs that ___________________________

____

4. A computer maintenance technician is a technician who __________

____

5. A supervisor is a person who ____________________________________

____

UNIT TWO: PHYSICAL AND SPATIAL DESCRIPTIONS

TOPICS:

- Geometric Shapes
- Dimensions
- Measuring

SKILL OBJECTIVES:

- Comprehend and describe physical characteristics
- Take lecture notes
- Express numbers orally
- Comprehend and use symbols and abbreviations
- Read conversion tables
- Make diagrams from oral and written instructions

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate directly to the overall skill of being able to comprehend and give physical descriptions of objects, something that is important in all technical fields. This unit emphasizes the language of geometry and measurement.

Vocabulary Comprehension

Now that you have heard the lecture, test your listening comprehension. Draw each of the following figures and shapes:

A straight, horizontal line.

A vertical line.

Three parallel lines.

Two perpendicular lines (with a 90° angle).

A square with a diagonal line connecting two corners.

A rectangle.

A circle with a line showing its diameter.

A triangle with equal sides.

A pentagon

A hexagon

An octagon

A sphere

A cone

A cube

A cylinder

Now, draw a picture of a simple house using at least six of the shapes discussed in the lecture. Label each shape in your drawing by its name.

Practice with Adjectives

These are adjectives which describe the shapes you have learned. For each adjective, make one sentence which describes a shape or an object.

Examples: A coin is circular. OR A coin has a circular shape.
A ball is spherical. OR A ball has a spherical shape.

1. circular ________________
2. triangular ________________
3. rectangular ________________
4. square ________________
5. pentagonal ________________
6. hexagonal ________________
7. spherical ________________
8. conical ________________
9. cylindrical ________________
10. cubical ________________

Measuring

Using a ruler, measure each of the following lines. Record both U.S. and metric scale measurements.

	U.S.	Metric
1.		
2.		
3.		
4.		
5.		
6.		

Now, draw a line the length indicated.

7. 1 1/2"

8. 2 3/4"

9. 4.5 cm.

10. 3 1/8"

11. 7.2 cm.

12. 5 1/8"

13. 56 mm.

14. 30 mm.

15. 15/16"

Practice with Adjectives

We can talk about a measurement using either an adjective (such as "high") or a noun (such as "height").

Examples: The door is 6'8" high.
The height of the door is 6'8". OR The door has a height of 6'8".

Study the following words. If any are new to you, review them with your instructor.

Nouns	Adjectives
height	high
length	long
width	wide
thickness	thick
depth	deep

Rewrite each sentence using a different form of the descriptive word.

1. The window is 3'2" wide.

2. The desk is 4'5" long.

3. This piece of cardboard is .7 cm. thick.

4. That tall building has a height of 240 ft.

5. The depth of Taylor's water tank is 10 feet.

6. We need to measure how long the table is.

7. Tell me how wide the panel is.

8. I must know how high, how wide, and how long the truck is.

Technical Descriptions

A technical description of an object is very different from a non-technical description. Compare these two descriptions of a chair:

Non-technical Description

The chair I like to sit in when I read is a very old chair. You could call it an antique. It isn't really a very comfortable chair because the seat is too hard and the back is too straight. I think the main reason I like it is because it was a gift from my grandmother and it has sentimental value to me.

Technical Description

The chair is light brown in color and is made of oak. It stands 72 cm. high. The top of the seat is 44 cm. from the floor and is slightly higher at the sides and middle. It is supported by legs which are flat on two sides, rounded toward the outside, and tapered at the feet. The back of the chair is nearly vertical and is composed of six cylindrical dowels each 2.2 cm. in diameter. Connecting the dowels at the top is a curved panel with a width of 9 cm.

Discuss with your instructor the differences between these descriptions. Could they be descriptions of the same chair?

Can you make a drawing of the chair?

Technical Writing Assignment

Select an object and write a technical description of it. Give its measurements, describe what it is made of, and what it looks like. Try to use the vocabulary from this unit.

Conversion Chart

Using the following conversion chart, answer the questions.

Common Conversion
Metric to U.S. — U.S. to Metric

Length

Metric to U.S.	U.S. to Metric
1 millimeter = 0.03937 inch	1 inch = 25.40 millimeters
1 centimeter = 0.3937 inch	1 inch = 2.540 centimeters
1 meter = 39.37 inches	1 foot = 30.480 centimeters
1 meter = 3.2808 feet	1 foot = 0.3048 meter
1 meter = 1.0936 yards	1 yard = 91.440 centimeters
1 kilometer = 0.62137 mile	1 yard = 0.9144 meter
	1 mile = 1.609 kilometers

Area

Metric to U.S.	U.S. to Metric
1 sq. millimeter = 0.00155 sq. inch	1 sq. inch = 645.16 sq. millimeters
1 sq. centimeter = 0.1550 sq. inch	1 sq. inch = 6.4516 sq. centimeters
1 sq. meter = 10.7640 sq. feet	1 sq. foot = 929.03 sq. centimeters
1 sq. meter = 1.196 sq. yards	1 sq. foot = 0.0929 sq. meter
1 sq. hectometer = 2.471 acres	1 sq. yard = 0.836 sq. meter
1 hectare = 2.471 acres	1 acre = 0.4047 sq. hectometer
1 sq. kilometer = 0.386 sq. mile	1 acre = 0.4047 hectare
	1 sq. mile = 2.59 sq. kilometers

Mass (Weight)

Metric to U.S.	U.S. to Metric
1 gram = 0.03527 ounce	1 ounce (dry) = 28.35 grams
1 kilogram = 2.2046 pounds	1 pound = 0.4536 kilogram
1 metric ton = 2 204.6 pounds	1 short ton (2000 lb.) = 907.2 kilograms
1 metric ton = 1.102 tons (short)	1 short ton (2000 lb.) = 0.9072 metric ton

Volume (Capacity)

Metric to U.S.	U.S. to Metric
1 centiliter = 10 cm^3 = 0.338 fluid ounce	1 fluid ounce = 2.957 centiliters = 29.57 cm^3
1 deciliter = 100 cm^3 = 0.0528 pint (liq.)	1 pint (liq.) = 4.732 deciliters = 473.2 cm^3
1 liter = 1 dm^3 = 1.0567 quarts (liq.)	1 quart (liq.) = 0.9463 liter = 0.9463 dm^3
1 liter = 1 dm^3 = 0.26417 gallon (liq.)	1 gallon (liq.) = 3.7853 liters = 3.7853 dm^3

Chart courtesy of Glencoe Publishing Co., Machine Tool Technology, 1984.

1. How many inches are there in one centimeter? ____________

2. How many centimeters are there in one inch? ____________

3. How many feet are in one meter? ____________

   In two meters? ____________

4. How many grams are in an ounce? ____________

5. What is the relationship between pounds and kilograms? ____________

6. What is the relationship of liters to liquid quarts? ____________

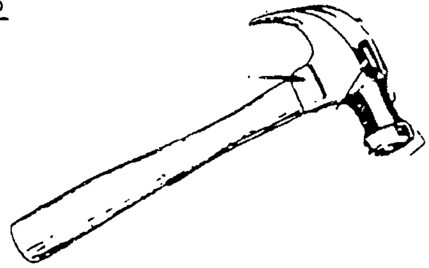
UNIT THREE: FUNCTIONAL DESCRIPTIONS

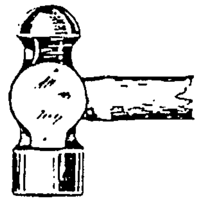
TOPICS: Basic Shop Tools, Fasteners, and Instruments

SKILL OBJECTIVES:
- Comprehend lecture and take notes
- Ask for and give names of basic tools
- Ask for and describe functions/uses of tools
- Refer to diagrams
- Read instructions for using shop instruments
- Take short answer tests

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate to being able to comprehend and give functional descriptions, in other words to describe "what things are used for." The topic for this unit is basic shop tools, but the language used to describe functions is similar for all different types of technical tools and equipment.

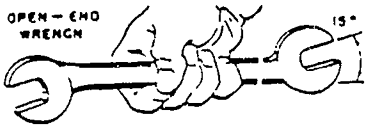
HAMMERS

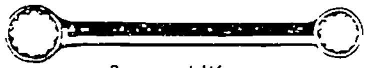




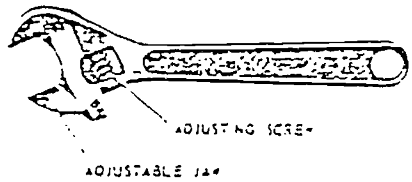
Ball Peen Hammer

WRENCHES



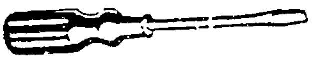


Box-end Wrench

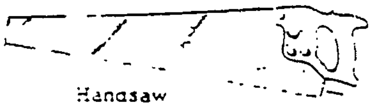


ADJUSTABLE OPEN-END WRENCH

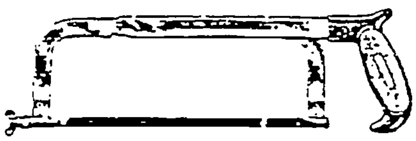
SCREWDRIVERS



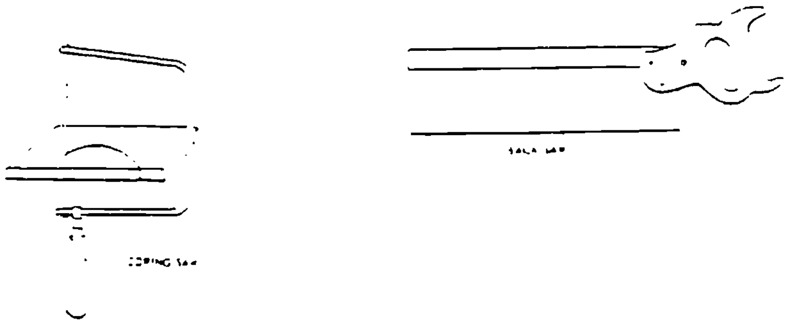
SAWS



Handsaw

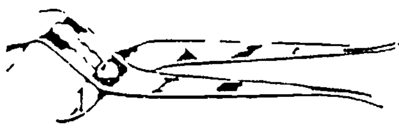


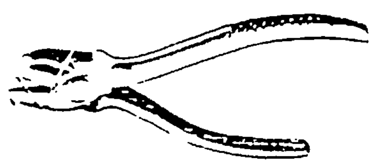
Hacksaw



Special Saws

PLIERS





Pictures courtesy of Allington Corporation from Tools and Basic Machines, 1968.

WORKSHEET 3A

Lecture Notes

Listen to the lecture. Do not write anything.
Listen to the lecture again. Write the names of the tools.
Listen to the lecture a third time. Write the names of the functions.

	TOOLS	FUNCTIONS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		

Vocabulary

Match the words with their definitions.

1. _____ to grip	a.	to change
2. _____ to drive	b.	not straight
3. _____ types	c.	opening
4. _____ single	d.	to hold
5. _____ slot	e.	kinds
6. _____ curved	f.	one
7. _____ to adjust	g.	to push

Write the correct words in the sentences.

1. A claw hammer is used to ________________ nail into wood.
2. A ball peen hammer is used to work with ________________.
3. A common screwdriver can be used with ______________________ screws.
4. The lecture discussed three ________________ of wrenches.
5. With an adjustable wrench, you can make the opening larger or ______________.
6. A handsaw is not used for cutting ________________ lines.
7. A hacksaw is ______________ for cutting metal.
8. You can ________________ the size of combination pliers.
9. Pliers are used to ________________ a lot of things.
10. Water pump pliers are used to grip plumbing objects, such as ____________.

Functions/Oral Practice

When describing the function of something, two constructions can be used.

"is used to + verb"	Ex:	A claw hammer is used to drive nails.
"is used for verb + ing"	Ex:	A claw hammer is used for driving nails.

1. Write a sentence with "is used to..."

____

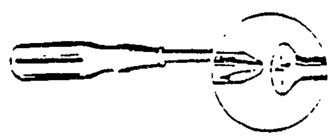
2. Write a sentence with "is used for..."

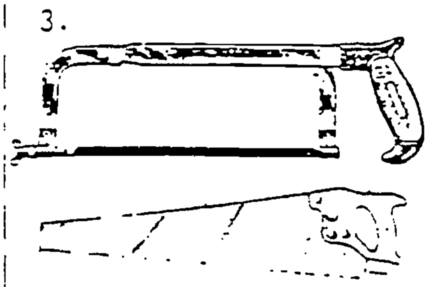
____

Read: Student A: What is this called?
Student B: They're pliers.
Student A: What are they used for?
Student B: They're used for gripping things.

Practice the dialog with a partner. Use the pictures below.

1.


2.


3.


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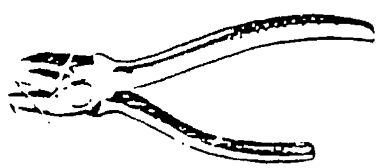

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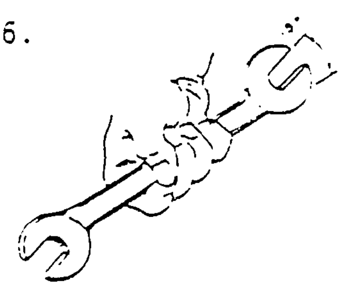


Functions/Written Practice

Complete each sentence below using "used to" and used for."

1. Pliers ______________________________ things.

   Pliers ______________________________ things.

2. A claw hammer ______________________________ nails.

   A claw hammer ______________________________ nails.

3. A handsaw ______________________________ wood.

   A handsaw ______________________________ wood.

4. A coping saw ______________________________ curved lines.

   A coping saw ______________________________ curved lines.

5. Wrenches ______________________________ nuts and bolts.

   Wrenches ______________________________ nuts and bolts.

6. A Phillips screwdriver ______________________________ Phillips screws.

   A Phillips screwdriver ______________________________ Phillips screws.

Functions

A. Think of six tools or pieces of equipment you have used at home or at a job. Write one sentence for each which describes its function.

Example: A lawnmower is used for cutting grass.

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

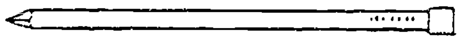
6. ____________________

B. Compare your sentences to those of your classmates. Compare the words you used to describe functions.

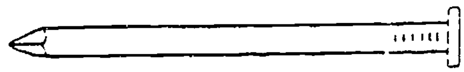
FASTENERS

We can speak of five basic kinds of fasteners which are used to join pieces and hold them in place: nails, screws, bolts, nuts, and washers. Each one has a different function.

Nails



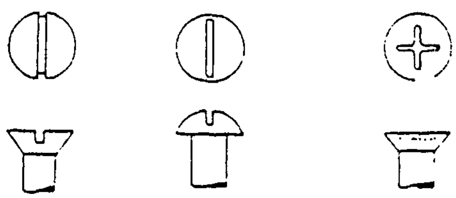
Finishing Nail



Common Nail

Nails are used to hold two surfaces together. They come in a variety of types and sizes. Nails can have either flat or countersunk heads. Finishing nails have countersunk heads which can be driven below the surface. They are used when the nails should not be seen, such as in furniture. A flathead nail, such as the common nail, does not actually lie flat; its stays above surface. Short flathead nails are used to nail roofing paper and plaster board.

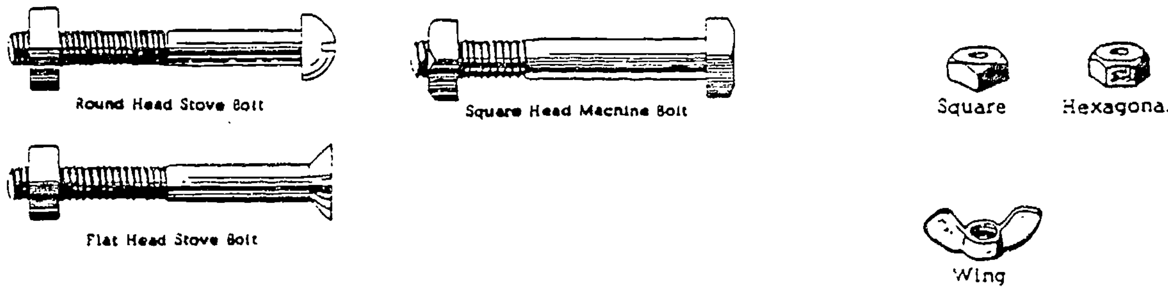
Screws



Flat Head Round Head Phillips Head

Here are some common types of screws. Screws are grouped according to their types of heads. Their heads can be round or flat. Ordinary screws have slotted heads. A screw can have a single slot or a Phillips slot. A Phillips slot has four sides. A Phillips screwdriver is used to tighten or loosen Phillips head screws. Screws can also be grouped according to the material they are used for--some screws are wood screws and others are metal screws.

Bolts and Nuts



A bolt is different from a screw. A bolt is not threaded into wood or metal. It slides through wood or metal and is held by a nut. Bolts can have round, square, or flat heads. Wrenches are used to tighten nuts to bolts.

There are many kinds of nuts. The most common nuts are square (four sides) or hexagonal (six sides). A special kind of nut is called the wing nut. It is used for making adjustments by hand rather than with a wrench.

Washers

Washers are used between bolt heads and surfaces and between bolts and nuts. They prevent damage to surfaces. The most common washer is the flat washer. A split lock washer is used to grip the nut and the surface tightly. A shake-proof washer has teeth. These teeth grip the surface and the nut. This washer is resistant to shaking, and for this reason it is often used on machines which vibrate.

Pictures courtesy of Allington Corporation from Tools and Basic Machines, 1968.

Reading Comprehension

Using the information from the reading, write short answers to the questions.

1. What is the reading passage about?

2. Which five types of parts are described in the passage?

3. What are nails used for?

4. What are finishing nails used for?

5. How can screws be grouped?

6. Which tool is used with Phillips head screws?

7. What is the difference between flathead and Phillips screws?

8. Why are washers used?

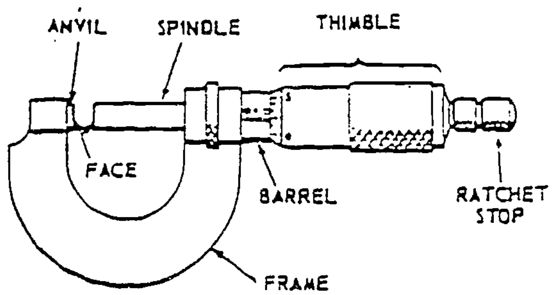
9. How are bolts held in place?

10. What is a wing nut?

MEASURING WITH MICROMETERS*

Micrometers (sometimes called "mikes") are instruments used for making very exact measurements. Micrometers can measure in thousandths of an inch.

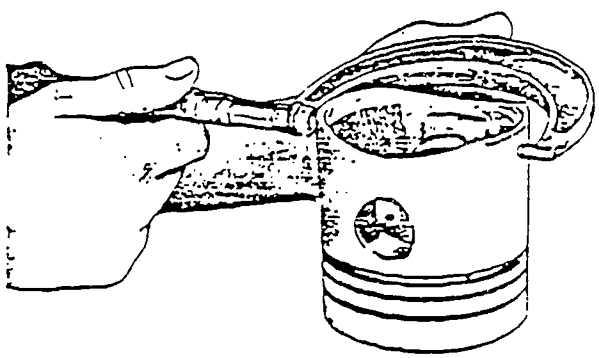
Outside Micrometer



Outside Micrometer

One type of micrometer commonly used is an outside micrometer. It is used to measure the size of parts, such as their diameter or thickness.

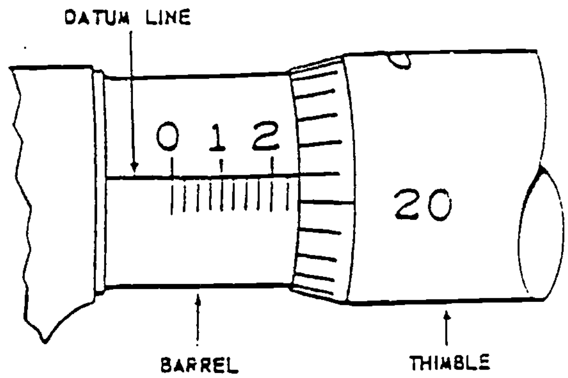
Correct Use



To measure an object, the thimble is screwed with the fingers until the distance between the anvil and the spindle fits over the object. Then the micrometer is brought over the object. Next, the thimble is turned until the faces of the spindle and the anvil touch the object.

* (accent on 2nd syllable, rhymes with "odometer")

Reading a Micrometer



The line which runs lengthwise on the barrel of the micrometer is called the datum line. Looking at this line tells you the measurement (thickness) of an object.

Each number on the barrel represents .100 (one hundred thousandths) inch. Each line between the numbers represents .025 (twenty five thousandths) inch. Each line on the thimble represents .001 (one thousandth) inch. In the picture above, the reading on the micrometer is:

	.200 inch
+	.025 inch
+	.021 inch
	.246 inch

WORKSHEET 3F

Reading Comprehension

After you have discussed the reading, write short answers to the questions.

1. What is a mike?

____

2. Which type of micrometer is discussed in this reading?

____

3. What are ends of the anvil and the spindle called?

____

4. Which part of the micrometer is turned to make a measurement? __________

____

5. What is connected to the thimble? ___________________________

6. Where is the datum line located? ___________________________

____

7. How many thousandths of an inch are represented between the numbers 0 and 1 on the barrel?

____

8. How do you read the numbers .200? (Write out the words.)

____

9. How do you read .021? (Write out the words.)

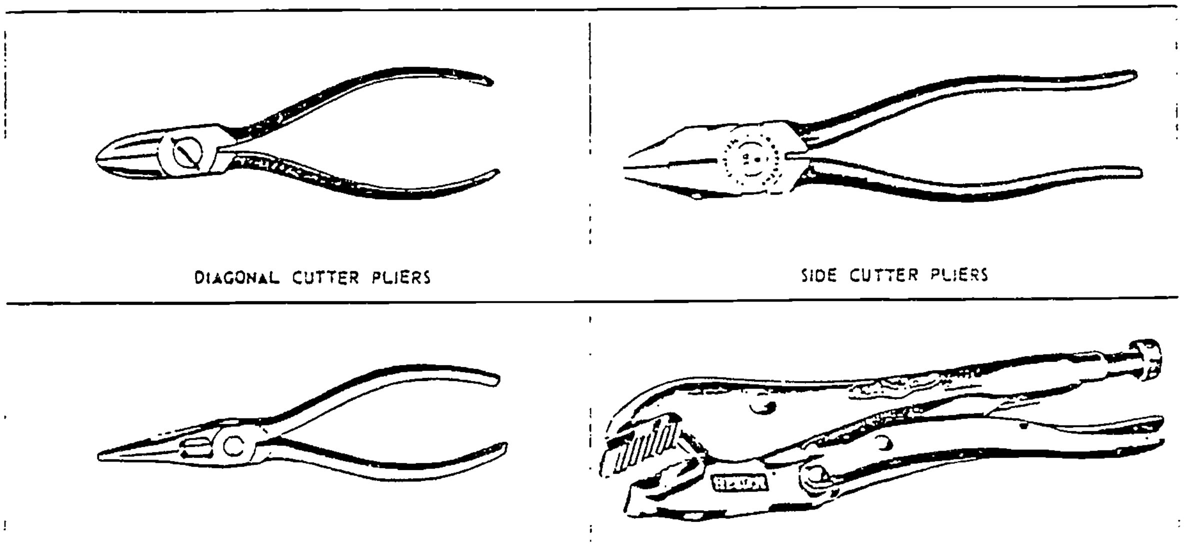
____

10. How do you read .246? (Write out the words.)

____

11. What is an outside micrometer used for?

____



DIAGONAL CUTTER PLIERS

Diagonal cutter pliers (Fig. 14) are ideal for pulling cotter pins, especially from slotted nuts. They may also be used for spreading the ends of cotter pins. *Never use diagonal pliers for cutting large-gauge wire.*

SIDE CUTTER PLIERS

Side cutter pliers (Fig. 14) are for the serviceman who cuts a lot of large-gauge wire.

NEEDLE-NOSE PLIERS

Needle-nose pliers are used primarily for handling small objects and for reaching into restricted areas. Never force them beyond their gripping capacity.

LOCK-GRIP PLIERS

Lock-grip pliers (Fig. 14) are specially designed to clamp and hold a round object. One jaw is adjustable to fit different sizes of nuts, bolt heads, pipes, or rods.

Never use these pliers on material where marring the finish is a problem.

SNAP RING PLIERS

Snap ring pliers (Fig. 15) are used to spread snap rings just the right amount as they are removed or installed.

This is a handy tool and also helps prevent overexpanding of snap rings.

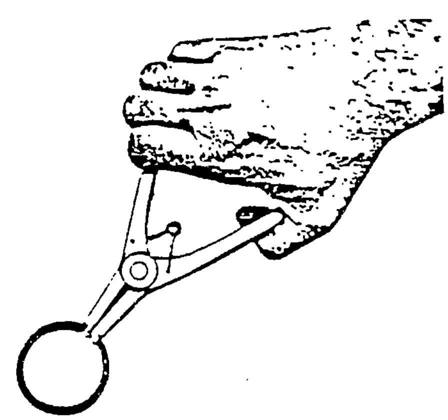


Fig. 15 — Use Of Snap Ring Pliers

OTHER TYPES OF PLIERS

Special types of pliers are also available for certain jobs: Battery (terminal nut) pliers, water pump nut pliers, ignition pliers, hose clamp pliers, brake spring pliers, retaining ring pliers, groove-grip snap ring pliers, horseshoe lock ring pliers, and slip-joint (channel) pliers.

CARE OF PLIERS

Keep pliers clean and occasionally put a drop of oil on the joint pin. This will prevent rusting, the enemy of all tools.

Reading Comprehension

Answer the questions with short answers.

1. What are diagonal cutter pliers used for?

2. Can diagonal pliers be used for cutting wire?

3. Which pliers are used for cutting large-guage wire?

4. Which pliers are adjustable?

5. What are needle-nose pliers used for?

6. What is another word for "grip"?

7. What is another name for slip-joint pliers?

8. What are snap ring pliers used to spread?

9. Where do you put oil on pliers?

10. What does oil prevent?

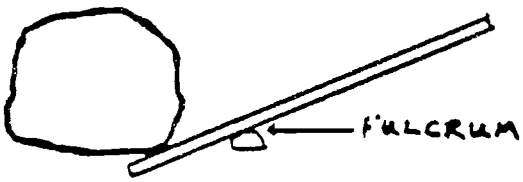
UNIT FOUR: PROCESS DESCRIPTIONS

TOPICS: Force and Work, Basic Machines, Mechanical Processes: Internal Combustion Engines and Steam Engines

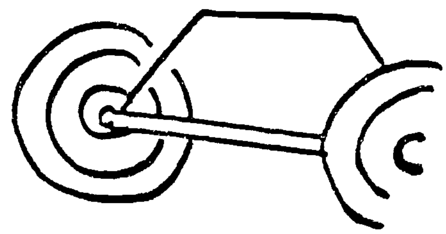
SKILL OBJECTIVES: Comprehend lecture and complete an outline
Discuss mechanical processes
Reconstruct steps in a process
Interpret diagrams and flow charts
Make an outline based on lecture
Take a fill-in test

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate directly to the overall skill of being able to comprehend and give process descriptions, in other words "how things work". The language used to describe mechanical processes is similar in all technical fields.

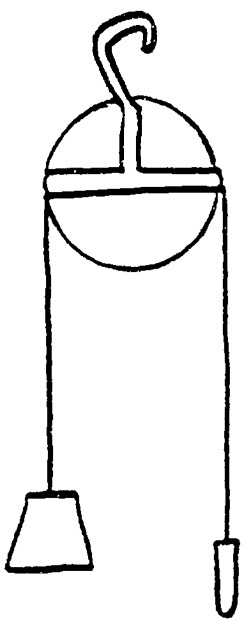
Six Basic Machines

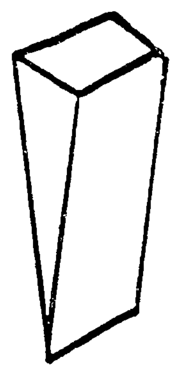


1. Lever

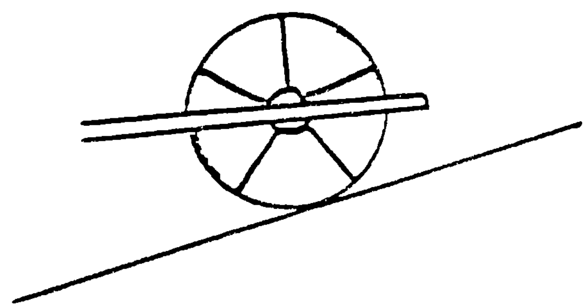


2. Wheel and Axle



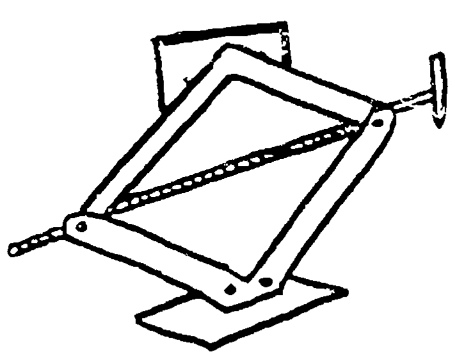


4. Wedge



5. Wheel on an Inclined Plane

3. Pulley



6. Screw

Outline of Lecture

Fill in the blanks in this outline as you listen to the lecture.

TOPIC: WORK AND BASIC MACHINES

I. Introduction

II. Physics

A. Physics is ______________________________

B. Physics focuses on ______________

III. Work

A. Tech. definition of work: ______________________________

____

B. Work = force x ____________.

C. Examples:

1. ______________________________

2. ______________________________

3. A 1 lb. book x 3 ft. = ____________ ft/lbs. of work.

4. A 10 lb. box x 4 ft. = ____________ ft/lbs. of work.

5. 2 types of motion: a.____________ b.____________

IV. Machines

A. Definition: ______________________________

____

B. Example: ______________________________

____

(Continued on next page)

V. Basic Machines

A. ______________________

1. The supporting point is the ____________________.

B. ______________________

C. ______________________

D. ______________________

1. Example: ____________________________________

E. ______________________

1. Example: ____________________________________

F. ______________________

1. It converts ____________ motion to ______________ motion.

VI. Summary

A. Complex machines use principles of ______________ machines to change the ____________ or _____________ of objects.

Word Problems

Answer the questions.

1. If you move a table which weighs 50 pounds a distance of 5 feet, how many foot/pounds of work have you done? ________________

2. If a machine moves a 3-pound object 40 feet, how much work has the machine done? __________________

3. If that same machine transports 50 of those 3-pound objects 40 feet, how much work has the machine done? ________________________

4. If you try to lift a 50-pound weight but can't move it, how much work have you done? ____________________

5. How much work has been done if you move a 10-pound object a distance of 6 inches? ___________________

INTERNAL COMBUSTION GASOLINE ENGINE

The gasoline engine was invented over 100 years ago. Since then, this type of engine has been used in millions of automobiles. Most automobiles today are still powered by gasoline engines.

The gasoline engine is called an internal combustion engine because gasoline is burned inside of a closed space in order to produce power. How does the fuel, gasoline, produce power? When gasoline mixed with air is burned, a small explosion takes place. If this happens inside of a closed container such as the one in Figure 1, pressure from the explosion blows the lid off the container. The lid blowing off the container is a form of power.

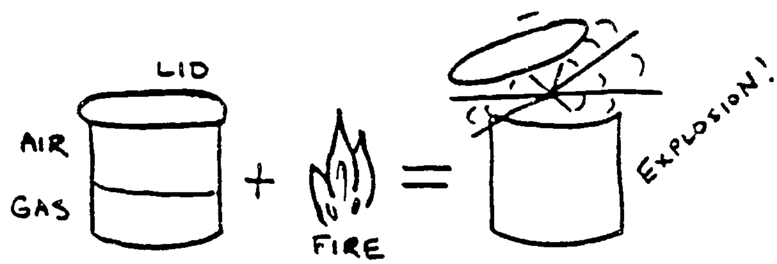


Figure 1: Blowing Off The Lid

The power that is produced by the explosion must be controlled. To do this, the lid must stay inside the container. In an automobile engine, this "lid" is called a piston, and the container is the cylinder. When there is an explosion inside the cylinder, the piston is forced through the cylinder. The piston is connected to a connecting rod, and the rod is connected to a crankshaft. The moving piston pushes on the connecting rod and turns the crankshaft, Figure 2.

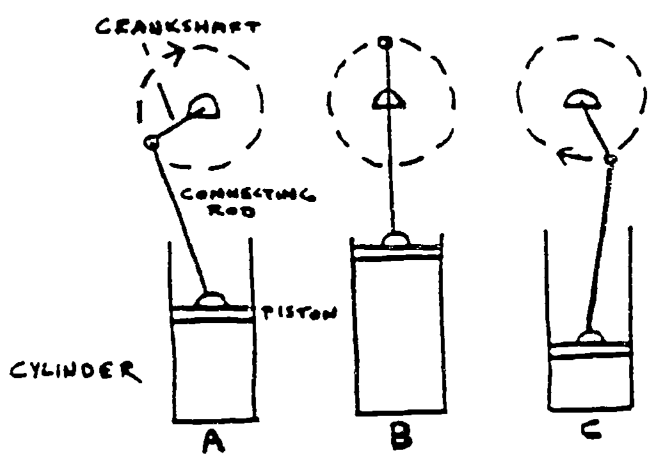


Figure 2. Lid Inside A Container Forms a Simple Engine.

As you can see in Figure 2, a simple explosion does work in a reciprocating (up and down) motion. This reciprocating motion is changed to rotary (circular) motion. The rotary motion produced by the engine is transferred to the wheels of the automobile.

Steps in a Process

Put these sentences into the correct order to describe the combustion process in an internal combustion gasoline engine.

Step No.

_______ The explosion forces the piston through the cylinder.

_______ Gasoline is mixed with air and enters the cylinder.

_______ The connecting rod turns the crankshaft.

_______ The piston pushes the connecting rod.

_______ This fuel mixture is burned inside the cylinder, causing an explosion.

Active vs. Passive Sentences

Match the phrase on the left to the one on the right with the same meaning. Connect the two with a line.

A	B
1. Most automobiles are powered by gasoline engines.	The explosion forces the piston through the cylinder.
2. In a carburetor, gasoline is mixed with air.	An explosion produces power.
3. Power is produced by an explosion.	Gasoline engines power most automobiles.
4. The piston is forced through the cylinder by the explosion.	The connecting rod turns the crankshaft.
5. The crankshaft is turned by the connecting rod.	A carburetor mixes gasoline with air.
6. In a car, rotary motion is used to turn the wheels.	A car uses rotary motion to turn the wheels.

Cause and Effect

Complete the sentences.

1. When gasoline mixed with air is burned, ______________________________

____

2. When an explosion occurs in a closed container, ______________________

____

3. When an explosion takes place in an engine cylinder, _________________

____

4. When the piston moves up and down, ___________________________________

____

5. When the rotary motion produced by the engine is applied to the axle,

____

NEWCOMEN'S STEAM ENGINE

In 1712, Thomas Newcomen built a steam engine. The engine was used for pumping water out of tin mines in southwest England. Steam engines were improved greatly in later years, but many of the same technical principles found in Newcomen's pump are still important today.

Newcomen's engine pumped water by raising and lowering a bucket in a deep shaft. The steam needed to drive the engine was produced by a coal-burning furnace.

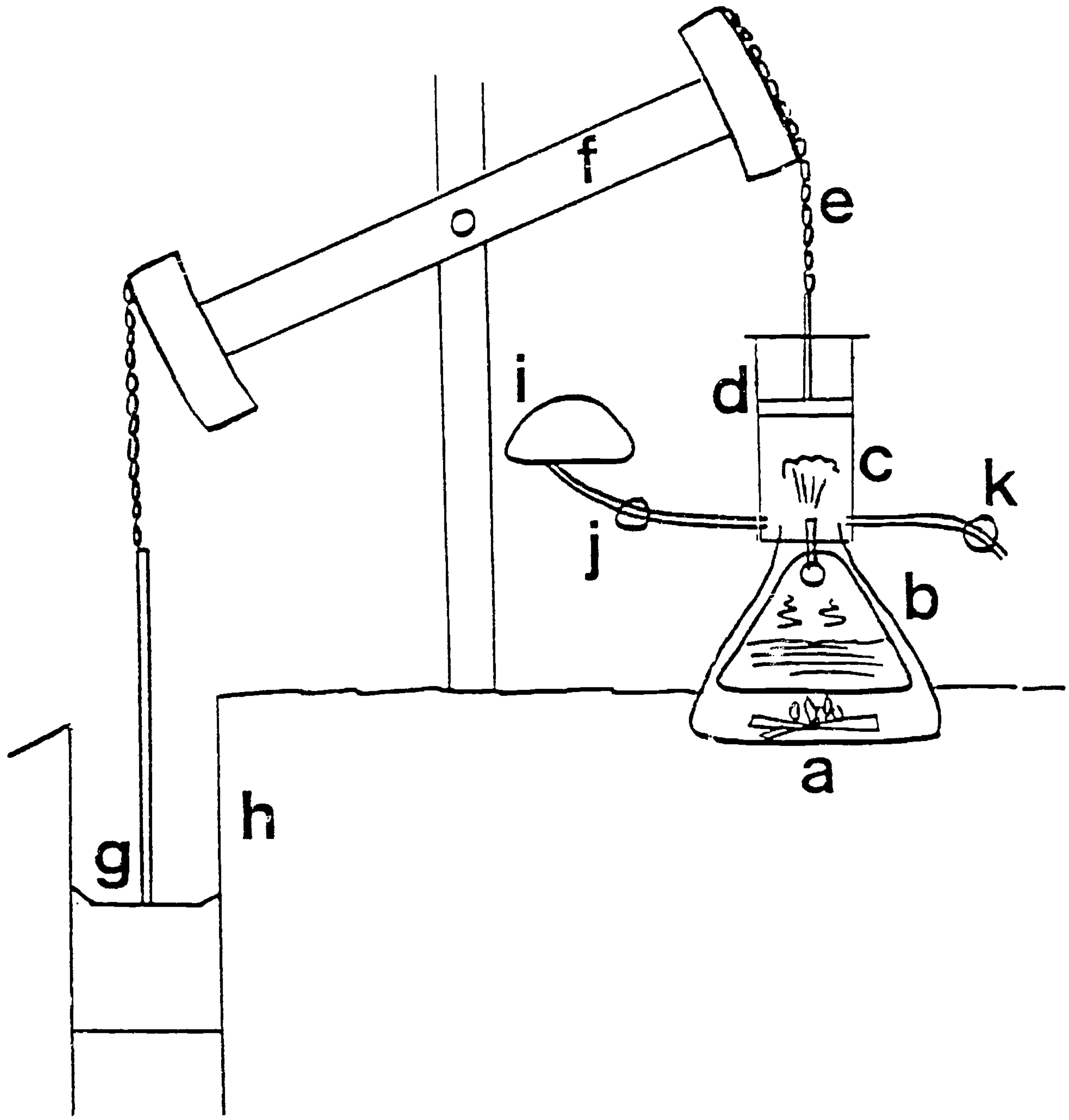
The pump worked as follows (refer to the diagram on the next page): The furnace (A) heated water in a boiler (B). The boiling water produced steam, which entered the cylinder (C). The pressure from the steam forced the piston (D) up the cylinder. The piston rod was attached by a chain (E) to a heavy beam (F). This "walking beam" was actually a lever that operated on the seesaw principle. When the piston ascended up the cylinder, the beam turned. This was due to the atmospheric pressure* which pushed the pump bucket and rod (G) down the shaft (H).

At this point, cold water (I) was let into the cylinder through a valve (J). This caused the steam in the cylinder to condense. The pressure in the cylinder decreased, producing a partial vacuum. The atmospheric pressure above the piston pushed it back down the cylinder. The water inside the cylinder exited through a valve (K). This movement of the piston lowered the beam, the other end of the beam rose, bringing the pump bucket up the shaft.

This cycle repeated itself approximately every four seconds. The walking beam rocked back and forth, continually pumping water up the shaft. Rods (not shown in the diagram) connected the beam to the valves. These rods opened and shut the valves at the appropriate times.

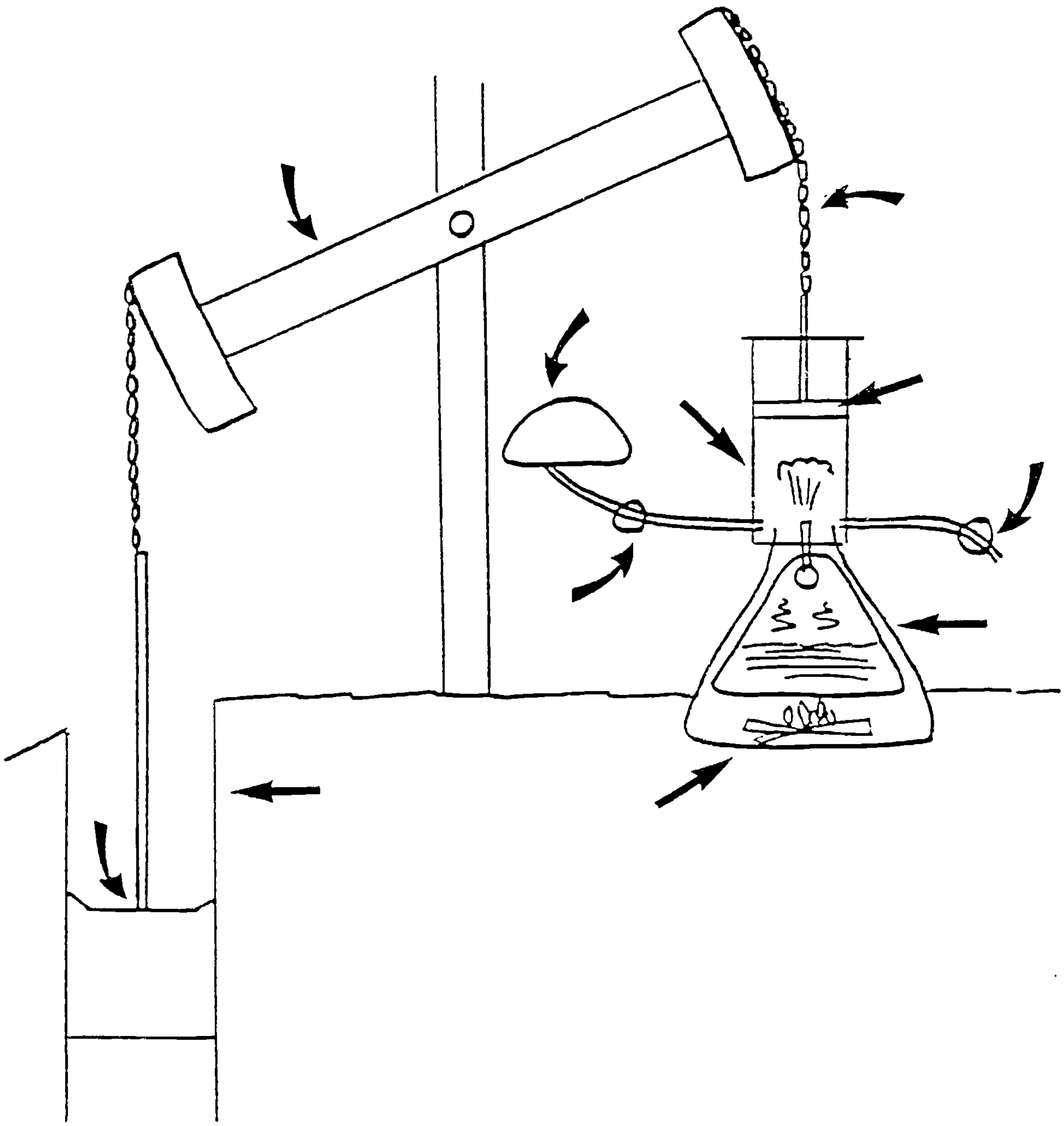
*Atmospheric pressure is air pressure.

NEWCOMEN'S STEAM ENGINE



Referring to a Diagram

Look at the first page of READING 4D, but do not look at the diagram on page 2. On this worksheet, label the parts of the steam engine with letters according to the description in the reading.



Steps in a Process

A. Put these sentences into the correct order to describe how Newcomen's steam-driven pump worked. The first one has been done for you.

_____ Steam entered the cylinder.
_____ The beam rose on the piston side and lowered on the pump side.
__1__ The furnace heated water.
_____ Cold water entered the cylinder.
_____ The piston moved up the cylinder.
_____ The beam lowered on the piston side and rose on the pump side.
_____ The piston moved down the cylinder.
_____ The pump bucket descended down the shaft.
_____ The pump bucket came up the shaft.
_____ The pressure in the cylinder decreased.

This description of the pumping process is written in the past tense. Why do you think this is so?

B. Imagine that the Newcomen pump is still being used today. On a separate sheet of paper, rewrite the above steps in the correct order. Put each sentence into the present tense.

Technical vs. Everyday Vocabulary

In the left column are "technical" words found in your reading. Match them to the more common expressions on the right which mean the same.

A	B
________ 1. produce	a. push
________ 2. force	b. work
________ 3. attach	c. go out
________ 4. operate	d. make
________ 5. appropriate	e. about
________ 6. exit	f. air
________ 7. approximately	g. connect
________ 8. atmospheric	h. right
________ 9. shut	i. go up
________ 10. ascend	j. close

THE FOUR-STROKE CYCLE IN AN INTERNAL COMBUSTION GASOLINE ENGINE

This reading passage provides more detailed information about the process which occurs in a cylinder in a gasoline engine.

As you know, the piston moves up and down inside the cylinder. Each upward and each downward movement is called a stroke. In order to bring the fuel mixture into the cylinder, burn it, and then push out the burned waste product (exhaust), four stokes of the piston take place. Figure 1 (p.2) shows the four-stroke cycle.

Intake Stroke

The piston is pulled down by the crankshaft. A type of "door" to the cylinder, which is called the intake valve, opens. This allows the air-fuel mixture to be drawn into the cylinder, View A.

Compression Stroke

At the end of the intake stroke, the intake valve closes. Then the crankshaft forces the piston up through the cylinder. This causes pressure in the cylinder, which compresses the air-fuel mixture, View B.

Firing Stroke

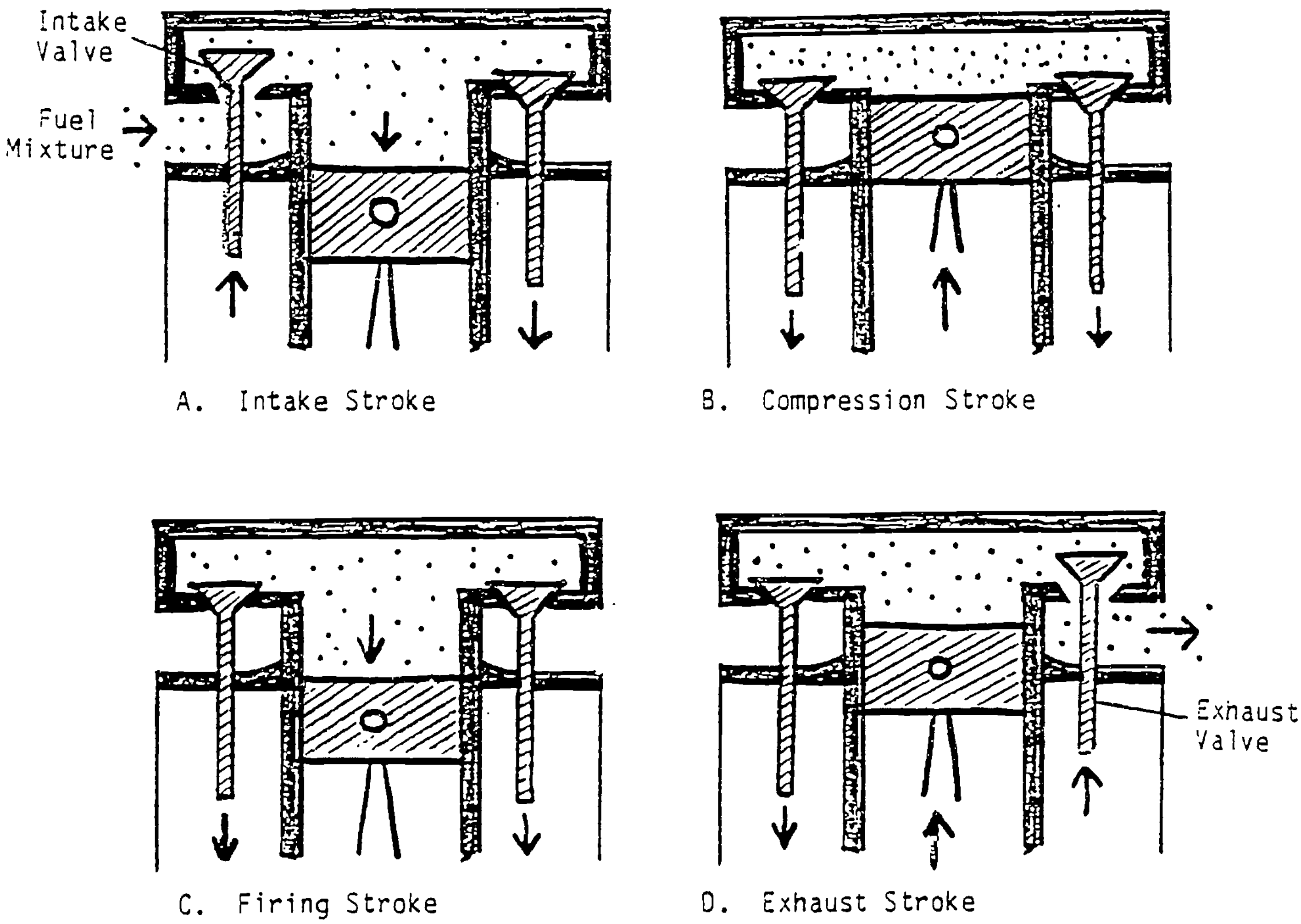
This is the stroke in which combustion (burning) takes place. The compressed air-fuel mixture is ignited by a spark from the spark plug. This explodes the mixture, and the pressure caused by the explosion drives the piston back down through the cylinder. Both valves are closed during this firing stroke, View C.

Exhaust Stroke

At the end of the firing stroke, the exhaust valve opens. The crankshaft forces the piston up through the cylinder. All the burned gases are exhausted from the cylinder. Now the system is ready for another intake stroke, View D.

This four-stroke cycle is repeated over and over again. All of the cylinders of the engine work together to produce enough power to run the automobile.

Figure 1. Four-stroke cycle in a gasoline engine cylinder.



Steps in a Process

A. Put the sentences into the correct order to describe the internal combustion process. The first one in each section has been done for you.

Intake and Compressions Strokes

_____ The intake valve closes.
__1__ The piston is pulled down by the crankshaft.
_____ The air-fuel mixture is compressed.
_____ The air-fuel mixture enters the cylinder.
_____ The intake valve opens.
_____ The piston goes up the cylinder.

Firing and Exhaust Strokes

_____ The explosion forces the piston back down the cylinder.
_____ The piston goes up the cylinder.
_____ The exhaust valve opens.
__1__ The air-fuel mixture is ignited and burns.
_____ The gases are exhausted from the cylinder.

B. Using the sentences above, write two paragraphs with the titles "Intake and Compression Strokes" and "Firing and Exhaust Strokes." Begin each sentence with a word which emphasizes its place in the process. For example: First, the piston is pulled down by the crankshaft. Here are some words you might use: first, second, third, then, next, after that, last, finally.

Active and Passive Sentences

The following sentences describe steps in the internal combustion process (they are not in order). Each step can be written as either an active or a passive sentence. Their meanings are the same. For each sentence provided, write the corresponding active or passive form. The first one has been done for you.

	Active	Passive
1.	The spark plug ignites the fuel mixture.	The fuel mixture is ignited by the spark plug.
2.	The piston compresses the fuel mixture.	____________________
3.	The connecting rod turns the crankshaft.	____________________
4.	Burning gas causes an explosion.	____________________
5.	____________________	The valve is opened by a camshaft.
6.	____________________	The car is powered by the engine.

(The following sentences contain two-word verbs. Be careful!)

7.	The crankshaft pulls the piston down.	The piston is pulled down by the crankshaft.
8.	The crankshaft forces the piston up.	____________________
9.	The explosion drives the piston down.	____________________
10.	____________________	The exhaust is pushed out by the piston.

Oral Presentations

Prepare a 3-5 minute oral presentation on a mechanical process and present it to the class. As your topic, choose a mechanical appliance or utensil you have at home (such as a toaster, a can opener, etc.) and explain in simple terms how it works.

Use this outline to help you prepare your presentation.

TOPIC: "How a ______________ Works"

Introduction

A. Who uses it

B. Its function

Mechanical Process (How it works)

A. First, ...

B.

C.

D.

E.

Conclusion

In addition to preparing your presentation, prepare two questions about your topic. After you have done your presentation, ask the class your questions to check their comprehension. Make sure that you have given the answers to your questions in your presentation.

Question	Answer
1. ______________	______________
2. ______________	______________

UNIT FIVE: DEFINITIONS, EXAMPLES, AND CLASSIFICATIONS

TOPICS:	Matter and Energy Changing States of Matter Energy Consumption Materials and Their Properties
SKILL OBJECTIVES:	Comprehend lecture and take lecture notes Identify, ask for, and give definitions Identify, ask for, and give examples Classify information into categories and subcategories Read tables Take true/false tests

---

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate directly to the overall skills of being able to define terms, give examples, and classify information. The topics for this unit are matter and energy, which are key concepts in understanding many technical processes and operations.

Outline of Lecture

Fill in the blanks in this outline as you listen to the lecture.

TOPIC: MATTER AND ENERGY

I. Introduction: Everything can be classified as matter or energy

II. Matter

A. Definition:

B. 3 Subcategories

1.

Examples:

2.

Examples:

3.

Examples:

III. Energy

A. Definition:

B.

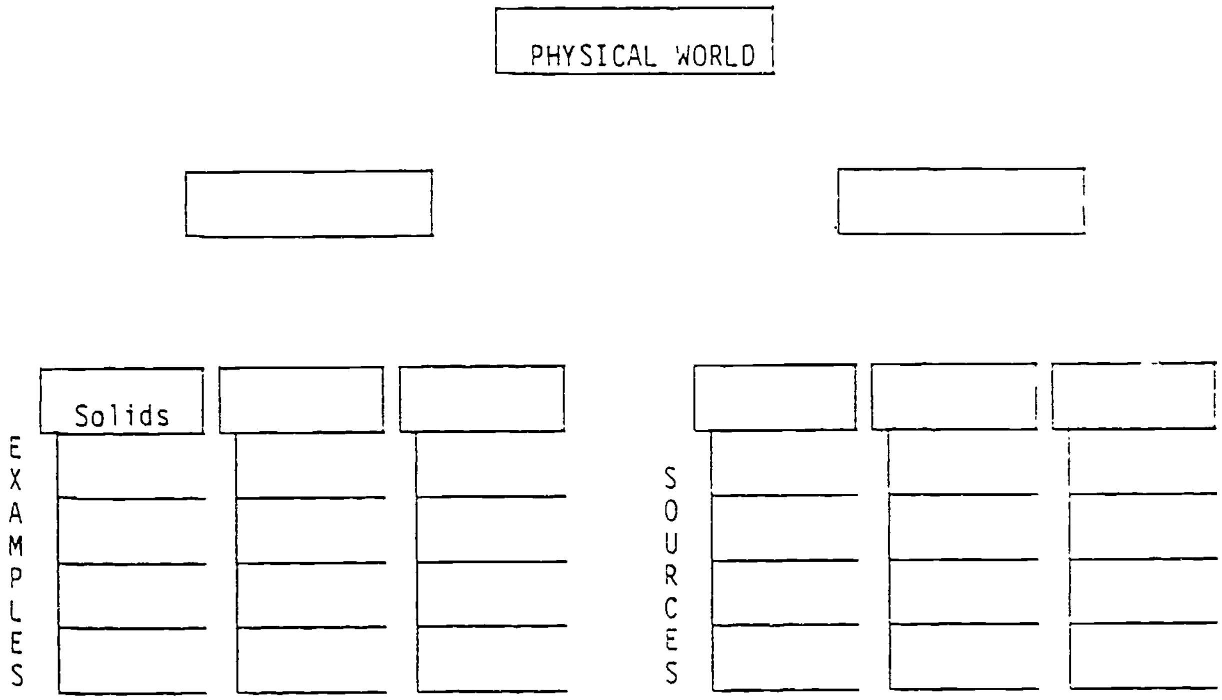
1.

2.

3.

Classifying Information

Based on the information in the lecture, fill in the empty boxes.



Oral Practice

Do this exercise with a partner.

First, ask your partner to define these words: **matter**, **solid**, **liquid**, **gas**, **energy**.

Student A: What is ________________?

Student B: ______________ is ______________________________.

Next, ask your partner about these categories: **matter**, **energy**.

St. A: How many types of ______________ are there?

St. B: There are __________ types of ________________.

They are ______________, _____________, etc.

Finally, ask your partner for examples of these: **solids**, **liquids**, **gases**, **light sources**, **heat sources**, **sources of electricity**.

St. A: What are some examples of ______________________?

St. B: Some examples are _______________, _____________, and

___________________.

When Student A is finished asking questions, partners switch roles and repeat the exercise.

CHANGING STATES OF MATTER

Many materials can change from one state of matter to another. For example, water can change from a solid (ice) to a liquid, or from a liquid to a gas (steam).

When a solid turns into a liquid, the process is called melting. Ice melts at 32° Fahrenheit (0°C). This temperature is known as the melting point for ice. Other solids melt at other temperatures. Figure 1 gives the melting points of three metals.

Figure 1

Metals	m.p.(melting point)
Iron (Fe)	1,536° C
Lead (Pb)	327° C
Mercury (Hg)	-39° C

Of course the reverse can also happen. Water can turn to ice, which means that a liquid is turning into a solid, i.e., freezing. This happens at a temperature which is called the freezing point.

When a liquid turns into a gas, we say that it vaporizes. This always happens when a liquid reaches its boiling point. The boiling point of water is 100° C. (Of course water also turns to a vapor very slowly at lower temperatures. This is called evaporation.) The freezing points and boiling points of various liquids is given in Figure 2.

Figure 2

Liquids	f.p.	b.p.
Water (H_2O)	0°C	100°C
Bromine (Br)	-7°C	58°C
Benzene (C_6H_6)	5°C	80°C

And finally, the reverse of this process is when a gas turns into a liquid. When this happens, we say that the gas or liquifies. Condensation, for example, is a process whereby a gas is converted to a liquid. When there is a lot of water vapor in the air, it can condense on an object and make it feel wet.

All gases become liquids when they are cooled down to their boiling points. Oxygen, for instrance, liquifies at -183°C. Below -219°C oxygen freezes, becoming a solid. Figure 3 shows the freezing points and boiling points for some gases.

<u>Figure 3</u>

Gases	f.p.	b.p.
Carbon Dioxide (CO_2)	-78°C	-57°C
Oxygen (O)	-219°C	-183°C
Hydrogen (H)	-259°C	-253°C

Reading Comprehension

Answer these questions about the reading.

1. What is the main idea expressed in the reading?
____

2. What is the process called when a solid turns into a liquid?
____
When a liquid turns into a solid? ______________
When liquid turns into a gas? ______________ or ______________
When a gas turns into a liquid? ______________ or ______________

3. When water boils, what is the product called? ______________
When water evaporates, what is the product called? ______________

4. What temperature is the same as 32° Fahrenheit? ______________

5. What is the reverse of melting? ______________

6. What is the reverse of vaporizing? ______________

Look at Figure 1.

7. What does "m.p." mean? ______________

8. What is the chemical symbol for lead? ______________

9. What is the melting point for lead? ______________

10. Which metal in the chart has the highest melting point? ______________

Look at Figure 2.

11. What do f.p. and b.p. stand for? ______________ and ______________

12. At what temperature does bromine become a solid? ______________

13. At what temperature does benzene become a gas? ______________

Look at Figure 3.

14. At what temperature does hydrogen become a liquid? ______________

15. What state is carbon dioxide in at -90°C? ______________
at -60°C? ______________ at -30°C? ______________

Oral Practice

Sometimes we give a definition of a word by telling about the process involved. For example:

Student A: Can you tell me the definition of melting?
Student B: Melting occurs (happens) when a solid becomes a liquid.

Student A: Can you give me an example?
Student B: An example is when ice turns to water.

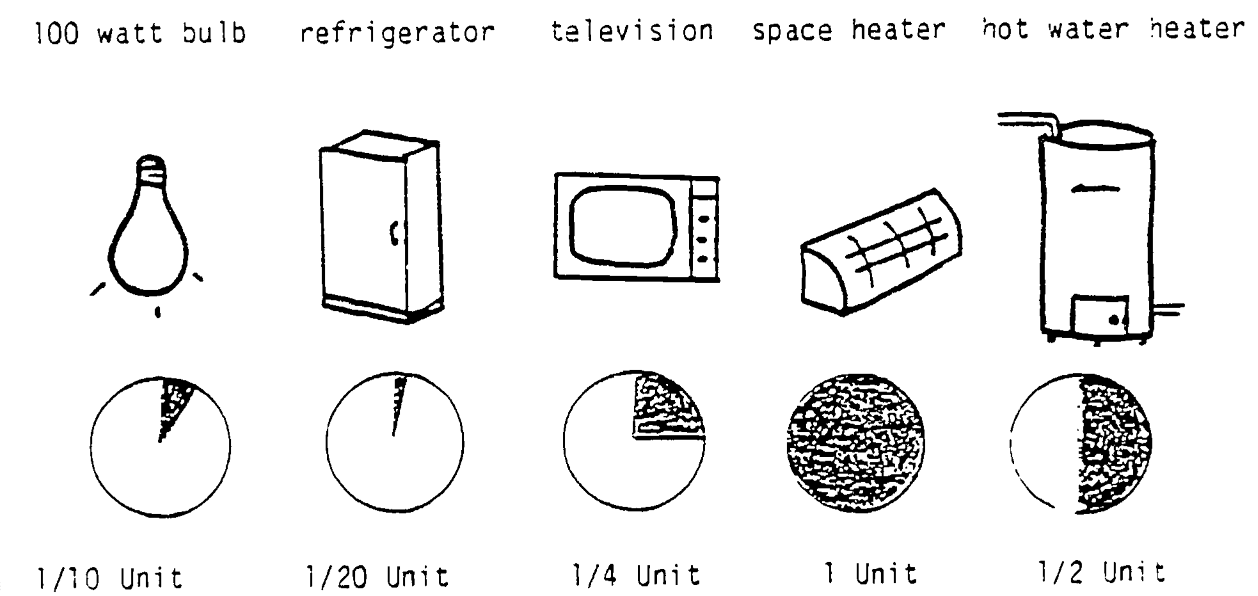
With a partner, practice asking for definitions and examples. Use these key words:

freezing
vaporizing (vaporization)
evaporation
condensing (condensation)
liquifying

After Student A has asked several questions, switch roles.

ENERGY CONSUMPTION

One of the forms of energy we depend on every day is electricity. Many of the appliances in our homes consume electricity, changing it into other forms of energy such as heat or light. The following diagram gives the number of units (one unit = 1 kilowatt/hour) consumed by each appliance.



Units Used by Electrical Appliances
(Expressed in Kilowatts per Hour)

Reading Comprehension

Use the information from the diagram to answer these questions.

1. Which appliance in the diagram uses the most electricity per hour?

   ____

2. If a 100 watt bulb is on for 3 hours, it uses 3/10 units of electricity.

   1/10 unit per hour x 3 hours = 3/10 units

   How many units does a 100 watt bulb use in 7 hours? ____________________

3. How many units of electricity do these appliances use when they run for the amount of time given?

   a. How much electricity does a refrigerator use when it runs for 10 hours? ______________________
   b. Television - 4 hours? _______________
   c. Hot water heater - 4 hours? ____________
   d. Space heater - 2 1/2 hours? ____________
   e. Three 100 watt bulbs - 5 hours? ___________

4. If you used these appliances every day for the number of hours given in Question 5, how many units would be used in one week? _________________

5. If one unit of electricity costs 15 cents, how much would the electricity bill be for the week? ____________________

Interviews

Interview a classmate about the appliances in his/her home or apartment. Ask what types of energy they use and how many hours per day they are used. You may also want to ask about their monthly utility bills for gas and electricity!

WORKSHEET 5D

Materials

A. Listen to your instructor talk about different types of materials. List them here:

Metals	Fiber Products	Chemically-Produced Materials

B. List some of the properties of materials:

Property	Definition

C. Put x's in the chart to show the properties of the materals you have discussed.

Properties of Common Materials

	Wood	Paper	Plastic	Rubber	Cotton	Glass	Steel	Copper	Polyester
rigid									
brittle									
flexible									
elastic									
strong									
heavy									
light									
a mixture of materials									

MATERIALS

Study the following definitions:

material	physical matter
element	a chemical substance that cannot easily be separated into different substances
iron	a heavy, strong, very common element
copper	a reddish-brown ductile (stretchable) metallic element
metal	a hard, strong material that can conduct heat or electricity
alloy	a mixture of two or more metallic elements
steel	a very strong metal alloy which contains iron and carbon
aluminum	a light but strong metallic element
carbon	a nonmetallic chemical element
brass	an alloy consisting of copper and zinc
low carbon steel	a malleable, "elastic" form of steel with a carbon content of .08-.25%
high carbon steel	a very strong form of steel with poor malleability, poor elasticity, and a carbon content of .6-1.5%

Are the following statements true or false? Write T for true, F for false.

1. _____ Iron is an element which is heavy and strong.
2. _____ It is difficult to separate an element into different substances.
3. _____ An alloy is an element.
4. _____ Aluminum is an element.
5. _____ Iron and carbon are found in steel.
6. _____ Metals can conduct electricity.
7. _____ Carbon is a form of metal.
8. _____ Copper and zinc mixed together form an alloy.
9. _____ Low carbon steel has good malleability.
10. _____ A steel with 1.0% carbon is classified as high carbon steel.

WORKSHEET 5F

Definitions

A. Select 10 words from this unit and write a brief definition for each.

Word	Definition
1. ______	______
2. ______	______
3. ______	______
4. ______	______
5. ______	______
6. ______	______
7. ______	______
8. ______	______
9. ______	______
10. ______	______

B. As a class, play "Jeopardy." Select three "contestants" to go in front of the class. A member of the "audience" reads a definition aloud. The first contestant to form a question which asks for the definition of the word earns one point.

Example: Member of audience: "Physical matter"
Contestant: "What is the definition of material?"

When one contestant has earned four points, select new contestants.

Metal Designation and Identification

Thousands of standard metal alloys are available, each of which has unique properties making it the best choice for certain applications. In order for different manufacturers to produce the same alloys, it was necessary to standardize the alloy compositions. For the convenience of manufacturers and consumers, it was also necessary to develop standard numbering systems so that each alloy could have its own unique designation.

Steel Numbering Systems

The two main steel numbering systems were developed by the Society of Automotive Engineers (SAE), and the American Iron and Steel Institute (AISI). These systems designate standard constructional grades of carbon and alloy steels according to their basic chemical composition. Both the SAE and AISI systems use a four-digit series of code numbers. Occasionally, a five-digit series is used for certain alloys.

First Digit

In the SAE and AISI code classification systems, the first number frequently, but not always, indicates the basic type of steel as follows:

1 — Carbon
2 — Nickel
3 — Nickel-chrome
4 — Molybdenum
5 — Chromium
6 — Chromium-vanadium
7 — Tungsten
8 — Nickel-chromium-molybdenum
9 — Silicomanganese

All Digits

The first two digits together indicate the series within the basic alloy group. There may be several series within a basic alloy group, depending on the amount of principal alloying elements. Hence, the second digit very often, but not always, indicates the approximate percentage of the principal alloying element. The third, fourth, and fifth digits are intended to indicate the approximate middle of the carbon range. The carbon content is indicated in points — 1-point carbon is 0.01%, 45-point carbon is 0.45%, and 100-point carbon is 1.0%.

Two examples of the SAE/AISI numbering system are explained in Fig. 130-1. The series designations and the types of steel which they designate are summarized in Table 130-1.

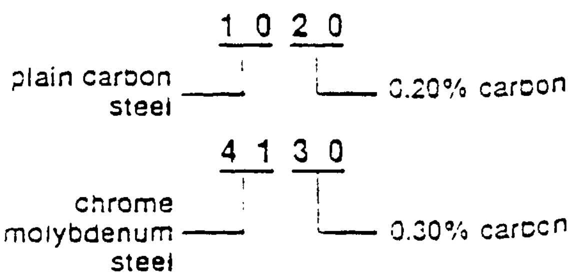


Fig. 130-1. SAE and AISI code numbers.

Table 130-1
Series Designations In SAE-AISI Steel Code

Series	Types			
10xx	Nonsulphurized carbon steels			
11xx	Resulphurized carbon steels (free machining)			
12xx	Rephosphorized and resulphurized carbon steels (free machining)			
13xx	Mn	1.75%		
*23xx	Ni	3.50%		
*25xx	Ni	5.00%		
31xx	Ni	1.25%	Cr 0.65%	
33xx	Ni	3.50%	Cr 1.55%	
40xx	Mo	0.20 or 0.25%		
41xx	Cr	0.50 or 0.95%	Mo 0.12 or 0.20%	
43xx	Ni	1.80%	Cr 0.50 or 0.80%	Mo 0.25%
44xx	Mo	0.40%		
45xx	Mo	0.52%		
46xx	Ni	1.80%	Mo 0.25%	
47xx	Ni	1.05%	Cr 0.45%	Mo 0.20 or 0.35%
48xx	Ni	3.50%	Mo 0.25%	
50xx	Cr	0.25, 0.40 or 0.50%		
50xxx	C	1.00%	Cr 0.50%	
51xx	Cr	0.80, 0.90, 0.95, or 1.00%		
51xxx	C	1.00%	Cr 1.05%	
52xxx	C	1.00%	Cr 1.45%	
61xx	Cr	0.60, 0.80 or 0.95%		
	V	0.12%, 0.10% min., or 0.15% min		
81xx	Ni	0.30%	Cr 0.40%	Mo 0.12%
86xx	Ni	0.55%	Cr 0.50%	Mo 0.20%
87xx	Ni	0.55%	Cr 0.05%	Mo 0.25%
88xx	Ni	0.55%	Cr 0.50%	Mo 0.35%
92xx	Mn	0.85%	Si 2.00%	Cr 0 or 0.35%
93xx	Ni	3.25%	Cr 1.20%	Mo 0.12%
94xx	Ni	0.45%	Cr 0.40%	Mo 0.12%
98xx	Ni	1.00%	Cr 0.80%	Mo 0.25%

*Not included in the current list of standard steels.

Abbreviations:

C	Carbon	**Mo**	Molybdenum
Cr	Chromium	**Ni**	Nickel
Mn	Manganese	**Si**	Silicon
		V	Vanadium

Reading courtesy of Glencoe Publishing Co., Machine Tool Technology, 1984.

Reading Comprehension

Based on the reading, answer the following questions.

1. Why was it necessary to standardize the metal alloys?
   ____
2. What does AISI stand for? ______________________________
   ____
3. How many digits does the number 1020 have? ______________
4. In the SAE and AISI system, what type of steel has the number 3 as the first digit in its code number? ________ What type has the first digit 7? ________
5. Fill in the blank: The second digit often indicates the approximate percentage of the ________ ________ ________.
   The second digit in the series number 44xx in Table 130-1 means that this alloy has about ________% Mo (Molybdenum).
6. Look at Figure 130-1. In the code number 1020, what do the third and fourth digits tell you? ______________________________

Look at Table 130-1. Answer the questions.

1. What does Ni stand for? ______________
   Mn? ______________
2. What % of molybdenum is contained in the series 45xx? ________
3. What % of chromium is contained in the series 43xx? ________
4. Of all the series, which one contains the most chromium? ________
5. Which series numbers are not included in the current list of standardized steels? ________ and ________
6. How many series contain a combination of these three elements: nickel, chromium and molybdenum? ________
7. Which series have five-digit numbers? ________, ________, and ________

UNIT SIX: COMPARATIVE DESCRIPTIONS

TOPICS: Electricity, Electronics

SKILL OBJECTIVES: Compare and contrast two topics
Take lecture notes
Refer to a table of contents and index
Read a schematic diagram
Take a multiple choice test

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate directly to the overall skills of being able to compare objects or ideas. The topics for this unit are electricity and electronics, but the language used to make comparisons is similar whenever you are talking about the differences and similarities between two things.

ELECTRONICS / *Background to Electronics*

Basic Principles. To understand how electron devices work, a person must know something about the nature of matter. All matter consists of tiny "building blocks" called *atoms*. Every atom, in turn, has one or more *electrons*—particles that carry an electric charge. In substances called *conductors*, which include most metals, the atoms have one or more electrons that can flow freely from atom to atom. Such a flow forms an *electric current*.

Electronics and the science of electricity both deal with electric current. But they differ in how they use it. Electricity deals with electric current mainly in the form of energy. The energy operates electric lights, electric motors, and other electric equipment. The current flows through wires or other conductors. Electronics, on the other hand, deals with electric current mainly in the form of pulses, or signals. The current flows through electron devices, which change the current's behavior to make it work as a signal.

The signals used in electronics may represent sounds, pictures, numbers, or other information. In computers, the signals stand for numbers. In radios and phonographs, they stand for sounds. TV signals carry both sound and picture information. Other electronic signals are used to count or compare objects, measure time or temperature, analyze the chemical composition of various substances, or detect radioactive materials.

To carry information, an electric current must go through a series of changes. Some changes control the direction of the current. Other changes vary the current's strength or its *frequency*—that is, the number of times it vibrates per second. Electronics depends on electron devices to make these changes.

Electron devices work because they can control an electric current—that is, a flow of electrons—quickly and accurately. The flow of electrons through a wire or other conductor cannot be controlled with great speed or accuracy. An electron device avoids this problem by producing a flow of electrons that is independent of a conducting material. Most electron devices made today create a flow of electrons in certain *semiconductor* materials, such as germanium or silicon. Semiconductors are not good conductors of electricity, nor are they good *insulators* (nonconductors). But if they are chemically treated in certain ways, they can both conduct and control an electric current.

Electron devices enable electronic equipment to work with great speed and accuracy. In computers, for example, the devices make changes in an electric current to solve mathematical problems. The devices work so rapidly that a computer can solve difficult problems millions of times faster than a person can. In TV sets, the devices strengthen TV signals and produce an accurate copy of the original sounds and pictures.

Source: World Book Encyclopedia

Definitions

Below are definitions of key words from the reading.
For each definition given, supply the missing word.

1. ______________________ The "building blocks" of all matter.

2. ______________________ Particles that carry an electric charge.

3. ______________________ Substances in which electrons can flow.

4. ______________________ The flow of electrons.

5. ______________________ The science of electric current in energy form to operate lights, motors, etc.

6. ______________________ The science of electric current in signals, such as sounds, pictures, or numbers.

7. ______________________ The number of times something happens in a given time period.

8. ______________________ Materials which can both conduct and control an electric current.

Comparing and Contrasting

Based on the information found in the readings, fill the blanks with words that show the relationships between the ideas. Choose from the following words and expressions. You will use some words more than once.

and	not	differ
both	nor	different
some	but	difference
other	on the other hand	
either		

Electronics and electricity ______________ deal with electric current. ______________ they ______________ in how they use electricity. In other words, there is a ______________ between electronics and electricity. Electricity deals with electric current mainly in the form of energy, ______________ electronics, __________ __________ __________ __________, deals with electric current in the form of signals.

In computers, the signals stand for numbers, ______________ in radios they stand for sound. And this is ______________ from TV, where the signals carry ______________ sound ______________ picture information.

To carry information, an electric current must be changed. ______________ changes control the direction, __________ __________ changes vary the frequency of the current.

In modern electronics, the flow of current is normally regulated by devices called semiconductors. Semiconductors are not good conductors of electricity, __________ are they good insulators. This means that they do ______________ conduct electricity well, and they do not stop the flow of electricity well ______________. __________ if they are chemically treated, they can __________ conduct ______________ control an electric current.

PHYSICAL MATERIALS

There are three physical materials which are used in electrical and electronic systems:

1. Conductors
2. Semiconductors
3. Insulators or non-conductors

Conductors

A conductor is a material which allows an electric current to pass through it. In a wire, for example, the electrical energy moves from one end to the other. A good conductor allows the current to pass freely. In other words, it offers very little resistance to current flow.

The resistance of a conductor depends on the length and thickness of the conductor. For example, a long wire offers more resistance to current flow than a short wire. That is, the longer the wire, the higher the resistance. On the other hand, a thick wire offers less resistance than a thin one. So, the greater the diameter of the wire, the less resistance it has.

The type of material a conductor is made of also affects its resistance. In most cases metals are the best conductors. Silver is the best conductor because it offers the least resistance to current flow.

Below are several conductors and their key properties:

Silver

- best conductor
- offers least resistance
- very expensive
- very heavy in weight
- not practical for most jobs because of expense

Copper

- good conductor
- offers low resistance
- not too expensive
- very heavy in weight
- widely used

Aluminum

- good conductor, but not as good as copper
- offers more resistance than copper
- moderately expensive
- very light
- widely used

Comparing/Contrasting

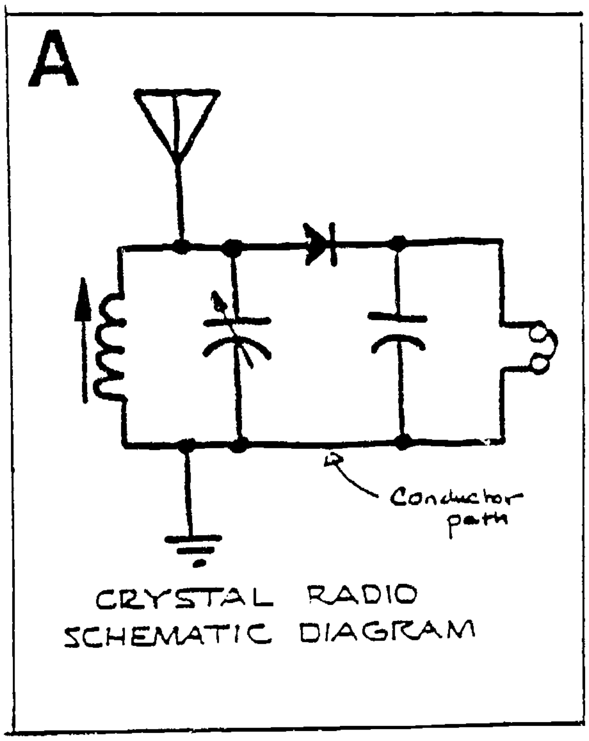
For each set of words given, make comparative statements based on the information in the reading. Use words such as: more, most, less, least, better, best, poor, poorest, etc.

Example 1:	silver, copper **expensive**	Silver is more expensive than copper. Copper is less expensive than silver.
Example 2:	silver, copper **weight**	Silver is approximately as heavy as copper.
Example 3:	silver, copper, aluminum **conductor**	Of the three metals, silver is the best conductor. Of the three metals, aluminum is the poorest conductor.

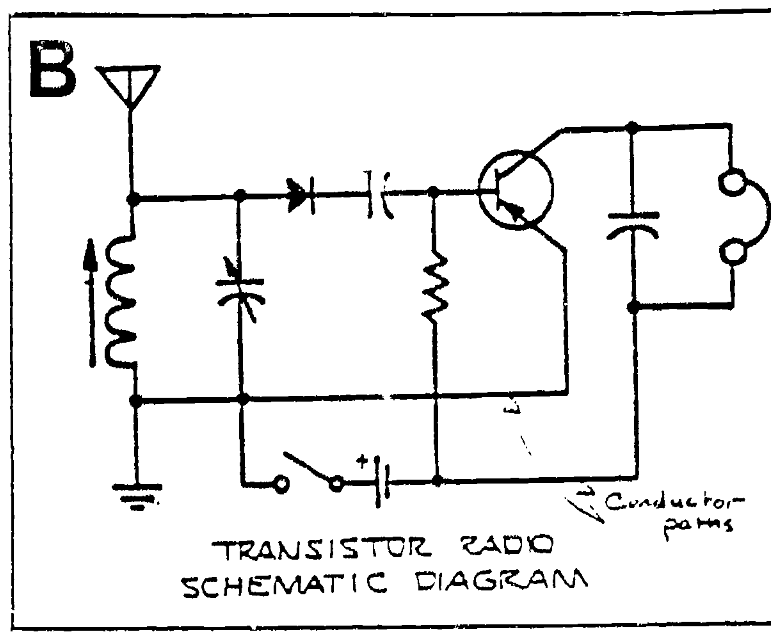
---

1. silver, aluminum
   expensive
2. copper, aluminum
   resistance
3. copper, aluminum
   expensive
4. silver, aluminum
   weight
5. copper, aluminum
   use
6. silver, copper
   conductor
7. silver, copper, aluminum
   conductor
8. silver, copper, aluminum
   expensive
8. silver, copper, aluminum
   expensive
9. silver, copper
   resistance
10. silver, copper, aluminum
    resistance
11. long wire, short wire
    resistance
12. thick wire, thin wire
    resistance
13. metal, glass
    conductor
14. long copper wire, short copper wire
    resistance

Instructions: Using the schematic diagram key below, compare Diagrams A and B.

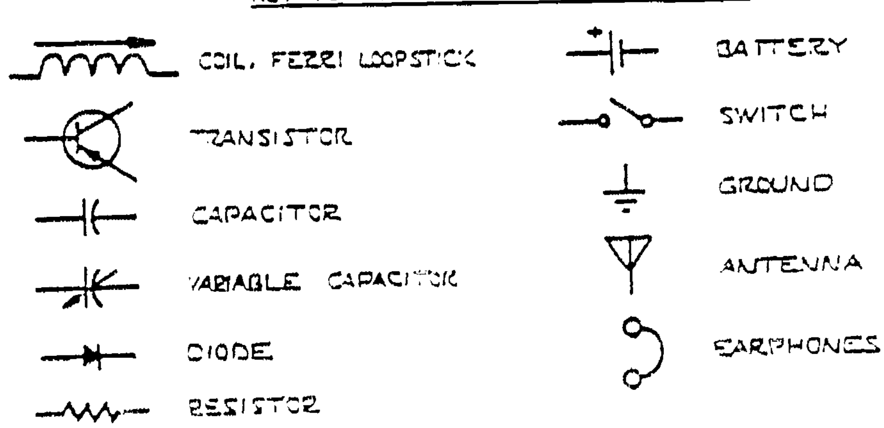


CRYSTAL RADIO SCHEMATIC DIAGRAM



TRANSISTOR RADIO SCHEMATIC DIAGRAM

KEY TO READING SCHEMATIC DIAGRAMS



Adapted from: Using the Language of Industry. Illinois State Board of Education.

Reading Comprehension

Using the information given in the schematic diagrams and the schematic diagram key, fill in the blanks to complete the sentences.

1. Both diagrams A and _____ are diagrams of radios. A shows a __________ radio and B shows a _____________ radio.

2. Besides the conductor paths, diagram A has a total of ______________ components. B has a total of ____________ components.

3. There are _____________ types of capacitors in each diagram.

4. A has a total of ____________ capacitors, and B has a total of _____________ capacitors.

5. Diagram ____________ has a resistor, but diagram ___________ does not.

6. In each diagram, the Ferri Loopstick is located between the ground and the _________________.

7. The far right sides of the diagrams show that each radio has ______________.

8. The bottom left corners of the diagrams show that each radio has a ________________.

9. Next to the battery in diagram B is a ________________.

10. Between the capacitors in diagram A is a ________________.

CONTENTS

Source: The Basic Book of Electricity and Electronics. American Technical Society. ©1979.

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Referencing Skills

On the handout is a table of contents and one page of the index from an electricity/electronics textbook. Using the handout, give short answers to the questions.

1. How many units are there in the "Introduction" section of the book? ________
2. On what page does the unit on "tools" begin? ________
3. What is the name of the first unit in the "Doing is learning" section? ________
4. What page does the unit on magnets begin? ________
5. How many pages long is the unit on testing electronic parts? ________
6. Which is the shortest unit in the book? ________
7. Which units talk about integrated circuits? ________
8. Which units have to do with the concept of "series and parallel"? ________
9. On what page is the index found? ________
10. Where can you get the definition of horsepower? ________
    Of coloumb? ________
11. How many different types of circuits are listed in the index? ________
12. If you want to know about short circuits, on what page do you look? ________
13. Where will you find information on the binary number system? ________
14. In which unit is there information on careers? ________
15. When is ferric chloride important? ________

Comparing and Contrasting

A. In a magazine or a newspaper, find two pictures of a product. The pictures should show two different models of the same product. For example, you may find two bicycles which have differences in style, size, cost, etc.

Imagine that you are a sales person. Try to convince customers that they should buy the model that you prefer. Write five sentences which support your argument.

Ex: Bicycle A is better because it has 10 speeds, whereas Bicycle B has only 3.

1.

2.

3.

4.

5.

B. Present your "sales pitch" to the class, showing your pictures and telling them why they should buy the model you think is best.

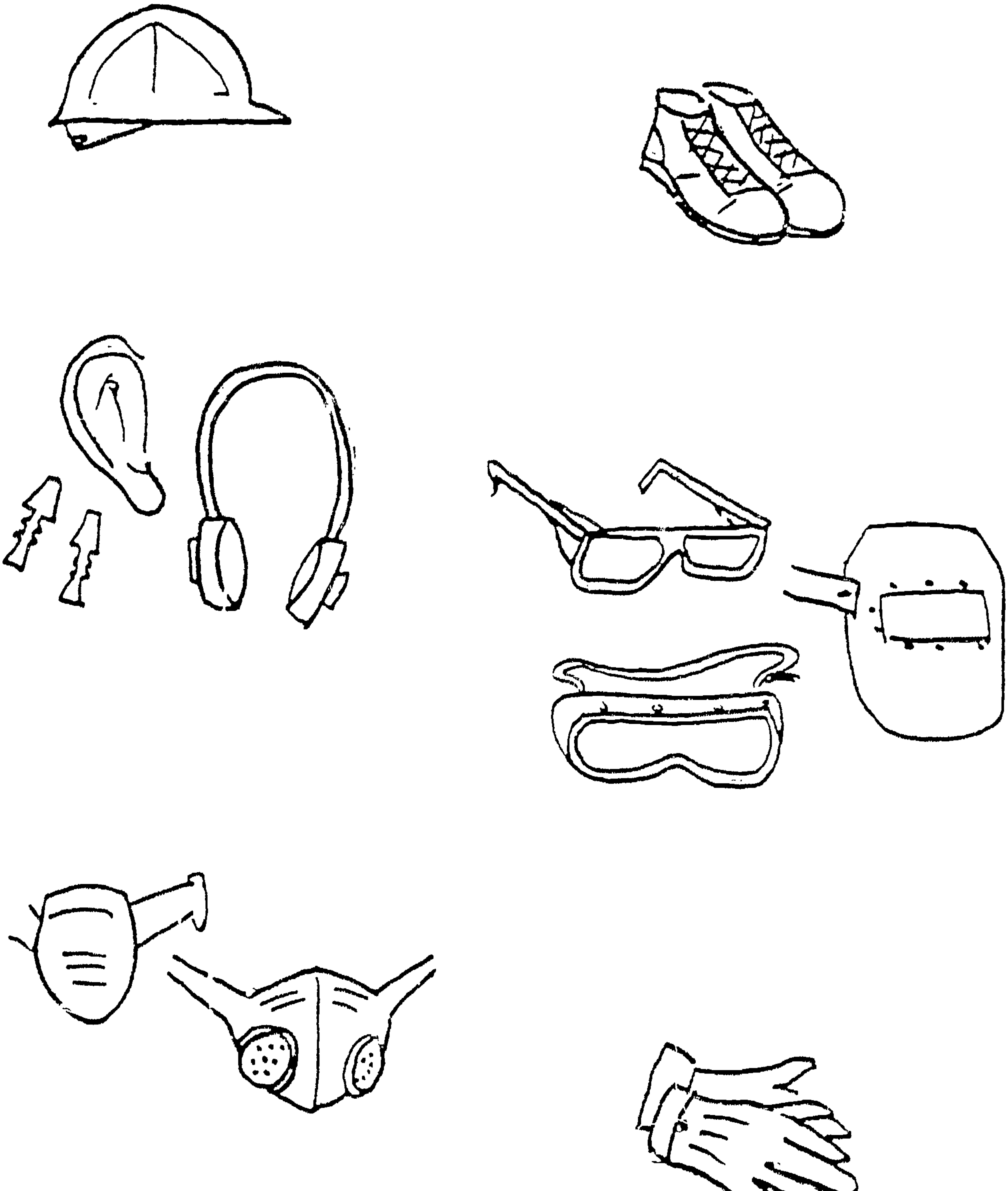
UNIT SEVEN: NON-SEQUENTIAL INSTRUCTIONS

TOPICS: Safety Precautions, Warnings

SKILL OBJECTIVES: Comprehend and give safety precautions and warnings
Read non-sequential instructions
Identify hazardous conditions
Read safety charts, signs, and labels
Take a true/false test

This unit will build your language and study skills in those areas found above in the "Skill Objectives" section. Most of them relate to the overall skill of being able to comprehend and give non-sequential instructions. These are instructions that do not have to be followed in a set order. The topic is safety, which is very important in every technical and industrial occupation.

VISUAL 7A



Matching Phrases

Use the information from the lecture to complete this matching exercise. Draw a line to connect the phrase on the left with the phrase on the right which correctly completes the sentence.

A. You must wear a chemical mask	you should always wear goggles.
If you don't think about safety,	falling materials.
Many accidents can be avoided by	it could result in an accident.
Work boots protect against	wearing the right protective equipment.
Whenever you work around flying materials,	to prevent breathing in toxic gases.

B. Goggles must be worn	when working with loud equipment.
A chemical mask must be worn	when working in an area where objects can fall.
Gloves must be worn	when working around flying particles.
A hard hat must be worn	when handling sharp or rough objects.
Ear muffs must be worn	when using materials that give off toxic gases.

Instructions/Written Practice

Instructions such as safety precautions can be stated in either a "direct" or an "indirect" way. For example:

1. Wear a hard hat! (direct)
2. A hard hat must be worn. (indirect)

Both sentences mean the same, but the first one has an imperative verb form "wear," and the second one has a passive verb form "must be worn."

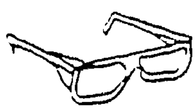
For each picture, write a "direct" instruction and an "indirect" instruction.

1. ______________________________

2. ______________________________

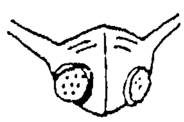
3. ______________________________

4. ______________________________



5. ______________________________

6. ______________________________



7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

Instructions/Oral Practice

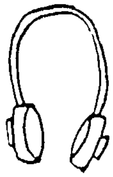
With a partner, practice the different ways of saying a safety precaution for each picture and set of words given.

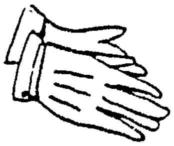
Example:  in areas where objects can fall.

1) Always wear a hard hat when working in areas where objects can fall.

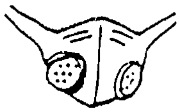
2) You must wear a hard hat when working in areas where objects can fall.

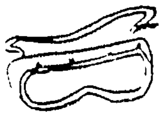
3) Hard hats must be worn when working in areas where objects can fall.

1)  around loud noises.

2)  with sharp objects.

3)  in a dusty area.

4)  around toxic gases.

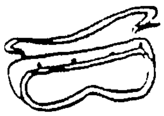
5)  around flying materials.

6)  by welders to protect against harmful light rays.

Instructions/Oral Practice

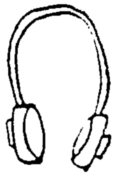
Do this exercise with a different partner. For each picture, practice making one direct and one indirect statement which describes what could happen if the piece of protective equipment is not worn.

Example:



a. If you don't wear safety goggles, you could injure your eyes.

b. If safety goggles are not worn, the eyes could be injured.

1. 

2. 

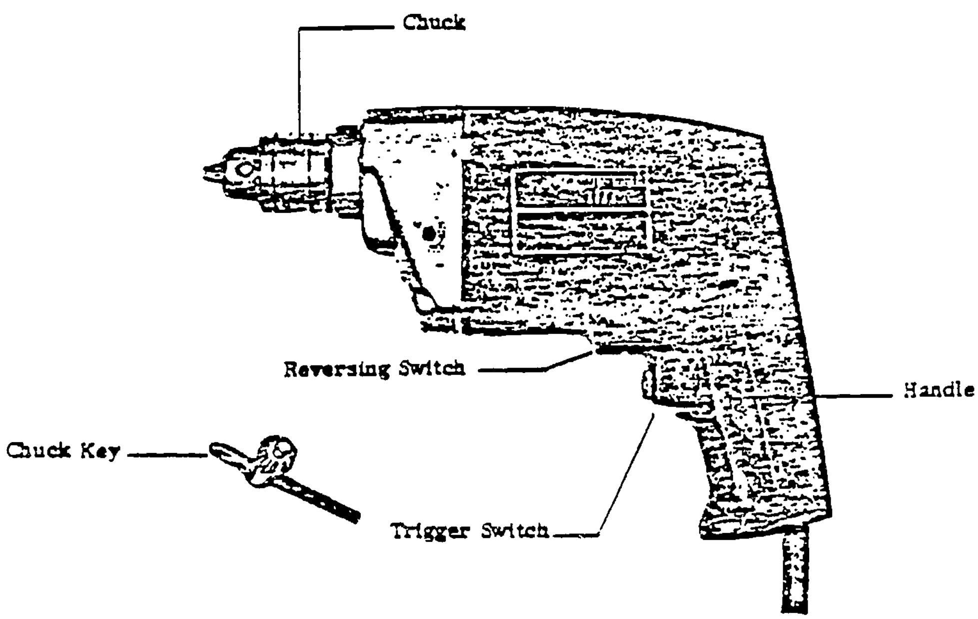
3. 

4. 

5. 

PORTABLE DRILL

1. TEACHER PERMISSION IS REQUIRED BEFORE USING THE PORTABLE DRILL.
2. EYE PROTECTION MUST BE WORN WHEN WORKING AROUND THE PORTABLE DRILL.
3. DISCONNECT THE POWER BEFORE CHANGING DRILL BITS.



4. Remove the chuck key immediately after using.
5. Make sure the switch is in the "off" position before plugging the drill in.
6. All work pieces must be secured.
7. Hold the drill firmly at all times.
8. If the work is caught by the drill, release the trigger.
   <u>Do not try to stop it by hand.</u>
9. Large drills should turn at slow speeds.
10. Keep hands, hair, loose clothing, and jewelry away from moving parts.

Restating Instructions

The reading contains 10 instructions for using the portable drill.

Below are the same instructions again, but they are given in different words and a different order. Find the instruction from the reading and the one below which mean the same, and write the number in front of the letter.

_______a. Always hold the drill tightly.

_______b. After you use the chuck key, take it off the chuck.

_______c. You must ask your instructor before you use this too!

_______d. The trigger switch must be OFF before you plug the drill in.

_______e. If you are using a large drill bit, drill slowly.

_______f. You must wear safety glasses or goggles when you use the drill.

_______g. Always unplug the cord before you change drill bits.

_______h. Be careful not to touch any part of your body or clothing to the turning drill bit.

_______i. If the piece you are drilling begins to move, stop drilling.

_______j. Hold down tightly the piece you are drilling.

SHOP TOOL SAFETY RULES

1. USE RIGHT TOOL. Don't force small tools to do the job of a heavy-duty tool. Otherwise you could break the tool or cause injury to yourself.

2. USE SAFETY EQUIPMENT with many tools. Always wear glasses or goggles when there is a danger of flying particles. A dust mask should be used if a cutting operation is dusty.

3. WEAR PROPER APPAREL. Don't wear loose clothing or jewelry because it can get caught in moving parts.

4. KEEP CHILDREN AWAY. All shop visitors should be kept a safe distance from the work area.

5. MAINTAIN TOOLS WITH CARE. Keep tools sharp or well-adjusted, and clean them periodically. Be sure handles are securely fastened.

6. STORE IDLE TOOLS. When not in use, tools should be stored--out of the way. Disconnect all power tools when not in use.

7. GROUND ALL POWER TOOLS. Use a three-pronged plug or an adaptor with wire attached to a known ground to prevent electric shock.

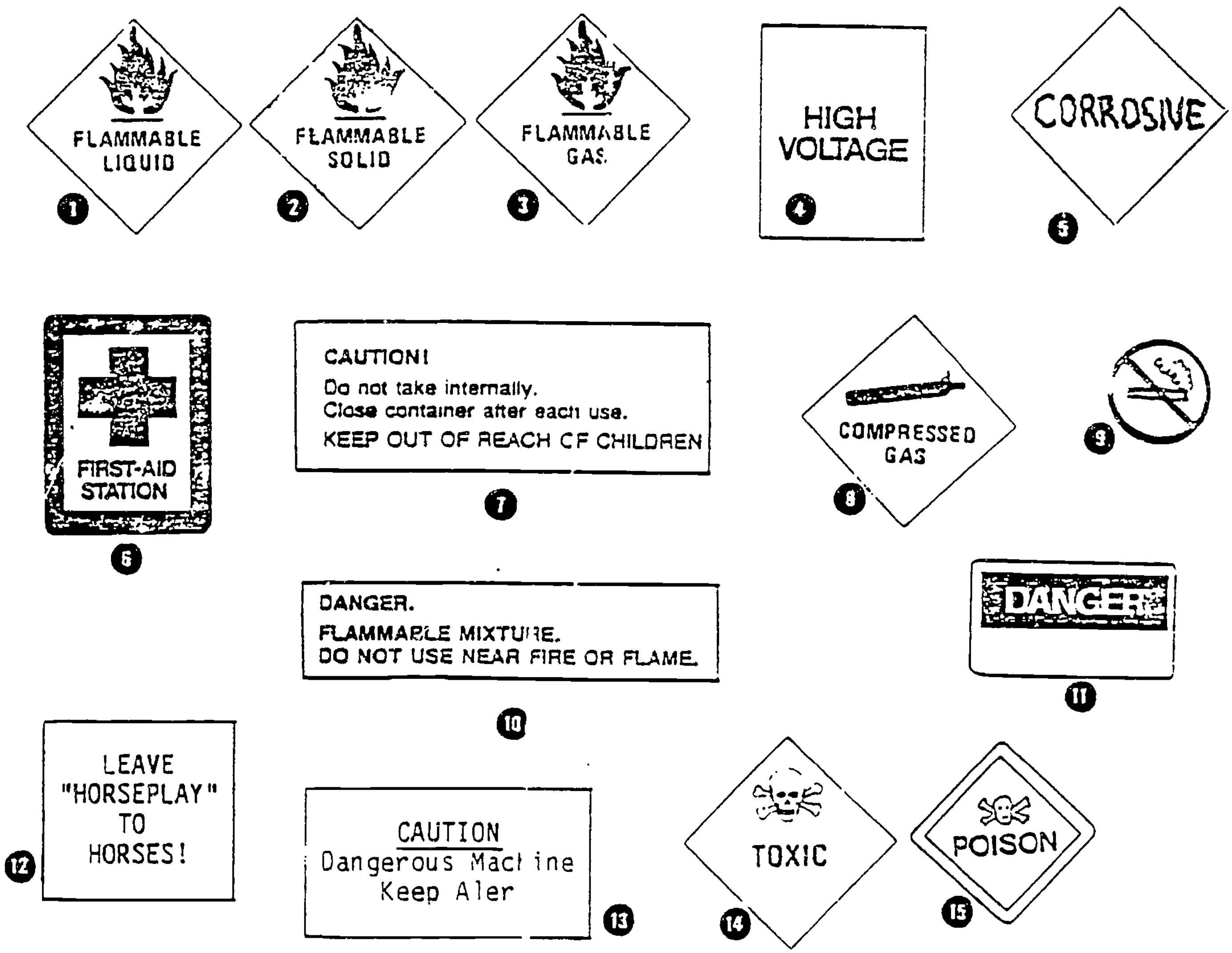
8. KEEP WORK AREA CLEAN. Cluttered areas and work benches invite accidents.

9. HAVE GOOD LIGHTING AND VENTILATION. Be sure bench areas are well-lit and that all exhaust fumes are drawn out of the shop.

10. KEEP A FIRST-AID KIT HANDY. All minor injuries should be treated at once to prevent infection.

SAFETY SIGNS AND LABELS

Below are signs and labels which you might see when working with dangerous materials or equipment. Discuss them with your instructor.



1. Which of the items pictured are signs?
   Which ones are labels?
2. Which would you expect to see around materials which can burn or explode?
3. Which would you expect to see around dangerous chemicals?
4. Which sign has to do with electricity?
5. Which sign warns you not to play around in a work area?
6. Which signs are so general that you could expect to see them in any shop?

Warnings

When you are working around dangerous equipment, you sometimes must warn your co-worker or fellow student of a danger. In this exercise you will practice giving warnings.

Do this exercise with a partner. Point to one of the signs or labels in Reading 7E. Your partner must give an appropriate warning to you. Take turns pointing and giving warnings to each other.

Example: Student A: (Points to Sign #1.)
Student B: "Look out! It could start on fire!"

Below are more sample warnings:

Look out! It could explode!

Watch out! You could get shocked!

Put out that cigarette!

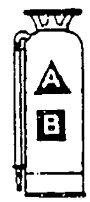
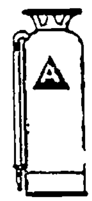
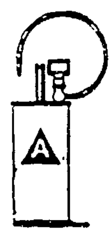
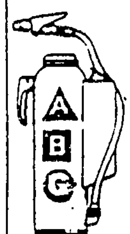
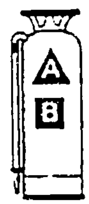
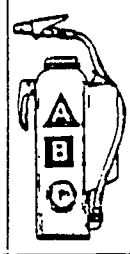
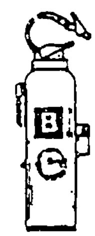
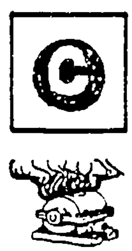
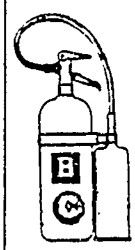
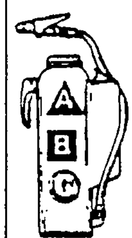
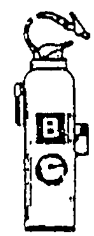
Pay attention! If you don't, you could injure your hand!

Don't breathe this stuff!

Be careful! Don't get it on your hands!

You've cut your finger. Go get the first aid kit!

Stop playing around in the shop!

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER						
		MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important! Using the wrong type extinguisher for the class of fire may be dangerous.						
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING...	...THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	**FOAM** Solution of Aluminum Sulphate and Bicarbonate of Soda	**CARBON DIOXIDE** Carbon Dioxide Gas Under Pressure	**SODA ACID** Bicarbonate of Soda Solution and Sulphuric Acid	**PUMP TANK** Plain Water	**GAS CARTRIDGE** Water Expelled by Carbon Dioxide Gas	**MULTI-PURPOSE DRY CHEMICAL**	**ORDINARY DRY CHEMICAL**
	**CLASS A FIRES** Use These Extinguishers ORDINARY COMBUSTIBLES • Wood • Paper • Cloth, Etc.							
	**CLASS B FIRES** Use These Extinguishers FLAMMABLE LIQUIDS, GREASE • Gasoline • Paints • Oils, Etc.							
	**CLASS C FIRES** Use These Extinguishers ELECTRICAL EQUIPMENT • Motors • Switches, Etc.							

Source: Developing Shop Safety Skills, American Association for Vocational Instructional Materials.

BEST COPY AVAILABLE

Reading Comprehension

Using the information from the diagram, circle T for true or F for false for each of the following statements.

1.	There are three main classes of fires.	T	F
2.	A class C fire involves electricity.	T	F
3.	Wood, paper and cloth are ordinary combustibles.	T	F
4.	A foam type extinguisher can be used on a class A fire.	T	F
5.	A pump tank water extinguisher can be used on a class B fire.	T	F
6.	Five types of extinguishers can be used on a class B fire.	T	F
7.	Most types of extinguishers can be used on electrical fires.	T	F
8.	All types of extinguishers can be used on class A fires.	T	F
9.	Burning switches can be extinguished with a foam extinguisher.	T	F
10.	Bicarbonate of soda mixed with sulphuric acid can be used to extinguish burning gasoline.	T	F
11.	There is one type of extinguisher which can be used on all three kinds of fires.	T	F
12.	There are only two types of extinguishers approved for class C fires.	T	F
13.	There is no extinguisher approved only for a class C fire.	T	F
14.	Using the wrong type of extinguisher is never dangerous.	T	F
15.	If you only have one fire extinguisher, the best one to have is probably the multi-purpose dry chemical variety.	T	F

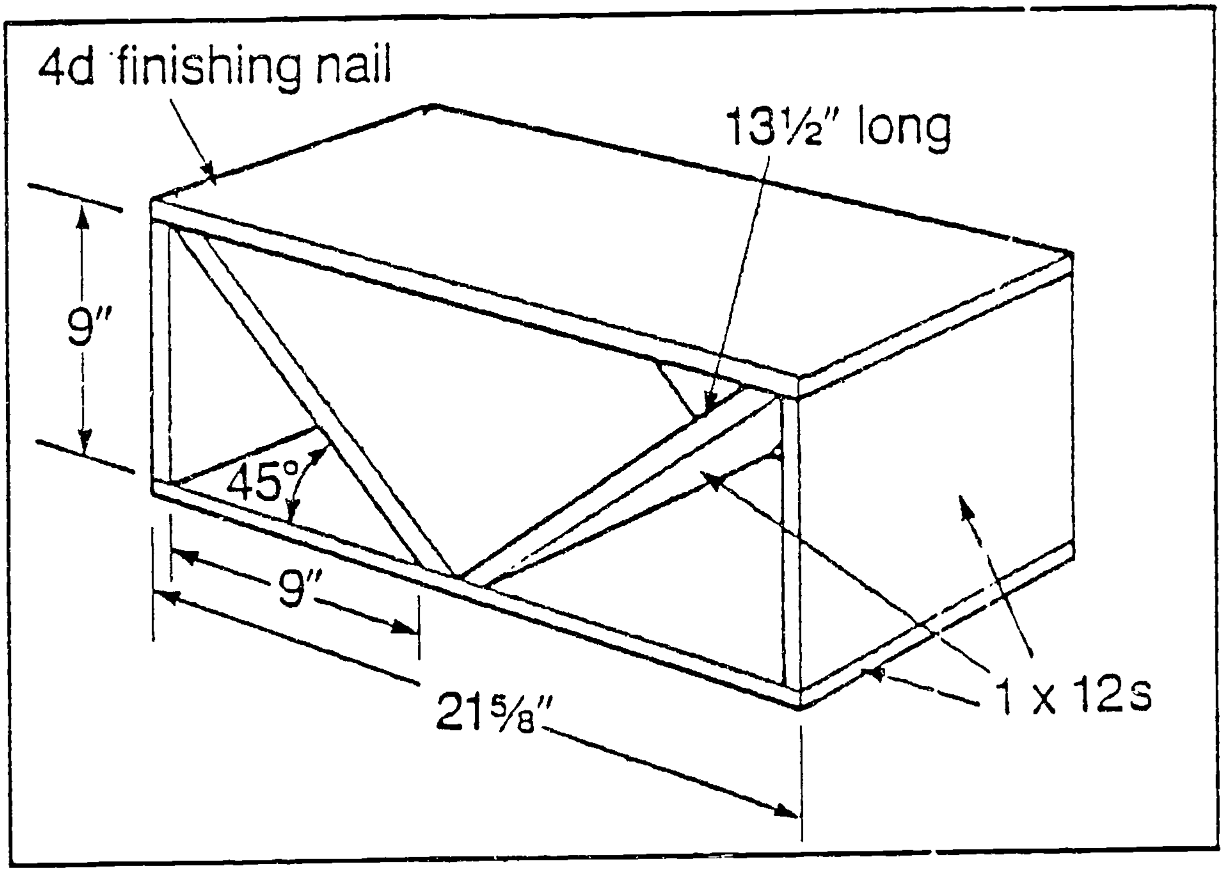
UNIT EIGHT: SEQUENTIAL INSTRUCTIONS

TOPICS: Assembly, repair and maintenance procedures

SKILL OBJECTIVES: Comprehend and describe steps in a procedure
Ask for instructions
Report on work completed or in progress
Recognize formal vs. informal vocabulary
Read instructional texts and use a glossary
Take open-book, short answer tests

This unit will build your language and study skills in those areas found above in the "Skills Objectives" section. Most of them relate to the overall skill of being able to comprehend and follow sequential instructions. These are instructions that must be followed in a set order. The topics are assembly, repair, and maintenance procedures, which are important in all technical fields.

Geometric Rack



From Basic Woodworking, copyright c1986, Lane Publishing Company, Menlo Park, CA 94025.

Steps in a Procedure

Put the steps for making the geometric rack in the correct order. Number them 1-11.

______ Measure, mark, and saw 45° angles on both ends of each divider.
______ Saw the board into 6 pieces.
______ Glue the dividers and nail them into the rack and nail them, using 8 nails.
______ Put glue on the surfaces of the boards which form the outside of the rack.
______ Let the finished rack dry overnight.
______ Wipe off extra glue.
______ Let the glue dry.
______ Get all the materials and tools you need for the project.
______ Measure the board and mark it for the correct lengths of the pieces you need.
______ Brush the rack with veneer or stain.
______ Nail the top, bottom, and sides together using 12 finishing nails.

Written vs. Spoken Instructions

Written instructions are more formal than spoken instructions, but they often have exactly the same meaning.

Example: Spoken "Get all the materials you need for the project."
Written Obtain the necessary materials for the project.

Practice making formal written instructions. Substitute one of the words below in the blank to make a formal written instruction out of the informal instruction given:

obtain	allow...to	fasten	apply
harden	insert	remove	finish
excess	proper		

1. First, ____get____ the required materials and tools.

   First, ________ the required materials and tools.

2. Then, measure the board and mark it for the ____correct____ lengths of the pieces you need.

   Then, measure the board and mark it for the ________ lengths of the pieces you need.

3. After sawing, ____put____ glue on the surfaces to be nailed.

   After sawing, ________ glue to the surfaces to be nailed.

4. Next, ____attach____ the top and bottom pieces to the sides, using 4d fin. nails.

   Next, ________ the top and bottom pieces to the sides, using 4d fin. nails.

5. ____Put____ the dividers into the rack and nail them.

   ________ the dividers into the rack and nail them.

6. ____Take off____ any ____extra____ glue which may have squeezed out.

   ________ any ________ glue which may have squeezed out.

7. Allow the glue to ____dry____ overnight.

   Allow the glue to ________ overnight.

8. The next day, ____brush____ the rack with veneer or stain.

   The next day, ________ the rack with veneer or stain.

9. ____Let____ the rack dry overnight.

   ________ the rack _____ dry overnight.

Oral Presentations

A. Prepare a short (under 5 minutes) oral presentation on how to perform a simple assembly, repair, or maintenance procedure of your choice. Give the presentation to your classmates. Imagine that your audience does not know how to perform the procedure you will describe. Tell them directly and clearly what they must do in order to perform the procedure.

Each presentation should include:

1) Introduction of the topic,
2) Materials needed for the procedure,
3) Steps in the procedure,
4) Any important safety precautions.

Here are some sample topics:

- changing the oil in a car
- defrosting a refrigerator
- making a model airplane
- installing a smoke alarm
- changing a bag in a vacuum cleaner
- playing a video cassette in a VCR
- cleaning a record album
- preparing a simple food dish (e.g., peanut butter and jelly sandwich)

B. During your presentation, the students in the audience will take notes on the procedure. Following your presentation, they may ask you questions about any part of the procedure that they did not understand.

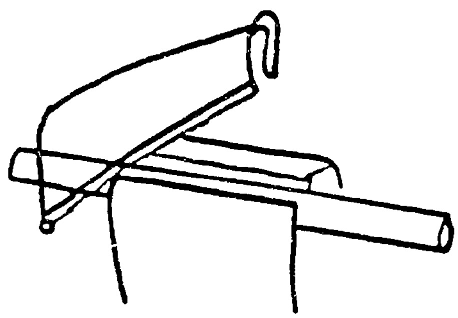
SOFT SOLDERING

Soldering is a method of joining or bonding two pieces of metal together. This is done by melting and flowing another metal or combination of metals with a lower melting temperature between the other two pieces. In soft soldering, the solder is usually made of 50% lead and 50% tin. In air conditioning and refrigeration servicing, the student will often need to join a repair tubing and other metals by this method. Often two pieces of tubing are joined together by means of a fitting. Whenever a connection is made using the soldering method, the resulting joint is called a sweat joint.

Below is the step-by-step procedure for making a sweat joint.

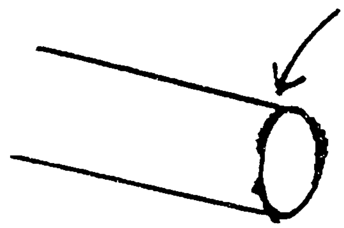
Step 1

Select and cut tube to proper length.



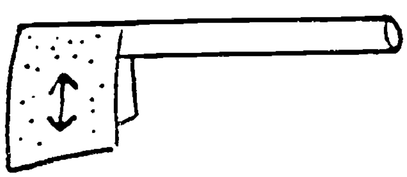
Step 2

Remove burr with file.



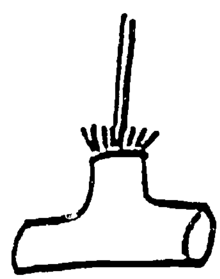
Step 3

Clean ends of tubing thoroughly with sandpaper.



Step 4

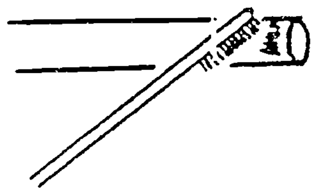
Clean inside of fitting with clean wire brush or sandcloth.



Reading adapted from the Project BEST Lab Manual, Project BEST, Oakton Community College, Des Plaines, IL, 1986.

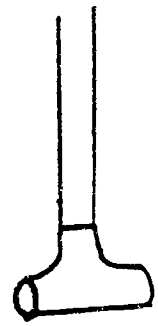
Step 5

Apply flux to outside of tube on one end, leaving 1/16" with no flux.



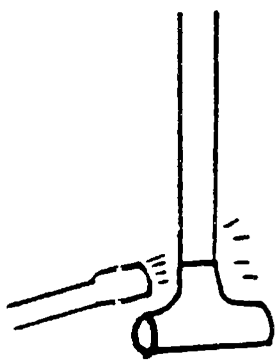
Step 6

Insert tubing into fitting.



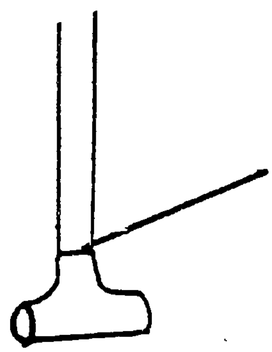
Step 7

Apply heat with torch to the assembly.



Step 8

Remove flame and touch solder to the joint, feeding it around the joint.



GLOSSARY

burr - rough edge
flux - sticky material used when soldering joints
joint - connection between two pieces; the place where pieces have been joined
sweat joint - soldered joint

Steps in a Procedure

A. Put the steps for soldering copper tubing in the correct order. Number them 1-10.

______ Solder is fed to the joint.
______ The outside ends of the tube are cleaned.
______ The tube is cut to the correct length.
______ Flux is applied to the tube.
______ Using a file, the burr is removed.
______ Heat is applied with a torch.
______ The tube and the fitting are assembled.
______ The inside of the fitting is cleaned.
______ The flame is removed.
______ The solder is melted by touching it to the hot metal.

B. Instructions can be given in an indirect form, using gerunds and passive verb constructions.

Example: After cutting the tube, the burr must be removed.

The same instruction can also be given in a direct form using imperative verbs.

Example: After you cut the tube, remove the burr.

For each of the instructions written below in an indirect form, write a sentence in the direct form.

1. Before cleaning the tubing, the burr must be removed.

____

2. Before applying flux, the tube must be cleaned.

____

3. Before assembling the parts, flux must be applied.

____

4. After heating the fitting, the torch is removed.

____

5. After removing the torch, the solder is fed around the joint.

____

Reporting on Progress

With a partner, practice asking and reporting about progress on a specific job. Several different kinds of jobs and the three steps involved are given below. Your partner will ask about your progress, and you will report that you've finished the first two steps and still have to do the third step. Take turns asking and reporting.

Example: Preparing a tube for soldering

1) Cut the tube. 2) Remove the burr. 3) Clean the tube.

Student A: How's it going?

Student B: Well, I've cut the tube and removed the burr, but I still have to clean it.

A. Soldering

1) Apply flux to the tube. 2) Heat the tube. 3) Apply solder to the tube.

B. Cutting a board

1) Measure the board. 2) Mark the correct length. 3) Saw it.

C. Finishing a surface

1) Sand the surface. 2) Apply a coat of paint. 3) Let it dry.

D. Repairing a car body

1) Fill the holes with bonding compound. 2) Apply primer paint. 3) Apply final coat of primer paint.

E. Tuning up a car

1) Change the spark plugs. 2) Check the distributor. 3) Set the timing.

Now, repeat the exercise. This time report that you have completed the first step but haven't completed the last two steps.

Example: Student A: How are you coming along?

Student B: I've cut the tube, but I haven't removed the burr or cleaned the tube yet.

This is a service maintenance chart found in the owner's guide of an American car made in the 1970's. The chart tells you which procedures must be done in order to keep the car in good running condition. It also tells you how often each procedure must be done.

REQUIRED MAINTENANCE SERVICES These services are not covered by the warranty, and you will be charged for the labor, parts, and lubricants used. **MAINTENANCE OPERATION**	SERVICE INTERVAL							
Number of months or thousands of miles, whichever comes first.	6	12	18	24	30	36	42	48
(E) Change engine oil (1)	X	X	X	X	X	X	X	X
(E) Replace oil filter (1)	X		X		X		X	
(E) Lubricate and check exhaust control valve for free operation (if so equipped)	X	X	X	X	X	X	X	X
(E) Replace fuel system filter	X							
(E) Check carburetor air cleaner element (2)		X				X		
(E) Replace carburetor air cleaner element (2)				X				X
(E) Adjust idle fuel mixture	X			X				
(E) Adjust fast idle speed	X			X				
(E) Adjust curb idle spee· and TSP off-speed	X			X				
(E) Check the carburetor throttle, choke and delay valve, and air valve – adjust or replace as required	X			X				
(E) Replace crankcase-emission filter in air cleaner (2)				X				X
(E) Torque intake manifold bolts			X					
(E) Inspect fuel vapor emission system (hose, vapor lines, and fuel filler cap) – replace as required				X				X
(E) Replace PCV valve				X				X

(E) Item of Emission Control System

(1) Under normal driving conditions.

(2) More often if operated in severe dust conditions.

Reading Comprehension

Using the information in Reading 8D, fill in the blanks with the current word(s).

1. The chart gives a list of the ______________ maintenance services.
2. The services are not covered by the ______________, so the owner of the car has to pay for them.
3. The service interval numbers 6, 12, 18, etc. represent the number of ________ or ____________ ______ ___________, whichever comes first.
4. The chart shows the service procedures for 6,000 through _____,000 miles.
5. The symbol (E) in front of each procedure means that it has to do with the _________ control system of the car.
6. According to the chart, you must change engine oil every _____ months or every _______ miles, whichever comes first.
7. The symbol (1) after the first procedure means that the service interval is correct when you drive under __________ conditions.
8. You must replace the oil filter every ___________ time you change the oil.
9. One thing you must do at 12 months or 12,000 miles is __________ the carburetor air cleaner element.
10. One thing you must do at 24 months or 24,000 miles is __________ the idle fuel mixture.
11. At 48 months or 48,000 miles, there are _____ scheduled procedures.
12. The greatest number of scheduled procedures must be done at ______ months or ___________ miles.

Procedures/Oral Practice

With a partner, practice asking about and telling when (or how often) the service procedures in Reading 8D must be performed. Choose a procedure and ask you partner about it. Take turns asking and responding until each person has asked five questions and given five responses.

Example 1: Student A: How often do I have to change the engine oil?
Student B: You have to change it every 6 months or 6,000 miles.

Example 2: Student A: When do I have to adjust the fast idle speed?
Student B: You have to adjust it at 6 months or 6,000 miles and at 24 months or 24,000 miles.

When you are finished, repeat the exercise but make one change in how you ask the questions and how you answer them. Most people who own cars do not perform the service procedures themselves. Rather, they have them performed by a mechanic. The expression "to have something done" shows that you will let another person do the work for you. Now, repeat the exercise, but use this expression.

Example: Student A: How often do I have to have the engine oil changed?
Student B: You have to have it changed every 6 months or 6,000 miles.

Sawing with the portable electric handsaw

The portable electric handsaw (Fig. 41–1) is used for crosscutting, ripping, beveling, and rabbeting and for cutting grooves, dadoes, and miters. Its great advantage is that since it is portable, it can be taken directly to a work area.

This tool, fitted with the right blades or abrasive disks, can be used for cutting many materials. It can cut ceramics, slate, marble, tile, nonferrous metals, corrugated galvanized sheets, and almost any other kind of building material. Woodcutting blades range in size from 4 to 12 in. (102 to 305 mm). The most popular blade is 6 to 8 in. (152 to 203 mm) in diameter. The combination saw blade is the kind most commonly used for all-purpose sawing.

The saws are light in weight, ranging from 6 to 12 lb (2.7 to 5.4 kg). Practically all of them have safety guards. Some have a special clutch arrangement to eliminate kickback. A ripping guide (Fig. 41–1) is a regular attachment and should always be used in ripping.

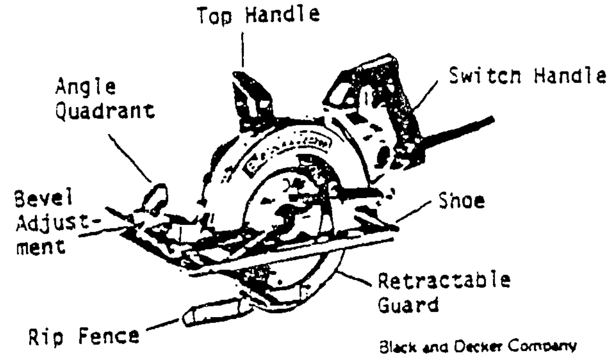


Fig. 41–1. A portable electric handsaw.

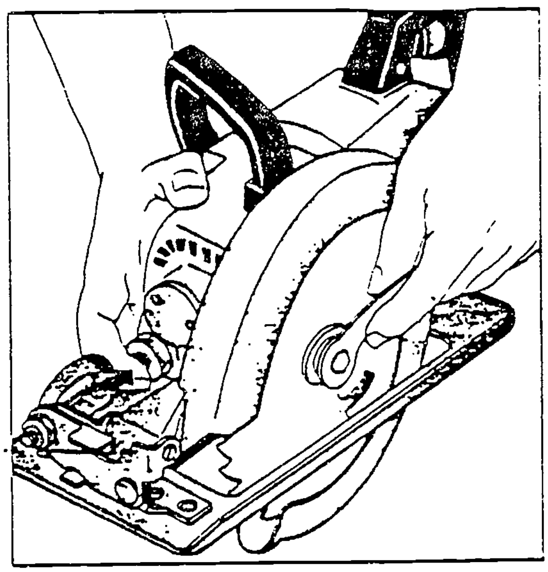


Fig. 41–2. Attaching the right blade. Note that the operator holds a finger on the button, which locks the mechanism while the saw blade is being tightened.

SAFETY

1. Always get your instructor's permission to use the portable electric handsaw.

Reading courtesy of McGraw-Hill Book Company, Webster Division, from General Woodworking, c1982, by C. Groneman.

2. Take the plug out of the electric power outlet when you are not using the tool.
3. Check to see that the electrical connection is grounded.
4. Make sure the blade is sharp. A dull blade may cause the saw to stall.
5. Keep the retractable safety guard operating freely. Use it at all times.
6. Always hold the electric saw firmly.
7. Use a guide in ripping.
8. Let the blade come to full speed before starting a cut.
9. Protect your clothing from the blade.
10. Do not try to make adjustments while the saw is working.
11. Always wear appropriate eye protection.

Sawing

1. Lay out or mark the board to be cut.
2. Make sure the right blade is attached to the saw (Fig. 41–2).
3. Adjust the blade to the correct depth. The teeth of the blade should extend about ½ in. (13 mm) below the board being cut.
4. Plug the cord into an electric outlet.
5. Put the front of the base plate on the edge or end of the board. Line up the blade with the cutting line. Be careful not to let the teeth touch the board.
6. Press the trigger switch. Let the motor run freely a few seconds before you start to cut. Note that the teeth cut upward into the board (Fig. 41–3).
7. Guide the saw slowly but steadily on the waste side of the marked line (Fig. 41–4), or use the guide if you are ripping (Fig. 41–5). If the saw stalls, do not release the trigger switch. Back the saw up a little. This will let the blade regain full speed.

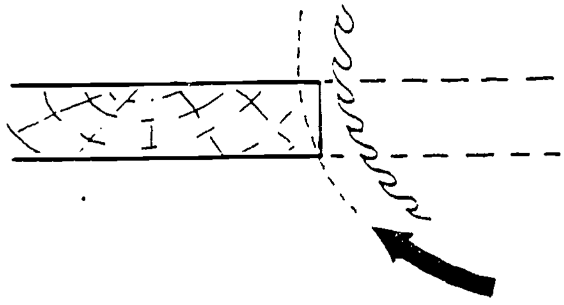


Fig. 41–3. The teeth of a portable electric handsaw cut upward.

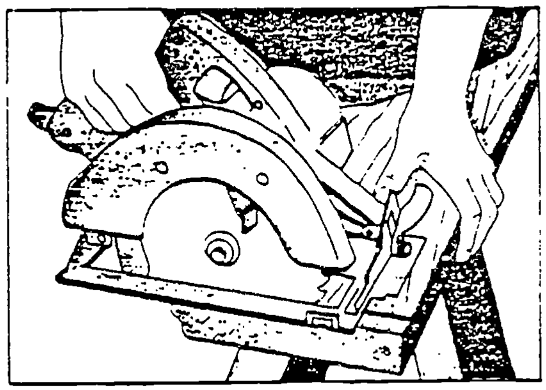


Fig. 41–4. Crosscutting with the portable electric handsaw.

Crosscutting generally does not require a guide; *ripping* does (Fig. 41–5). *Bevels* (slanted edges) can be cut by regulating the bevel adjustment and by using angle guides (Fig. 41–6).

Discussion topics

1. What is the great advantage of the portable electric handsaw?

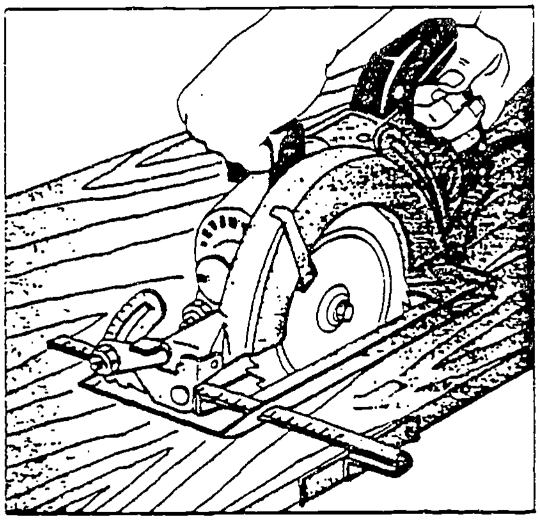


Fig. 41–5. Ripping, using a ripping fence as a guide.

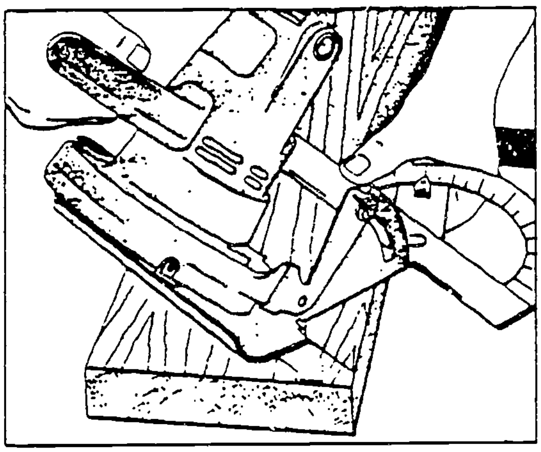


Fig. 41–6. Cutting a compound bevel with the aid of an adjustable angle guide.

2. What blade is most commonly used on the portable electric handsaw?
3. What attachment should you use when ripping with the portable electric handsaw?
4. In which direction do the teeth on a handsaw blade cut?
5. What do you do if the portable electric handsaw stalls?

(Below are a few words found in the glossary of the book General Woodworking.)

GLOSSARY

Many of the words used in *General Woodworking*, and listed in this glossary, have several meanings. The definitions given here will help you understand the technical use of these words in the field of woodworking.

bevel A slanted edge.

combination blade A circular saw blade with a combination of ripsaw and crosscut-saw teeth; operates on a power-driven saw frame.

crosscut To saw against the grain.
crosscut saw A saw for cutting across the

dado (noun) A groove cut in a board; usually part of a dado joint.

grain The size and arrangement of the cells and pores of a tree. The three main kinds of wood grain are fine, medium, and coarse.

miter joint A joint made by fastening together two pieces of wood whose ends have been cut at an angle.

rabbet (noun) A groove cut on the edge or face of a board, especially as part of a rabbet joint.
rabbet (verb) To cut a rabbet in a board; to join two edges in a rabbet joint.
rabbet joint A joint made by fastening two rabbeted pieces together.

rip To saw or split lumber with the grain.

APPENDIX

TEST-TAKING STRATEGIES

One aim of the VITT Curriculum is to familiarize students with the types of tests they may encounter in vocational programs. Most vocational instructors give either tests which are standardized and only require students to circle or check answers, e.g. multiple choice and true/false, or they give tests which they can construct quickly, e.g. short answer tests. Instructors prefer to give tests which can be graded quickly, and thus rarely do they give tests that require long written answers. The quizzes in this curriculum are representative of the types of tests most often found in vocational programs.

In order to perform well on tests, it is important that students learn about and apply test-taking strategies. Both general test-taking strategies and strategies relating to taking specific types of tests are included in this appendix. They are intended to serve as the basis for study and class discussion both before and after students take each of the VITT quizzes.

GENERAL STRATEGIES

Preparing for Tests

1. Try to find out what kind of test will be given. If you know what kind of test to expect, you can prepare by asking yourself practice questions like the ones which might be on the test.

2. Begin preparing for the test as soon as possible. Remember that studying often for short periods is more effective than studying for long hours at one time.

3. When you prepare for a test, think of the task positively! It is the best opportunity to really learn the material for future application. 4. Ask the instructor which concepts and topics are most important to study. Instructors will usually give you this information, althougn they will not tell you the exact questions on the test.
5. Look at all your notes and readings and organize the information into logical units, such as main topics.
6. Make a study plan by writing down the main topics and adding the most important points to concentrate on.
7. Read all lecture notes, notes from readings, and review important exercises you have done.
8. Make a new set of study notes which contain the most important information.
9. Practive writing difficult words and their definitions.
10. Review your notes on several different days.
11. Test your memory of important facts by looking away from your notes and asking yourself questions.
12. If it's difficult for you to study alone, form a study group. Discussing the subject matter with other students helps the memory. However, you should know the basic facts <u>before</u> you study with other people. This is important for two reasons: 1) so that you can contribute your knowledge to the study session, and 2) so that you can recognize incorrect statements when your study partners make them.

Before the Test

1. Get a good night's sleep before the test. Being well rested makes it easier to remember what you have learned and studied.
2. Relax. Being too nervous makes it difficult to recall information you know.
3. Don't study anything new the day of the test--this will only make you nervous.
4. Eat a light meal a few hours before the test. Do not take a test on either an empty stomach or a full stomach; this will negatively effect your ability to concentrate.
5. Arrive in the test room a little early so you can make yourself comfortable.
6. Keep an optimistic attitude; don't let negative comments from other students make you nervous.

Taking the Test

1. Listen carefully to the teacher's instructions before and after the test is passed out.
2. When you receive the test, look at all of the different parts and pages to see what types of questions and how many questions there are.
3. Budget your time. If it is a long test you may have to decide how long to spend on each part.
4. Read all directions carefully; they may be different from what you expected.
5. Study all examples carefully.
6. If you don't understand what you are supposed to do, ask the instructor.
7. When you begin to write, skip questions which are very difficult and return to them after you have finished the other questions. Often you will find clues to the answer in another part of the test.
8. If you don't know the answer to a question, make a guess (unless it is the type of test on which you lose points for incorrect answers). The concept of "educated guessing" is crucial to test-taking. "Guessing" is the underlying strategy to improving test scores beyond what knowledge of the content area alone would allow. Guessing involves applying knowledge of a specific test format and identifying clues in the test items.
9. Your first response is usually correct. Don't change an answer unless you are sure you made a mistake or misunderstood the question.
10. When you have finished answering all the questions, spend as much time as you have left to go back and check your answers.
11. Make sure your name is on the test or answer sheet before you turn it in.

After the Test

1. When you get the tesc back, go over the results carefully.
2. Pay equal attention to the items you got right and those you missed.
3. Add any new information to the ones you got right and make corrections to the items you missed directly on the test form.
4. For the items you missed, try to determine the reason why. Was your study plan a good one?
5. Use the test results to help you improve your plan for studying the next test.

SPECIFIC STRATEGIES

Multiple Choice Test Strategies

1. Try to figure out the answer before you look at the choices.
2. Read all the choices before you pick one. If none seem 100% correct, take the closest one.
3. If you are recording your answers on a separate answer sheet (especially machine-graded answer sheets), make sure that you mark your answers accurately.
4. Choices with absolute expressions such as "always, all, never," and "none" are usually incorrect.
5. Choices with expressions which are more "flexible," such as "usually, often," and "generally" are often correct.
6. If two choices are similar, usually one of them is correct.
7. If two answers are direct opposites, usually one of them is correct.
8. Make sure the choice agrees grammatically with the stem.
9. If two quantities (numbers) are almost the same, one is usually correct.
10. If the quantities (numbers) cover a wide range, usually one in the middle is correct.

True-False Test Strategies

1. Read each word carefully. If one word is false, the whole statement is false.
2. Don't spend too much time analyzing the statements; true-false test questions test your knowledge of facts and usually don't require interpretation.
3. Statements with absolute expressions such as "all, always, never," and "only" are usually false.
4. Statements with "flexible" expressions such as "usually" are usually true.
5. There are usually more "trues" on a test than "falses."

Fill-in-the-Blank Test Strategies

1. Read the statements carefully but don't overanalyze their meanings. The words you need to fill the blanks come directly from your lectures and readings.
2. After you have looked at all the words in a statement, try reading the statement quickly. Sometimes this will help you "see" or "hear" the missing word(s) in your mind.
3. Pay attention to the number of blanks in a statement. Usually the teacher knows exactly how many words must be used.
4. Pay attention to the length of the blanks. Some teachers will make the blanks short or long depending on which word must go in the blank.
5. Remember that the words you put into the blanks must fit meaningfully and grammatically. That is, the words must make sense and they must be the correct parts of speech.

Short-Answer Test Strategies

1. These questions usually test how well you have memorized certain words or facts. Your answers should be short and clear. Do not give interpretations.
2. Look ahead to the other questions to make sure you don't give the answer to a question which is coming up.
3. Often you must define a word. When giving a definition of a concept or an object, remember to consider:

   WHAT - What category it is in; what it looks like; what it's characteristics are

   WHERE- Where it is found or used

   WHEN - When it is used or takes place

   HOW - How it works, how it is used

   Examples:

   Define solid.

   Answer: A form of matter which has a definite shape.

   Define coping saw.

   Answer: A wood saw that's used to saw curved lines in wood.

   Define piston.

   Answer: A part in an internal combustion engine which moves up and down in a cylinder.

Open-Book and Take-Home Test Strategies

1. Prepare well for the test. This is the most important strategy because these tests are often the most difficult kind.
2. Know where to find the information in your book(s). This type of exam doesn't test what you know as much as it tests your ability to find important information quickly.
3. Use the table of contents and the index to help you find the information you need.
4. When you find an answer to a test question, try to write the answer using your own words.
5. If you copy more than a few words directly from the book, put the words in quotation marks and give the name of the book and the page number.

"Pop Quiz" Strategies

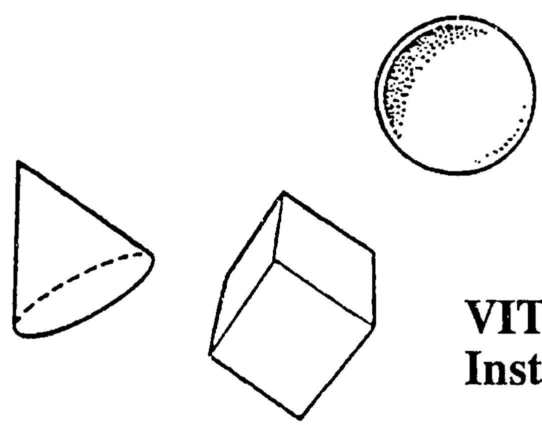
1. The only way to prepare for these is to do your homework! Complete all study and reading assignments on time and keep up with the course syllabus.

VESL for Industrial and Technical Training (VITT) Curriculum:

Illinois State Board of Education

Adult, Vocational and Technical Education

Instructor's Guide



VITT
Instructor's Guide

VESL for Industrial and Technical Training (VITT) Curriculum: Instructor's Guide

Illinois State Board of Education

Adult, Vocational and Technical Education

Project Staff:

Jeanne Lopez-Valadez
Director

David Pankratz
Developer

Northwest Educational Cooperative

June, 1989

KTI 471

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VOCATIONAL EDUCATION PROGRAM IMPROVEMENT SECTION

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2. Date material was completed: June, 1989

3. Please check those applicable: New material ____ Revised material X
   Field-tested material X

4. Originating agency: Northwest Educational Cooperative

   Address: 1855 Mt. Prospect Rd. Des Plaines, IL Zip Code 60018

5. Name(s) of developer(s): David Pankratz

   Address: 1855 Mt. Prospect Rd. Des Plaines, IL Zip Code 60018

6. Developed pursuant to Contract Number: KTI 471

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   - __ 03 Bus., Mrktng. & Man. Occup.
   - __ 04 Distributive Education
   - __ 07 Health Occupations Education
   - __ 09 Home Economics Education
   - __ 10 Industrial Technology
   - X 16 Technical Education
   - X 17 Trade & Industrial Educ.
   - __ 22 Cooperative Education
   - X Career Education
   - X Other (Specify) VESL

8. Education Level

   - __ Pre-K Thru 6
   - __ 7-8
   - __ 9-10
   - X 11-12
   - X Post-Secondary
   - X Adult
   - __ Tchr. (Inservice)
   - __ Adm. (Pre Service)
   - __ Other (Specify) ____

9. Intended for Use By:

   - __ Student
   - X Classroom Teacher
   - __ Local Administrator
   - __ Teacher Ed.
   - __ Guidance Staff
   - __ State Personnel
   - __ Other (Specify) ____

10. Student Type:

   - __ Regular
   - __ Disadvantaged
   - __ Handicapped
   - X Limited-English Profic.
   - __ Other (Specify) ____

11. Medium and Format of Materials:

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14. What level(s) of assistance is required to provide implementation of this outcome?

___ awareness X understanding
___ deciding ___ implementing

15. Are Consultive/Inservice (or staff development) available? Yes X No___

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Department of Adult, Vocational & Technical Education
Vocational Educ. Program Improvement Section, E-426
100 North First Street
Springfield, Illinois 62777
(217) 782-4620

16. General Description

This revised instructor's guide provides teacher and student materials (with answer keys) for implementing an approximately 64 hour course to teach limited English proficient (LEP) students language and study skills for transition into mainstream vocational education programs or employment in any occupational area in the industrial/technical cluster.

A separate product, VESL for Industrial and Technical Training (VITT) Curriculum: Student Materials, contains the materials for student use.

17. Person Completing this Abstract David Pankratz

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TABLE OF CONTENTS

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Sincere appreciation is extended to these people for their generous contributions to this product.

David Pankratz, Developer

SECTION I

INTRODUCTION

INTRODUCTION

Curriculum Overview

The VITT curriculum provides guidelines and instructional materials for a course designed to help prepare English as a Second Language (ESL) students for vocational training programs in industrial and technical fields. The curriculum focuses on language skill areas most critical for students making the transition from ESL courses to vocational courses in which English is the language of instruction. Study skills and test-taking skills are also included in the curriculum design.

The curriculum is not designed to prepare students for any specific vocational training field. Rather, it takes a more generic "technical English" approach, and is thus appropriate for students who plan to enroll in vocational training in any field in the industrial and technical cluster. This cluster typically includes the areas of construction, manufacturing, electronics, mechanics, and graphic communications.

Target Audience

The curriculum is appropriate for students who know which particular vocational field they are interested in as well as those who do not. Course topics are broad enough to be of interest to all pre-technical students and provide a survey of various technical fields. The materials are also appropriate for persons who have already had technical training in their native language, but need to develop English language skills in order to apply their knowledge to an English speaking work setting.

The instructional materials provided are designed for ESL students who have attained at least an intermediate level of proficiency in English. The assumption is made that students are already familiar with the major grammatical forms of spoken and written English, including simple conditionals and passive verb constructions. Students should have oral language skills which allow them to communicate on everyday topics, listening skills adequate for following instructions and comprehending the main points in everyday conversations, reading skills which allow them to comprehend brief reading passages, and writing skills sufficient to respond to controlled exercises. Most local programs have a system for assessing student level. If the program does not establish a particular course as a prerequisite for this one, a pre-screening instrument should be used which focuses on listening and reading comprehension skills since these are the areas stressed in the curriculum.

Some of the materials provided in the curriculum may seem difficult for intermediate level students, but they are not intended to discourage them. Because students in technical vocational programs invariably encounter language which is "over their heads", especially in their textbooks, the curriculum includes several authentic readings. This approach exposes students to the language structures they can expect to encounter when they enroll in vocational programs.

Technical training programs require students to have varying degrees of knowledge in mathematics. This curriculum does not attempt to teach math skills. Some exercises deal with numbers, measurement, and so forth, but the emphasis is on the language required to express those concepts and not on the mathematical concepts themselves. The exercises assume that students have a basic understanding of addition, subtraction, multiplication, division, and fractions.

Students in either secondary or post-secondary educational programs can potentially benefit from the course. Teachers are encouraged to modify the instructional activities according to the language proficiency level and vocational interests of their students.

Instructor

This curriculum should to be used by an instructor who has professional qualifications in ESL teaching methodology. Experience teaching vocational ESL is not necessary, but it would be an advantage. The instructor does not need to be proficient in technical subject matter, although an affinity for technical topics and concepts is desirable. Preparation time for teaching will vary depending on the degree to which the classroom activities must be modified in order to fit the needs of the students.

Instructional Hours

The materials provide for approximately 64 hours of classroom instruction. The course would probably best be structured as an intentive course with a minimum of four hours of instruction per week.

Conceptual Framework

An overview of the content of the instructional units is provided in this introductory section on pages 5-6. Each unit is developed around a rhetorical function and then incorporates technical topics, vocabulary and grammar which serve to reinforce the teaching of that function. (The decision to design the curriculum around rhetorical functions was based in part on the work of Louis Trimble, especially the book English for Science and Technology: A Discourse Approach, 1985.) Study skills and test-taking skills are also integrated into each unit.

A. Rhetorical Functions

Rhetorical functions were chosen as the organizational focal points of the units because they give the best insight into the types of language encountered by students in technical training programs. Most of the language in these programs is either descriptive or instructional in nature. Stated informally, students must be able to comprehend how things appear (physical description), how they work (functional and process description), and how objects or concepts relate to each other (definition, classification, and comparison). They must also respond to written and oral explanations about how to do a procedure (instructions). It is not intended that students be drilled on the concept of rhetorical functions; the functions simply served as the framework for developing the instructional units.

B. Technical Topics and Vocabulary

The unit topics reflect ideas, concepts and vocabulary that are of relevance to most technical fields. It is important to keep in mind, however, that it is not the primary intent of the curriculum to teach technical concepts. Rather, the topics provide raw material for teaching language skills.

C. Grammar

The curriculum does not provide a comprehensive grammar review, nor does it take a systematic approach to grammar in the traditional sense. The grammatical patterns which are emphasized are those which commonly occur in technical, training-related language. These include imperatives, passives, and conditionals. The instructor is encouraged to use the readings and the worksheets as the basis for teaching and/or reviewing important grammar points depending on the needs of the students.

D. Language Skills

Listening, speaking, reading and writing skills have been integrated throughout all eight units. Emphasis has been placed on the aspects of those skills which are most important in vocational training situations. Listening skills include following lectures or taking verbal instructions. Reading focuses on technical descriptions and interpreting graphs, charts, diagrams, etc. Speaking focuses on affirming comprehension, rephrasing information and asking for clarification of confusing points. Writing is important for note-taking and providing short answer responses to comprehension questions or quiz items.

E. Study Skills

Study skills and language skills are not easily separable. Activities which build skills such as discrete listening, note-taking, scanning, graphical literacy and summarizing are interspersed throughout the curriculum. It is also important that students develop test-taking skills. The VITT unit quizzes expose students to a variety of test formats, and Appendix A summarizes both general and specific test-taking strategies. In an effort to make this a "skill-oriented" as opposed to a "content-oriented" course, it is important that the development of study skills be considered an integral part of classroom instruction.

Unit Overview

UNIT	RHETORICAL FUNCTION	LANGUAGE FORMS	LANGUAGE AND STUDY SKILLS	TOPICS
1	Definitions and Classifications	Present tense/statements and questions Word forms "There is/are" Adverbs of sequence Modal "must"	Defining Classifying Outlining Reading graphs and charts Taking multiple choice tests	Technical occupations Vocational training
2	Physical and Spatial Descriptions	Descriptive adjectives Prepositions of location Ordinal numbers	Describing physical characteristics Taking lecture notes Expressing numbers orally Using symbols and abbreviations Reading conversion tables Following instructions to make diagrams	Geometric shapes Dimensions Measuring
3	Functional Descriptions	Infinitives and gerunds: "used to," "used for" Passive verb constructions Modals + passives	Describing functions Taking lecture notes Referring to diagrams Reading instructions Taking short answer tests	Shop tools, fasteners and instruments
4	Process Descriptions	Passive verbs Adverbs of sequence Adverbial clauses Simple past and present tenses Comparative expressions	Discussing mechanical processes Reconstructing steps in processes Reading diagrams and flow charts Outlining Taking fill-in tests	Force and work Basic machines Mechanical processes

UNIT	RHETORICAL FUNCTION	LANGUAGE FORMS	LANGUAGE AND STUDY SKILLS	TOPICS
5	Definitions, Examples, and Classifications	Passive verbs Conditionals Relative Pronouns Math word problems	Defining Classifying Outlining Giving examples Reading tables Taking true/false tests	Matter and energy Materials
6	Comparative Descriptions	Descriptive adjectives Comparative adjectives Prepositions of location Passive verbs Adverbial clauses	Comparing and contrasting Notetaking Referring to indexes Reading diagrams Taking multiple choice tests	Electricity Electronics
7	Non-sequential Instructions	Imperatives Adverbs of frequency Modals Modals + passives Conditionals	Giving warnings and precautions Reporting on conditions Reading signs and labels Reading instructions Taking true/false tests	Warnings Safety precautions
8	Sequential Instructions	Imperatives Adverbs of sequence Gerunds Deletion of definite articles	Describing steps in a procedure Asking for instructions Reporting on work done or in progress Recognizing formal versus informal vocabulary Taking open-book, short answer tests	Assembly, repair and maintenance procedures

SECTION II

CURRICULUM IMPLEMENTATION

CURRICULUM IMPLEMENTATION

Organization of VITT Materials

The materials necessary for implementing the course are found in the eight instructional units in Section III. Each unit begins with a teacher's guide which lists the main topics and skill objectives for that unit. Following is a chart which indicates the unit activities and how to conduct them, the estimated time required for each activity, the key language structures and vocabulary covered by the activity, and a listing of the materials needed. Following the chart are the unit materials. Lectures, activity guides, teacher notes, and quizzes are found only in the Instructor's Guide. The quizzes must be photocopied and distributed to students as units are completed. The student readings and worksheets, including answers to the worksheet questions, are also included in the Instructor's Guide. For student use, the readings and worksheets are available separately in VITT Curriculum: Student Materials.

Unit materials are labeled in the upper right corners with a number and a letter. The number refers to the unit, and the letter refers to the activity. For example, "Lecture 1A" is the lecture for Unit One, Activity A. "Worksheet 1B" is the worksheet for Unit One, Activity B. If an activity has more than one worksheet, a number of parentheses wil follow the letter. For example, "Worksheet 5B(2)" is the second workshet for Unit Five, Activity B.

Teaching Methodology and Approach

This course should be taught by an experienced ESL instructor with professional training in ESL teaching methodology. For this reason, the instructions for conducting each of the learning activities found at the beginning of each unit are brief and assume that the instructor is familiar with effective methods for introducing and working with new material. It is important that instructors use teaching approaches and styles that have worked best for them in the past.

In general, most of the activities in this curriculum are designed to be taught using a three-step approach: 1) preview the content, 2) teach it, and 3) review it and conduct follow-up exercises. It is also important that the instructor encourage students to draw on their previous knowledge of a subject and the clues provided in a reading or a lecture to improve their comprehension of new material. For example, when working with a new reading passage, the instructor can 1) ask pre-reading questions to get students to survey a new piece before actually reading it, 2) have students read the text silently for new ideas, 3) ask general comprehension questions to assess understanding of main ideas, 4) have students read the passage a second time for details, and 5) consistently encourage students to use reading context and visuals to understand new concepts and vocabulary.

The listening activities found in this curriculum are primarily intended to provide content materials for note-taking activities in a realistic lecture context. For this reason, pre-listening activities should be kept to a minimum in order to simulate a real lecture situation. The instructor may want to write the most critical vocabulary words from the lecture on the board before the lecture begins, but no detailed descriptions should be given. As in the reading activities, students need to be encouraged to try and understand new vocabulary from the context and/or visuals before formal explanations are provided.

The instructor will want to review grammatical patterns with which stdudents need additional practice. Each of the unit activities has a "grammatical" focus which is indicated in the "Key Language" section on the activity guides. The instructor should use the grammatical features stressed in individual activities as a springboard for teaching/reviewing those particular features. This provides the best assurance that students see the connection between particular grammar and the related technical content.

In addition to teaching language skills, a major objective of the VITT curriculum is to develop test-taking skills. The instructor should introduce and review test-taking strategies (see Appendix) throughout the course. The VITT quizzes as well as worksheet exercises serve as material for discussing various test formats and accompanying strategies. Strategies can be discussed both before and after students complete a particular worksheet or quiz. Individual test questions can be analyzed to determine which test-taking strategies apply specifically to that question.

The curriculum emphasises the language skills most essential to students who will be entering technical programs, and developing these skills should be a priority for the instructor as well. In addition to listening to lectures, note-taking, and making sense of difficult technical readings, students need to learn how to follow oral and written instructions, ask questions when they have not understood, and provide appropriate responses when asked if they have understood.

It is essential that the instructor keep in mind that a key objective is to prepare students for the "unsheltered" environment of mainstream technical vocational programs. In these programs, students are expected to be self-sufficient and to seek out the knowledge and resources they need. In vocational courses, reading and study assignments are not always presented clearly, the instructor does not always speak clearly, and the day-to-day activities and expectations are not always predictable. ESL students must learn to become more assertive in order to survive in a new unsheltered training environment. If students do not understand something or miss an assignment, they must approach the instructor or a fellow student. Many instructors in vocational programs state that their biggest problem in teaching ESL students is that the students do not seek out help when they need it.

The instructor of this curriculum should prepare students for these challenges by both discussing these issues with students and creating situations which demand that stdudents respond appropriately. For example, "pop quizzes" can be given the day an assignment should have been completed to test whether students are doing their homework on time. Instructors should attempt gradually to get away from using "sheltered English" and begin to speak more naturally, incorporating slang and idiomatic expressions as vocational instrucators do.

Student Evaluation

The instructor needs to develop a means of evaluating student progress in the course and providing students with feedback on their performance. Included in the curriculum are unit quizzes at the end of each unit to assess comprehension of the unit content. An evaluation plan should also consider student performance on the other written tasks they are completing, i.e., worksheets and lecture notes, as well as their oral performance in class activities. It is recommended that instructors use some kind of grading system to let students know how well they are progressing. The grading system should also encourage students to participate in free discussion activities and to ask questions. Using a grading system is a realistic and appropriate means of assessing student performance since most vocational programs give letter grades for student work.

Adaptation

As with any curriculum or set of instructional materials, this curriculum and the activities which have been included should be adapted by the teacher to fit the needs of the students. Although it is assumed that all stdudents in the course will be at an intermediate level of English or above and be interested in pursuing some sort of technical training, there will nonetheless be differences which must be considered.

Student's career interests and the training opportunities available to them will vary. If the instructor determines that a majority of the students in a class plan to enroll in an auto mechanics program, for example, the instructor should try to incorporate more readings and visual materials from that content area into classroom activities. As stated previously, even though the primary objective of the VITT curriculum is not to teach content-specific concepts, it is good to utilize content materials of interest and relevance to the students in order to most effectively develop language skills.

Instructors are encouraged to use vocational textbooks, instructional aids, and professional technical journals as resources for developing additional classroom activities. The instructor should select specific items from those resources based on three criteria: topical interest, rhetorical focus, and level of difficulty. Topics should be selected which are neither too specific nor too general. The passage should contain some identifiable rhetorical focus so that it can be used to examine particular rhetorical or grammatical constructions. And the passage should be at a reading level which challenges but does not discourage the students.

The question arises whether readings from original sources should be simplified or not. There are advantages to both simplified and authentic readings, and for this reason this curriculum has incorporated both. Authentic, unedited readings provide the most realistic study material. On the other hand, simplified readings may be more helpful in terms of teaching a particular language structure. Adapting a reading allows the instructor to emphasize or add specific vocabulary items or grammatical patterns which need to be stressed.

For students wanting to go into vocational programs, entrance requirements will vary greatly. Many vocational programs require that students complete prerequisite courses before they can enroll. The instructor should become aware of these requirements so that s/he can help students plan their strategies. The language skills required in programs will vary as well. In a two-year program leading to an associate degree, for example, reading skills will be very important. In a hands-on oriented program, reading skills will play a lesser role and the ability to follow oral instructions will be more important. All of these factors will affect how the instructor chooses and adapts instructional activities. The instructor needs to research the types of vocational programs the students will most likely enter, the kinds of instructional materials used, and the expectations placed on students in those programs.

The instructor must also adapt teaching to the abilities and educational background of the students. Students with strong oral skills will require more work with reading and writing exercises. Students who already have good reading skills, on the other hand, will benefit from more activities which develop their oral skills. Regardless of their level in English proficiency, some students may already have good study skills and others may not. Reading and note-taking skills transfer well from one language to another, so that students who have already developed these skills in their native language will have a tremendous head start. The instructor's job is to adapt the materials to meet the individual needs of the students, and in some cases this might mean omitting entire activities and adding new ones in their place.

Career Awareness

Finally, an important goal of the curriculum is to expose students to the many training and employment opportunities available to them in the industrial and technical/occupational cluster. These opportunities should be explored with students to the extent possible.

The most effective way to insure that the link is made to actual vocational programs and employers is to incorporate career awareness activities into the ESL curriculum. There are several ways that the ESL instructor can help expose students to some of their options. At some schools, there may be a counselor who can provide information about the opportunities for further education at the school. The ESL instructor can arrange to bring a counselor into the classroom to speak to students. It is ideal if students can be taken out of the classroom and given a tour of the vocational facilities at the school itself or other places where training is offered. Students can also gain insight into programs by visiting counseling and career placement centers. In addition to counselors, a variety of other people may be available to help provide students with information about their opportunities including vocational instructors, vocational special needs coordinators, recruiters, and admissions and financial aid specialists.

Some ESL instructors have found inviting former students back to the classroom to share their experiences especially productive and insightful. Former students who are successfully employed or enrolled in a vocational program can motivate current students and sensitize them to the tangible benefits of learning English. Prospective employers may also be invited to the ESL class to discuss job opportunities, job qualifications, and some of the positive and negative experiences they have had in employing limited English-proficient (LEP) workers. It should be noted that class "interviews" with invited guests usually proceed best when students have been informed of the visit in advance and have prepared questions for the speakers.

Whether students are taken out of the classroom to investigate career opportunities or speakers are brought in, the link that is made is valuable in familiarizing students with their career opportunities. These activities also provide lots of information in both oral and written forms that is ideally suited for content-based language instruction. Informational talks, tours and planned interviews develop listening and speaking skills, and brochures and applications provide excellent material for developing reading and writing skills.

Career awareness activities should become an important part of the ESL curriculum and be used to develop students' career goals and their language skills concurrently. The instructor can play a vital role in encouraging students' interest in technical careers, exposing them to their options, and preparing them to make the transition into training or employment.

SECTION III

INSTRUCTIONAL UNITS 1-8

TEACHER'S ACTIVITY GUIDE

UNIT ONE: DEFINITIONS AND CLASSIFICATIONS

TOPICS: Technical Occupations, Vocational Training

SKILL OBJECTIVES:
- Comprehend a lecture
- Follow an outline
- Ask for and give definitions
- Classify information
- Refer to, read, and construct graphs and charts
- Take a multiple choice test

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction (15 min.) Ask sts., "What is technology? "What are some technical occupations?" State learning objectives for the course; emphasize those for Unit One. Answer sts. questions about course.		Technical Occupations and Job Titles	
A) **Listening: "Mini-lecture" (50 min.)** Prepare a lecture based on the text in Lecture 1A. It is preferable not to read the lectur from the page. Rather, you should give a [illegible] based on lecture no[illegible] which you have developed from the text. You can use the outline in Worksheet 1A for developing your notes. Give the lecture. Refer students to Visual 1A while they are listening. After the lecture, ask questions to assess general comprehension. Give lecture 2nd time; have sts. follow outline on Worksheet 1A while listening. Ask questions to assess comprehension of lecture details. (Optional) Give lecture 3rd time; sts. add written notes to their worksheet.	"There is/are" Adverbs of sequence: "First, next, last" "Have to"	produce production construction manufacturing mechanical electronics graphic communications Job Titles testing maintenance repair	Lecture 1A Visual 1A Worksheet 1A

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
B) Definitions/Oral Practice (30 min.) Sts. read sentences with key words underlined on Worksheet 1B. Ask sts. about meanings of key words. Have sts. practice asking for meanings of words and giving definitions.	Present tense questions, verb forms	mean meaning define definition	Worksheet 1B
C) Word Forms (30 min.) Explain differences between word forms. Have sts. complete word form chart (Worksheet 1C). Review sts. work. Have sts. create sentences using various forms of key words.	Parts of speech-nouns, verbs, adjectives	vocation vocational industry industrial technology technical occuption occupational	Worksheet 1C
D) Reading/Discussion/Oral Reports (Time will vary) Pre-reading: Have sts. look at reading. Ask, "What is the reading about? What do you expect to find out in this reading?" Reading: Sts. read silently. Ask global comprehension questions. Ask about specific vocabulary. Follow-up: Discuss students' future plans with them. Have them share how they got information about their desired occupations. Have sts. prepare a brief (3-5 min.) report at home on the occupation of their choice and present it orally to the class. (Note: Oral reports are time consuming and can become tedious if too many reports are given at one time. They should be spread out over several class sessions. To conserve time, sts. can be divided into small groups and give their reports in that group only.)	Simple present tense/present continuous tense	career path needs goals availablilty security vacations work conditions indoors/outdoors variety routine counselor employer	Reading 1D

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
E) Reading/Graphs and Charts (50 min.) Pre-reading: Have sts. look at reading and diagrams (Reading 1E). Ask, "What is the reading about?" Reading: Sts. read silently. Ask general comprehension questions. Discuss graph format and content. Ask specific questions about information in reading and graphs. Follow-up: Have sts. do Worksheet 1E individually. As a group, go over answers.	Expressions signalling classification: "The first four..., the last two..., the other..., all...,	training employment degree certification job placement enrollment breakdown distribution demands job market	Reading 1E Worksheet 1E
F) Reading/Definitions (45 min) Pre-reading: Have sts. look briefly at Reading 1F. Ask, "What is the reading about?" Reading: Sts. read silently. Discuss reading with sts. and clarify imporatant vocabulary. Follow-up: Sts. complete Worksheet 1F(1). Review answers. Sts. complete Worksheet 1F(2). Review answers.	Modal verb "must" 3rd person singular verbs	computer technicians troubleshooter install test trouble-free customer defective component contract diagnostic pinpoint	Reading 1F Worksheet 1F(1) Worksheet 1F(2)
G) Evaluation (30 min.) Explain multiple choice test format. Sts. take Quiz 1. (The instructor must make multiple copies of the quiz and distribute them to sts. The student materials do not contain the unit quizzes.) Review answers and discuss multiple choice test-taking strategies(Appendix).			Quiz 1 (Multiple choice) Quiz 1 Answer Key

INDUSTRIAL AND TECHNICAL OCCUPATIONS

Today I'd like to give you an overview of the industrial and technical occupations. Industry is of course related to the production of something, such as the production of an automobile. An example of an industry is the automobile industry. Another example is the electronics industry. The electronics industry produces televisions, radios, stereos and even computers. Now, the jobs that people have, or the occupations--the technical occupations--all relate to knowing how to build those products. Not everyone in a technical occupation builds things, however. Sometimes people repair things. Sometimes they do maintenance work. To make it easier to talk about the different types of industrial and technical occupations, let's put them into some groups (refer to Visual 1A). There are about five groups: the construction occupations, the manufacturing occupations, the mechanical occupations, the electronics field and graphic communications.

First of all, construction. Most of the things that people do in construction occupations relate to building. They work on residential buildings or commercial buildings. They not only build, but they also do repair work on buildings. Some examples of occupations in the construction area are bricklayers, carpenters, electricians, painters, and plumbers.

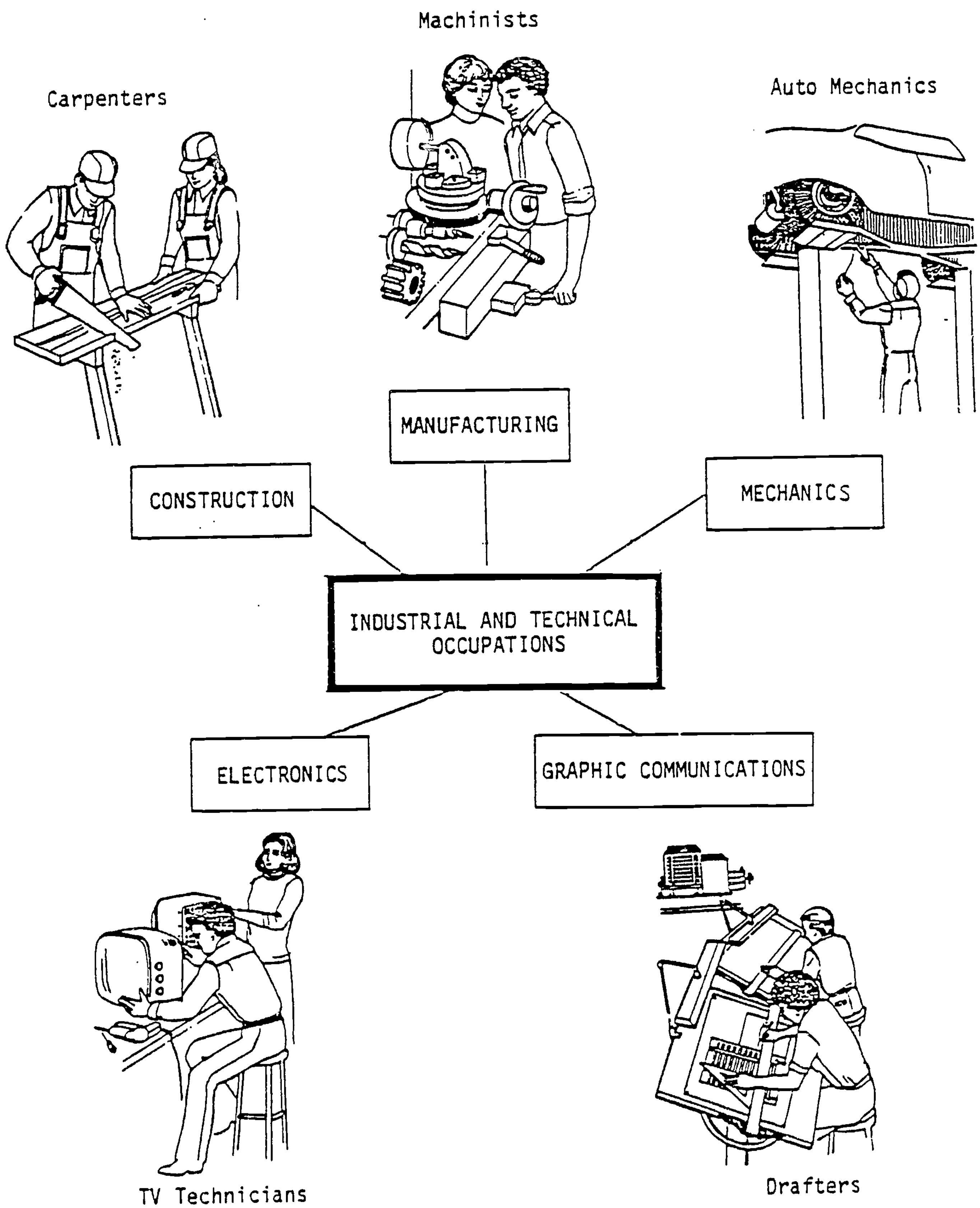
Next, there is the manufacturing group of occupations. People in the manufacturing occupations are directly involved in the production of something--machine parts or complete pieces of equipment. People who work in the manufacturing industry must have a good understanding of mechanical processes. Mathematics is important in manufacturing, too. Many processes require the worker to make mathematical calculations. One occupation in the manufacturing group is machine tool operator. Another one of the occupations that is very modern is numerical control machine tool operator. Numerical control machine operators use a computerized system for producing machine parts.

The next area we would like to talk about is the electronics. As you know, the field of electronics has become more and more important in recent years. People in the electronics field work with electrical and electronic equipment. Some assemble equipment. Others do testing, maintenance and repair of electronic equipment. Examples of occupations are computer repair technicians, and radio and T.V. technicians.

The next occupational group I want to mention is the mechanical group of occupations. Now, I'm talking about fields like auto mechanics, and heating and air conditioning. Technicians in these fields have to enjoy working with machines. They have to enjoy understanding how a machine works. They have to know how to repair these machines when something goes wrong.

The last area we would like to talk about is graphic communications. The first thing that comes to mind is probably drafting. Does everybody know what drafting is? Well, drafting involves making drawings. These drawings are the plans for a project. Today, more and more drafters work with computers. This is called computer assisted design, or CAD for short. Drafters have to have strong math skills, must understand measurements, geometry, and they have to be exact. Graphic communications refers to any occupation that has to do with communicating in graphics--in other words, visually.

In summary, we've talked about five occupational areas. They are construction, manufacturing, electronics, the so-called mechanical occupations, and graphic communications. Do you know which area interests you most? Do you know what kind of vocational programs there are at your school or in your community for getting training in these occupations?



Illustrations from the WRIOT Test (Wide Range Interest-Opinion Test), Jastak Associates, Inc.

Outline of Lecture

Follow along with this outline as you hear the lecture.

TOPIC: INDUSTRIAL AND TECHNICAL OCCUPATIONS

I. Introduction
   A. Industries - Products
      1. Automobile Industry
      2. Electronics Industry
   B. Technical Occupations
   C. Five Groups of Occupations
II. Construction
   A. Building
   B. Repair Work
   C. Jobs
III. Manufacturing
   A. Production
   B. Math
   C. Jobs
IV. Electronics
   A. Equipment
   B. Construction, Testing, Repair
   C. Jobs
V. Mechanical
   A. Jobs
   B. Working with Machines, Repair
VI. Graphic Communications
   A. Drafting
   B. CAD
   C. Math Skills
VII. Summary
   A. Training Opportunities

Definitions

A. For this exercise you will need a partner.
Study the following sentences.

1. A vocation is a profession or a trade which requires special training.
2. Many students are enrolled in vocational training.
3. An industry involves the production of goods.
4. The United States is an industrial country.
5. Technology is the science related to developing products and using them.
6. Computer electronics is a technical field.
7. An occupation is an activity or a job that someone has been trained for.
8. There are many occupational opportunities in the construction field.

B. Ask your partner to define the following words:
vocation, industry, technology, occupation

Examples: What does __________ mean?
What is the definition of __________?

Your partner will say a definition for each word, using the sentences in Part A above as a guide. When you have finished, switch roles and repeat the exercise.

C. Now, take turns making sentences using these words:
vocational, industrial, technical, occupational
Use the sentences in Part A above to help you.

D. Finally, interview your partner about his/her experience with technology in school or at work. Use the words above in your questions.

Word Forms

Fill in the missing words.

Noun	Adjective	Verb
technology	*technical* *technological*	X
industry	*industrial*	industrialize
vocation	*vocational*	X
occupation	occupational	X

Write one sentence for each of the words you have added to the chart.

1. *(Responses will vary.)*

2.

3.

4.

5.

Planning for the world of work

As you read this, you're probably still in school. But you're thinking more and more about the day when you'll go to work. . . .

. . . And since work is going to be your main activity during your adult years, it's a subject worth careful planning.

Perhaps you're not sure just what you can do. Or what you want to do. But you do know you want a job — a paying job that will bring you many of the good things of life.

Well, now is the best time to be exploring the types of occupations that interest you. Keep in mind, of course, that there is probably no one job that's perfect in all respects. The jobs that you'll have (no doubt you'll try more than one) should be determined by your own needs and goals. And you can get a job that fits you if you know yourself.

There are many questions to consider besides money and job availability. What about job security? Length of work hours? Vacations? Early retirement? Working conditions? Is the work indoors or outdoors? Is there a variety of duties or one set routine? Is the work done alone or with people? These are some of the questions that you might want to ask when talking with your counselor or future employer.

A. Discuss this reading with your teacher and classmates.

B. Which occupation are you interested in? Outside of class, conduct research to find out about this occupation. Get information which answers the questions in the last paragraph of this reading. Give a 3-5 minute oral report to the class.

Reading, slightly adapted, courtesy of General Electric Company from the brochure "So you want to go to work", 1983.

VOCATIONAL PROGRAMS AT MONROE TECHNICAL COLLEGE

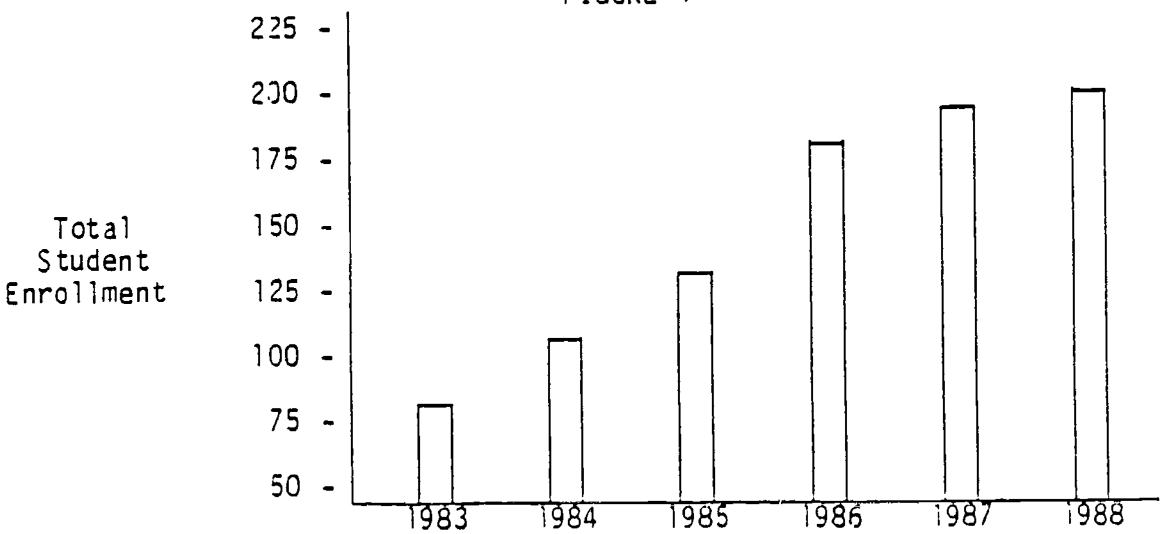
Monroe Technical College has been offering certificate and degree programs in vocational education since 1958. It has become widely known for practical training programs which prepare students for employment. Students at Monroe can choose from a variety of programs leading to jobs in technical and industrial occupations.

Monroe College offers training opportunities in the following programs: Automobile Mechanics, Electronics, Building Engineering, Climate Control Technology, Building Construction and Manufacturing Technology. The first four programs consist of two years of coursework and lab work leading to an associate degree. The last two are one-year programs leading to certification.

The programs at Monroe are very job-oriented. The Auto Mechanics and Building Construction programs include on-the-job training. The other four programs familiarize students with future workplace conditions by inviting guest speakers to visit classes and taking students on field trips to company sites. All of the programs offer classes during the week. Building Engineering also offers courses on weekends. All programs include job placement services for graduates.

Total student enrollment has increased rapidly in recent years from 80 students in 1983 to 200 in 1988 (see Figure 1).

FIGURE 1



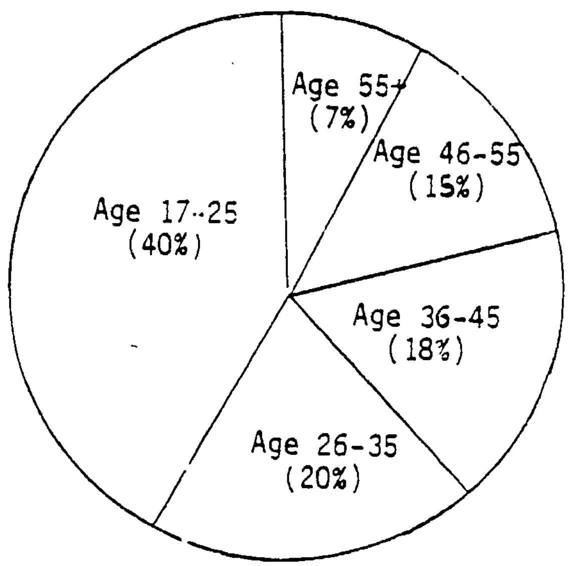
ENROLLMENT AT MONROE TECHNICAL COLLEGE

For the year 1988, enrollment in each program was as follows:

Automobile Mechanics	42
Electronics	60
Building Engineering	25
Climate Control Technology	25
Building Construction	34
Manufacturing Technology	14
Total	200

Monroe serves all different types of student. The student body is racially mixed. Approximately 25% of Monroe students are female. All age groups are represented by the students. For a breakdown of the age distribution of students for the year 1988, see Figure 2.

FIGURE 2



AGE DISTRIBUTION AT MONROE TECHNICAL COLLEGE
1988

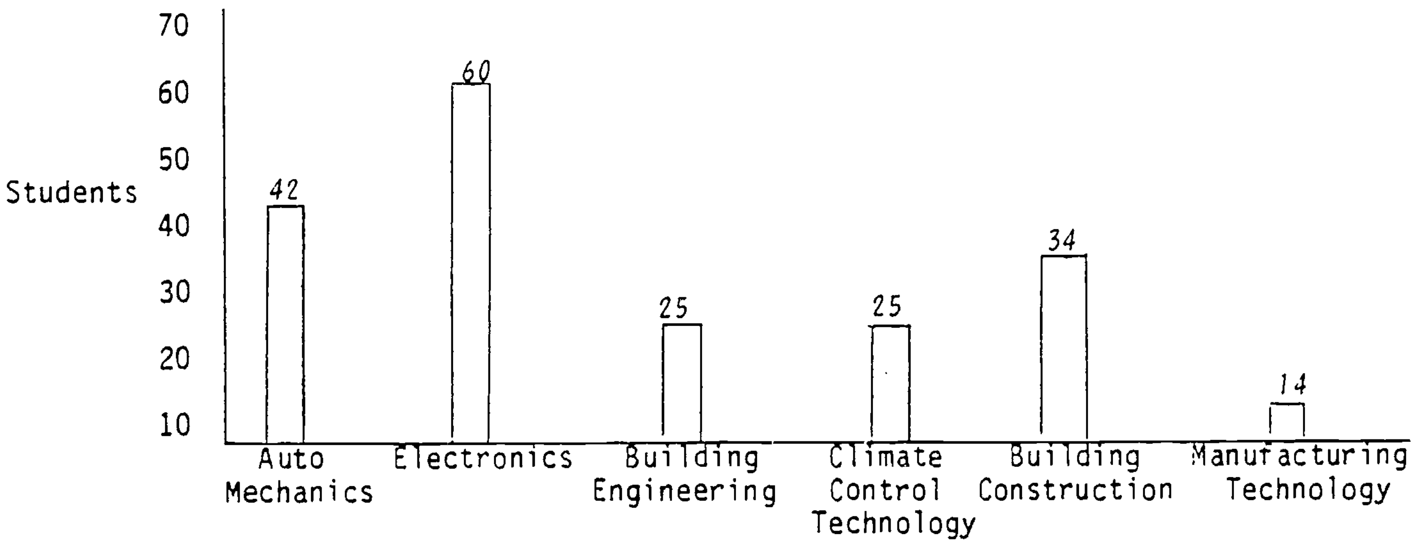
The growing and diverse student body in Monroe's vocational programs reflects the changing times. Technical and industrial occupations are requiring that workers have more and more skills. Monroe is keeping up with these demands by teaching not only technical skills, but also the language, math and problem-solving skills which workers need in today's job market.

Graphs and Charts

A. Complete the chart on the basis of the information given in the reading. Use an "X" to mark the appropriate boxes.

	Associate Degree	Certificate	On-the-Job Training	Job Placement	Weekend Courses
Auto Mechanics	X		X	X	
Electronics	X			X	
Building Engineering	X			X	X
Climate Control Technol.	X			X	
Building Construction		X	X	X	
Manufacturing Technology		X		X	

B. Based on the information in the reading, make a bar graph which shows the enrollment for each program in the year 1988. The bar for "Auto Mechanics" has been done for you.



PROGRAM ENROLLMENT AT MONROE TECHNICAL COLLEGE FOR 1988

Computer Technicians

Computer technicians are basically troubleshooters. They enjoy installing and testing new computer systems so they'll run trouble-free for the customer. However, they spend most of their time helping to maintain customer equipment — routinely adjusting, oiling and cleaning mechanical, electromechanical and electronic parts and checking for loose connections and defective components or circuits.

Usually called field engineers or customer engineers, computer technicians are employed by computer manufacturers or firms that hold long-term contracts to service computer equipment. These technicians routinely use tools such as voltammeters, ohmmeters and oscilloscopes. And they run diagnostic programs to help pinpoint certain malfunctions.

Because they service computer systems that work twenty-four hours a day, technicians must be on call at odd hours, and available to rotate shifts so they can be available to fix computers. Overtime, often more than eight hours a week, is common.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. Others decide to concentrate on helping other technicians with difficult problems. A few become supervisors or move into equipment or service sales. This is a field where opportunities will continue to grow for years to come.

Reading courtesy of General Electric from the brochure, "What's it like to be a technician?", 1985.

Reading Comprehension

On the basis of the information in the reading, discuss the answers to the questions and then write them.

1. What are some of the things that a computor technician must do?

   a) *Responses will vary. Basically, a computer technician must:*

   b) *troubleshoot, install, test, maintain, or repair computer systems.*

   c) __________

   d) __________

   e) __________

2. Who do computer technicians work for?

   They work for computer manufacturers or firms that service computer equipment.

3. When do computer technicians work?

   They often work odd hours and overtime.

4. Look at the last paragraph. Do all technicians have the same job?

   No. Some maintain or repair paticular equipment, some help other technicians, others become supervisors or salespersons.

5. If you were a computer technician what would you like to specialize in?

   (Responses will vary.)

A. Matching

The words in the left column are found in your reading. Match them to the words on the right with similar meanings and write the letters in the blanks.

1. __g__ install
2. __f__ maintain
3. __e__ defective
4. __j__ routinely
5. __i__ pinpoint
6. __a__ repair
7. __b__ type
8. __h__ overtime
9. __c__ rotate
10. __d__ trouble-free

a. fix
b. kind
c. change
d. without difficulties
e. broken
f. keep in good condition
g. put in
h. extra hours
i. locate
j. regularly

B. Definitions

Complete the following definitions: (Resonses will vary.)

1. A computer technician is a person who installs, tests, maintains and repairs computer equipment.

2. A computer manufacturer is a company that produces computer systems or components.

3. Diagnostic programs are programs that pinpoint malfuctions.

4. A computer maintenance technician is a technician who keeps computer equipment in good condition.

5. A supervisor is a person who directs the work of other employees.

Circle the letter of the best answer for each question.

1. Which is an example of an industry?
   a. automobile manufacturing
   b. automobile driving
   c. automobile sales
   d. automobile color

2. Which is not one of the industrial and technical occupational areas?
   a. construction
   b. electronics
   c. business management
   d. graphic communications

3. What is a vocation?
   a. a technical book
   b. a holiday
   c. a small shop
   d. a profession or trade

4. Some workers in technical occupations maintain equipment. This means they:
   a. obtain equipment for a customer.
   b. make sure equipment is in good running condition.
   c. buy equipment from a dealer.
   d. produce a lot of equipment.

5. Which occupation is in the construction field?
   a. musician
   b. plumber
   c. telephone repair person
   d. press operator

6. Why do people participate in training programs?
   a. to get a better job
   b. to learn a vocation
   c. to improve math and language skills
   d. all of the above

7. What does the word "enrollment" mean?
   a. the cost of a program
   b. the number of students in a program
   c. a piece of a pie chart
   d. a career in electronics

8. "There are training programs at Monroe College." This sentence means:
   a. Monroe has training programs.
   b. The programs are far away.
   c. Monroe is a well-known school.
   d. The programs are free.

9. A designer <u>must</u> explain the design to the client. Which means the same as the underlined word?
   a. can
   b. has to
   c. will
   d. does

10. What does a computer technician do?
   a. manufactures computers
   b. installs and tests computers
   c. creates computer programs
   d. repairs trouble-free components

QUIZ 1
ANSWER KEY

Circle the letter of the best answer for each question.

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TEACHER'S ACTIVITY GUIDE

UNIT TWO: PHYSICAL AND SPATIAL DESCRIPTIONS

TOPICS: Geometric Shapes
Dimensions
Measuring

SKILL OBJECTIVES: Comprehend and describe physical characteristics
Take lecture notes
Express numbers orally
Comprehend and use symbols and abbreviations
Read conversion tables
Make diagrams from oral and written instructions

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction Survey sts. familarity with basic geometry and measuring techniques. Stress that these concepts are important in giving and understanding technical descriptions. State Unit Two objectives.			
A) **Listening: Lecture (40 min.)** Using lecture Notes 2A, give lecture. Sts. take notes. Ask global comprehension questions. Sts. complete worksheet. In pairs, sts. check each other's work.	Descriptive adjectives	Geometry Terms: Lines and shapes and their characteristics, e.g. parallel line circle, round, etc.	Lecture Notes 2A Worksheet 2A
B) **Vocabulary (30 min.)** Introduce, explain, and have sts. repeat the vocabulary items on worksheet. Sts. complete worksheet. Review answers, orally.	Descriptive adjectives	Adjectives describing shapes, e.g. circular, triangular, etc.	Worksheet 2B
C) **Lecture/Oral Practice (20 min.)** Using Lecture Notes 2C, conduct discussion. Ask sts. to repeat key phrases during the discussion.	Oral expression of fractions and decimals	Fractions: one fourth, quarter, etc. Decimals: "point two five," etc.	Lecture Notes 2C

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
D) Listening/Physical Response (20 min.) Using Activity Notes 2D, give oral instructions to sts. Sts. make drawings, label them, and write equations. Check their work.	Imperative verbs	draw divide label equation	Teacher's Activity Notes 2D
E) Listening/Discussion (30 min.) Using lecture notes 3E, give lecture. Involve sts. by asking questions during presentation. Sts. complete worksheet. Check their work.		measure scale inch metric millimeter(mm) centimeter (cm) meter (m)	Lecture Notes 2E Students need rulers with both U.S. and metric scales Worksheet 2E
F) Vocabulary (20 min.) Preview the vocabulary on Worksheet; discuss it with sts. if necessary. Sts. complete worksheet. Review answers orally.	Word forms: nouns/adj. Oral expression of numbers	height/high length/long width/wide thickness/thick depth/deep	Worksheet 2F
G) Reading/Writing/Oral Reports (Time will vary.) Pre-reading: Ask sts. what kind of information they would expect a technical description to give. Reading: Sts. read silently. Ask comprehension questions. (Optional) Sts. draw the chair described in the reading. Sts. select an object, examine it and measure it. Sts. write short technical description of the object, focusing on vocabulary in this unit. Review sts. work and/or have them read their descriptions to the class, letting classmates guess which object they are describing.	Descriptive adjectives including use of past participles as adjectives Prepositions of location	supported rounded tapered curved	Reading 2G Students need rulers or tape measures

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
H) Graphical Literacy (20 min.) Pre-reading: Ask sts., "What is this chart for?" Discuss it briefly with them. Reading: Sts. study chart and complete worksheet. Follow-up: Review answers. other about chart. Ask sts. additional questions based on chart. In pairs, have sts. ask each other 10 questions about chart.	Wh-questions "There are"	U.S. and Metric expressions for length, area, mass and volume	Reading/ Worksheet 2H
I) Evaluation (20 min.) Make sure sts. understand quiz format. Sts. take quiz. Review results.			Quiz 2 (Following instructions to make diagrams) Quiz 2 Answer Key

BASIC GEOMETRY

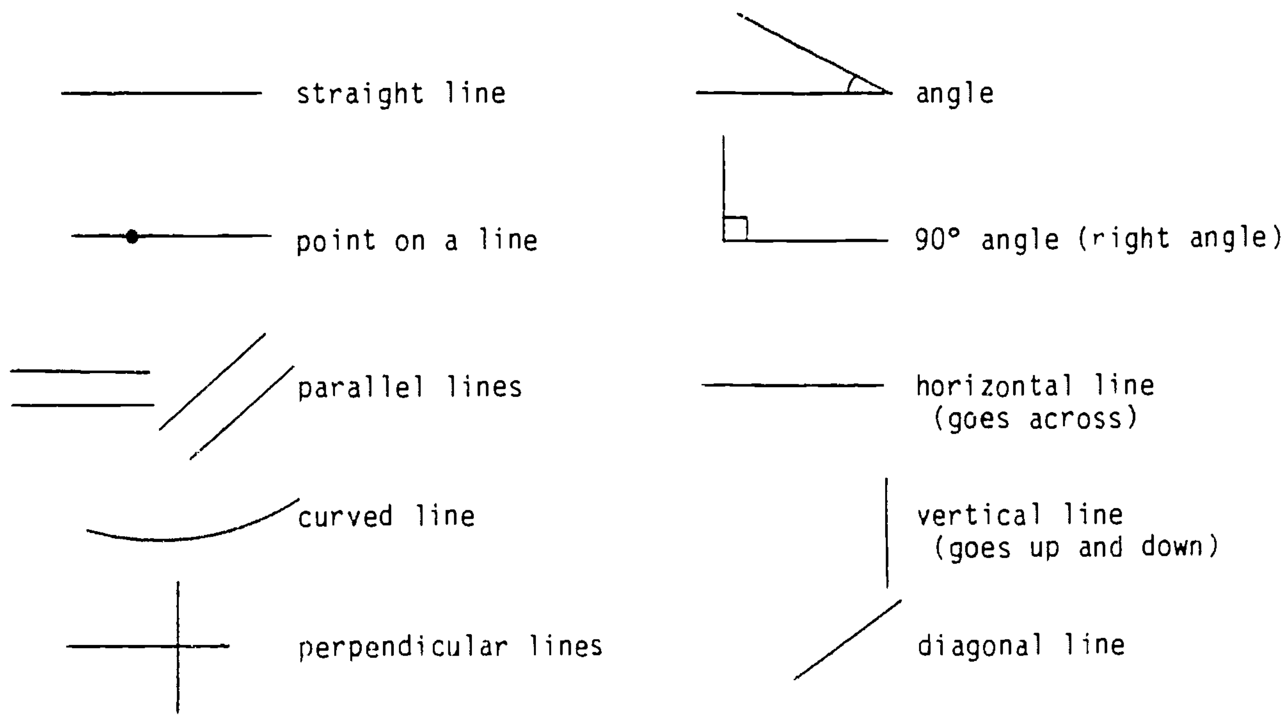
Instructor: These notes are intended to help you lead the students through a discussion of basic geometry concepts.
Ask questions which allow students to volunteer as much information as they can before you give formal definitions and explanations.
Have the students take notes on the lecture.

Lecture:

A) Introduce the subject of geometry.

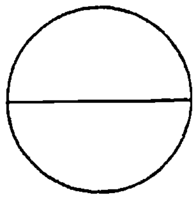
1. Ask students what geometry is. (Def.: The branch of mathematics that deals with the study of points, lines, planes, and solids.)
2. Ask if anyone has ever studied geometry.
3. Briefly discuss practical applications: drafting, blueprint reading, construction, etc.

B) Introduce the following lines and angles: say the name, draw each item on the board, repeat the name, write the name, and have students write and repeat the names.



Review these items. Ask sts. for examples of these items found in the classroom: horizontal lines (i.e. blackboard) vertical lines (door frame), parallel lines (blackboard and doorframe), perpendicular lines (tiles or panels), right angles (corners of room, blackboard, etc.).

C. Introduce shapes and their characteristics. Use the same procedure as in part B. "Now I am going to draw a..."



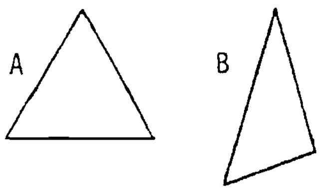
Circle

It is round.

The outside of the circle is called the circumference.

A line through the center of the circle is the diameter.

Each half of the circle is called a semicircle.

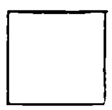


Triangle

Triangles have three sides.

In some triangles the lines and angles are all equal (A).

In others they are unequal (B).

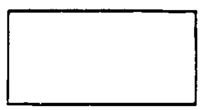


Square

It has four equal sides.

The lines on each side are parallel.

There are four right angles in it.

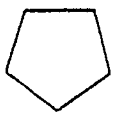


Rectangle

Four sides = parallel lines.

Not all sides are equal.

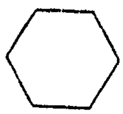
Four right angles.



Pentagon

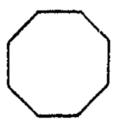
5 sides.

None are parallel.



Hexagon

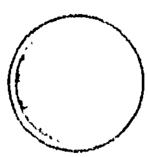
6 sides.



Octagon

8 sides.

D. Explain that all the lines and shapes covered so far have been two dimensional figures. These figures are flat and have only two dimensions, such as length and width. Next, introduce three dimensional objects. They have three dimensions. Sometimes they are referred to as height, width and depth.



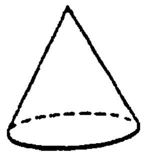
Sphere

What are some examples of spheres?

Examples: a ball, an orange, the earth.

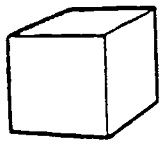
Cylinder (tube)

Examples: a pencil, a straw, a rod.



Cone

Examples: a party hat, the point of a pencil.



Cube

Length, width, and height are equal.

Examples: a square box, a dice.

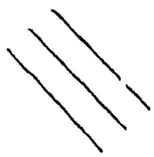
Vocabulary Comprehension

Now that you have heard the lecture, test your listening comprehension. Draw each of the following figures and shapes:

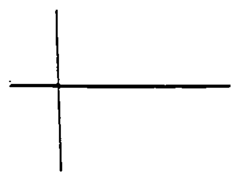
A straight, horizontal line.

A vertical line.

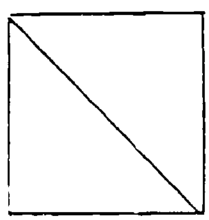
Three parallel l·nes.



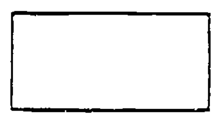
Two perpendicular lines (with a 90°. angle).



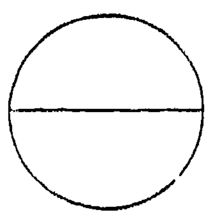
A square with a diagonal line connecting two corners.



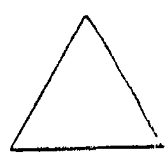
A rectangle.



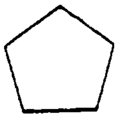
A circle with a line showing its diameter.



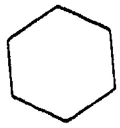
A triangle with equal sides.



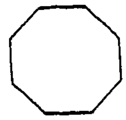
A pentagon



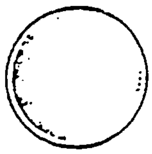
A hexagon



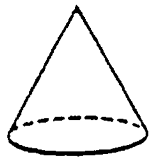
An octagon



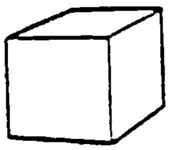
A sphere



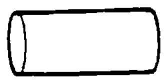
A cone



A cube



A cylinder



Now, draw a picture of a simple house using at least six of the shapes discussed in the lecture. Label each shape in your drawing by its name.

Practice with Adjectives

These are adjectives which describe the shapes you have learned. For each adjective, make one sentence which describes a shape or an object.

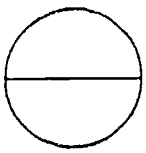
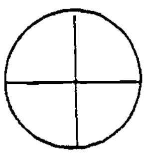
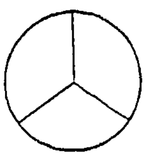
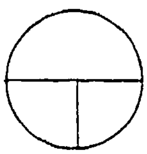
Examples: A coin is circular. OR A coin has a circular shape.
A ball is spherical. OR A ball has a spherical shape.

1. circular (Responses will vary.)
2. triangular
3. rectangular
4. square
5. pentagonal (The Pentagon in Wash. DC is pentagonal; so is the Chrysler emblem.)
6. hexagonal (Hex nuts for some bolts are hexagonal.)
7. spherical
8. conical
9. cylindrical
10. cubical

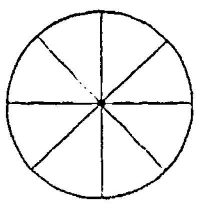
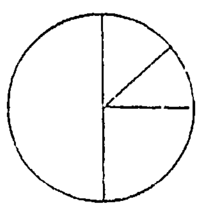
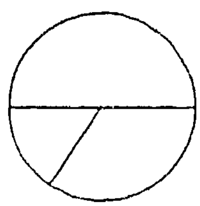
FRACTIONS AND DECIMALS

Instructor: There are notes included to help you give a simple lecture on fractions and decimals. The following illustrations can be drawn on the blackboard. Since most of your students will probably already have an understanding of the basic mathematical concepts presented here, remember to emphasize the language needed to express them.

A. When we divide something into parts, we speak of fractions or decimals. For each diagram, have students practice equations orally.

	Fractions	Decimals
	1/2 + 1/2 = 2/2 = 1 "One half plus one half equals two halves equals one."	.5 + .5 = 1.0 "Point five plus point five equals one point zero."
	1/4 + 1/4 + 1/4 + 1/4 = 4/4 = 1 "One fourth (or quarter) plus...	.25 + .25 + .25 + .25 = 1.0 "Point two five plus...
	1/3 + 1/3 + 1/3 = 3/3 = 1	.33 + .33 + .33 = 1.0
	1/2 + 1/4 + 1/4 4/4 = 1	.5 + .25 + .25 = 1.0

B. Describe several more examples in terms of fractions and decimals and/or have students volunteer to try doing this.

C. Review the names of the fractions and decimals. Ask students to pronounce numbers you put on the board.

1/2	.5	
1/4	.25	
1/8	.125	
1/16	3/16	7/16

etc.

1 1/2 = 1.5

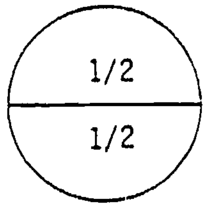
2 3/4 = 2.75

3 7/8 = 3.875

etc.

Have students make drawings and label them according to your verbal instructions. Do an example for them on the board.

Example: Draw a circle.
Divide it into 2 equal parts.
Label the parts in fractions.
Write a mathematical equation for the drawing.



1/2 + 1/2 = 1

1. Draw a circle. Divide it into 4 equal parts. Label the parts in fractions. Write a mathematical equation which expresses the drawing (1/4 + 1/4 + 1/4 + 1/4 = 1).

2. Draw another circle. Divide it into 4 equal parts also. Label the parts in decimals. Write an equation (.25 + .25 + .25 + .25 = 1).

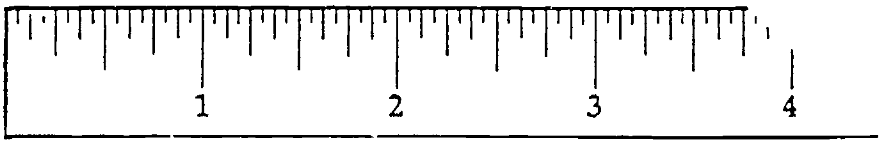
3. Draw a square. Divide it in half. Divide one of the halves into halves again. Label the parts in fractions. Write an equation (1/2 + 1/4 + 1/4 = 1).

4. Draw two rectangles which are the same size. Divide each into thirds. Label one in fractions and the other in decimals. Write an equation for each drawing (1/3 + 1/3 + 1/3 = 1, .33 + .33 + .33 = 1).

5. Draw a square. Divide it into 4 equal parts. Divide one of the fourths into 4 equal parts. Label the fractions. Write an equation (1/4 + 1/4 + 1/4 + 1/16 + 1/16 + 1/16 + 1/16 = 1).

Apply concepts of fractions and decimals to a brief discussion of measuring. Each student should have a ruler with both a U.S. scale and a metric scale.

Discuss inches, half inches, quarter inches, eighths, and sixteenths. You will need a diagram on the blackboard such as the following:



Ask "How many, half inches are there in an inch?", "How many quarter inches in a half inch?", etc. (Symbols: inch = ", foot = ').

Point to exact points on the diagram and ask, "What is the exact measurement here?" Have students repeat responses as a group. Emphasize correct pronunciation.

Next, discuss millimeters, centimeters, and meters on the metric scale.

10 millimeters	=	1 centimeter
100 centimeters	=	1 meter
1000 millimeters	=	1 meter

(Abbreviations: millimeter-mm., centimeter-cm., meter-m.).

1.5 cm.	=	1 cm. + 50 mm.
1.5 m.	=	1 m. + 50 cm.
1.56 m.	=	1 m. + 56 cm.
1.568 m.	=	1 m. + 56 cm. + 8 mm.

and so on...

Measuring

Using a ruler, measure each of the following lines. Record both U.S. and metric scale measurements.

		U.S.	Metric
1.	____________		
2.	______________________		
3.	_______________		
4.	_____		
5.	________		
6.	___		

Instructor: Please measure these lines to determine their exact lengths.

Now, draw a line the length indicated.

7. 1 1/2"

8. 2 3/4"

9. 4.5 cm.

10 3 1/8"

11. 7.2 cm.

12. 5 1/8"

13. 56 mm.

14. 80 mm.

15. 15/16"

Practice with Adjectives

We can talk about a measurement using either an adjective (such as "high") or a noun (such as "height").

Examples: The door is 6'8" high.
The height of the door is 6'8". OR The door has a height of 6'8".

Study the following words. If any are new to you, review them with your instructor.

Nouns	Adjectives
height	high
length	long
width	wide
thickness	thick
depth	deep

Rewrite each sentence using a different form of the descriptive word.

1. The window is 3'2" wide.

   The width of the window is 3'2". OR The window has a width of 3'2".

2. The desk is 4'5" long.

   The length of the desk is 4'5". OR The desk has a length of 4'5".

3. This piece of cardboard is .7 cm. thick.

   The thickness of this piece of cardboard is .7 cm. OR This piece has a...

4. That tall building has a height of 240 ft.

   That tall building is 240 ft. high,

5. The depth of Taylor's water tank is 10 feet.

   Taylor's water tank is 10 feet deep.

6. We need to measure how long the table is.

   We need to measure the length of the table.

7. Tell me how wide the panel is.

   Tell me the width of the panel.

8. I must know how high, how wide, and how long the truck is.

   I must know the height, the width, and the length of the truck.

Technical Descriptions

A technical description of an object is very different from a non-technical description. Compare these two descriptions of a chair:

Non-technical Description

The chair I like to sit in when I read is a very old chair. You could call it an antique. It isn't really a very comfortable chair because the seat is too hard and the back is too straight. I think the main reason I like it is because it was a gift from my grandmother and it has sertimental value to me.

Technical Description

The chair is light brown in color and is made of oak. It stands 72 cm. high. The top of the seat is 44 cm. from the floor and is slightly higher at the sides and middle. It is supported by legs which are flat on two sides, rounded toward the outside, and tapered at the feet. The back of the chair is nearly vertical and is composed of six cylindrical dowels each 2.2 cm. in diameter. Connecting the dowels at the top is a curved panel with a width of 9 cm.

Discuss with your instructor the differences between these descriptions. Could they be descriptions of the same chair?

Can you make a drawing of the chair?

Technical Writing Assignment

Select an object and write a technical description of it. Give its measurements, describe what it is made of, and what it looks like. Try to use the vocabulary from this unit.

Conversion Chart

Using the following conversion chart, answer the questions.

Common Conversion
Metric to U.S. — U.S. to Metric

Length

Metric to U.S.	U.S. to Metric
1 millimeter = 0.03937 inch	1 inch = 25.40 millimeters
1 centimeter = 0.3937 inch	1 inch = 2.540 centimeters
1 meter = 39.37 inches	1 foot = 30.480 centimeters
1 meter = 3.2808 feet	1 foot = 0.3048 meter
1 meter = 1.0936 yards	1 yard = 91.440 centimeters
1 kilometer = 0.62137 mile	1 yard = 0.9144 meter
	1 mile = 1.609 kilometers

Area

Metric to U.S.	U.S. to Metric
1 sq. millimeter = 0.00155 sq. inch	1 sq. inch = 645.16 sq. millimeters
1 sq. centimeter = 0.1550 sq. inch	1 sq. inch = 6.4516 sq. centimeters
1 sq. meter = 10.7640 sq. feet	1 sq. foot = 929.03 sq. centimeters
1 sq. meter = 1.196 sq. yards	1 sq. foot = 0.0929 sq. meter
1 sq. hectometer = 2.471 acres	1 sq. yard = 0.836 sq. meter
1 hectare = 2.471 acres	1 acre = 0.4047 sq. hectometer
1 sq. kilometer = 0.386 sq. mile	1 acre = 0.4047 hectare
	1 sq. mile = 2.59 sq. kilometers

Mass (Weight)

Metric to U.S.	U.S. to Metric
1 gram = 0.03527 ounce	1 ounce (dry) = 28.35 grams
1 kilogram = 2.2046 pounds	1 pound = 0.4536 kilogram
1 metric ton = 2 204.6 pounds	1 short ton (2000 lb) = 907.2 kilograms
1 metric ton = 1.102 tons (short)	1 short ton (2000 lb) = 0.9072 metric ton

Volume (Capacity)

Metric to U.S.	U.S. to Metric
1 centiliter = 10 cm^3 = 0.338 fluid ounce	1 fluid ounce = 2.957 centiliters = 29.57 cm^3
1 deciliter = 100 cm^3 = 0.0528 pint (liq.)	1 pint (liq.) = 4.732 deciliters = 473.2 cm^3
1 liter = 1 dm^3 = 1.0567 quarts (liq.)	1 quart (liq.) = 0.9463 liter = 0.9463 cm^3
1 liter = 1 dm^3 = 0.26417 gallon (liq.)	1 gallon (liq.) = 3.7853 liters = 3.7853 dm^3

Chart courtesy of Glencoe Publishing Co., Machine Tool Technology, 1984.

1. How many inches are there in one centimeter? 0.3937

2. How many centimeters are there in one inch? 2.540

3. How many feet are in one meter? 3.2808

   In two meters? 6.5616

4. How many grams are in an ounce? 28.35

5. What is the relationship between pounds and kilograms? 1 lb. = 0.4536 kilograms

6. What is the relationship of liters to liquid quarts?

   1 liter = 1.0567 quarts

QUIZ 2

In the corresponding box in the grid, do the following:

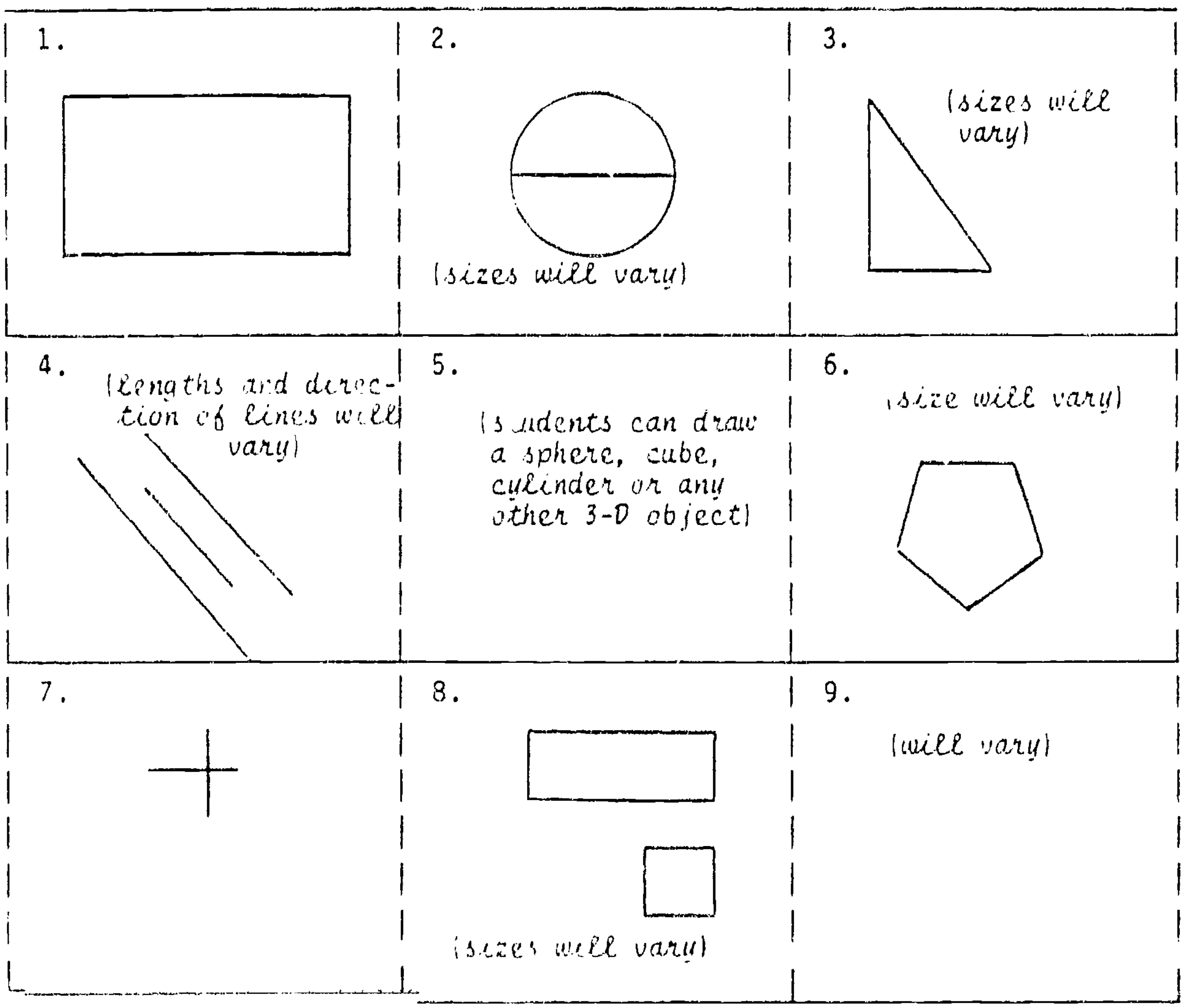
1. Draw a rectangle 1 1/2" long and 7/8" wide.
2. Draw a circle with a diameter of 2.5 centimeters.
3. Draw a right triangle (90° angle).
4. Draw 3 vertical lines which are all parallel to each other.
5. Draw a three-dimensional object.
6. Draw a pentagon.
7. Draw two perpendicular lines, each 1.2 cm. long.
8. Draw a rectangle and a square which have the same width.
9. Draw a triangle with unequal sides. Measure each side and write the measurement next to the line.

1.	2.	3.
4.	5.	6.
7.	8.	9.

QUIZ 2
ANSWER KEY

In the corresponding box in the grid, do the following:

1. Draw a rectangle 1 1/2" long and 7/8" wide.
2. Draw a circle with a diameter of 2.5 centimeters.
3. Draw a right triangle (90° angle).
4. Draw 3 vertical lines which are all parallel to each other.
5. Draw a three-dimensional object.
6. Draw a pentagon.
7. Draw two perpendicular lines, each 1.2 cm. long.
8. Draw a rectangle and a square which have the same width.
9. Draw a triangle with unequal sides. Measure each side and write the measurement next to the line.



TEACHER'S ACTIVITY GUIDE

UNIT THREE: FUNCTIONAL DESCRIPTIONS

TOPICS: Basic Shop Tools, Fasteners, and Instruments

SKILL OBJECTIVES:
Comprehend lecture and take notes
Ask for and give names of basic tools
Ask for and describe functions/uses of tools
Refer to diagrams
Read instructions for using shop instruments
Take a short answer test

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction (15 min.) Ask "What are the names of some tools that you have used? Write the names on the board. Ask "What are they used for?" Write the uses on the board. State the unit objectives.			
A) Listening Comprehension/ Note-taking (50 min.) Prepare a lecture based on the text in Lecture 3A. Give the lecture, referring to Visual 3A. Give the lecture again, having sts. write the names of the tools on Worksheet 3A. Give lecture a 3rd time, having sts. write the functions of the tools. Review worksheet.	"used for" + ing "used to" + infinitive	hammer wrench screwdriver saw plier drive pull turn hold tighten loosen saw cut grip	Visual 3A Lecture 3A Worksheet 3A
B) Vocabulary (20 min.) Explain the instructions for the worksheet. Sts. complete worksheet. Review answers	"used for" "used to"	Tools and functions from lecture	Worksheet 3B

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
C) Functions (30 min.) Review the grammar point on Worksheet 3C(1). Ask sts. for examples. Divide sts. into pairs. Sts. practice orally. Sts. complete worksheet 3C(2) individually.	"used for" "used to"	(same as above)	Worksheet 3C(1) Worksheet 3C(2)
D) Functions/Discussion (30 min.) Using worksheet, have sts. write original sentences describing functions. Compare sts. responses. For example, you could have each read 3 sentences aloud while another student writes the key words on the blackboard.	"used for" "used to"	(will vary)	Worksheet 3D
E) Reading (30 min.) Pre-reading: "Look at the illustrations. Look at the subtitles. Ask, "What is the passage about?" Reading: Sts. read silently. Ask, "What did you find out?" Sts. read silently again or aloud. Ask "What items are described?" "What are their functions?" Follow-up: Sts. complete the worksheet. Review answers.	"used for" "used to" modal "can" + passive	nails screws bolts nuts washers	Reading 3E Worksheet 3E
F) Reading/Graphical Literacy (30 min.) Pre-reading: "Look at the illustrations? What do the illustrations tell you?" Reading: Sts. read silently. Ask, "What did you find out? Sts. read silently again. Ask, "What is a micrometer used for? How do you use it?" Comprehension: Sts. complete worksheet silently. Review answers.	passive verb constructions Ex: "Nails are used", "heads can be driven"	instrument micrometer measurement measure thickness thousandth lengthwise represent reading	Reading 3F Worksheet 3F

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
G) Reading/Graphical Literacy (30 min.) Ask pre-reading questions. Sts. read silently. Ask global comp. questions. Sts. read again. Sts. complete worksheet. Review answers.	"used for" "used to" imperatives adverbs of frequency: "never"	Types of pliers cut clamp adjustable spread prevent	Reading 3G Worksheet 3G
H) Evaluation (30 min.) Discuss short answer quiz format. Sts. take quiz. Review answers and discuss short answer test-taking strategies (Appendix).			Quiz 3 (Short Answer) Quiz 3 Answer Key

BASIC TOOLS

Today we are going to talk about some common tools. These tools are used in many different kinds of occupations. You are probably familiar with some of these tools already since they are often found in many workshops, homes, and even cars.

The first tool we are going to talk about is the hammer. Look at the first picture. This is called a claw hammer. Look at the end (point to it)--it looks like a claw. It has a narrow V. This claw is used for pulling nails. The other end of the hammer is used for driving nails. A second common hammer is the ball peen hammer. This hammer is used by mechanics. It is for pounding metal or machinery. Look at the round end. This is called the peen. It is round like a ball. Riveting, for example, is started with the ball peen and finished with the flat end.

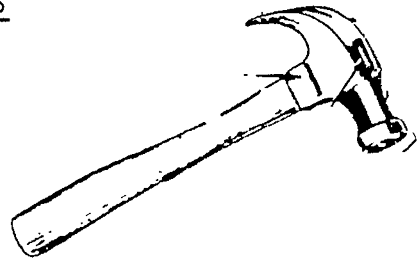
Wrenches are shown in the next illustration. There are many different sizes and types. Wrenches are used to turn or hold nuts and bolts. We are going to talk about three types of wrenches. The first, the open-end wrench, has an open end which fits around the nut or bolt. Another wrench is the box end. It is used for bolts and nuts which are in small places. This wrench must be lifted off after each turn. The third wrench is the adjustable wrench. This wrench has a jaw which can be adjusted to make the opening larger or smaller. These wrenches come in different sizes and with different handles.

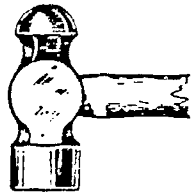
There are two common types of screwdrivers. A common screwdriver is used to tighten or loosen a single-slot screw. The Phillips screwdriver is used with screws which have a four-way slot.

A saw is a tool which you probably know about. Some saws are used for cutting wood. A handsaw is used for sawing wood. There are other saws which you may or may not know about. A backsaw is used to cut a straight line across a piece of wood. A coping saw is used for cutting curved lines. There are other saws for cutting metal. A hacksaw is an example of this type of saw.

Pliers are another tool which everybody knows. Combination pliers are used to hold and grip a lot of things. Look at the slot in one of the pieces (point to it). With this slot, we can adjust the size of the pliers. Water pump pliers are often used in plumbing jobs. They can grip larger objects such as pipes and faucets. Diagonal pliers are made for cutting They are never used for holding.

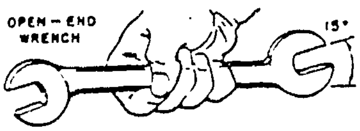
HAMMERS

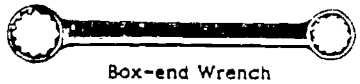




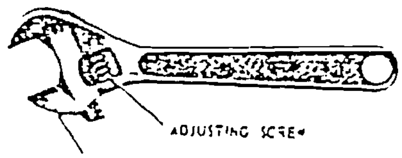
Ball Peen Hammer

WRENCHES



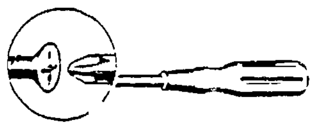


Box-end Wrench

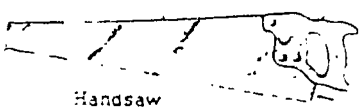


ADJUSTABLE OPEN-END WRENCH

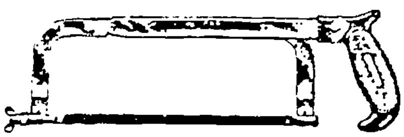
SCREWDRIVERS



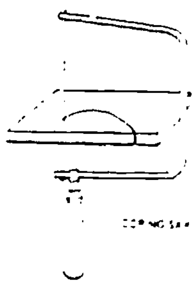
SAWS

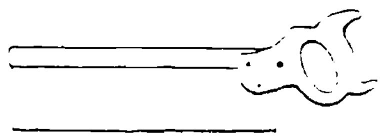


Handsaw



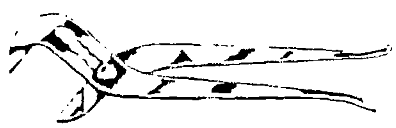
Hacksaw

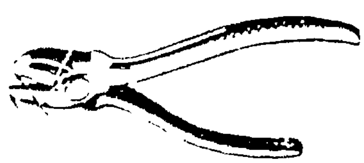




Special Saws

PLIERS





Pictures courtesy of Allington Corporation from Tools and Basic Machines, 1968.

Lecture Notes

Listen to the lecture. Do not write anything.
Listen to the lecture again. Write the names of the tools.
Listen to the lecture a third time. Write the names of the functions.

	TOOLS	FUNCTIONS
1.	claw hammer	pulling and driving nails
2.	ball peen hammer	pounding metal
3.	open end wrench	turning nuts and bolts
4.	box end wrench	turning nuts in small places
5.	adjustable wrench	turning nuts; jaws can be adjusted
6.	common screwdriver	tightening and loosening single slot screws
7.	Phillips screwdriver	tightening or loosening four-way slot screws
8.	hand saw	sawing wood
9.	backsaw	cutting a straight line in wood
10.	coping saw	cutting curved lines
11.	hacksaw	cutting metal
12.	combination pliers	holding and gripping; size is adjustable
13.	water pump pliers	gripping pipes and faucets
14.	diagonal pliers	cutting

WORKSHEET 3B

Vocabulary

Match the words with their definitions.

1.	d to grip	a.	to change
2.	g to drive	b.	not straight
3.	e types	c.	opening
4.	f single	d.	to hold
5.	c slot	e.	kinds
6.	b curved	f.	one
7.	a to adjust	g.	to push

Write the correct words in the sentences.

1. A claw hammer is used to *drive a* nail into wood.
2. A ball peen hammer is used to work with *metal*.
3. A common screwdriver can be used with *single slot* screws.
4. The lecture discussed three *types* of wrenches.
5. With an adjustable wrench, you can make the opening larger or *smaller*.
6. A handsaw is not used for cutting *curved* lines.
7. A hacksaw is *used* for cutting metal.
8. You can *adjust* the size of combination pliers.
9. Pliers are used to *grip* a lot of things.
10. Water pump pliers are used to grip plumbing objects, such as *pipes*.

Functions/Oral Practice

When describing the function of something, two constructions can be used.

"is used to + verb" Ex: A claw hammer is used to drive nails.
"is used for verb + ing" Ex: A claw hammer is used for driving nails.

1. Write a sentence with "is used to..."

____

2. Write a sentence with "is used for..."

____

Read: Student A: What is this called?
Student B: They're pliers.
Student A: What are they used for?
Student B: They're used for gripping things.

Practice the dialog with a partner. Use the pictures below.

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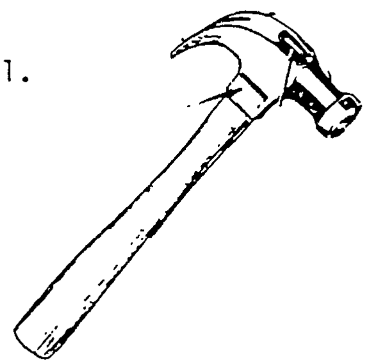

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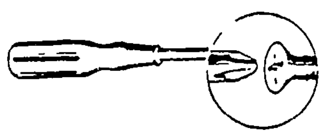

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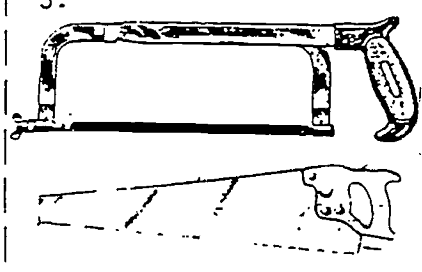

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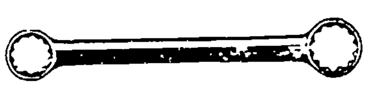

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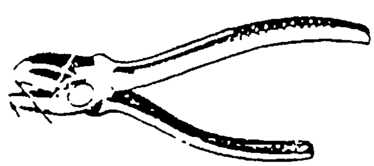

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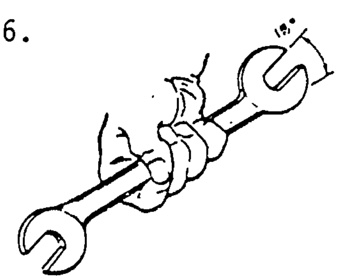


Functions/Written Practice

Complete each sentence below using "used to" and used for."

1. Pliers *are used to grip* things.

   Pliers *" " for gripping* things.

2. A claw hammer *is used to pull (or drive)* nails.

   A claw hammer *" " for pulling (or driving)* nails.

3. A handsaw *is used to saw* wood.

   A handsaw *" " for sawing* wood.

4. A coping saw *is used to cut* curved lines.

   A coping saw *" " for cutting* curved lines.

5. Wrenches *are used to turn* nuts and bolts.

   Wrenches *" " for turning* nuts and bolts.

6. A Phillips screwdriver *is used to turn* Phillips screws.

   A Phillips screwdriver *" " for turning* Phillips screws.

Functions

A. Think of six tools or pieces of equipment you have used at home or at a job. Write one sentence for each which describes its function.

Example: A lawnmower is used for cutting grass.

1. *(Responses will vary.)* ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

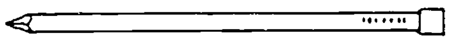
6. ______________________________

B. Compare your sentences to those of your classmates. Compare the words you used to describe functions.

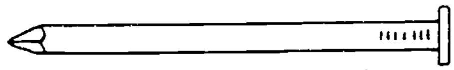
FASTENERS

We can speak of five basic kinds of fasteners which are used to join pieces and hold them in place: nails, screws, bolts, nuts, and washers. Each one has a different function.

Nails



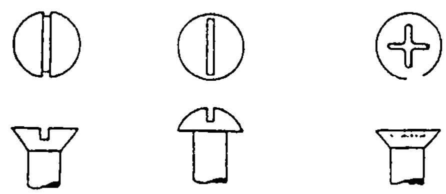
Finishing Nail



Common Nail

Nails are used to hold two surfaces together. They come in a variety of types and sizes. Nails can have either flat or countersunk heads. Finishing nails have countersunk heads which can be driven below the surface. They are used when the nails should not be seen, such as in furniture. A flathead nail, such as the common nail, does not actually lie flat; its stays above surface. Short flathead nails are used to nail roofing paper and plaster board.

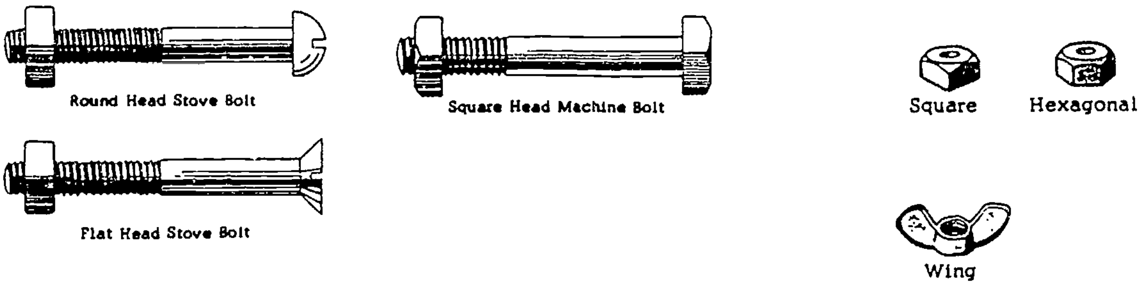
Screws



Flat Head   Round Head   Phillips Head

Here are some common types of screws. Screws are grouped according to their types of heads. Their heads can be round or flat. Ordinary screws have slotted heads. A screw can have a single slot or a Phillips slot. A Phillips slot has four sides. A Phillips screwdriver is used to tighten or loosen Phillips head screws. Screws can also be grouped according to the material they are used for--some screws are wood screws and others are metal screws.

Bolts and Nuts



A bolt is different from a screw. A bolt is not threaded into wood or metal. It slides through wood or metal and is held by a nut. Bolts can have round, square, or flat heads. Wrenches are used to tighten nuts to bolts.

There are many kinds of nuts. The most common nuts are square (four sides) or hexagonal (six sides). A special kind of nut is called the wing nut. It is used for making adjustments by hand rather than with a wrench.

Washers

Washers are used between bolt heads and surfaces and between bolts and nuts. They prevent damage to surfaces. The most common washer is the flat washer. A split lock washer is used to grip the nut and the surface tightly. A shake-proof washer has teeth. These teeth grip the surface and the nut. This washer is resistant to shaking, and for this reason it is often used on machines which vibrate.

Pictures courtesy of Allington Corporation from Tools and Basic Machines, 1968.

Reading Comprehension

Using the information from the reading, write short answers to the questions.

1. What is the reading passage about?

   Different types of fasteners.

2. Which five types of parts are described in the passage?

   Nails

   Screws

   Bolts

   Nuts

   Washers

3. What are nails used for?

   To hold surfaces together.

4. What are finishing nails used for?

   On things where the nails should not be seen, such as furniture.

5. How can screws be grouped?

   According to their head types.

6. Which tool is used with Phillips head screws?

   Phillips screwdriver.

7. What is the difference between flathead and Phillips screws?

   A flathead screw has one slot; Phillips screws have four.

8. Why are washers used?

   To prevent damage to surfaces.

9. How are bolts held in place?

   By nuts.

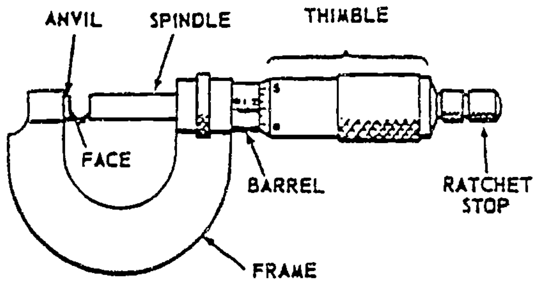
10. What is a wing nut?

    A special kind of nut for making adjustments by hand.

MEASURING WITH MICROMETERS*

Micrometers (sometimes called "mikes") are instruments used for making very exact measurements. Micrometers can measure in thousandths of an inch.

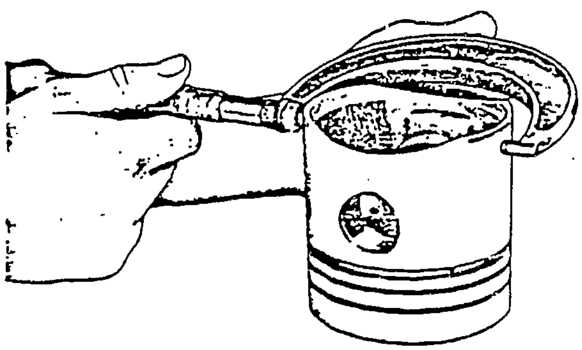
Outside Micrometer



Outside Micrometer

One type of micrometer commonly used is an outside micrometer. It is used to measure the size of parts, such as their diameter or thickness.

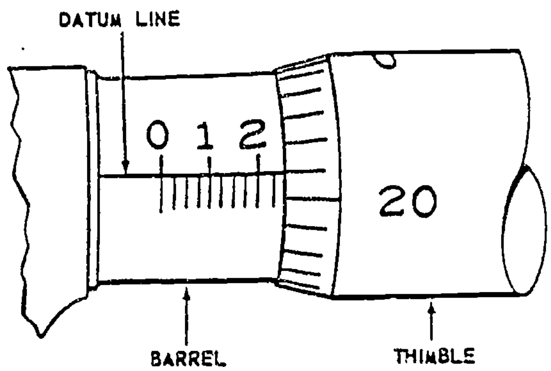
Correct Use



To measure an object, the thimble is screwed with the fingers until the distance between the anvil and the spindle fits over the object. Then the micrometer is brought over the object. Next, the thimble is turned until the faces of the spindle and the anvil touch the object.

* (accent on 2nd syllable, rhymes with "odometer")

Reading a Micrometer



The line which runs lengthwise on the barrel of the micrometer is called the datum line. Looking at this line tells you the measurement (thickness) of an object.

Each number on the barrel represents .100 (one hundred thousandths) inch. Each line between the numbers represents .025 (twenty five thousandths) inch. Each line on the thimble represents .001 (one thousandth) inch. In the picture above, the reading on the micrometer is:

$$\begin{array}{rl} & .200 \text{ inch} \\ + & .025 \text{ inch} \\ + & .021 \text{ inch} \\ \hline & .246 \text{ inch} \end{array}$$

Reading Comprehension

After you have discussed the reading, write short answers to the questions.

1. What is a mike?

   A micrometer.

2. Which type of micrometer is discussed in this reading?

   An outside micrometer.

3. What are ends of the anvil and the spindle called?

   Faces. (see diagram)

4. Which part of the micrometer is turned to make a measurement?

   The thimble.

5. What is connected to the thimble? *The barrel.*

6. Where is the datum line located? *On the barrel.*

7. How many thousandths of an inch are represented between the numbers 0 and 1 on the barrel?

   .100 (one hundred thousandths)

8. How do you read the numbers .200? (Write out the words.)

   two hundred thousandths

9. How do you read .021? (Write out the words.)

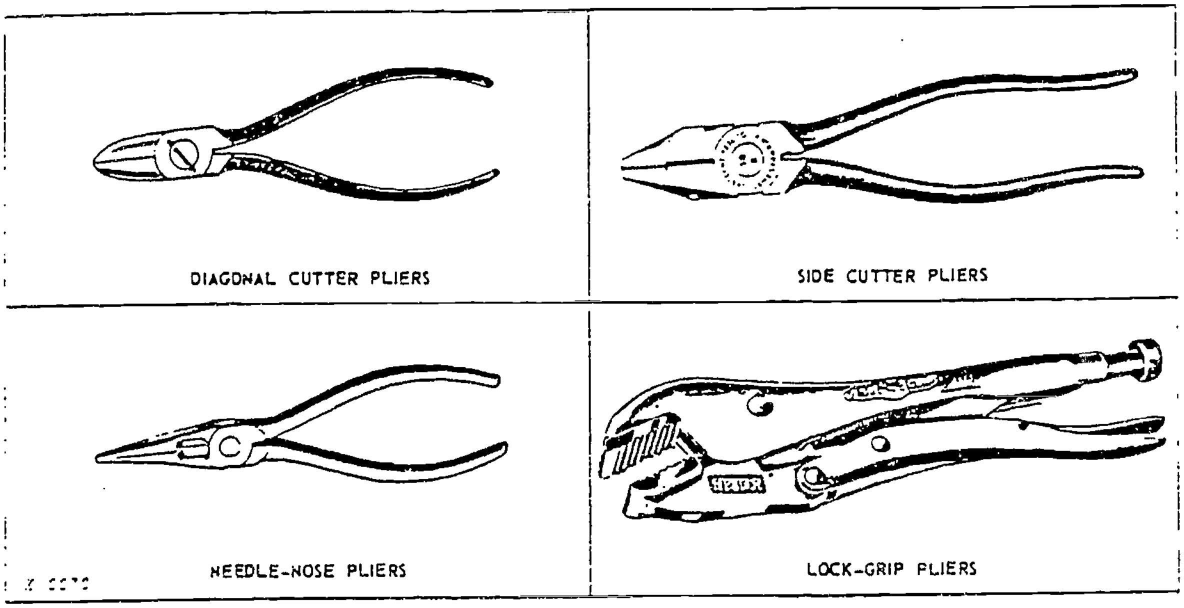
   twenty-one thousandths

10. How do you read .246? (Write out the words.)

    two hundred forty-six thousandths

11. What is an outside micrometer used for?

    Measuring the size of parts.



DIAGONAL CUTTER PLIERS

Diagonal cutter pliers (Fig. 14) are ideal for pulling cotter pins, especially from slotted nuts. They may also be used for spreading the ends of cotter pins. *Never use diagonal pliers for cutting large-gauge wire.*

SIDE CUTTER PLIERS

Side cutter pliers (Fig. 14) are for the serviceman who cuts a lot of large-gauge wire.

NEEDLE-NOSE PLIERS

Needle-nose pliers are used primarily for handling small objects and for reaching into restricted areas. Never force them beyond their gripping capacity.

LOCK-GRIP PLIERS

Lock-grip pliers (Fig. 14) are specially designed to clamp and hold a round object. One jaw is adjustable to fit different sizes of nuts, bolt heads, pipes, or rods.

Never use these pliers on material where marring the finish is a problem.

SNAP RING PLIERS

Snap ring pliers (Fig. 15) are used to spread snap rings just the right amount as they are removed or installed.

This is a handy tool and also helps prevent overexpanding of snap rings.

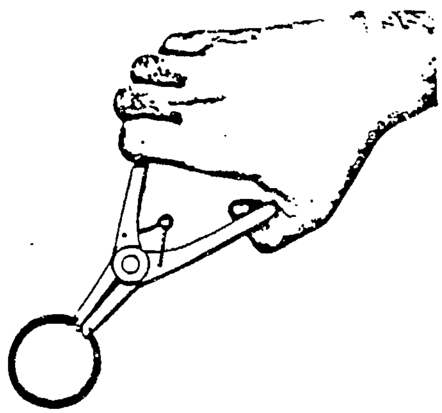


Fig. 15 — Use Of Snap Ring Pliers

OTHER TYPES OF PLIERS

Special types of pliers are also available for certain jobs: Battery (terminal nut) pliers, water pump nut pliers, ignition pliers, hose clamp pliers, brake spring pliers, retaining ring pliers, groove-grip snap ring pliers, horseshoe lock ring pliers, and slip-joint (channel) pliers.

CARE OF PLIERS

Keep pliers clean and occasionally put a drop of oil on the joint pin. This will prevent rusting, the enemy of all tools.

Reading Comprehension

Answer the questions with short answers.

1. What are diagonal cutter pliers used for?

   Pulling cotter pins and spreading the ends of cotter pins.

2. Can diagonal pliers be used for cutting wire?

   Only small-guage wire--never large-guage wire.

3. Which pliers are used for cutting large-guage wire?

   Side cutter pliers.

4. Which pliers are adjustable?

   Lock-grip pliers.

5. What are needle-nose pliers used for?

   Handling small objects.

6. What is another word for "grip"?

   Clamp.

7. What is another name for slip-joint pliers?

   Channel pliers.

8. What are snap ring pliers used to spread?

   Snap rings.

9. Where do you put oil on pliers?

   On the joint pin.

10. What does oil prevent?

    Rusting.

QUIZ 3

Answer the following questions with short answers.

1. What is a claw hammer used for?

___

2. Which wrench can be adjusted to hold different sizes of bolts?

___

3. Which type of screws is a Phillips screwdriver for?

___

4. Which tool can be used to tighten and loosen bolts?

___

5. Which saw is used for cutting metal?

___

6. Which pliers are used for cutting?

___

7. Should pliers be used to tighten bolts?

___

8. How many sides does a nut usually have?

___

9. What do micrometers measure?

___

10. Which parts of the micrometer do you look at to read a measurement?

___

QUIZ 3
ANSWER KEY

Answer the following questions with short answers.

1. What is a claw hammer used for?

   pulling and driving nails

2. Which wrench can be adjusted to hold different sizes of bolts?

   adjustable wrench

3. Which type of screws is a Phillips screwdriver for?

   screws with a four-way slot

4. Which tool can be used to tighten and loosen bolts?

   a wrench

5. Which saw is used for cutting metal?

   hacksaw

6. Which pliers are used for cutting?

   diagonal pliers

7. Should pliers be used to tighten bolts?

   no

8. How many sides does a nut usually have?

   four or six sides

9. What do micrometers measure?

   the size (diameter) of parts

10. Which parts of the micrometer do you look at to read a measurement?

    the barrel and the thimble

TEACHER'S ACTIVITY GUIDE

UNIT FOUR: PROCESS DESCRIPTIONS

TOPICS: Force and Work, Basic Machines, Mechanical Processes: Internal Combustion Engines and Steam Engines

SKILL OBJECTIVES: Comprehend lecture and complete an outline
Discuss mechanical processes
Reconstruct steps in a process
Interpret diagrams and flow charts
Make an outline based on lecture
Take a fill-in test

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction Ask students, "What is a machine? What is work? Do you know the technical definition of work?" Introduce Unit Four topics and objectives.			
A) Listening: Lecture (50 min.) Prepare a lecture based on the text in Lecture 4A. Give the lecture, referring to Visual 4A. Ask general comprehension questions. Give lecture 2nd time; sts. complete outline on Worksheet 4A(1) while listening. As a class, review outlines. Sts. complete Worksheet 4A(2).		work force physics distance machine motion lever pulley wedge inclined plane screw	Lecture 4A Visual 4A Worksheet 4A(1) Worksheet 4A(2)
B) Reading/Graphical Literacy (60 min.) Ask pre-reading questions. Students read silently and/or aloud. Sts. ask questions; assess sts. comprehension. Sts. complete Worksheet 4B(1); review answers. Sts. complete Worksheet 4B(2); you can use this as an opportunity to teach/review passive verb constructions. Sts. complete Worksheet 4B(3); you can use this as an opportunity to teach/review dependent and independent clauses.	Passive verb constructions Dependent clauses with "when"	Internal Combustion Gasoline Engine fuel explosion power piston cylinder connecting rod crankshaft reciprocating and rotary motion	Reading 4B Worksheet 4B(1) Worksheet 4B(2) Worksheet 4B(3)

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
C) Listening: Lecture (30 min.) Using lecture Notes 4C and Reading 4D, give lecture. When you are finished, point to the diagram and ask for name of important parts. Ask sts. to summarize the process orally.	Simple past tense Passive constructions	steam pump furnace boiler valve beam seesaw atmospheric pressure shaft rod	Lecture Notes 4C (Reading 4D)
D) Reading/Graphical Literacy 50 min.) Students read silently. Ask questions about the steps in the process, e.g. "What happened after.., then, next" etc. Students complete worksheets. Check their work and/or have peers check work.	Simple past tense Simple present tense Passive constructions Technical vs. everyday vocabulary	Vocabulary from Activity C force attach operate principle rock back and forth	Reading 4D Worksheet 4D (1) Worksheet 4D (2) Worksheet 4D (3)
E) Reading/Graphical Literacy (50 min.) Ask prereading questions. Students read silently. Ask general reading comp. questions. Students read again. Ask/answer questions. Students complete worksheets; you can use Worksheet 4E(2) as an opportunity to teach/review passive constructions. Check their work.	Passives Adverbs of sequence	stroke cycle exhaust valve intake compression ignite spark plug	Reading 4E Worksheet 4E (1) Worksheet 4E (2)
F) Oral Presentations (time will vary) Have sts. prepare and give oral presentations on a mechanical process according to the instructions on Worksheet 4F.	Passive verb constructions Adverbs of sequence	(will vary)	Worksheet 4F

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
G) Evaluation (30 min.) Discuss fill-in-the-blank quiz format. Sts. take quiz. Review answers and discuss fill-in-the-blank test strategies (Appendix).			Quiz 4 (Fill-in-the-blank) Quiz 4 Answer Key

BASIC MACHINES

In this unit, we would like to talk a little more specifically about some of the physical concepts that are important to understand when you talk about machines, and the work that machines do. The field that we are talking about here is usually called physics. Some of you may have had physics classes in school. Physics is the study of the relationship between matter and energy. The most important thing to keep in mind is that physics usually focuses on movement--how things move.

You've often heard words like work and machines and force; in fact, the words work and machine we use almost every day. When you think of work, you probably think of your job. You say, "I did a lot of work"--or something like that. But, we have to be careful in technical fields because the word "work," for example, has a very specific definition. The definition of work is: the effect of a force multiplied by the distance over which that force is applied. We can say it like this: Work equals force times distance (Work = Force x Distance). For example, when you push on a book you are applying force to that book. When you push a book across the table, you are doing work--in the technical sense. You are moving that book over a distance. Another example might be if you are lifting--lifting a book from the floor up onto the table--you are also doing work--because you are making a change in that book's position.

Now, if a book weighs one pound, and you move it up three feet from the floor to the table, you have done three foot/pounds of work. Remember, one pound, three feet--we multiply the weight times the distance and that gives us a number that tells us exactly how much work has been done. Three foot/pounds. Again, work is the result of a force multiplied by the distance.

Another example: If you lift a ten pound box up to that table that is four feet high, how much work are you doing? Well, you multiply the ten pounds times three feet and you get forty foot/pounds of work. Again, as I said, in order to do any kind of work in a technical sense you have to apply force over a distance. If you push on a table but you can't move the table because it is too heavy, you have not done any work. There are different types of movements or motions. For example if you move something in a straight line, that's called linear motion. If you turn something, for example, turn it around and around, you are doing rotary motion.

Now let's talk about basic machines. A machine is a device that applies a force for us to help us do work. A simple example would be a bottle opener. If you try to open a bottle with your fingers by pulling the cap off of the bottle you can't do it; the cap is on too tight. But if you take a bottle opener and use it to to remove the bottle cap from the bottle, it is very simple and you can do the work. A bottle opener is a simple type of machine that takes the force that you are pushing up with and applies that force to one small point on the side of the bottle cap, and that's why the bottle cap comes off so easily.

There are six basic machines. The bottle opener that I mentioned before is an example of the first type of basic machine and that is called a lever. A lever consists of a straight piece that you apply pressure to in order to do work at the end of that straight piece or bar. As you can see in picture #1, force can be applied downward on the lever to apply upward force to the large rock. The supporting point under the lever is called the fulcrum. Without the lever you couldn't move the rock. The force that is applied to the lever is transferred to the rock so that you can move it more easily.

The second type of machine which can be seen in picture #2 is the wheel and axle. The wheel and axle is of course a very old machine and people have used it since prehistoric times. The wheel and axle is used to transport objects. Obviously it is easier to move things over a surface if you can put them up on a wheel and roll them along.

The third basic machine is the pulley, picture #3. The pulley consists of a wheel with a groove inside of it and a rope that runs through the pulley. The pulley is used to raise a heavy object. The principal of the pulley is like a lever. The wheel acts as a fulcrum, like it did on the first picture.

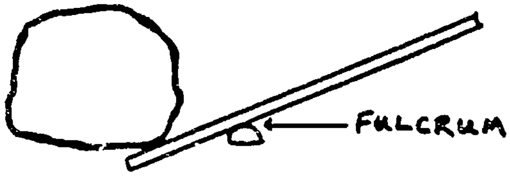
The fourth type of basic machine is called a wedge. A wedge is really very simple and is basically just a triangle with two surfaces that meet to form a sharp angle. A good example of using a wedge would be a person splitting wood. If you put a wedge into the wood and hit it with a hammer, then the force that you apply to the end of the wedge is transmitted down to a single point and the wood splits into two pieces.

The fifth type of basic machine is the inclined plane. It may be difficult for you to think of this as a machine, but it really is a device that allows people to do work easier. You can push a weight up an inclined plane with less force than it takes to move that same weight straight up. If you have to lift a certain weight to a certain height, but you do it more slowly up an inclined plane, it takes less force at any one point in time to do the job. For example, you can drive your car up an inclined plane but you can't drive your car straight up at a vertical angle. The car does not have enough power to do that.

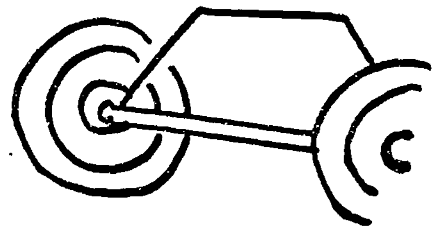
The last type of basic machine is the screw. The screw is a spiral form of an inclined plane. One modern application of the screw, for example, is a screw jack. A screwing motion can be used to raise very heavy objects over a short distance. The interesting thing about the screw jack is that it is a machine that converts rotary motion into linear motion. The jack uses rotary motion to raise an object vertically.

So, in summary, all of these basic machines are used to help people do work--the level, the pulley, the wheel and axle, wedges, inclined planes, and screws. Now, of course, in today's modern world we use very complex machines, but all of them use principles of these basic types of machines--basic principles of force and work to change the position or motion of objects.

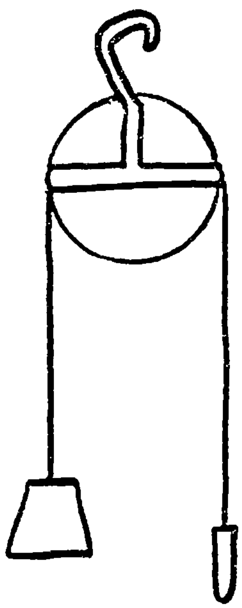
Six Basic Machines



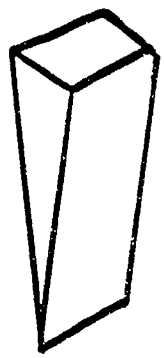
1. Lever



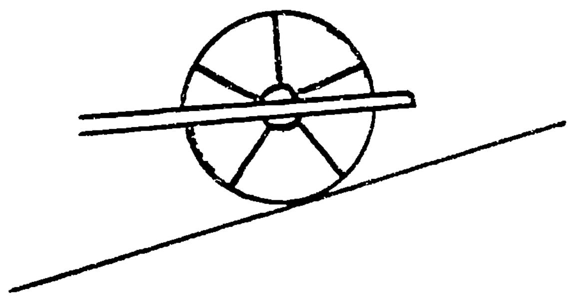
2. Wheel and Axle



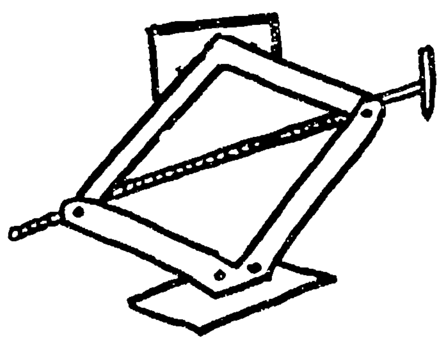
3. Pulley



4. Wedge



5. Wheel on an Inclined Plane



6. Screw

Outline of Lecture

Fill in the blanks in this outline as you listen to the lecture.

TOPIC: WORK AND BASIC MACHINES

I. Introduction

II. Physics

A. Physics is *the study of matter and energy.*

B. Physics focuses on *movement.*

III. Work

A. Tech. definition of work: *effect of force multiplied by the distance (over which the force is applied).*

B. Work = force x *distance*.

C. Examples:

1. *Pushing a book across a table.*

2. *Lifting a book.*

3. A 1 lb. book x 3 ft. = *3* ft/lbs. of work.

4. A 10 lb. box x 4 ft. = *40* ft/lbs. of work.

5. 2 types of motion: a. *linear* b. *rotary*

IV. Machines

A. Definition: *Device that applies a force to help us do work.*

B. Example: *Bottle opener--it applies force on one side of a bottle cap.*

(Continued on next page)

V. Basic Machines

A. Lever

1. The supporting point is the fulcrum.

B. Wheel and axle

C. Pulley

D. Wedge

1. Example: A person splitting wood.

E. Inclined Plane

1. Example: You can drive your car up a road but not straight up.

F. Screw

1. It converts rorary motion to linear motion.

VI. Summary

A. Complex machines use principles of basic machines to change the position or motion of objects.

Word Problems

Answer the questions.

1. If you move a table which weighs 50 pounds a distance of 5 feet, how many foot/pounds of work have you done? *250 ft/lbs*

2. If a machine moves a 3-pound object 40 feet, how much work has the machine done? *120 ft/lbs*

3. If that same machine transports 50 of those 3-pound objects 40 feet, how much work has the machine done? *50 x 3 x 40 = 6000 ft/lbs*

4. If you try to lift a 50-pound weight but can't move it, how much work have you done? *none*

5. How much work has been done if you move a 10-pound object a distance of 6 inches? *5 ft/lbs*

INTERNAL COMBUSTION GASOLINE ENGINE

The gasoline engine was invented over 100 years ago. Since then, this type of engine has been used in millions of automobiles. Most automobiles today are still powered by gasoline engines.

The gasoline engine is called an internal combustion engine because gasoline is burned inside of a closed space in order to produce power. How does the fuel, gasoline, produce power? When gasoline mixed with air is burned, a small explosion takes place. If this happens inside of a closed container such as the one in Figure 1, pressure from the explosion blows the lid off the container. The lid blowing off the container is a form of power.

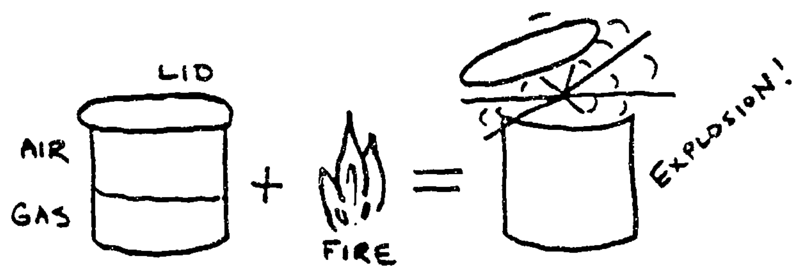


Figure 1: Blowing Off The Lid

The power that is produced by the explosion must be controlled. To do this, the lid must stay inside the container. In an automobile engine, this "lid" is called a piston, and the container is the cylinder. When there is an explosion inside the cylinder, the piston is forced through the cylinder. The piston is connected to a connecting rod, and the rod is connected to a crankshaft. The moving piston pushes on the connecting rod and turns the crankshaft, Figure 2.

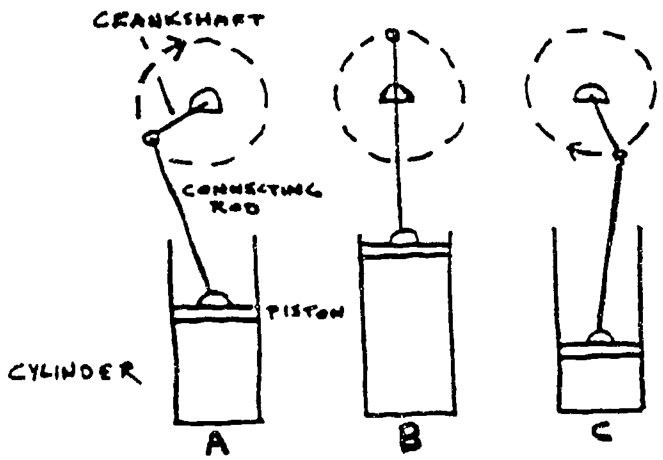


Figure 2. Lid Inside A Container Forms a Simple Engine.

As you can see in Figure 2, a simple explosion does work in a reciprocating (up and down) motion. This reciprocating motion is changed to rotary (circular) motion. The rotary motion produced by the engine is transferred to the wheels of the automobile.

Steps in a Process

Put these sentences into the correct order to describe the combustion process in an internal combustion gasoline engine.

Step No.

3 The explosion forces the piston through the cylinder.

1 Gasoline is mixed with air and enters the cylinder.

5 The connecting rod turns the crankshaft.

4 The piston pushes the connecting rod.

2 This fuel mixture is burned inside the cylinder, causing an explosion.

Active vs. Passive Sentences

Match the phrase on the left to the one on the right with the same meaning. Connect the two with a line.

A	B
1. Most automobiles are powered by gasoline engines.	The explosion forces the piston through the cylinder.
2. In a carburetor, gasoline is mixed with air.	An explosion produces power.
3. Power is produced by an explosion.	Gasoline engines power most automobiles.
4. The piston is forced through the cylinder by the explosion.	The connecting rod turns the crankshaft.
5. The crankshaft is turned by the connecting rod.	A carburetor mixes gasoline with air.
6. In a car, rotary motion is used to turn the wheels.	A car uses rotary motion to turn the wheels.

Cause and Effect

Complete the sentences.

1. When gasoline mixed with air is burned, *an explosion takes place.*

2. When an explosion occurs in a closed container, *the pressure blows the lid off the container.*

3. When an explosion takes place in an engine cylinder, *the piston is forced through the cylinder.*

4. When the piston moves up and down, *the connecting rod turns the crankshaft.*

5. When the rotary motion produced by the engine is applied to the axle, *the wheels on the car turn.*

Using Reading 4D as a guide, introduce and give a brief lecture on Newcomen's steam engine and pump. Have students look at the diagram from Reading 4D(p.2) as you lecture. Do not let them read the text before or during your lecture.

Avoid "reading" the text to the class. Rather, paraphrase the steps which describe how the pump operated. Use everyday vocabulary (e.g. "made" instead of "produced", pushed instead of "forced," etc.) and point to the relevant parts of the diagram as you explain the process.

NEWCOMEN'S STEAM ENGINE

In 1712, Thomas Newcomen built a steam engine. The engine was used for pumping water out of tin mines in southwest England. Steam engines were improved greatly in later years, but many of the same technical principles found in Newcomen's pump are still important today.

Newcomen's engine pumped water by raising and lowering a bucket in a deep shaft. The steam needed to drive the engine was produced by a coal-burning furnace.

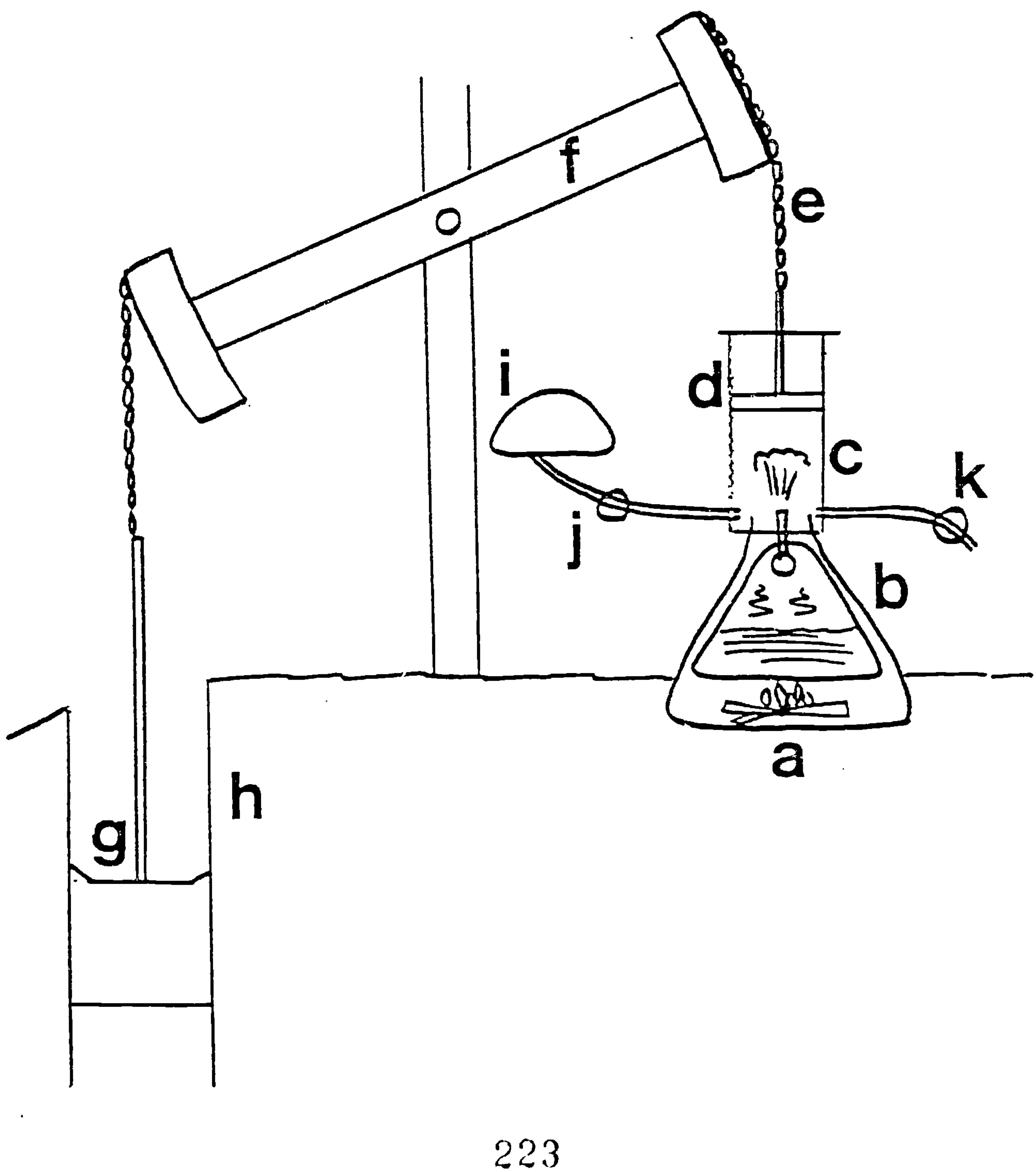
The pump worked as follows (refer to the diagram on the next page): The furnace (A) heated water in a boiler (B). The boiling water produced steam, which entered the cylinder (C). The pressure from the steam forced the piston (D) up the cylinder. The piston rod was attached by a chain (E) to a heavy beam (F). This "walking beam" was actually a lever that operated on the seesaw principle. When the piston ascended up the cylinder, the beam turned. This was due to the atmospheric pressure* which pushed the pump bucket and rod (G) down the shaft (H).

At this point, cold water (I) was let into the cylinder through a valve (J). This caused the steam in the cylinder to condense. The pressure in the cylinder decreased, producing a partial vacuum. The atmospheric pressure above the piston pushed it back down the cylinder. The water inside the cylinder exited through a valve (K). This movement of the piston lowered the beam, the other end of the beam rose, bringing the pump bucket up the shaft.

This cycle repeated itself approximately every four seconds. The walking beam rocked back and forth, continually pumping water up the shaft. Rods (not shown in the diagram) connected the beam to the valves. These rods opened and shut the valves at the appropriate times.

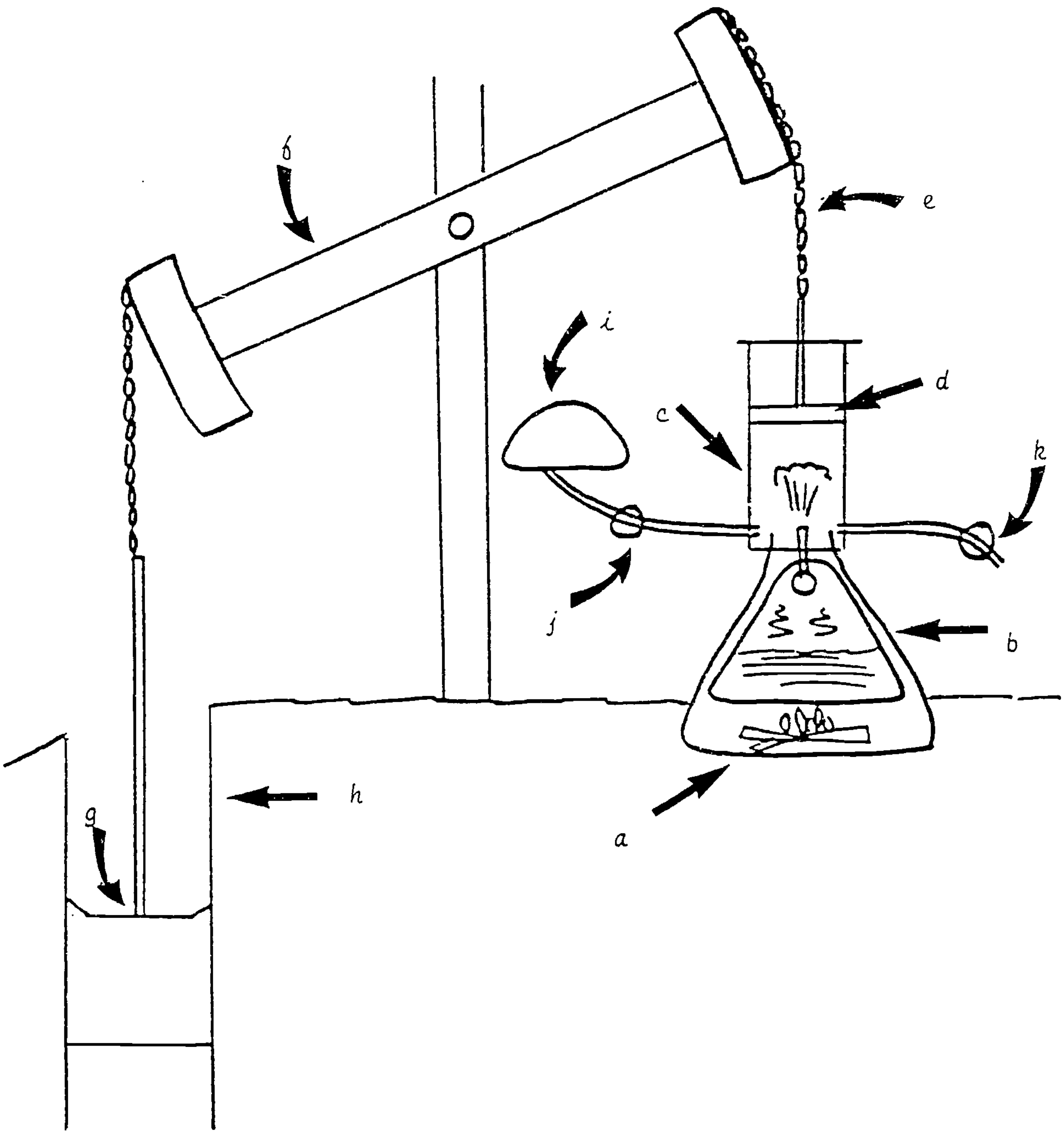
*Atmospheric pressure is air pressure.

NEWCOMEN'S STEAM ENGINE



Referring to a Diagram

Look at the first page of READING 4D, but do not look at the diagram on page 2. On this worksheet, label the parts of the steam engine with letters according to the description in the reading.



Steps in a Process

A. Put these sentences into the correct order to describe how Newcomen's steam-driven pump worked. The first one has been done for you.

2	Steam entered the cylinder.
4	The beam rose on the piston side and lowered on the pump side.
1	The furnace heated water.
6	Cold water entered the cylinder.
3	The piston moved up the cylinder.
9	The beam lowered on the piston side and rose on the pump side.
8	The piston moved down the cylinder.
5	The pump bucket descended down the shaft.
10	The pump bucket came up the shaft.
7	The pressure in the cylinder decreased.

This description of the pumping process is written in the past tense. Why do you think this is so?

B. Imagine that the Newcomen pump is still being used today. On a separate sheet of paper, rewrite the above steps in the correct order. Put each sentence into the present tense.

Technical vs. Everyday Vocabulary

In the left column are "technical" words found in your reading. Match them to the more common expressions on the right which mean the same.

	A	B
d	1. produce	a. push
a	2. force	b. work
g	3. attach	c. go out
b	4. operate	d. make
h	5. appropriate	e. about
c	6. exit	f. air
e	7. approximately	g. connect
f	8. atmospheric	h. right
j	9. shut	i. go up
i	10. ascend	j. close

THE FOUR-STROKE CYCLE IN AN INTERNAL COMBUSTION GASOLINE ENGINE

This reading passage provides more detailed information about the process which occurs in a cylinder in a gasoline engine.

As you know, the piston moves up and down inside the cylinder. Each upward and each downward movement is called a stroke. In order to bring the fuel mixture into the cylinder, burn it, and then push out the burned waste product (exhaust), four stokes of the piston take place. Figure 1 (p.2) shows the four-stroke cycle.

Intake Stroke

The piston is pulled down by the crankshaft. A type of "door" to the cylinder, which is called the intake valve, opens. This allows the air-fuel mixture to be drawn into the cylinder, View A.

Compression Stroke

At the end of the intake stroke, the intake valve closes. Then the crankshaft forces the piston up through the cylinder. This causes pressure in the cylinder, which compresses the air-fuel mixture, View B.

Firing Stroke

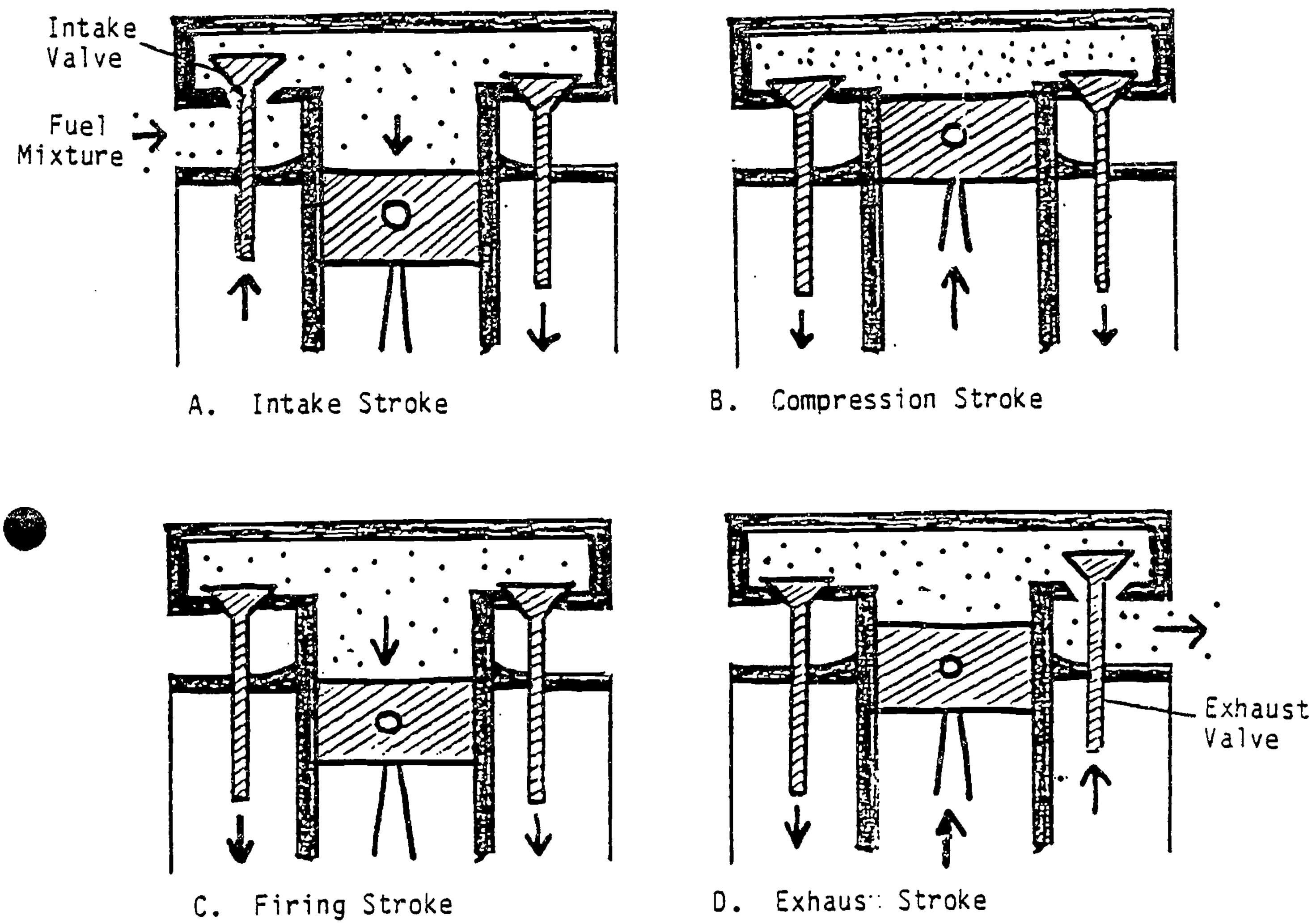
This is the stroke in which combustion (burning) takes place. The compressed air-fuel mixture is ignited by a spark from the spark plug. This explodes the mixture, and the pressure caused by the explosion drives the piston back down through the cylinder. Both valves are closed during this firing stroke, View C.

Exhaust Stroke

At the end of the firing stroke, the exhaust valve opens. The crankshaft forces the piston up through the cylinder. All the burned gases are exhausted from the cylinder. Now the system is ready for another intake stroke, View D.

This four-stroke cycle is repeated over and over again. All of the cylinders of the engine work together to produce enough power to run the automobile.

Figure 1. Four-stroke cycle in a gasoline engine cylinder.



Steps in a Process

A. Put the sentences into the correct order to describe the internal combustion process. The first one in each section has been done for you.

Intake and Compressions Strokes

4 The intake valve closes.
1 The piston is pulled down by the crankshaft.
6 The air-fuel mixture is compressed.
3 The air-fuel mixture enters the cylinder.
2 The intake valve opens.
5 The piston goes up the cylinder.

Firing and Exhaust Strokes

2 The explosion forces the piston back down the cylinder.
4 The piston goes up the cylinder.
3 The exhaust valve opens.
1 The air-fuel mixture is ignited and burns.
5 The gases are exhausted from the cylinder.

B. Using the sentences above, write two paragraphs with the titles "Intake and Compression Strokes" and "Firing and Exhaust Strokes." Begin each sentence with a word which emphasizes its place in the process. For example: First, the piston is pulled down by the crankshaft. Here are some words you might use: first, second, third, then, next, after that, last, finally.

Active and Passive Sentences

The following sentences describe steps in the internal combustion process (they are not in order). Each step can be written as either an active or a passive sentence. Their meanings are the same. For each sentence provided, write the corresponding active or passive form. The first one has been done for you.

	Active	Passive
1.	The spark plug ignites the fuel mixture.	The fuel mixture is ignited by the spark plug.
2.	The piston compresses the fuel mixture.	The fuel mixture is compressed by the piston.
3.	The connecting rod turns the crankshaft.	The crankshaft is turned by the connecting rod.
4.	Burning gas causes an explosion.	An explosion is caused by burning gas.
5.	A camshaft opens the valve.	The valve is opened by a camshaft.
6.	The engine powers the car.	The car is powered by the engine.

(The following sentences contain two-word verbs. Be careful!)

	Active	Passive
7.	The crankshaft pulls the piston down.	The piston is pulled down by the crankshaft.
8.	The crankshaft forces the piston up.	The piston is forced up by the crankshaft.
9.	The explosion drives the piston down.	The piston is driven down by the explosion.
10.	The piston pushes the exhaust out.	The exhaust is pushed out by the piston.

Oral Presentations

Prepare a 3-5 minute oral presentation on a mechanical process and present it to the class. As your topic, choose a mechanical appliance or utensil you have at home (such as a toaster, a can opener, etc.) and explain in simple terms how it works.

Use this outline to help you prepare your presentation.

TOPIC: "How a ________________ Works"

Introduction

A. Who uses it

B. Its function

Mechanical Process (How it works)

A. First, ...

B.

C.

D.

E.

Conclusion

In addition to preparing your presentation, prepare two questions about your topic. After you have done your presentation, ask the class your questions to check their comprehension. Make sure that you have given the answers to your questions in your presentation.

Question	Answer
1. ________________________________	________________________________
2. ________________________________	________________________________

QUIZ 4

Fill in the blanks with the correct words.

1. The study of physics focuses on the way objects ____________________.

2. "Work" is defined as the result of ________________ multiplied by the ________________ over which the force is applied.

3. Linear motion is movement in a ________________ ________________.

4. If something is turning, this is called ________________ motion.

5. There are six basic machines. Five of them are ____________________, ________________________, ________________________, ________________________, and ____________________.

Think about an automobile engine. Answer the questions.

6. First, gasoline is mixed with ________________________.

7. This fuel mixture ________________________ in the cylinder.

8. The explosion pushes the ________________________.

9. The crankshaft is turned by the ________________________.

10 The ____________________ valve opens to release burned gases.

QUIZ 4
ANSWER KEY

Fill in the blanks with the correct words.

1. The study of physics focuses on the way objects *move*.

2. "Work" is defined as the result of *a force* multiplied by the *distance* over which the force is applied.

3. Linear motion is movement in a *straight* *line*.

4. If something is turning, this is called *rotary* motion.

5. There are six basic machines. Five of them are *a lever*, *wheel and axle*, *pulley*, *wedge*, and *wheel on an inclined plane*.
and screw. (Any five are correct.)

Think about an automobile engine. Answer the questions.

6. First, gasoline is mixed with *air*.

7. This fuel mixture *burns (or "is burned")* in the cylinder.

8. The explosion pushes the *piston*.

9. The crankshaft is turned by the *crankshaft*.

10 The *exhaust* valve opens to release burned gases.

Oral Practice

Do this exercise with a partner.

First, ask your partner to define these words: **matter, solid, liquid, gas, energy.**

Student A: What is _______________?

Student B: _____________ is ___________________________.

Next, ask your partner about these categories: **matter, energy.**

St. A: How many types of _____________ are there?

St. B: There are ________ types of _______________.

They are ____________, ____________, etc.

Finally, ask your partner for examples of these: **solids, liquids, gases, light sources, heat sources, sources of electricity.**

St. A: What are some examples of ____________________?

St. B: Some examples are _____________, ____________, and

________________.

When Student A is finished asking questions, partners switch roles and repeat the exercise.

CHANGING STATES OF MATTER

Many materials can change from one state of matter to another. For example, water can change from a solid (ice) to a liquid, or from a liquid to a gas (steam).

When a solid turns into a liquid, the process is called melting. Ice melts at 32° Fahrenheit (0°C). This temperature is known as the melting point for ice. Other solids melt at other temperatures. Figure 1 gives the melting points of three metals.

Figure 1

Metals	m.p.(melting point)
Iron (Fe)	1,536° C
Lead (Pb)	327° C
Mercury (Hg)	-39° C

Of course the reverse can also happen. Water can turn to ice, which means that a liquid is turning into a solid, i.e., freezing. This happens at a temperature which is called the freezing point.

When a liquid turns into a gas, we say that it vaporizes. This always happens when a liquid reaches its boiling point. The boiling point of water is 100° C. (Of course water also turns to a vapor very slowly at lower temperatures. This is called evaporation.) The freezing points and boiling points of various liquids is given in Figure 2.

Figure 2

Liquids	f.p.	b.p.
Water (H_2O)	0°C	100°C
Bromine (Br)	-7°C	58°C
Benzene (C_6H_6)	5°C	80°C

And finally, the reverse of this process is when a gas turns into a liquid. When this happens, we say that the gas or liquifies. Condensation, for example, is a process whereby a gas is converted to a liquid. When there is a lot of water vapor in the air, it can condense on an object and make it feel wet.

All gases become liquids when they are cooled down to their boiling points. Oxygen, for instrance, liquifies at -183°C. Below -219°C oxygen freezes, becoming a solid. Figure 3 shows the freezing points and boiling points for some gases.

Figure 3

Gases	f.p.	b.p.
Carbon Dioxide (CO_2)	-78°C	-57°C
Oxygen (O)	-219°C	-183°C
Hydrogen (H)	-259°C	-253°C

Reading Comprehension

Answer these questions about the reading.

1. What is the main idea expressed in the reading? *Matter can change from one state to another.*

2. What is the process called when a solid turns into a liquid? *melting*

   When a liquid turns into a solid? *freezing*

   When liquid turns into a gas? *vaporizing* or *evaporation*

   When a gas turns into a liquid? *liquifying* or *condensation*

3. When water boils, what is the product called? *vapor (or steam)*

   When water evaporates, what is the product called? *vapor*

4. What temperature is the same as 32° Fahrenheit? *0°C*

5. What is the reverse of melting? *freezing*

6. What is the reverse of vaporizing? *liquifying*

Look at Figure 1.

7. What does "m.p." mean? *melting point*

8. What is the chemical symbol for lead? *Pb*

9. What is the melting point for lead? *327°C*

10. Which metal in the chart has the highest melting point? *Iron (Fe)*

Look at Figure 2.

11. What do f.p. and b.p. stand for? *freezing point* and *boiling point*

12. At what temperature does bromine become a solid? *-7°C*

13. At what temperature does benzene become a gas? *80°C*

Look at Figure 3.

14. At what temperature does hydrogen become a liquid? *-253°C*

15. What state is carbon dioxide in at -90°C? *solid*

    at -60°C? *liquid* at -30°C? *gas*

Oral Practice

Sometimes we give a definition of a word by telling about the process involved. For example:

Student A: Can you tell me the definition cf melting?
Student B: Melting occurs (happens) when a solid becomes a liquid.

Student A: Can you give me an example?
Student B: An example is when ice turns to water.

With a partner, practice asking for definitions and examples. Use these key words:

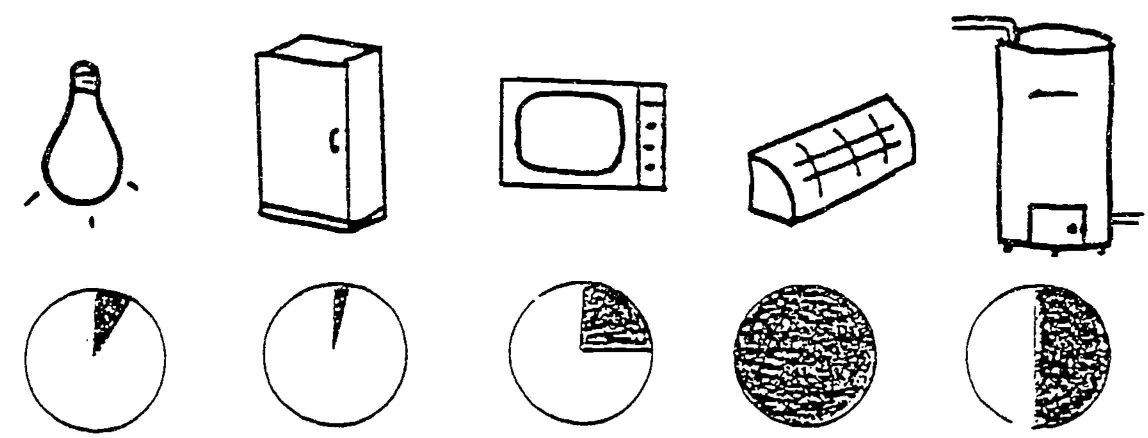
freezing
vaporizing (vaporization)
evaporation
condensing (condensation)
liquifying

After Student A has asked several questions, switch roles.

ENERGY CONSUMPTION

One of the forms of energy we depend on every day is electricity. Many of the appliances in our homes consume electricity, changing it into other forms of energy such as heat or light. The following diagram gives the number of units (one unit = 1 kilowatt/hour) consumed by each appliance.

100 watt bulb | refrigerator | television | space heater | hot water heater



1/10 Unit | 1/20 Unit | 1/4 Unit | 1 Unit | 1/2 Unit

Units Used by Electrical Appliances
(Expressed in Kilowatts per Hour)

Reading Comprehension

Use the information from the diagram to answer these questions.

1. Which appliance in the diagram uses the most electricity per hour?
   space heater

2. If a 100 watt bulb is on for 3 hours, it uses 3/10 units of electricity.
   1/10 unit per hour x 3 hours = 3/10 units
   How many units does a 100 watt bulb use in 7 hours? *7/10 units*

3. How many units of electricity do these appliances use when they run for the amount of time given?
   a. How much electricity does a refrigerator use when it runs for 10 hours? *1/2 unit*
   b. Television - 4 hours? *1 unit*
   c. Hot water heater - 4 hours? *2 units*
   d. Space heater - 2 1/2 hours? *2 1/2 units*
   e. Three 100 watt bulbs - 5 hours? *1 1/2 units*

4. If you used these appliances every day for the number of hours given in Question 5, how many units would be used in one week? *7 1/2 x 7 = 52 1/2 units*

5. If one unit of electricity costs 15 cents, how much would the electricity bill be for the week? *52 1/2 x .15 = $7.88 (7.875)*

Interviews

Interview a classmate about the appliances in his/her home or apartment. Ask what types of energy they use and how many hours per day they are used. You may also want to ask about their monthly utility bills for gas and electricity!

TEACHER'S ACTIVITY GUIDE

UNIT FIVE: DEFINITIONS, EXAMPLES, AND CLASSIFICATIONS

TOPICS:
Matter and Energy
Changing States of Matter
Energy Consumption
Materials and Their Properties

SKILL OBJECTIVES:
Comprehend lecture and take lecture notes
Identify, ask for, and give definitions
Identify, ask for, and give examples
Classify information into categories and subcategories
Read tables
Take a true/false test

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction (10 min.) Preview the sts. knowledge of the unit topics. Ask, "What is matter? What is energy? State the unit objectives.			
A) Listening: Lecture (60 min.) Prepare a lecture based on the text in Lecture 5A. Give lecture. Ask general comprehension questions. Give lecture 2nd time; have sts. take notes on Worksheet 5A(1). Review sts. lecture notes with them. Sts. complete Worksheet 5A(2). Review. Sts., in pairs, do Worksheet 5A(3).	"There is/are" Rhetorical questions Modal + passive: "can be divided"	matter energy concept weight category subcategory type example solid liquid gas state motion light heat electricity	Lecture 5A Worksheet 5A(1) Worksheet 5A(2) Worksheet 5A(3)

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
B) Reading/Graphical Literacy (30 min.) Ask pre-reading questions. Sts. read silently. Ask general comprehension questions. Sts. read 2nd time; you may want sts. to read aloud. Sts. complete Worksheet 5B(1). Review answers. In pairs, sts. practice giving definitions and examples using Worksheet 5B(2).	Definitions: "When... happens, this is called ...	melt temperature Fahrenheit Celsius melting point turn/become freeze vaporize boil evaporate condense liquify	Reading 5B Worksheet 5B(1) Worksheet 5B(2)
C) Reading/Discussion (30 min.) Ask pre-reading questions. Sts. read silently. Ask general comprehension questions. Sts. complete Worksheet 5C. Review questions and answers orally to assure comprehension, especially of math word problems. Have sts. interview each other according to the instructions on the worksheet.	Math word problems Conditionals	energy form electricity consume change unit kilowatt appliance	Reading 5C Worksheet 5C
D) Lecture/Discussion (30 min.) Using Activity Guide 5D: Lead a brainstorming and discussion activity. Sts. make a chart like the one provided. Conclude with a class discussion.	Wh-questions Descriptive adjectives "used for"	material metal fiber chemical mixture property characteristic use	Teacher's Activity Guide 5D Worksheet 5D
E) Reading/Definitions (30 min.) Sts. read and study definitions silently. Sts. complete true/false reading comprehension activity. Review answers.	Relative pronouns in definitions	copper iron element steel alloy aluminum carbon brass ductile malleable/ity conduct	Reading/ Worksheet 5E

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
F) Definitions/"Jeopardy" (30 min.) Have sts. write definitions on Worksheet 5F. When they are finished, play "Jeopardy" as described on the worksheet. Following this activity or at a later point in the course, you may want to play "Jeopardy" again using vocabulary from other units.		Unit 5 Vocabulary	Worksheet 5F
G) Reading/Graphical Literacy (Advanced level) (30 min.) Ask pre-reading questions Sts. read silently. Sts. complete worksheets. Review answers.	Referential markers (words and phrases referring to visuals) Ordinal numbers	standardize unique applications composition designation indicate digit code series range	Reading 5G Worksheet 5G
H) Evaluation (30 min.) Discuss true/false quiz format. Sts. take quiz. Review answers and discuss true/false test-taking strategies (Appendix).			Quiz 5 (True/False) Quiz 5 Answer Key

MATTER AND ENERGY

Today I'm going to talk about the concepts of matter and energy. These two concepts--matter and energy--are important in any scientific or technical discussion. Our physical world, or the world we see around us, is made up of many different things. But everything we see and talk about can be classified as either matter or energy.

First let's talk about the first category, matter. What is matter? Matter is anything that has weight--a rock, a tree, or an airplane. Even the air we breathe is matter. We can't see air but it does have weight.

Matter can be divided into three subcategories. That is, there are three types of matter. They are solids, liquids, and gases. First, solids. Solids are materials or objects which have a definite shape. Examples of solids are paper, metals, a book, a piece of equipment, machine parts, and even the earth.

The second subcategory of matter is liquids. A liquid is matter without a definite shape. You can pour liquids from one container into another. Examples are water, gasoline, and liquid nitrogen.

The third subcategory of matter is gases. Gases have no shape at all. Gases float. An example is air. Another example is carbon monoxide.

Now, the three types of matter I've talked about are sometimes called states of matter. Water is a good example of something that can change from one state of matter to another. Ice is the solid form of water. The water that comes out of your water faucet is a liquid, of course. And when water is boiled, it turns into steam, which is a gas.

At the beginning of the lecture I mentioned two concepts--matter and energy. Let's turn our attention to energy. What is energy? Well, contrary to matter, energy does not have weight. Energy is usually in motion--that is, it is usually moving, and most often it is moving very fast.

Energy can also be divided into three basic types: light, heat, and electricity. The sun is a natural source of light and heat. A flame also provides light and heat naturally. Lightning is a natural source of electricity. There are also, of course, many so-called artificial sources of energy. These are devices that people have created. Electric power stations produce electricity. Batteries are the source of electricity in many portable appliances, such as radios. Man-made electricity is used to produce light and heat with many everyday appliances.

Outline of Lecture

Fill in the blanks in this outline as you listen to the lecture.

TOPIC: MATTER AND ENERGY

I. Introduction: Everything can be classified as matter or energy

II. Matter

A. Definition: *Anything that has weight.*

B. 3 Subcategories

1. *Solids*

Examples: *Paper , metal,....*

2. *Liquids*

Examples: *Water, gasoline,...*

3. *Gases*

Examples: *Air, carbon monoxide,...*

III. Energy

A. Definition: *Doesn't have weight--usually in motion.*

B. *3 Types*

1. *Light*

Ex.: *Sun is a natural source, flame also.*

2. *Heat*

Ex.: *Sun*

3. *Electricity*

Ex.: *Lightning--natural sourc*
Power stations--artificial source
Batteries-- " "

WORKSHEET 5A(2)

Classifying Information

Based on the information in the lecture, fill in the empty boxes.

PHYSICAL WORLD

MATTER

EXAMPLES	Solids	Liquids	Gases
	paper	water	air
	metal	gasoline	carbon mono.
	book	liquid nitro.	
	earth		

ENERGY

SOURCES	Light	Heat	Electricity
	sun	sun	lightning
	flame	flame	power stations
			batteries

1. Lead a brain-storming session with students about materials and their characteristics. Have students complete Worksheet 5D as you discuss the concepts.

   A. First, ask for examples of materials in these categories:

Metals	Fiber Products	Chemically-Produced Materials
steel	wood	plastic
iron	paper	polyester
copper	cardboard	rubber
aluminum	cotton	glass
etc.	etc.	concrete

   B. Next, discuss some of the words used to discuss the various properties of these materials:

      rigid: stiff; not bending or flexible
      brittle: easily broken or shattered
      flexible: able to bend without breaking
      elastic: able to return to original shape after bending or stretched
      strong: firm, durable, able to witnstand pressure
      light: having little weight for its size
      heavy: having great weight for its size

   C. Have students complete chart on Worksheet 5D. Compare responses.

   D. Have students form sentences orally about each of the materials in the chart. Example: "Wood is a light, rigid material used for building furniture and light construction projects."

   E. Discuss how the use of materials for building and manufacturing has changed over time. For example, plastics have replaced wood in many manufactured goods. What are the advantages and disadvantages?

Materials

A. Listen to your instructor talk about different types of materials. List them here:

Metals	Fiber Products	Chemically-Produced Materials

(Responses will vary depending on the instructor's presentation.)

B. List some of the properties of materials:

Property	Definition

C. Put x's in the chart to show the properties of the materals you have discussed.

Properties of Common Materials

	Wood	Paper	Plastic	Rubber	Cotton	Glass	Steel	Copper	Polyester
rigid	X		X			X	X	X	
brittle			*some types*			X			
flexible			*some types*	X					
elastic				X					
strong			*some types*				X		
heavy							X	X	
light	X		X		X				
a mixture of materials			X			X	X		X

MATERIALS

Study the following definitions:

material	physical matter
element	a chemical substance that cannot easily be separated into different substances
iron	a heavy, strong, very common element
copper	a reddish-brown ductile (stretchable) metallic element
metal	a hard, strong material that can conduct heat or electricity
alloy	a mixture of two or more metallic elements
steel	a very strong metal alloy which contains iron and carbon
aluminum	a light but strong metallic element
carbon	a nonmetallic chemical element
brass	an alloy consisting of copper and zinc
low carbon steel	a malleable, "elastic" form of steel with a carbon content of .08-.25%
high carbon steel	a very strong form of steel with poor malleability, poor elasticity, and a carbon content of .6-1.5%

Are the following statements true or false? Write T for true, F for false.

1. T Iron is an element which is heavy and strong.
2. T It is difficult to separate an element into different substances.
3. F An alloy is an element.
4. T Aluminum is an element.
5. T Iron and carbon are found in steel.
6. T Metals can conduct electricity.
7. F Carbon is a form of metal.
8. T Copper and zinc mixed together form an alloy.
9. T Low carbon steel has good malleability.
10. T A steel with 1.0% carbon is classified as high carbon steel.

Definitions

A. Select 10 words from this unit and write a brief definition for each.

Word	Definition
1. (Resonses will vary.)	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

B. As a class, play "Jeopardy." Select three "contestants" to go in 'ront of the class. A member of the "audience" reads a definition aloud. 'he first contestant to form a question which asks for the definition of the word earns one point.

Example: Member of audience: "Physical matter"
Contestant: "What is the definition of material?"

When one contestant has earned four points, select new contestants.

Metal Designation and Identification

Thousands of standard metal alloys are available, each of which has unique properties making it the best choice for certain applications. In order for different manufacturers to produce the same alloys, it was necessary to standardize the alloy compositions. For the convenience of manufacturers and consumers, it was also necessary to develop standard numbering systems so that each alloy could have its own unique designation.

Steel Numbering Systems

The two main steel numbering systems were developed by the Society of Automotive Engineers (SAE), and the American Iron and Steel Institute (AISI). These systems designate standard constructional grades of carbon and alloy steels according to their basic chemical composition. Both the SAE and AISI systems use a four-digit series of code numbers. Occasionally, a five-digit series is used for certain alloys.

First Digit

In the SAE and AISI code classification systems, the first number frequently, but not always, indicates the basic type of steel as follows:

1 — Carbon
2 — Nickel
3 — Nickel-chrome
4 — Molybdenum
5 — Chromium
6 — Chromium-vanadium
7 — Tungsten
8 — Nickel-chromium-molybdenum
9 — Silicomanganese

All Digits

The first two digits together indicate the series within the basic alloy group. There may be several series within a basic alloy group, depending on the amount of principal alloying elements. Hence, the second digit very often, but not always, indicates the approximate percentage of the principal alloying element. The third, fourth, and fifth digits are intended to indicate the approximate middle of the carbon range. The carbon content is indicated in points — 1-point carbon is 0.01%, 45-point carbon is 0.45%, and 100-point carbon is 1.0%.

Two examples of the SAE/AISI numbering system are explained in Fig. 130-1. The series designations and the types of steel which they designate are summarized in Table 130-1.

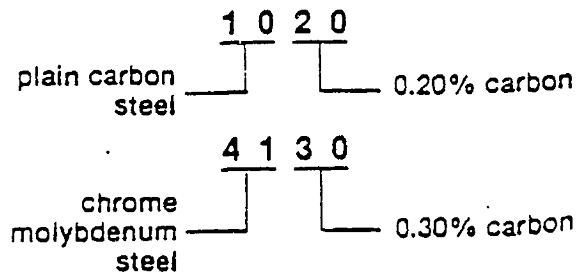


Fig. 130-1. SAE and AISI code numbers.

Table 130-1
Series Designations in SAE-AISI Steel Code

Series	Types			
10xx	Nonsulphurized carbon steels			
11xx	Resulphurized carbon steels (free machining)			
12xx	Rephosphorized and resulphurized carbon steels (free machining)			
13xx	Mn	1.75%		
*23xx	Ni	3.50%		
*25xx	Ni	5.00%		
31xx	Ni	1.25%	Cr 0.65%	
33xx	Ni	3.50%	Cr 1.55%	
40xx	Mo	0.20 or 0.25%		
41xx	Cr	0.50 or 0.95%	Mo 0.12 or 0.20%	
43xx	Ni	1.80%	Cr 0.50 or 0.80%	Mo 0.25%
44xx	Mo	0.40%		
45xx	Mo	0.52%		
46xx	Ni	1.80%	Mo 0.25%	
47xx	Ni	1.05%	Cr 0.45%	Mo 0.20 or 0.35%
48xx	Ni	3.50%	Mo 0.25%	
50xx	Cr	0.25, 0.40 or 0.50%		
50xxx	C	1.00%	Cr 0.50%	
51xx	Cr	0.80, 0.90, 0.95, or 1.00%		
51xxx	C	1.00%	Cr 1.05%	
52xxx	Cr	1.00%	Cr 1.45%	
61xx	Cr	0.60, 0.80 or 0.95%		
	V	0.12%, 0.10% min., or 0.15% min.		
81xx	Ni	0.30%	Cr 0.40%	Mo 0.12%
86xx	Ni	0.55%	Cr 0.50%	Mo 0.20%
87xx	Ni	0.55%	Cr 0.05%	Mo 0.25%
88xx	Ni	0.55%	Cr 0.50%	Mo 0.35%
92xx	Mn	0.85%	Si 2.00%	Cr 0 or 0.35%
93xx	Ni	3.25%	Cr 1.20%	Mo 0.12%
94xx	Ni	0.45%	Cr 0.40%	Mo 0.12%
98xx	Ni	1.00%	Cr 0.80%	Mo 0.25%

*Not included in the current list of standard steels.

Abbreviations:

C	Carbon	Mo	Molybdenum
Cr	Chromium	Ni	Nickel
Mn	Manganese	Si	Silicon
		V	Vanadium

Reading courtesy of Glencoe Publishing Co., Machine Tool Technology, 1984.

Reading Comprehension

Based on the reading, answer the following questions.

1. Why was it necessary to standardize the metal alloys?
   In order for different manufacturers to produce the same alloys.
2. What does AISI stand for? *American Iron and Steel Institute*
3. How many digits does the number 1020 have? *4*
4. In the SAE and AISI system, what type of steel has the number 3 as the first digit in its code number? *nickel-chrome* What type has the first digit 7? *tungsten*
5. Fill in the blank: The second digit often indicates the approximate percentage of the *principal alloying element*.
   The second digit in the series number 44xx in Table 130-1 means that this alloy has about *.40* % Mo (Molybdenum).
6. Look at Figure 130-1. In the code number 1020, what do the third and fourth digits tell you? *.20% carbon*

Look at Table 130-1. Answer the questions.

1. What does Ni stand for? *nickel*
   Mn? *manganese*
2. What % of molybdenum is contained in the series 45xx? *.52%*
3. What % of chromium is contained in the series 43xx? *.50 or .80%*
4. Of all the series, which one contains the most chromium? *52xxx*
5. Which series numbers are not included in the current list of standardized steels? *23xx* and *25xx (see note under chart)*
6. How many series contain a combination of these three elements: nickel, chromium and molybdenum? *5 (47xx, 81xx, 86xx, 87xx, 88xx)*
7. Which series have five-digit numbers? *50xxx*, *51xxx*, and *52xxx*

Read the statements. Circle "True" or "False."

1.	Two important concepts in technical fields are matter and energy.	True	False
2.	Matter is anything that has energy.	True	False
3.	Three types of matter are solids, liquids, and objects.	True	False
4.	Gases have weight.	True	False
5.	Solids normally have a definite shape.	True	False
6.	Liquids always have a definite shape.	True	False
7.	Freezing is the process of changing from a solid to a liquid.	True	False
8.	Melting is the process of changing from a gas to a liquid.	True	False
9.	Evaporation is changing from a liquid to a gas.	True	False
10.	Lightning is a natural source of electricity.	True	False
11.	Rigid materials are sometimes brittle.	True	False
12.	Rubber is a flexible material.	True	False
13.	Durable materials wear out quickly.	True	False
14.	An alloy is a mixture of metallic elements.	True	False
15.	Steel is a very strong metal alloy.	True	False
16.	Electricity is the only true form of energy.	True	False
17.	Home appli ances consume energy.	True	False
18.	A 100 watt light bulb uses more energy than a television.	True	False
19.	The "kilowatt" is a commonly used unit of electricity.	True	False
20.	The sun is an artificial source of energy.	True	False

QUIZ 5
ANSWER KEY

Read the statements. Circle "True" or "False."

1.	Two important concepts in technical fields are matter and energy.	True	False
2.	Matter is anything that has energy.	True	False
3.	Three types of matter are solids, liquids, and objects.	True	False
4.	Gases have weight.	True	False
5.	Solids normally have a definite shape.	True	False
6.	Liquids always have a definite shape.	True	False
7.	Freezing is the process of changing from a solid to a liquid.	True	False
8.	Melting is the process of changing from a gas to a liquid.	True	False
9.	Evaporation is changing from a liquid to a gas.	True	False
10.	Lightning is a natural source of electricity.	True	False
11.	Rigid materials are sometimes brittle.	True	False
12.	Rubber is a flexible material.	True	False
13.	Durable materials wear out quickly.	True	False
14.	An alloy is a mixture of metallic elements.	True	False
15.	Steel is a very strong metal alloy.	True	False
16.	Electricity is the only true form of energy.	True	False
17.	Home appli ances consume energy.	True	False
18.	A 100 watt light bulb uses more energy than a television.	True	False
19.	The "kilowatt" is a commonly used unit of electricity.	True	False
20.	The sun is an artificial source of energy.	True	False

TEACHER'S ACTIVITY GUIDE

UNIT SIX: COMPARATIVE DESCRIPTIONS

TOPICS: Electricity, Electronics

SKILL OBJECTIVES: Compare and contrast two topics
Take lecture notes
Refer to a table of contents and index
Read a schematic diagram
Take a multiple choice test

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction Ask sts., "What is electricity? What is electronics? What are some electronic products? Do you know the difference between electricity and electronics?" State the unit objectives.			
A) Reading (50 min/) Ask pre-reading questions. Sts. read silently. Sts. ask questions about difficult vocabulary; help sts. clarify meanings by using context. Assess general comprehension. Sts. complete Worksheet 6A(1). Review answers. Discuss emphasis in reading on comparing and contrasting. Sts. complete Worksheet 6A(2); you may use this as an opportunity to teach/review markers of comparison such as "whereas, however, like, similar, etc."	Expressions of comparison/ contrast, e.g., "both, but they differ... on the other hand...," etc.	electronics device atom flow electric/ity/al charge electron current conduct/or signals frequency semiconductor insulator accurate/ly accuracy	Reading 6A Worksheet 6A(1) Worksheet 6A(2)
B) Listening: Lecture (50 min.) Prepare a lecture based on the text in Lecture 6B. Give lecture; have sts. take lecture notes. Ask comp. questions about main topics and organization. Ask detailed questions to assess sts. note-taking. Give lecture 2nd time, stopping to put important notes on	Expressions of comparison/ contrast.	Vocabulary from Activity A nucleus proton wire vacuum tube semiconductor integrated circuit silicone	Lecture 6B

(Continued on next page)

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
B) Cont. blackboard, i.e. simulate note-taking process to create a model set of notes. Use abbreviations, symbols, arrows, and two column format for comparing when appropriate Have students compare their notes to yours.		sophisticated sensitive humidity	
C) Reading, Oral Practice (40 min.) Ask pre-reading questions. (Note that reading covers only one of the three areas addressed in the first paragraph. Have student(s) read aloud. Ask comp. questions. Sts. practice comparative expressions orally, using worksheet as a guide. Review grammar as necessary.	Comparative adjectives	conductor resistance offer (resistance) affect silver copper aluminum	Reading 6C Worksheet 6C
D) Graphical Literacy (20 min.) Sts. examine reading. Ask global comp. questions, i.e., "How are the two radios similar, different?" Sts. complete worksheet. Review worksheets.	Prepositions of location.	schematic diagram components found in a transistor radio	Reading 6D Worksheet 6D
E) Reading Table of Contents, Index (20-30 min.) Survey reading orally with sts. Point out importance of cross-referencing between table of contents and index. (Note that page nos. appear left of chapter headings.) Ask, for example, "Which chapters contain information on batteries? How do you know this?"	Alphabetizing Wh-questions	Electricity and electronics terminology	Reading 6E Worksheet 6E
F) Comparisons/Written and Oral (Time will vary) Have sts. bring two pictures from home and complete the tasks on Worksheet 6F.	Expressions of comparison	(Will vary)	Worksheet 6F

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
G) Evaluation (30 min.) Review multiple choice test format. Sts. take quiz. Review answers and strategies for multiple choice tests, using test items as examples (Appendix).			Quiz 6 (Multiple Choice) Quiz 6 Answer Key

ELECTRONICS / Background to Electronics

Basic Principles. To understand how electron devices work, a person must know something about the nature of matter. All matter consists of tiny "building blocks" called *atoms*. Every atom, in turn, has one or more *electrons*—particles that carry an electric charge. In substances called *conductors*, which include most metals, the atoms have one or more electrons that can flow freely from atom to atom. Such a flow forms an *electric current.*

Electronics and the science of electricity both deal with electric current. But they differ in how they use it. Electricity deals with electric current mainly in the form of energy. The energy operates electric lights, electric motors, and other electric equipment. The current flows through wires or other conductors. Electronics, on the other hand, deals with electric current mainly in the form of pulses, or signals. The current flows through electron devices, which change the current's behavior to make it work as a signal.

The signals used in electronics may represent sounds, pictures, numbers, or other information. In computers, the signals stand for numbers. In radios and phonographs, they stand for sounds. TV signals carry both sound and picture information. Other electronic signals are used to count or compare objects, measure time or temperature, analyze the chemical composition of various substances, or detect radioactive materials.

To carry information, an electric current must go through a series of changes. Some changes control the direction of the current. Other changes vary the current's strength or its *frequency*—that is, the number of times it vibrates per second. Electronics depends on electron devices to make these changes.

Electron devices work because they can control an electric current—that is, a flow of electrons—quickly and accurately. The flow of electrons through a wire or other conductor cannot be controlled with great speed or accuracy. An electron device avoids this problem by producing a flow of electrons that is independent of a conducting material. Most electron devices made today create a flow of electrons in certain *semiconductor* materials, such as germanium or silicon. Semiconductors are not good conductors of electricity, nor are they good *insulators* (nonconductors). But if they are chemically treated in certain ways, they can both conduct and control an electric current.

Electron devices enable electronic equipment to work with great speed and accuracy. In computers, for example, the devices make changes in an electric current to solve mathematical problems. The devices work so rapidly that a computer can solve difficult problems millions of times faster than a person can. In TV sets, the devices strengthen TV signals and produce an accurate copy of the original sounds and pictures.

Source: World Book Encyclopedia

Definitions

Below are definitions of key words from the reading.
For each definition given, supply the missing word.

1. *atoms* — The "building blocks" of all matter.
2. *electrons* — Particles that carry an electric charge.
3. *conductors* — Substances in which electrons can flow.
4. *electric current* — The flow of electrons.
5. *electricity* — The science of electric current in energy form to operate lights, motors, etc.
6. *electronics* — The science of electric current in signals, such as sounds, pictures, or numbers.
7. *frequency* — The number of times something happens in a given time period.
8. *semiconductors* — Materials which can both conduct and control an electric current.

Comparing and Contrasting

Based on the information found in the readings, fill the blanks with words that show the relationships between the ideas. Choose from the following words and expressions. You will use some words more than once.

and	not	differ
both	nor	different
some	but	difference
other	on the other hand	
either		

Electronics and electricity _both_ deal with electric current. _But_ they _differ_ in how they use electricity. In other words, there is a _difference_ between electronics and electricity. Electricity deals with electric current mainly in the form of energy, _but_ electronics, _on_ _the_ _other_ _hand_, deals with electric current in the form of signals.

In computers, the signals stand for numbers, _but_ in radios they stand for sound. And this is _different_ from TV, where the signals carry _both_ sound _and_ picture information.

To carry information, an electric current must be changed. _some_ changes control the direction, _and_ _other_ changes vary the frequency of the current.

In modern electronics, the flow of current is normally regulated by devices called semiconductors. Semiconductors are not good conductors of electricity. _nor_ are they good insulators. This means that they do _not_ conduct electricity well, and they do not stop the flow of electricity well _either_. _But_ if they are chemically treated, they can _both_ conduct _and_ control an electric current.

ELECTRICITY AND ELECTRONICS

Today we would like to talk about electricity and electronics. Is there a difference between electricity and electronics? Yes, there is a difference, but there are also similarities. Both fields involve the form of energy we know as electricity.

First, let's start by talking about some basic principles of physics that are important to understanding electricity. We've already talked about matter. Matter is made up of atoms. Atoms are really the building blocks of all matter. Atoms are little tiny particles that consist of a nucleus, protons, and electrons. In the center of each atom is a nucleus. And, next to the nucleus are protons. Protons have what we call a positive charge. Electrons, on the other hand, move in a circle around the outside of the atom. Electrons have a negative charge.

In most materials all the parts of the atoms stick together. In a few materials, however, electrons in an atom can become free. That is, they can separate from the atom and they are capable of moving away from the atom. These are called free electrons. In metals such as copper or silver, the atoms are very close to each other and the free electrons in those atoms can travel from one atom to the next. When they travel from one atom to the next, this is called a flow. And that flow is an electric current. Electricity can be defined as the study and the application of the flow of electric currents.

Now, when you think of electrical appliances--refrigerators, motors, heaters, lights, etc.--you probably think of the electricity flowing through wires, which is absolutely correct. Electricity involves the movement of electrons through wires or conductors, as we said before. In an electrical system, this electricity is used directly by the appliance to produce light or heat, for example.

Now let's talk about electronics. Electronics takes an electric current and transforms it into little spurts of electricity. Instead of a constant flow, you have little spurts or little pulses of electricity. These pulses can be used to form signals. These signals could be in the form of numbers, for example in computers, or in the form of sound, as in radios or stereos. The pulses can even be in the form of pictures, as in television.

How do electronic products take the raw electrical current and transform it into signals? Well, there are components in an electrical circuit that change the electricity. Some examples of those components are vacuum tubes, semi-conductors, or integrated circuits. The first components which were used to make an electrical current electronic were vacuum tubes. Vacuum tubes were used in the first radios that were built. Then vacuum tubes were replaced by what we call semi-conductors. Semi-conductors have that name because they are not a pure conductor of electricity. They can conduct electricity but they can also stop electricity. So, they act almost as a gate in an electric current. The most modern form of an electronic component is an integrated circuit. Integrated circuits are found in all sophisticated electronic products. Perhaps a better name for these components is devices. Electronic devices change or control the electric current.

All electronic items are electrical, but not all electrical ones are electronic. So, in a sense, electronics is a more sophisticated or a more complex way to use the raw energy that we know as electricity.

So what is the advantage of electronics over electricity? Well, electronic devices make it possible for equipment to work with much greater speed and much greater accuracy. In computers, for example, the electronic devices make changes in electrical currents to solve mathmatical problems. Another advantage of electronics is that electronic systems have almost no moving parts, and in some cases no moving parts at all. Because there are no moving parts, there is nothing that can wear out. Electronic componenets are also much lighter than electric components. Electronic systems do have disadvantages, too. Electronic systems are also more delicate than electrical systems. They are easier to damage and they are more easily affected by heat and humidity. They are even sensitive to electricity in the air.

More and more components in what used to be electrical appliances are now electronic. Refrigerators and air conditioning systems are good examples. They used to be purely electric systems and now they are being built with more and more electronic components. Electronic products have become much cheaper in recent years. We can expect to see more and more electronic products and electronic components in the coming years.

PHYSICAL MATERIALS

There are three physical materials which are used in electrical and electronic systems:

1. Conductors
2. Semiconductors
3. Insulators or non-conductors

Conductors

A conductor is a material which allows an electric current to pass through it. In a wire, for example, the electrical energy moves from one end to the other. A good conductor allows the current to pass freely. In other words, it offers very little resistance to current flow.

The resistance of a conductor depends on the length and thickness of the conductor. For example, a long wire offers more resistance to current flow than a short wire. That is, the longer the wire, the higher the resistance. On the other hand, a thick wire offers less resistance than a thin one. So, the greater the diameter of the wire, the less resistance it has.

The type of material a conductor is made of also affects its resistance. In most cases metals are the best conductors. Silver is the best conductor because it offers the least resistance to current flow.

Below are several conductors and their key properties:

Silver
- best conductor
- offers least resistance
- very expensive
- very heavy in weight
- not practical for most jobs because of expense

Copper
- good conductor
- offers low resistance
- not too expensive
- very heavy in weight
- widely used

Aluminum
- good conductor, but not as good as copper
- offers more resistance than copper
- moderately expensive
- very light
- widely used

Comparing/Contrasting

For each set of words given, make comparative statements based on the information in the reading. Use words such as: more, most, less, least, better, best, poor, poorest, etc.

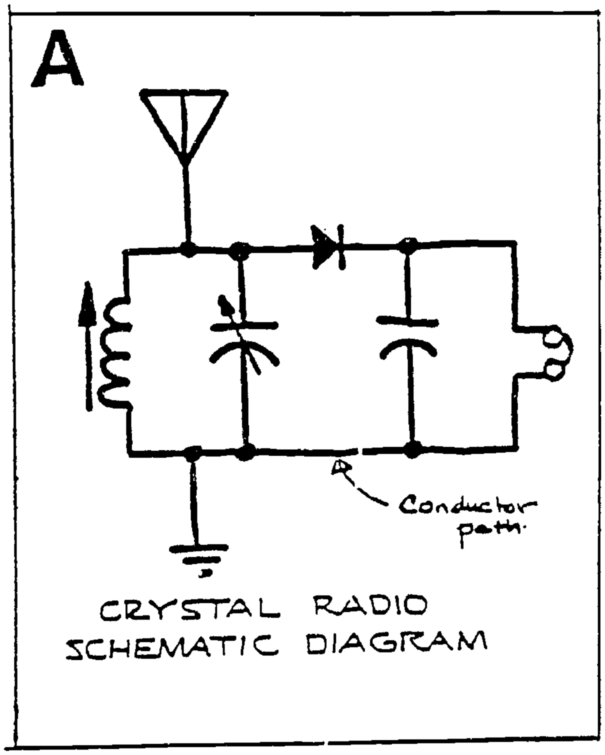
Example 1:	silver, copper **expensive**	Silver is more expensive than copper. Copper is less expensive than silver.
Example 2:	silver, copper **weight**	Silver is approximately as heavy as copper.
Example 3:	silver, copper, aluminum **conductor**	Of the three metals, silver is the best conductor. Of the three metals, aluminum is the poorest conductor.

---

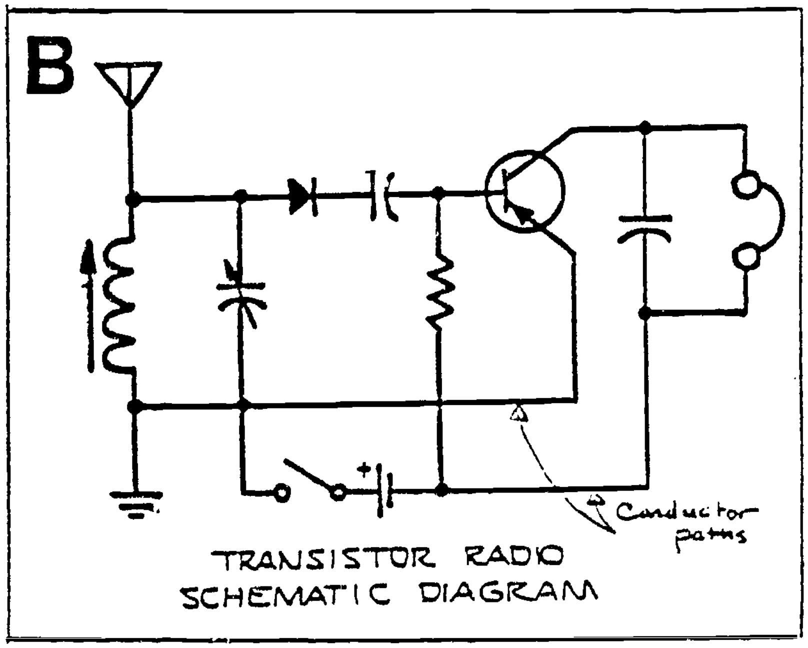
1. silver, aluminum
   expensive
2. copper, aluminum
   resistance
3. copper, aluminum
   expensive
4. silver, aluminum
   weight
5. copper, aluminum
   use
6. silver, copper
   conductor
7. silver, copper, aluminum
   conductor
8. silver, copper, aluminum
   expensive

8. silver, copper, aluminum
   expensive
9. silver, copper
   resistance
10. silver, copper, aluminum
    resistance
11. long wire, short wire
    resistance
12. thick wire, thin wire
    resistance
13. metal, glass
    conductor
14. long copper wire, short copper wire
    resistance

Instructions: Using the schematic diagram key below, compare Diagrams A and B.

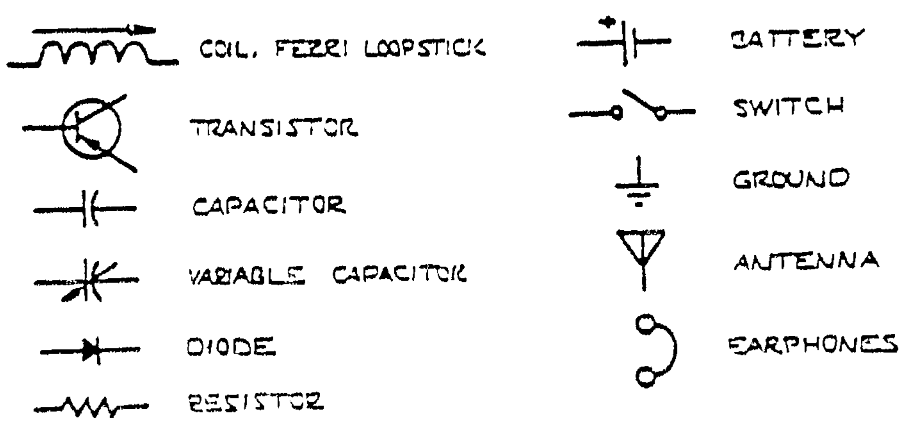


CRYSTAL RADIO SCHEMATIC DIAGRAM



TRANSISTOR RADIO SCHEMATIC DIAGRAM

KEY TO READING SCHEMATIC DIAGRAMS



Adapted from: Using the Language of Industry. Illinois State Board of Education.

Reading Comprehension

Using the information given in the schematic diagrams and the schematic diagram key, fill in the blanks to complete the sentences.

1. Both diagrams A and B are diagrams of radios. A shows a crystal radio and B shows a transistor radio.

2. Besides the conductor paths, diagram A has a total of 7 components. B has a total of 10 components.

3. There are 2 types of capacitors in each diagram.

4. A has a total of 2 capacitors, and B has a total of 3 capacitors.

5. Diagram B has a resistor, but diagram A does not.

6. In each diagram, the Ferri Loopstick is located between the ground and the antenna.

7. The far right rides of the diagrams show that each radio has earphones.

8. The bottom left corners of the diagrams show that each radio has a ground.

9. Next to the battery in diagram B is a switch.

10. Between the capacitors in diagram A is a diode.

CONTENTS

READING 58

Source: The Basic Book of Electricity and Electronics. American Technical Society. ©1979.

Referencing Skills

On the handout is a table of contents and one page of the index from an electricity/ electronics textbook. Using the handout, give short answers to the questions.

1. How many units are there in the "Introduction" section of the book? 3
2. On what page does the unit on "tools" begin? 5
3. What is the name of the first unit in the "Doing is learning" section? soldering
4. What page does the unit on magnets begin? 48
5. How many pages long is the unit on testing electronic parts? 4
6. Which is the shortest unit in the book? Unit 2
7. Which units talk about integrated circuits? Units 30 and 31
8. Which units have to do with the concept of "series and parellel"? 15 and 16
9. On what page is the index found? 121
10. Where can you get the definition of horsepower? Unit 13
    Of coloumb? Unit 11
11. How many different types of circuits are listed in the index? 7
12. If you want to know about short circuits, on what page do you look? 41
13. Where will you find information on the binary number system? 83
14. In which unit is there information on careers? Unit 1
15. When is ferric chloride important? for building printed circuit boards

Comparing and Contrasting

A. In a magazine or a newspaper, find two pictures of a product. The pictures should show two different models of the same product. For example, you may find two bicycles which have differences in style, size, cost, etc.

Imagine that you are a sales person. Try to convince customers that they should buy the model that you prefer. Write five sentences which support your argument.

> Ex: Bicycle A is better because it has 10 speeds, whereas Bicycle B has only 3.

1.

2.

3.

4.

5.

B. Present your "sales pitch" to the class, showing your pictures and telling them why they should buy the model you think is best.

QUIZ 6

Circle the letter of the response which best completes the statement.

1. In an electric current,
   a. protons flow from atom to atom.
   b. building blocks form atoms.
   c. electrons flow from atom to atom.
   d. devices can flow.

2. Electricity and electronics both deal with
   a. electric current.
   b. semiconductors.
   c. vacuum tubes.
   d. signals.

3. Electric energy operates electric lights. Electronics, on the other hand, involves electric current in the form of
   a. motors.
   b. wire.
   c. series.
   d. signals.

4. One thing electronic signals <u>cannot</u> represent is
   a. pictures.
   b. wires.
   c. sounds.
   d. numbers.

5. A conductor allows an electric current to flow through it. An insulator, on the other
   a. hand, cannot conduct electricity.
   b. side, cannot conduct electricity.
   c. way, cannot conduct electricity.
   d. means, cannot conduct electricity.

6. In most cases metals are the best
   a. nonconductors.
   b. semiconductors.
   c. vacuum tubes.
   d. conductors.

7. As a conductor, a long wire offers
   a. most resistance than a short wire.
   b. more resistance to a short wire.
   c. as much resistance as a short wire.
   d. more resistance than a short wire.

8. An example of an electrical device or component is
   a. a frequency.
   b. a semiconductor.
   c. a battery.
   d. an atom.

9. A technical drawing of an electronic device is called a
   a. diagram schematic.
   b. transistor picture.
   c. schematic diagram.
   d. variable capacitor.

10. Electronic devices enable equipment to operate
   a. more quickly.
   b. more efficiently.
   c. more accurately.
   d. all of the above.

QUIZ 6
ANSWER KEY

Circle the letter of the response which best completes the statement.

1. In an electric current,
   a. protons flow from atom to atom.
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    a. more quickly.
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TEACHER'S ACTIVITY GUIDE

UNIT SEVEN: NON-SEQUENTIAL INSTRUCTIONS

TOPICS: Safety Precautions, Warnings

SKILL OBJECTIVES: Comprehend and give safety precautions and warnings
Read non-sequential instructions
Identify hazardous conditions
Read safety charts, signs, and labels
Take a true/false test

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction Discuss with students their experiences with hazardous conditions or materials at workplaces. State learning objectives of unit.			
A) **Listening: Lecture (45 min.)** Prepare a lecture based on the text in Lecture 7A. Give lecture, referring to visual; sts. take notes on 1) names of protective equipment, and 2) what hazards they protect from. Ask general comprehension questions. Give lecture 2nd time; sts. improve notes. Sts. complete worksheet. Review worksheet.	Passive constructions with modal verbs Conditionals	safety accident prevent injury hazard protective equipment hard hat ear plugs/ muffs goggles helmet poison/ous toxic dust mask chemical mask	Lecture 7A Visual 7A Worksheet 7A
B) **Grammar: Written and Oral Practice (30 min.)** Sts. complete Worksheet 7B(1) in writing; explain grammar as needed. Review worksheet. Sts. practice orally with a partner using 2nd and 3rd worksheets; you can use these worksheets to teach/review passive verbs with modals and conditionals.	Imperative verb forms Passive verbs with modals Conditionals	Protective equipment Hazardous conditions	Worksheet 7B(1) Worksheet 7B(2) Worksheet 7B(3)

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
C) Reading Non-Sequential Instructions (30-40 min.) (Refer to Teacher Notes 7C for information and key comprehension questions on the reading.) Ask pre-reading questions. Sts. read silently. Discuss reading, using Teacher's Notes. (Instructor may want to convert imperative statements from reading to passives and vice-versa as a class activity.) Sts. complete Worksheet 7C. Review worksheet.	Imperatives Passive constructions with modals	portable drill disconnect remove switch secure keep away release trigger	Teacher's Notes 7C Reading 7C Worksheet 7C
D) Reading Safety Rules (25-50 min.) Ask pre-reading questions. Sts. read silently or aloud. Ask sts. to mark imperative verb forms by underlining them and mark passive constructions by circling them. Have each student draw a picture of a shop situation where one or more rules given in reading are not being followed. Sts. look at each other's pictures and state what is wrong and give the appropriate safety precaution.	Imperatives Passive construction with modals	safety rules apparel maintain well-adjusted idle ground (verb) adaptor electric shock cluttered ventilation exhaust fumes first-aid kit infection	Reading 7D
E) Reading Signs (30 min.) Sts. examine signs and labels in reading. Discuss items using comprehension questions provided in reading. Point to signs and give examples of warnings which workers might give each other on the job (see Worksheet 7E for examples). Sts. do oral exercise on worksheet.	Imperatives	Safety Signs and Labels flammable voltage corrosive caution "horseplay" alert poison toxic	Reading 7E Worksheet 7E

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
F) Reading/Graphical Literacy (20-30 min.) Ask pre-reading questions. Sts. examine diagram. Assess general understanding of the diagram format. Sts. complete worksheet. Review answers.		fire extinguisher "approved" extinguisher combustible	Reading 7F Worksheet 7F
G) Evaluation (30 min.) Sts. take Quiz 7. Correct quizzes. Review answers and review true/false test-taking strategies (Appendix).			Quiz 7 (True/false) Quiz 7 Answer Key

WORK SAFETY

Safety is a very important concept in any type of work that involves working with tools or machinery. You might have heard the expression "safety first." This means that whenever you work in a situation which could be dangerous, you must always think about doing the job safely before you think about anything else. Doing a job without thinking about safety can result in an accident or a personal injury to you. Safety is really about preventing accidents.

A lot of accidents can,be avoided by wearing the right clothing and protective equipment. In the construction industry, for example, there are several types of equipment which are important to know about and use.

The first piece of equipment which is worn by construction workers at the worksite is a "hard hat" (refer to visual). A hard hat must be worn at all times to protect the worker from falling objects. It also protects against a heavy blow or a hit to the head. The hard hat is as important to the construction worker as a football helmet is to a football player.

Next, construction workers have to protect their feet from heavy materials which could fall and cause injury. Special work boots with steel toes are designed for this purpose (refer to visual). Good, strong shoes protect against heavy materials, and they also give the worker more support so that he or she won't slip and fall.

Loud noises at the worksite can also be a hazard to workers' ears. In many types of jobs the work can be very noisy, especially if you are working around power tools. There are two main types of protective devices for the ears: ear plugs and ear muffs (refer to visual). Ear plugs are usually made of soft rubber or plastic and they fit right into the ears. Ear muffs give each better protection than ear plugs. They should always be worn when working with a loud piece of equipment like a jack hammer, for example.

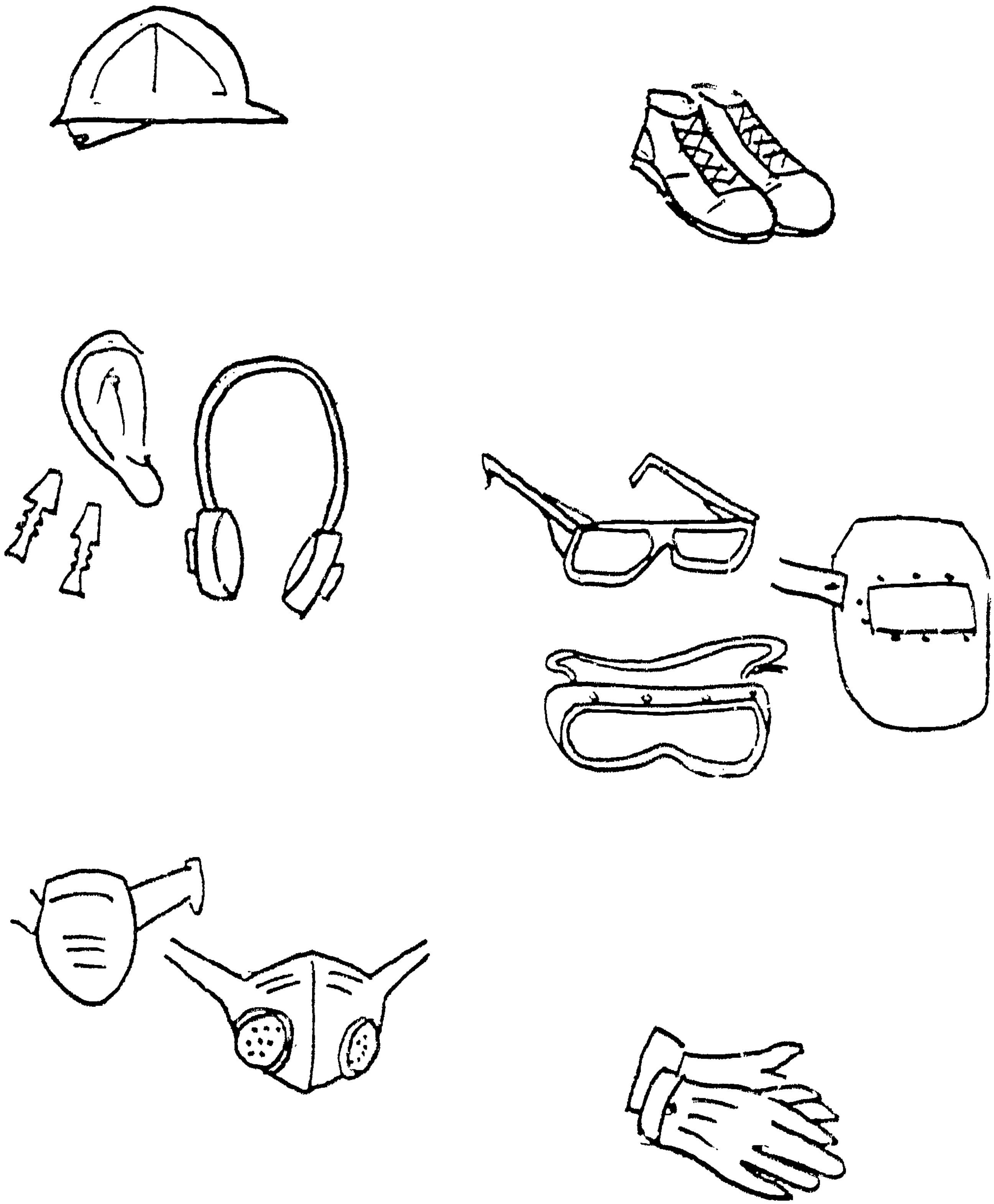
The next pictures you see show different types of eye protection. The first one is a pair of safety glasses. The second one shows safety goggles. They are important to wear whenever you are working with materials that could fly up and hit you in the face. You should always wear goggles when sawing, for example. The next picture shows a welding helmet. Of course welders wear this type of helmet to protect their eyes and face from spattering hot metal and to shield their eyes from the harmful rays of light.

For some jobs, you need to wear a mask which will protect your lungs against dust or against poisonous gases. There are different types of masks, depending on the job. If you are working in an area where the air is full of dust, you should wear a dust mask. Other jobs require that you work with materials that give off toxic, or poisonous, gases. For example, many types of glues and paints are very toxic. For these jobs a chemical mask must be worn.

The last picture shows a pair of heavy leather gloves. Gloves protect the hands from sharp metal objects and from hot metal which can cause burns. It is even a good idea to wear heavy gloves when handling rough wood.

Each type of job has different safety hazards, and so the type of equipment which must be worn will be determined by the job. The rules of safety must be followed at all times to avoid accidents to you and your co-workers.

VISUAL 7A



Matching Phrases

Use the information from the lecture to complete this matching exercise. Draw a line to connect the phrase on the left with the phrase on the right which correctly completes the sentence.

A. You must wear a chemical mask	you should always wear goggles.
If you don't think about safety,	falling materials.
Many accidents can be avoided by	it could result in an accident.
Work boots protect against	wearing the right protective equipment.
Whenever you work around flying materials,	to prevent breathing in toxic gases.

B. Goggles must be worn	when working with loud equipment.
A chemical mask must be worn	when working in an area where objects can fall.
Gloves must be worn	when working around flying particles.
A hard hat must be worn	when handling sharp or rough objects.
Ear muffs must be worn	when using materials that give off toxic gases.

Instructions/Written Practice

Instructions such as safety precautions can be stated in either a "direct" or an "indirect" way. For example:

1. Wear a hard hat! (direct)
2. A hard hat must be worn. (indirect)

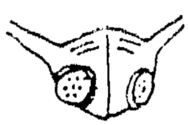
Both sentences mean the same, but the first one has an imperative verb form "wear," and the second one has a passive verb form "must be worn."

For each picture, write a "direct" instruction and an "indirect" instruction.

1. Wear gloves!
2. Gloves must be worn.

3. Wear work boots!
4. Work boots must be worn.

5. Wear safety glasses!
6. Safety glasses must be worn.



7. Wear a chemical mask!
8. A chemical mask must be worn.

9. Wear earmuffs!
10. Earmuffs must be worn.

Instructions/Oral Practice

With a partner, practice the different ways of saying a safety precaution for each picture and set of words given.

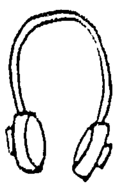
Example:

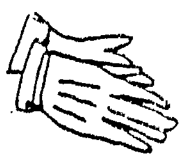
in areas where objects can fall.

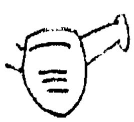
1) Always wear a hard hat when working in areas where objects can fall.

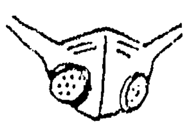
2) You must wear a hard hat when working in areas where objects can fall.

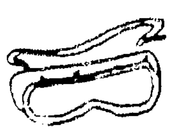
3) Hard hats must be worn when working in areas where objects can fall.

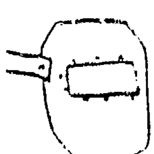
1)  around loud noises.

2)  with sharp objects.

3)  in a dusty area.

4)  around toxic gases.

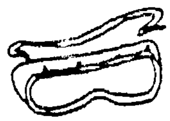
5)  around flying materials.

6)  by welders to protect against harmful light rays.

Instructions/Oral Practice

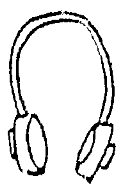
Do this exercise with a different partner. For each picture, practice making one direct and one indirect statement which describes what could happen if the piece of protective equipment is not worn.

Example:



a. If you don't wear safety goggles, you could injure your eyes.

b. If safety goggles are not worn, the eyes could be injured.

1. 

2. 

3. 

4. 

5. 

Reading 7C is typical of instructions given for the use of a piece of equipment or machinery. The writer intended to make the instructions simple, but they are difficult to follow because they are not presented in a logical order.

Discuss this and other difficult aspects of the reading with the students. You may want to focus on these questions:

1. Which steps do you have to take <u>before</u> you use the drill? (Ans.: 1,2,5,6)

2. Which steps are important while you are drilling? (Ans.: 7,8,9,10)

3. Which steps have to do with changing drill bits? (Ans: 3,4)
   Note: Drill bits are not shown in the picture!

4. Which steps are important in terms of safety considerations? (Ans.: 1-10!)

5. Why are the first three instructions in a box? (Ans.: Because they are considered by the writer to be most important.)

Also, discuss grammatical patterns found in the instructions.

1. How many instructions are "direct" (imperatives)? (Ans.: 3,4,5,7,8,10)

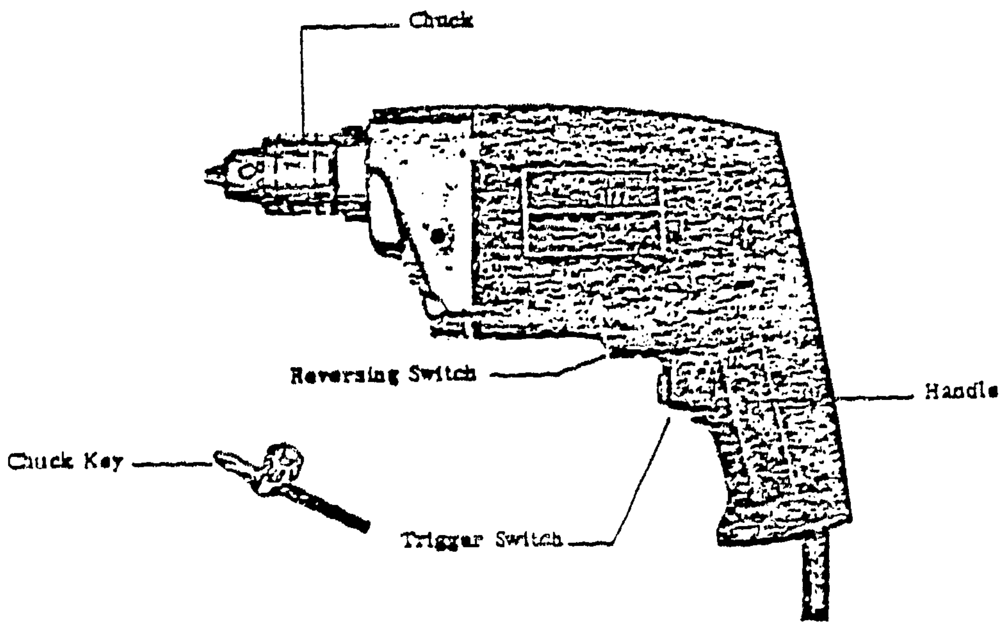
2. How many are "indirect" (passives)? (Ans.: 1,2,6,9)

3. How is step No. 9 different? (Ans.: It is indirect, but not a passive construction.)

4. How is step No. 8 different? (Ans.: It is a conditional statement. You only release the trigger in the middle of a job <u>if</u> the piece you are drilling gets caught by the bit and begins to turn.)

PORTABLE DRILL

1. TEACHER PERMISSION IS REQUIRED BEFORE USING THE PORTABLE DRILL.
2. EYE PROTECTION MUST BE WORN WHEN WORKING AROUND THE PORTABLE DRILL.
3. DISCONNECT THE POWER BEFORE CHANGING DRILL BITS.



4. Remove the chuck key immediately after using.
5. Make sure the switch is in the "off" position before plugging the drill in.
6. All work pieces must be secured.
7. Hold the drill firmly at all times.
8. If the work is caught by the drill, release the trigger.
   Do not try to stop it by hand.
9. Large drills should turn at slow speeds.
10. Keep hands, hair, loose clothing, and jewelry away from moving parts.

Restating Instructions

The reading contains 10 instructions for using the portable drill.

Below are the same instructions again, but they are given in different words and a different order. Find the instruction from the reading and the one below which mean the same, and write the number in front of the letter.

7 a. Always hold the drill tightly.

4 b. After you use the chuck key, take it off the chuck.

1 c. You must ask your instructor before you use this tool!

5 d. The trigger switch must be OFF before you plug the drill in.

9 e. If you are using a large drill bit, drill slowly.

2 f. You must wear safety glasses or goggles when you use the drill.

3 g. Always unplug the cord before you change drill bits.

10 h. Be careful not to touch any part of your body or clothing to the turning drill bit.

8 i. If the piece you are drilling begins to move, stop drilling.

6 j. Hold down tightly the piece you are drilling.

SHOP TOOL SAFETY RULES

1. USE RIGHT TOOL. Don't force small tools to do the job of a heavy-duty tool. Otherwise you could break the tool or cause injury to yourself.

2. USE SAFETY EQUIPMENT with many tools. Always wear glasses or goggles when there is a danger of flying particles. A dust mask should be used if a cutting operation is dusty.

3. WEAR PROPER APPAREL. Don't wear loose clothing or jewelry because it can get caught in moving parts.

4. KEEP CHILDREN AWAY. All shop visitors should be kept a safe distance from the work area.

5. MAINTAIN TOOLS WITH CARE. Keep tools sharp or well-adjusted, and clean them periodically. Be sure handles are securely fastened.

6. STORE IDLE TOOLS. When not in use, tools should be stored--out of the way. Disconnect all power tools when not in use.

7. GROUND ALL POWER TOOLS. Use a three-pronged plug or an adaptor with wire attached to a known ground to prevent electric shock.

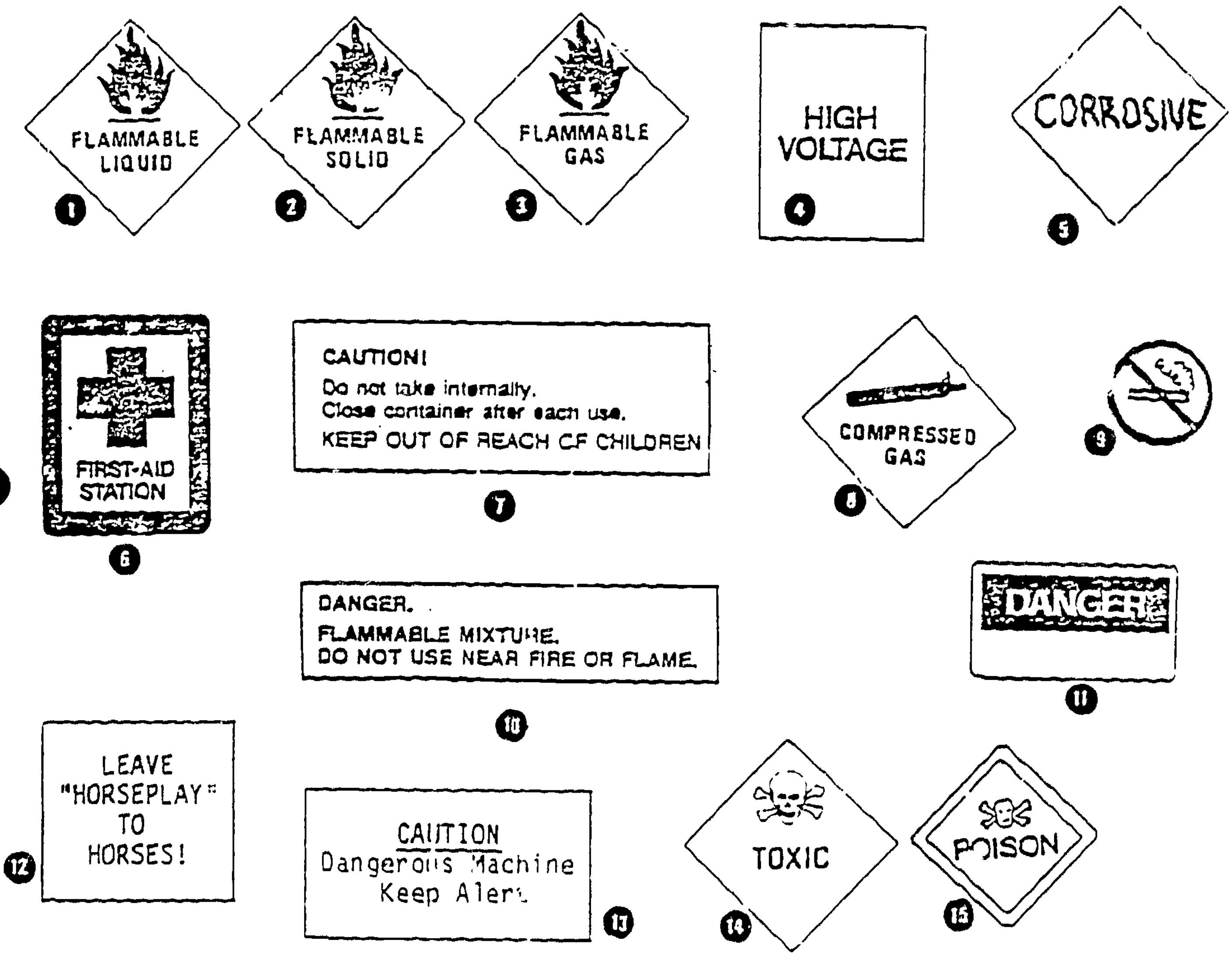
8. KEEP WORK AREA CLEAN. Cluttered areas and work benches invite accidents.

9. HAVE GOOD LIGHTING AND VENTILATION. Be sure bench areas are well-lit and that all exhaust fumes are drawn out of the shop.

10. KEEP A FIRST-AID KIT HANDY. All minor injuries should be treated at once to prevent infection.

SAFETY SIGNS AND LABELS

Below are signs and labels which you might see when working with dangerous materials or equipment. Discuss them with your instructor.



1. Which of the items pictured are signs?
   Which ones are labels?
2. Which would you expect to see around materials which can burn or explode?
3. Which would you expect to see around dangerous chemicals?
4. Which sign has to do with electricity?
5. Which sign warns you not to play around in a work area?
6. Which signs are so general that you could expect to see them in any shop?

Warnings

When you are working around dangerous equipment, you sometimes must warn your co-worker or fellow student of a danger. In this exercise you will practice giving warnings.

Do this exercise with a partner. Point to one of the signs or labels in Reading 7E. Your partner must give an appropriate warning to you. Take turns pointing and giving warnings to each other.

Example: Student A: (Points to Sign #1.)
Student B: "Look out! It could start on fire!"

Below are more sample warnings:

Look out! It could explode!

Watch out! You could get shocked!

Put out that cigarette!

Pay attention! If you don't, you could injure your hand!

Don't breathe this stuff!

Be careful! Don't get it on your hands!

You've cut your finger. Go get the first aid kit!

Stop playing around in the shop!

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER						
		MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important! Using the wrong type extinguisher for the class of fire may be dangerous.						
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING...	...THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	FOAM Solution of Aluminum Sulphate and Bicarbonate of Soda	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	SODA ACID Bicarbonate of Soda Solution and Sulphuric Acid	PUMP TANK Plain Water	GAS CARTRIDGE Water Expelled by Carbon Dioxide Gas	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL
A	CLASS A FIRES Use These Extinguishers ORDINARY COMBUSTIBLES • Wood • Paper • Cloth, Etc.	A B		A	A	A	A B C	
B	CLASS B FIRES Use These Extinguishers FLAMMABLE LIQUIDS, GREASE • Gasoline • Paints • Oils, Etc.	A B	B C				A B C	B C
C	CLASS C FIRES Use These Extinguishers ELECTRICAL EQUIPMENT • Motors • Switches, Etc.		B C				A B C	B C

Source: Developing Shop Safety Skills, American Association for Vocational Instructional Materials.

Reading Comprehension

Using the information from the diagram, circle T for true or F for false for each of the following statements.

1. There are three main classes of fires.	T	F
2. A class C fire involves electricity.	T	F
3. Wood, paper and cloth are ordinary combustibles.	T	F
4. A foam type extinguisher can be used on a class A fire.	T	F
5. A pump tank water extinguisher can be used on a class B fire.	T	F
6. Five types of extinguishers can be used on a class B fire.	T	F
7. Most types of extinguishers can be used on electrical fires.	T	F
8. All types of extinguishers can be used on class A fires.	T	F
9. Burning switches can be extinguished with a foam extinguisher.	T	F
10. Bicarbonate of soda mixed with sulphuric acid can be used to extinguish burning gasoline.	T	F
11. There is one type of extinguisher which can be used on all three kinds of fires.	T	F
12. There are only two types of extinguishers approved for class C fires.	T	F
13. There is no extinguisher approved only for a class C fire.	T	F
14. Using the wrong type of extinguisher is never dangerous.	T	F
15. If you only have one fire extinguisher, the best one to have is probably the multi-purpose dry chemical variety.	T	F

Circle T for true or F for false for each of the following statements.

1.	A lot of accidents can be avoided by wearing the right clothing and protective equipment.	T	F
2.	Ear plugs or ear muffs should be worn when working with loud equipment.	T	F
3.	Work boots protect against toxic gases.	T	F
4.	If safety glasses or goggles are not worn around flying particles, the eyes could be injured.	T	F
5.	You should disconnect a power tool when it is not being used.	T	F
6.	All injuries should be treated within 48 hours to prevent infection.	T	F
7.	Flammable materials should be used around fire or flame.	T	F
8.	"Horseplay" is dangerous because animals could be injured.	T	F
9.	Using the wrong type of extinguisher is never dangerous.	T	F
10.	If you have only one fire extinguisher, the best one to have is probably the multi-purpose dry chemical variety.	T	F

QUIZ 7
ANSWER KEY

Circle T for true or F for false for each of the following statements.

1. A lot of accidents can be avoided by wearing the right clothing and protective equipment. T F

2. Ear plugs or ear muffs should be worn when working with loud equipment. T F

3. Work boots protect against toxic gases. T F

4. If safety glasses or goggles are not worn around flying particles, the eyes could be injured. T F

5. You should disconnect a power tool when it is not being used. T F

6. All injuries should be treated within 48 hours to prevent infection. T F
   (*They should be treated immediately.*)

7. Flammable materials should be used around fire or flame. T F

8. "Horseplay" is dangerous because animals could be injured. T F

9. Using the wrong type of extinguisher is never dangerous. T F

10. If you have only one fire extinguisher, the best one to have is probably the multi-purpose dry chemical variety. T F

TEACHER'S ACTIVITY GUIDE

UNIT EIGHT: SEQUENTIAL INSTRUCTIONS

TOPICS: Assembly, repair and maintenance procedures

SKILL OBJECTIVES: Comprehend and describe steps in a procedure
Report on work completed or in progress
Recognize formal vs. informal vocabulary
Read instructional texts and use a glossary
Take open-book, short answer tests

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
Introduction Ask sts. about their experiences with following technical instructions, e.g., reading assembly instructions. Ask, "Have you ever had to read manufacturer's instructions? What was difficult about them?" State learning objectives for Unit Eight.			
A) **Listening: Lecture (60 min.)** Give lecture, stopping to answer questions during the lecture; sts. take notes. Ask for volunteers who can restate the instructions given in the lecture. Repeat the lecture if appropriate. Sts. complete worksheets. Review worksheets.	Imperatives Conditionals Formal vs. informal vocabulary Adverbs of sequence	woodworking veneer, stain power saw angle guide protractor divider apply	Lecture 8A Visual 8A Worksheet 8A(1) Worksheet 8A(2)
B) **Oral Presentations (Time will vary)** Refer to Worksheet 8B for conducting this activity. Discuss the assignment on the worksheet with sts. As each st. gives an oral presentation, have other sts. take notes. Following each presentation, have sts. ask the presenter questions. Finally, ask 2-3 comprehension questions and have sts. either respond orally or submit answers in writing.	Imperatives Adverbs of sequence	Oral Instructions Assembly and Repair Materials	Worksheet 8B

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
C) Reading (60 min.) Refer to Teacher's Notes 8C. Introduce reading topic. Ask pre-reading questions. Sts. read silently. Sts. ask questions; assess and facilitate comprehension. Discuss feature of "article deletion" (Notes 8C). Sts. complete worksheets; discuss grammar as necessary.	Passives Adverbial clauses with gerunds Present perfect Article deletion	soldering molten adhesion bond fitting join joint assemble/ly tube flux torch mallet	Teacher's Notes 8C Reading 8C Worksheet 8C(1) Worksheet 8C(2)
D) Reading/Graphical Literacy (45 min.) Ask pre-reading questions. Sts. read and examine chart silently. Assess general comprehension. Sts. complete Worksheet 8D(1). Review answers. Sts. do oral activity on Worksheet 8D(2); discuss grammar as needed.	Must/have to Prepositions of time "to have something done"	Maintenance Procedures scheduled service interval warranty replace lubricate adjust	Reading 8D Worksheet 8D(1) Worksheet 8D(2)
E) Reading (40-60 min.) Refer to Teacher's Notes 8E. Ask pre-reading questions. Sts. read silently or aloud. Assess general comprehension. Sts. read 2nd time. Conduct post-reading activities.	Imperatives Gerunds Passive constructions with modals	Electric Portable Saw Sawing Applications Safety Precautions and Procedures	Teacher's Notes 8E Reading 8E
F) Reading/Discussion (Time will vary) In advance, ask sts. to bring to class instructions which describe a procedure. Refer to Teacher's Activity 8F for information on conducting this activity.			Teacher's Activity Guide 8F Instructions brought to class by sts.

ACTIVITIES	KEY LANGUAGE	KEY VOCABULARY	MATERIALS
G) Evaluation (30 min.) Inform sts. in advance that quiz will be "open-book" and discuss open-book test strategies (See Appendix). Sts. take quiz, using notes and unit materials. Review answers and test-taking strategies.			Quiz 8 (Open book, short answer) Quiz 8 Answer Key

BUILDING A GEOMETRIC BOTTLE RACK

Today I would like to talk about a little woodworking project. I would like to tell you how to make a simple geometric rack. Most people use the rack for storing bottles of wine, but you could use it to store any kind of bottles or cylindrical objects. Take a look at the diagram. As you can see, only a few materials and some basic tools will be needed for building the rack.

These are the materials you'll need:

- 8 feet of 1 by 12 pine wood or any other light wood--in other words, one 8 foot board which is 1" thick and 12" wide
- 20 finishing nails, size 4d--4d nails are 1 1/2" long
- yellow carpenter's glue
- veneer or stain
- paintbrush

Now, you'll need some basic tools. You'll need a saw--either a handsaw or a portable electric powersaw. If you use a power saw, you'll need an angle guide for cutting angles. If you use a handsaw, you won't need an angle guide for cutting, of course, but you'll need some way of measuring and marking angles before you saw. A protractor can be used for this. The only other tool you'll need is a hammer.

So, do you understand what materials and tools you'll need for the job? Any questions? (Pause ...answer any questions.)

O.K., this is what you do. First, you measure the board and mark it to the lengths shown in the picture (refer to visual). You can see that you need two pieces 21 5/8" long, two pieces 9" long and two pieces 13 1/2" long. Next, you saw the boards. Now, the pieces that are 13 1/2" long are the dividers that go into the middle of the rack, and you'll have to cut both ends of each divider at a 45° angle. If you're using a power saw, use your angle guide on the saw to do this. If you're using a hand saw, you'll need to mark the 45° angles in pencil before you saw. Do this by using a protractor, some kind of straight-edge (such as a ruler) and a pencil.

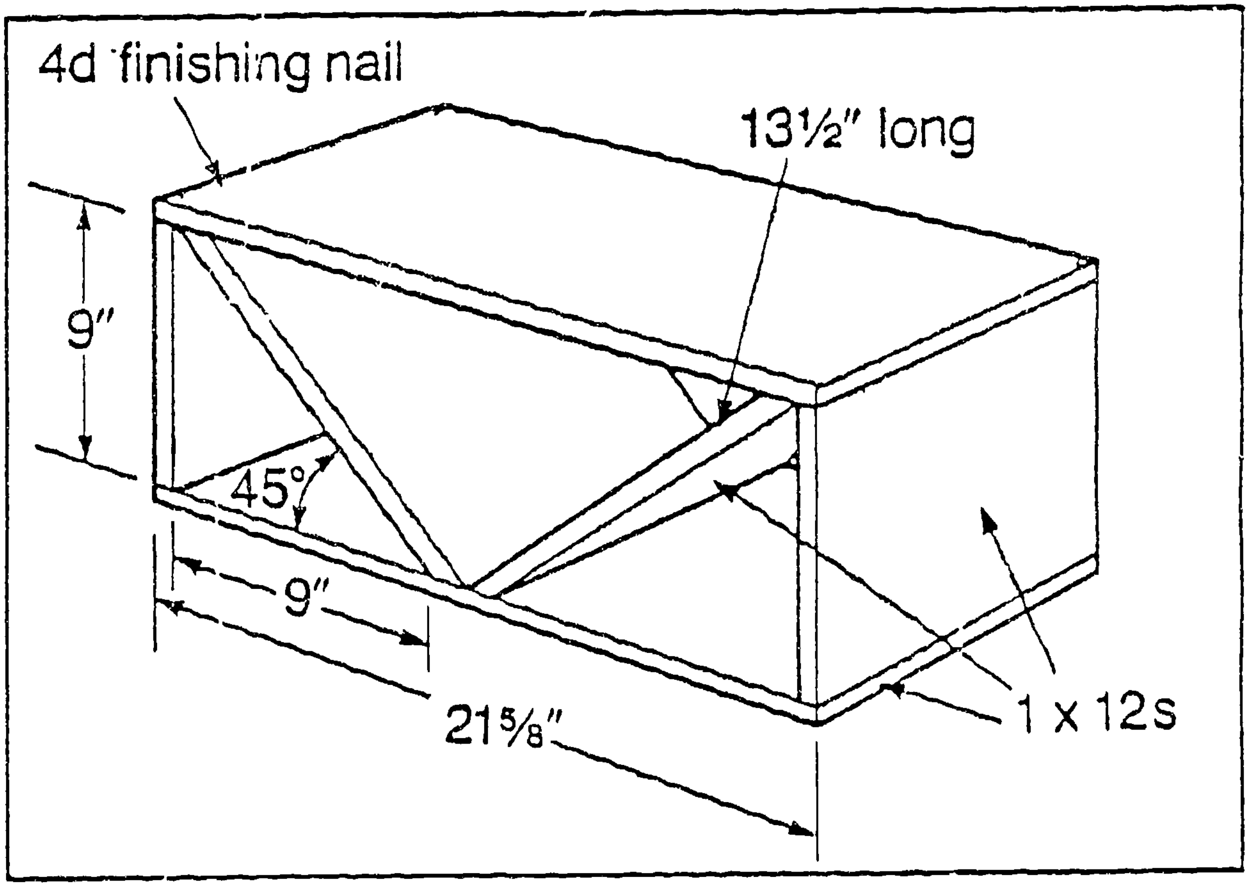
Now, when you have all your pieces sawed, all you have to do is put them together! Your long pieces are the top and bottom of the rack and the short pieces are the sides. Put yellow glue on the surfaces to be nailed. Nail the pieces together to form a box, just like in the diagram. Use a total of 12 nails for this. Then glue the ends of the dividers and nail them into the box. You'll be using 4 nails for each divider.

Remove any glue which may have squeezed out. The best way to do this is by wiping it off with a wet rag. Now let the glue dry overnight.

The last thing you'll do is finish the rack. Apply some kind of veneer or stain to the rack, using a brush. Let it dry overnight again.

Any questions? (pause...answer any questions) Well--it's a simple project, and it will really turn out nicely if you put it together according to these instructions.

Geometric Rack



From Basic Woodworking, copyright c1986, Lane Publishing Company, Menlo Park, CA 94025.

Steps in a Procedure

Put the steps for making the geometric rack in the correct order. Number them 1-11.

__4__ Measure, mark, and saw 45° angles on both ends of each divider.

__3__ Saw the board into 6 pieces.

__7__ Glue the dividers and nail them into the rack and nail them, using 8 nails.

__5__ Put glue on the surfaces of the boards which form the outside of the rack.

__11__ Let the finished rack dry overnight.

__8__ Wipe off extra glue.

__9__ Let the glue dry.

__1__ Get all the materials and tools you need for the project.

__2__ Measure the board and mark it for the correct lengths of the pieces you need.

__10__ Brush the rack with veneer or stain.

__6__ Nail the top, bottom, and sides together using 12 finishing nails.

Written vs. Spoken Instructions

Written instructions are more formal than spoken instructions, but they often have exactly the same meaning.

Example: Spoken "Get all the materials you need for the project."
Written Obtain the necessary materials for the project.

Practice making formal written instructions. Substitute one of the words below in the blank to make a formal written instruction out of the informal instruction given:

obtain	allow...to	fasten	apply
harden	insert	remove	finish
excess	proper		

1. First, get the required materials and tools.

   First, *obtain* the required materials and tools.

2. Then, measure the board and mark it for the correct lengths of the pieces you need.

   Then, measure the board and mark it for the *proper* lengths of the pieces you need.

3. After sawing, put glue on the surfaces to be nailed.

   After sawing, *apply* glue to the surfaces to be nailed.

4. Next, attach the top and bottom pieces to the sides, using 4d fin. nails.

   Next, *fasten* the top and bottom pieces to the sides, using 4d fin. nails.

5. Put the dividers into the rack and nail them.

   Insert the dividers into the rack and nail them.

6. Take off any extra glue which may have squeezed out.

   Remove any *excess* glue which may have squeezed out.

7. Allow the glue to dry overnight.

   Allow the glue to *harden* overnight.

8. The next day, brush the rack with veneer or stain.

   The next day, *finish* the rack with veneer or stain.

9. Let the rack dry overnight.

   Allow the rack *to* dry overnight.

Oral Presentations

A. Prepare a short (under 5 minutes) oral presentation on how to perform a simple assembly, repair, or maintenance procedure of your choice. Give the presentation to your classmates. Imagine that your audience does not know how to perform the procedure you will describe. Tell them directly and clearly what they must do in order to perform the procedure.

Each presentation should include:

1) Introduction of the topic,
2) Materials needed for the procedure,
3) Steps in the procedure,
4) Any important safety precautions.

Here are some sample topics:

- changing the oil in a car
- defrosting a refrigerator
- making a model airplane
- installing a smoke alarm
- changing a bag in a vacuum cleaner.
- playing a video cassette in a VCR
- cleaning a record album
- preparing a simple food dish (e.g., peanut butter and jelly sandwich)

B. During your presentation, the students in the audience will take notes on the procedure. Following your presentation, they may ask you questions about any part of the procedure that they did not understand.

Preparation for Reading 8C

Discuss want soldering is and its application before you ask students to read Reading 8C.

Solder is a mixture of tin and lead. Soldering is a process whereby solder is melted and used to join two pieces of metal. In plumbing, soldering is used to install and repair water pipes and drains. In refrigeration work, soldering can be used to join either two pieces of copper tubing or a piece of copper tubing to a "fitting." A fitting is a piece which connects two pieces of tubing, and is usually made of brass. A "T" fitting is shown in the pictures in the reading.

In the type of soldering shown in the reading, the pieces which will be soldered are heated using a torch. The solder itself is not heated by the torch. When the solder is touched to the hot metal, it melts and flows around the joint.

Discussion of article deletion

After the students have read the reading and you have insured their comprehension by discussing it with them, point out that Steps 1-8 in the reading are missing many definite and indefinite articles. Ask students if they had noticed. Explain that omitting articles is very common in technical writing, especially in procedures.

In Step 1, for example, a grammatically correct sentence would read, "Select and cut the tube to the (proper) length".

Point out several examples of missing articles in Steps 1-8 and ask students if they can identify additional ones.

You will also notice that in this reading the feature of "article deletion" is not consistent. Sometimes the articles are provided, but usually they are not.

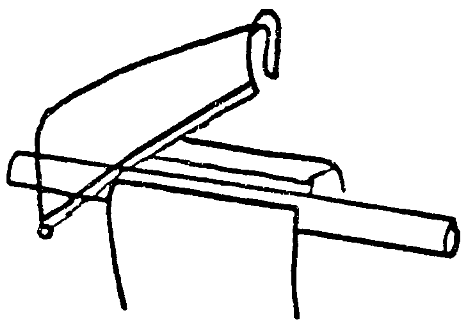
SOFT SOLDERING

Soldering is a method of joining or bonding two pieces of metal together. This is done by melting and flowing another metal or combination of metals with a lower melting temperature between the other two pieces. In soft soldering, the solder is usually made of 50% lead and 50% tin. In air conditioning and refrigeration servicing, the student will often need to join a repair tubing and other metals by this method. Often two pieces of tubing are joined together by means of a fitting. Whenever a connection is made using the soldering method, the resulting joint is called a sweat joint.

Below is the step-by-step procedure for making a sweat joint.

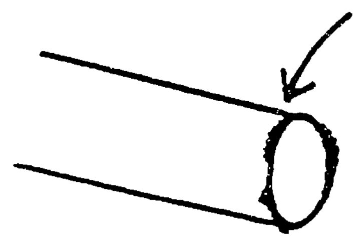
Step 1

Select and cut tube to proper length.



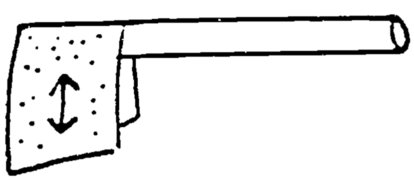
Step 2

Remove burr with file.



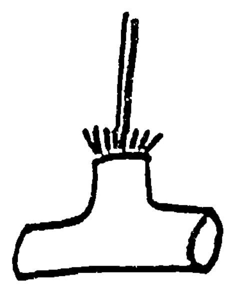
Step 3

Clean ends of tubing thoroughly with sandpaper.



Step 4

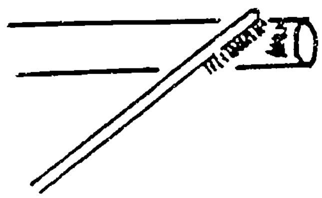
Clean inside of fitting with clean wire brush or sandcloth.



Reading adapted from the Project BEST Lab Manual, Project BEST, Oakton Community College, Des Plaines, IL, 1986.

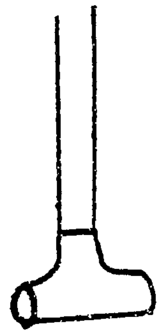
Step 5

Apply flux to outside of tube on one end, leaving 1/16" with no flux.



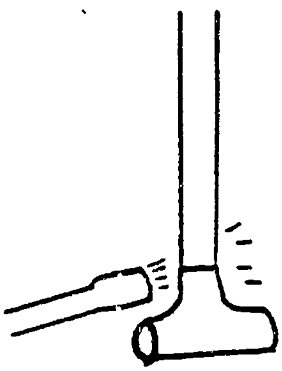
Step 6

Insert tubing into fitting.



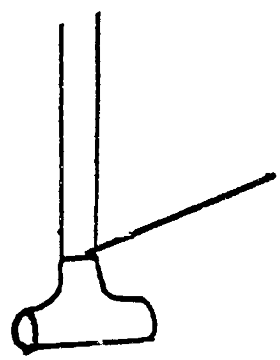
Step 7

Apply heat with torch to the assembly.



Step 8

Remove flame and touch solder to the joint, feeding it around the joint.



GLOSSARY

burr - rough edge
flux - sticky material used when soldering joints
joint - connection between two pieces; the place where pieces have been joined
sweat joint - soldered joint

Steps in a Procedure

A. Put the steps for soldering copper tubing in the correct order. Number them 1-10.

10	Solder is fed to the joint.
3	The outside ends of the tube are cleaned.
1	The tube is cut to the correct length.
5	Flux is applied to the tube.
2	Using a file, the burr is removed.
7	Heat is applied with a torch.
6	The tube and the fitting are assembled.
4	The inside of the fitting is cleaned.
8	The flame is removed.
9	The solder is melted by touching it to the hot metal.

B. Instructions can be given in an indirect form, using gerunds and passive verb constructions.

Example: After cutting the tube, the burr must be removed.

The same instruction can also be given in a direct form using imperative verbs.

Example: After you cut the tube, remove the burr.

For each of the instructions written below in an indirect form, write a sentence in the direct form.

1. Before cleaning the tubing, the burr must be removed.

   Before you clean the tubing, remove the burr.

2. Before applying flux, the tube must be cleaned.

   Before you apply flux, clean the tuge.

3. Before assembling the parts, flux must be applied.

   Before you assemble the parts, apply the flux.

4. After heating the fitting, the torch is removed.

   After you heat the fitting, remove the torch,

5. After removing the torch, the solder is fed around the joint.

   After you remove the torch, feed the solder around the joint.

Reporting on Progress

With a partner, practice asking and reporting about progress on a specific job. Several different kinds of jobs and the three steps involved are given below. Your partner will ask about your progress, and you will report that you've finished the first two steps and still have to do the third step. Take turns asking and reporting.

Example: Preparing a tube for soldering

1) Cut the tube. 2) Remove the burr. 3) Clean the tube.

Student A: How's it going?

Student B: Well, I've cut the tube and removed the burr, but I still have to clean it.

A. Soldering

1) Apply flux to the tube. 2) Heat the tube. 3) Apply solder to the tube.

B. Cutting a board

1) Measure the board. 2) Mark the correct length. 3) Saw it.

C. Finishing a surface

1) Sand the surface. 2) Apply a coat of paint. 3) Let it dry.

D. Repairing a car body

1) Fill the holes with bonding compound. 2) Apply primer paint. 3) Apply final coat of primer paint.

E. Tuning up a car

1) Change the spark plugs. 2) Check the distributor. 3) Set the timing.

Now, repeat the exercise. This time report that you have completed the first step but haven't completed the last two steps.

Example: Student A: How are you coming along?

Student B: I've cut the tube, but I haven't removed the burr or cleaned the tube yet.

This is a service maintenance chart found in the owner's guide of an American car made in the 1970's. The chart tells you which procedures must be done in order to keep the car in good running condition. It also tells you how often each procedure must be done.

SCHEDULED MAINTENANCE

REQUIRED MAINTENANCE SERVICES These services are not covered by the warranty, and you will be charged for the labor, parts, and lubricants used. **MAINTENANCE OPERATION**	SERVICE INTERVAL							
Number of months or thousands of miles, whichever comes first.	6	12	18	24	30	36	42	48
(E) Change engine oil (1)	X	X	X	X	X	X	X	X
(E) Replace oil filter (1)	X		X		X		X	
(E) Lubricate and check exhaust control valve for free operation (if so equipped)	X	X	X	X	X	X	X	X
(E) Replace fuel system filter	X							
(E) Check carburetor air cleaner element (2)		X				X		
(E) Replace carburetor air cleaner element (2)				X				X
(E) Adjust idle fuel mixture	X			X				
(E) Adjust fast idle speed	X			X				
(E) Adjust curb idle speed and TSP off-speed	X			X				
(E) Check the carburetor throttle, choke and delay valve, and air valve – adjust or replace as required	X			X				
(E) Replace crankcase-emission filter in air cleaner (2)				X				X
(E) Torque intake manifold bolts			X					
(E) Inspect fuel vapor emission system (hose, vapor lines, and fuel filler cap) – replace as required				X				X
(E) Replace PCV valve				X				X

(E) Item of Emission Control System

(1) Under normal driving conditions.

(2) More often if operated in severe dust conditions.

Reading Comprehension

Using the information in Reading 8D, fill in the blanks with the current word(s).

1. The chart gives a list of the _required_ maintenance services.

2. The services are not covered by the _warranty_, so the owner of the car has to pay for them.

3. The service interval numbers 6, 12, 18, etc. represent the number of _months_ or _thousands_ _of_ _miles_, whichever comes first.

4. The chart shows the service procedures for 6,000 through _48_,000 miles.

5. The symbol (E) in front of each procedure means that it has to do with the _emmision_ control system of the car.

6. According to the chart, you must change engine oil every _6_ months or every _6,000_ miles, whichever comes first.

7. The symbol (1) after the first procedure means that the service interval is correct when you drive under _normal_ conditions.

8. You must replace the oil filter every _second_ time you change the oil.

9. One thing you must do at 12 months or 12,000 miles is _check_ the carburetor air cleaner element.

10. One thing you must do at 24 months or 24,000 miles is _adjust_ the idle fuel mixture.

11. At 48 months or 48,000 miles, there are _6_ scheduled procedures.

12. The greatest number of scheduled procedures must be done at _24_ months or _24,000_ miles.

Procedures/Oral Practice

With a partner, practice asking about and telling when (or how often) the service procedures in Reading 8D must be performed. Choose a procedure and ask you partner about it. Take turns asking and responding until each person has asked five questions and given five responses.

Example 1: Student A: How often do I have to change the engine oil?
Student B: You have to change it every 6 months or 6,000 miles.

Example 2: Student A: When do I have to adjust the fast idle speed?
Student B: You have to adjust it at 6 months or 6,000 miles and at 24 months or 24,000 miles.

When you are finished, repeat the exercise but make one change in how you ask the questions and how you answer them. Most people who own cars do not perform the service procedures themselves. Rather, they have them performed by a mechanic. The expression "to have something cone" shows that you will let another person do the work for you. Now, repeat the exercise, but use this expression.

Example: Student A: How often do I have to have the engine oil changed?
Student B: You have to have it changed every 6 months or 6,000 miles.

Notes on Reading 8E

Reading 8E, taken from a vocational textbook on woodworking, was selected because it contains so many of the language features emphasized in Units 1-8 of this curriculum, including:

- definition
- function
- physical description
- safety considerations
- instructions for using a piece of equipment
- references to visuals

Use the reading to summarize and reinforce what students have learned thus far in the course. Any number of reading and post-reading activities can be done, depending on the time available. Here are some suggested activities:

1.a. During first reading, students mark unfamiliar vocabulary words.
b. Following reading, students discuss which of the words they marked were explained or made clear further along in the reading either through text, a visual, or from the entries in the glossary.

2. Students give short written responses to the discussion topic questions.

3. Students identify the sentences in the reading that:
   a. Give a definition
   b. Describe a function
   c. Give a physical description
   d. Give safety precautions
   e. Give instructions for operating
   f. Refer to visuals

4. Using the information from the reading, students practice giving a definition for the tool and describing the tool's function and physical characteristics.

5. Students' categorize safety precautions in two groups: 1) those which apply to all power tools, and 2) those which are specific to using this tool.

6. Students discuss which of the instructions for use must be carried out for every cut and which do not. (Ans.: Instructions 1, 5, 6 and 7 must be performed for every cut. Instructions 2, 3, and 4 only apply when the saw blade has to be adjusted or changed.)

   Ask students why instruction 4 follows instruction 3.
   (Ans.: During adjustments, the saw must be unplugged).

Sawing with the portable electric handsaw

The portable electric handsaw (Fig. 41–1) is used for crosscutting, ripping, beveling, and rabbeting and for cutting grooves, dadoes, and miters. Its great advantage is that since it is portable, it can be taken directly to a work area.

This tool, fitted with the right blades or abrasive disks, can be used for cutting many materials. It can cut ceramics, slate, marble, tile, nonferrous metals, corrugated galvanized sheets, and almost any other kind of building material. Woodcutting blades range in size from 4 to 12 in. (102 to 305 mm). The most popular blade is 6 to 8 in. (152 to 203 mm) in diameter. The combination saw blade is the kind most commonly used for all-purpose sawing.

The saws are light in weight, ranging from 6 to 12 lb (2.7 to 5.4 kg). Practically all of them have safety guards. Some have a special clutch arrangement to eliminate kickback. A ripping guide (Fig. 41–1) is a regular attachment and should always be used in ripping.

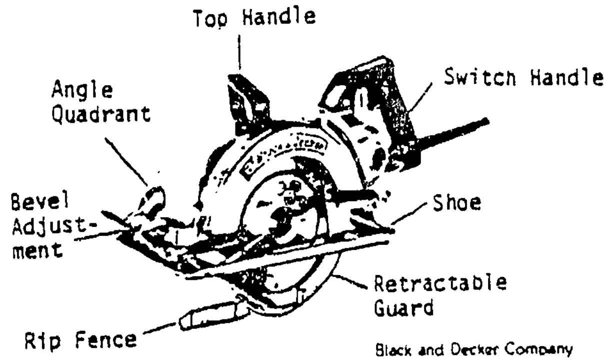


Fig. 41–1. A portable electric handsaw.

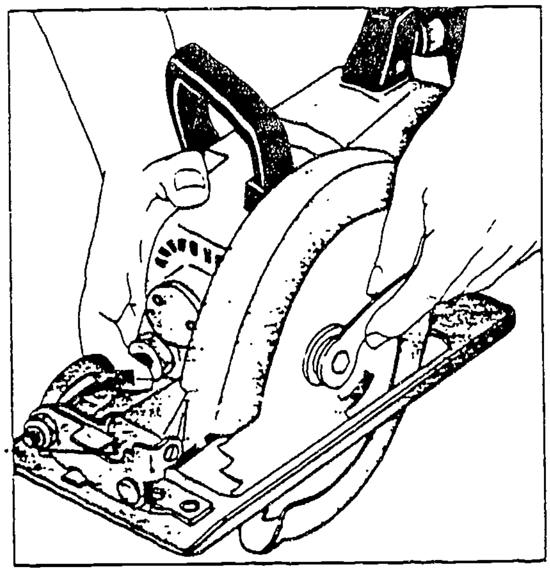


Fig. 41–2. Attaching the right blade. Note that the operator holds a finger on the button, which locks the mechanism while the saw blade is being tightened.

SAFETY

1. Always get your instructor's permission to use the portable electric handsaw.

2. Take the plug out of the electric power outlet when you are not using the tool.
3. Check to see that the electrical connection is grounded.
4. Make sure the blade is sharp. A dull blade may cause the saw to stall.
5. Keep the retractable safety guard operating freely. Use it at all times.
6. Always hold the electric saw firmly.
7. Use a guide in ripping.
8. Let the blade come to full speed before starting a cut.
9. Protect your clothing from the blade.
10. Do not try to make adjustments while the saw is working.
11. Always wear appropriate eye protection.

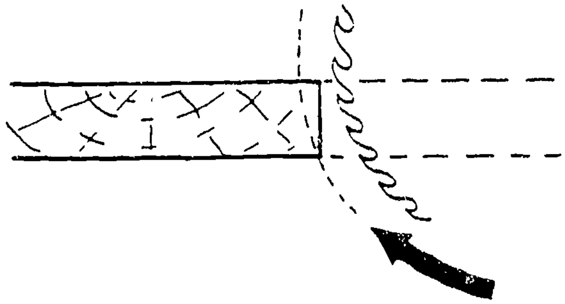


Fig. 41–3. The teeth of a portable electric handsaw cut upward.

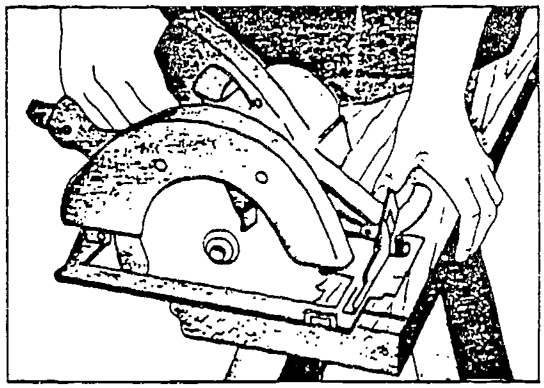


Fig. 41–4. Crosscutting with the portable electric handsaw.

Sawing

1. Lay out or mark the board to be cut.
2. Make sure the right blade is attached to the saw (Fig. 41–2).
3. Adjust the blade to the correct depth. The teeth of the blade should extend about ½ in. (13 mm) below the board being cut.
4. Plug the cord into an electric outlet.
5. Put the front of the base plate on the edge or end of the board. Line up the blade with the cutting line. Be careful not to let the teeth touch the board.
6. Press the trigger switch. Let the motor run freely a few seconds before you start to cut. Note that the teeth cut upward into the board (Fig. 41–3).
7. Guide the saw slowly but steadily on the waste side of the marked line (Fig. 41–4), or use the guide if you are ripping (Fig. 41–5). If the saw stalls, do not release the trigger switch. Back the saw up a little. This will let the blade regain full speed.

Crosscutting generally does not require a guide; *ripping* does (Fig. 41–5). *Bevels* (slanted edges) can be cut by regulating the bevel adjustment and by using angle guides (Fig. 41–6).

Discussion topics

1. What is the great advantage of the portable electric handsaw?

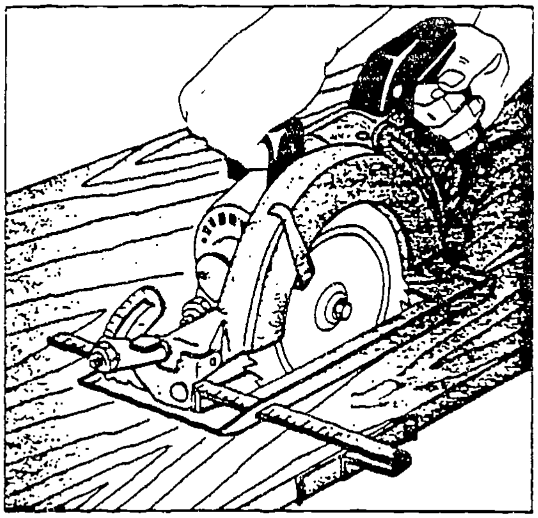


Fig. 41–5. Ripping, using a ripping fence as a guide.

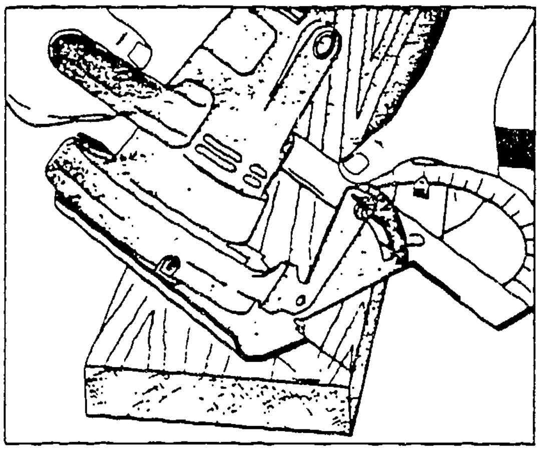


Fig. 41–6. Cutting a compound bevel with the aid of an adjustable angle guide.

2. What blade is most commonly used on the portable electric handsaw?
3. What attachment should you use when ripping with the portable electric handsaw?
4. In which direction do the teeth on a handsaw blade cut?
5. What do you do if the portable electric handsaw stalls?

(Below are a few words found in the glossary of the book General Woodworking.)

GLOSSARY

Many of the words used in *General Woodworking*, and listed in this glossary, have several meanings. The definitions given here will help you understand the technical use of these words in the field of woodworking.

bevel A slanted edge.

combination blade A circular saw blade with a combination of ripsaw and crosscut-saw teeth; operates on a power-driven saw frame.

crosscut To saw against the grain.

crosscut saw A saw for cutting across the

dado (noun) A groove cut in a board; usually part of a dado joint.

grain The size and arrangement of the cells and pores of a tree. The three main kinds of wood grain are fine, medium, and coarse.

miter joint A joint made by fastening together two pieces of wood whose ends have been cut at an angle.

rabbet (noun) A groove cut on the edge or face of a board, especially as part of a rabbet joint.

rabbet (verb) To cut a rabbet in a board; to join two edges in a rabbet joint.

rabbet joint A joint made by fastening two rabbeted pieces together.

rip To saw or split lumber with the grain.

Discussion of Technical Instructions

1. Ask students to bring a set of instructions of their choice to class which describe how to perform an assembly, repair, or maintenance procedure. Instructions which are not too long, describe a relatively simple procedure and have illustrations are best. An example might be instructions which tell the user how to assemble the parts of a new product.

2. Select one or two of the samples which students have brought in and make copies for each student.

3. As a class, read and discuss the instructions. Analyze the items that make the instructions unclear or difficult to understand.

4. As a class, "rewrite" the instructions to make them more straightforward. You can either rewrite the instructions on the board or have students make selected changes to their copies. Items to look for and change include:

   a. Steps presented in an illogical order.

   b. Highly technical expressions (including nouns, adjectives, verbs, and idiomatic expressions) that can be simplified.

   c. Passive constructions that can be expressed in the active voice.

   d. Unclear or missing transitions between steps.

   e. Article deletions which cause ambiguity.

   f. Any other features which may cause confusion or present linguistic barriers to understanding.

This is an "open book" quiz. Use the Unit 8 readings, worksheets and your notes to help you answer the following questions.

1. What tools do you need to make the simple wooden geometric rack discussed in class?

____

2. What kind of nails are required for making the rack?

____

3. What does the term "joint" mean?

____

4. Give an example of something you could use to clean a piece of tubing before you solder it.

____

5. What happens to solder when it is touched to hot metal?

____

6. What does "apply" mean in technical instructions?

____

7. In soft soldering, what is the solder usually made of?

____

8. Refer to the chart on "Required Maintenance Services" in Reading 8D. What do the numbers 6, 12, 18, etc. represent?

____

9. Refer again to the chart in Reading 8D. When do the intake manifold bolts have to be torqued?

____

10. What is the great advantage of a portable electric handsaw?

____

QUIZ 8
ANSWER KEY

This is an "open book" quiz. Use the Unit 8 readings, worksheets and your notes to help you answer the following questions.

1. What tools do you need to make the simple wooden geometric rack discussed in class?

   You need a saw and a hammer.

2. What kind of nails are required for making the rack?

   4d finishing nails

3. What does the term "joint" mean?

   The connection between two pieces. (Glossary, READING 3C)

4. Give an example of something you could use to clean a piece of tubing before you solder it.

   Sandpaper.

5. What happens to solder when it is touched to hot metal?

   It melts.

6. What does "apply" mean in technical instructions?

   To "put on". (WORKSHEET 8A(2))

7. In soft soldering, what is the solder usually made of?

   50% lead and 50% tin

8. Refer to the chart on "Required Maintenance Services" in Reading 8D. What do the numbers 6, 12, 18, etc. represent?

   Months or thousands of miles, whichever comes first.

9. Refer again to the chart in Reading 8D. When do the intake manifold bolts have to be torqued?

   At 18 months or 18,000 miles.

10. What is the great advantage of a portable electric handsaw?

    It can be taken directly to the work area.

APPENDIX

TEST-TAKING STRATEGIES

One aim of the VITT Curriculum is to familiarize students with the types of tests they may encounter in vocational programs. Most vocational instructors give either tests which are standardized and only require students to circle or check answers, e.g. multiple choice and true/false, or they give tests which they can construct quickly, e.g. short answer tests. Instructors prefer to give tests which can be graded quickly, and thus rarely do they give tests that require long written answers. The quizzes in this curriculum are representative of the types of tests most often found in vocational programs.

In order to perform well on tests, it is important that students learn about and apply test-taking strategies. Both general test-taking strategies and strategies relating to taking specific types of tests are included in this appendix. They are intended to serve as the basis for study and class discussion both before and after students take each of the VITT quizzes.

GENERAL STRATEGIES

Preparing for Tests

1. Try to find out what kind of test will be given. If you know what kind of test to expect, you can prepare by asking yourself practice questions like the ones which might be on the test.

2. Begin preparing for the test as soon as possible. Remember that studying often for short periods is more effective than studying for long hours at one time.

3. When you prepare for a test, think of the task positively! It is the best opportunity to really learn the material for future application. 4. Ask the instructor which concepts and topics are most important to study. Instructors will usually give you this information, although they will not tell you the exact questions on the test.
5. Look at all your notes and readings and organize the information into logical units, such as main topics.
6. Make a study plan by writing down the main topics and adding the most important points to concentrate on.
7. Read all lecture notes, notes from readings, and review important exercises you have done.
8. Make a new set of study notes which contain the most important information.
9. Practive writing difficult words and their definitions.
10. Review your notes on several different days.
11. Test your memory of important facts by looking away from your notes and asking yourself questions.
12. If it's difficult for you to study alone, form a study group. Discussing the subject matter with other students helps the memory. However, you should know the basic facts <u>before</u> you study with other people. This is important for two reasons: 1) so that you can contribute your knowledge to the study session, and 2) so that you can recognize incorrect statements when your study partners make them.

Before the Test

1. Get a good night's sleep before the test. Being well rested makes it easier to remember what you have learned and studied.
2. Relax. Being too nervous makes it difficult to recall information you know.
3. Don't study anything new the day of the test--this will only make you nervous.
4. Eat a light meal a few hours before the test. Do not take a test on either an empty stomach or a full stomach; this will negatively effect your ability to concentrate.
5. Arrive in the test room a little early so you can make yourself comfortable.
6. Keep an optimistic attitude; don't let negative comments from other students make you nervous.

Taking the Test

1. Listen carefully to the teacher's instructions before and after the test is passed out.
2. When you receive the test, look at all of the different parts and pages to see what types of questions and how many questions there are.
3. Budget your time. If it is a long test you may have to decide how long to spend on each part.
4. Read all directions carefully; they may be different from what you expected.
5. Study all examples carefully.
6. If you don't understand what you are supposed to do, ask the instructor.
7. When you begin to write, skip questions which are very difficult and return to them after you have finished the other questions. Often you will find clues to the answer in another part of the test.
8. If you don't know the answer to a question, make a guess (unless it is the type of test on which you lose points for incorrect answers). The concept of "educated guessing" is crucial to test-taking. "Guessing" is the underlying strategy to improving test scores beyond what knowledge of the content area alone would allow. Guessing involves applying knowledge of a specific test format and identifying clues in the test items.
9. Your first response is usually correct. Don't change an answer unless you are sure you made a mistake or misunderstood the question.
10. When you have finished answering all the questions, spend as much time as you have left to go back and check your answers.
11. Make sure your name is on the test or answer sheet before you turn it in.

After the Test

1. When you get the test back, go over the results carefully.
2. Pay equal attention to the items you got right and those you missed.
3. Add any new information to the ones you got right and make corrections to the items you missed directly on the test form.
4. For the items you missed, try to determine the reason why. Was your study plan a good one?
5. Use the test results to help you improve your plan for studying the next test.

SPECIFIC STRATEGIES

Multiple Choice Test Strategies

1. Try to figure out the answer before you look at the choices.
2. Read all the choices before you pick one. If none seem 100% correct, take the closest one.
3. If you are recording your answers on a separate answer sheet (especially machine-graded answer sheets), make sure that you mark your answers accurately.
4. Choices with absolute expressions such as "always, all, never," and "none" are usually incorrect.
5. Choices with expressions which are more "flexible," such as "usually, often," and "generally" are often correct.
6. If two choices are similar, usually one of them is correct.
7. If two answers are direct opposites, usua ly one of them is correct.
8. Make sure the choice agrees grammatically with the stem.
9. If two quantities (numbers) are almost the same, one is usually correct.
10. If the quantities (numbers) cover a wide range, usually one in the middle is correct.

True-False Test Strategies

1. Read each word carefully. If one word is false, the whole statement is false.
2. Don't spend too much time analyzing the statements; true-false test questions test your knowledge of facts and usually don't require interpretation.
3. Statements with absolute expressions such as "all, always, never," and "only" are usually false.
4. Statements with "flexible" expressions such as "usually" are usually true.
5. There are usually more "trues" on a test than "falses."

Fill-in-the-Blank Test Strategies

1. Read the statements carefully but don't overanalyze their meanings. The words you need to fill the blanks come directly from your lectures and readings.
2. After you have looked at all the words in a statement, try reading the statement quickly. Sometimes this will help you "see" or "hear" the missing word(s) in your mind.
3. Pay attention to the number of blanks in a statement. Usually the teacher knows exactly how many words must be used.
4. Pay attention to the length of the blanks. Some teachers will make the blanks short or long depending on which word must go in the blank.
5. Remember that the words you put into the blanks must fit meaningfully and grammatically. That is, the words must make sense and they must be the correct parts of speech.

Short-Answer Test Strategies

1. These questions usually test how well you have memorized certain words or facts. Your answers should be short and clear. Do not give interpretations.
2. Look ahead to the other questions to make sure you don't give the answer to a question which is coming up.
3. Often you must define a word. When giving a definition of a concept or an object, remember to consider:

   WHAT - What category it is in; what it looks like; what it's characteristics are

   WHERE- Where it is found or used

   WHEN - When it is used or takes place

   HOW - How it works, how it is used

   Examples:

   Define solid.

   Answer: A form of matter which has a definite shape.

   Define coping saw.

   Answer: A wood saw that's used to saw curved lines in wood.

   Define piston.

   Answer: A part in an internal combustion engine which moves up and down in a cylinder.

Open-Book and Take-Home Test Strategies

1. Prepare well for the test. This is the most important strategy because these tests are often the most difficult kind.
2. Know where to find the information in your book(s). This type of exam doesn't test what you know as much as it tests your ability to find important information quickly.
3. Use the table of contents and the index to help you find the information you need.
4. When you find an answer to a test question, try to write the answer using your own words.
5. If you copy more than a few words directly from the book, put the words in quotation marks and give the name of the book and the page number.

"Pop Quiz" Strategies

1. The only way to prepare for these is to do your homework! Complete all study and reading assignments on time and keep up with the course syllabus.