

ACTIVITIES

CROSS-CURRICULAR EXTENSIONS

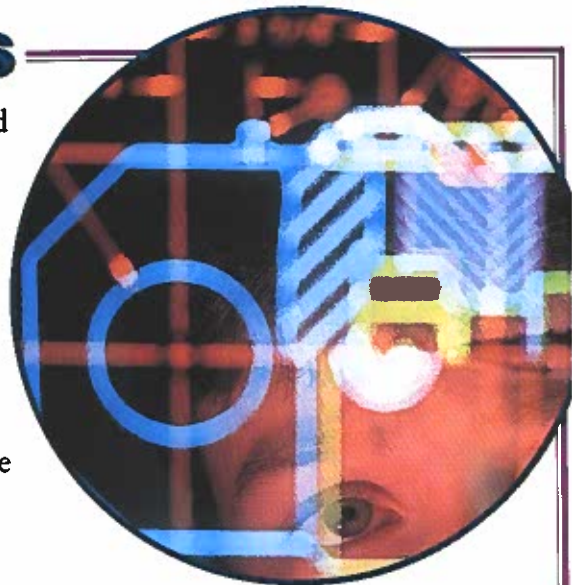
- 1. SCIENCE** Make a working Rube Goldberg-type invention that uses simple machines. (If you haven't seen one of Rube Goldberg's inventions, do some research!)
- 2. MATHEMATICS** Make a drawing and build a scale model of an invention.
- 3. COMMUNICATION** Write an article for your school newspaper on current fads in your school or community.

EXPLORING CAREERS

As you've read, many companies have research and development departments that develop new product ideas. Here are two careers involved in research and development.

Electrical Engineer Almost any piece of equipment that plugs into electrical current or runs on batteries was designed in part by an electrical engineer. These workers design products and test them to be sure that they work. If not, it's back to the drawing board. Electrical engineers have excellent mathematics skills and are good problem solvers.

Computer Microchip Designer Microchip designers create the "brains" of computers and other electronic devices. Also known as semiconductor processors, microchips can be found in everything from garage-door openers to portable CD players. Designing involves teamwork, so designers must like working closely with others and sharing ideas. Good problem-solving skills are also a must.



ACTIVITY

Take a vote in your class as to the most useful invention in the classroom. What do you think you would miss the most if it were not there?

Making Things

SECTION

1 What Resources Do We Need?

2 Choosing and Conserving Resources

ACTION ACTIVITY **Setting Up a Recycling Center**

3 How Products Are Manufactured

ACTION ACTIVITY **Making a Can Crusher**

What Resources Do We Need?

SECTION 1

THINGS TO EXPLORE

- Tell what a resource is.
- Identify different categories of resources needed to make a product.
- Tell the difference between renewable and nonrenewable resources.

TechnoTerms

fossil fuel
nonrenewable
profit
renewable
resource

Before a product can be made, resources are needed. A **resource** is anything that is used in the production of the product. What are some of the resources used to make products, and where do you find them? Fig. 7-1.

Resource Groups

Resources fall into seven basic groups that include the following:

- **People.** Technology is created by people. People have used their ideas and knowledge to invent and build products that meet their needs. Companies hire people for their ideas and skills.

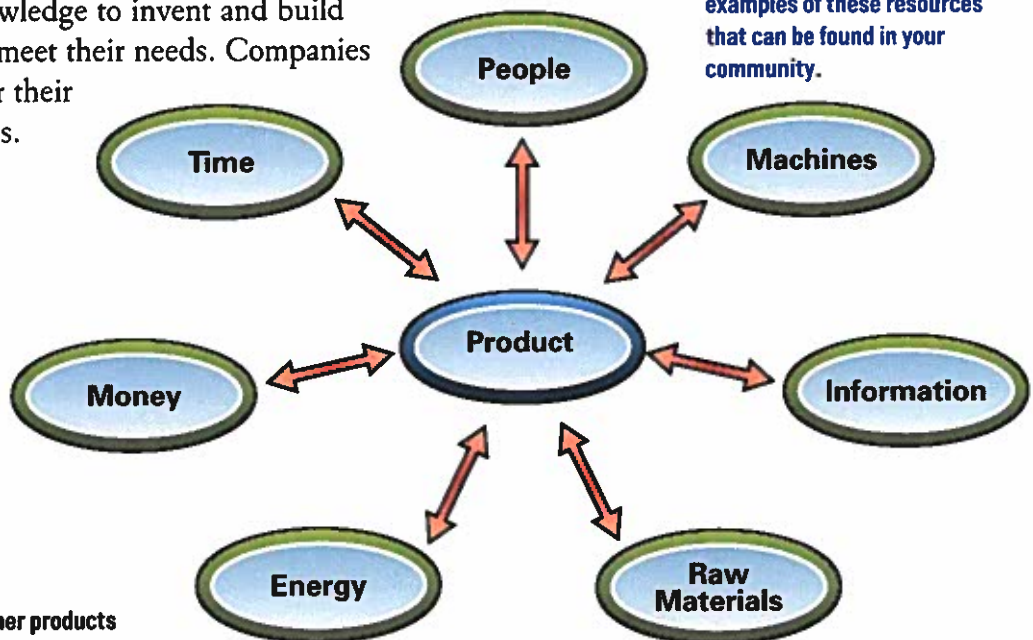


Fig. 7-1. Many resources are used to make a product. Name examples of these resources that can be found in your community.

OPPOSITE TVs and other products are made at this electronics factory. How many resources are being used in this picture?



Fig. 7-2. Electricity produced by this hydroelectric plant on the Columbia River in the Pacific Northwest is renewable. As long as the river flows, its energy can be gathered and used. Many people are concerned about the effects of dams on the environment. Research the pros and cons of dams and hold a class debate on the issue.

INFOLINK

See Chapter 13 for more information on energy.

- **Machines.** We rely on machines as a resource to help us do work. By means of computer technology, machines often run automatically.

- **Information.** People use information to design, produce, and sell products. Because our knowledge base is growing so quickly, there are companies that gather, organize, and sell information.

- **Raw materials.** You probably know that natural resources include water, land, minerals, fuels, and timber. But

did you know that some of these resources, such as **fossil fuels** (oil, coal, natural gas), are **nonrenewable**? Nonrenewable means that once the resource has been used up, it is gone forever!

- **Energy.** Energy is used to make things and to transport products. It is also used to heat, cool, and light the buildings that we live and work in. Some sources of energy are limited. **Renewable** resources can be replaced. Renewable energy sources include plant and animal matter (biomass), geothermal heat (heat from the earth), and the energy of moving water. Fig. 7-2. The sun is the source of nearly all forms of energy on Earth.
- **Money.** You need money to start and maintain a business. Once a company is making a **profit** (money left over after all bills are paid), it uses much of that money to expand the business.
- **Time.** Time is a resource because it takes time to make a product. In many cases, time helps determine which other resources you can use and how you can use them.

SECTION 1

TechCHECK

1. What is a resource?
2. Name six different resources you might use to make things.
3. What does *nonrenewable* mean?
4. **Apply Your Knowledge.** Research renewable and nonrenewable resources. Make a newsletter using desktop publishing to share this information with others.

Choosing and Conserving Resources

THINGS TO EXPLORE

- Explain why resources are selected to make certain products.
- Tell how you can conserve resources and protect the environment.

TechnoTerms

conserved
decompose

Early people relied on muscle power to survive and to make the things they needed. As technology grew and changed, people were able to extend that power by using machines. Fig. 7-3. The energy of moving water, steam, oil, and the atom have been added to the list of resources that people can use to make things.

Choosing Resources

Whether or not a resource is used to make a product often depends on its availability. Suppose you were going to start a company that needed to use a great deal of electricity. You would probably try to find an area in the country where electricity is always available and low in cost.

As you design products, you should pick materials that fit the product. For example, paper clips made of pure silver might look good, but they would be too heavy and too expensive to be practical.

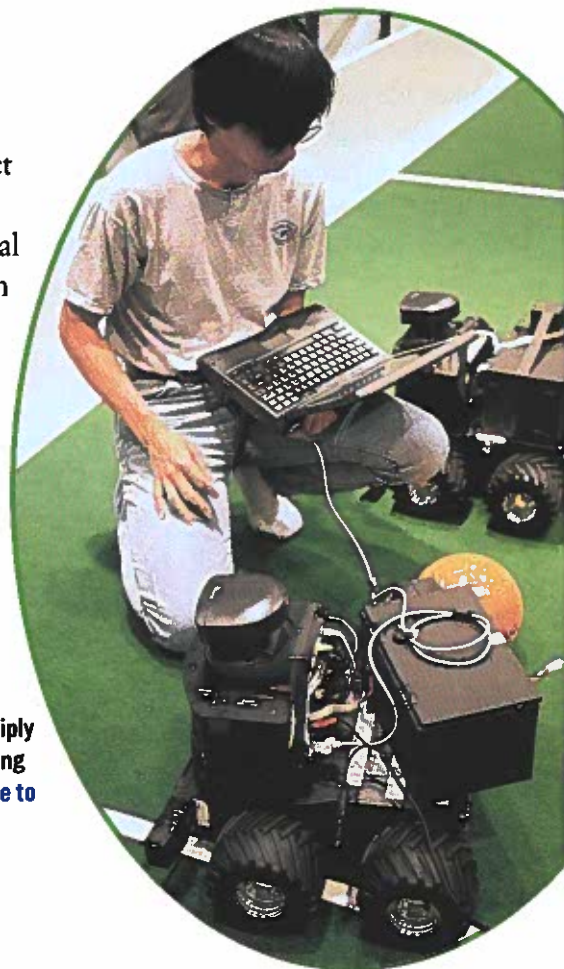


Fig. 7-3. Machines help us multiply our human powers—even for playing soccer! What games would you like to see robots play?

INFOLINK

See Chapter 1 for more information about the development of technology.



Fig. 7-4. You can save fuel resources by carpooling with a friend to school. Name some other methods for saving energy.

TechnoFact

GASP! Did you ever think about the fact that the air you breathe and the water you drink are recycled? The Earth is a *closed system*. There are no other sources of air or water than what has always been on Earth. The air you are breathing now and the water you have been drinking have been used by someone else before you. (But if air and water are polluted, they cannot be used safely again by anyone.)

You must also use resources wisely and not waste them. For example, the cost of energy used to make and transport products is increasing. If energy can be **conserved** (saved), that may help reduce the cost of products. Fig. 7-4.

Some nonrenewable resources, such as aluminum, can be recycled (used again). Aluminum requires a great deal of electricity to produce the first time. By recycling, you can save not only the mineral resource but the energy used to produce it as well.

Is Our World Disposable?

Are companies producing products without thinking about the appropriate use of resources? These are hard questions for you to answer, but you need to ask them.

For example, you are surrounded by products that companies claim are “disposable.” Think about all the paper and plastic cups, food containers, and packaging materials that your family throws in the garbage each week. As you learned in Chapter 3, these materials end up being thrown into landfills where they take many years to **decompose** (break down). Today, you must use resources carefully and be aware of how they will affect the environment after they are no longer in use.

INFOLINK

See Chapter 3 for more information about landfills and recycling.

Be Part of the Solution, Not Part of the Problem

The problems facing us and our environment did not happen overnight. They cannot be solved overnight either. Some of the suggestions below might not sound as if they would be much help, but they will. Think about the results over your entire lifetime! We can all do things that will make a difference.

- **Recycle materials.** Aluminum, newspaper, glass, and other materials can be recycled. Recycling helps in two ways. It saves the energy that would be needed to make new materials. It also keeps the materials from taking up space in landfills. In addition, recycling can save manufacturers and consumers money.
- **Conserve energy.** Using less energy means burning less fossil fuel or producing less nuclear waste. If everyone used less energy, it would help them save money and help the environment, too. Fig. 7-5.

TechnoFact

IT ADDS UP Even if you recycle only one pound of aluminum each month, you will have recycled about 300 pounds by the time you are in your 40s. Because aluminum is so light, that's a lot of soda cans!



Fig. 7-5. The solar car (top) has photovoltaic cells in its roof. The sun provides the energy. The state of Iowa helps conserve energy by using flexible fuel vehicles (bottom) that run on blends of gasoline and up to 85 percent ethanol (an alcohol made from grains). Which service stations in your community sell ethanol blends?

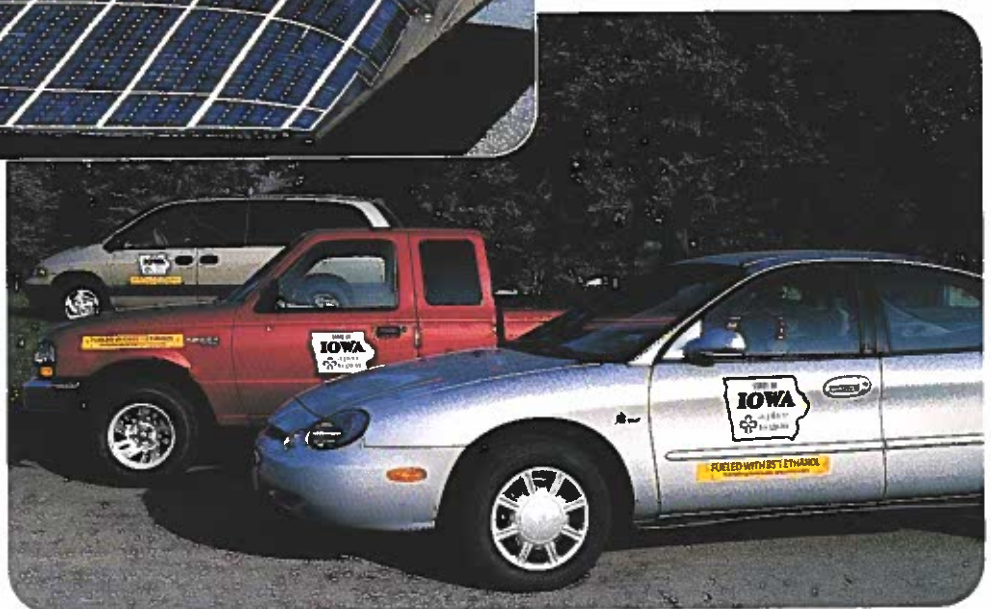




Fig. 7-6. People can have an effect on technology by the way they cast their votes. Ask a family member how he or she voted regarding a recent technology-related issue. How did the voting turn out?

TechnoFact

SMART LIGHTS

Think about all the lights left on in homes and office buildings when no one is there. That's a huge waste of electricity. New sensor systems can turn lights off when a room is empty. When someone enters, they react to movement and turn the lights back on. Researchers predict that these "smart" lighting systems will save 20 to 40 percent of electric lighting costs.

- **Get involved.** Be a part of public service organizations in your school, your community, your state, or even at the national level. Help these groups to clean up the streets, build parks, fix up old houses, or do other things to conserve resources and improve the environment.
- **Be technologically literate.** Studying technology can help you make informed choices about appropriate uses of resources and how they affect the environment. You will also be able to make informed choices when you vote for people who will represent you in government. Fig. 7-6. That is where many decisions about handling our resources are made.

As you design systems and products in the next chapters, be aware of all the resources you use. Most important, be a good consumer of these resources.

SECTION 2

TechCHECK

1. Why might a manufacturer choose one resource over another?
2. What does it mean to use a resource carefully?
3. Name four things you can do to conserve resources and help the environment.
4. **Apply Your Knowledge.** Organize a group of students to collect the litter around your school for a week. Recycle as many materials as you can. Keep track of what things you find and create a news bulletin or newscast to share your findings.

Setting Up a Recycling Center

Real World Connection

Just think of all the paper and aluminum cans discarded every day. Fig. A. If your class can help to make recycling easy and convenient, more people might pitch in and help. In this activity, you'll set up a recycling center.

Be sure to fill out your **TechNotes** and place them in your portfolio.

Design Brief

Design and make a recycling center for your school or classroom. The center should provide containers that are clearly marked for the type of materials to be put in them. Your design should also include posters that explain the importance of recycling and how to use the recycling center.

Materials/Equipment

- posterboard
- markers
- garbage cans
- plastic bags
- computer with graphics software (optional)

SAFETY FIRST

Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.



Fig. A

(Continued on next page)

**ACTION
ACTIVITY****Procedure**

1. Work as a large group. Brainstorm ideas for the recycling center. Ask the principal of your school to give your class advice on the best way to set up your recycling center.
2. Decide how you would like to have your center work and choose its location. If your school is very large, you might consider having two or more centers or a small center for each classroom.
3. Make a plan for who will be responsible for each detail of your center. For example:
 - Who will empty the containers when they are full?
 - Where will the materials be taken for bulk recycling?
 - How will you safely handle broken glass or heavy paper?
 - Which teachers can you get to help?
 - Who will make the posters to encourage people to use the recycling center?

4. After your class has built the center, advertise it in the student newspaper, on bulletin boards, and in any other place where students and teachers will notice.
5. Start your recycling project with a special announcement from the principal or a cooperating teacher. Encourage other students to help with the project.

Evaluation

1. Which recyclable material is most common in your school? Which material is least used?
2. What would have happened to the recycled material if your project had not been started?
3. **Going Beyond.** Make a large poster that illustrates in a graph the amount of material your school is recycling.
4. **Going Beyond.** Research materials used commonly in your school, such as copier and computer paper. Find out if those materials are available in recycled form. Compare the prices of new paper and recycled paper.



How Products Are Manufactured

SECTION 3

THINGS TO EXPLORE

- Define what a process is.
- List four different processes used to make things.
- Use manufacturing processes to make a product.

TechnoTerms

manufactured
processes
quality control

Everyday products, such as the pen or pencil you write with, the paper you use, and the bus that may have brought you to school, are made, or **manufactured**, in factories. The raw materials are changed into products by means of **processes**. Fig. 7-7.

Manufacturing Processes

The major manufacturing processes and the machines used for them can be put into the following groups:

- **Forming:** Molding or changing the shape of materials
- **Machining:** Changing the shape of materials by cutting away pieces, or “chips”
- **Fastening:** Holding materials together with nuts and bolts, welding, or adhesives
- **Finishing:** Painting, varnishing, or coating products with plastic

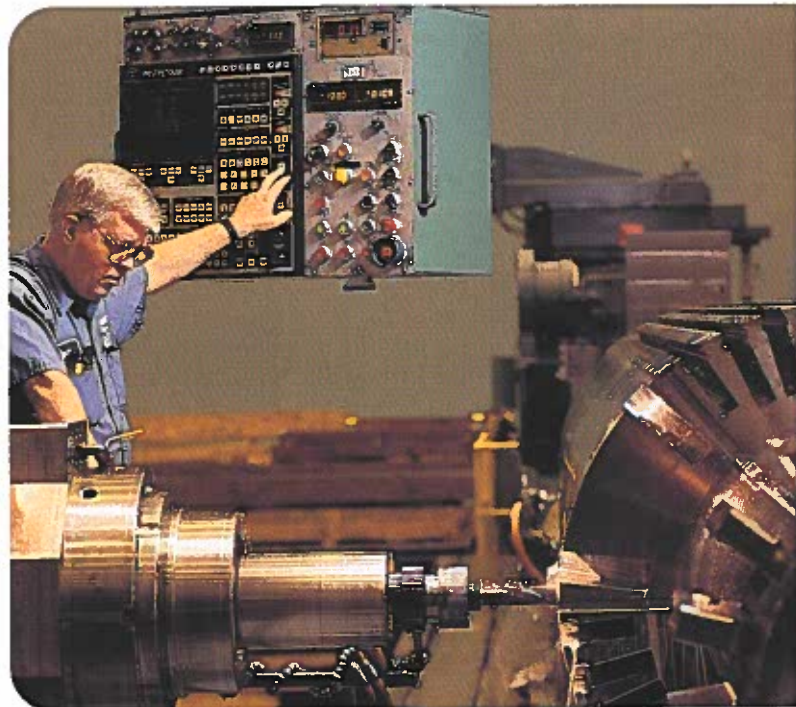


Fig. 7-7. An automated machine does precision drilling. Drilling is which of the four processes?

INFOLINK

See Chapter 11
for more
information
about quality
control.

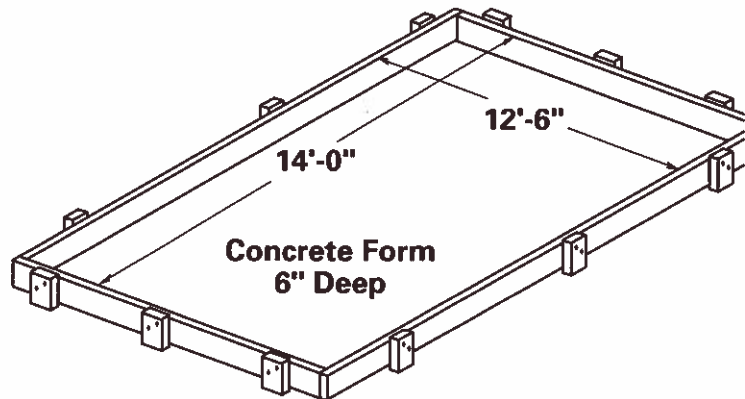


Fig. 7-8. A laser is an intensely focused beam of light. Here a laser is used to cut metal. Name some other uses for lasers.

MATHEMATICS CONNECTION

The Builders' Favorite!

Did you know that concrete is the most commonly used building material on Earth? Think about the fact that buildings, roads, dams, house foundations, and even sidewalks are often made of concrete.



INFOLINK

See Chapter 9 for more information about measurement.

In all processes, accurate measurements are important. Measurement can be done by hand or automatically by a machine. As products are made, they are often checked to see if they are the right size or shape. This inspection of parts is called **quality control**.

People have been developing new processes and perfecting old processes since the Stone Age. You have learned about a few of them. Today the development of manufacturing processes is especially rapid. For example, technology has made it possible to use lasers and high-pressure jets of water to cut through tough materials. Fig. 7-8.

SECTION 3

TechCHECK

1. What is a process?
2. Describe four different manufacturing processes.
3. What process involves painting or varnishing?
4. **Apply Your Knowledge.** List and describe the processes you think would be needed to build a car.

TechnoFact

OSHA Many of the activities in this book include safety reminders. Your school also has rules about safety. In the workplace, the **Occupational Safety and Health Administration (OSHA)** sets safety standards. **OSHA** was established by the federal government and is part of the U.S. Department of Labor. Representatives of **OSHA** visit workplaces to make sure that safety standards are met.

Concrete is a mixture of sand and gravel held together by a “paste” of cement and water. The mixture has to be held in shape in a *form* while a chemical reaction called *hydration* makes the concrete harden, or *cure*.

The amount of concrete needed to fill a form is both a mathematics and a technology problem. The example here shows you how much concrete it takes to make a patio 14'-0" x 12'-6" x 6".

Step 1. Calculate the volume of the form. (Hint: Change inches to decimal feet.)

$$14 \times 12.5 \times .5 = 87.5 \text{ cubic feet}$$

Step 2. Change cubic feet to cubic yards.

Concrete is sold by the cubic yard. A cubic yard is 27 cubic feet (3' x 3' x 3').

Step 3. Divide cubic feet by 27 (one cubic yard).

$$\frac{87.5}{27} = 3.24 \text{ cubic yards}$$

ACTIVITY

How much concrete would you need to make a sidewalk 6" thick, 4' wide, and 50' long? Ask a local concrete supplier how much one cubic yard of concrete costs. Calculate the cost of your sidewalk.

Making a Can Crusher

Be sure to fill out your **TechNotes** and place them in your portfolio.

Real World Connection

One of the problems with recycling cans is that they take up a lot of space. By crushing them, many more cans can be transported easily to a recycling center. In this activity, you will design a product that can be used to crush aluminum cans.

Design Brief

Design and make an aluminum can crusher that will help people save space when recycling. The can crusher must be safe to operate, easy to use, and effective. The cans must be crushed to less than one-half their original volume. The materials used to build the can crusher must be some that have been recycled.

Materials/Equipment

- wood (plywood, etc.), scrap pieces 2" x 4", 2" x 6"
- steel or aluminum scrap, 1" x 1" x 1/8"
- miscellaneous fasteners
- abrasive paper
- band or scroll saw
- belt or disk sander
- drill press and drill bit set
- hacksaw
- screwdriver
- wrenches
- file
- computer with CAD software (optional)

SAFETY FIRST

- Your teacher will show you how to use the machines in your technology lab. Ask questions about anything that is not clear to you.
- Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.

Procedure

1. In this activity, you will build your own can crusher. First you must decide on a design. Think about how you would like your crusher to work—by stepping on it? by using your hands?
2. Your design must consider safety. You should avoid pinch points, where fingers could be caught during use. Some possible designs are shown in Fig. A.
3. As you put the finishing touches on your design, list the materials that you will need. Your list might look like this:

Quantity	Part Name	Material
2	linkage	1" x 1" x 1/8" steel

4. After you have finished your design and list of materials, have your teacher check your plans.
5. Follow the safety rules for each machine you use in making your crusher. Remember to ask the teacher for help if you are not sure how to do something.
6. Assemble your crusher, and check it for splinters or sharp edges that could cause injury. Use abrasive paper or a file to remove any sharp edges.
7. Test your crusher with an empty soda can.

Evaluation

1. How can your design be improved? Discuss the changes with your teacher.
2. Write a set of instructions for the safe use of your product. Attach the instructions to your crusher before you take it home.
3. **Going Beyond.** Design a machine that could safely crush hundreds of cans per hour.
4. **Going Beyond.** Research machines that are designed to crush materials such as rock or coal. Make a sketch that illustrates how the machines operate.

SAFETY FIRST

It is important that you wear safety glasses and follow the general safety rules for proper operation of any hand tools or machines.

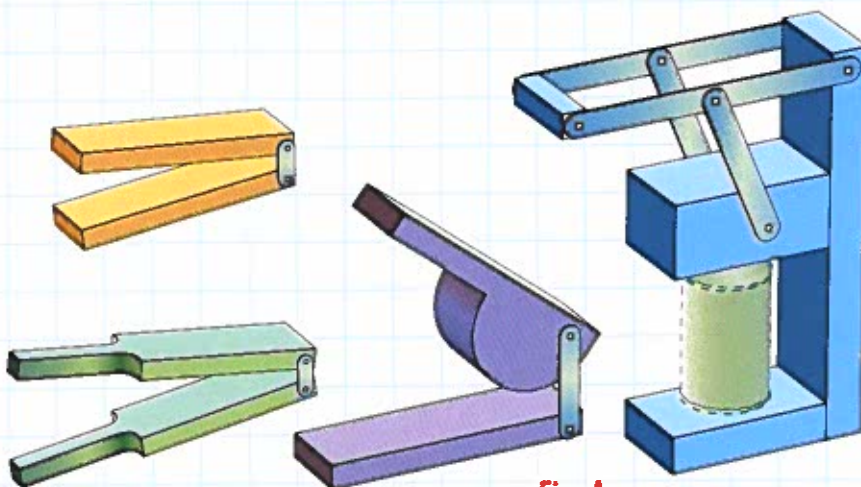


Fig. A

REVIEW &

CHAPTER SUMMARY

SECTION 1

- Resources can be anything used in the production of a product.
- People, machines, information, raw materials, energy, money, and time are categories of resources used in manufacturing.
- Renewable resources can be replaced; nonrenewable resources cannot be replaced.

SECTION 2

- Choosing a resource depends on its availability, usefulness, and cost.
- Recycling materials and conserving energy are just two ways you can help save resources and protect the environment.

SECTION 3

- Everyday products are manufactured in factories using various materials and machines.
- Manufacturing processes are operations that help change a raw material into a finished product.
- Major manufacturing processes include machining, forming, fastening, and finishing.

REVIEW QUESTIONS

1. Name some advantages to conserving resources.
2. Name the seven basic groups of resources.
3. Name the four categories of manufacturing processes.
4. What is quality control?
5. Name one example of a renewable resource.

CRITICAL THINKING

1. If you had to produce a product in a short time, what kinds of resources would you try to use?
2. Contact an environmental protection agency near you. Find out what special problems affect your town and how you can help solve them.
3. Interview a business person. Find out how that person is a resource person for you or others.
4. Create your own logo for recycling.
5. Create a commercial with video and sound effects or create a flyer to use in your school.