CHAPTER 2

ACTIVITIES

CROSS-CURRICULAR EXTENSIONS

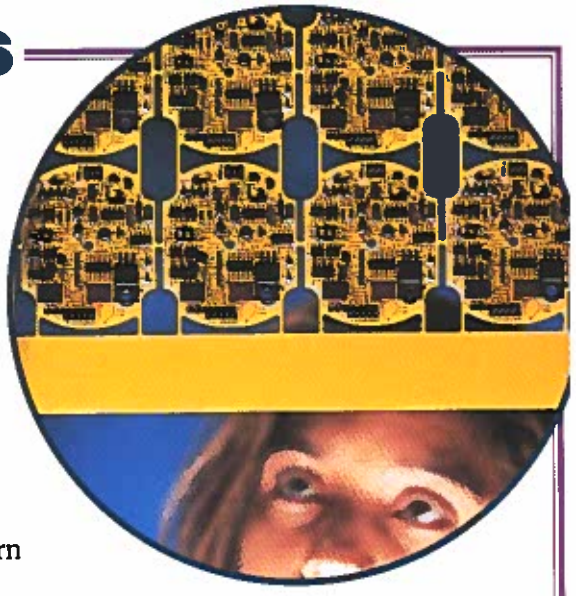
1. **HEALTH EDUCATION** Research the role of technology in sports.

2. **SCIENCE** Explain what causes a curve ball in baseball or why tennis balls are fuzzy.

3. **MATHEMATICS** Research ten mathematics formulas that could be used in technology. Explain how they could be used.

4. **SOCIAL STUDIES** List ten inventions that led to the development of another invention. Choose one and make a presentation about it to the class.

EXPLORING CAREERS



At one time people believed that computers would be of use only to scientists and engineers. They are now used by almost everyone. They have changed the way we receive and share information. Here are two careers that involve computers.

Computer Programmer Programmers write detailed instructions, called programs, that tell the computer what steps to take in order to perform a function. Programmers can find jobs in almost all areas of the work world. Mathematics and problem-solving skills are important. So is a willingness to learn new technology and keep your skills up to date.

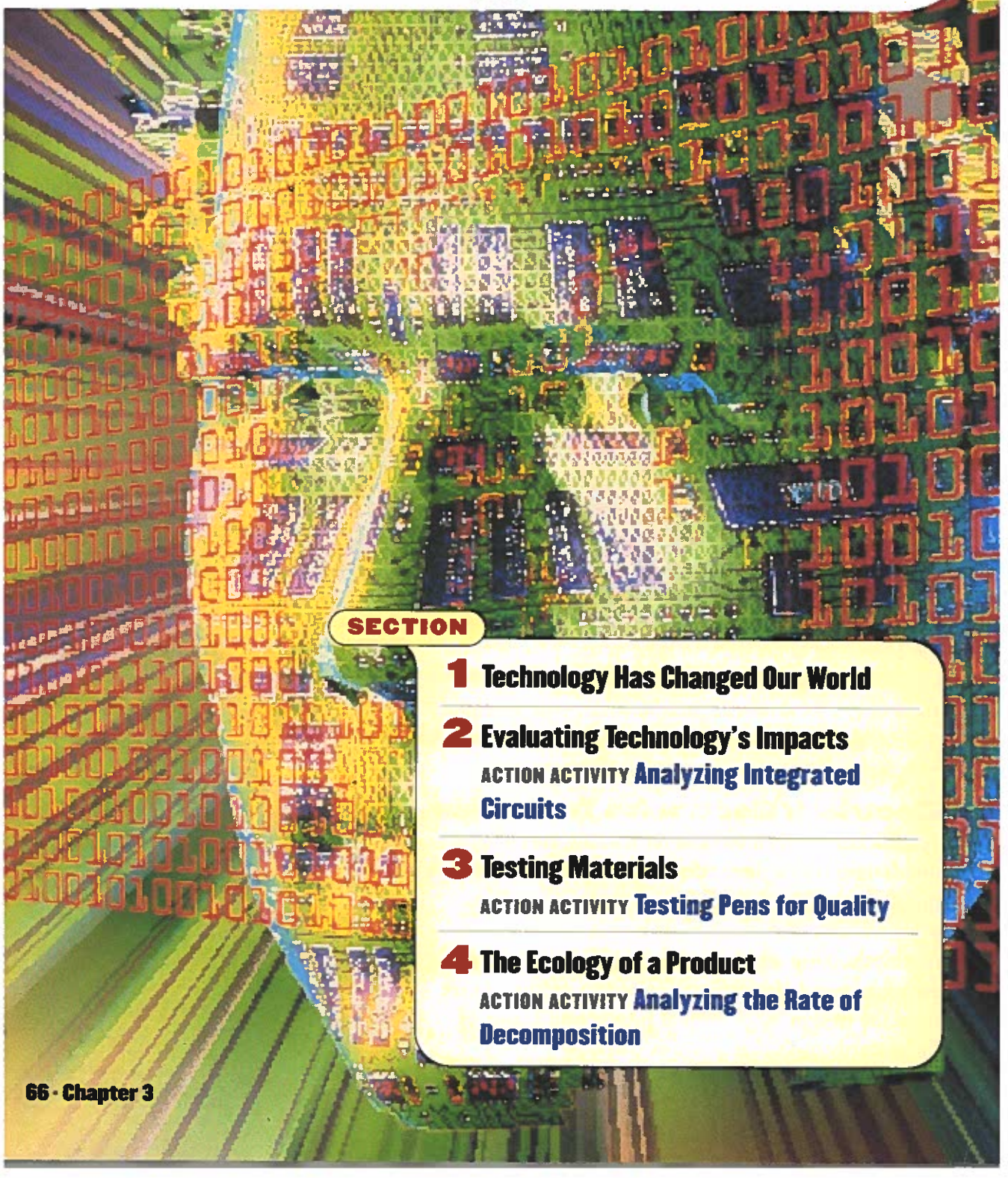
Electrical/Electronics Technician Technicians are responsible for making sure that the designs an engineer develops actually work. If not, they study the problem and come up with a solution. These workers must be good at troubleshooting and have a strong background in computers and electronics. Helping a product move from the design stage to final production is one of the rewards of working in this career.

ACTIVITY

Select a career from the 1800s. Write down the changes that people from that period would find if they went to work in the same career today. What tools or methods are used now?

CHAPTER 3

How Technology Affects You



SECTION

1 Technology Has Changed Our World

2 Evaluating Technology's Impacts
ACTION ACTIVITY Analyzing Integrated Circuits

3 Testing Materials
ACTION ACTIVITY Testing Pens for Quality

4 The Ecology of a Product
ACTION ACTIVITY Analyzing the Rate of Decomposition

Technology Has Changed Our World

SECTION 1

THINGS TO EXPLORE

- Explain how the rapid change in technology has changed society.
- Tell how changes in technology make other new things possible.

TechnoTerms
impact
palmtop

Chapter 1 explained the rapid changes that take place with technology. This growth has had many **impacts**, or effects. It has caused our society to change rapidly, too. For example, ask your parents or grandparents what they did for fun when they were your age. They probably played board games or listened to the radio. You might play video games or listen to CDs.

Benefits of Technology

Technology has improved some things and made other things possible. For example, before low-cost calculators were available, people used slide rules and expensive adding machines to do complex mathematics problems. Now, almost everyone owns a low-cost calculator. Before 1961, no one had ever seen the Earth from a distance. Now, thanks to new space technology, we know what the Earth, as well as the other planets, looks like. Fig. 3-1.

Fig. 3-1. The small glowing object in the lower left corner is the first planet in another solar system ever photographed directly. The photo was taken by NASA's *Hubble Space Telescope*, which orbits the Earth and which has given us many other thrilling photos. Find a picture of the Eagle Nebula taken by the *Hubble* and share it with the class.

OPPOSITE This image was created on a computer, which allows an artist to create many special effects.

Technology has also had impacts on your school life. In your classroom, you might be sitting in a chair designed by computer to fit your size. Maybe you use a computer or a word-processing typewriter to help you with your schoolwork. Teachers now teach with videos instead of movies in the classroom. Even the equipment you use in gym classes or football has been improved by technology.

Everyday Technology

Remember the groups of technology mentioned on page 54? They are manufacturing, construction, energy/power, transportation, communication, and bio-related technology. Every group of technology affects your life every day. In this book, you will learn about technologies in each group and about how we make and use technology,

Technology has even changed the way we buy things. Today it is common to get cash from an automatic teller machine, or ATM. You can search for the lowest prices and buy a car using a home computer. Many people find it easier to pay bills, send gifts, and even order pizza using a computer.

Computer technology is very important. Some people take their computers with them everywhere they go. Small computers called *laptops* are common. Even smaller pocket-sized computers called **palmtops** are popular. Many people use them to keep track of appointments and expenses. This type of technology will continue to get smaller and more powerful.

TechnoFact

SHRINKING COMPUTERS The first digital computer, the Mark I, was built in 1943. It was 55 feet long and weighed several tons. The first desktop computer systems, built in the 1970s, weighed about 100 pounds. Today we have laptops and palmtops that people can easily carry with them, but that's not the end of the story. Scientists are now working on new types of computers that will make palmtops seem big and clumsy. Imagine a computer the size of a wristwatch, with voice input and wireless Internet access. In a few years, you could be wearing such a computer.

INFOLINK

These chapters focus on a technology group.
7 & 10–manufacturing
12–construction
13–energy/power
14–transportation
15 & 16–communication
19–bio-related

SECTION 1 TechCheck

1. Name one way technology has changed society.
2. How has technology changed the way you learn at school?
3. What technology made seeing the Earth from a distance possible?
4. **Apply Your Knowledge.** Make a chart using pictures of the technologies you think affect you and your classmates most.

SECTION 2

Evaluating Technology's Impacts

THINGS TO EXPLORE

- Evaluate technologies and their effects on you and the environment.
- Investigate the construction of an integrated circuit (IC).

TechnoTerms
biodegradable
evaluate
flowchart

Sometimes people invent a technology they think is needed for a certain area but forget to **evaluate** (judge) its impact on other areas. The impact on the environment is one example. Fig. 3-2. For this reason, some technological changes may be viewed as good and some as bad. However, we can't always predict how a technology will affect us or our world. We can only be sure that almost everything changes eventually.

Questions to Ask

As a member of society, your job is to constantly evaluate technology. How can it be used to obtain the most benefits for people and the environment while causing the least harm?

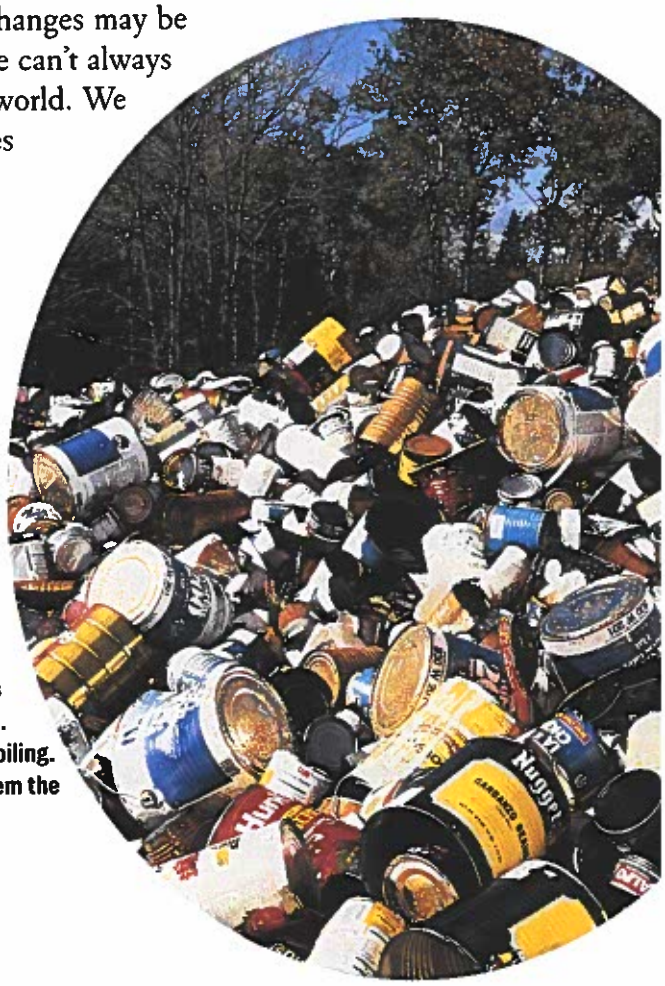
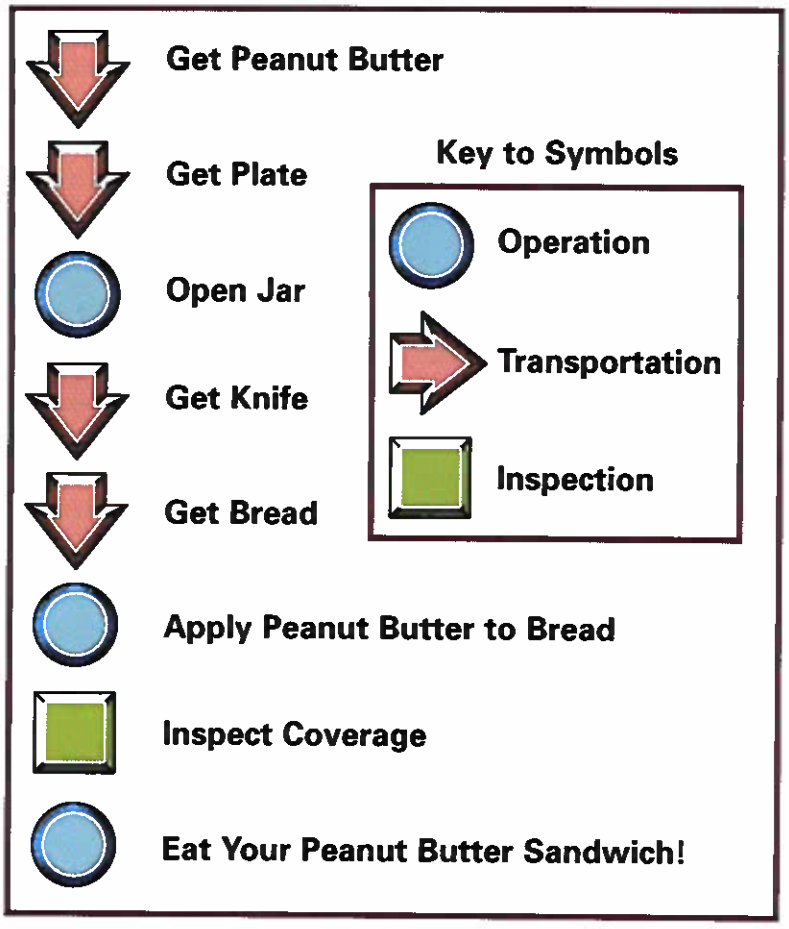


Fig. 3-2. When producing food in "tin" cans was first invented, everyone thought it was wonderful. Foods could be stored for long periods without spoiling. No one imagined then how much of a waste problem the empties would be.

TechnoFact

SPACE LITTER Only a few hundred of the thousands of human-made objects in space today are working spacecraft. What's left is "space junk." Almost twenty *tons* of junk were left on the moon after the *Apollo* landings! You can still find two golf balls, an astronaut's pin, a stereo camera, a television camera on a tripod, various tools for geology, and even an armrest. What should we do about all the things we put into space after they quit working?



The process of making a sandwich has been analyzed in this flowchart. Do any of the steps cause harm? Are any of the steps wasteful?

COMMUNICATION CONNECTION

Analyzing a Process Using a Flowchart

The same questions about the impact of a product can be asked about the steps in the process used to produce it. Do any of the steps cause harm? Are any of the steps wasteful?

The steps in a process can become very complicated. There is an easy way to keep track of them. **Flowcharts** are used to illustrate the steps using symbols. Each symbol represents a special step in the process. For example, graphic symbols can represent various steps in the following processes:

- **Transportation:** Moving an object from one place to another
- **Operation:** Usually, using machines to change the shape of a product

Here are some questions that are useful to ask about a technology's impact.

- Does the technology require more or less energy or more or fewer natural resources than an existing technology?
- Will it damage the environment? For example, is it **biodegradable** (able to break down to natural materials)?
- Is it easier to use, or does it save time?
- Does it require special training to use?
- Does it put people out of work, create new jobs, or both?
- Is there a real need for this technology?
- Is this an appropriate use of technology?

TechnoFact

WHY NOT SWITCH?
Some products that we throw away could easily be replaced with different products that would last longer or that could be reused. Disposable products are a good example. Every year we throw away the following disposable items:
2,000,000,000 razors
16,000,000,000 diapers
1,600,000,000 ballpoint pens

SECTION 2 TechCheck

1. What kinds of technology do you use most? List five. What impacts do you think they have?
2. What questions do you need to ask in evaluating the effects of a technology?
3. Why is it important to evaluate a technology?
4. **Apply Your Knowledge.** Evaluate a product using the suggested questions at the top of this page.

- **Delay:** Waiting for the next step
- **Inspection:** Checking the quality of a product
- **Storage:** Putting the product in stock

A flowchart can also show where a process might be stopped because an important step can't be completed. Flowcharts help in the planning process when deadlines must be met.

Even a simple process can be shown in a flowchart. See the flowchart on the opposite page.

ACTIVITY

Show the steps in the process of brushing your teeth. Can the steps you include prevent the wasting of water?

ACTION ACTIVITY

Analyzing Integrated Circuits

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

Real World Connection

You may have seen the many electronic parts, called *components*, that make up a computer or a television. Today we can put millions of them on a single "chip" of silicon smaller than the nail on your little finger. These chips are called *integrated circuits* (ICs). Fig. A.

ICs are so small that people have a hard time assembling them into useful products. For this reason, two layers of plastic with electrical pin connectors are used to hold them. This special "sandwich" of plastic is called a dual in-line package (DIP).

Integrated circuits are found in computers, CD players, video games, wristwatches, cars, refrigerators, and even toasters. Without them, our lives would be very different.

Design Brief

Break apart a recycled integrated circuit. Use a stereo microscope to look at the chip and the wires connected to it.

Materials/Equipment

- ICs provided by your instructor; otherwise, take one from a donated electronic product
- chisel and hammer
- vise
- stereo microscope

SAFETY FIRST

- **Follow the general safety rules listed on pages 42-43 and specific rules provided by your teacher for tools and machines. Be sure to wear safety glasses when breaking apart the ICs.**
- **Do NOT take apart TVs, computer monitors, or anything containing a picture tube. Dangerous voltages remain in these devices and can give you a shock even if the devices are not plugged in. Ask your teacher for help.**

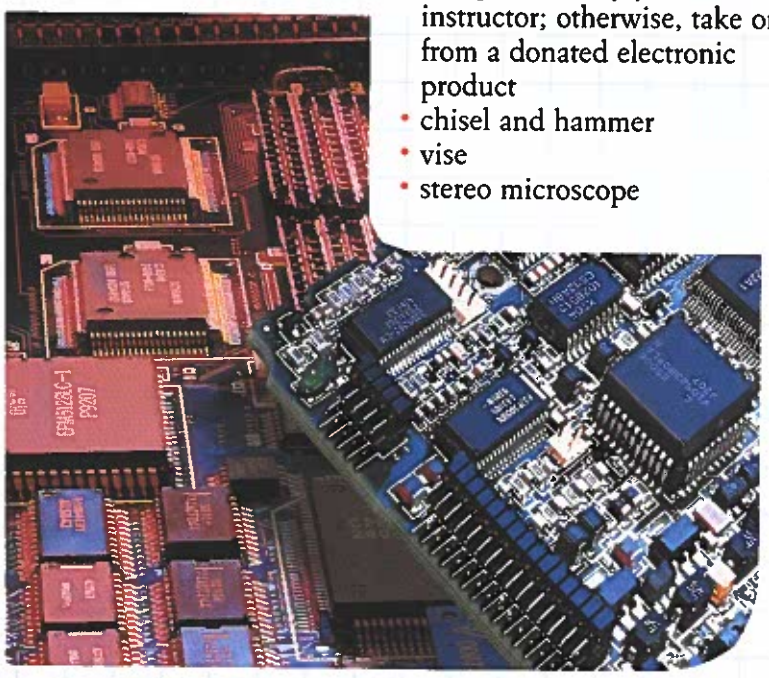


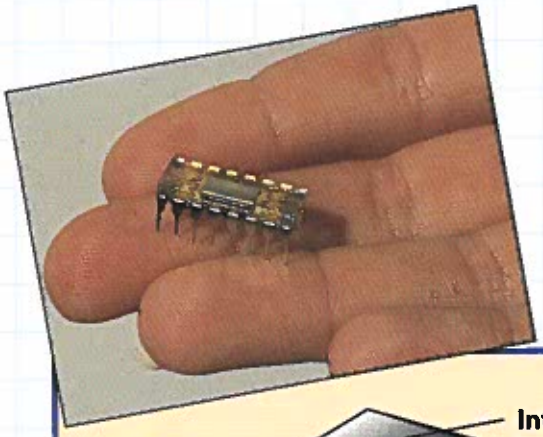
Fig. A

Procedure

1. Obtain an integrated circuit.
2. Use a chisel and hammer to break off the top layer of the DIP. Fig. B.
3. Study the actual IC and the connecting wires under the microscope.

Evaluation

1. What does "IC" stand for?
2. List five products that contain ICs.
3. What does "DIP" stand for?
4. **Going Beyond.** Research how ICs are made. Make a chart showing how they are made.
5. **Going Beyond.** Measure an actual IC and make a model by increasing its size at least ten times.
6. **Going Beyond.** Research the history of the first integrated circuits.



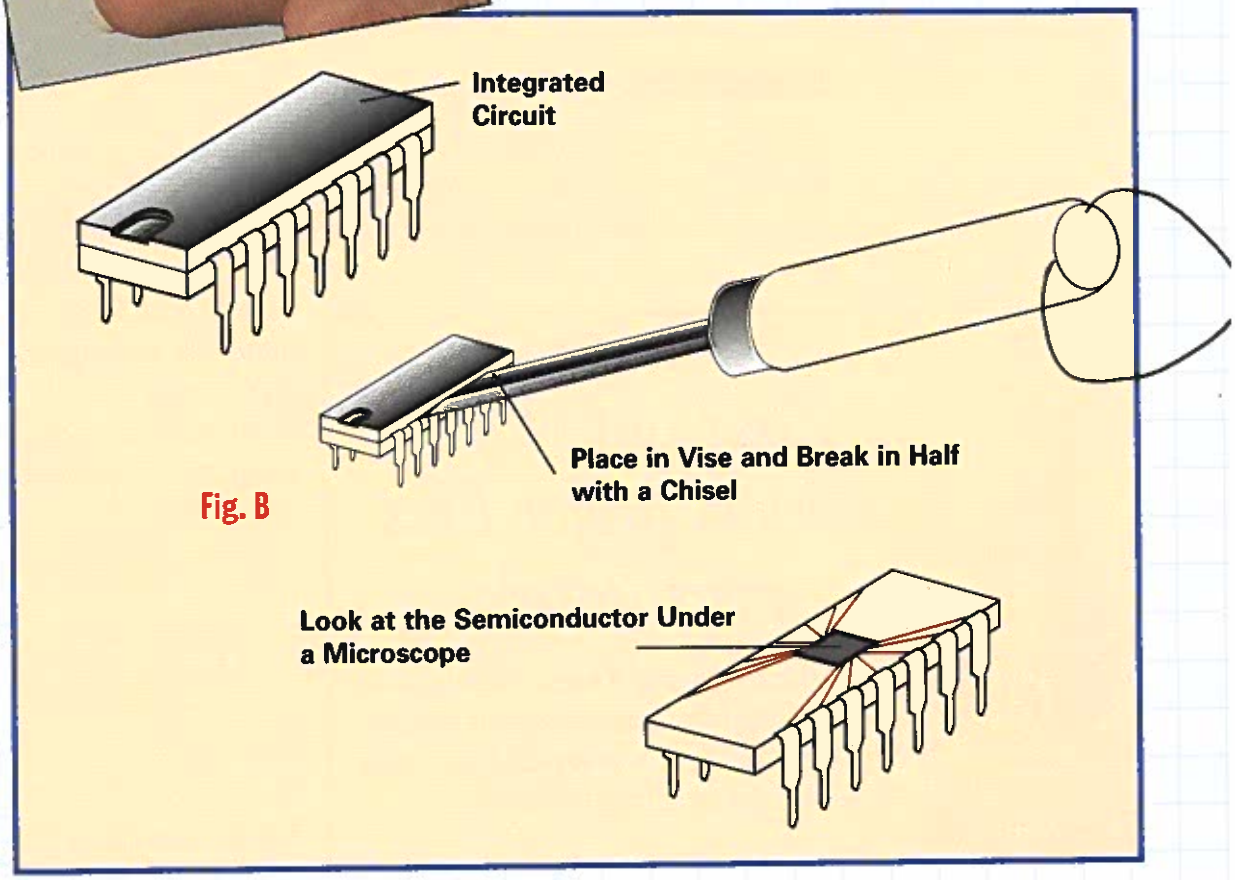


Fig. B

SECTION 3

Testing Materials

TechnoTerms

consumers
independent product testing
materials testing
standard

THINGS TO EXPLORE

- Explain what materials testing is and why it is important.
- Identify standard tests for materials.
- Test materials and compare data.

Have you ever seen a commercial on television stating that one product is better than another? Fig. 3-3. The reputation of products can determine whether a manufacturer is a success or failure. A company does a lot of testing of its products before it sells them.

Standards

Materials that are used to make products must meet specific **standards** (set of values or conditions) for properties such as strength, hardness, resistance to rust, and flammability (ability to catch fire). The materials must first undergo **materials testing** to see if they meet the standards. Then the products themselves are tested. Fig. 3-4.

Fig. 3-3. Comparisons are often made in print ads as well as TV commercials. What evidence does this ad give for its claims?

Fig. 3-4. Cosmetic items must be tested carefully. No one wants to use a product that might cause a harmful reaction. Look at the label for a cosmetic item at home tonight. What does it say, if anything, about the testing done?

Product Testing

Have you ever purchased a product that you thought was poorly made? Test results can help you decide if you want to buy a product. **Independent product testing** is testing done by government agencies or companies not involved in making the products. These test results help **consumers** (people who buy products or services) make wise choices when shopping.

TechnoFact

ASTM Charles Dudley was a chemist working for the Pennsylvania Railroad. The railroad bought large amounts of materials from many different suppliers. Dudley soon saw there was a need for standards for industrial materials. Such standards could help make products more reliable and safe. In 1898, he founded the American Society for Testing and Materials. Today the ASTM publishes thousands of voluntary standards in over 100 technical areas, from textiles to nuclear energy. The standards are used at all stages of manufacturing, from design to marketing.

SECTION 3 TechCheck

1. What is materials testing?
2. Name three properties a material could be tested for.
3. Why do companies need to test products?
4. **Apply Your Knowledge.** Design a way to test paper towels for absorbency. Make a comparison graph on the computer.

ACTION ACTIVITY

Testing Pens for Quality

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

Real World Connection

Comparing products for quality and value is a never-ending job for consumers. No one likes to be cheated. That is why companies that make inferior products often go out of business.

In this activity, you will test different pens for quality.

Design Brief

Build a device to do a comparison test of writing pens. Evaluate the results of your test.

Materials/Equipment

- wood
- dowel rod
- paper roll
- pens
- bandsaw
- drill press
- nail, wood screws
- washers

SAFETY FIRST

Follow the general safety rules listed on pages 42-43. Ask your teacher how to build your test device safely. Follow the specific rules that your teacher provides on the safe use of tools and machines.

Procedure

Part 1 · Building the Test Device

1. Form groups of four or five students. Each group will build a testing device.
2. Cut the wood for the base of the test device. Ask your teacher for help.
3. Drill holes for the dowel rods, crank nail, and wood screws.
4. Assemble the parts as shown in Fig. A.

Part 2 · Comparing the Products

1. Place the test pens in the holes as shown in Fig. A.
2. Start turning the crank to begin the test. Make sure each pen is writing on the paper.
3. Crank to the end of the roll. Place a spacer washer between the wood base and the paper roll. Move the crank to the other dowel rod.
4. Crank the paper in the other direction making another set of test lines.
5. Repeat steps 3 and 4, inserting a spacer washer each time to move the paper roll enough to make a new line.
6. Watch to see which pen stops writing first.

Evaluation

1. What is a consumer?
2. Why is it important for businesses to make quality products?
3. What could happen to a company that makes inferior products?
4. **Going Beyond.** Use a 12-volt DC gear-head motor to make your test device work automatically.
5. **Going Beyond.** Design, build, and use a device to test the effectiveness of various powdered cleansers.
6. **Going Beyond.** Research the testing done at Underwriters Laboratories, Inc. Make a chart or a computer presentation showing your research.

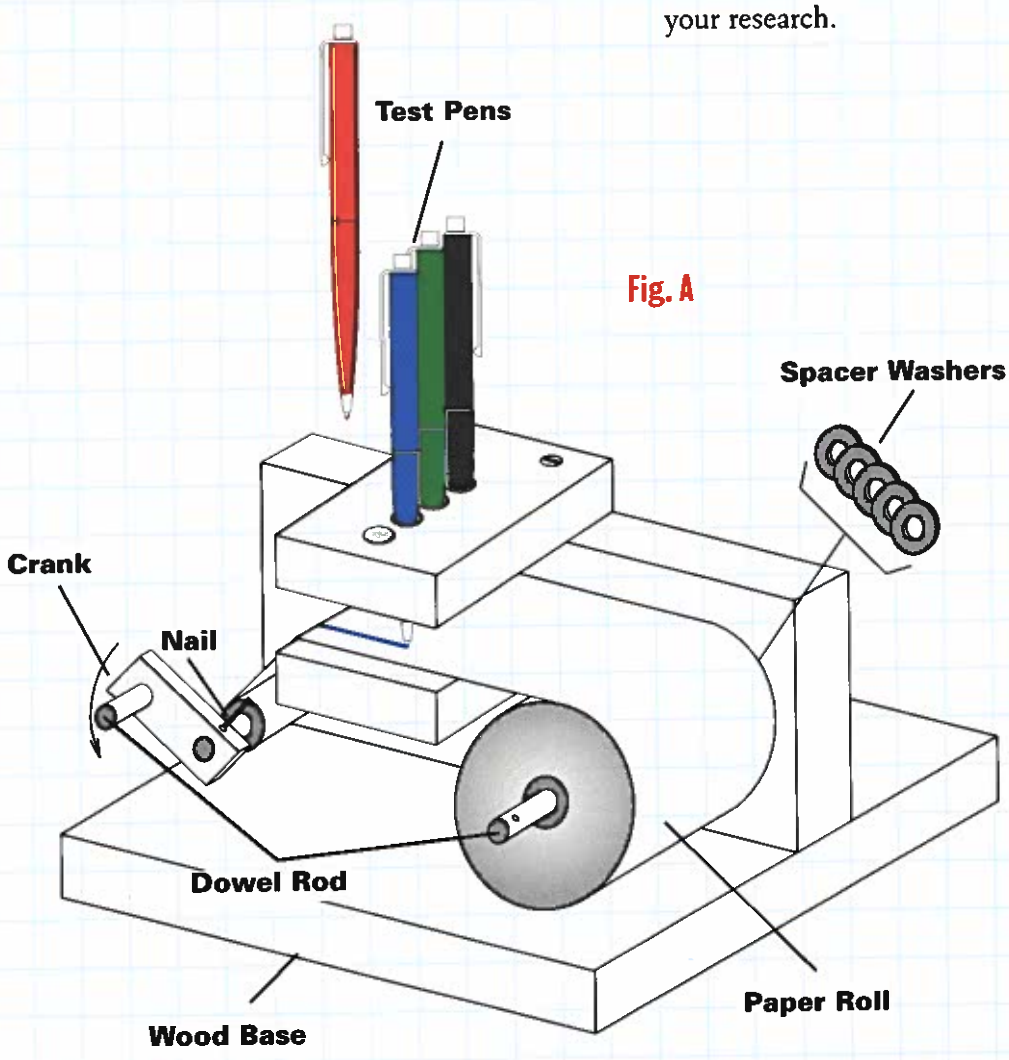


Fig. A

SECTION 4

The Ecology of a Product

THINGS TO EXPLORE

- Explain what ecology is.
- Tell why recycling is important.
- Compare the time it takes different materials to decompose.

TechnoTerms

ecology
landfill
recycling

We live in a "throwaway" world. When we're finished with a product, we often just throw it away instead of fixing it or **recycling** (reusing) it. Did you know that every man, woman, and child in the United States creates an average of 5 pounds of garbage a day? That's 230 million tons of garbage every year!

Ecology is the study of how things interact with the environment. Part of designing a product is planning ahead for what will happen to it after it is no longer useful. That includes every product from newspapers to jet airplanes. Fig. 3-5.

Fig. 3-5. Old cars and trucks are a big waste problem because they take up so much space. How does your community dispose of old vehicles?

TechnoFact

FROM OLD JUNKER TO SHINY NEW MODEL Nationwide, 20,000 cars are junked each day. Researchers are taking apart cars to experiment with reusing the materials. They are making glove compartments from waste products and using fabric scraps to make sound insulation. In the future, more plastics will probably be used in cars, because plastics can easily be reused.

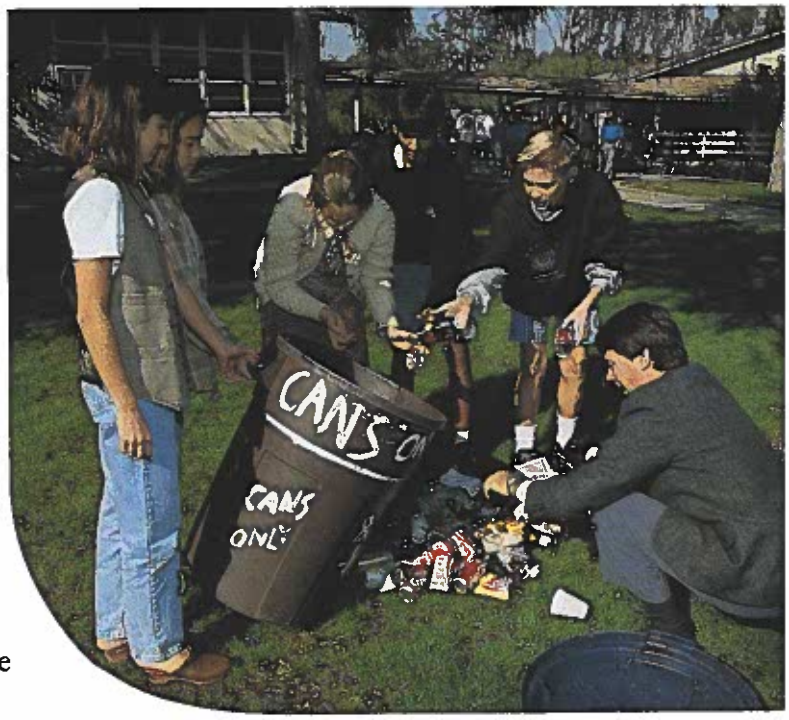


Fig. 3-6. Materials like aluminum, which can be recycled, must be separated from other waste. Research how recycling plants sort waste. Report your findings to the class.

Why Recycle?

Do you ever stop to think what happens to the things you throw away? Many of them end up in **landfills** (garbage dumps) where they are buried or burned. Others are sometimes dumped into the oceans. Disposing of materials in these ways can eventually cause air or water pollution.

Whenever possible, the best alternative is to use materials that are biodegradable. Biodegradable materials break down naturally and return to the earth. Those materials that take a long time to decompose (break down), such as aluminum, plastic, and glass, should be recycled. Fig. 3-6. Some products, such as the batteries in flashlights, transistor radios, and other electronic devices, should always be recycled because they contain *hazardous* materials (materials that can be harmful to health).

TechnoFact

MONEY THROWN AWAY The cost of throwing away our trash is going up fast because of new rules to protect the environment and because of lack of landfill space. It can cost $50 per ton to throw away trash. If you multiply the 230,000,000 tons of garbage we throw away each year by $50, we spend $11,500,000,000 just on garbage!

SECTION 4 TechCheck

1. What is ecology?
2. Why is recycling necessary?
3. Name some items at school you can recycle.
4. **Apply Your Knowledge.** Contact the agency that operates your local landfill. Ask about their five-year and ten-year plans for managing the landfill.

ACTION ACTIVITY

Analyzing the Rate of Decomposition

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

Real World Connection

When materials are put into landfills, it is hoped that they will decompose and return to the earth. In this activity, you will compare the rate at which different materials decompose when exposed to the weather.

Design Brief

Compare the rate of decomposition of packaging materials that are exposed to the weather.

Materials/Equipment

- packaging materials, such as cardboard, plastic wrap, grocery bags, and paper wrappings (Certain materials are supposed to be biodegradable. Include some of those.) Fig. A.
- sample board (1/4" x 36" x 36" plywood)
- tacks, glue
- measuring tools
- hand and power tools
- video camera (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

Procedure

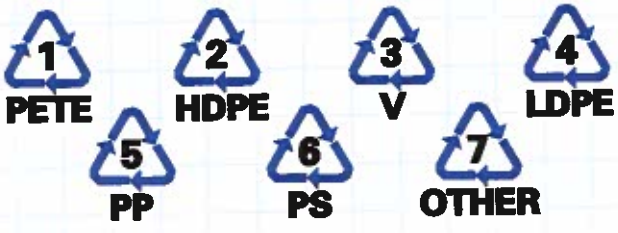
1. This activity will involve the entire class. Each student should bring in a sample of a packaging material that would normally be thrown away.
2. Cut your sample into two pieces. One half of your sample will be kept inside. The other half will be exposed to the weather conditions found in your area.
3. As a class, create two test boards on which to tack or glue the packaging materials. Make each board exactly the same way. The board to be kept inside is called the *control*. The second board, to be placed outside, is called the *variable*.
4. Each student should mount a test sample on each board using tacks or glue. Label all the samples so they can be compared later.
5. Store the control in a safe place inside. Put the variable outside in a place where it will be exposed to the weather and sun.
6. *Optional*: Videotape the start of the experiment and add to the tape each month during the test. In this way, a video record of the decomposition process can be shown at the end of the test. Another option is to take photographs.
7. Compare the variable to the control after each month. Make a log of the changes in each material.

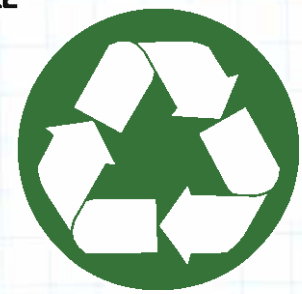
Evaluation

1. Which materials break down the fastest in your area?
2. Which packaging material takes the longest to break down?
3. Make a list of five products that are commonly purchased in a grocery store. How could packages of each product be changed to help protect the environment?
4. **Going Beyond.** Write an advertisement that encourages people to recycle. This type of short "commercial" is called a *public service announcement* (PSA). Ask your teacher if your PSA could be read on a local radio station. Fig. B shows symbols that are found on some packaging. Find out what they mean. How might you use them in your PSA?
5. **Going Beyond.** Research who makes some of the packaging materials or products you tested. Write to them telling them the results of the test and inviting a response.

RECYCLABLE

Fig. B





RECYCLED

CHAPTER 3

REVIEW &

CHAPTER SUMMARY

SECTION 1

- The rapid growth of technology has caused our society to change. Changes in technology make a lot of different things possible.

SECTION 2

- Part of your job as a member of society is to evaluate technology's effects on you and your environment.

SECTION 3

- Materials that are used to make products must pass specific standards. Materials are tested to see if they meet these standards.
- Product testing helps consumers make wise choices.

SECTION 4

- Ecology is the study of how things interact with the environment.
- Part of designing a product is planning ahead for what will happen to it after it is used.
- Recycling is one way to reduce garbage and save resources.

REVIEW QUESTIONS

1. Select a product you bought yourself. Would your parents have been able to buy the product when they were your age? Would your grandparents?
2. What is the impact of the product from question 1 on the environment?
3. Why do materials need to be tested?
4. What does the term *decompose* mean?

CRITICAL THINKING

1. Name two technologies that you have seen change in the last five years.
2. Explain why change is sometimes good and sometimes bad. Give examples.
3. What technology would you miss the most if it had never been developed? Explain why.
4. Design your own test for a product's quality or durability.
5. With your teacher's permission, gather several garbage cans from rooms in the school. Wear gloves and separate the garbage into recyclable and non-recyclable materials. Make a graph of your data to share.