ACTIVITIES

CROSS-CURRICULAR EXTENSIONS

1. SCIENCE Design and test an earthquake alarm. The materials may include a simple battery-operated electric buzzer.

2. COMMUNICATION Asking "what-if" questions helps open your mind. Think about this one. "What would happen if people had twelve fingers instead of ten?" Write down your ideas and share them with your classmates in a brainstorming session.

3. MATHEMATICS Find a new way to show exponential growth. Make a graph or a model to show your results.

EXPLORING CAREERS

Almost all of our usual activities are being changed by technology. It's only natural that people's jobs and the duties they perform are also changing. Here are two careers that have been greatly affected by advances in technology:

Cyberlibrarian Online libraries make some books, periodicals, and reference materials easily available. They can be read by anyone, anywhere, anytime. Libraries are hiring more cyberlibrarians, those who have computer experience and Internet skills. These workers can conduct online searches and teach visitors how to navigate the Internet.

Automotive Technician When you start the engine, step on the gas, set the cruise control, change the radio station, and hit the brakes you are using computers. Today, all of these automobile functions, along with dozens more that take place under the hood, are controlled by computer chips.

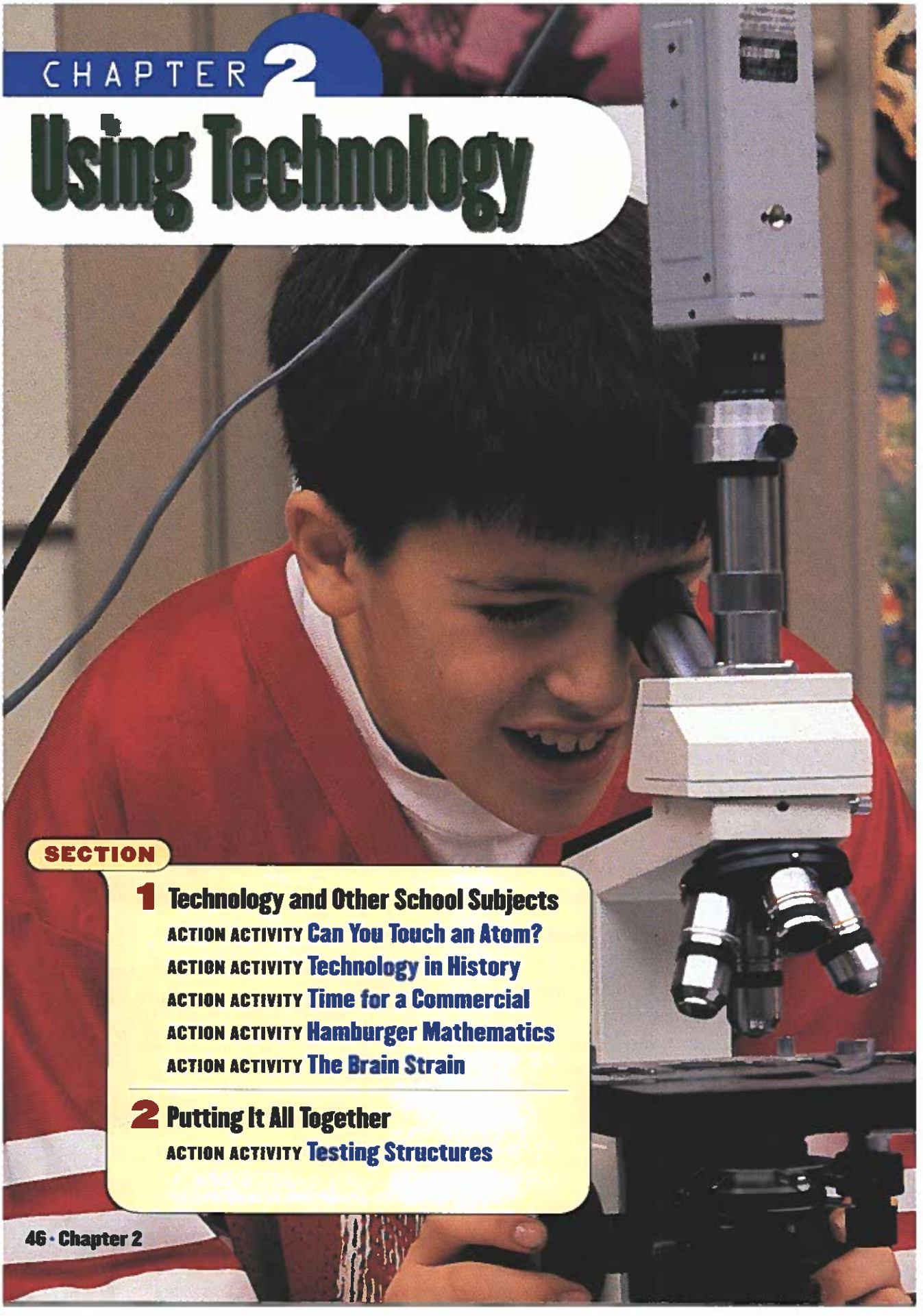
Knowledge and training in automotive technology, combined with skills in computers and electronics, are necessary for this job.

ACTIVITY

Research a career that interests you. What are the requirements for entering this career? How can a person advance? How does technology affect the career?

CHAPTER 2

Using Technology



SECTION

Technology and Other School Subjects

SECTION 1

THINGS TO EXPLORE

- Describe how technology affects you in school.
- Explore technology's connections with other school subjects such as science, social studies, communication, mathematics, physical education, and health.

TechnoTerms
atom
theory
timeline

Technology touches almost everything. In your everyday life, you may take technology for granted. But common items such as your toothbrush and your shoes are very different from those of the past because of developments in plastics technology. Toothbrushes were once made of hog bristles instead of plastic. Today's running shoes, made of plastics, are very different in weight from the kangaroo leather running shoes of earlier days. Fig. 2-1.

Think About This

Did you ever stop to think that even candy bars change with technology? Hershey Foods Corporation has developed and patented a heat-resistant milk chocolate bar. The special chocolate bar is supposed to hold its shape at temperatures of up to 140° F.

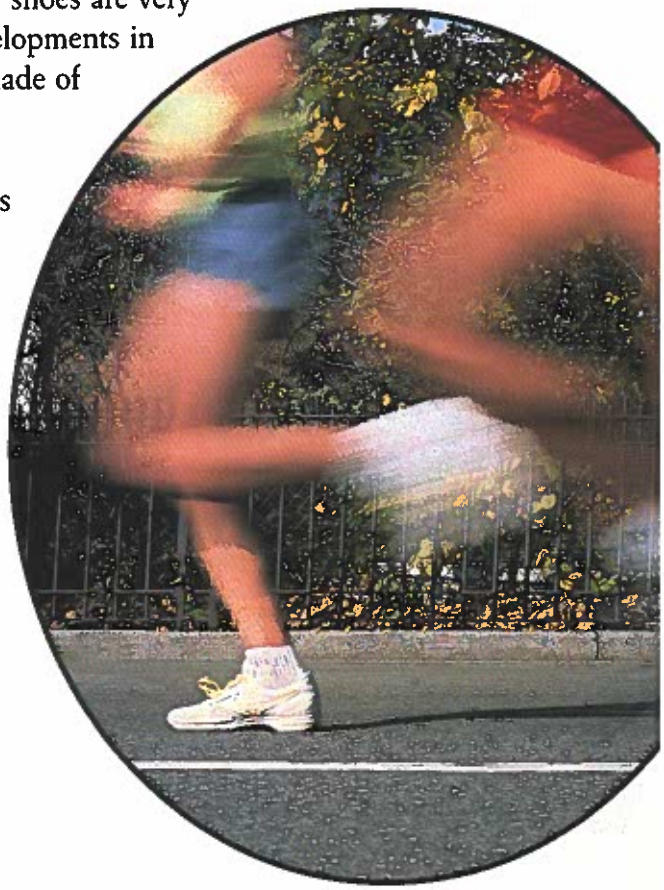


Fig. 2-1. The design of running shoes has changed over time. Why do you think the weight of running shoes is important?

OPPOSITE Technology has created high-powered microscopes that enable us to see things invisible to the naked eye.

Fig. 2-2. **Many schools benefit from technology.** List all the technologies you use regularly at your school.

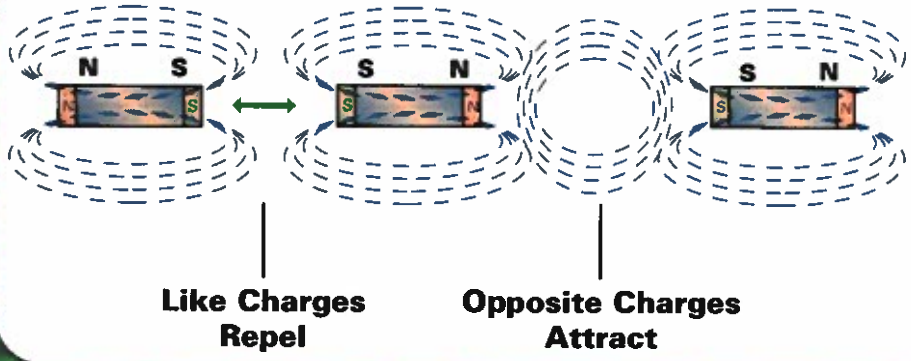
Technology is part of school, too. Think of the technologies that play a part in your classroom today. Your desks and chairs were designed to fit you instead of a third grader. Many classrooms provide access to VCRs, televisions, laser disc players, compact discs (CDs), and computers. Fig. 2-2.

We depend on technology to make our lives better. Because technology is so important to our world, it's important to understand what it is and how it works. School subjects can help you do that. That's one of the ways school subjects help prepare you to be an intelligent, useful member of our society.

Let's see how technology is related to such subjects as science, mathematics, social studies, language arts, and health or physical education.

SCIENCE CONNECTION

The Untouchables



You know from studying science that electrons, one of the three basic parts of an atom, spin around the atom's center, or nucleus.

Technology and Science

Although technology and science are closely tied together, they are different. Science usually gives you the **theories** (ideas) about something. Technology lets you use your knowledge and resources to solve problems. Fig. 2-3.

Much of what scientists do is based on the scientific method. They start with a theory and then try to prove its truth. For example, for centuries people had theories about what matter was made of. Using tools of technology, scientists discovered that matter is made of **atoms**.

INFOLINK

See Chapter 1 for more information about the scientific method.

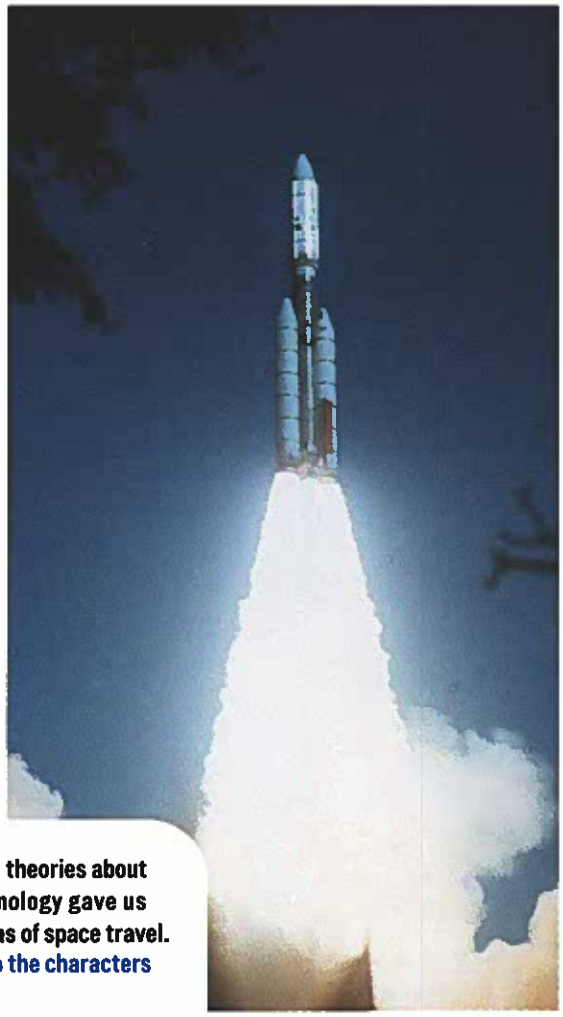


Fig. 2-3. First, scientists developed theories about traveling in outer space. Then technology gave us rockets so we could solve the problems of space travel. Watch the movie *October Sky*. How do the characters solve problems related to rocketry?

You also know that electrons have a negative electrical charge. But did you know that these negative charges keep one atom from touching another? This is because like charges repel, or push away, from each other, just as the like poles of two magnets do. So even though you might think that the atoms in something as hard as a brick are packed close together, they don't really touch at all!

ACTIVITY

Make a model of an atom that shows the electrons in orbit around the nucleus (neutrons and protons).

Technology and Mathematics

Mathematics and technology work well together. Technology has produced calculators and computers that can make many computations quickly and accurately. Fig. 2-4. However, you still have to know what operations—addition, subtraction, multiplication, and division—to use in solving a problem. You also must know how to enter the information correctly into a calculator or computer.

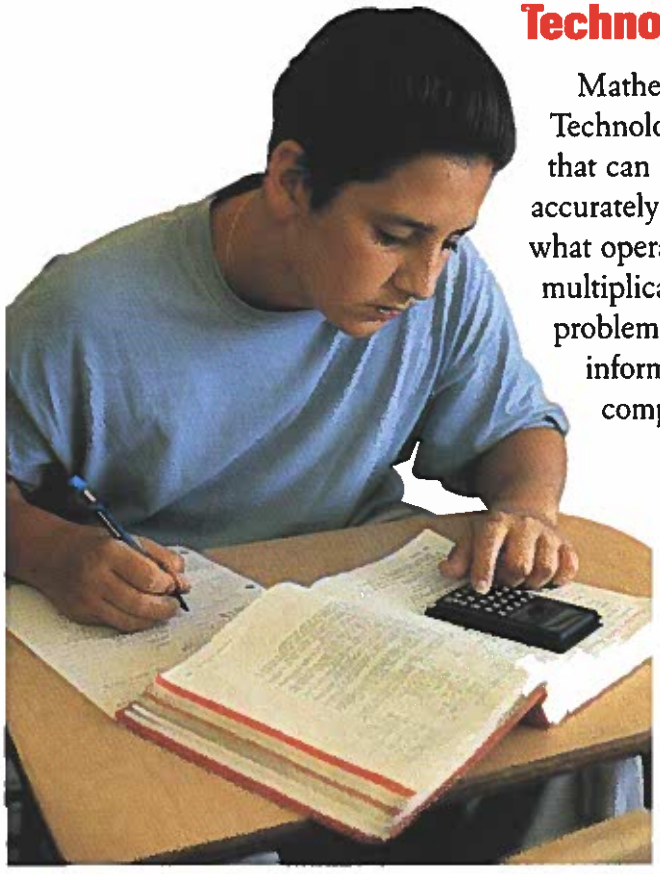


Fig. 2-4. Most schools allow calculators in classes. Take a position either for or against this statement: Because of automatic calculators, many students are not developing adequate mathematics skills. Write a paragraph defending your position.

Technology and Social Studies

Most people think that technology is related only to science and mathematics. While this connection is easy to see, technology is just as much a part of social studies and other subjects.

People use history as a way of charting the present or planning the future. A study of history shows that technology definitely has changed with the times. Fig. 2-5. At each point in time, different technologies were important for what they could do to help us. Some technologies no longer exist because there's no use for them today. Other technologies have changed to better meet our needs. A graph called a **timeline** can show how the speed of technology change has increased in the past century.

Technology and Communication

Being able to communicate with others is a skill that is important in all your school subjects. You may think of it only in terms of language arts or reading. However, in all your courses you need to be able to let your teachers and classmates know what your ideas are. Technology gives you many different ways to communicate using sound, the written word, and visual images. Fig. 2-6.

Fig. 2-5. Have you ever seen a phonograph like the one shown here? Manufactured around 1900, this model reproduced sound by means of a needle that followed a groove in a rotating disk, called a "record." Does the phonograph seem completely different from the CD player? Research how CDs are made and compare the two.

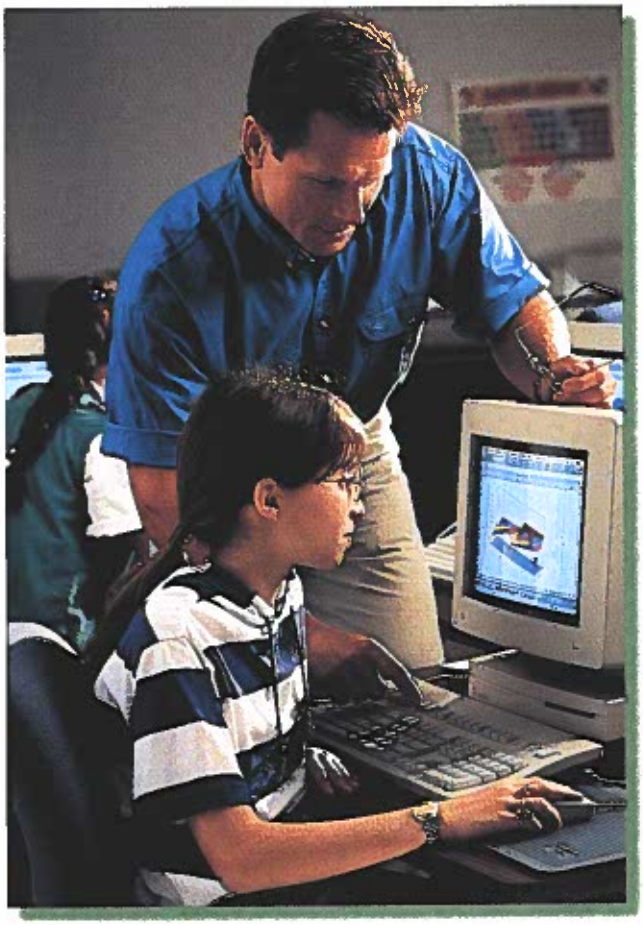


Fig. 2-6. Many people think that, if they know how to use a computer, they won't need to learn reading, spelling, and grammar. Not so. They must be able to correctly tell the computer what to do.

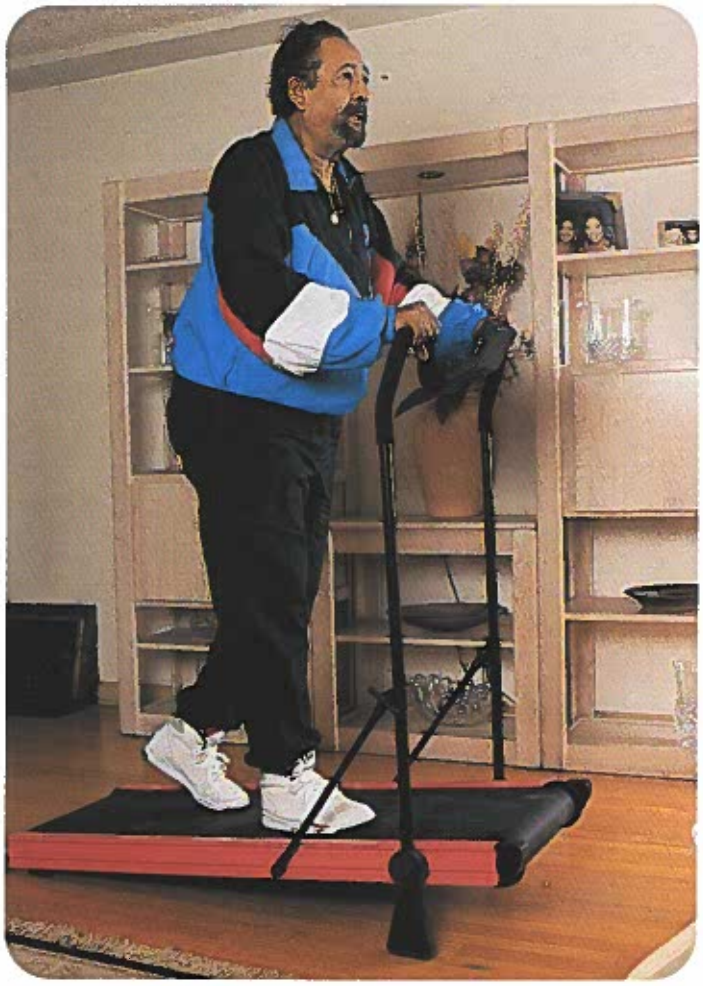


Fig. 2-7. **Treadmills are an important innovation for people who must exercise every day. People can walk for as long as necessary without experiencing bad weather. Name some other recent health-related technologies.**

Technology and Health/Physical Education

Many recent developments in technology have taken place in the field of health. Technology has come up with new products and methods that help us stay healthy and fit. Fig. 2-7.

Technology will play an even more important part in your future. Thanks to advancements in medical technology, people are living longer and more active lives. As a result, it is common for joints to just wear out. Low friction, plastic replacement joints make it possible for many people to continue an active life. Do you know anyone who has had a hip, knee, or elbow joint replaced?

Medical technology may one day make it possible to grow new body parts. Experiments are being done to see if special cells can grow new tissue. This could help many people that have been injured in accidents or are suffering from disease.

SECTION 1

TechCheck

1. What technologies do you use in your classroom today?
2. How are technology and science connected?
3. Name one technology you use both at home and at school.
4. **Apply Your Knowledge.** In small groups, brainstorm ways technology has changed your school and the way you learn. Share your ideas in a newsletter, a video production, a radio broadcast, or a chart.

ACTION ACTIVITY

Science—Can You Touch an Atom?

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

Real World Connection

Everything in our world is made of atoms and combinations of atoms called molecules. Scientists use high-powered electron microscopes to see as much as they can about the atom. However, many people have the wrong idea of what atoms are really like. Atoms are mostly empty space.

In this activity you will make sketches that show the size relationships among atoms and their parts.

Design Brief

In this activity, you will visualize the real size of atoms and their basic parts (electrons, protons, and neutrons). Fig. A.

Procedure

1. First, let's think about how small an atom really is. Divide a piece of paper into three equal spaces. Number the spaces 1, 2, and 3. In each space make a sketch showing sizes to scale.
2. In space 1, illustrate the fact that if a baseball were enlarged to the size of the Earth, its atoms would be the size of marbles.
3. In space 2, illustrate the fact that if a single atom were enlarged to the size of a fourteen-story building (140 feet tall), the nucleus would be the size of a grain of salt.
4. In space 3, make a sketch showing the atoms of your finger as your finger "touches" the top of your desk.

Evaluation

1. From what you have learned, can you really touch an atom? Explain your answer.
2. What is in the space between the nucleus and the electrons in an atom?
3. **Going Beyond.** Research the ways atoms move in solids, liquids, and gases. Make a graph or chart on the computer to share with the class.

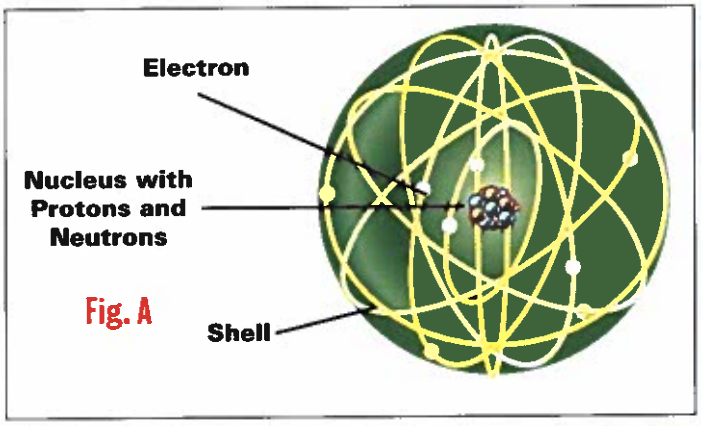


Fig. A

SECTION 1
ACTIVITY 2

ACTION ACTIVITY

Social Studies—Technology in History

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

Real World Connection

Advancements in technology have helped give us the quality of life we enjoy today. In this activity, you will organize and chart some of the events in history that have led to the present high level of technology.

Design Brief

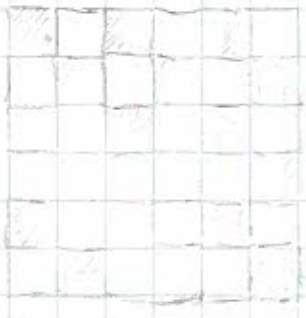
Technology is sometimes divided into the following groups: communication, construction, manufacturing, transportation, energy/power, and bio-related technology. In this activity, you will sort events in history into one of the groups and make a timeline.

Materials/Equipment

- adding machine paper
- markers or pens
- meter stick

Procedure

1. Work in groups of four. Measure and cut 1 meter of adding machine paper.
2. Use a meter stick to draw one line on the paper for each of the groups. Label each line.
3. Use a scale of 10 cm = 1000 years. Mark your timeline starting at 3500 B.C.
4. See the list on the next page. Chart each of the events on the appropriate line. Use circled numbers to represent each event.



Evaluation

1. How does your timeline show the rapid growth of technology? Explain.
2. During what period did most of the technological developments occur?
3. Was it sometimes hard to determine the group to which a technology belongs? Most technologies really belong to several groups. For example, transistors are used in communications devices, but making transistors involves manufacturing. What other "crossovers" can you identify?
4. **Going Beyond.** Do some research on one development in the timeline list. Share what you find in a short report.
5. **Going Beyond.** List your favorite technology inventions. Research their development and place them on the completed timeline.

①	3500 B.C.	Writing first used by Sumerians
②	3000 B.C.	Egyptians created first book
③	1500 B.C.	Pulleys and simple machines used
④	A.D. 1045	Movable type used in printing
⑤	A.D. 1450	Printing press invented
⑥	A.D. 1712	Piston steam engine developed
⑦	A.D. 1835	Morse code/telegraph invented
⑧	A.D. 1876	Telephone invented
⑨	A.D. 1892	Reinforced concrete created
⑩	A.D. 1906	Radio developed
⑪	A.D. 1926	Television invented
⑫	A.D. 1926	Liquid-fueled rocket developed
⑬	A.D. 1933	FM broadcasting system introduced
⑭	A.D. 1946	ENIAC computer developed
⑮	A.D. 1947	Transistors invented
⑯	A.D. 1957	Sputnik (first artificial satellite) put into space
⑰	A.D. 1960	First laser operated Fig. A.
⑱	A.D. 1961	First man flew in space
⑲	A.D. 1966	First soft landing made on the moon by Luna 9
⑳	A.D. 1969	Neil Armstrong became first man on the moon
㉑	A.D. 1977	The Apple II started the personal computer industry
㉒	A.D. 1977	Fiber-optic cable first used in commercial communication
㉓	A.D. 1977	MRI (magnetic resonance imaging) first used by doctors
㉔	A.D. 1978	The 5 1/4-inch disk became the standard format for storage of computer data
㉕	A.D. 1981	Reusable spacecraft, U.S. Space Shuttle *Columbia*, made first flight
㉖	A.D. 1982	Synthetic insulin, the first drug manufactured using recombinant DNA, was sold
㉗	A.D. 1985	British Antarctic survey team discovered a hole in the ozone layer
㉘	A.D. 1986	Karl Muller and Georg Bednorz discovered a ceramic material able to superconduct at 35° Kelvin, a new record for high-temperature transmisson
㉙	A.D. 1988	The U.S. Patent Office approved a patent for a genetically altered mouse
㉚	A.D. 1988	A voice-operated typewriter recognized dictated words
㉛	A.D. 1988	The world's first public maglev system went into operation in West Berlin
㉜	A.D. 1990	A new line of biodegradable plastics was developed
㉝	A.D. 2000	Scientists deciphered the genetic code of the fruit fly

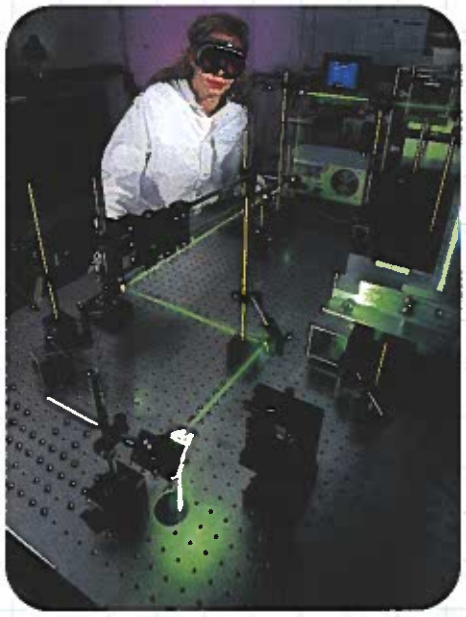


Fig. A

SECTION 1

ACTIVITY 3

ACTION ACTIVITY

Communication—Time for a Commercial

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

Real World Connection

If you are like many people, you see or hear dozens of commercial messages each day on television or radio. They often involve many forms of communication. However, most people don't think about how commercials are made.

In this activity, you will use communication skills and technology to produce your own commercial.

Design Brief

Write and produce a video (TV—something seen) or audio (radio—something heard) commercial for an imaginary product. Fig. A.

Materials/Equipment

- blank audio or video tapes
- props
- video camera
- VCR
- television
- audio tape recorder
- sound effects equipment
- computer (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. Work in groups of four or five students. Elect someone in your group to be the director. The director will organize the production of your commercial.
2. Brainstorm an imaginary product. Make a sample of your product to be used as a prop if you are making a video commercial. You might make a label that could be glued to a box, for example.
3. Write the script for your commercial. You may include everyone in your group, but you will need one person to operate the camera or the audio recorder. Your group might need to use sound effects (SFX) or video effects (EFX). All actions, sounds, or dialogue (talking) must be a part of your script. Use the format shown in Fig. B.
4. Gather any other props you need, and plan to bring any special clothes or costumes for your rehearsal and taping. The director of your group should schedule the use of the video or audio equipment with the teacher.
5. Rehearse and revise your production so that it lasts exactly 60 seconds. Record the final version.
6. Play your finished commercial for the class.

Evaluation

1. Survey the class to see how effective your commercial was.
2. How would you change your commercial to make it better?
3. Why is it necessary to write a script to use during production?
4. **Going Beyond.** Create a longer production such as a news program. Videotape your show so you can share it with others.
5. **Going Beyond.** Write a script and produce a public service announcement.

SOUND	VIDEO	DIALOGUE
LOUD ROCK MUSIC	FADE IN: TWO GIRLS TALKING	MARY: ARE YOU GOING TO THE DANCE SATURDAY NIGHT? KEISHA: NO, HECTOR NEVER ASKED ME.
PHONE RINGS	ZOOM IN: KEISHA ON PHONE	KEISHA: OH, HI, HECTOR. WE WERE JUST TALKING ABOUT YOU.

Fig. B

SECTION 1
ACTIVITY 4

ACTION ACTIVITY

Mathematics—Hamburger Mathematics

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

Real World Connection

Every fast-food restaurant must try to keep costs down to be competitive. Fig. A. The fast-food industry has used technology to help produce meals as efficiently as possible. That makes the job of a business manager very challenging!

In this activity you will act as the business manager of a restaurant.

Design Brief

Your fast-food restaurant plans to sell 2 billion hamburgers during the next year. As business manager, you will solve several problems involving mathematics.

Fig. A

Following are amounts needed to make one hamburger:

- beef, 113.5 g
- ketchup, 2.1 mL
- mustard, 1.5 mL
- salt, .19 g
- mayonnaise, 2.76 mL

Materials/Equipment

- paper
- pencil
- calculator or computer and spreadsheet software

Procedure

Answer the following questions using a calculator or computer spreadsheet.

1. If the average cow yields 175 kg of ground beef, how many cows will be needed for you to reach your 2-billion-hamburger goal?
2. If a tank holds 10 m^3 (cubic meters), how many truckloads of ketchup, mustard, and mayonnaise will be needed?
3. How many tons of salt should be ordered? (*Hint:* You will need to find out how many grams are in a pound and how many pounds are in a short ton.)

Evaluation

1. If your restaurant sells hamburgers for $1.49 and they cost $1.19 to make, what will your annual profit be?
2. Would your place of business survive in your own hometown? Why or why not?
3. How many grams are in 1 pound?
4. **Going Beyond.** What would your annual profit be if you raised the price of a hamburger to $1.75?
5. **Going Beyond.** Ask someone at a local fast-food restaurant how many hamburgers are sold on an average day. Make a comparison chart to show your findings.

ACTION ACTIVITY

SECTION 1
ACTIVITY 5

Health Education—The Brain Strain

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

Real World Connection

It is important to exercise both your muscles and your brain. Why not do both at the same time? In this activity, you will design an exercise and study cell where you can do homework while exercising your muscles.

Design Brief

Work in groups of two or three to design and sketch a combination exercise machine and study area. The exercise equipment might be similar to a stationary bicycle or a stair-stepping machine. The study area should include a place to write, a light, and a place for a computer. The design must let you exercise and study at the same time!

SAFETY FIRST

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

Materials/Equipment

- paper
- pencil
- equipment catalogs
- computer with graphics software (optional)
- exercise machine (optional)

Procedure

1. Brainstorm possible solutions to the design problem with your group members.
2. Evaluate each idea and come to a *consensus* (agreement) on a practical design.
3. Use old catalogs or ads to find pictures of the equipment you would like to put into your exercise-study cell.
4. Design the exercise-study cell to be safe, quiet, and easy to use.
5. Make a sketch or a computer drawing of your product. Think of a name for it and estimate a retail (store) price.
6. Present your product idea to the class.

Evaluation

1. Does the exercise-study cell adjust to fit people of different sizes? Explain.
2. Could the exercise-study cell be used by a physically challenged person? Explain.
3. Does the product include pinch points where you or small children might become caught or injured?
4. Have the following items been considered in the design: fire resistance? low cost? environmental impact?
5. Would you buy such a product? Explain.
6. **Going Beyond.** Make a commercial about your product for radio or television.
7. **Going Beyond.** Visit your local fitness center or gym. Learn about the different pieces of equipment and the purpose of each.

SECTION 2

Putting It All Together

THINGS TO EXPLORE

- Explain how solving real-world problems requires a combination of technology, mathematics, science, and communication.
- Put technology, mathematics, science, and communication to work together to solve a problem.
- Design and test an earthquake-resistant structure.

TechnoTerm
integrated

School subjects are often separated to make it easier for you to concentrate on certain things at one time. But in the real world, you don't use mathematics only from 1:00 p.m. to 2:00 p.m. and science from 2:05 p.m. to 3:05 p.m. Can you imagine an automotive engineer waiting until 1:00 p.m. to solve a math problem related to a car's design? Fig. 2-8. He or she must put many skills to work at the same time to get things done. The subjects you learn in school need to be **integrated** (used together) for you to solve problems.

INFOLINK

See Chapter 1 about how technology is created.

Technology Integrates Subjects

Your technology classes often provide good examples of how math, science, and language arts can be integrated. For example, you might be talented in mathematics or science. What

Fig. 2-8. This engineer is working on a model of a new car design. He uses his mathematics skills all during the day.

Fig. 2-9. Have you ever had trouble understanding what someone was trying to explain? Perhaps that person needed to work on his or her communication skills.

you know is valuable to your team, but you must know how to explain your idea. That means using communication skills, too. Fig. 2-9. In the next activity and in other activities in this book, you will need to integrate your knowledge and skills from technology, mathematics, science, and other subjects in order to solve problems.

TechnoFact

ALL SHOOK UP Did you know that lasers are used to detect the movement of faults in earthquake areas? A laser is mounted on one side of a known fault line. Its beam is aimed across the fault line to a target. Even a small movement can be detected by watching the beam on the target.

SECTION 2 TechCheck

1. What does integrated mean?
2. How does integrating technology, science, mathematics, and other subjects make it easier to solve problems?
3. While at school, why do you usually have a separate scheduled time for mathematics or science?
4. **Apply Your Knowlege.** Discuss with your teacher what science, mathematics, or communication concepts are useful in video production.

SECTION 2

ACTION ACTIVITY

Testing Structures

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

Real World Connection

You often hear about earthquakes in the news. They may occur close to home or in other parts of the world.

The Earth's crust is made of very large sections called plates. The plates move around, some sliding over or under the edges of other plates. The plates themselves have cracks called faults. As the plates move against one another, pressure builds up along these faults. When the stress gets too great, movement in the faults occurs. This movement is what we call an earthquake.

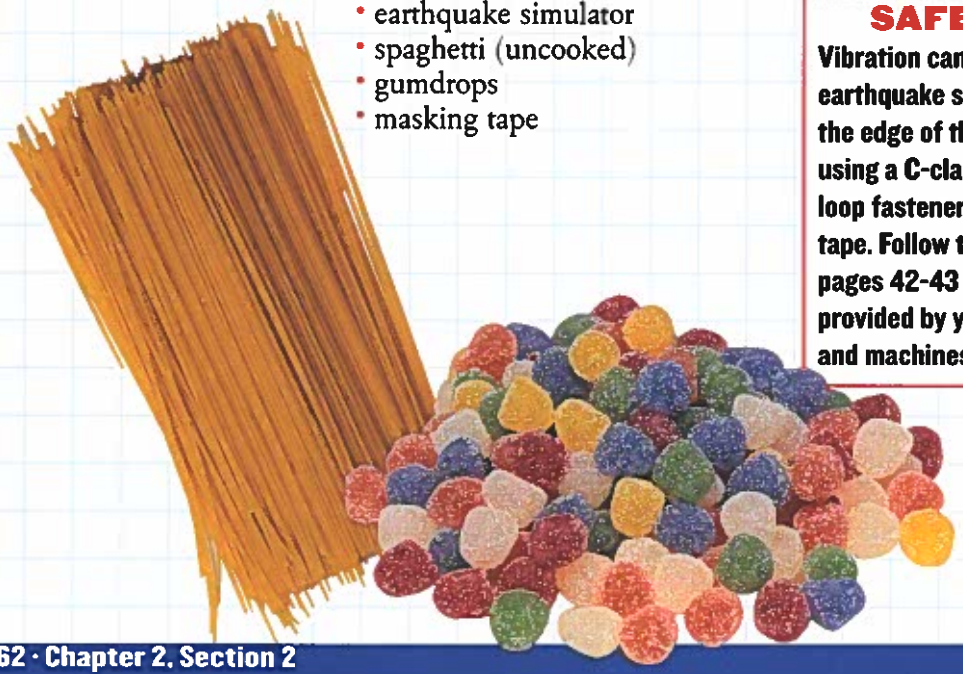
The buildings we live in can be designed to help stand up to the shaking forces of an earthquake. Reinforced foundations and braces in a structure can add strength and flexibility. The structure then moves with the earthquake instead of shaking apart.

Design Brief

Use the skills you have developed in many subject areas to design, build, and test a structure that will withstand the forces of a simulated earthquake. Ask your teacher for help.

Materials/Equipment

- earthquake simulator
- spaghetti (uncooked)
- gumdrops
- masking tape



SAFETY FIRST

Vibration can cause the earthquake simulator to fall off the edge of the table. Attach it using a C-clamp, Velcro hook and loop fasteners, or double-faced tape. Follow the safety rules on pages 42-43 and the specific rules provided by your teacher for tools and machines.

SECTION
ACTION
ACTIVITY

Procedure

1. Design and build both a short and a tall structure using spaghetti and gumdrops as shown in Fig. A.
2. Tape the structures to the base of the earthquake tester.

Test 1

1. Adjust the movement of the simulator to a slow speed. (The vibration speed is called the *frequency*.) Use a watch to set the speed at one or two cycles per second.
2. Watch the movements of the structures. Record the amount and direction of movement of each structure in your TechNotes.

Test 2

1. Slowly increase the speed of the earthquake simulator. Watch the effect on your structures.
2. Continue to increase the speed of the tester.
3. Note the amount and direction of movement in each structure. Record your observations in your TechNotes.

Test 3

1. Change the design of your structures by adding braces.
2. Repeat the tests while watching carefully. Record your results.

Evaluation

1. How did you use science, mathematics, and communication skills during this activity?
2. What does *frequency* refer to in an earthquake?
3. Why is it important that structures be designed to withstand earthquakes?
4. What do you think would happen in an earthquake if a short building were built too close to a tall building?
5. What is an earthquake fault?
6. **Going Beyond.** Videotape the tests. Play them back at slow speed to analyze structural failure, if any.
7. **Going Beyond.** Design, build, and test a structure that is as tall as you are.
8. **Going Beyond.** Research the history of earthquakes in your area.

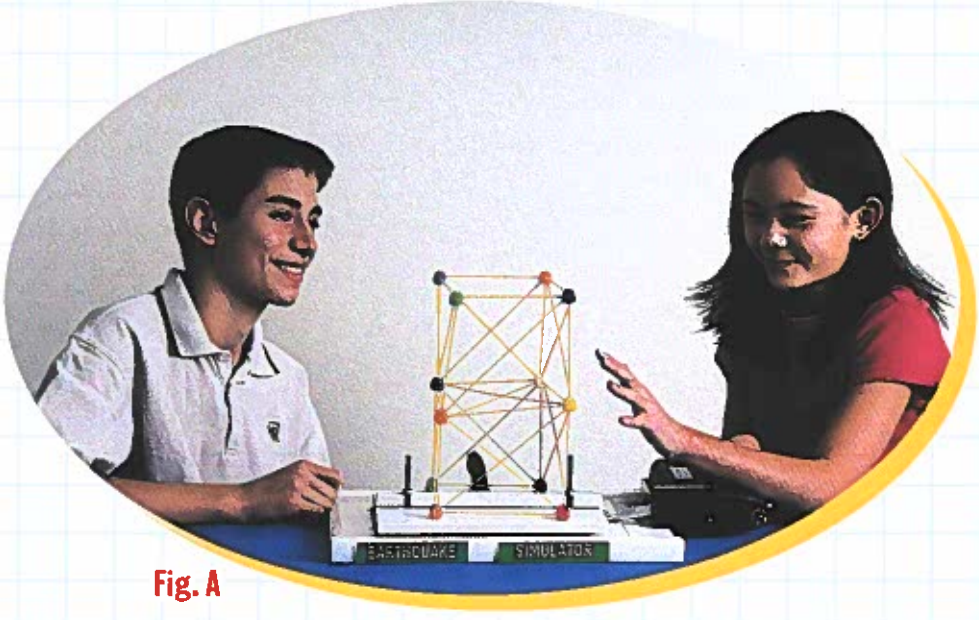


Fig. A

CHAPTER 2

REVIEW &

CHAPTER SUMMARY

SECTION 1

- One important way technology reaches you is through your school subjects.
- Technology plays a part in subjects such as science, mathematics, social studies, language arts, and health or physical education.
- Science usually gives you the theories (ideas), while technology lets you use your knowledge and resources to solve problems.
- Although technological devices like calculators make mathematics easier, a user must still know what to do with the information.
- At each point in history, different technologies were important for what they could do to help us.
- Technology has come up with new products that help us keep fit and healthy.

SECTION 2

- Technology education helps give you the "bigger picture" of how topics like mathematics, science, and language arts can be used together to find solutions.

REVIEW QUESTIONS

1. Name one way technology helps you in the classroom.
2. What tools of technology do you use in your mathematics classes?
3. How are science and technology different?
4. What can you learn from creating a timeline?
5. How does technology help us stay healthy?
6. Why do you need to integrate technology, science, mathematics, communication, and other subjects to solve problems?

CRITICAL THINKING

1. How does technology affect you most at home?
2. Name and explain one way in which technology and science work together to improve the environment.
3. How would your life be different if you could not use computers or television sets?
4. What medical developments have made your life better?
5. Why do you think calculators were invented?