Chapter Highlights

● Technology is people using tools, materials, and information to create products or services that meet our wants and needs.

● The products of technology have become part of our everyday lives. Technology can be found throughout everything we do.

● The families of technology are communication technology, production technology, transportation technology, and biotechnology.

● Science is the study of our natural world, whereas technology is the study of our people-made world.

● Science and technology together make a powerful team that can improve our people-made world.

Test Your Knowledge

1. Define *technology*.
2. What family of technology helps us gather, store, and share information?
3. What family of technology provides most of our everyday products?
4. How has technology brought the world community closer together?
5. If you were studying how the planets revolve around the sun, would you be studying science or technology?
6. Give two examples of how science and technology working together have improved your life or surroundings.
7. Farmers may soon be harvesting plants that have been developed to resist freezing in cold weather. What family of technology will this product come from?
8. Explain the differences between science and technology.
9. List five ways technology has influenced your daily routines.
10. What products in your home are the result of communication, transportation, and production technology? List two products for each of these families of technology.

Correlations

SCIENCE

1. Tomatoes are fragile. Packing them for shipment is hard because they are round. Find out what science and biotechnology have done to create a more cube-shaped tomato.

MATH

1. You read in this chapter that pacemakers regulate heartbeats. If a person's heart beats 70 times per minute, how many times will the heart beat in one 24-hour period?

LANGUAGE ARTS

1. For one day, try not using a television or telephone. How did you spend your time? How did you communicate with friends outside your home? In a paragraph or two, describe your day.

SOCIAL STUDIES

1. Make a list of the brand-name products in your home. Report your findings to the class. Determine the top ten brand names listed in the entire class and find out where these companies have factories.
2. Draw a map of the world and write the company names from Activity 1 in their respective countries.

CHAPTER 2

Technology Brings About Change

Introduction...................................

Technology is a powerful force that brings about changes in the way people live and work. The impacts, or influences, of technology can be positive, negative, or sometimes both. You can feel the impacts of technological change in your home, your community, and the world.

New technologies have changed forever how people communicate, produce products, transport things, and meet their daily needs. Changes due to technology can take place quickly or very gradually. In a mere 75 years, people have gone from dreaming about flying to landing on the moon. In a short 50 years, we have gone from no television to live TV programs viewed around the world by way of satellite systems.

After reading this chapter, you should be able to ....

Explain when and how technological change began.

Discuss how people satisfy their needs with technology.

Discuss the impacts of the Agricultural Era.

Discuss the impacts of the Industrial Era.

Discuss the impacts of the Information Era.

Words you will need.........................

Agricultural Era
Industrial Revolution
Industrial Era
mass production
factory system

cottage industry
Information Era
service industry
electronic cottage

When Did Technological Change Begin?

Technology began when people first attempted to satisfy their needs by developing tools. Who were these early toolmakers? Archaeologists tell us they were our ancestors, the cave dwellers. Cave dwellers lived during the Stone Age, which began about 1,000,000 B.C.

Early humans had a very difficult life. Finding food, staying warm, and protecting themselves from wild animals amounted to a full-time job. Early technology helped make their harsh lives easier.

Early humans were *nomadic*—they moved from place to place in search of food. They hunted, fished, and picked wild fruits and vegetables to survive.
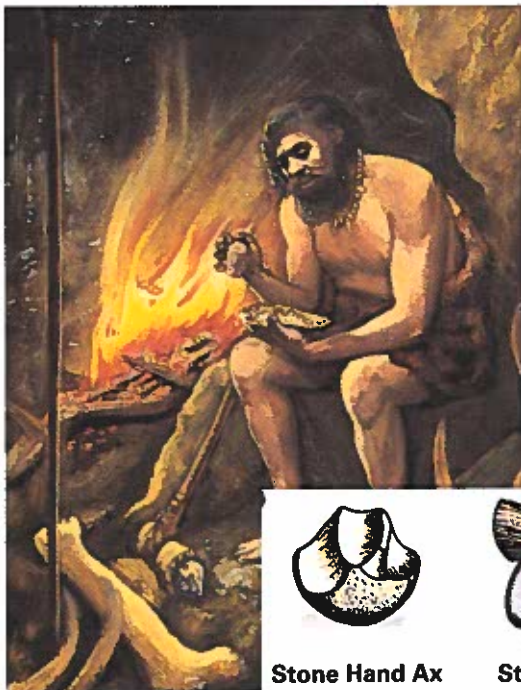
The first products of technology were probably simple sticks and bones. Cave dwellers used these simple tools to kill animals for food and to defend themselves from enemies. Fig. 2–1.

Can a stick really be considered technology? We have learned that technology is defined as people using tools, materials, and information to satisfy their needs. Sticks, stones, and bones were the only toolmaking materials available. What greater need exists than that of finding food? As primitive as these tools seem today, they were high technology a million years ago.

These simple tools changed how people satisfied their everyday needs. Tools of stone and wood marked the beginning of a process of change that still goes on today.

▶▶▶ **FOR DISCUSSION** ◀◀◀

1. If you were a cave dweller drawing on a cave wall, what kind of thoughts would you want to express?
2. If you were stranded on an unpopulated island, what would be the first three tools you would make?

Extension

Activity

■ **Using sticks, stones, and string or twine, make a small version of the type of hammer that cave dwellers may have used.**

Fig. 2-1. Early humans made tools from materials that were available. They shaped stones, wood, and bones into spears, clubs, and axes. Perhaps the first attempts at technology, these simple tools made life easier and better for our ancestors.

Stone Hand Ax   **Stone Ax with Wood Handle**
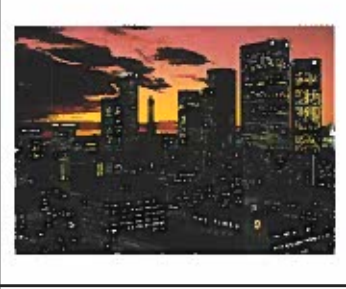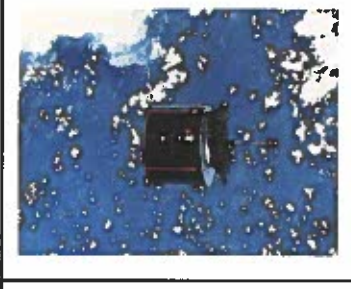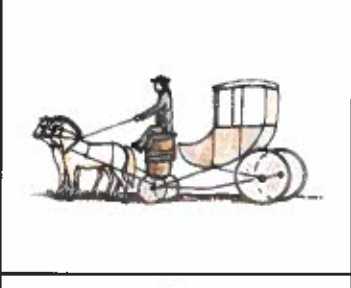
	AGRICULTURAL AGE	INDUSTRIAL AGE	INFORMATION AGE
FOOD			
SHELTER			
COMMUNICATION			
TRANSPORTATION			
HEALTH CARE			

Fig. 2-2. People's basic wants and needs have not changed, but the ways in which people meet those wants and needs have changed a great deal.

Technology Satisfies People's Needs

In their attempts to satisfy their needs, our early ancestors created new technologies. The stone ax, the wheel, the canoe, and even fire-building were technologies people developed to help satisfy their needs and wants.

All people have basic needs and wants. These include food, water, shelter, communication, recreation, protection, transportation, and health care. These needs and wants have remained the same since humans first walked this planet. Although our needs and wants never really change, the products we use to satisfy them change rapidly. Fig. 2–2.

In recent years, people have used technology to customize items for use by groups with special needs. For example, some telephones today are connected to flashing lights. This allows people who cannot hear the telephone ring to know when someone is calling them.

▶▶▶ FOR DISCUSSION ◀◀◀

1. Food today comes in many different forms. Canned food and fresh food are two examples. List four other ways food can be purchased.
2. Technology has changed our approach to recreation. What types of fun things do you think kids did during the early 1800s?

The Agricultural Era

Our ancestors began satisfying their needs by developing more and more new technology. Hunters gradually became farmers. To prepare the ground for planting, the farmers designed the sickle, the hoe, and the plow. The **Agricultural Era** was about to begin.

During the Agricultural Era, people banded together and stayed in one place. They formed villages centered around farming and domesticated animals such as cattle and horses. They learned how to plant and harvest many crops. Fig. 2–3.

Large, permanent shelters replaced the nomadic tents. People in each community were assigned specific jobs. Some people were hunters, some developed farming techniques, and others cared for the animals. Craftspeople made products for sale and trade. They wove fibers into fabrics, forged metals into tools, and carved wood into furniture. Fig. 2–4.

The Agricultural Era was a period of change that lasted into the early 1800s. People were happy with the results of technological change, and they wanted more.

> **TECHNOLOGY TRIVIA**
>
> The medication digitalis, used today to help patients who have heart disease, was first used in A.D.1550 for the same purpose. It was made from the foxglove herb.

Fig. 2-3. Farming changed the way people lived and worked. Hunters became farmers as nomadic people settled in villages and began growing their own food.

Fig. 2-4. Craftspeople worked at home or in small shops. By the 1700s, these "cottage industries" produced many products for the home and the community. The woman shown here is spinning wool. Because she worked in her own home, she also had the freedom to enjoy a book while she worked.

▶▶▶ FOR DISCUSSION ◀◀◀

1. The Egyptians were among the first people to farm the land. How do you think people first discovered they could plant and grow their own food?

2. Today, only two percent of the American work force is made up of farmers. How can such a small percentage of people produce enough food for our entire population?

The Industrial Era

Inventors responded to society's desire for new products with an explosion of new technologies. The **Industrial Revolution,** as it was called, began in England around 1750. The word *revolution* means "drastic change." The industrial revolution drastically changed how people lived and worked. It also marked the beginning of the **Industrial Era.**

The steam engine was one of the great forces behind the Industrial Era. People developed methods of powering machines by steam. They replaced hand-powered tools and machines with steam-powered equipment. Fig. 2–5.

Fig. 2-5. By the late 1800s, entire factories were powered by steam. In this textile factory, an overhead shaft and belt system allowed a single steam engine to run every machine in the factory.

To meet the demand for more products, people developed factories that used **mass production** techniques. This **factory system** enabled people to produce products faster and less expensively. The **cottage industry**—craftspeople working out of homes and small shops—could not compete with the new factories. Many of the craftspeople closed their businesses and went to work in the factories for wages.

The factories provided many people with jobs. They became an important part of the European and American economies. Cities expanded quickly as people moved from rural farm areas into the cities to work in the factories.

Ideas also moved with new speed. Change began taking place faster and faster. The Industrial Era lasted into the mid-1900s.

TECHNOLOGY TRIVIA

Lazlo Biro and his brother George produced the first commercially successful ball-point pen in 1938.

▶▶▶ FOR DISCUSSION ◀◀◀

1. Why do handmade products usually cost more than mass-produced products?

2. Laws preventing young children from working in factories were a direct result of the Industrial Era. What do you think brought these laws about?

IMPACT

The change to a factory-based economy affected all aspects of life. Before, most people spent their entire lives in the same area, rarely meeting strangers. Now, they moved to cities, where they met other people from different backgrounds. In the cities, there were more opportunities for education and for good jobs. Money became more important, both for the basics (people no longer grew their own food) and for status (success was measured by the things one owned). Families spent less time together; so parents had less influence on their children. For many, life became easier in some ways but more complex in others.

Community Activity

■ A company called MegaIndustries is planning to build a factory near the small town of Glenville. What would be the effects upon the community? What kinds of information would Glenville residents need to gather in order to plan for expected changes?

Major changes also occurred in transportation. Ships, trains, automobiles, and airplanes were developed or refined during the Industrial Era. They helped move products to new markets.

The Information Era

The world today is the result of continuing technological change. Our basic needs are met by complicated devices. Our lives are centered around information—all kinds of information. People gather, store, and use more information than ever before. Fig. 2–6.

For this reason, we live in what is known as the **Information Era.** People today gather so much information that we double our knowledge every seven years. We use this information to create new products and services to meet our wants and needs.

What are services? Many of our needs cannot be satisfied by products. To satisfy these needs, we need help from other people. Doctors, repair people, hospital workers, restaurant workers, technicians, and thousands of other people make up the **service industry.** The Information Era has caused an explosion of jobs in the service industry.

The computer is an essential tool of the Information Era. Computers do calculations almost instantly. They can scan their vast memories to provide us with instant access to information.

Fig. 2-6. Our world is centered around information that comes in many forms and on endless subjects. We have created many new technologies to help us gather, store, and communicate the information we use every day. How many examples can you find here?

Computers now perform many of the activities that people used to do. Home computers connect us through telephone lines to banks, stores, libraries, and even our doctors' offices. People can do much of their work at home and send it into their offices using modems or fax machines. Fig. 2–7. This arrangement is becoming so common that home offices are now referred to as the **electronic cottage.**

Of all the technologies that have emerged during the Information Era, medical technologies are perhaps the most amazing. Organ transplants, body replacement parts, miracle drugs, and medical machines have extended our life expectancy to 75 years and well beyond. Fig. 2–8.

Changes continue to take place in transportation, communication, production and biological technologies. Most of these changes help make our lives easier and better.

We must not forget, though, that technology has had many negative impacts on our lives. Pollution, energy shortages, and depletion of our natural resources are topics that we will discuss in detail later in this text.

▶▶▶ FOR DISCUSSION ◀◀◀

1. Has the need for higher education changed in the Information Age? Why?
2. In your opinion, what technology has had the greatest impact on your life?

Extension

Activity

■ Make a list of at least 25 types of service work. Which types have originated relatively recently? Share lists in a class discussion.
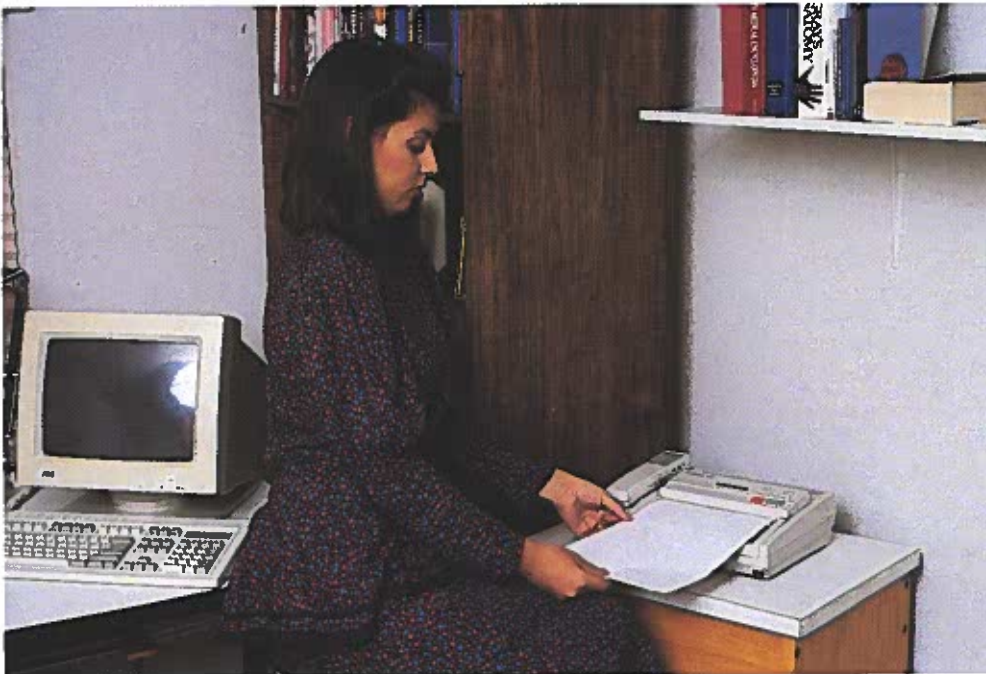
Fig. 2-7. People who worked out of their homes during the Agricultural Era made up the cottage industry. Communication devices developed in the Information Era have allowed a return to working in the home. Home offices are often referred to as the "electronic cottage."

Retinal Implant

Cochlear
(Inner Ear)
Implant

Facial Bone
Regeneration

Teeth
Implants

Voice Box

Pacemaker

Skin Regeneration

Insulin Dispenser

Hip Joint

Finger Joints

Synthetic Blood Vessels
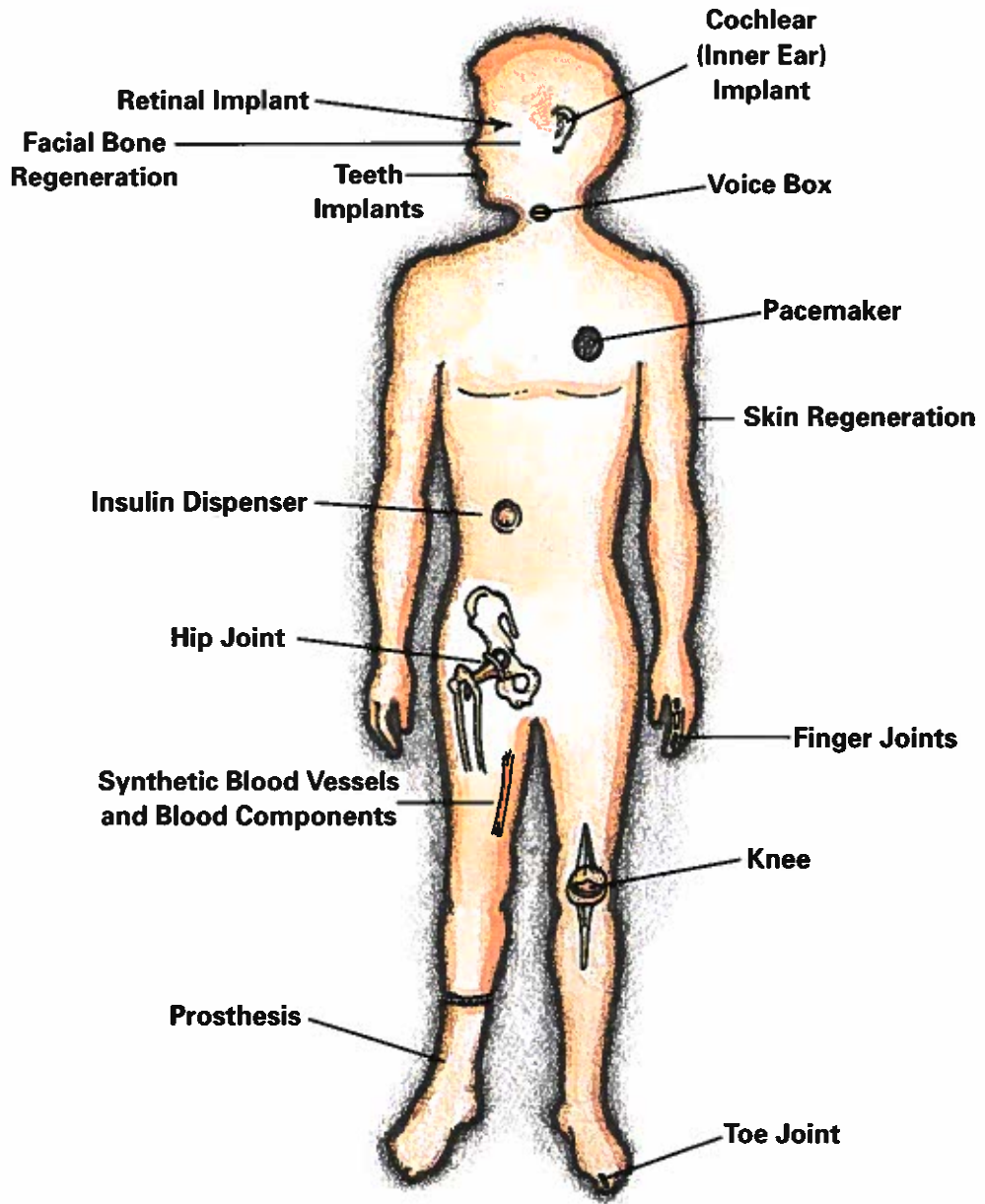and Blood Components

Knee

Prosthesis

Toe Joint

Fig. 2-8. Technological advances in health care have extended our life expectancy in the Information Age. Science and technology use information to replace natural body parts. Advances in tissue research will permit regeneration of certain body parts.

Chapter Highlights

● Technology is a powerful force that changes how we live and work.

● Technology produces products and services that help satisfy our physical and emotional needs.

● The Agricultural Era brought people together into communities that centered around farming and handcrafted products.

● The Industrial Era brought about machine-made products and the factory system. A new lifestyle emerged, centered around city living.

● Today, we live in the Information Era. Our lives are centered around gathering, storing, sharing, and using information to create products and services.

Test Your Knowledge

1. Give at least two examples of how today's technology can be used to benefit people with special needs.

2. The automobile and airplane were first produced in which era?

3. The plow is a tool used to make the trench in which farmers plant their seeds. List three ways people have developed to push or pull a plow.

4. Describe the differences between making products by hand and by using the factory system.

5. Give three examples of how modern technology helps people satisfy their physical needs.

6. List three products of technology that help satisfy people's need to communicate.

7. We all enjoy recreation, such as playing games, going to movies, and listening to music. How does recreation help satisfy our emotional needs?

8. Is the stone ax an example of technology? Why?

9. How has the computer changed the way people work?

10. Give three examples of how technology has increased our average life span.

Correlations

SCIENCE

1. You read in this chapter that a flashing light can signal hearing-impaired people that the phone is ringing. Find out how a TDD can help them communicate with the caller.

MATH

1. Life expectancy has increased 50 percent since 1910. If the average person of that time lived 50 years, what would be the average lifespan today?

LANGUAGE ARTS

1. Interview a parent or grandparent about a typical school day when he or she was your age. In an essay compare and contrast a typical school day today with the one that was described to you.

SOCIAL STUDIES

1. Your family car is an example of the advance made in transportation as a result of the Industrial Revolution. Find out exactly how automobiles are mass produced. If you live by a car manufacturing plant, see if you can tour the plant and see the production line first-hand.

You Can Make a Difference

The Knowledge Master Open

Which structure is correctly paired with its system?
(a) ganglion—skeletal system
(b) kidneys—circulatory system
(c) tongue—integumentary system
(d) feathers—reproductive system
(e) pituitary gland—endocrine system

Can you answer this question? Could you answer it with the help of a team of your classmates? If so, your school might be interested in forming a Knowledge Master Open team.

Every spring, middle school/junior high students all over the world form teams to compete in the Knowledge Master Open, an academic contest run on classroom computers. Technological advances such as microcomputers and fax machines let schools compete in a national/international contest without the expense of traveling to a central site.

The students at Washington Grade and Junior High School have a scholastic bowl team which travels to other nearby schools for academic competition. When the Computer Lab Director, Mrs. Diane Hoover, received information about the Knowledge Master Open (KMO), she knew the scholastic bowl team would be interested in competing.

A panel of teachers selected eighteen students from grades 6, 7, and 8 to compete in the contest. Since the questions were about varied topics such as literature, earth science, current events, art and music, economics and law, math, history, and trivia, the teachers chose students with a variety of interests and "specialties."

Mrs. Hoover received a computer disk from KMO which contained the official competition questions. The contest disk was programmed so that it could only be run once for actual competition purposes. Only students could be involved after the computer hardware was set up.

On the day of competition, Mrs. Hoover placed the disk in the computer and entered the password. Then the students took over and the competition began! Students had two

chances to answer each question. They earned five points for each question they answered correctly on the first try. They also received bonus points for speedy answers. On the second try, they earned two points for a correct answer. No points were deducted for incorrect answers.

Students were allowed to use pencil and paper during the competition, but they could not use calculators and books. Mrs. Hoover, acting as sponsor and supervisor, was not allowed to help in any way.

The competition lasted for 2½ hours. When it was over, Mrs. Hoover called Knowledge Master Central in Durango, Colorado, with the team results. The computer disk provided a summary of how well the students did in each content area of the contest.

Within a week of the competition, the Washington students received the world-wide results of the Knowledge Master Open competition. Checking the results from KMO, the team dis-

covered that they had answered the same number of questions correctly as a school from the Philippines (183 out of 200). The Washington students, however, took a second try on 25 of the questions, whereas the students in the Philippines tried a second time on 36 questions. How exciting to compete with students thousands of miles away without having to pack a suitcase!
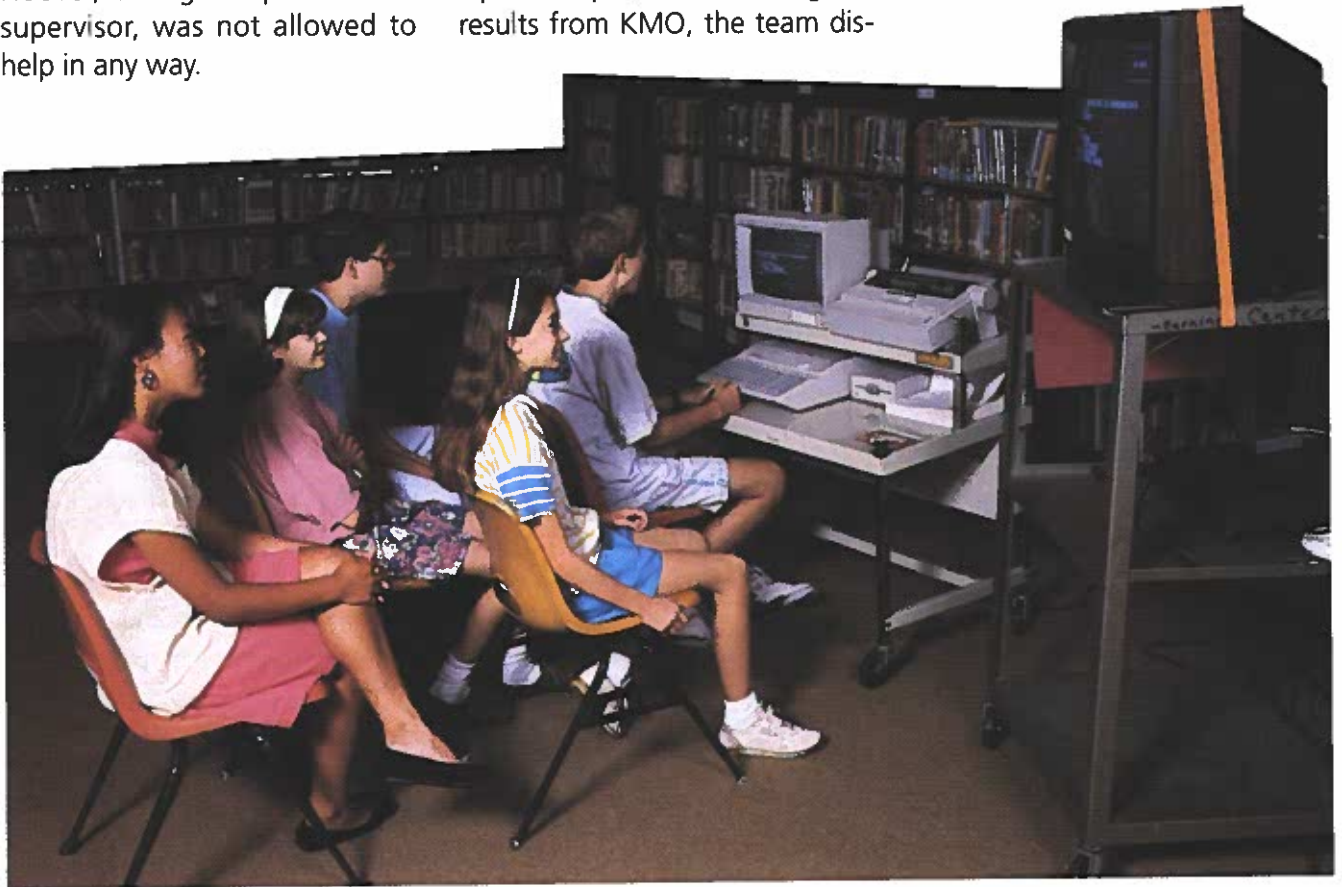
TECHNOLOGY RELIES ON RESOURCES

Activity Brief
Combining the Resources of Technology

PART 1: Here's the Situation ....

Resources are all the things you depend on to get a job done. What kind of resources would you depend on to write a report on a famous inventor? You would surely depend on books for information. Your teacher would also be a valuable resource for facts on famous people. You might even watch a video on the life of the inventor. If you did, your TV and VCR would become resources. If you wrote the report by hand, your pen, paper, and a dictionary would be resources. If you used a word processor to prepare the report, your computer and printer would be resources.

Technology is also dependent on resources to get a job done. When people use technology to create a product or service, they rely on seven important resources: people, information, energy, tools and machines, materials, capital (such as money), and time. As you do this activity and as you read Chapters 3 through 9, you will learn more about the seven resources of technology.

PART 2: Your Challenge...........

In this activity, you and your teammates will form your own company and design and then manufacture a hand-held game. Through experience, you will learn how each of the seven resources of technology can be used in the creation of the game.

PART 3: Specifications and Limits...........

Your game and the way in which your company develops it will need to meet certain standards. Read the following specifications and limits carefully before you begin.

1. The finished game must be hand-held and may not exceed 25 square inches in area.

2. The game must be hand-operated with no electrical parts.

3. The game must have a well-defined way of winning or completing the challenge.

4. Your team must produce a prototype (unique, one-of-a-kind item) of the game and then manufacture one game per team member.

5. You must hand in the following:
   - all sketches and drawings
   - a log sheet of your team's daily progress
   - a sample game

PART 4: Materials...........

There are many materials you might use to build your game. Here is a list of possibilities. Possible tools you might use are also given.

Materials

acetate
aluminum rivets (bumpers)
cardboard
construction paper
foam core board
glue
marbles
pine wood
poster board
rubber bands
springs
steel bearings
tin plate
washers
wood dowels
wood molding

Tools

hand tools
markers
scissors
utility knife

Safety Notes

- As you do this activity, remember to follow all the safety guidelines your teacher has explained to you.
- Use all tools properly. Use special care with tools that are sharp.
- If you use any power tools, be sure you understand how to operate them, and always get your teacher's permission.

PART 5: Procedure..........

The game you choose to design and manufacture will be up to you. Still, there are certain steps to follow that will make your work easier.

1. Working in manufacturing teams of 3 students each, brainstorm ideas for games. Keep a list. Try themes like sports and movies.
2. Develop a sketch of an idea you think will be a marketable game. Fig.II-1 shows one possibility.
3. Present your idea to the team. Consider ideas presented by your teammates.

Then, as a team, adopt an idea or combine ideas into a new design.
4. Build a prototype of the game.
5. Test the prototype. Make any necessary changes in the game design.
6. Set up the production sequence for producing the game and make a trial run. Make any changes that are necessary in your production sequence.
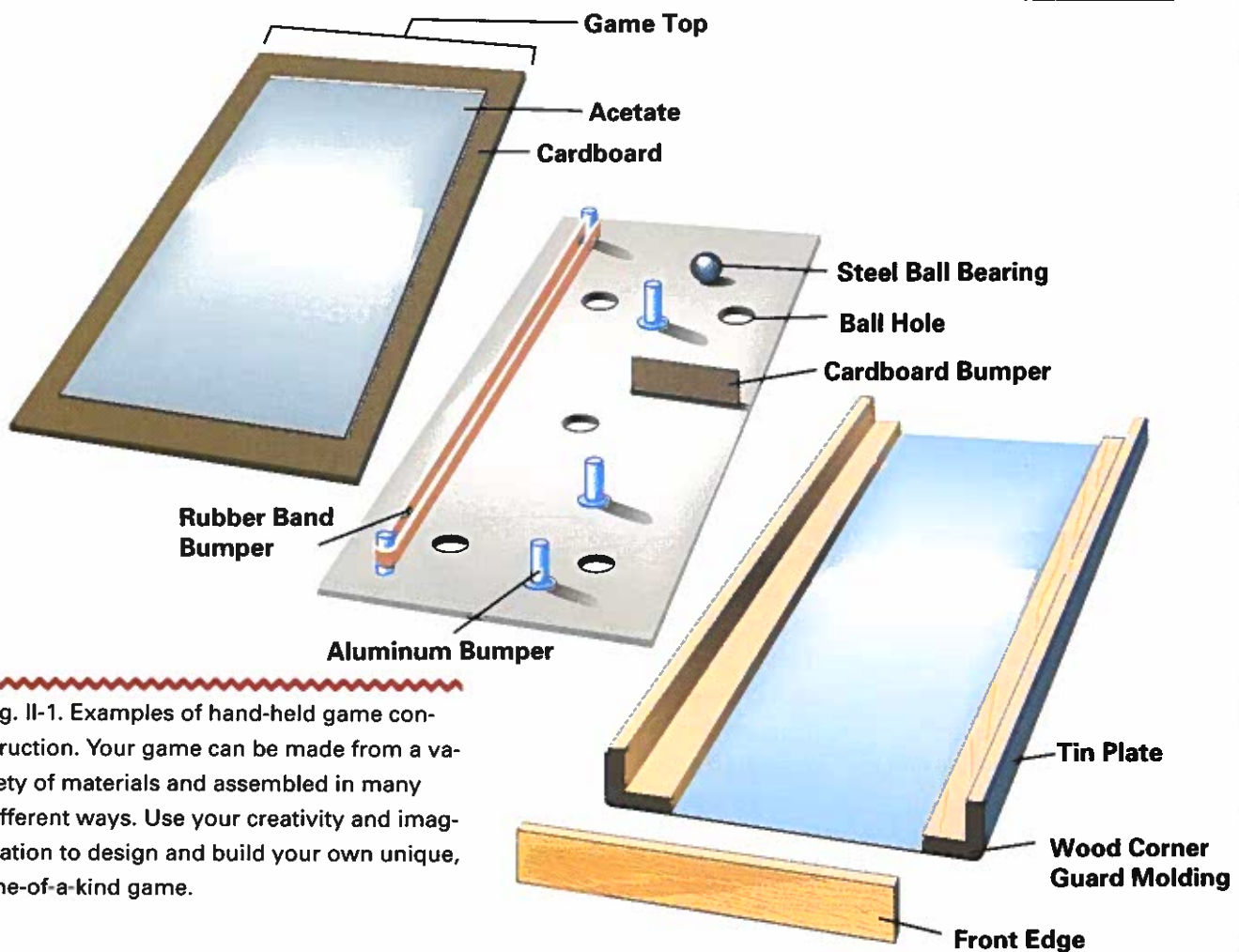7. Manufacture the game.

Fig. II-1. Examples of hand-held game construction. Your game can be made from a variety of materials and assembled in many different ways. Use your creativity and imagination to design and build your own unique, one-of-a-kind game.