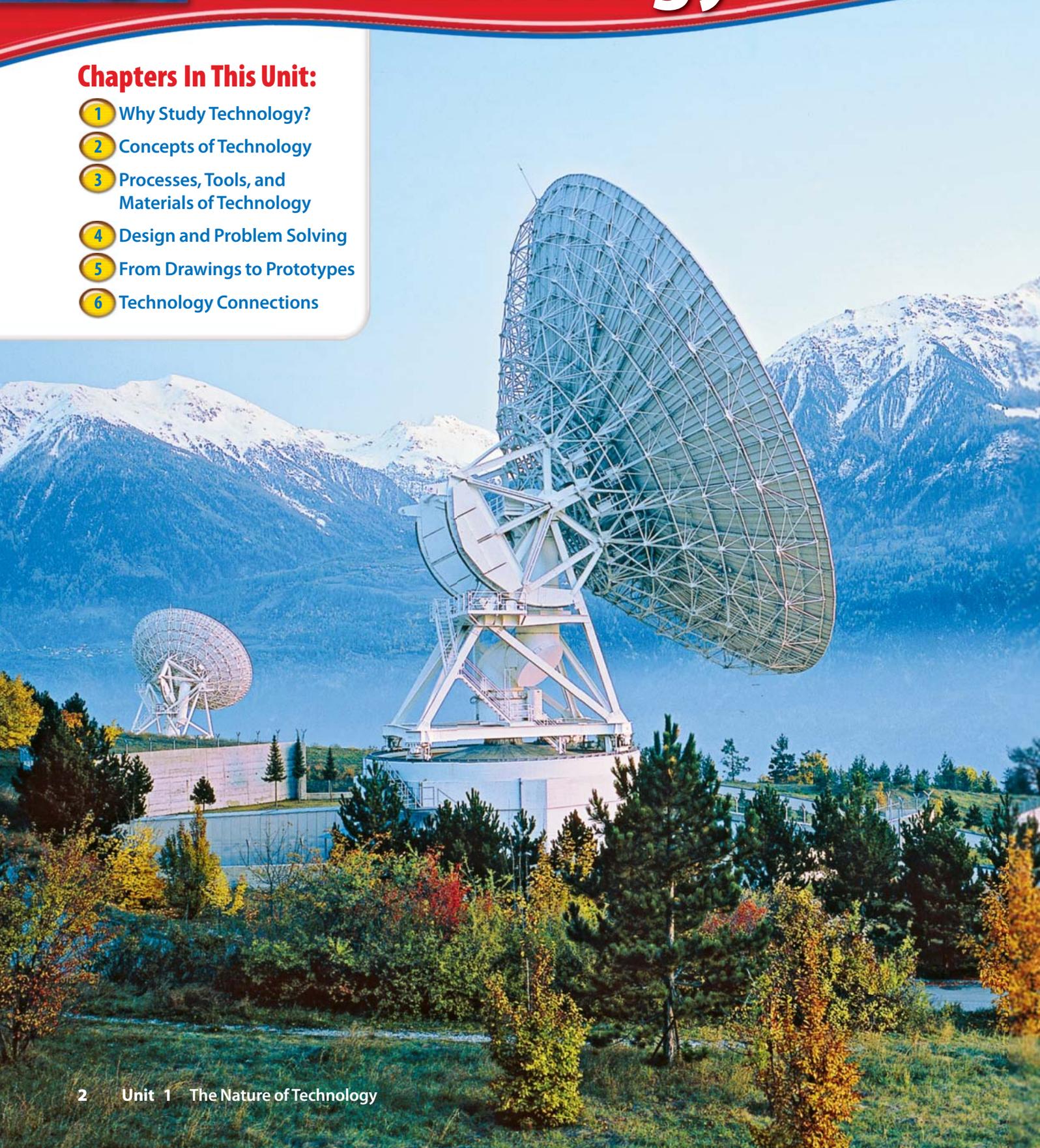


The Nature of Technology

Chapters In This Unit:

- 1 Why Study Technology?
- 2 Concepts of Technology
- 3 Processes, Tools, and Materials of Technology
- 4 Design and Problem Solving
- 5 From Drawings to Prototypes
- 6 Technology Connections





Unit Thematic Project Preview

Redesigning an Invention

As part of this unit, you will learn about the concepts, tools, and materials of technology. Products are created through design and problem solving, using drawings and prototypes. Knowing about the nature of technology and its history can lead to new inventions and innovations.

As you read this unit, use this checklist to prepare for the project at the end of this unit:

PROJECT CHECKLIST

- ✓ Think about some simple tools or inventions you use every day.
- ✓ Ask your teacher what equipment you will need to do this lab.
- ✓ Find out where you can get an application for a patent.

WebQuest Internet Project

- Go to glencoe.com to this book's Online Learning Center (OLC) to find the WebQuest activity for Unit 1. Begin by reading the Task. This WebQuest activity will help you learn about the different types of plastics used for technology and how they can be recycled.

Explore the Photo

The Wide World of Technology You probably know that computers, cell phones, and rockets are all technology. Some technologies depend on satellite technology. *How might satellite dishes relate to products you use?*

Why Study Technology?

Sections

- 1.1 Technology and You
- 1.2 Making Technology Happen
- 1.3 How Technology Changes

What You'll Learn

- **Define** technology.
- **Identify** reasons for studying technology.
- **Explain** the advantages of being technologically literate.
- **Name** the workers who do technology.
- **Describe** how science, engineering, and technology are linked.
- **Explain** how teens have contributed to technology.
- **Discuss** how technology changes.
- **Describe** the influence of democracy on technology in the United States.

Explore the Photo



Build a Better Robot Technology helps build robots. Building small industrial robots is a lot of fun, and some students can enter robot competitions for prizes. *Besides getting the chance to work on fun projects, what are some other reasons for studying technology?*





Launch the TECHNOLOGY LAB

Build a High-Tech Paper Airplane

At the end of this chapter, you will make two high-technology paper airplanes. Then you will test them. Get a head start by using this checklist to prepare for the Technology Lab.

PROJECT CHECKLIST

- ✓ Do some research on the Internet and look at some paper airplanes.
- ✓ Start making sketches of different paper airplanes.
- ✓ Begin to collect materials you will need for this lab, such as paper and a stopwatch.

Technology and You

Reading Guide

Before You Read

Preview How would you define the word *technology*?

Content Vocabulary

- technology
- technologically literate

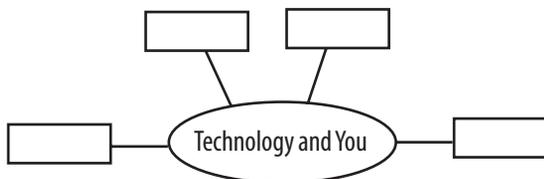
Academic Vocabulary

You will see these words in your reading and on your tests. Find their meanings at the back of this book.

- project
- device

Graphic Organizer

Draw the section diagram. Use it to organize and write down information as you read.



Go to glencoe.com to this book's OLC for a downloadable graphic organizer and more.

TECHNOLOGY STANDARDS

- STL 4** Cultural, Social, Economic & Political Effects
- STL 6** Role of Society
- STL 17** Information & Communication Technologies

ACADEMIC STANDARDS

Science

NSES F Science and technology in society

Social Studies

NCSS 8 Science, Technology, and Society

STL *National Standards for Technological Literacy*

NCTM *National Council of Teachers of Mathematics*

NCTE *National Council of Teachers of English*

NSES *National Science Education Standards*

NCSS *National Council for the Social Studies*

Enjoying Technology

What is the origin of the word *technology*?

Technology means different things to different people. A physician might think of technology as a way to produce a new medicine. To a space engineer, it might mean making better rocket engines. Technology is so widespread that it is part of everyone's life.

The word *technology* comes from the Greek word *techne*, which means "art." You might think that art means only paintings or sculpture. But the Greeks believed an artist could make useful products from natural materials such as trees, rocks, and plants.

In this book you will learn *about* technology, inventing, and how things work. You will also learn to *do* technology—and you may learn to *enjoy* technology.

As You Read

Connect What kinds of technology do you use every day?

Technology and Society

What are the different kinds of technology?

Technology is the practical use of human knowledge to extend human abilities and to satisfy human needs and wants.

Technology provides us with most things we use in our society. It can be broken down into six general groups or types of technologies.

1. **Energy and power**—This type of technology deals with the electricity and power that makes things run. We can generate electricity and power from many sources today.
2. **Biotechnology**—This type of technology is based on biology, or the science of living things. Breakfast cereals, medicines, and bionic arms and legs are products of biotechnology.
3. **Communication**—This type of technology includes the use of cell phones, iPods, DVD recorders, and similar items.
4. **Manufacturing**—This type of technology includes items that were made or processed in a factory. Practically everything you use is a product of manufacturing technology.
5. **Construction**—This type of technology deals with building houses, bridges, skyscrapers, and other **projects** such as playgrounds and monuments.
6. **Transportation**—This type of technology deals with moving people or products in cars, ships, airplanes, trains, or other vehicles.

All of this technology has improved over the years. When your grandparents were your age, they may have watched black-and-white television. Today you might watch your favorite shows on the Internet or on a high-definition television. Think of how cell phones have changed. Houses have also changed, and so have the foods and entertainment that you enjoy. What other changes in technology can you identify?

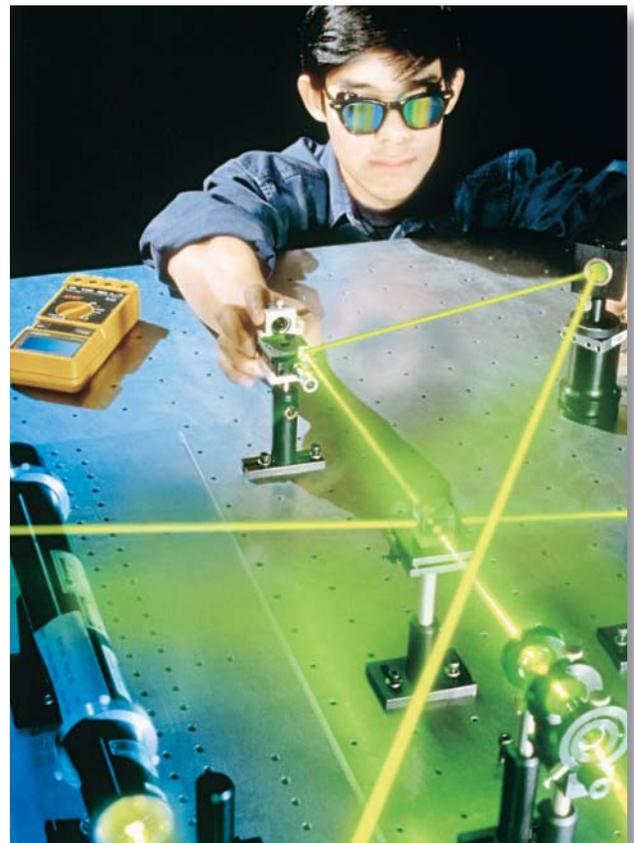


Reading Check

Define What is technology?



Seeing the Light Today technologists use lasers in many fields that involve communication technology, manufacturing technology, and biotechnology. *Why do you think this student is wearing goggles?*



Tech Stars

Corbis/Bettmann

Steve Jobs and Steve Wozniak

Founders of Apple Computers

In 1977, Steve Jobs and Steve Wozniak designed and built the world's first commercially successful personal computer, the Apple II. It was the first of many innovative products made by the now well-known company. The men built the computer in Jobs' garage with money they collected by selling belongings, such as Jobs' Volkswagen bus and Wozniak's calculator. Jobs and Wozniak chose the name *Apple* for their company because Jobs once spent a summer in Oregon picking apples.



iPod® Nation By 1985, Apple Computers had become a large, successful company. Jobs and Wozniak left the company to pursue other interests. Jobs rejoined Apple in 1996 to rebuild the brand. Apple is now a leader in the digital music world with iPod and iTunes®.

English Language Arts/Writing Write a short essay identifying types of technology you think Apple uses, and explain your choices.



Go to glencoe.com to this book's OLC to learn about young innovators in technology.

Why We Study Technology

What school subjects are related to technology?

Why should you study technology? That question is easy to answer. Technology is fun, rewarding, and exciting. It is fun because you get to work with your hands. It is rewarding because you get to see the results of your work. Each day brings new ideas and new challenges, which make technology exciting.

Studying technology will also help you develop your problem-solving skills. You can learn to identify a problem and come up with a solution.

You will also find that technology is related to other subjects that you study in school such as:

- Mathematics
- Science
- Social studies
- English language arts
- Art

You might enjoy all of your classes more after you begin to see the relationships between technology and other subjects.



List What are some reasons for studying technology?

Being Technologically Literate

Do you know what “technologically literate” means?

Technology is often in the news. A journalist might report on a particular electrical power plant, a food additive, or a safety **device** on an automobile. It is important that you understand the importance of technology. Every day in many ways, technology affects the lives of people around the world.

For example, automobile air bags have saved many lives in collisions. However, they inflate so quickly that they have caused injury and death in some cases. As a result, the federal government allows car owners to install an on/off switch for the air bags. Do you think the government should let people do this? To answer this question, you first need to know something about the technology being discussed.

Does working on a small engine sound difficult to you? With a basic understanding of technology, it might not be as hard as you think. Being **technologically literate** means understanding technology and feeling comfortable with it. Sometimes there is no one correct answer to a problem. You need to think about and evaluate each situation, and then make a decision. When you can do this, you will be technologically literate.



A Green World

Workplaces, businesses, and public places are adopting sustainable and “green” practices that are friendly to our environment. Laws are requiring this, and many consumers and employees are demanding it. Saving energy and using resources wisely can save the environment and money, too.

Try This Think of five ways to make your school “green.” For example, use energy-saving light bulbs.

section

1.1

assessment

After You Read Self-Check

1. Name two communication products.
2. Name two transportation products.
3. Explain what it means to be technologically literate.

Think

4. Discuss how you think cars today are different from cars made 50 years ago. How did society’s demands and values influence these differences?

Practice Academic Skills

English Language Arts/Writing

5. Walter Chrysler, the man who started the Chrysler car company, once said, “Someday I’d like to show a poet how it feels to design and build a railroad locomotive.” Imagine designing a new technology product that changes the world. Imagine inventing that new product, and write a poem about how that would make you feel.

STEM Mathematics

6. Kevin did research for a paper at the library. It took him 25 minutes to drive to the library, 35 minutes to determine what books would help him, 15 minutes to find the books, and 2 hours to collect the information. For a similar paper, he did his research online. It took him 1 hour and 50 minutes to gather the information he needed. How much time did he save by doing research online?

Math Concept Time When you are adding or subtracting time, work with minutes and hours separately.

1. Total the individual times to determine how many minutes it took.
2. Remember that 60 minutes equals one hour.



For help, go to glencoe.com to this book’s OLC and find the Math Handbook.

Making Technology Happen

Reading Guide

Before You Read

Preview How does technology involve people?

Content Vocabulary

- science
- engineering

Academic Vocabulary

- automatic
- survey

Graphic Organizer

Draw the section diagram. Use it to organize and write down information as you read.

Science, Technology, and Engineering

1. Science	2. Technology	3. Engineering
	Makes things happen	



Go to glencoe.com to this book's OLC for a downloadable graphic organizer and more.

TECHNOLOGY STANDARDS

STL 3 Relationships & Connections

STL 7 Influence on History

STL 19 Manufacturing Technologies

ACADEMIC STANDARDS

Science

NSES E Understandings about science and technology

Social Studies

NCSS 4 Individual Development and Identity

STL *National Standards for Technological Literacy*

NCTM *National Council of Teachers of Mathematics*

NCTE *National Council of Teachers of English*

NSES *National Science Education Standards*

NCSS *National Council for the Social Studies*

The People Who Do Technology

Who are the people who create and use technology?

More than anything else, technology involves people. People make things happen. People apply the technology. Long ago workers in technology called themselves “artisans.” That word is based on the word *art*, just like *artist*. An artisan is a highly skilled worker or craftsperson. Two modern names for people who work in technology are *technician* and *technologist*. You can use either word to describe a person who works in technology.

As You Read

Predict Think of different words that might be related to the word *technology*.

Reading Check

Identify What is another word for technologist?

Science, Technology, and Engineering

How are the areas of science, technology, and engineering related?

You may notice that the words *science* and *technology* are often used together. Your dictionary probably uses the word *science* in the definition of the word *technology*. Although science and technology are related, they are not the same. **Science** explains *how* things happen. Technology *makes* things happen.

Scientists helped to create electronic microchips. Technologists used those microchips to make digital cameras, **automatic** sprinklers, MP3 players, and other electronic devices. Scientists discovered lasers before technologists built laser-operated medical equipment.

Engineering

Another important profession is **engineering**. It often fits between science and technology. Using their knowledge of science and mathematics, engineers determine *how to make* things. For example, chemical engineers who work with mechanical engineers design machines that produce plastics and other materials. Technologists build the products that the engineers design.



Reading Check

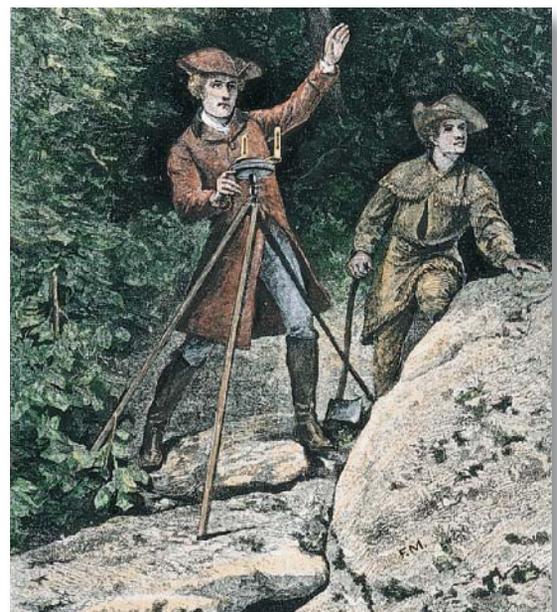
Distinguish What is the difference between science and engineering?

Teens and Technology

How have teenagers contributed to the development of technology?

Believe it or not, teens have made important contributions to technology. Have you ever heard of George Westinghouse? He started a company that still uses his last name. He is known for inventing improved brakes for trains. However, when he was only 19 years old, Westinghouse patented a new type of steam engine. It was not successful, but he was on his way.

 **A Young Technologist** As a young man, George Washington surveyed millions of acres of land in Virginia. He used a tool called a circumference set. *Why do you think a surveyor is a technologist?*



Imagine
This...

Technology Today and Tomorrow

In every chapter, you will discover exciting innovations in technology today. The technology of tomorrow may cause important changes in our lives.

What kind of new inventions can you imagine for communication of the future?

 Go to glencoe.com to this book's OLC for answers and to learn more about the technology of tomorrow.

Academic Connections Social Studies

An Inventive President

U.S. presidents are known for many things. One president was an inventor who patented his invention. A patent is a government document granting a person the right to produce or sell his or her invention. No one else may copy it.

Apply Go to the Internet to research past presidents. Identify the president who was granted a patent and name his invention.

George Washington, the first president of the United States, was a self-taught surveyor long before he became a military leader in the Revolutionary War. During the 1700s, Washington assisted in **surveying** 5 million acres for the largest landowner in the state of Virginia. He also helped plan the city of Alexandria, Virginia. He was appointed Official Surveyor of Culpeper County in Virginia when he was only 17 years old.

At age 14, Elmer Sperry invented a swiveling headlamp for trains so that an engineer could see around curves while the train was traveling along the railroad tracks. Although the headlamp was not successful, the gyrocompass he later invented was remarkable. Sperry's gyrocompass is still used in all ship and airplane guidance systems.

Good inventions are still being created by young people today. Students at Hampshire College in Massachusetts created the "Grease Car," which turns used cooking oil into fuel. Other students invented a hand braking system for wheelchairs and a scooter-bicycle combination.

Would you like to be an inventor? Ask your teacher for more information about organizations like the National Collegiate Inventors and Innovators Alliance as well as other groups dedicated to young innovators.

section

1.2

assessment



After You Read

Self-Check

1. Name two words that describe a person who works in technology.
2. Explain the difference between science and technology.
3. Identify who designs a gear—a scientist, an engineer, or a technologist. Explain why.

Think

4. Find an engineer who works in your community. Briefly describe what this person does for a living.

Practice Academic Skills



Science

5. Manufacture a useful product out of raw materials. Present the product to your class, explaining the materials you used to make it and its purpose. For example:
 - Tree branches to make small wooden items
 - Rocks to make jewelry or other decorative items

- Dyed sand to make paintings, as used by Native Americans
- Grass or straw to make woven hot pads



Mathematics

6. Roberta is designing a car that will run on solar energy. The flywheel of the car needs to have a circumference of 62.8 inches. What is the diameter of the flywheel?

Math Concept

Determining Measurement When working with geometric shapes, be sure to use the correct formulas.

1. Remember, the circumference of a circle is equal to its diameter times π .
2. Use 3.14 to represent π .



For help, go to glencoe.com to this book's OLC and find the Math Handbook.

How Technology Changes

Reading Guide

Before You Read

Preview How has technology changed to meet people's needs?

Content Vocabulary

- nanotechnology
- machine tool

Academic Vocabulary

- predict
- tradition

Graphic Organizer

Draw the section diagram. Use it to organize and write down information as you read.

U.S. Technology Products

- | | |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |



Go to glencoe.com to this book's OLC for a downloadable graphic organizer and more.

TECHNOLOGY STANDARDS

- STL 3** Relationships & Connections
- STL 4** Cultural, Social, Economic & Political Effects
- STL 6** Role of Society
- STL 7** Influence on History

ACADEMIC STANDARDS

Science

NSES 8 Content Standard G History of Science

English Language Arts

NCTE 1 Read text to acquire new information.

STL *National Standards for Technological Literacy*

NCTM *National Council of Teachers of Mathematics*

NCTE *National Council of Teachers of English*

NSES *National Science Education Standards*

NCSS *National Council for the Social Studies*

Technology and History

What examples of today's technology are based on past technology?

Throughout history, technology has helped change societies and cultures. It has influenced politics and economies. In turn, technology itself has been influenced by changes in civilization. See **Figure 1.1** on page 14.

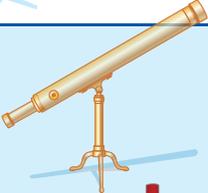
Building on the Past

In everything we do, we build on the efforts of people who came before us. Isaac Newton was a famous British scientist during the 1700s who investigated the motion of the planets.

As You Read

Analyze How does technology of the past lead to technology of the future?

Figure 1.1 The History of Technology

Iron Age Beginning about 1200 B.C.E.		Iron replaced metals such as copper and bronze. Iron agricultural tools made permanent farming settlements more desirable.
Middle Ages Beginning about 500		Windmills, horseshoes, papermaking, mechanical clocks, and faster ships were all developed and had important effects on society.
The Renaissance Beginning about 1300		Architecture, the arts and humanities, and canal construction flourished. Microscopes, telescopes and many other devices and processes were invented.
The Industrial Revolution Beginning about 1750		Manufacturing, transportation, communication, and construction all advanced rapidly. Education improved and people had more leisure time.
The Information Age Beginning about 1900		Machines were invented that could process, store, and exchange data electronically. Computers and other electronic devices have transformed society.

 **Through the Ages** Technology has been evolving since the beginning of time.

What might be some more examples of Information Age technology?

Newton said, “If I have seen further [than others], it is by standing upon the shoulders of giants.” He meant that his accomplishments were based on the earlier work of other people. In technology, those people are the artisans, technicians, engineers, and scientists who came before us.

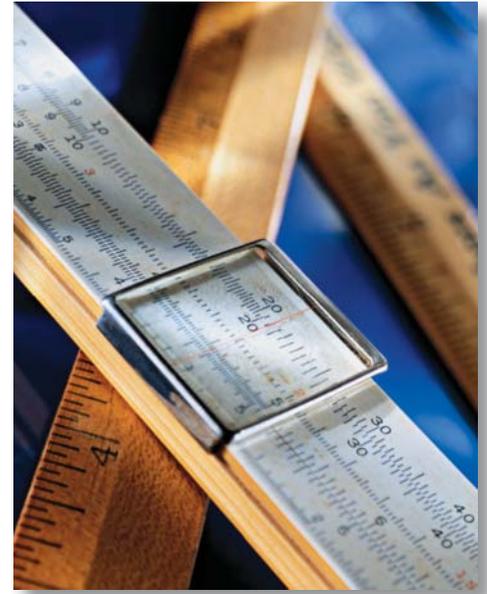
The first Boeing 707 airplanes were designed by people who used slide rules to make calculations. Today’s airplanes are designed by people who use pocket calculators and computers. Technology moves forward by adapting, so that each new product is an improvement over an existing product.

The Evolution of Technology

Technology is continually evolving, which means it is changing and growing. Thomas Edison invented the phonograph, but he knew nothing about tape recordings. Compact disc recordings replaced tapes. Digital files are replacing compact discs.

For example, a new technology you might have heard about is **nanotechnology**. It is the science of working with the atoms or molecules of materials to develop very small machines. The term comes from the word *nano*, which means “one billionth.” Years ago a famous physicist, Richard Feynman, **predicted** that we would be able to build a machine so small that it would be the size of just a few thousand atoms. That is very small. His prediction came true. Some tiny machines have parts so small that you need a microscope to see them!

Technology is changing more rapidly today than ever before. See **Figure 1.2** on page 16. One reason for this is better communication. Centuries ago news traveled slowly. Today the Internet allows information to travel around the world in seconds.



Reading Check

Summarize What are some ways in which technology changes?

Changing Rules The engineers who built the first Boeing 707 airplanes used slide rules like these to make calculations. Today’s engineers use computers and small calculators. *Is this an example of evolution in technology? Why or why not?*

Technology in the United States

What happened when technology met democracy?

Since the 1700s, the United States has developed a reputation as a place where an intelligent and energetic person could be successful. Americans have developed new ideas about work, community, and success. Under democracy, Americans are basically free to try different ways of doing things. This system has encouraged technical advances and new businesses.

Ethics in Action

Making the Grade Online

Many teachers are now posting grades on school Web sites. Parents seem to like the idea. Online grades make it easier for parents and students to keep track of progress. They can check the students’ most recent grades at work or at home.

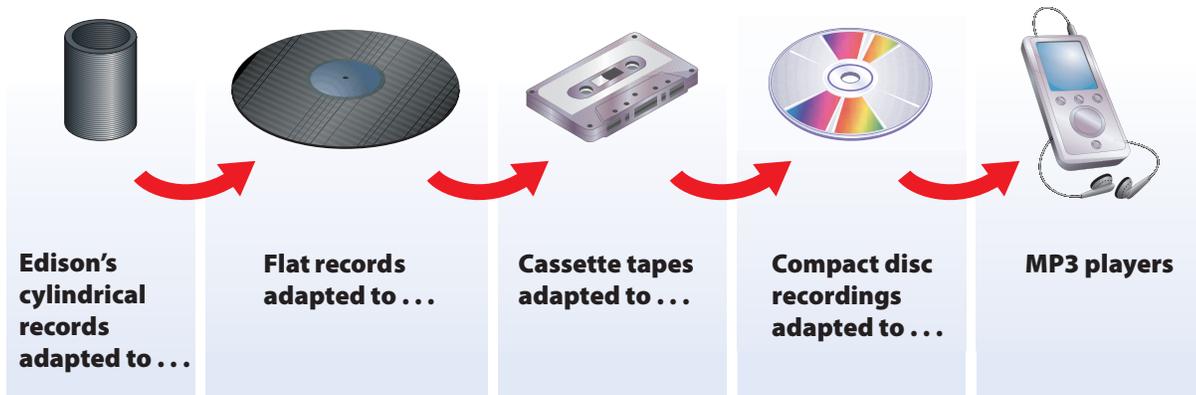
“A” for Effort But online grading programs have drawbacks. One problem is hackers. They might erase or change grades. Another problem is privacy. If your grades are posted online, other students might be able to see them.

English Language Arts/Writing

Do Unto Others Yuri’s teacher, Mr. Santiago, posts grades online. To protect the class’s privacy, Mr. Santiago uses ID numbers instead of names.

1. By accident, Yuri learns another student’s ID number. On the Web site, Yuri sees that the other student got a low grade.
2. What should Yuri do and why? Write your answer in one paragraph.

Figure 1.2 What's Next?



 **Changing Tunes** Voice and music recording media have evolved from Edison's records to today's MP3s. *What kind of recording technology do you think will be popular ten years from now?*

After the United States began manufacturing machine tools, Americans developed many other technological products. **Machine tools** are machines for shaping and finishing metals and other materials. These products include electronic computers, industrial robots, liquid-fueled rockets, reliable suspension bridges, photocopier machines, diesel engines for locomotives, electronic television, the metal-framed skyscraper, and the practical helicopter.

The heritage of American technology is very rich. You have benefited from and have inherited a powerful technological **tradition**. You can help to continue that tradition as you study and use technology.

section

1.3

assessment

 After You Read

Self-Check

1. Identify Isaac Newton.
2. Name the type of product the United States used to first enter the arena of technology.
3. List five products that were originally developed in the United States.

Think

4. Give an example from your own life of how you have built on the efforts of someone else.

Practice Academic Skills



English Language Arts/Writing

5. Choose and investigate an interesting career in technology. Write a short essay describing what you like about it.



Social Studies

6. Technology has played an important role in society throughout history to make things easier, safer, and more efficient. Choose a technology product you use today. Use the Internet and/or your library and research its history. Find out when and why it was invented. What was used before it was invented? Write a few paragraphs describing what you find.

Exploring Careers *in* Technology

Aaron Stewart-Ahn

FILMMAKER

Q: *What do you do?*

A: I am a filmmaker who works on music videos, documentaries on musicians, and now commercials. I hope to make feature films soon.

Q: *What kind of training and education did you need to get this job?*

A: I attended a post-graduate film school. However, today's filmmaking technology has become very accessible to everyone. You can buy enough equipment to become a filmmaker for less than the cost of attending an expensive film school. I suggest young filmmakers get an education in the liberal arts—literature, philosophy, history—so they can develop stories and ideas to share.

Q: *What do you like about your job?*

A: I like everything about the process of filmmaking. I like working with other creative people, the unexpected happy accidents, the way film involves all the performing arts and techniques. But it takes hard work to get the next job, and you must sometimes work long hours.

Q: *How did you get interested in your job?*

A: My parents would take me to movies at a very young age. Then I started to play with toys by lining up action figures the way a director sets up a shot. My mother told me what a director did when I was five. I said, "I want to do that." Despite the ups and downs of my life, I never gave up.



English Language Arts/Writing

Script Writing Write a script for a short film or just a scene in a film. Write dialogue (talking) and describe scenery, and any action.

1. Using a word processor, write a script including dialogue, action, camera direction, etc.
2. Make a "storyboard" of your script. This means: Draw on paper or use a graphics program to show how you picture your script.
3. Display your storyboard and read your script to the class. Or if you have a presentation software program, combine your script and images as a slideshow to show the class.



Go to glencoe.com to this book's OLC to learn more about this career.

Real-World Skills

Writing, speaking, listening, problem-solving

Academics and Education

English language arts, social studies, mathematics

Career Outlook

Growth as fast as average for the next ten years

Source: *Occupational Outlook Handbook*

Chapter Summary

Section 1.1 Technology is the practical use of human knowledge to extend human abilities and to satisfy human needs and wants. It involves turning natural items into useful products. We study technology because it is fun, rewarding, and exciting. If you are technologically literate, you are comfortable with technology. You can evaluate each situation and make informed decisions.

Section 1.2 The areas of science, technology, and engineering are related but different. Scientists try to explain how things happen. Engineers figure out how to make things. Technologists make things by operating machines and assembling parts. All of these people work together to create and produce the products we need. Teenagers can also contribute to the development of technology.

Section 1.3 We build on the efforts of people who came before us. Technology advances by adapting, so each new product is an improvement over an existing one. New inventions are almost always based on earlier accomplishments. One reason technology has thrived in the United States is because people feel free under democracy to try different ways of doing things.

Review Content Vocabulary and Academic Vocabulary

- On a sheet of paper, use each of these terms and words in a written sentence.

Content Vocabulary

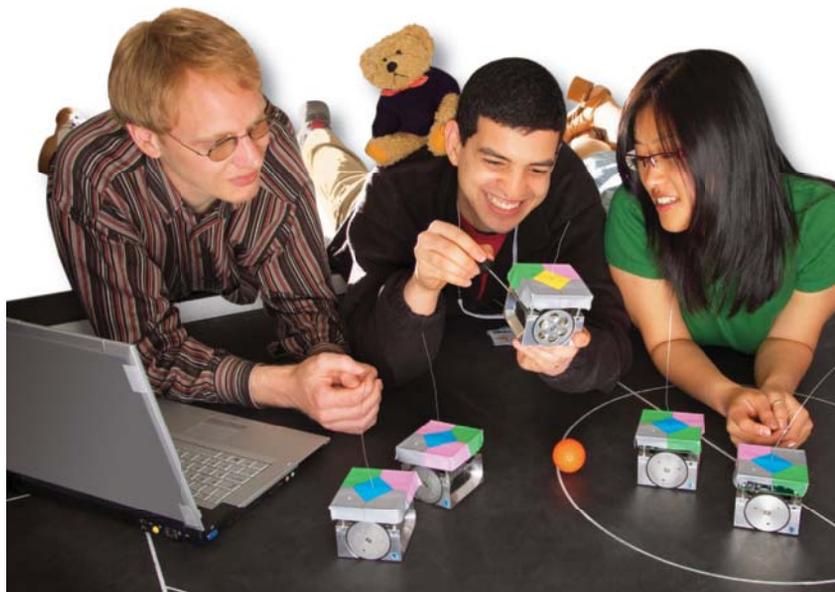
- technology
- technologically literate
- science
- engineering
- nanotechnology
- machine tool

Academic Vocabulary

- project
- device
- automatic
- survey
- predict
- tradition

Review Key Concepts

- Define** technology.
- List** reasons for studying technology.
- Explain** the advantages of being technologically literate.
- Identify** the workers who do technology.
- Discuss** the connection between science, engineering, and technology.
- Explain** how teens have contributed to technology.
- Explain** how technology changes.
- Describe** how democracy in the United States has influenced technology.
- Identify** the technology you use in your life.



Real-World Skills

- 11. Observation** Practice your observation skills by looking for technology at home or in the classroom. Write a summary of what you see, describing why the technology is needed and how your life would be different without it.

STEM Technology Skill

- 12. Spreadsheets** Many companies use spreadsheet software to organize data or information. Spreadsheets make comparing data fast and easy.
- Research the cost of a product at several stores. Use spreadsheet software and input what you find. Include information like the price, cost of transportation, and mailing costs.
 - Compare the costs. What is the least expensive option? Consider all costs.



WINNING EVENTS

Student Representative

Situation You and three team members have been elected student representatives for your school. You must present arguments to your school board about two issues:

- Access and use of cell phones by students during school hours
- Access and use of the Internet by students

Activity Work together to prepare arguments for and against the use of these technologies. Present to your classmates. Two members will argue pros, and two will argue cons.

Evaluation You will be evaluated on how well you meet these performance indicators:

- Knowledge of the subject
- Quality of your argument
- Stage presence—quality of voice, poise



Go to glencoe.com to this book's OLC for information about TSA events.

Academic Skills



Social Studies

- 13.** Write a report describing three products developed in the United States. Discuss why each product was developed at the time in this country. Discuss political, social, and economic factors at the time.



Mathematics

- 14.** Clarence rides his bicycle to school every day. The diameter of his front tire is 24 inches. His school is 2,500 feet away. How many times will his front wheel rotate on his way to school?



Measurement The distance around a circle is called the “circumference.” When a wheel rotates, it covers a distance equal to its circumference as it moves on the ground. The circumference of a circle is equal to its diameter multiplied by π , which is 3.14.



Standardized Test Practice

Directions Choose the letter of the best answer. Write the letter on a separate piece of paper.

- What is the definition of the term *technologically literate*?
 - Reading about technology
 - Being able to read manuals
 - The practical use of human knowledge to extend ability
 - Being informed about technology and feeling comfortable using it
- Science makes things happen, and technology explains how things happen.
 - T
 - F

Test-Taking Tip When you are taking a test, do not rush yourself. Read the entire question and look for key words. Focus on your work.

Build a High-Tech Paper Airplane

You probably already know how to fold a simple paper airplane. The ordinary pointed-nose style has been around for a long time. However, you may not have had the opportunity to fold a high-technology paper airplane (HTPA). An HTPA requires careful planning and folding.

In 1967, *Scientific American* magazine held its first International Paper Airplane Competition. There were 12,000 entries from 28 countries. This lab is based on activities from the competition.

Tools and Materials

- ✓ Paper
- ✓ Pencil
- ✓ Scissors
- ✓ Colored markers
- ✓ Ruler
- ✓ Yardstick, meterstick, or tape measure
- ✓ Stopwatch
- ✓ Paper clips
- ✓ Tape

Set Your Goal

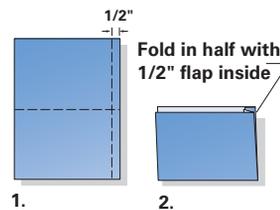
Your goal is to make two different HTPAs, and then find out which one flies farther and stays up longer. The ordinary pointed-nose style flies about 15 feet and can stay up for about four seconds. One HTPA winner in the *Scientific American* competition stayed in the air for 10.2 seconds. The winner for distance flew 91 feet. Different conditions can affect a paper airplane's abilities. For example, a breeze from an open window or a heating vent could help or hurt a flight.

Know the Criteria and Constraints

In this lab, you will use a simple *systems technique*. A systems technique breaks down a complex project into basic elements. Here are the basic elements for each HTPA construction:

1. Select an HTPA design.
2. Draw the plans.
3. Construct the HTPA.
4. Operate and fly the HTPA.
5. Collect flight information.
6. Evaluate the flight information.

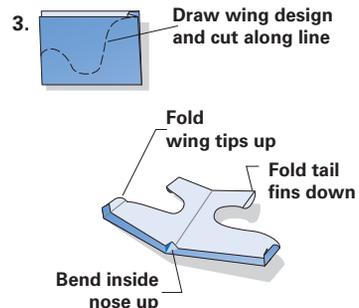
F4F Wildcat



Design Your Project

Follow these steps to design your project and complete this lab.

1. Select a paper airplane design from the three plans in your textbook.
2. Carefully draw the plans for your design on a sheet of paper.



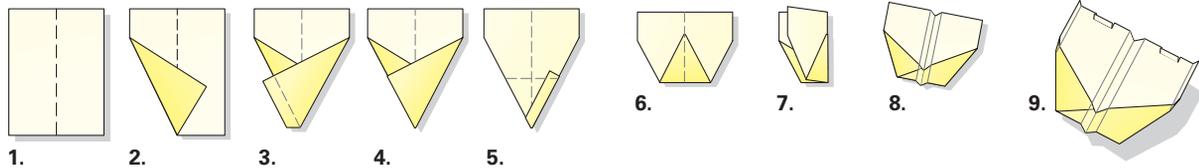
3. Fold the airplane according to the plans. Fold sharp edges.
4. Decorate your airplane using colored markers so that you can easily identify it.
5. Fly your HTPA three times.
6. Use the stopwatch to measure the length of each flight in seconds.
7. Use a measuring device such as a tape measure to determine the straight-line distance from the point where the HTPA was launched to the point where it stopped.
8. If your plane does not fly well at first, try placing a very small weight at the nose. You can use a piece of tape or small paper clip for a weight.
9. Repeat the preceding steps with another design.

Evaluate Your Results

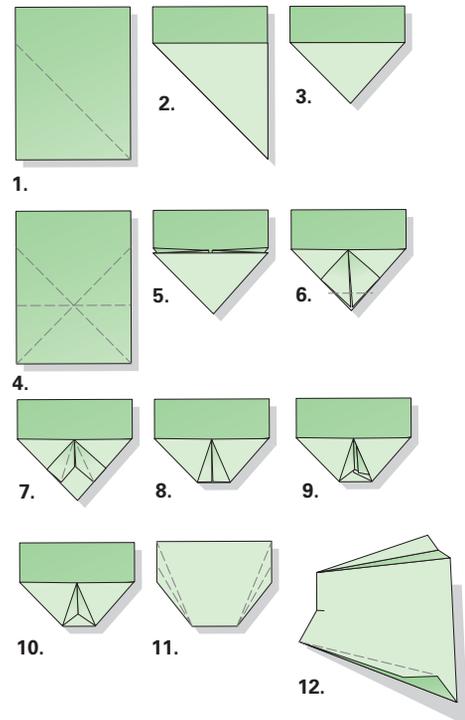
After you create, fly, and measure two HTPAs, answer these questions on a separate piece of paper.

1. Which HTPA flew farther and stayed up longer? Why?
2. Which HTPA was more fun to fly? Why?

P47 Thunderbolt



Mark VB Spitfire



Academic Skills Required to Complete Lab				
Tasks	English Language Arts	Math	Science	Social Studies
Research performance of the different planes you create.	✓	✓	✓	
Gather data of time in air and distance planes fly.	✓	✓	✓	
Write results and evaluation.	✓	✓	✓	
Create presentation.	✓			
Present process, results, and evaluation to the class.	✓			