Unit 1 The Wonders of Science

Chapter 1 What Is Science?

Chapter 2 The Process of Discovery

Scientists study tornadoes to learn how to predict their behavior.

Scientists study known facts and try to discover new facts. The basic steps in the science process, which is used by scientists to uncover new facts, are listed in the chart. Scientists perform different activities to carry out those steps.

Use the chart to answer the questions.

1. What are the steps of the science process?

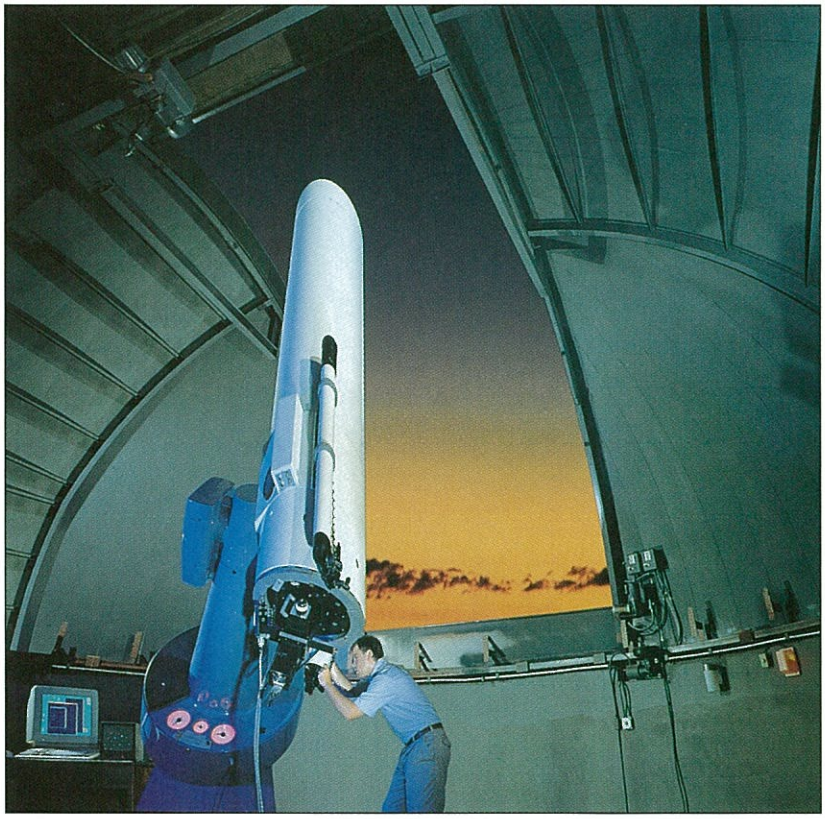
2. Which step has measuring as an activity?

3. What is the last step of the science process?

The Science Process

Basic Steps	Examples From a Study on Tornadoes
1. Describe a problem.	Find highest tornado wind speed.
2. Gather information.	Check science journals.
3. Suggest an answer.	Tornado winds can reach speeds of 200 miles per hour.
4. Perform experiments.	Measure tornado winds, using special instruments.
5. Draw conclusions and report results.	Tornado winds can reach speeds of at least 300 miles per hour.

Chapter 1 What Is Science?



This scientist is looking at stars that are trillions of miles away. Scientists study many things here on Earth and far away. What are some of the things you think scientists study?

Learning Objectives

- Define science and identify what scientists do.
- Describe what the universe consists of.
- Explain the science process.
- Explore the meaning and uses of technology.
- List the three main branches of science.
- Identify two careers in science.
- LAB ACTIVITY: Observe and describe common objects.
- SCIENCE IN YOUR LIFE: List examples of technology.

Words to Know

science	the study of nature and the universe
universe	all that exists, including the planets, sun, stars, and space
galaxy	a very large group of stars that travel together through space
atom	the smallest part of a substance that can still be recognized as that substance
observation	the careful study of something
experiment	a kind of test that scientists use to discover or prove something
research	to study a subject, usually using books and doing experiments
technology	science discoveries and skills that are put to use
laser	a device that produces a narrow, strong beam of light
life science	the study of living things and how they behave
physical science	the study of matter and energy
earth science	the study of the Earth, including its rocks, oceans, air, and weather; also the study of the sun, moon, planets, and stars
matter	anything that takes up space
energy	the ability of something or someone to do work or produce heat

1-1 From Atoms to Galaxies

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Amazing Facts

Imagine that you are outside on a clear night. You look up. What do you see? Stars, of course. You can see hundreds or even thousands of them. Actually, you are seeing the stars as they were many years ago.

The stars are so far away that it takes years for their light to reach the Earth. In fact, some of the stars you see may not exist anymore! They may have burned themselves out long ago. Yet, the light they once gave off is still traveling through space. This is one of the amazing facts of **science**, the study of nature and the **universe.** The universe is all that exists, including the planets, sun, stars, and space.

Another amazing science fact is that at this moment, you are covered with tiny living creatures. They snack on pieces of dead skin. These eight-legged animals are called *mites*. Some even live on your eyelids. Science is filled with amazing facts.

✓ **What is science?**

Understanding the Universe

Scientists try to make sense of things in the universe. They study very large objects, such as galaxies. A **galaxy** is a very large group of stars that travel together through space.

Scientists also try to understand the smallest objects in the universe. Galaxies and all other objects in the universe are made up of tiny particles called atoms. An **atom** is the smallest part of a substance that can still be recognized as that substance. Atoms are so tiny that you cannot see them with your eyes alone. Scientists must use special instruments to study atoms.

✓ **What do scientists study to make sense of things in the universe?**

Science Fact

Scientists once thought that the atom was the tiniest thing in the universe. Now they know that the atom is made up of even smaller parts.

Science as Facts and Processes

Science has two parts. The first part is the knowledge that scientists have already gathered. This includes many science facts. An example of a science fact is that plants need sunlight to grow.

The second part of science is the process of discovery. By reading this book, you are taking part in the process of discovery.

The process of discovery is the way people learn new facts. It is a series of steps leading from one discovery to another.

For example, a scientist may make an **observation** and may then perform an **experiment.** An observation is the careful study of something. An experiment is a kind of test that scientists use to discover or prove something. Based on observations and results of experiments, scientists draw *conclusions*. This is how scientists discover new facts.

✓ **What are the two parts of science?**

Science Fact

Scientists are expected to report the results of their experiments honestly and accurately. This is part of what is known as science ethics. Science ethics is a set of rules for acting in a responsible and caring way when doing science.

Facts that Change

Science Fact

What people used to believe often seems silly today. Perhaps 2,000 years from now people will read this book. Some of the ideas in it might seem silly to them.

Many people think science is only facts. They think that once scientists discover a fact, there is little left to learn about the fact. However, in science, facts are always changing. For example, people used to believe that the Earth was flat. They thought that they had good reason to believe this. Of course, now we know that the Earth is round. A new fact was discovered, and an old fact is no longer believed to be true.

Figure 1-1 *At one time, people believed that the Earth was flat. They thought that ships fell off the Earth when they reached its edge.*

The Greek philosopher Aristotle was one of the first people to do scientific **research** on plants and animals. To research a subject is to study it, usually using books and doing experiments. Research is the testing of old facts to discover something new. Aristotle lived more than 2,000 years ago. He made many discoveries. He also made some mistakes. For example, he observed that male horses have more teeth than female horses. So he decided that men have more teeth than women have!

Aristotle was not a bad scientist. Two thousand years ago, science was still very young. Scientists were just beginning to learn how to do research. For his time, Aristotle was a great scientist. His work led to many discoveries by scientists who followed him.

✓ **Why do facts in science change?**

Lesson Review

1. What does the universe contain?
2. What do scientists study?
3. What is an experiment? How do scientists do research?
4. **CRITICAL THINKING** Suppose you have a houseplant that you want to plant outside. You do not know if it can live outside. How could you find out?

Great Moments in Science

THE FIRST LIQUID-FUELED ROCKET

In 1926, the American scientist Robert H. Goddard launched the first rocket to use liquid fuel. It burned gasoline and liquid oxygen. The rocket reached a height of 41 feet (12.5 meters) and traveled at a speed of 60 miles (96 kilometers) per hour.

Goddard's invention made spaceflight possible. Today, liquid-fueled rockets are used to launch spacecraft that explore the planets. They also launch the space shuttle. Scientists perform experiments in the space shuttle. Other spacecraft gather information about the Earth and other objects in space. They also receive and send signals that are used by televisions and telephones.

CRITICAL THINKING How was Goddard's invention important to the exploration of space?

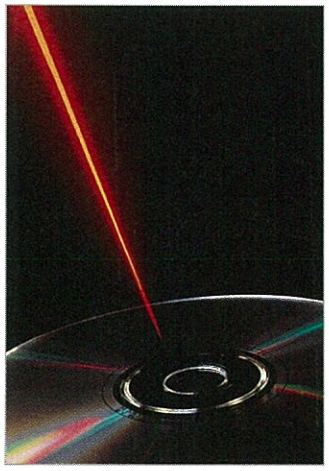
The work of Robert H. Goddard led to the space shuttle.

1·2 Science at Work

Words to Know

technology	science discoveries and skills that are put to use
laser	a device that produces a narrow, strong beam of light
life science	the study of living things and how they behave
physical science	the study of matter and energy
earth science	the study of the Earth, including its rocks, oceans, air, and weather; also the study of the sun, moon, planets, and stars
matter	anything that takes up space
energy	the ability of something or someone to do work or produce heat

Science as Solution



Laser beam

Every day, new scientific discoveries are making life better for the world. **Technology** is science discoveries and skills that are put to use. Technology helps to solve problems or make life better for people. The following paragraphs describe a few problems that technology has solved.

For many years, people used tape cassettes to record music. However, when the music was played, background noise could sometimes be heard. Another problem was that the tape eventually wore out. So scientists and engineers came up with a new technology for recording and playing music. It uses a metal-coated plastic disc instead of tape. It is called a *compact disc* or *CD*. A beam of light inside a CD player plays the music. The beam of light is very narrow and very strong. A device called a **laser** produces a narrow, strong beam of light. Music played from a compact disc is always sharp and clear. There is no background noise, and the discs rarely wear out.

Braille is a system of writing for the blind. It was invented by Louis Braille, a Frenchman who himself was blind. Braille consists of a code of 63 characters. Each character is made up of one to six raised dots. Many books have been translated into Braille. The process, however, takes a lot of time and is expensive. To solve this problem, a new machine was invented called the Kurzweil Personal Reader. This machine uses an electronic device that reads the print on a page. Then a computer voice says the printed words aloud. Blind people can use the Kurzweil Personal Reader to read anything in print.

Cassava is an important food crop in Africa. Several million Africans eat this root. In the early 1970s, mealybugs were brought to Africa by accident from South America. They began attacking the cassava crops. Scientists searched for a way to stop the bugs. They went to South America to look for a natural enemy of the bug. They brought back to Africa a wasp that feeds on the mealybug. In this way, scientists saved the food supply for millions of people.

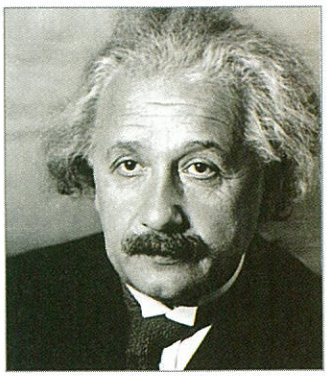
✓ **How does technology help people?**

The Branches of Science

Science is a large area of study. In this book, you will study the three main branches of science: **life science**, **physical science**, and **earth science**.

Life science is the study of living things and how they behave. Life scientists study plants, animals—including humans—and other living things.

Physical science is the study of **matter** and **energy**. Matter is anything that takes up space. Matter can be in solid, liquid, or gas form. Physical scientists study matter. They also study forms of energy such as light, heat, and electricity. Energy is the ability of something or someone to do work or produce heat. Finally, physical scientists study how machines work.



The great physical scientist Albert Einstein (1879–1955) made important discoveries about matter and energy.

Earth science is the study of the Earth, including its rocks, oceans, air, and weather. It is also the study of the sun, moon, planets, and stars.

✓ **What are the three main branches of science?**

Careers in Science

Science is one of the fastest-growing career fields in the world. There are science-related jobs in medicine, farming, computers, forestry, and building, among others.

People with science backgrounds work in zoos, factories, laboratories, hospitals, and parks. In fact, just about every industry uses scientists for at least some of its work.

Not all people who work in science have college degrees. You can work in many science-related jobs with a high school diploma and on-the-job training.

✓ **Where can people with science backgrounds find jobs?**

Modern Leaders in Science

RITA ROSSI COLWELL

In 1998, Rita Rossi Colwell became the director of the National Science Foundation (NSF). NSF is a government agency that gives money for science research. It also supports science museums. NSF helps teachers improve science courses in elementary schools and high schools. Dr. Colwell's job includes deciding what science projects the government should support. She has done research and has written many articles and books.

CRITICAL THINKING Why does Dr. Colwell need to decide which science projects to support?

Rita Rossi Colwell

Making the Right Choices

The technologies you read about earlier in this chapter all helped to solve problems. The solutions took a long time to come up with, however. Millions of dollars were spent. Thousands of people had to make choices about which research to support and how to pay for it.

Science today is practiced mostly by groups of people working together. Once in a while, a brilliant scientist working alone makes a big discovery. More often, though, a lot of people are involved in making the discovery.

This is where you come in. Even if you do not choose a career in science, you can help choose what projects should be supported. Should tax money be spent on new weapons or to grow more food? Should it be spent finding a cure for AIDS or on cancer research?

Now, more than ever, it is important for people to know something about science. As a citizen, you can help make the right choices.

✓ **How are most choices in science made today?**

Lesson Review

1. What are two ways technology has made life better?
2. What kinds of things are studied in life science, earth science, and physical science?
3. Why is it important that people today know about science?
4. **CRITICAL THINKING** You already know many science facts. Name one science fact from each of the three branches of science.

LAB ACTIVITY
Making Observations

BACKGROUND
One of the ways scientists make new discoveries is by observing. Scientists make observations by looking at things closely. They also make observations by listening, feeling, and smelling.

Safety Alert

Do not taste any objects or smell any chemicals.

PURPOSE
You will make careful observations to accurately describe objects.

MATERIALS
paper, pencil, hand lens, 5 classroom objects

WHAT TO DO
1. Copy the chart to the right.
2. Work with a partner. Choose four classroom objects to observe. List the objects in the chart.
3. For each object, observe the characteristics listed in the chart. Use a hand lens to observe the objects close up. Record your observations in the chart.
4. Choose a "mystery" object in the classroom to observe. Describe the object, but do not say what the object is. Have your partner record what he or she thinks the object is based on your descriptions. Switch roles and try to guess your partner's mystery object.

Object	Size	Shape	Color	Texture	Other Observations
Mystery Object:					

DRAW CONCLUSIONS
- How did your observations help you describe each object?
- Did you identify your partner's mystery object? What other observations or descriptions would have made the object easier to identify?

SCIENCE IN YOUR LIFE
Using Technology

Technology can make life easier. For example, it is less work to wash laundry in a washing machine than by hand.

You can save time by using technology. Airplanes transport people across the country in just a few hours. Microwave ovens allow you to make dinner faster.

Today, people are safer because of technology. Smoke alarms help protect you from fires. Air bags in cars help protect you in accidents.

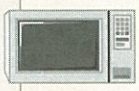
Finally, technology can make your life more fun or more interesting. Think of how video games, CD players, and computers might make your life more fun.

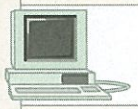
Although technology helps people, it also can do harm. For example, cars and trucks pollute the air. Chemicals from factories are dumped into lakes and rivers. Computers and machines now do some work that people were once paid to do. However, most people feel that technology has made life better.

Make a technology chart.

The chart above shows some examples of technology. In a similar chart, list five other examples. Next to each example, tell how that technology makes your life better. Does it make your life easier, safer, or more fun? Does it save you time?

Examples of Technology


Microwave Oven


Personal Computer


Portable CD Player

Critical Thinking

Choose one of the examples of technology in your chart. How do you think people in the past got along without that technology?

Chapter

1 Review

Summary

Science is the study of nature and the universe. Scientific discoveries and technology usually make life better for the world.

Lesson 1.1

Science includes facts and processes that scientists use to discover new facts. These processes include making observations, doing experiments, and drawing conclusions. Science facts change as scientists do more research.

Lesson 1.2

Technology is the use of science discoveries and skills to solve problems or make life better for people. Many careers require knowledge of science. Life science, physical science, and earth science are the three main branches of science.

Vocabulary Review

universe
observation
experiment
research
technology
science
galaxy
earth science

Complete each sentence with a term from the list.

1. As part of their _____, scientists may do experiments.
2. A _____ is a very large group of stars that travel together through space.
3. The study of nature and the universe is called _____.
4. The branch of science that studies rocks, weather, and oceans is _____.
5. The sun, planets, and stars are part of the _____.
6. Scientists use a test called an _____ to discover or prove something.
7. When scientists study something carefully, they are making an _____.
8. Using science discoveries and skills to make life better is called _____.

Chapter Quiz

Write your answers on a separate sheet of paper.

1. What makes up the universe?
2. Why must scientists use special instruments to study atoms?
3. What is the process of discovery?
4. How do scientists discover new facts?
5. What are three examples of technology in your home?
6. How does technology help people?
7. What do life scientists study?
8. What do physical scientists study?
9. What are two careers in science?
10. Why is it helpful to know about science?

Test Tip
Make sure you understand what each test question is asking. Read a question twice before you answer it.

Research Project

Do research and write a report on a science-related career. You might gather information by using books from the library and using the Internet. You can also set up interviews. The report should describe the career and tell the skills that a person needs to do the job. Also include the amount of education or training needed. Tell about how much the job pays.

Chapter 2 The Process of Discovery

Scientists study practically everything, from rocks to the human body. Can you think of anything that scientists do not study?

Learning Objectives

- Explain the five steps of the scientific method.
- Identify metric units of length, volume, and weight.
- Describe equipment used in a science laboratory.
- Discuss safety rules for work in the laboratory.
- LAB ACTIVITY: Measure the length and volume of objects.
- ON-THE-JOB SCIENCE: Explore the duties of a medical lab technician.