

## SECTION

# 1

### READING WARM-UPS

#### Objectives

- Describe three methods of investigation.
- Identify benefits of science in the world around you.
- Describe five jobs that use science.

#### Terms to Learn

science

### READING STRATEGY

**Prediction Guide** Before reading this section, write the title of each heading in this section. Next, under each heading, write what you think you will learn.

**science** the knowledge obtained by observing natural events and conditions in order to discover facts and formulate laws or principles that can be verified or tested

Why do leaves change color in the fall?

Why did the dinosaurs die out?

How do birds know where to go when they migrate?


## Science and Scientists

*You are enjoying a picnic on a summer day. Crumbs from your sandwich fall to the ground, and ants carry the crumbs away. You wonder, Why do ants show up at picnics?*

Congratulations! You just took one of the first steps of being a scientist. How did you do it? You observed the world around you. Then, you asked a question about your observations. And asking a question is part of what science is all about.

### Start with a Question

The world around you is full of amazing things. Single-celled algae float unseen in ponds. Volcanoes erupt with explosive force. Mars may have had water in the past. And 40-ton whales glide through the oceans. These things or others, such as those shown in **Figure 1**, may lead you to ask a question. A question is the beginning of science. **Science** is the knowledge obtained by observing the natural world in order to discover facts and to formulate laws and principles that can be verified or tested.

 **Reading Check** What is science? (See the Appendix for answers to Reading Checks.)

### In Your Own Neighborhood

Take a look around your home, school, and neighborhood. Often, you take things that you use or see every day for granted. But one day you might look at something in a new way. That's when a question hits you! The student in **Figure 1** didn't have to look very far to realize that he had some questions to ask.

### The World and Beyond

You don't have to stop at questions about things in your neighborhood. Ask questions about atoms or galaxies, pandas and bamboo, or earthquakes. A variety of plants and animals live in a variety of places. And each place has a unique combination of rocks, soil, and water.

You can even ask questions about places other than those on Earth. Look outward to the moon, the sun, and the planets in our solar system. Beyond that, you have the rest of the universe! There are enough questions to keep scientists busy for a long time.

**Figure 1** Part of science is asking questions about the world around you.



## Investigation: The Search for Answers

After you ask a question, it's time to look for an answer. But *how* do you start your investigation? Several methods may be used.

### Research

You can find answers to some of your questions by doing research, as **Figure 2** shows. You can ask someone who knows a lot about the subject of your question. You can find information in textbooks, encyclopedias, and magazines. You can search on the Internet. You might read a report of an experiment that someone did. But be sure to think about the sources of your information. Use information only from reliable sources.

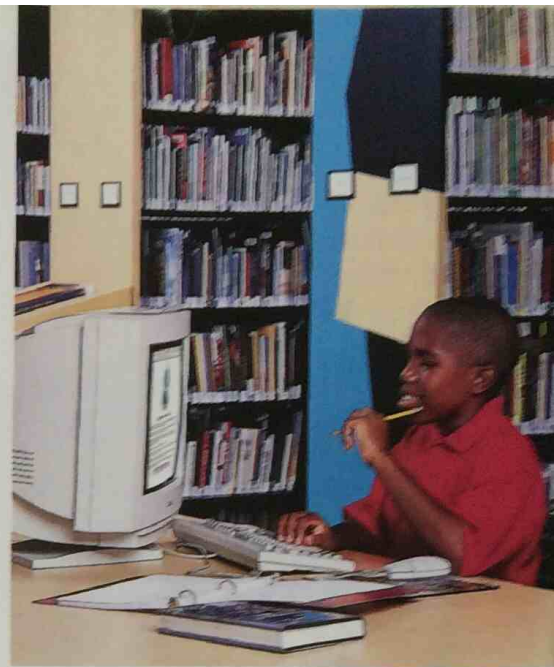
### Observation

You can also find answers to questions by making careful observations. For example, if you want to know how spiders spin their webs, look for a web. When you find one, return to observe the spider as it spins. But be careful in making observations. Sometimes, what people expect to observe affects what they do observe. For example, most plants need light to grow. Does that mean that all plants need bright sunlight? Do some plants prefer shade? Some people might "observe" that bright light is the only answer. To test an observation, you may have to do an experiment.

### Experimentation

You might answer the question about light and shade by doing a simple experiment, such as the one shown in **Figure 3**. Your research and your observations can help you plan your experiment. What should you do if your experiment needs something that is hard to get? For example, what do you do if you want to know whether a certain plant grows in space? Don't give up! Try to find results from someone else's experiment!

**Figure 3** This student is doing an experiment to find out whether this type of plant grows better in shade or in direct sunlight.



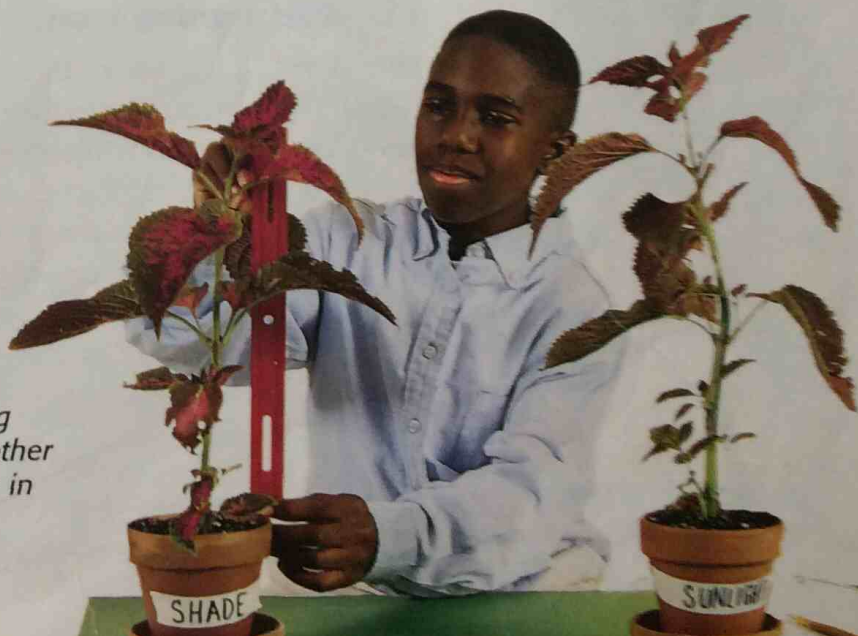
**Figure 2** A library is a good place to begin your search for answers.

## SCHOOL to HOME

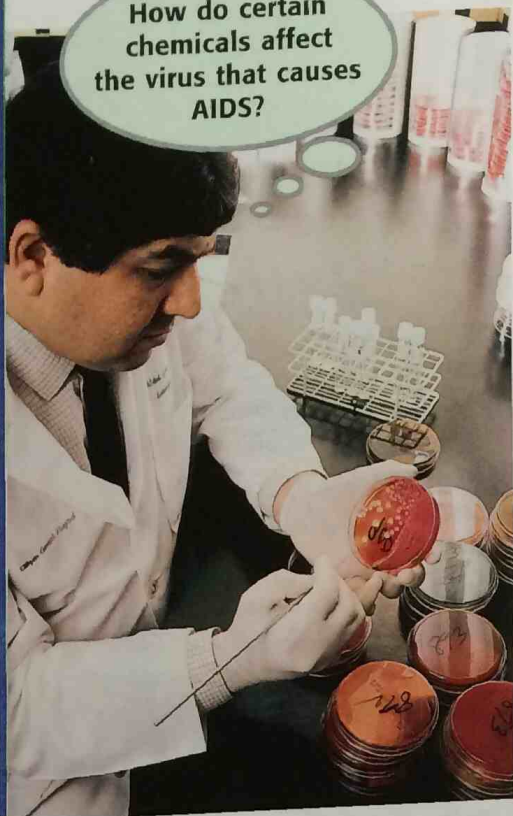
### Ask a Question

The next time you're outside, look carefully around you. Think of a science-related question that you would like to answer. Write the question in your **science journal**. Discuss with a parent which methods of investigation would be most likely to help you answer your question.

## ACTIVITY



How do certain chemicals affect the virus that causes AIDS?



**Figure 4** Abdul Lakhani studies AIDS to find a cure for the disease.

## Why Ask Questions?

Although scientists cannot answer every question immediately, they do find some interesting answers. Do any of the answers really matter? Absolutely! As you study science, you will see how science affects you and society around you.

## Fighting Diseases

Polio is a disease that can cause paralysis by affecting the brain and nerves. Do you know anyone who has had polio? You probably don't. But in 1952, polio infected 58,000 Americans. Fortunately, vaccines developed in 1955 and 1956 have eliminated polio in the United States. In fact, the virus that causes polio has been wiped out in most of the world.

Today, scientists are searching for cures for diseases such as mad cow disease, tuberculosis, and acquired immune deficiency syndrome (AIDS). The scientist in **Figure 4** is learning more about AIDS, which kills millions of people every year.

## Saving Resources

Science also helps answer the question, How can we make resources last longer? Recycling is one answer. Think about the last time that you recycled an aluminum can. By recycling that can, you saved more than just the aluminum, as **Figure 5** shows. Using science, people have developed more-efficient methods and better equipment for recycling aluminum, paper, steel, glass, and even some plastics. In this way, science helps make resources last longer.

**Figure 5** Resources Saved Through Recycling



Compared with producing aluminum from its ore, recycling 1 metric ton (1.1 tons) of aluminum:



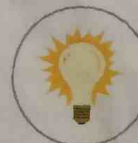
produces 95% less air pollution



saves 4 metric tons (4.4 tons) of ore



produces 4 metric tons (4.4 tons) fewer chemical products



uses 14,000 kWh less energy



produces 97% less water pollution

## Answering Society's Questions

Sometimes, society faces a question that does not seem to have an immediate answer. For example, at one time, the question of how to reduce air pollution did not have any obvious, reasonable answers. The millions of people who depended on their cars could not just stop driving. As the problem of air pollution became more important to people, scientists developed different technologies to address it. For example, one source of air pollution is exhaust from cars. Through science, people have developed cleaner-burning gasoline. People have even developed new ways to clean up exhaust before it leaves the tailpipe of a car!

**Reading Check** How can society influence the types of technologies that are developed?

## Scientists All Around You

Believe it or not, scientists work in many different places. If you think about it, any person who asks questions and looks for answers could be called a scientist! Keep reading to learn about just a few people who use science in their jobs.

### Zoologist

A *zoologist* (zoh AHL uh jist) is a person who studies the lives of animals. Dale Miquelle, shown in **Figure 6**, is part of a team of Russian and American zoologists studying the Siberian tiger. The tigers have almost become extinct after being hunted and losing their homes. By learning about the tigers' living space and food needs, zoologists hope to make a plan that will help the tigers survive better in the wild.



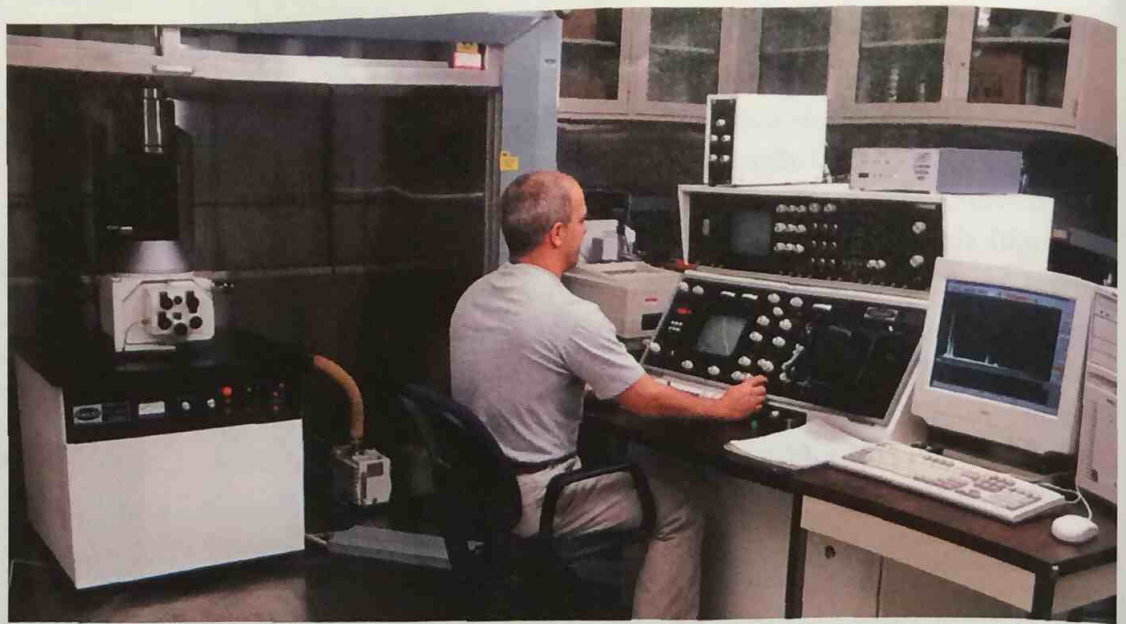
## CONNECTION TO Biology

**Technology and Aging** People are living longer than ever before. Research some of the health problems that elderly people may face, such as heart or vision problems. Then, research how these health problems are influencing the development of new technologies. Make a poster illustrating one of these problems and one or more technologies being developed to address it.

## ACTIVITY

**Figure 6** To learn how much land a Siberian tiger covers, Dale Miquelle tracks a tiger that is wearing a radio-transmitting collar.

**Figure 7** This geochemist may work outdoors when collecting rock samples from the field. Then, he may work indoors as he analyzes the samples in his laboratory.



### Geochemist

Some scientists work outdoors most of the time. Other scientists spend much of their time in the laboratory. A geochemist (JEE oh KEM ist), such as the one shown in **Figure 7**, may work in both places. A *geochemist* is a person who specializes in the chemistry of rocks, minerals, and soil.

Geochemists determine the economic value of these materials. They also try to find out what the environment was like when these materials formed and what has happened to the materials since they first formed.

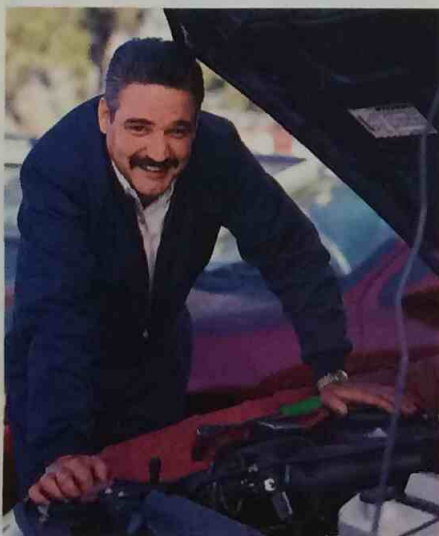
### Mechanic

Do you have a machine that needs repairs? Call a mechanic, such as Gene Webb in **Figure 8**. Mechanics work on everything from cars to the space shuttle. Mechanics use science to solve problems. Mechanics must find answers to questions about why a machine is not working. Then, they must find a way to make it work. Mechanics also think of ways to improve the machine, to make it work faster or more efficiently.

### Oceanographer

An *oceanographer* studies the ocean. Some oceanographers study waves and ocean currents. Others study plants and animals that live in the ocean. Still others study the ocean floor, including how it forms.

While studying the ocean floor, oceanographers discovered black smokers. Black smokers are cracks where hot water (around 300°C!) from beneath Earth's surface comes up. These vents in the ocean floor are home to some strange animals, including red-tipped tube worms and blind white crabs.



**Figure 8** A mechanic can help keep a car's engine running smoothly.

## Volcanologist

If black smokers aren't hot enough for you, perhaps you would like to become a volcanologist (VAHL kuh NAHL uh jist). A *volcanologist* studies one of Earth's most interesting processes—volcanoes. The volcanologist shown in **Figure 9** is photographing lava flowing from Mt. Etna, a volcano in Italy. Mt. Etna's lava may reach temperatures of 1,050°C. By learning more about volcanoes, volcanologists hope to get better at predicting when a volcano will erupt. Being able to predict eruptions would help save lives.

**Reading Check** What does a volcanologist do?



**Figure 9** Volcanologists gain a better understanding of the inside of the Earth by studying the makeup of lava.

## SECTION Review

### Summary

- Science is a process of gathering knowledge about the natural world by making observations and asking questions.
- Science begins by asking a question.
- Even if science cannot answer the question right away, the answers that scientists find may be very important.
- A question may lead to a scientific investigation, including research, observations, and experimentation.
- Science can help save lives, fight diseases, save resources, and protect the environment.
- A variety of people may become scientists for a variety of reasons.

### Using Key Terms

1. In your own words, write a definition for the term *science*.

### Understanding Key Ideas

2. A zoologist might study any of the following EXCEPT
  - a. shellfish living in ponds.
  - b. the reason that mole rats live in large groups underground.
  - c. environmental threats to sea turtles.
  - d. rocks and minerals in the Painted Desert.
3. Describe five careers that use science.
4. How are observation and experimentation different?
5. How may what people expect to observe affect what they do observe? How can people avoid this problem?

### Math Skills

6. Students in a science class collected 50 frogs from a pond. They found that 15 of the frogs had serious deformities. What percentage of the frogs had deformities?

### Critical Thinking

7. **Making Inferences** An ad for deluxe garbage bags says that the bags are 30% stronger than regular garbage bags. Describe how science can help you find out if this claim is true.
8. **Identifying Relationships** Make a list of three things that you consider to be a problem in society. Give an example of how new technology might solve these problems.
9. **Applying Concepts** Look at **Figure 9**. Write five questions about what you see. Describe how science might help you answer your questions. Share your questions with your classmates.

SCILINKS

NSTA

Developed and maintained by the  
National Science Teachers Association

For a variety of links related to this chapter, go to [www.scilinks.org](http://www.scilinks.org)

**Topic: Careers in Science**  
**SciLinks code: HSM0244**