

# The Nature of Science

**BIG Idea** Earth scientists use specific methods to investigate Earth and beyond.

## 1.1 Earth Science

**MAIN Idea** Earth science encompasses five areas of study: astronomy, meteorology, geology, oceanography, and environmental science.

## 1.2 Methods of Scientists

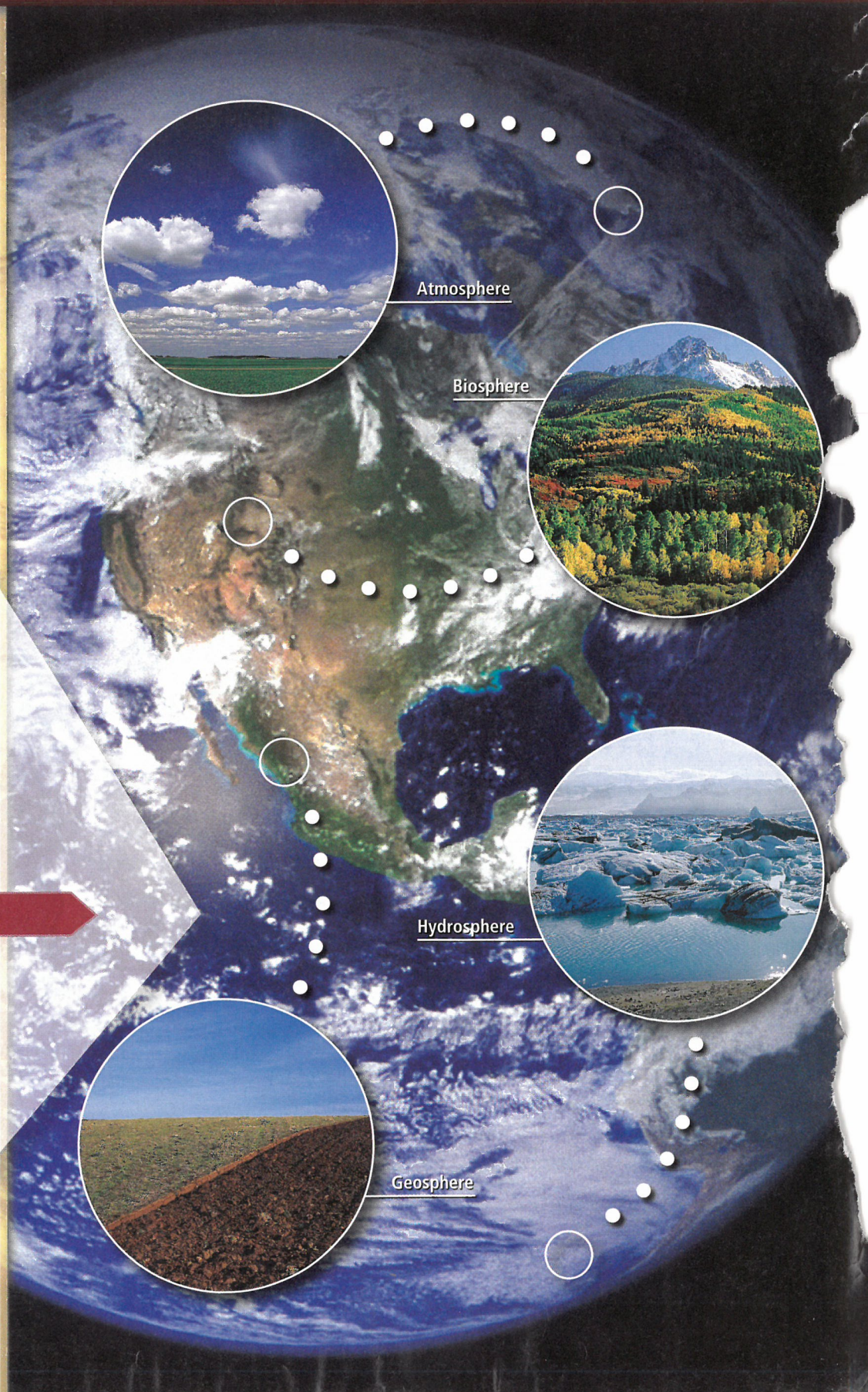
**MAIN Idea** Scientists use scientific methods to structure their experiments and investigations.

## 1.3 Communication in Science

**MAIN Idea** Precise communication is crucial for scientists to share their results effectively with each other and with society.

## GeoFacts

- The temperature of Earth's core is thought to be as high as 7227°C.
- It is about 6378 km to the center of Earth.
- Seventy percent of Earth's freshwater is contained in glaciers.



# Start-Up Activities

## LAUNCH Lab

### Why is precise communication important?

Have you ever explained something to someone only later to find out that what you thought was a clear explanation was confusing, misleading, or even incorrect? Precise communication is an important skill.

#### Procedure

1. Read and complete the lab safety form.
2. Obtain an **object** from your teacher. Do not show it to your partner.
3. Write one sentence that accurately describes the object in detail without identifying or naming the object.
4. Give your partner the description and allow him or her a few minutes to identify your object.
5. Now use your partner's description to identify his or her object.

#### Analysis

1. **Identify** Were you and your partner able to identify each others' objects? Why or why not?
2. **Error Analysis** Work together to rewrite each description in your science journals to make them as accurate as possible.
3. **Compare** Trade the new descriptions with another pair of students. Did this pair of students have an easier time determining the objects than you and your partner did? Why or why not?

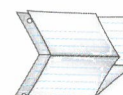
### FOLDABLES™ Study Organizer

**Earth's Systems**  
Make this Foldable to compare Earth's four main systems.

- ▶ **STEP 1** Fold a sheet of paper in half lengthwise.



- ▶ **STEP 2** Fold the sheet into fourths (fold in half and half again).



- ▶ **STEP 3** Unfold and cut the top flap along the fold lines to make four tabs. Label the tabs *Geosphere*, *Hydrosphere*, *Atmosphere*, and *Biosphere*.



#### FOLDABLES Use this Foldable with Section 1.1.

As you read this section, summarize Earth's systems and how they interact.

### Earth Science online

Visit [glencoe.com](http://glencoe.com) to

- ▶ study entire chapters online;
- ▶ explore **Concepts in Motion** animations:
  - Interactive Time Lines
  - Interactive Figures
  - Interactive Tables
- ▶ access Web Links for more information, projects, and activities;
- ▶ review content with the Interactive Tutor and take Self-Check Quizzes.

## Section 1.1

### Objectives

- ▶ **Compare** the areas of study within Earth science.
- ▶ **Identify** Earth's systems.
- ▶ **Explain** the relationships among Earth's systems.
- ▶ **Explain** why technology is important.

### Review Vocabulary

**technology:** the application of knowledge gained from scientific research to solve society's needs and problems

### New Vocabulary

astronomy  
meteorology  
geology  
oceanography  
environmental science  
geosphere  
atmosphere  
hydrosphere  
biosphere

## Earth Science

**MAIN Idea** Earth science encompasses five areas of study: astronomy, meteorology, geology, oceanography, and environmental science.

**Real-World Reading Link** From the maps you use when traveling, to the weather report you use when deciding whether or not to carry an umbrella, Earth science is part of your everyday life.

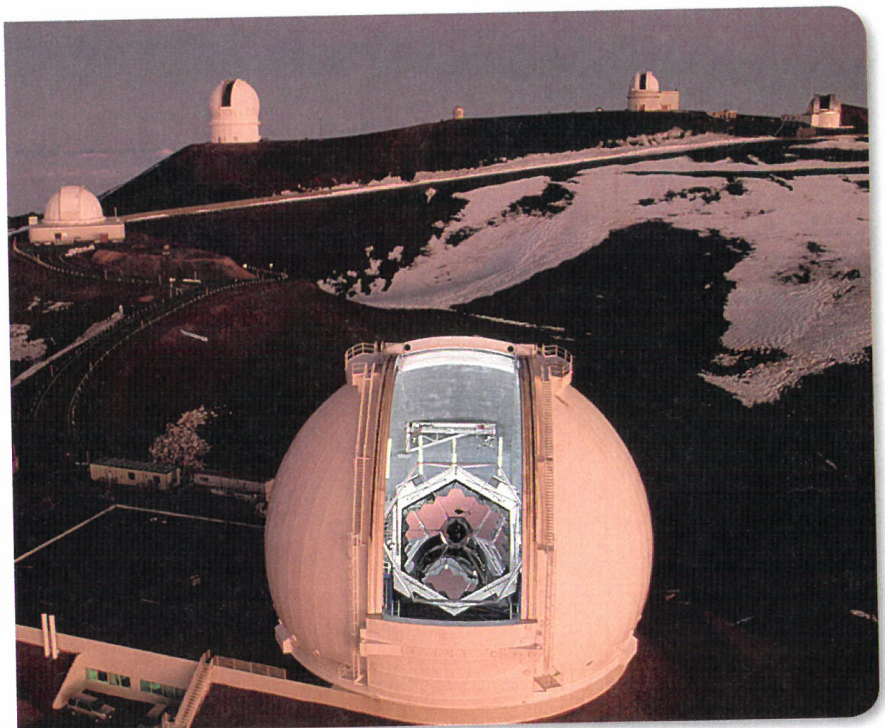
### The Scope of Earth Science

The scope of Earth science is vast. This broad field can be broken into five major areas of specialization: astronomy, meteorology, geology, oceanography, and environmental science.

**Astronomy** The study of objects beyond Earth's atmosphere is called **astronomy**. Prior to the invention of sophisticated instruments, such as the telescope shown in **Figure 1.1**, many astronomers merely described the locations of objects in space in relation to each other. Today, Earth scientists study the universe and everything in it, including galaxies, stars, planets, and other bodies they have identified.

**Meteorology** The study of the forces and processes that cause the atmosphere to change and produce weather is **meteorology**. Meteorologists also try to forecast the weather and learn how changes in weather over time might affect Earth's climate.

■ **Figure 1.1** The Keck I and Keck II telescopes are part of the Mauna Kea Observatories in Hawaii. One of the Keck telescopes is visible here in its protective dome.



**Geology** The study of the materials that make up Earth, the processes that form and change these materials, and the history of the planet and its life-forms since its origin is the branch of Earth science known as **geology**. Geologists identify rocks, study glacial movements, interpret clues to Earth's 4.6-billion-year history, and determine how forces change our planet.

**Oceanography** The study of Earth's oceans, which cover nearly three-fourths of the planet, is called **oceanography**. Oceanographers study the creatures that inhabit salt water, measure different physical and chemical properties of the oceans, and observe various processes in these bodies of water. When oceanographers are conducting field research, they often have to dive into the ocean to gather data, as shown in **Figure 1.2**.

**Environmental science** The study of the interactions of organisms and their surroundings is called **environmental science**. Environmental scientists study how organisms impact the environment both positively and negatively. The topics an environmental scientist might study include natural resources, pollution, alternative energy sources, and the impact of humans on the atmosphere.

**Subspecialties** The study of our planet is a broad endeavor, and as such, each of the five major areas of Earth science consists of a variety of subspecialties, some of which are listed in **Table 1.1**.



■ **Figure 1.2** Oceanographers study the life and properties of the ocean.  
**Investigate** What kind of training would this Earth scientist need?

**Concepts in Motion**

**Interactive Table** To explore more about the scope of Earth science, visit [glencoe.com](http://glencoe.com).

**Table 1.1**

**Subspecialties of Earth Science**

| Major Area of Study          | Subspecialty               | Subjects Studied   |
|------------------------------|----------------------------|--|
| <b>Astronomy</b>             | astrophysics               | physics of the universe, including the physical properties of objects found in space   |
|                              | planetary science          | planets of the solar system and the processes that form them   |
| <b>Meteorology</b>           | climatology                | patterns of weather over a long period of time   |
|                              | atmospheric chemistry      | chemistry of Earth's atmosphere, and the atmospheres of other planets  |
| <b>Geology</b>               | paleontology               | remains of organisms that once lived on Earth; ancient environments  |
|                              | geochemistry               | Earth's composition and the processes that change it   |
| <b>Oceanography</b>          | physical oceanography      | physical characteristics of oceans, such as salinity, waves, and currents  |
|                              | marine geology             | geologic features of the ocean floor, including plate tectonics of the ocean   |
| <b>Environmental science</b> | environmental soil science | interactions between humans and the soil, such as the impact of farming practices; effects of pollution on soil, plants, and groundwater |
|                              | environmental chemistry    | chemical alterations to the environment through pollution and natural means  |

**FOLDABLES**

Incorporate information from this section into your Foldable.

## Earth's Systems

Scientists who study Earth have identified four main Earth systems: the geosphere, atmosphere, hydrosphere, and biosphere. Each system is unique, yet each interacts with the others.

**Geosphere** The area from the surface of Earth down to its center is called the **geosphere**. The geosphere is divided into three main parts: the crust, mantle, and core. These three parts are illustrated in **Figure 1.3**.

The rigid outer shell of Earth is called the crust. There are two kinds of crust—continental crust and oceanic crust. Just below the crust is Earth's mantle. The mantle differs from the crust both in composition and behavior. The mantle ranges in temperature from 100°C to 4000°C—much warmer than the temperatures found in Earth's crust. Below the mantle is Earth's core. You will learn more about the crust, mantle, and core in Unit 5.

**Atmosphere** The blanket of gases that surrounds our planet is called the **atmosphere**. Earth's atmosphere contains about 78 percent nitrogen and 21 percent oxygen. The remaining 1 percent of gases in the atmosphere include water vapor, argon, carbon dioxide, and other trace gases. Earth's atmosphere provides oxygen for living things, protects Earth's inhabitants from harmful radiation from the Sun, and helps to keep the planet at a temperature suitable for life. You will learn more about Earth's atmosphere and how parts of this system interact to produce weather in Unit 4.

**Hydrosphere** All the water on Earth, including the water in the atmosphere, makes up the **hydrosphere**. About 97 percent of Earth's water exists as salt water, while the remaining 3 percent is freshwater contained in glaciers, lakes and rivers, and beneath Earth's surface as groundwater. Only a fraction of Earth's total amount of freshwater is in lakes and rivers. You will find out more about Earth's hydrosphere in Units 3, 4, and 7.

### VOCABULARY

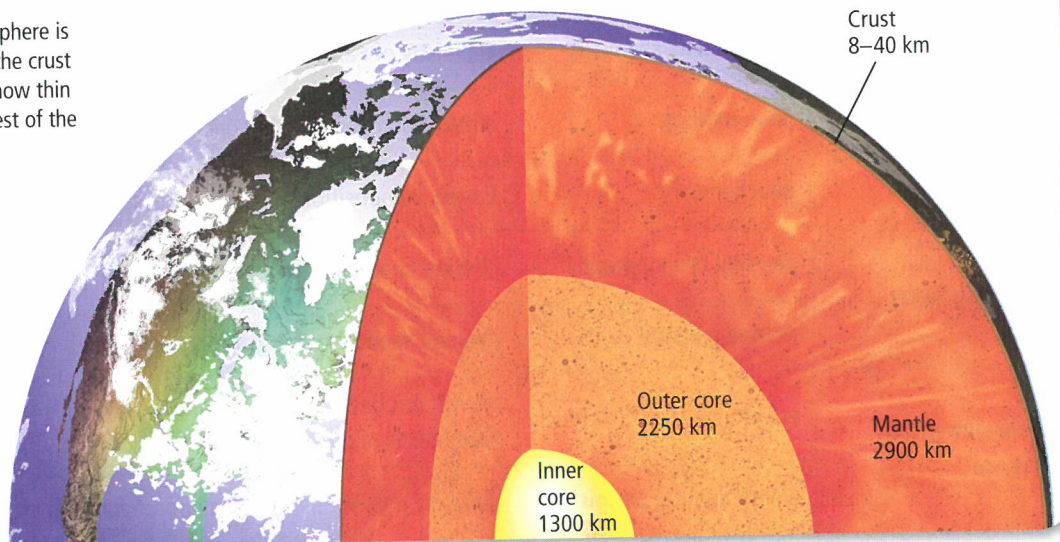
#### SCIENCE USAGE V. COMMON USAGE

##### Crust

**Science usage:** the thin, rocky, outer layer of Earth

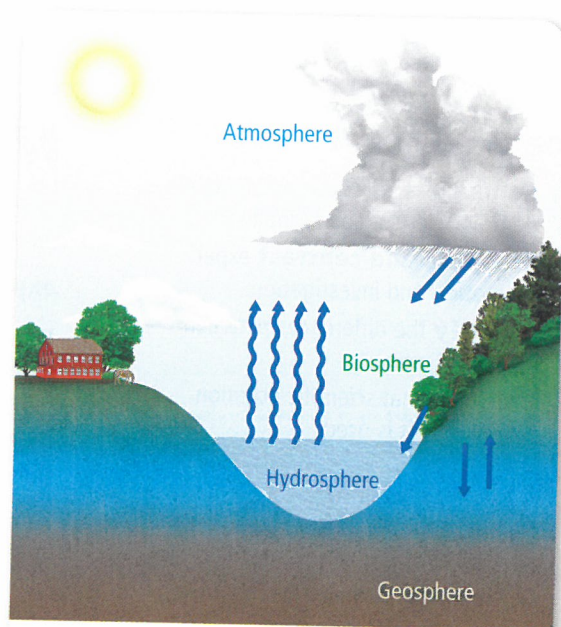
**Common usage:** the hardened exterior or surface part of bread

■ **Figure 1.3** Earth's geosphere is composed of everything from the crust to the center of Earth. Notice how thin the crust is in relation to the rest of the geosphere's components.



**Biosphere** The **biosphere** includes all organisms on Earth as well as the environments in which they live. Most organisms live within a few meters of Earth's surface, but some exist deep beneath the ocean's surface, and others live high atop Earth's mountains. All of Earth's life-forms require interaction with at least one of the other systems for their survival.

As illustrated in **Figure 1.4**, Earth's biosphere, geosphere, hydrosphere, and atmosphere are interdependent systems. For example, Earth's present atmosphere formed millions of years ago through interactions with the geosphere, hydrosphere, and biosphere. Organisms in the biosphere, including humans, continue to change the atmosphere through their activities and natural processes. You will explore interactions among Earth's biosphere and other systems in Units 3, 4, 6, and 7.



■ **Figure 1.4** All of Earth's systems are interdependent. Notice how water from the hydrosphere enters the atmosphere, falls on the biosphere, and soaks into the geosphere.

## Technology

The study of science, including Earth science, has led to many discoveries that have been applied to solve society's needs and problems. The application of scientific discoveries is called technology. Technology is transferable, which means that it can be applied to new situations. Freeze-dried foods, ski goggles, and the ultralight materials used to make many pieces of sports equipment were created from technologies used in our space program. Technology is not used only to make life easier. It can also make life safer. Most people have smoke detectors in their houses to help warn them if there is a fire. Smoke detectors were also invented as part of the space program and were adapted for use in everyday life.

## Section 1.1 Assessment

### Section Summary

- ▶ Earth is divided into four systems: the geosphere, hydrosphere, atmosphere, and biosphere.
- ▶ Earth systems are all interdependent.
- ▶ Identifying the interrelationships between Earth systems leads to specialties and subspecialties.
- ▶ Technology is important, not only in science, but in everyday life.
- ▶ Earth science has contributed to the development of many items used in everyday life.

### Understand Main Ideas

1. **MAIN Idea** Explain why it is helpful to identify specialties and subspecialties of Earth science.
2. **Apply** What are three items you use on a daily basis that have come from research in Earth science?
3. **Compare and contrast** Earth's geology and geosphere.
4. **Hypothesize** about human impact on each of Earth's systems.
5. **Compare and contrast** the hydrosphere and biosphere.

### Think Critically

6. **Predict** what would happen if the makeup of the hydrosphere changed. What would happen if the atmosphere changed?

### WRITING in Earth Science

7. Research a subspecialty of Earth science. Make a brochure about a career in this field.