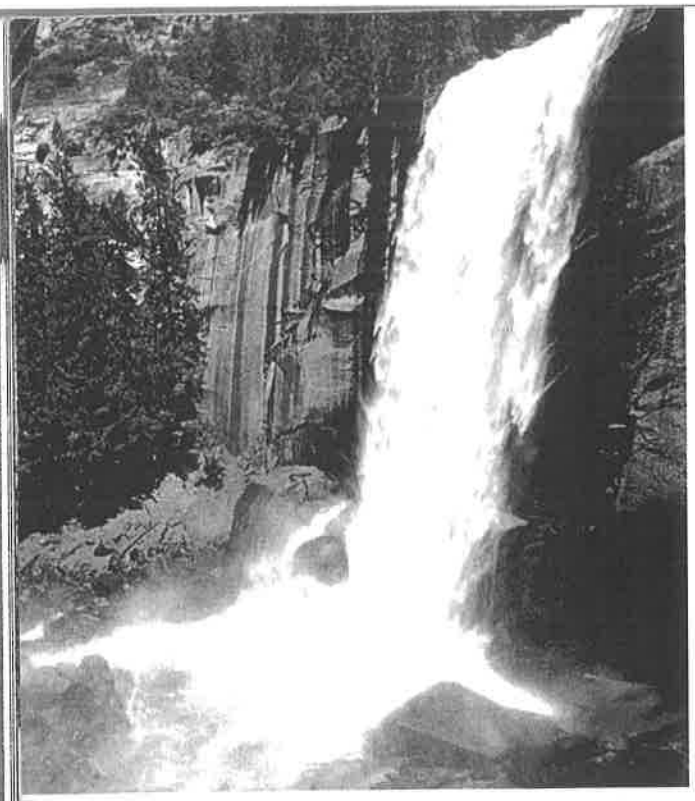


FIGURE 6
Law of Gravity
The force of gravity pulls the water in this waterfall toward Earth's center.

Scientific Theories and Laws

As scientists study the natural world, they develop concepts that explain their observations. These concepts are called scientific theories. A **scientific theory** is a well-tested scientific concept that explains a wide range of observations. An accepted theory has withstood repeated tests. But if tests fail to support a theory, scientists change the theory or abandon it.

When scientists repeatedly observe the same result in specific circumstances, they may arrive at a scientific law. **Unlike a theory, a scientific law describes an observed pattern in nature, but does not provide an explanation for it.** A scientific law is a statement that describes what scientists expect to happen every time under a particular set of conditions. For example, the law of gravity states that the force of gravity acts between all objects in the universe. As a result of gravity, any two objects in the universe attract each other. Scientists have repeatedly tested this law and found it to be true.

Reading Checkpoint **What is a scientific law?**

Section 1 Assessment

S 6.7.a, 6.7.c E-LA: Reading 6.1.0, Writing 6.2.0

Vocabulary Skill **High-Use Academic Words** In a complete sentence, explain what happens in a controlled experiment. Use the word *factor* in your explanation.

Reviewing Key Concepts

1. a. **Reviewing** What is science?
   b. **Explaining** Explain three main skills that scientists use.
   c. **Applying Concepts** Can you make an inference without having made any observations? Explain your answer.
2. a. **Defining** Define the term *scientific inquiry*.
   b. **Explaining** You may have heard the saying "Red sky at morning, sailors take warning." This means that stormy weather may follow if the sky looks red at sunrise. Could you test this using scientific inquiry? Explain.
   c. **Problem Solving** To determine whether the saying in part (b) is true, what kinds of data would you need to collect?
3. a. **Defining** What is a scientific theory? What is a scientific law?
   b. **Comparing and Contrasting** How do scientific theories differ from scientific laws?

Writing in Science

Volcano Inquiry Look at the photograph in Figure 1. With a partner, think of a question about volcanoes that you would like to answer. Write your question in your notebook. List anything you already know about the topic of your question that might help you answer it. Then state your question as a hypothesis.

Section 2

Studying Earth

CALIFORNIA Standards Focus

S 6.3.a Students know energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.

S 6.4.a Students know the sun is the major source of energy for phenomena on Earth's surface; it powers winds, ocean currents, and the water cycle.

- What are the parts of the Earth system?
- How is energy transferred in the Earth system?
- What are the branches of Earth science?

Key Terms

- energy
- atmosphere
- hydrosphere
- lithosphere
- biosphere
- matter
- wave
- heat
- thermal energy
- Earth science

Lab zone Standards Warm-Up

What Is the Source of Earth's Energy?

1. Pour 100 mL of tap water into a clear plastic jar and tighten the lid.
2. Place the jar in the sun for 10 minutes.
3. Move the jar to a shaded location and wait several minutes
4. Observe the sides of the jar. What do you see?

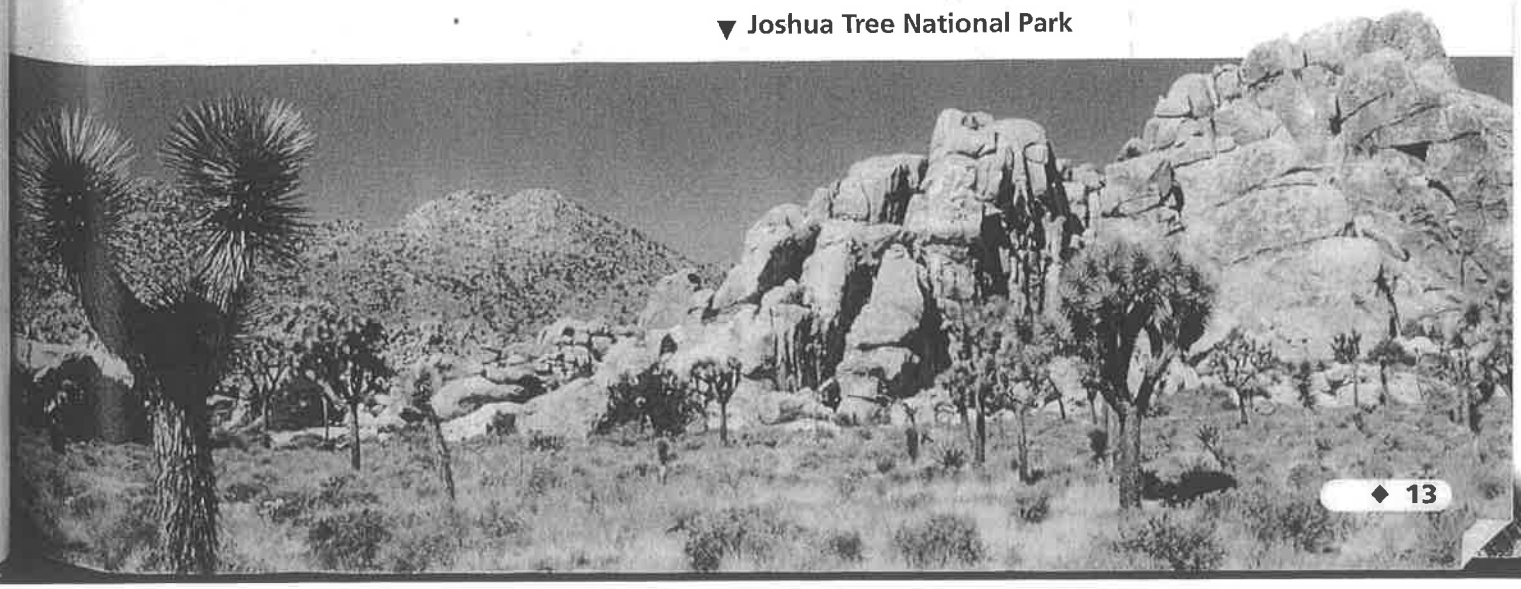
Think It Over

Inferring What can you infer about the energy source for the changes you observed in the bottle? Explain how the bottle could serve as model of Earth's ocean and atmosphere.

Joshua Tree National Park, in California's Mojave Desert, is a popular spot for people who enjoy the outdoors. If you visit the park, you can take a nature trail to observe desert animals and wildflowers. You can also ride a mountain bike past cactuses and Joshua trees, or explore huge granite boulders. But whatever you do, be sure to apply sunblock, wear a hat, and drink plenty of water!

When you get thirsty, you can pause in the cool shade of a boulder for a drink of water. But when you step out of the shade into the bright sun, your skin feels warm right away. You may wonder why you feel warmer in the sun than in the shade. To understand this, you need to know how sunlight is related to the concept of energy.

▼ Joshua Tree National Park



The Structure of the Earth System

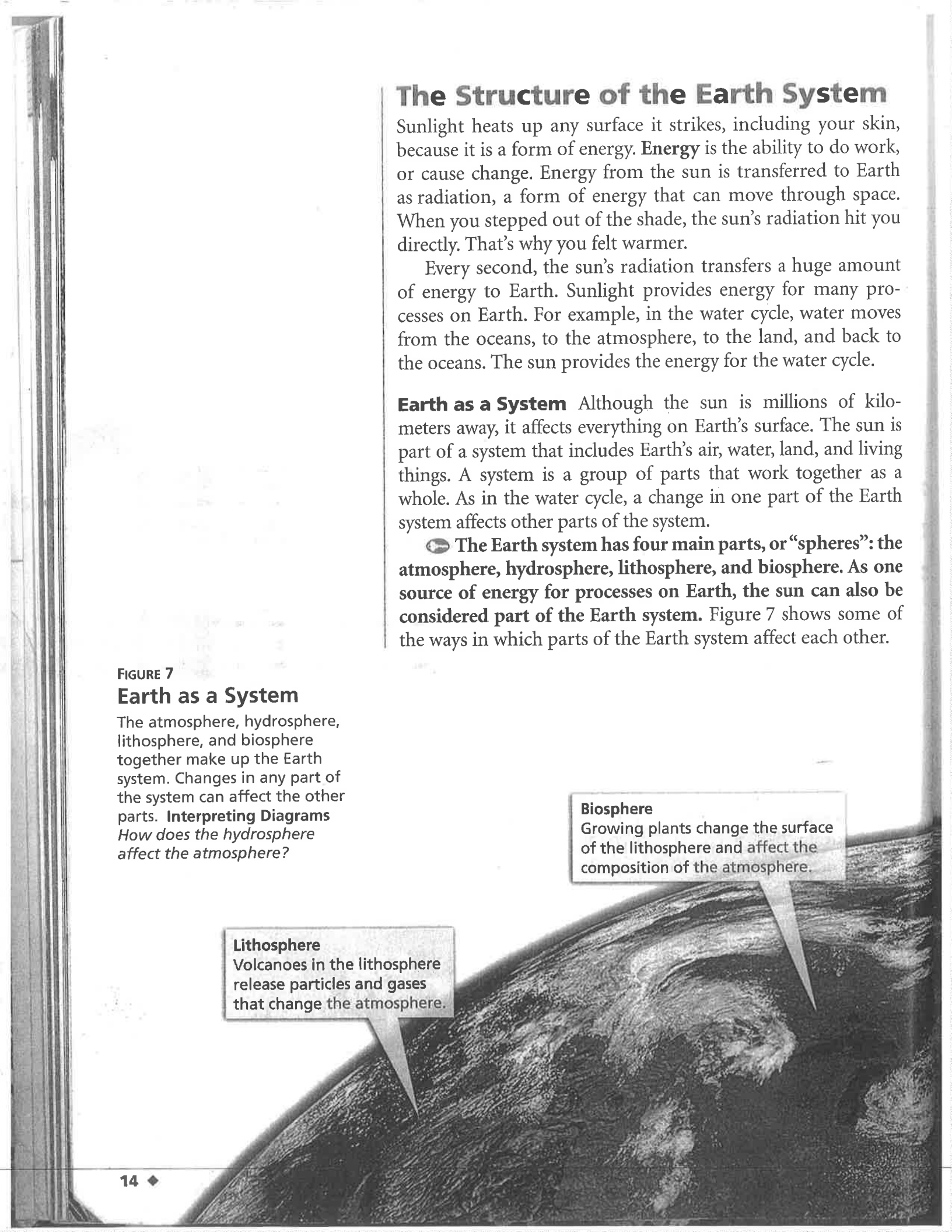
Sunlight heats up any surface it strikes, including your skin, because it is a form of energy. **Energy** is the ability to do work, or cause change. Energy from the sun is transferred to Earth as radiation, a form of energy that can move through space. When you stepped out of the shade, the sun's radiation hit you directly. That's why you felt warmer.

Every second, the sun's radiation transfers a huge amount of energy to Earth. Sunlight provides energy for many processes on Earth. For example, in the water cycle, water moves from the oceans, to the atmosphere, to the land, and back to the oceans. The sun provides the energy for the water cycle.

Earth as a System Although the sun is millions of kilometers away, it affects everything on Earth's surface. The sun is part of a system that includes Earth's air, water, land, and living things. A system is a group of parts that work together as a whole. As in the water cycle, a change in one part of the Earth system affects other parts of the system.

The Earth system has four main parts, or "spheres": the atmosphere, hydrosphere, lithosphere, and biosphere. As one source of energy for processes on Earth, the sun can also be considered part of the Earth system. Figure 7 shows some of the ways in which parts of the Earth system affect each other.

FIGURE 7
Earth as a System
The atmosphere, hydrosphere, lithosphere, and biosphere together make up the Earth system. Changes in any part of the system can affect the other parts. **Interpreting Diagrams** *How does the hydrosphere affect the atmosphere?*



Atmosphere The outermost sphere is the **atmosphere** (AT muh sfeer), the mixture of gases that surrounds the planet. By far the most abundant gases are nitrogen and oxygen, but the atmosphere also contains water vapor, carbon dioxide, and other gases.

Hydrosphere Earth's oceans, lakes, rivers, and ice form the **hydrosphere** (HY druh sfeer). Most of the hydrosphere consists of the salt water in the oceans, but fresh water is also part of the hydrosphere. Oceans cover more than two thirds of Earth.

Lithosphere Earth's solid, rocky outer layer is called the **lithosphere** (LITH uh sfeer). The lithosphere is made up of the continents as well as smaller landmasses called islands. The lithosphere extends under the entire ocean floor. The surface of the lithosphere varies from smooth plains to wrinkled hills and valleys to jagged mountain peaks.

The energy for some processes that shape the lithosphere comes from the heat of Earth's interior. For example, deep inside Earth, some rock melts, forming the lava that erupts from volcanoes.

Biosphere All living things—whether in the air, in the oceans or on and beneath the land surface—make up the **biosphere** (BY uh sfeer). The biosphere extends into each of the other three spheres.

Reading Checkpoint **What is the biosphere?**

Lab zone **Skills Activity**

Classifying

Classify each of the events below according to which parts of the Earth system are involved in the event.

1. Heavy rain washes soil and rocks down a hillside.
2. Fog forms above a lake before dawn and then "burns off" after the sun rises.
3. The roots of a tree absorb water and nutrients from the soil.