Close, *continued*

Answers to Section Review

1. because it consists of many interacting components
2. In an open system, matter and energy are added and removed. In a closed system, only energy enters or leaves.
3. The atmosphere contains gases that sustain life and shield Earth from harmful radiation. The hydrosphere covers more than 70% of Earth's surface and is made up of all water that is not gaseous. The geosphere consists of the rock and soil of Earth's crust and the solid and molten rock within the interior. The biosphere contains all living organisms and extends from the deep ocean to the atmosphere.
4. Energy in the Earth system comes from the sun and from Earth's interior.
5. through chemical reactions, radioactive decay, radiation of heat and light, and the growth and decay of organisms
6. In the short-term cycle, CO_2 is absorbed from the atmosphere by plants, which produce carbohydrates that are consumed by organisms. Carbon is returned to the atmosphere mainly as CO_2 from animal and plant respiration and decay. In the long-term cycle, carbon also becomes buried in rock.
7. Nitrogen from the atmosphere is fixed by bacteria in the soil and water. This nitrogen is absorbed by plants, which are consumed by animals, and is returned to the soil or water when dead animals decompose. Other bacteria return nitrogen to the atmosphere.
8. Water that evaporates into the atmosphere moderates the temperature of air; water as precipitation in the geosphere causes weathering of rock; liquid water in the biosphere sustains life; water as precipitation in the hydrosphere replenishes supplies of fresh water.
9. It would add carbon dioxide to the atmosphere, because when organisms such as trees burn, CO_2 is released.
10. an open system, because matter was being added to it
11. As carbon moves through the carbon cycle, it undergoes physical and chemical changes that involve transfers of energy.
12. A *system* may be a *closed system* or an *open system* such as Earth in which both *matter* and *energy* are exchanged in the *atmosphere, hydrosphere, geosphere,* and *biosphere*.

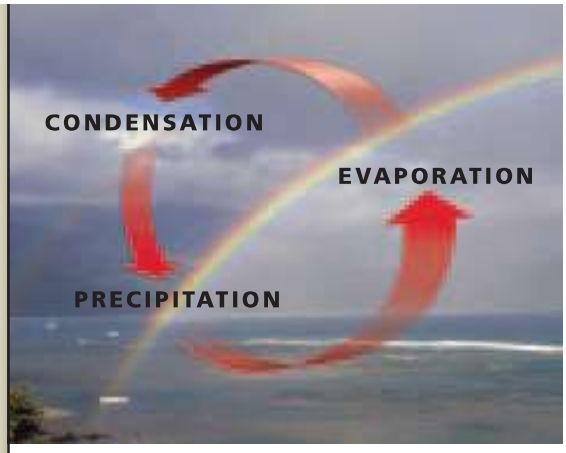

Figure 8 ▶ The water cycle is the continuous movement of water from the atmosphere to Earth's surface and back to the atmosphere.

The Water Cycle

The movement of water from the atmosphere to Earth's surface and back to the atmosphere is always taking place. This continuous movement of water is called the *water cycle*, which is shown in **Figure 8.** In the water cycle, water changes from liquid water to water vapor through the energy transfers involved in evaporation and transpiration. Evaporation occurs when energy is absorbed by liquid water and the energy changes the water into water vapor. Transpiration is the release of moisture from plant leaves. During these processes, water absorbs heat and changes state. When the water loses energy, it condenses to form water droplets, such as those that form clouds. Eventually, water falls back to Earth's surface as precipitation, such as rain, snow, or hail.

Humans and the Earth System

All natural cycles can be altered by human activities. The carbon cycle is affected when humans use fossil fuels. Fossil fuels form over millions of years. Carbon dioxide is returned to the atmospheric reservoir rapidly when humans burn these fuels. Also, both the nitrogen and phosphorus cycles are affected by agriculture. Some farming techniques can strip the soil of nitrogen and phosphorus. Many farmers replace these nutrients by using fertilizers, which can upset the balance of these elements in nature.

Section 2 Review

1. **Explain** how Earth can be considered a system.
2. **Compare** an open system with a closed system.
3. **List** two characteristics of each of Earth's four major spheres.
4. **Identify** the two main sources of energy in Earth's system.
5. **Identify** four processes in which matter and energy cycle on Earth.
6. **Explain** how carbon cycles in Earth's system.
7. **Explain** how nitrogen cycles in Earth's system.

CRITICAL THINKING

8. **Identifying Relationships** For each of Earth's four spheres, describe one way that the water cycle affects the sphere.
9. **Determining Cause and Effect** What effect, if any, would you expect a massive forest fire to have on the amount of carbon dioxide in the atmosphere? Explain your answer.
10. **Analyzing Ideas** Early Earth was constantly being bombarded by meteorites, comets, and asteroids. Was early Earth an open system or a closed system? Explain your answer.
11. **Analyzing Relationships** Explain the role of energy in the carbon cycle.

CONCEPT MAPPING

12. Use the following terms to create a concept map: *closed system, system, open system, matter, atmosphere, biosphere, energy, geosphere,* and *hydrosphere.*

CHAPTER RESOURCES

Chapter Resource File

- Section Quiz GENERAL

Workbooks

- Study Guide (also in Spanish)