SECTION 3

Recycling Water

As You Read

What You'll Learn

- **Describe** the sources of Earth's freshwater supply.
- **Identify** Earth's water reservoirs.
- **Explain** the processes by which water is recycled.

Vocabulary

groundwater
soil water
aquifer
surface water

Why It's Important

The water cycle makes water constantly available for many processes on Earth.

Earth's Water Reservoirs

Many people call Earth the "water planet" because about 70 percent of Earth is covered by water. But, only a small portion is available for human use. Of the world's total water supply, 97 percent is located in the oceans and is salt water, leaving only about three percent that is freshwater, as shown in **Table 1.** More than three-quarters of that is frozen in glaciers. Of the less than one percent of Earth's total water supply available for human use, much of it lies underneath Earth's surface. Next you can think big as you begin your examination of Earth's water reservoirs with the oceans.

Oceans *Water, water everywhere, but not a drop to drink,* so goes the poem. Ocean water is plentiful on Earth, but it's salty and therefore not readily available for human use. You would have to remove the salt if you wanted to use ocean water for drinking, bathing, or irrigating crops. Unfortunately, removing salt from ocean water usually isn't practical and is only done in a few arid regions. To find a lot of freshwater, you might want to travel to Earth's frozen poles.

Table 1 Distribution of Earth's Water

Location of Water	Total Supply (%)
Oceans	97.2
Glaciers	2.15
Groundwater	0.62
Freshwater lakes	0.009
Saline lakes and inland seas	0.008
Soil water	0.005
Atmosphere	0.001
Stream channels	0.0001

Ice Ice sheets and glaciers are common in Earth's polar regions. For example, large areas of Greenland and Antarctica are covered by ice. These ice sheets lock up a large percentage of Earth's freshwater. Ice accounts for just more than two percent of the total water on Earth, but that's 77 percent of the planet's freshwater supply. People have proposed using ships to tow large pieces of polar ice to places that need freshwater. It's an expensive proposition, and imagine the danger if ice sheets break up in commercial shipping lanes. Melting the ice into usable water also would be a difficult task. Fortunately, in many places water can be found just by digging a hole.

Groundwater You might have wondered what happens to rain after it falls. If you leave a bucket outside in a rainstorm, it can fill quickly with water. Where does the water that lands on the ground go? Some of it runs off and flows into streams, and some evaporates. A large amount soaks into the ground. Water that is held underground in layers of rock and sediment is called **groundwater.** The part of the groundwater that is held within openings in the soil is called **soil water.** It keeps plants and crops alive. Groundwater also includes underground streams. People in houses that get their water from wells are drinking groundwater. The water is purified as it slowly permeates through layers of sediment and rock. However, if groundwater becomes polluted, it can be extremely difficult to clean.

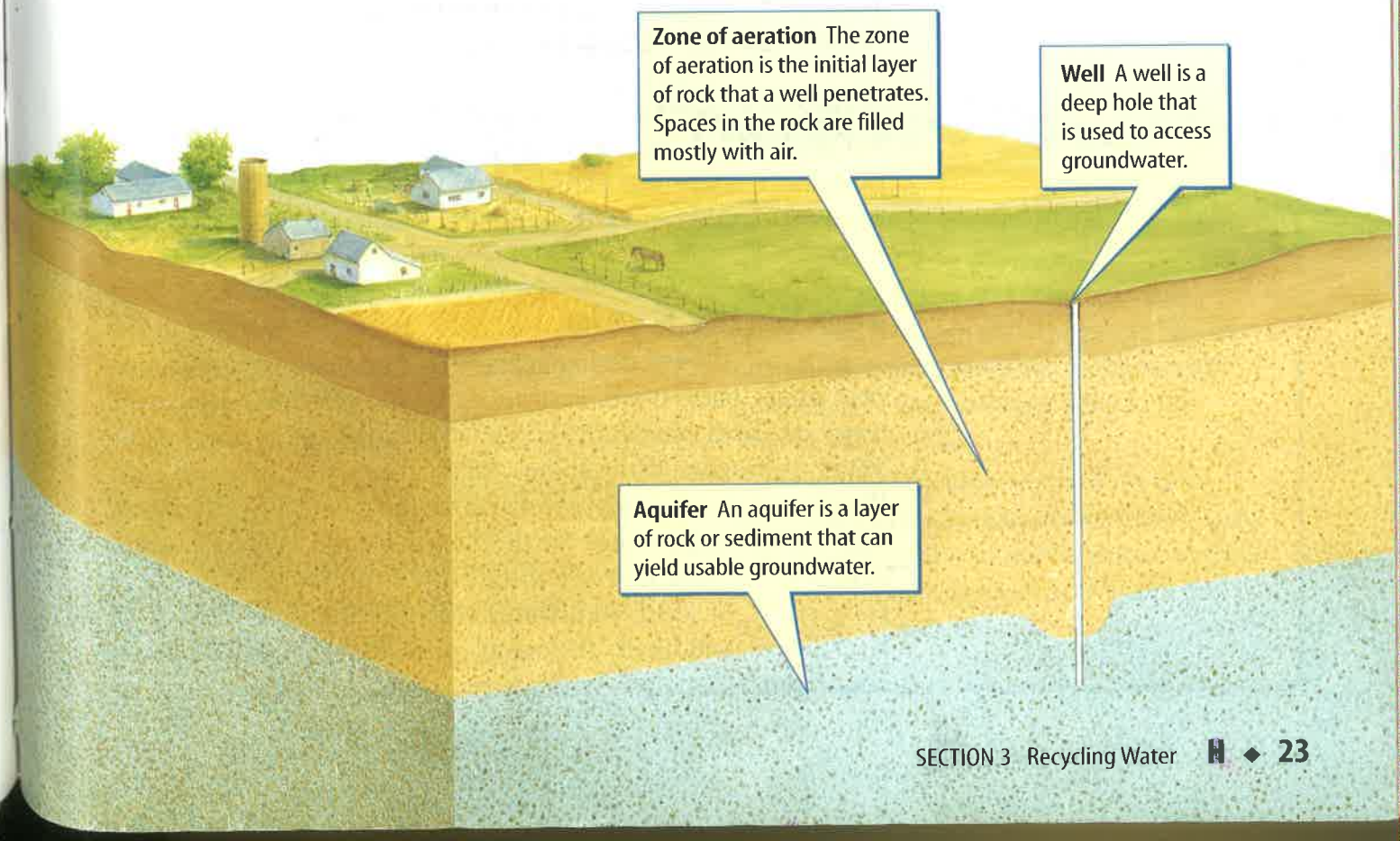
Reading Check *Where can groundwater be found?*

Aquifers An **aquifer** is a layer of rock or sediment that has enough well-connected openings to allow groundwater to flow through it. Water collects in the open spaces between rock particles. This water flows slowly from one open space to another at rates of a few meters per year. Sometimes aquifers are used to supply water to towns and farms, as shown in **Figure 15.** The water is pumped to Earth's surface through a well. Sometimes Earth's surface dips below the level where groundwater would be. This is where natural lakes and rivers are located.

SCIENCE Online

Research Visit the Glencoe Science Web site at **science.glencoe.com** for information about saltwater intrusion and other problems that can occur with groundwater. Make a poster illustrating what you learn.

Figure 15
Aquifers are found at different depths. Some are near the surface, and others are hundreds of meters below the surface. *How is water extracted from aquifers?*



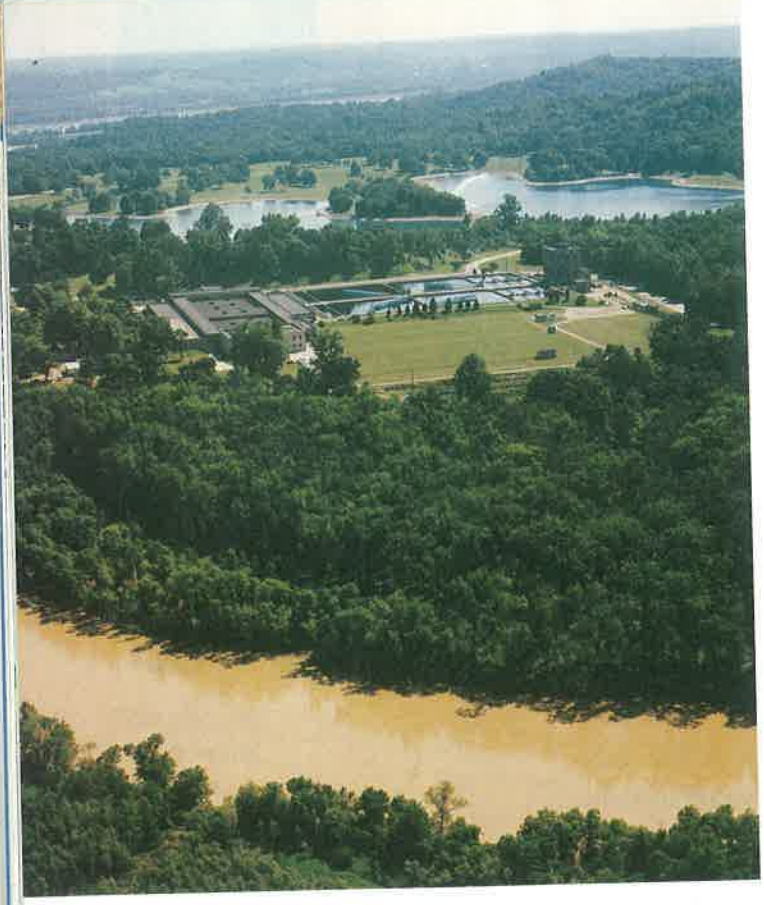


Figure 16
Your city might have a water-intake plant like this one in Cincinnati, Ohio. Here, water is processed for drinking and other uses.

Lakes, Rivers, and Ponds You already have learned about groundwater. The water at Earth's surface is called **surface water.** It is found in streams, rivers, ponds, lakes, and reservoirs. This is the water you easily can see and use, as shown in **Figure 16.**

Reading Check *What are three sources of surface water?*

Water in the Atmosphere Have you tried to dry your towel on a towel rack and discovered it remained damp hours later? That's because air holds water, too. Earth's atmosphere can consist of anywhere from near zero to about four percent water vapor by volume. Water vapor in Earth's atmosphere has several important roles. Clouds need it to form, therefore water vapor is the source of rain, sleet, and snow. But the role of water vapor in the atmosphere is even more complex.

Recall that each time water undergoes a change of state it gives off heat or absorbs heat. For example, heat is given off when water vapor condenses to form the water droplets in clouds. But, heat is removed when water evaporates into water vapor. That's why you feel cold when you are soaking wet. The atmosphere uses these heating and cooling properties of water to move energy around. In the process it can brew up wind, storms, and even hurricanes.

Water vapor serves another important function in the atmosphere. Much as a sweater keeps warm air next to your skin, water vapor in the atmosphere absorbs energy and acts as a blanket to help keep Earth warm and hospitable to life.

The Water Cycle

Are you still wondering how water from King Tut's reflecting pool might make it into your morning shower? It is because the water on Earth constantly recycles itself through the water cycle. Water evaporates from oceans, lakes, rivers, puddles, and even the ground. It then rises into Earth's atmosphere as water vapor, which condenses to form the droplets in clouds. When the water droplets become heavy enough, they fall back to Earth as rain, snow, or sleet. Rainwater runs off the surface back to rivers, lakes, and finally the ocean, as shown in **Figure 17.** Water continuously circulates in this way.

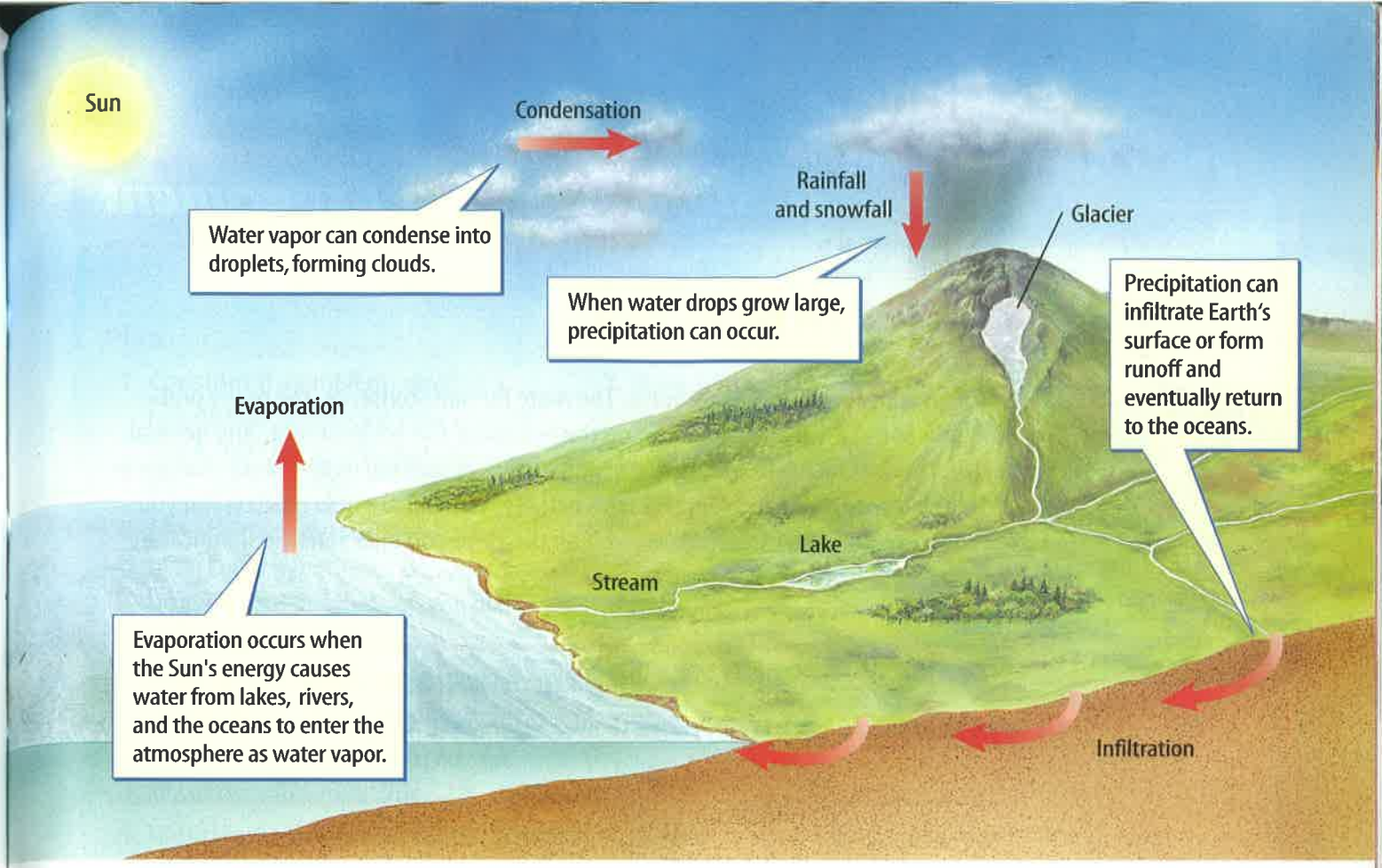


Figure 17
Water constantly cycles from Earth to the atmosphere and back to Earth again.

A Valuable Resource Humans are lucky that water circulates, but this doesn't mean that it doesn't need to be cared for. Now that you have learned how important water is to Earth, you can understand why it is crucial that it be protected. Earth holds many treasures, and water is truly a valuable resource.

Section 3 Assessment

1. Approximately what percentage of Earth's total water supply is available as surface freshwater?
2. How is soil water different from other groundwater?
3. What is an aquifer?
4. What source of freshwater is most easily accessible?
5. **Think Critically** How could a water molecule in a puddle near your home make its way to the ocean?

Skill Builder Activities

6. **Recognizing Cause and Effect** If more water is pumped from wells than soaks into an aquifer, what could happen to the amount of groundwater? **For more help, refer to the Science Skill Handbook.**
7. **Communicating** Research the water cycle. Write a one-page summary in your Science Journal of the steps involved and the reason why the result is a constant supply of clean water. **For more help, refer to the Science Skill Handbook.**