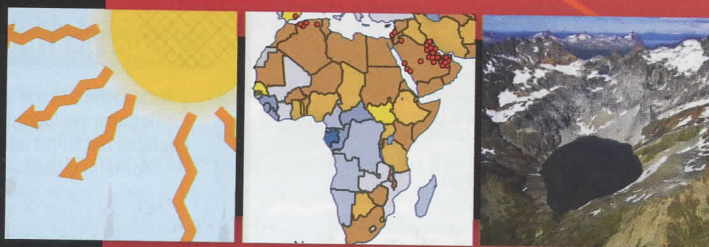


- ✓ INFOGRAPHIC
The Water Cycle
- ✓ MAP Global Desalination
- ✓ INTERACTIVE
SELF-CHECK QUIZ
- ✓ VIDEO Earth's Water



Reading HELPDESK

Academic Vocabulary

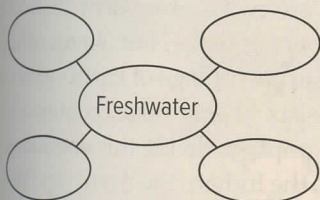
- constant
- enormous

Content Vocabulary

- water cycle
- evaporation
- condensation
- precipitation
- desalination
- groundwater
- aquifer

TAKING NOTES: Key Ideas
and Details

IDENTIFYING As you read the lesson, use a concept map like the one below to write descriptions of the freshwater sources on Earth, including how they are used by humans.



LESSON 3

Earth's Water

ESSENTIAL QUESTION • How do physical processes shape Earth's surface?

IT MATTERS BECAUSE

The amount of water on Earth remains fairly constant and moves in the water cycle. Salt water covers much of the Earth's surface. Although there is only a small amount of freshwater on Earth, it is necessary to sustain life.

The Water Cycle

GUIDING QUESTION What drives the Earth's water cycle?

As you recall, oceans, lakes, rivers, and other bodies of water make up the Earth's hydrosphere. Almost all of the hydrosphere is salt water found in the oceans, seas, and a few large saltwater lakes. The remainder is freshwater found in lakes, rivers, glaciers, and groundwater.

The total amount of water on Earth does not change, but it is constantly moving—from the oceans to the air to the land and finally back to the oceans. This regular movement of water is called the **water cycle**. The sun drives the water cycle by evaporating water from the surfaces of bodies of water. **Evaporation** is the changing of liquid water into vapor, or gas. The sun's energy causes evaporation. Water vapor rising from bodies of water and plants is gathered in the air. The amount of water vapor the air holds depends on its temperature. Warm air holds more water vapor than cool air.

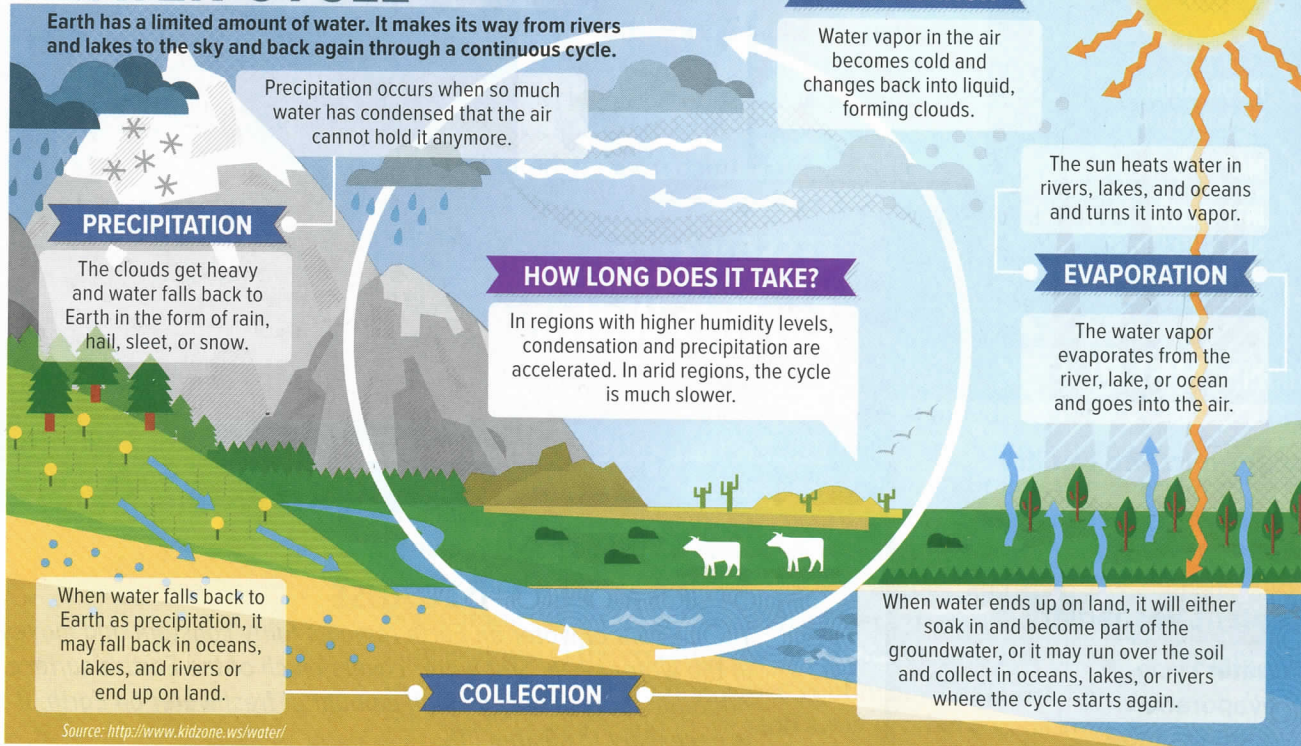
When warm air cools, it cannot retain all of its water vapor, so the excess water vapor changes into liquid water—a process called **condensation**. Tiny droplets of water come together to form clouds. When clouds gather more water than they can hold, they release moisture, which falls to the Earth as **precipitation**—rain, snow, or sleet, depending on the air temperature and wind conditions. This precipitation sinks into the ground and collects in streams and lakes to return to the oceans. Soon most of it evaporates, and the cycle begins again.

The amount of water that evaporates is approximately the same amount that falls back to Earth. This amount varies little from year to year. Thus, the total volume of water in the water cycle is fairly **constant**.

✓ **READING PROGRESS CHECK**

Explaining What causes evaporation?

WATER CYCLE



The water cycle depicts the movement of water from ocean to air to ground and back to the ocean.

▲ CRITICAL THINKING

- 1. Categorizing** What are three types of precipitation? Where might this precipitation end up?
- 2. Speculating** How might contaminated water end up affecting people even if they live far away from the source?

water cycle regular movement of Earth's water from ocean to air to ground and back to the ocean

evaporation the process of converting liquid into vapor, or gas

condensation the process of excess water vapor changing into liquid water when warm air cools

precipitation moisture that falls to the Earth as rain, sleet, hail, or snow

constant unchanging

enormous gigantic; exceedingly large

Bodies of Salt Water

GUIDING QUESTION What is salt water?

Seen from space, the Earth's oceans and seas are more prominent than its landmasses. About 70 percent of the Earth's surface is water, but almost all of this is salt water. Freshwater makes up only a small percentage of Earth's water.

About 97 percent of the Earth's water consists of one huge, continuous body of water that circles all the continents. Geographers divide this **enormous** expanse into five oceans: the Pacific, the Atlantic, the Indian, the Arctic, and the Southern. The first four lie in large basins between the continents, while the Southern Ocean extends from the coast of Antarctica north to 60° S latitude. The Pacific, the largest of the oceans, covers more area than all the Earth's land combined. The Pacific Ocean is also deep enough in some places to cover Mount Everest, the world's highest mountain, with more than 1 mile (1.6 km) to spare.

Seas, gulfs, and bays are bodies of salt water smaller than oceans. These bodies of water are often partially enclosed by land. As one of the world's largest seas, the Mediterranean Sea is almost entirely encircled by southern Europe, northern Africa, and southwestern Asia. The Gulf of Mexico is nearly encircled by the coasts of the United States and Mexico.

Although 97 percent of the world's water is found in oceans, the water is too salty for drinking, farming, or manufacturing. The world's growing population and increasing urbanization require freshwater for such activities. Governments,

planners, and scientists continue to look for ways to meet the world's growing need for freshwater. Today, some of these efforts focus on ways to remove the salt from ocean water or groundwater in a process known as **desalination**.

Desalination is a controversial topic, however. Supporters point out that it is one of the most promising solutions to the problem of freshwater shortages.

PRIMARY SOURCE

"Desalination is a promise fulfilled. Today, hundreds of million people around the world have access to clean water thanks to desalination. Just as importantly, desalination is also a promise for the future, with its unique ability to deliver a reliable, sustainable and new source of water to our thirsty planet."

—Corrado Sommariva, invitation to the International Desalination Association 2013 World Congress

Critics of the process argue that it does not come without economic and environmental costs. Desalinated ocean water is one of the most expensive forms of freshwater available because of the costs associated with collecting the ocean water, removing the salt, and distributing the new freshwater. For example, desalinated water in the United States can cost up to five times more than other sources of freshwater. Such high costs make desalination an impossible option for many less developed countries, where limited funds are already stretched too thin.

Some countries, such as Saudi Arabia and the United Arab Emirates, use desalination because other freshwater sources are scarce and because they have the financial and energy resources to support such ventures. In fact, about three-fourths of the world's desalinated water is produced in North Africa and Southwest Asia. Desalination plants in the United States—mostly in California, Florida, and Texas—also produce a small amount of freshwater.

The environmental concerns surrounding desalination are related to ocean and marine biodiversity. When ocean water is collected, marine life is drawn up in the intake pipe and eventually destroyed during the desalination process.

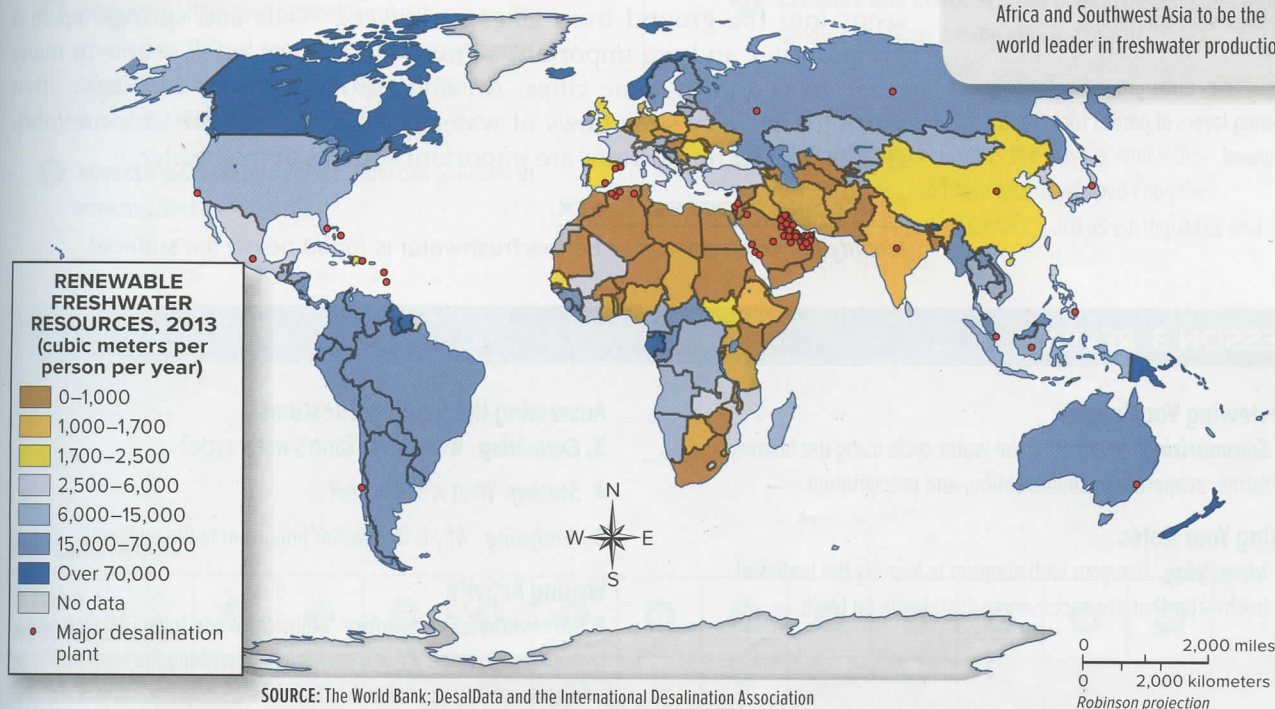
desalination the removal of salt from seawater to make it usable for drinking and farming

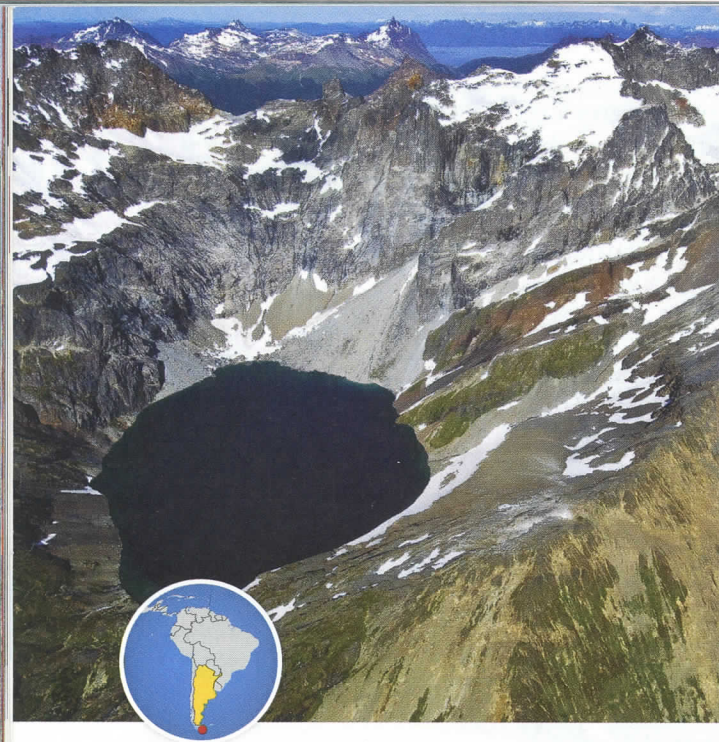
GEOGRAPHY CONNECTION

Desalination is an option for some countries to meet freshwater needs.

- PLACES AND REGIONS** In which general region of the world are many of the desalination plants located?
- ENVIRONMENT AND SOCIETY** Which energy resource allows North Africa and Southwest Asia to be the world leader in freshwater production?

Global Desalination





Glacial lakes, like this one in Argentina, are most abundant in high-altitude areas that were once occupied by glaciers.

▲ CRITICAL THINKING

1. **Identifying** Other than Argentina, where else could you find glacial lakes?
2. **Classifying** What are the different sources of freshwater?

groundwater water located underground within the Earth that supplies wells and springs

aquifer underground water-bearing layers of porous rock, sand, or gravel

In addition, wastewater from the process affects coastal water quality. Besides being very salty, this brine may be warmer in temperature and contain chemicals, which have detrimental effects on water and marine organisms.

✓ READING PROGRESS CHECK

Identifying What is the name of the process that removes salt from ocean water?

Bodies of Freshwater

GUIDING QUESTION Why is freshwater important to life on Earth?

Only about 3 percent of Earth's total water supply is freshwater, and most is not available for human consumption. More than two-thirds of Earth's freshwater is frozen as glaciers and ice caps. Another sixth is found beneath the surface. Lakes, streams, and rivers contain less than one-third of 1 percent of Earth's freshwater.

A lake is a body of water completely surrounded by land. Most lakes contain freshwater, although some, such as Southwest Asia's Dead Sea, are saltwater remnants of ancient seas. Many lakes are found where glacial movement has cut deep valleys and built up dams of soil and rock that held back melting ice water. North America has thousands of glacial lakes.

Flowing water forms streams and rivers. Meltwater, an overflowing lake, or a spring may be the source, or the beginning, of a stream. Streams may combine to form a river, a larger stream of higher volume that follows a channel along a particular course. When rivers join, the major river systems that result may flow for thousands of miles. The smaller streams or rivers that flow into larger rivers are called *tributaries*. Rain, runoff, and water from these tributaries swell rivers as they flow toward a lake, gulf, sea, or ocean. The place where the river empties into another body of water is its mouth.

Groundwater, freshwater that lies beneath the Earth's surface, comes from rain and melted snow that filter through the soil and from water that seeps into the ground from lakes and rivers. Wells and springs tap into groundwater and are important sources of freshwater for people in many rural areas and in some cities. An underground porous rock layer often saturated by very slow flows of water is called an **aquifer** (A•kwuh•fuhr). Aquifers and groundwater are important sources of freshwater.

✓ READING PROGRESS CHECK

Identifying What portion of Earth's freshwater is found below the surface?

LESSON 3 REVIEW

Reviewing Vocabulary

1. **Summarizing** Summarize the water cycle using the following terms: evaporation, condensation, and precipitation.

Using Your Notes

2. **Identifying** Use your web diagram to identify the bodies of freshwater that are necessary to sustain life on Earth.

Answering the Guiding Questions

3. **Explaining** What drives Earth's water cycle?
4. **Stating** What is salt water?
5. **Analyzing** Why is freshwater important to life on Earth?

Writing Activity

6. **Informative/Explanatory** Many cities and towns develop near sources of water. Write a paragraph describing the sources of water used by your community.