networks

There's More Online!

DIAGRAM The Solar System

- DIAGRAM Underwater
- DIAGRAM Water, Land, and Air
- INTERACTIVE SELF-CHECK QUIZ
- VIDEO Planet Earth

Reading **HELP**DESK

Academic Vocabulary

- sphere
- theory

Content Vocabulary

- hydrosphere
- lithosphere
- atmosphere
- biosphere
- continental shelf

TAKING NOTES: Key Ideas and Details

DESCRIBING Use a graphic organizer like the one below to list descriptions for the components that make life on Earth possible: the hydrosphere, lithosphere, atmosphere, and biosphere.

Component	Description
hydrosphere	
lithosphere	
atmosphere	
biosphere	

MERCURY

SUN





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

IT MATTERS BECAUSE

Physical processes shape Earth's surface. Understanding that Earth is part of a larger physical system called the solar system helps us see how it is possible for life on our planet to survive and thrive. Earth's physical systems are affected by natural forces such as earthquakes and volcanoes that can influence human activity on the planet.

Our Solar System

GUIDING QUESTION In what physical system does Earth exist?

Earth is part of our solar system, which is made up of the sun and all of the countless objects that revolve around it. At our solar system's center is the sun—a star, or ball of burning gases. About 109 times wider than Earth, the sun's enormous mass—the amount of matter it contains– creates a strong pull of gravity. This basic physical force keeps the Earth and the other objects revolving in orbit around the sun.

Except for the sun, **spheres** called planets are the largest objects in the solar system. At least eight planets are known to exist, and each is in its own orbit around the sun. Mercury, Venus, Earth, and Mars are the inner planets, or those nearest the sun. Earth, the third planet from the sun, is about 93 million miles (150 million km) away from the sun. Farthest from the sun are the outer planets—Jupiter, Saturn, Uranus, and Neptune.

The planets vary in size with Jupiter being the largest. Earth ranks fifth in size, and Mercury is the smallest. All of the planets except Mercury and Venus have moons—smaller spheres or satellites that orbit them. Earth has 1 moon, and Saturn has at least 18 moons. At least five other objects are dwarf planets. Pluto was known as the smallest planet in the solar system until 2003 when astronomers changed its status. Today Pluto is called a *dwarf planet*. Dwarf planets are small round bodies that orbit the sun, but do not have enough gravity to have cleared the area around their orbits of other orbiting bodies, thus making them too small to be considered planets.

The four inner planets are called *terrestrial planets* because they have solid, rocky crusts. Mercury and Venus are scalding hot, and Mars is a cold, barren desert. Only Earth has temperatures that are moderate enough to allow liquid water at the surface and to support a variety of life.

The four outer planets are called the *gas giant planets*. They are more gaseous and less dense than the terrestrial planets, although they are larger in diameter. Each gas giant is like a miniature solar system, with orbiting moons and encircling rings. Only Saturn's rings, however, are easily seen from Earth by telescope.

Thousands of smaller objects—including asteroids, comets, and meteoroids revolve around the sun. Asteroids are small, irregularly shaped, planet-like objects. They are found mainly between Mars and Jupiter in the asteroid belt. A few asteroids follow paths that cross Earth's orbit. Others, like the recently discovered asteroid 2015 PDC, are held in a balance between the gravitational pull from the sun and an equal force from the Earth.

Comets, made of icy dust particles and frozen gases, look like bright balls with long, feathery tails. Their orbits are inclined at every possible angle to Earth's orbit. They may approach from any direction.

Meteoroids are pieces of space debris—chunks of rock and iron. When they occasionally enter Earth's atmosphere, friction usually burns them up before they reach the Earth's surface. Those that collide with Earth are called meteorites. Meteorite strikes, although rare, can significantly affect the landscape, leaving craters and causing other devastation. In 1908 a huge area of forest in the remote Russian region of Siberia was flattened and burned by a mysterious fireball. Scientific **theory**—a plausible general principle offered to explain observed facts—speculates that it was a meteorite or comet. A writer describes the effects:

PRIMARY SOURCE

"The heat incinerated herds of reindeer and charred tens of thousands of evergreens across hundreds of square miles. For days, and for thousands of miles around, the sky remained bright with an eerie orange glow—as far away as western Europe people were able to read newspapers at night without a lamp."

-Richard Stone, "The Last Great Impact on Earth," Discover, September 1996

READING PROGRESS CHECK

Drawing Conclusions What prevents most asteroids, comets, and meteoroids from colliding with Earth?

Connecting Geography to SCIENCE

Astronomy

Like geographers, astronomers use maps to organize information. Geographers focus on mapping the Earth's surface, while astronomers map the sky. Astronomers have divided the sky into 88 sectors, or boxes, made up of patterns of stars. These sectors are a way to spatially organize the landscape of the sky, called the skyscape. Astronomy has also become part of everyday geography here on Earth. Many towns have been given astronomical names. Some of these towns are Neptune, Tennessee; Earth, Texas; Jupiter, Florida; Moon Township, Pennsylvania; and Orion, Alabama, named after the wellknown constellation.

COMPARING In what way is the job of the astronomer similar to that of a geographer?



Planet Earth is part of a solar system centered on the sun. Earth is one of at least eight planets orbiting the sun.

▲ CRITICAL THINKING

1. Classifying Which four planets are closest to the sun?

2. Drawing Conclusions Why might it be impossible for life to exist on Neptune? Think about where it is located.

.

theory a plausible general principle offered to explain observed facts

hydrosphere the water areas of the Earth, including oceans, lakes, rivers, and other bodies of water

lithosphere uppermost layer of the Earth that includes the crust, continents, and ocean basins

atmosphere a thin layer of gases that surrounds the Earth

biosphere the part of the Earth where life exists

Getting to Know Earth

GUIDING QUESTION How does the biosphere support life on Earth?

The Earth is a rounded object that is slightly wider around the center than from top to bottom. Earth has a larger diameter at the Equator—about 7,930 miles (12,760 km)—than from Pole to Pole, but the difference is less than 1 percent. With a circumference of about 24,900 miles (40,060 km), Earth is the largest of the inner planets in the solar system.

The surface of the Earth is made up of water and land. About 70 percent of our planet's surface is water. Oceans, lakes, rivers, underground water, and other bodies of water make up a part of the Earth called the **hydrosphere**.

About 30 percent of the Earth's surface is land, including continents and islands. Land makes up a part of the Earth called the **lithosphere**, the Earth's crust. The lithosphere also includes the ocean basins, or the land beneath the oceans.

The air we breathe is part of Earth's **atmosphere**, a thin layer of gases extending above the planet's surface. The atmosphere is composed of 78 percent nitrogen, 21 percent oxygen, and small amounts of argon and other gases.

All people, animals, and plants live on or close to the Earth's surface or in the atmosphere. The part of the Earth that supports life is the **biosphere**. Life outside the biosphere, such as on a space station orbiting Earth, exists only with the assistance of mechanical life-support systems.

Water, Land, and Air



The atmosphere, hydrosphere, and lithosphere form the biosphere, the part of Earth where life exists.

▲ CRITICAL THINKING

1. Classifying What are Earth's water systems called?

2. Drawing Conclusions How does human activity impact the biosphere?



Landforms are natural features at the surface of the Earth's lithosphere. Many of the Earth's landforms have a particular shape or elevation. Landforms often contain rivers, lakes, and streams.

Underwater landforms are as diverse as those found on dry land. In some places the ocean floor is a flat plain. Other parts feature mountain ranges, cliffs, valleys, and deep trenches. Seen from space, Earth's most visible landforms are the seven large landmasses called continents. Australia and Antarctica stand alone, while the others are joined in some way. Europe and Asia are parts of one landmass called Eurasia. A narrow strip of land called the Isthmus of Panama links North America and South America. At the Sinai Peninsula, the human-made Suez Canal separates Africa and Asia.

The **continental shelf** is an underwater extension of the coastal plain. Continental shelves slope out from land for as far as 800 miles (1,287 km). They descend gradually to a depth of about 660 feet (200 m), where a sharp drop marks the beginning of the continental slope. This area drops sharply to the ocean floor.

Great contrasts exist in the heights and depths of the Earth's surface. The highest point on Earth is in South Asia at the top of Mount Everest, which is 29,028 feet (8,848 m) above sea level. The lowest dry land point at 1,312 feet (400 m) below sea level is the shore of the Dead Sea in Southwest Asia. Earth's deepest known depression lies under the Pacific Ocean, southwest of Guam in the Mariana Trench, a narrow, underwater canyon about 36,198 feet (11,033 m) deep.

READING PROGRESS CHECK

Categorizing What organisms might live in the hydrosphere?

LESSON 1 REVIEW

Reviewing Vocabulary

1. *Explaining* Define *continental shelf* and explain where it is located.

Using Your Notes

2. *Describing* Use your graphic organizer to describe the three parts of the Earth's biosphere.

Mt. Everest has such low oxygen levels and atmospheric pressure that hikers must prepare their bodies well in advance to adjust to altitude changes in order to avoid illness or death.

▲ CRITICAL THINKING

- **1. Categorizing** In which part of the Earth's biosphere is Mt. Everest located?
- 2. Predicting Mt. Everest has such high altitudes that it is almost outside of which part of the biosphere?

continental shelf part of a

continent that extends out underneath the ocean

Answering the Guiding Questions

- 3. Identifying In what physical system does Earth exist?
- 4. Discussing How does the biosphere support life on Earth?

Writing Activity

5. *Marrative* Consider the ratio of water and land on Earth. How might life on Earth be different if the proportions were reversed?