LESSON 2

Our Planet, Earth

GET READY TO READ

START UP

Study the photograph of an area in Peru. What aspects of geography can you identify in this picture?

GUIDING QUESTIONS

- How does Earth's movement explain the days and seasons?
- What is Earth's internal structure?
- What forces shape Earth's surface?

TAKE NOTES

Literacy Skills: Interpret Visual Information

Use the graphic organizer in your Active Journal to take notes as you read the lesson.

PRACTICE VOCABULARY

Use the vocabulary activity in your Active Journal to practice the vocabulary words.

Vocabulary

equinox
solstice
weathering
erosion
deposition
plate tectonics
fault
magma

Academic Vocabulary

portion
sustain

Why do we have seasons? Why do some days have more light than others? How did the land where we live take the form that it did? These are all questions that can be answered by Earth's position and movements in space and by forces both inside and on the surface of Earth.

Earth in Space

Earth, the sun, the planets, and the stars in the sky are all part of our galaxy, or cluster of stars. We call our galaxy the Milky Way because its stars look like a trail of spilled milk across a night sky far from city lights. Our sun is one of its billions of stars.

Even though the sun is about 93 million miles (150 million km) away, it provides Earth with heat and light. To understand how far Earth is from the sun, consider that this distance is nearly 4,000 times the distance around Earth at the Equator.

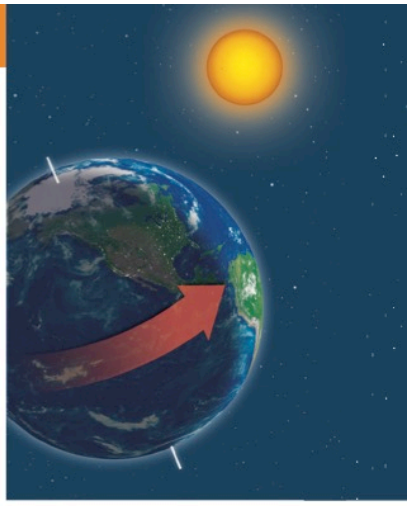
Rotation of Earth As Earth revolves around the sun, it is also rotating, or spinning, in space. Earth rotates around its axis.

Each complete turn, or rotation, takes about 24 hours. At any one time, it is night on the side of Earth facing away from the sun. As Earth rotates, that side of Earth turns to face the sun, and the sun appears to rise. The sun's light shines on that side of Earth. It is daytime. Then, as that side of Earth turns away from the sun, the sun appears to set. No sunlight reaches that side of Earth. It is nighttime.

Time Zones Because Earth rotates toward the east, the day starts earlier in the east than it does farther west. Over short distances, the time difference is small. For example, the sun rises about four minutes earlier in Beaumont, Texas, than it does in Houston, 70 miles to the west. But if every town had its own local time, people would have a hard time keeping track. So governments have agreed to divide the world into standard time zones, or areas sharing the same time. Times in neighboring zones are one hour apart.

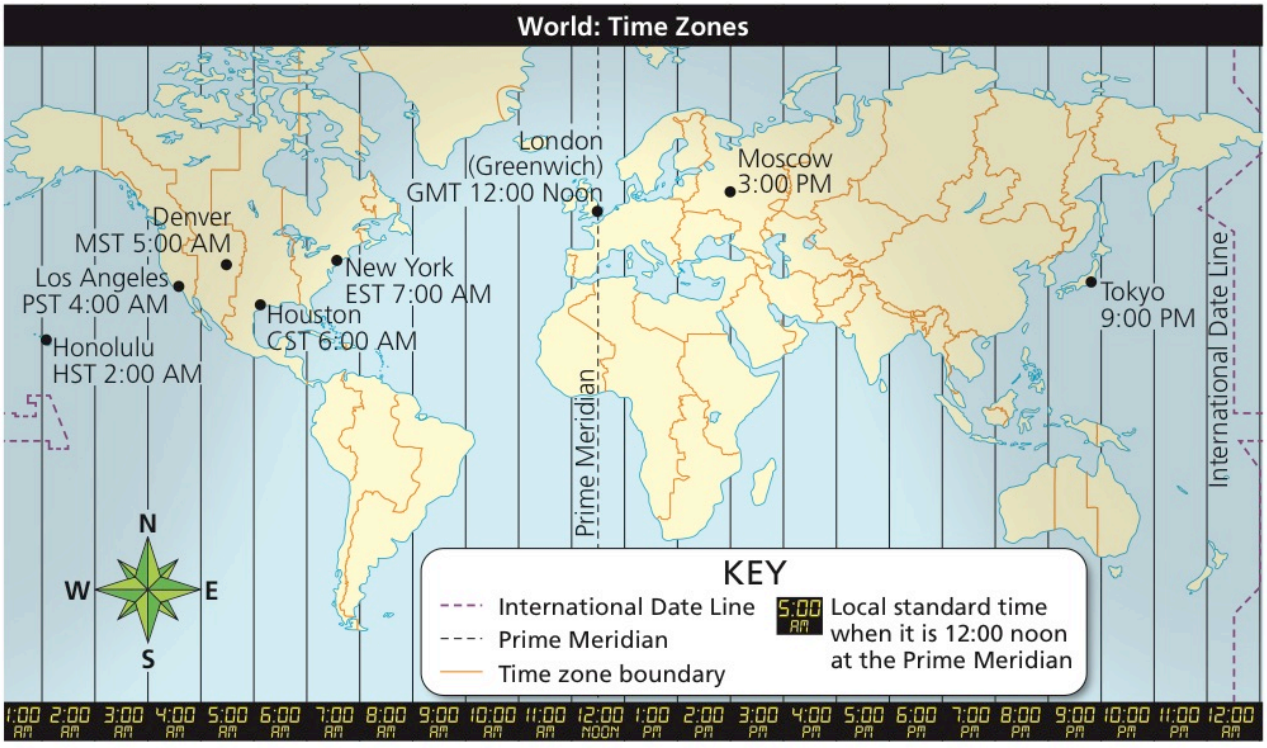
The Prime Meridian The Prime Meridian, in Greenwich, England, is at the center of one of these zones. The standard time in that zone is sometimes known as Greenwich Mean Time (GMT), or Universal Time (UT). Other time zones are sometimes described in terms of how many hours they are behind or ahead of UT. For example, Central Standard Time in the United States is UT–6, which means six hours behind UT.

READING CHECK **Identify Main Ideas** What causes daytime to turn to nighttime?



Analyze Images Earth rotates toward the east, causing the day-night cycle. **Draw Conclusions** Which part of the United States will see daylight first?

INTERACTIVE
How Does Earth Move?



Analyze Diagrams Earth is divided into time zones. Most neighboring zones are one hour apart. **Infer** If it is 8 P.M. in New York, what time is it in Los Angeles?

Why Are There Seasons?

Earth travels around the sun in an oval-shaped orbit. An orbit is the path one object makes as it revolves around another. Earth takes 365 1/4 days, or one year, to make one complete journey around the sun, called a revolution.

Earth's axis, an imaginary line between the North and South poles, is tilted relative to its orbit. Therefore, as Earth makes a revolution, direct sunlight moves north and south of the Equator as the year progresses. That is why seasons occur.

March Equinox

About March 21, the sun is directly overhead at noon on the Equator. At this point in Earth's orbit, its axis is tilted neither toward nor away from the sun. An **equinox** (EE kwih nahks) is a point at which, everywhere on Earth, days and nights are nearly equal in length. March brings the spring equinox in the Northern Hemisphere and the fall equinox in the Southern Hemisphere.

June Solstice

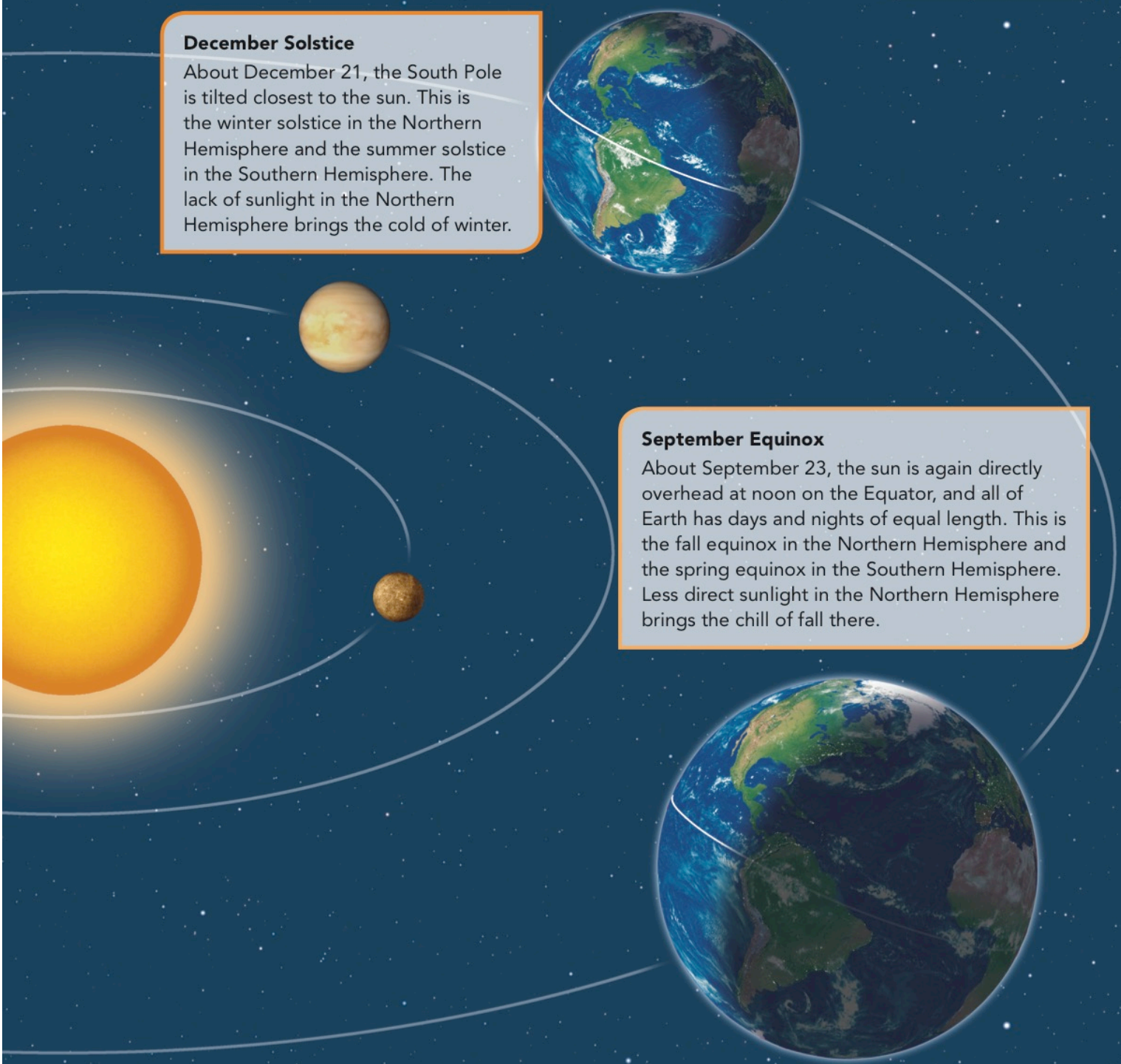
About June 21, the North Pole is tilted closest to the sun. This brings the heat of summer to the Northern Hemisphere. This is the summer solstice in the Northern Hemisphere and the winter solstice in the Southern Hemisphere. A **solstice** (SOHL stis) is a point at which days are longest in one hemisphere and shortest in the other.

Earth's orbit around the sun affects the length of daylight as well as the seasons. An **equinox** (EE kwih nahks) is a point at which, everywhere on Earth, days and nights are nearly equal in length. A **solstice** (SOHL stis) is a point at which days are longest in one hemisphere and shortest in the other. The winter solstice has the shortest length of daylight, and the summer solstice the longest.

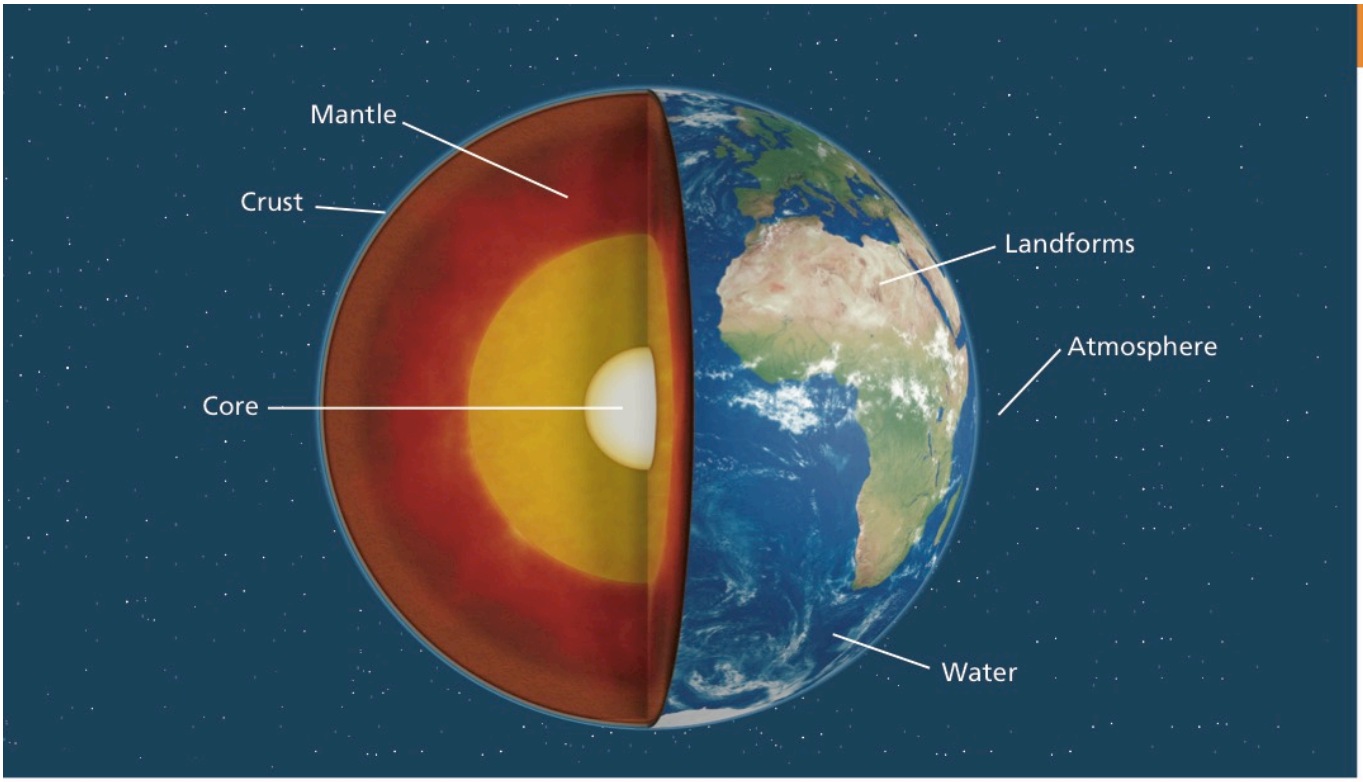
READING CHECK **Draw Conclusions** How can days be short and cold in one hemisphere when they are long and hot in another?

Analyze Diagrams
Seasons are caused by the tilt of Earth's axis as it revolves around the sun. **Synthesize Visual Information** Which hemisphere gets the most daylight at the December solstice?

December Solstice
About December 21, the South Pole is tilted closest to the sun. This is the winter solstice in the Northern Hemisphere and the summer solstice in the Southern Hemisphere. The lack of sunlight in the Northern Hemisphere brings the cold of winter.



September Equinox
About September 23, the sun is again directly overhead at noon on the Equator, and all of Earth has days and nights of equal length. This is the fall equinox in the Northern Hemisphere and the spring equinox in the Southern Hemisphere. Less direct sunlight in the Northern Hemisphere brings the chill of fall there.



Analyze Diagrams
Above Earth's surface is the atmosphere, a thick layer of gases or air that includes life-giving oxygen. Earth's atmosphere acts like a blanket, holding in heat from the sun, which makes life possible. **Draw Conclusions** On which part of the Earth's structure do people live?

Earth's Structure

Understanding Earth's inner and outer structure will help you to understand the forces that shape the world we live in. Earth's inner layers include the core and mantle. Its outer layers are the crust, including landforms, the water found at its surface, and the atmosphere.

Inside Earth A sphere of very hot metal at the center of Earth is called the **core**. Despite temperatures greater than 5,000°F (3,000°C), the inner core is solid because of the great pressure of the layers above it. The outer core is hot liquid metal.

The **mantle** is a thick, rocky layer around the core. The mantle is also hot, with temperatures greater than 3,300°F (1,800°C). The mantle is solid, but its temperature makes it fluid, or able to flow.

Land and Water The layer of rocks and minerals that surrounds the mantle is called the **crust**. The crust is thinnest beneath the ocean floor and thickest beneath high mountains.

The surface of the crust includes the land areas where people live as well as the ocean floor. Only about 29 percent of Earth's surface is land. There are many different landforms, or shapes and types of land. Water covers about 71 percent of Earth's surface. The oceans hold about 97 percent of Earth's water. This water is salty. Most fresh water, or water without salt, is frozen in ice sheets around the North and South Poles. Only a tiny **portion** of Earth's water is unfrozen fresh water. Fresh water comes from lakes, rivers, and ground water, which are fed by rain and snow.

Academic Vocabulary
portion • *n.*, part of a whole

READING CHECK **Identify Main Ideas** What two layers lie below Earth's surface, and what layer is found atop them?

What Forces on Earth's Surface Shape the Land?

Two kinds of processes shape the landforms on Earth's surface: processes on Earth's surface that wear Earth's crust down, and processes beneath its surface that push the crust up. Forces on Earth's surface wear down and reshape the land.

Academic Vocabulary

sustain • *v.*, to provide something necessary; to maintain

Weathering **Weathering** is a process that breaks rocks down into tiny pieces. There are two kinds of weathering: chemical weathering and mechanical weathering. In chemical weathering, rainwater or acids carried by rainwater dissolve rocks. In mechanical weathering, moving water, ice, or sometimes wind breaks rocks into little pieces. Mechanical weathering can happen after chemical weathering has weakened rocks.

Weathering helps create soil. Tiny pieces of rock combine with decayed animal and plant material to form soil. Soil and pieces of rock may undergo **erosion,** a process in which water, ice, or wind remove small pieces of rock and move them somewhere else.

Soil is required to **sustain** plant and animal life and for agriculture. Because of this, weathering is very important to human settlement patterns. As you read earlier, people tend to settle in areas that have fertile soil and ample water. This makes it easier to grow the crops needed to feed a community.

Weathering can be a constructive force that helps form soil. Erosion can be a destructive force that carries fertile topsoil away and leaves land unsuitable for farming. In the 1930s, a combination of drought, unwise farming practices, and strong winds led to the Dust Bowl in the central United States. For nearly a decade, dust storms stripped the land of soil. Many farmers were forced to abandon their land and move west to find jobs.

Shaping Landforms Weathering and erosion have shaped many of Earth's landforms. These landforms include mountains and hills. Mountains are wide at the bottom and rise steeply to a narrow peak or ridge. Hills are lower than mountains and often have rounded tops. While forces within Earth create mountains, forces on Earth's surface wear them down.

The parts of mountains and hills that are left standing are the rocks that are hardest to wear away. Millions of years ago, the Appalachian Mountains in the eastern United States were as high as the Rocky Mountains of the western United States. Rain, snow, and wind wore the Appalachians down into much lower peaks.

Rebuilding Earth's Surface When water, ice, and wind remove material, they deposit it farther downstream or downwind to create new landforms. **Deposition** is the process of depositing, or dropping, eroded material. Plains, or large areas of flat or gently rolling land, are often formed by the deposition of material carried downstream by rivers. Deltas are flat, fan-shaped plains built in the seabed where a river fans out and deposits material over many years.

Analyze Images

The power of the wind to shape landforms is clear in these structures from Arches National Park in Utah. **Classify and Categorize** What process shaped these rocks?

INTERACTIVE

Sea Floor Spreading

A plateau is a large, mostly flat area that rises above the surrounding land. Plateaus often have at least one side that is a steep slope. At the top of this slope is usually a layer of rock that is hard to wear down. Valleys are stretches of low land between mountains or hills. Rivers often form valleys where there are rocks that are easy to wear away.

READING CHECK **Compare and Contrast** How is erosion different from weathering?

What Forces Inside Earth Shape the Land?

Forces deep inside Earth are constantly reshaping its surface. **Plate tectonics** is a process involving huge blocks of Earth's crust and upper mantle that are called tectonic plates. Tectonic plates include continents or parts of continents, along with parts of the ocean floor.

Earth's tectonic plates lie upon a layer of hot mantle rock, which flows like melted plastic. Plates may move atop the mantle an inch or two (a few centimeters) a year.

Over time, the movement of tectonic plates creates mountains. When two plates of crust push against each other, the pressure makes the crust bend to form steep mountains.

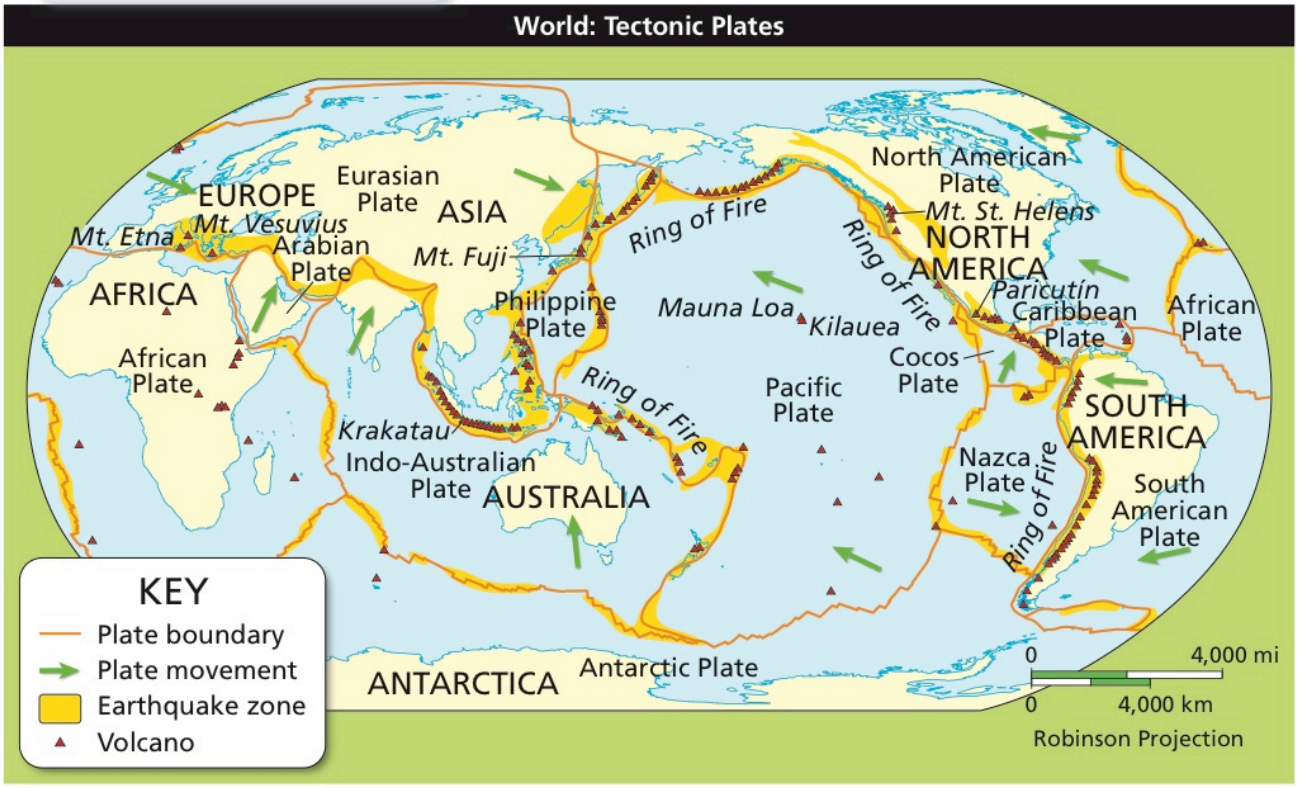
Earthquakes When plates slide against each other, earthquakes occur. They often occur at seams in Earth's crust called **faults,** often near the boundaries between plates. Earthquakes cause the ground to shake. Some earthquakes are too small

GEOGRAPHY SKILLS

The map shows Earth's major tectonic plates and the directions in which they are moving. Earthquakes and volcanoes occur along plate edges.

1. **Movement** In what direction is the Pacific Plate moving in relation to the Eurasian Plate?
2. **Infer** Why is the Ring of Fire sometimes called the Pacific Ring of Fire?

World: Tectonic Plates



for people to feel. But others can destroy buildings and cause great harm. For example, the 1906 San Francisco earthquake killed more than 3,000 people.

Volcanoes When plate movement forces oceanic crust beneath continental crust, steam and heat are released, melting the rocks above. This causes the rock to melt and rise, forming volcanoes. The Pacific Ring of Fire describes the chain of volcanoes forming a semicircle around the eastern, northern, and western edges of the Pacific Ocean. Here, oceanic plates are forced beneath continental plates. This movement creates dynamic belts of earthquakes and volcanoes.

Volcanoes spew **magma,** or molten rock, from inside Earth to the surface. When magma erupts out of a volcano and flows onto Earth's surface, it is called lava. Volcanic eruptions can be very dangerous for people, but volcanoes also serve an important purpose. When lava cools, new land forms. Undersea volcanoes can even grow into islands after thousands of years of eruptions.

Natural Hazards Volcanoes and earthquakes are examples of natural hazards, or dangers. Other natural hazards include hurricanes, tornadoes, landslides, and floods.

These events threaten lives and property. But people can take steps to prepare for natural disasters, so that damage will not be as severe when a disaster strikes. For example, architects can design buildings that will not collapse when the ground shakes. Local governments can set routes for people to leave affected areas during a hurricane. Citizens can practice what to do during an earthquake and keep emergency supplies at home.

READING CHECK **Identify Supporting Details** What are some ways people prepare for natural hazards?

Analyze Images
Volcanoes pour out hot lava, ash, rocks, and poisonous gases, making them dangerous. **Identify Cause and Effect** What causes volcanoes to erupt?

Lesson Check

Practice Vocabulary

1. What is the difference between an **equinox** and a **solstice**?
2. How are **faults** related to **plate tectonics**?

Critical Thinking and Writing

3. **Draw Conclusions** How might our lives change if Earth's atmosphere were damaged? Explain.
4. **Draw Conclusions** To choose a safe location for a new town, what questions about processes inside Earth and on its surface would you ask? Explain.
5. **Classify and Categorize** Consider three different landforms. For each, list the main processes that form it. Are the processes inside Earth or on its surface? How are the different processes related?
6. **Writing Workshop: Gather Evidence** In your Active Journal, describe an experience you have had with the seasons, extreme weather, or a natural disaster like an earthquake or flood.

Identify Cause and Effect

Follow these steps and use the source to identify cause and effect.

INTERACTIVE

Analyze Cause and Effect

1 Identify the key event. Choose one event or condition that you want to explain. Once you have chosen an event, you can look for possible causes and effects of that event. If you're reading a piece of text, you might identify the most important event.

- **a.** What is the most important event?
- **b.** What happened in this event?

2 Study earlier events or conditions as possible causes of the key event. A cause of the key event must happen before the key event. Look for earlier events or conditions by asking, "Why did the key event happen?" or "What led to the key event?"

- **a.** What condition precedes the key event?
- **b.** How is that condition related to the key event?

3 Study later events or conditions as possible effects of the event. Events often have their own effects. They may include short-term effects or longer lasting ones. To find later events, ask "What did the key event lead to?" or "What was a result of the key event?"

- **a.** What happened next after the event?
- **b.** What happened after that?
- **c.** What happens at the December solstice?
- **d.** How is the movement of Earth around the sun connected to that?

Secondary Source

The Cycle of the Seasons

Earth is tilted on its axis. As a result, the amount of heat from the sun that reaches the Northern and Southern Hemispheres changes during the year. At the March equinox, the sun is directly over the Equator and heats both hemispheres equally. This is the beginning of spring in the Northern Hemisphere and of autumn in the Southern.

As Earth moves around the sun, its tilt angles the Northern Hemisphere toward the sun. At the June solstice, the Northern Hemisphere receives more heat than the Southern Hemisphere. It is summer north of the Equator and winter south of it.

Earth continues to revolve around the sun. At the September equinox, the sun is over the Equator again, and the two hemispheres receive equal amounts of heat again. This signals the beginning of autumn north of the Equator and of spring to the south.

Over the next months, the Southern Hemisphere is tilted more and more toward the sun and the Northern Hemisphere more and more away from it. Because of this, southern areas receive more heat and at the December solstice, summer begins there. The Northern Hemisphere receives less heat. Winter begins.