

Reading for Understanding

▶ Key Ideas

BEFORE YOU READ

Think about what you already know about the Earth's physical geography.

NOW YOU WILL LEARN

Geographers have specialized ways to view and interpret information about the world.

▶ Vocabulary

TERMS & NAMES

geography the study of people, places, and environments

environment the physical surroundings of a location

spatial where a place is located and its physical relationship to other places, people, or environments

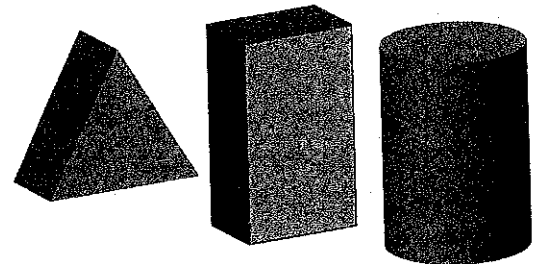
location an exact position using latitude and longitude, or a description of a place in relation to places around it

place a geographical term that describes the physical and human characteristics of a location

region an area that has one or more common characteristics that unite or connect it with other areas

BACKGROUND VOCABULARY

three-dimensional an image in which there is a sense of depth and perspective



Visual Vocabulary Three-dimensional shapes

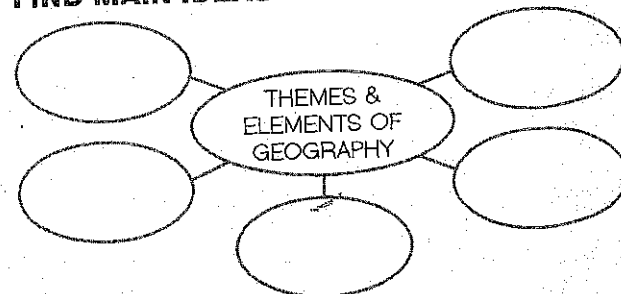
▶ Reading Strategy

Re-create the web diagram shown at right. As you read and respond to the **KEY QUESTIONS**, use the diagram to help you find main ideas about the themes and elements of geography.



Skillbuilder Handbook, page R4

FIND MAIN IDEAS



GRAPHIC ORGANIZERS

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Themes and Elements of Geography



1.02 Generate, interpret, and manipulate information from tools such as maps, globes, charts, graphs, databases, and models to pose and answer questions about space and place, environment and society, and spatial dynamics and connections.

3.04 Describe how physical processes such as erosion, earthquakes, and volcanoes have resulted in physical patterns on the earth's surface and analyze their effects on human activities.

Connecting to Your World

Have you ever drawn a map to show someone how to get to your house? Or have you described your hometown to someone who doesn't live there? If you answered yes to these questions, you were doing what geographers do. Geographers try to answer the questions, "Where are things located?" and "Why are they there?" Basic questions like these form the framework for the subject called geography. **Geography** is the study of people, places, and environments. An **environment** is the physical surroundings of a location.

Ways of Thinking About Geography

KEY QUESTION What are the themes and elements of geography?

Geographers study the world in **spatial** terms. This means they look at the space where a place is located and its physical relationship to other places, people, and environments. Geographers—and students of geography—use two different methods to organize geographic information: the five themes and the six essential elements of geography. The categories vary slightly, but the graphic on the next two pages will help you learn how to apply these ideas as you read this text.

Three-Dimensional Model This computer-generated model is used to study geographic conditions in the Los Angeles region.

The Five Themes of Geography

The world is a big place and studying it is a complicated task. You can make that job easier by learning five core themes of geography. These themes can help you answer geographic questions.

1 LOCATION

Where are things located?

Location means either an exact position using latitude or longitude, or a description of a place in relation to places around it.



Rio de Janeiro, Brazil

2 PLACE

What is a particular location like?

Place describes physical characteristics such as mountains or rivers, as well as human characteristics such as the people who live there.



Beijing, China

3 REGION

How are places similar or different?

Regions have physical or human characteristics that unite them and make them different from or similar to other regions.

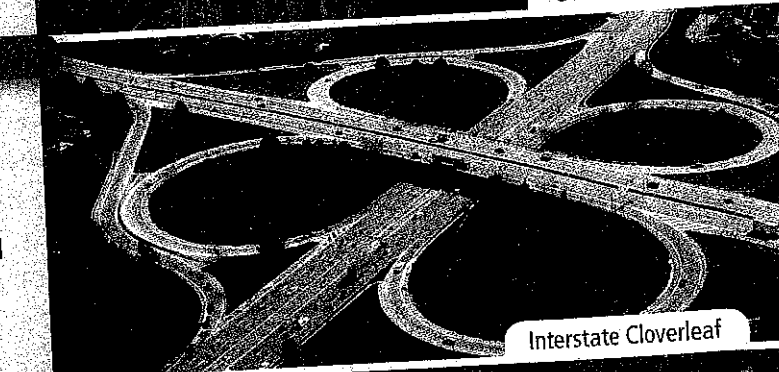


Gobi Desert

4 MOVEMENT

How do people, goods, and ideas move from one location to another?

Movement of people, goods, and ideas changes places and regions and the people who live there.



Interstate Cloverleaf

5 HUMAN-ENVIRONMENT INTERACTION

How do people relate to the physical world?

Humans adapt to their environment and change elements of it.



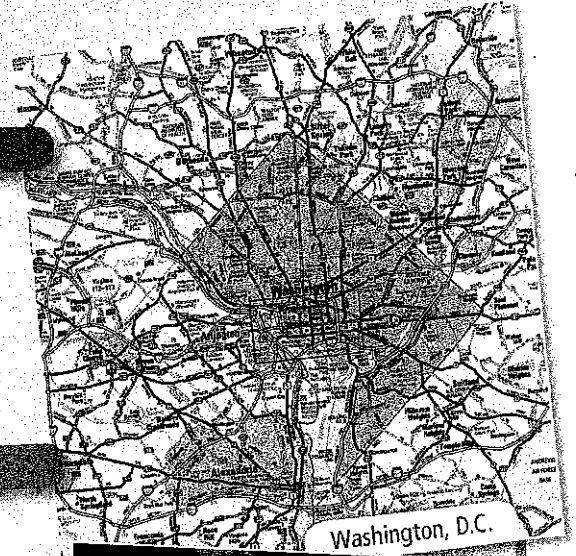
Pacific Ocean Windsurfing

Six Essential Elements

Geographers use six key ideas or elements to help them understand people, places, and environments on the Earth.

1 THE WORLD IN SPATIAL TERMS

Geographers study the locations of places and distributions or patterns of features by using maps, data, and other geographic tools. Knowing about the world in spatial terms helps geographers understand physical and human patterns.



Washington, D.C.

2 PLACES AND REGIONS

Geographers look for characteristics of places and then compare their similarities and differences.

Mount Everest



Volcano Specialist

3 PHYSICAL SYSTEMS

Geographers study changes in the Earth's surface. Where and why people choose to live in certain locations may depend on Earth's surface conditions.

4 HUMAN SYSTEMS

Geographers study human settlement patterns and use of resources. This information helps explain human interactions and lifestyles.



South Asian Teapickers

5 ENVIRONMENT AND SOCIETY

Geographers study how people interact with the environment and how they use resources.

6 THE USES OF GEOGRAPHY

Geographers study patterns and processes in the world. This information helps people understand the past and plan for the future.



Surveyor

Five Themes of Geography Now that you have seen the geographic themes and elements side by side, let's look more closely at an example of one of the themes and elements as it applies to a particular place.

The theme of human-environment interaction is a good place to get an idea of how a geographer thinks. For thousands of years, people have found it valuable to settle by rivers. A river can provide food, water, transportation, and other needs of daily life. However, rivers can flood, destroying homes and villages, and taking human life. So, humans began to alter their environment by building walls called levees to protect the land from floods. Sometimes they created dams to control the flow of water and to save some water for times when they needed it. A geographer who asks the questions "Where do people choose to live?" and "Why here?" will answer that the river provides many needs for a group of people. So, people will likely be found in areas that have rivers as a resource. As it turns out, we know that early civilizations such as those in Egypt, Southwest Asia, India, and China began in river valleys.

Six Essential Elements Using the six elements helps geographers make sense both of physical processes on the Earth and of human systems devised by the people who live there.

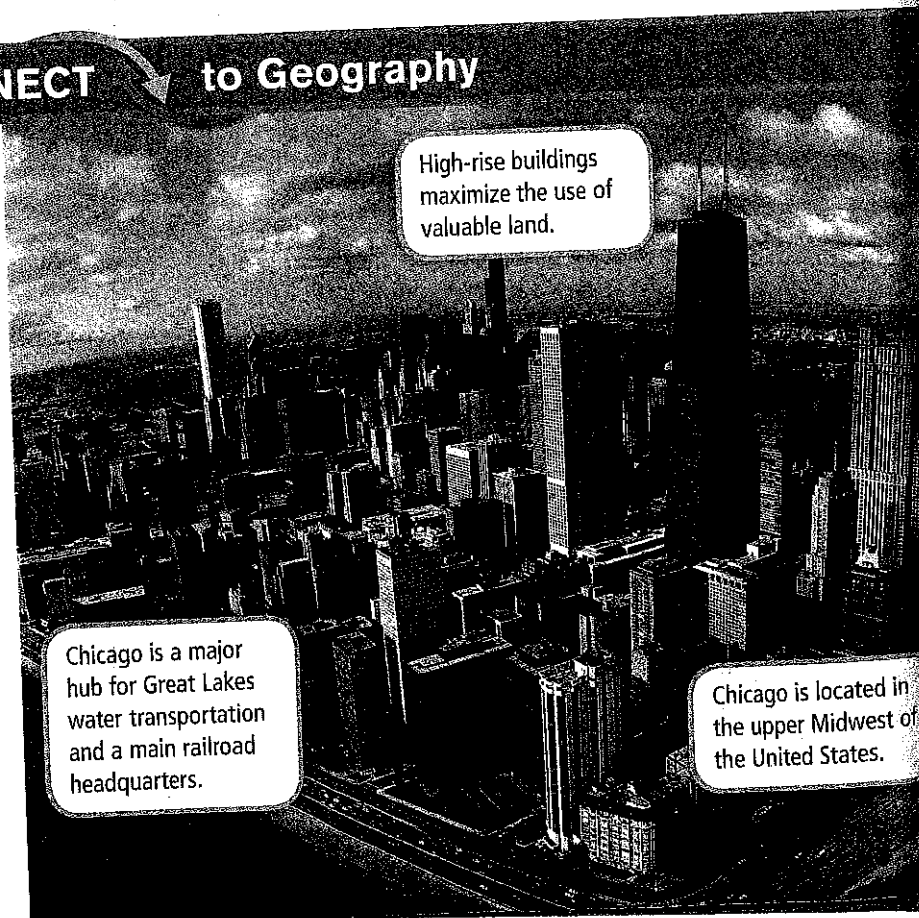
Let's look at the element of physical systems. Geographers want to know how these systems work to reshape the Earth's surface and what impact these changes have on plants, animals, and people. Volcanoes

CONNECT to Geography

Chicago The skyline of Chicago towers over the shore of Lake Michigan. One of the largest cities in the United States, Chicago has long been the economic and cultural center of the region.

CRITICAL THINKING

Find Main Ideas Look at the image of Chicago at right. Which of the five themes and six elements of geography do the captions reflect?




High-rise buildings maximize the use of valuable land.


Chicago is a major hub for Great Lakes water transportation and a main railroad headquarters.

Chicago is located in the upper Midwest of the United States.

are an example of a physical force that changes the shape of the Earth's surface and may have a dramatic effect on human populations. A volcanic eruption may kill people, plants, and animals living in the area. Flows of lava may change the landscape, burn forests or crops, and possibly alter the course of rivers. Islands in the Pacific Ocean have been created by volcanic eruptions, and still others have disappeared between the waves when they were blown apart by eruptions. Volcanoes can also trigger earthquakes. Geographers studying physical systems point out that many volcanoes take place in certain areas of the world. Studying this pattern of volcanic action helps explain where and why people live in certain locations.

Using the five themes of geography and the six essential elements will help you to think like a geographer. The themes and elements will help you to think about particular places and the physical processes and human activities that shaped those places in the past—and continue to do so. They will also enable you to look for patterns and connections in geographic information. You will be better able to answer the two main geographic questions, "Where are things located?" and "Why are they there?" You will learn about the tools used to record and analyze geographic information in the next section.

 **FIND MAIN IDEAS** Identify the five themes and six essential elements of geography.

 **ONLINE QUIZ**
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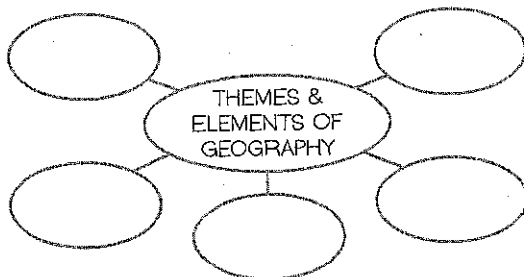
Section 1 Assessment

TERMS & NAMES

- 1. Explain the importance of**
- geography
 - environment
 - spatial

USE YOUR READING NOTES

- 2. Find Main Ideas** Use your completed web diagram to answer the following question:
What are the five themes of geography?



KEY IDEAS

- 3.** What two questions do geographers try to answer?
4. How do geographers use the five themes?
5. What are the six elements that geographers use to look at the world?

CRITICAL THINKING

- 6. Summarize** What does it mean to study the world in spatial terms?
7. Compare and Contrast How do you think the study of geography differs from that of history?
8. CONNECT to Today How does studying geography help you understand the world in which you live?
9. ART Make a Poster Create a poster that lists the five themes and six elements of geography. For each theme or element, include the definition and a photograph or drawing to illustrate it.

SECTION
2

Reading for Understanding

► Key Ideas

BEFORE, YOU LEARNED

Geography is the study of Earth's physical features and the interaction of people with the environment and with each other.

NOW YOU WILL LEARN

Geographers use technological tools to help them understand both Earth's physical processes and the activities of people on Earth.

► Vocabulary

TERMS & NAMES

globe a model of the earth in the shape of a sphere

map a representation of a part of the Earth

cartographer (kahr•TAHG•ruh•fur) a geographer who creates maps

surveyor a person who measures the land

remote sensing obtaining information about a site by using an instrument that is not physically in contact with the site

Landsat a series of information-gathering satellites that orbit above Earth

Global Positioning System (GPS)

a system that uses a network of earth-orbiting satellites to pinpoint location

Geographic Information Systems (GIS)

a computer or Internet-based mapping technology

BACKGROUND VOCABULARY

database a collection of information that can be analyzed

debris (duh•BREE) the scattered remains of something broken or destroyed

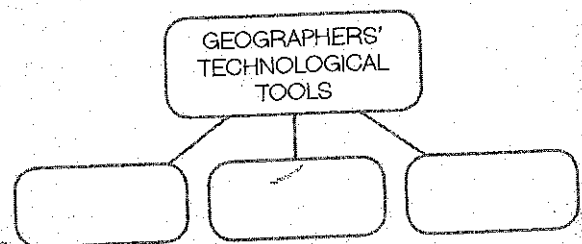
► Reading Strategy

Re-create the web diagram shown at right. As you read and respond to the **KEY QUESTIONS**, use the diagram to summarize ideas about geographers' technological tools.



Skillbuilder Handbook, page R5

SUMMARIZE



GRAPHIC ORGANIZERS

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Technology Tools for Geographers



- 1.02** Generate, interpret, and manipulate information from tools such as maps, globes, charts, graphs, databases, and models to pose and answer questions about space and place, environment and society, and spatial dynamics and connections.
- 3.03** Examine the development and use of tools and technologies and assess their influence on the human ability to use, modify, or adapt to their environment.

Connecting to Your World

When you were a much younger student, you probably used paper and pencil to do your schoolwork. Now, when you have an assignment to complete, you most likely use a computer and the Internet. Today's geographers and other scientists use high-tech instruments and advanced computer software to create maps and databases. A **database** is a collection of information that can be analyzed. Geographers use these tools and their analysis to answer geographic questions.



Gerardus Mercator
A Flemish cartographer, Mercator developed a type of map still used today.

The Science of Mapmaking

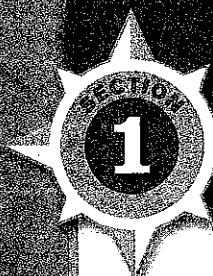
KEY QUESTION How has technology changed mapmaking?

In their work, geographers use photographs, graphs, globes, and maps. A **globe** is a model of the Earth in the shape of a sphere. It shows the actual shape of the Earth. But you can only see half at any one time, and it is not easy to carry around. So, geographers use maps. A **map** is a representation of a part of the Earth. Maps can help geographers see patterns in the way human or physical processes occur. **Cartographers** (kahr•TAGH•ruh•furs) are geographers who create maps.

Animated GEOGRAPHY

Landsat Satellite
This satellite provides visible and infrared views of the Earth.

 [Click here](#) to see how satellites gather data @ClassZone.com



Reading for Understanding

▶ Key Ideas

BEFORE, YOU LEARNED

Geographers use technology to learn about physical processes on Earth.

NOW YOU WILL LEARN

The Earth is composed of many layers. Its surface continually changes because of the drifting of its plates.

▶ Vocabulary

TERMS & NAMES

- magma** molten rock
- continent** one of seven large landmasses on the Earth's surface
- tectonic plate** a large rigid section of the Earth's crust that is in constant motion
- earthquake** a sudden movement of the Earth's crust followed by a series of shocks
- Ring of Fire** a zone of volcanoes around the Pacific Ocean
- volcano** an opening in the Earth's crust from which molten rock, ash, and hot gases flow or are thrown out
- weathering** the gradual physical and chemical breakdown of rocks on the Earth's surface

- erosion** the wearing away and movement of weathered materials by water, wind, or ice
- sediment** pieces of rock in the form of sand, stone, or silt deposited by wind, water, or ice
- glacier** a large, slow-moving mass of ice



Visual Vocabulary glacier

▶ Reading Strategy

Re-create the chart shown at right. As you read and respond to the **KEY QUESTIONS**, use the chart to organize important details about the external and internal forces shaping the Earth.

 Skillbuilder Handbook, page R7

CATEGORIZE

INTERNAL FORCES	EXTERNAL FORCES
1.	1.
2.	2.
3.	3.
4.	4.

 **GRAPHIC ORGANIZERS**
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The Earth and Its Forces



1.02 Generate, interpret, and manipulate information from tools such as maps, globes, charts, graphs, databases, and models to pose and answer questions about space and place, environment and society, and spatial dynamics and connections.

3.04 Describe how physical processes such as erosion, earthquakes, and volcanoes have resulted in physical patterns on the earth's surface and analyze their effects on human activities.

Connecting to Your World

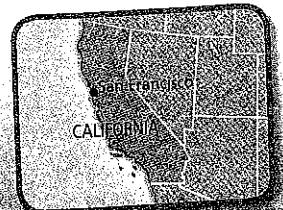
Have you ever experienced an earthquake or the eruption of a volcano? Probably not. But you may have seen these events on television. Perhaps you saw the coverage of the great earthquake in Indonesia on December 26, 2004. Hundreds of thousands of people were killed or displaced by this earthquake and the tsunami, or great wave, it caused. Earthquakes and volcanoes are just two of the many forces that change the Earth's surface.

Internal Forces Shaping the Earth

KEY QUESTION How is the Earth's surface shaped by internal forces?

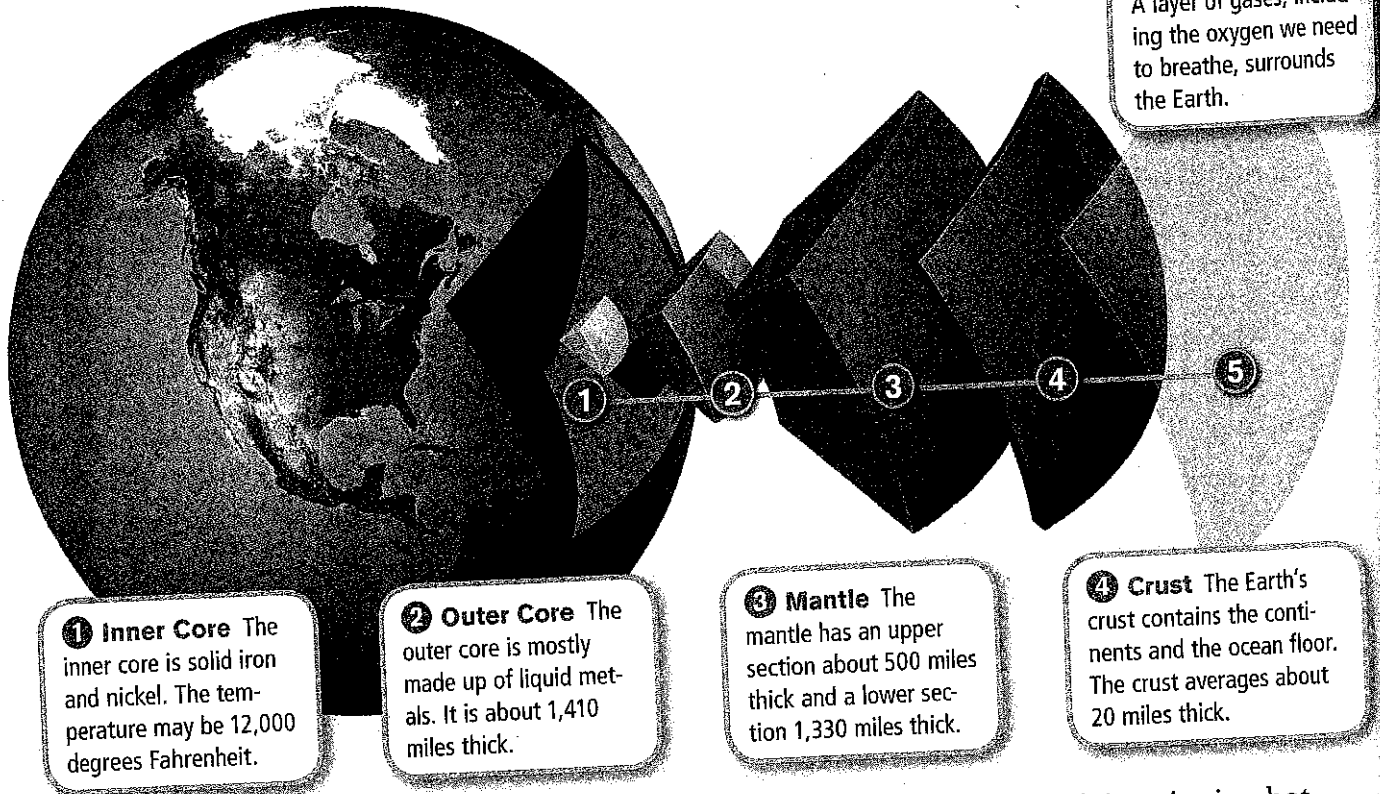
The Earth is one of eight planets that orbit the sun. It is located about 93 million miles from the sun. The Earth's circumference, or distance around, is 24,900 miles. Its diameter, or distance through the center of Earth, is about 7,900 miles. Earth is unique in the solar system—the sun and its planets—because it supports life. This is because the Earth has lots of breathable air and usable water. In fact, the Earth's surface is about three-fourths water and one-fourth land. The Earth appears to be a solid ball, but it is actually made of different layers that are like shells set inside each other.

San Francisco Earthquake The earthquake in 1989 was the worst quake since 1906.



Earth's Layers

It is about 3,900 miles to the center of the Earth.
The Earth has five different layers.



1 Inner Core The inner core is solid iron and nickel. The temperature may be 12,000 degrees Fahrenheit.

2 Outer Core The outer core is mostly made up of liquid metals. It is about 1,410 miles thick.

3 Mantle The mantle has an upper section about 500 miles thick and a lower section 1,330 miles thick.

4 Crust The Earth's crust contains the continents and the ocean floor. The crust averages about 20 miles thick.

5 Atmosphere A layer of gases, including the oxygen we need to breathe, surrounds the Earth.

Earth's Molten Interior The center of the Earth's interior is a hot metal core made up of one layer of iron and one of nickel. The inner core is solid. The outer core is liquid, because the metal has melted. Lying just above the core is the mantle. The mantle is a soft layer of hot rock, some of which is molten, or melted. It is the largest of the Earth's layers. The molten rock of the mantle is called **magma**.

The crust is the Earth's thin outer layer, or shell. It is the solid, rocky surface of the Earth that forms the ocean floors and the large landmasses called **continents**. The crust is the part of the Earth on which we live. It floats on top of the mantle. The crust is only about five miles thick under the oceans but averages about 22 miles thick under the continents. The Earth's layers are illustrated above.

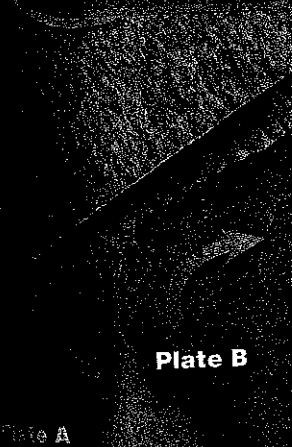
Geographers have identified seven continents on the Earth's surface. The continents, in order of their size, are Asia, Africa, North America, South America, Antarctica, Europe, and Australia. Europe and Asia are actually one great landmass that is sometimes referred to as Eurasia or the Eurasian continent. Antarctica is a continent because it has a landmass beneath its icy surface. The Arctic does not, and so it is not a continent.

Tectonic Plates The surface of the Earth is constantly moving and changing, even as you read this sentence. Geographers use technological tools to observe and measure forces deep inside the Earth and on the surface that reshape the Earth's crust.

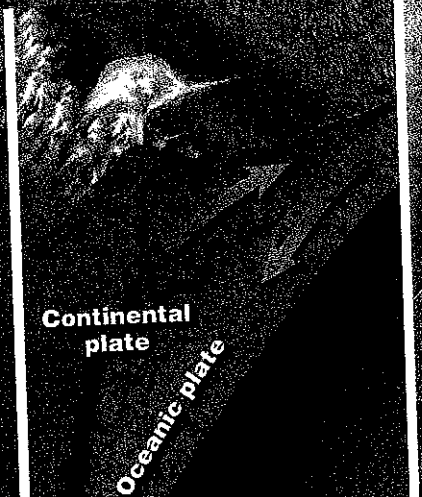
Plate movement, earthquakes, and the activity of volcanoes are all internal forces that change the landscape. The Earth's crust is divided into a number of large rigid pieces called **tectonic plates**. These plates are shown on the map at the beginning of the chapter. The continents and oceans are located on these plates, which float on the magma of the Earth's mantle. Heated magma cools as it reaches the crust and then sinks downward. This process causes the magma to act like a conveyor belt under the plates. The plates move slowly against each other, at a rate of up to four inches a year. The plate movement can cause earthquakes and volcanic eruptions. There are four types of tectonic plate movements that are shown in the diagrams below. Each of the movements causes changes in the shape of Earth's crust.

COMPARING

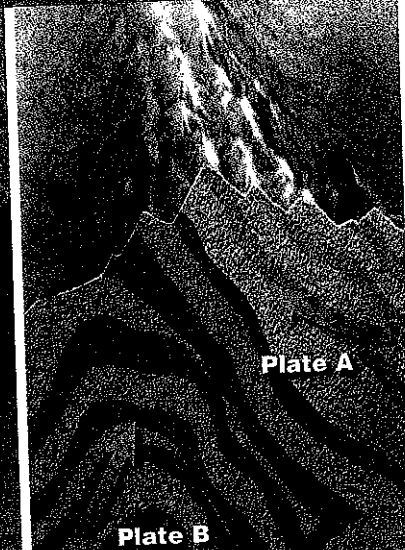
Tectonic Plate Movements



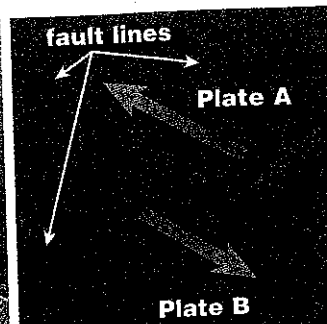
Spreading (Divergent) Magma pushes the plates apart. As rock cools, it sinks below the ocean surface.



Diving (Subduction) Continental plate (lighter) forces oceanic (denser) plate under it. Volcanoes may result from this movement.



Colliding (Convergent) Continental plates bend and fold at their edges. Mountains can be formed as a result.



Sliding (Transform) Plates slide past each other, causing a fracture in the crust. The fracture is called a fault. Some earthquakes are caused by sliding plates.



Reading for Understanding

▶ Key Ideas

BEFORE, YOU LEARNED

Internal and external forces shape the surface of the Earth.

NOW YOU WILL LEARN

Interaction between landforms and bodies of water makes life on Earth possible.

▶ Vocabulary

TERMS & NAMES

drainage basin the area drained by a major river

ground water water found beneath the Earth's surface

hydrologic cycle the circulation of water between the Earth, the oceans, and the atmosphere

landform a feature on the Earth's surface formed by physical force

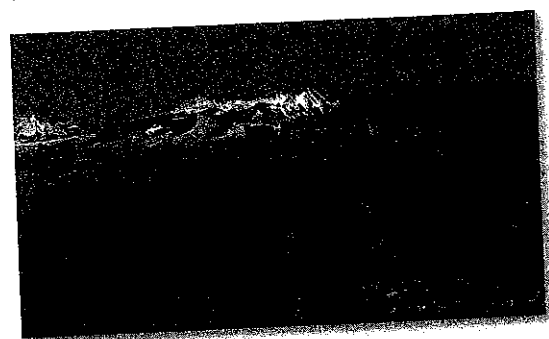
plateau a broad, flat area of land higher than the surrounding land

relief the difference in the elevation of a landform from its lowest point to its highest point

continental shelf the submerged land at the edge of a continent

BACKGROUND VOCABULARY

atmosphere the layer of gases that surround the Earth



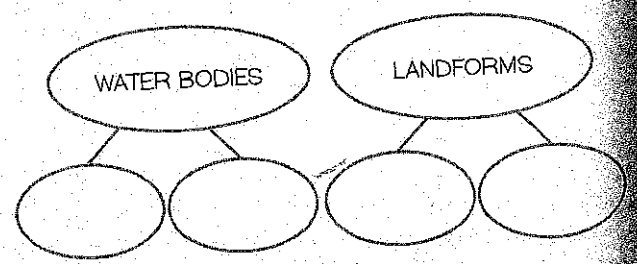
Visual Vocabulary landform

▶ Reading Strategy

Re-create the web diagram shown at right. As you read and respond to the **KEY QUESTIONS**, use the diagram to organize important details about the Earth's landforms and bodies of water.

See Skillbuilder Handbook, page R4

FIND MAIN IDEAS



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Bodies of Water and Landforms



- 2.01** Identify key physical characteristics such as landforms, water forms, and climate, and evaluate their influence on the development of cultures in selected African, Asian and Australian regions.
- 3.04** Describe how physical processes such as erosion, earthquakes, and volcanoes have resulted in physical patterns on the earth's surface and analyze their effects on human activities.

Connecting to Your World

How important is water to your life and to life on Earth? Without enough usable water, there would be no life. The Earth is able to support plant and animal life because of its abundance of water. It appears to be the only planet in our solar system able to do so. The Earth is sometimes called the "blue planet" because bodies of water cover so much of its surface.



The Earth from Space

Bodies of Water

KEY QUESTION What are the two types of water found on Earth?

Almost three-fourths of the surface of the Earth is covered by water. Most of the water—more than 97 percent of it—is salt water. This is the water in the oceans and seas. Only about 2.5 percent of the Earth's water is fresh water—that is, water containing little or no salt.

Fresh Water Most fresh water is locked in frozen form in ice caps or glaciers. Much of the rest is found in rivers, streams, and lakes.

Iguacu Falls This series of 275 falls is located between Brazil and Argentina.



The Great Salt Lake This huge lake in northern Utah covers about 1,700 square miles. It is a remnant, or remainder, of a huge ancient fresh water lake called Lake Bonneville. That lake existed around 14,000 years ago and was about ten times as large as the Great Salt Lake. As the climate became drier and warmer over the centuries, Lake Bonneville's waters began to evaporate. But the salt it contained did not. That's why the Great Salt Lake is one of the saltiest bodies of water in the world.

CRITICAL THINKING

Summarize How did freshwater Lake Bonneville become the Great Salt Lake?



Russia's Lake Baikal, for example, is the world's largest lake and contains 20 percent of all Earth's fresh water. Rivers and streams move water downhill to or from larger bodies of water. Smaller streams and rivers that flow into a major river are called tributaries. The region drained by a river and its tributaries is called a **drainage basin**. The Amazon River system in South America is the world's largest drainage basin.

Some fresh water, called **ground water**, is found beneath the Earth's surface. This water is held in the pores and cracks of rocks and can be pumped from the ground.

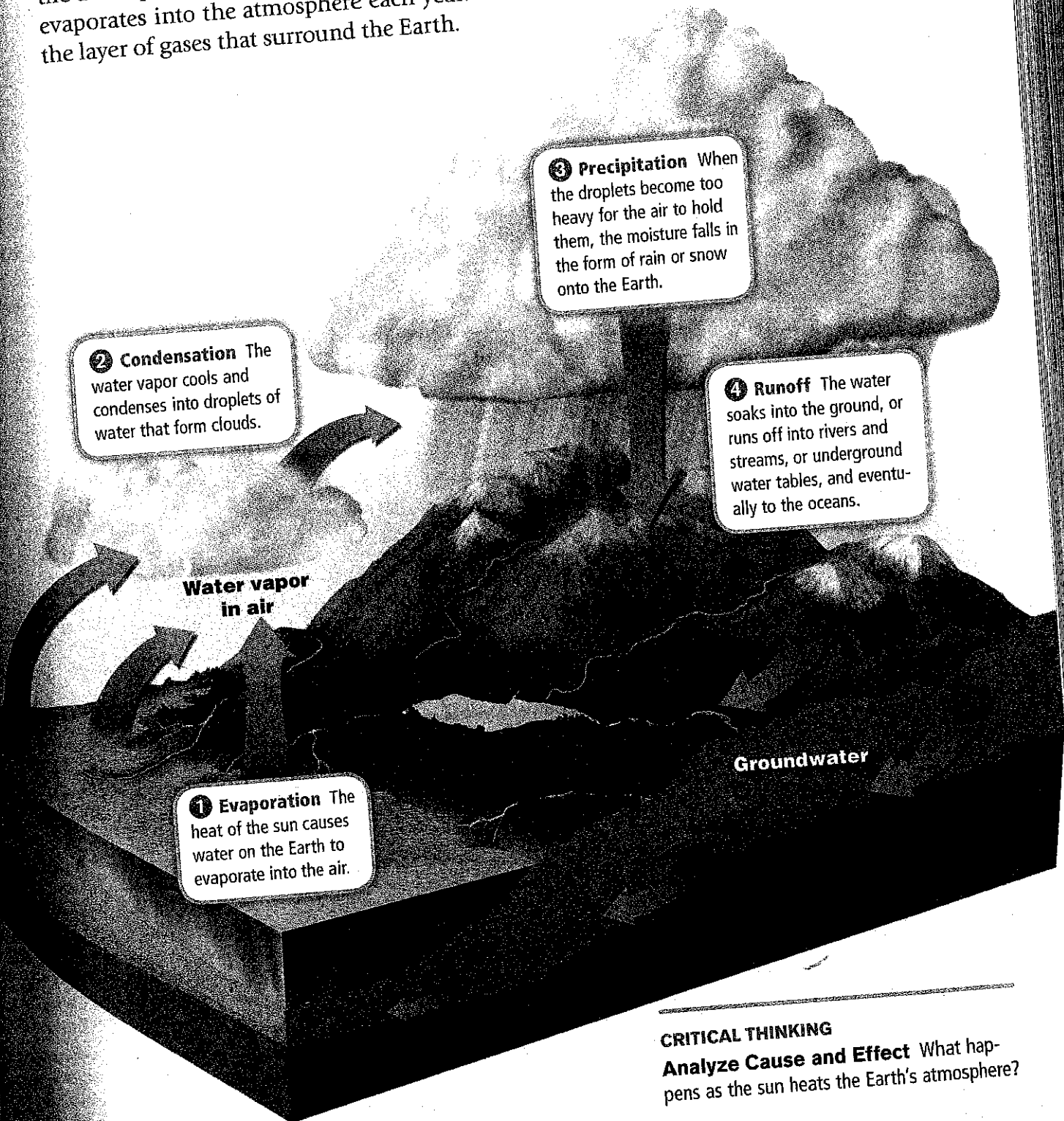
Salt Water The water in the Earth's oceans and seas is called salt water because it contains a small percentage of dissolved minerals and chemical compounds called salts. Actually, all of the oceans and seas are part of the same body of water, which is divided by the continents. Geographers gave names to the different areas of the oceans.

The Earth's oceans are the Pacific, Atlantic, Indian, and Arctic, and the Southern Ocean, which is the body of water around Antarctica. The Pacific Ocean is the largest and covers almost one-third of the Earth. A body of salt water that is completely or partly enclosed by land is called a sea. An example is the Mediterranean Sea. Oceans and seas are sources of food, energy, and minerals and are used for transportation and recreation. They also help to distribute Earth's heat.

COMPARE Compare the two types of water on the Earth.

Hydrologic Cycle

The Earth's water is renewed by a never-ending process called the hydrologic cycle, or water cycle. The **hydrologic cycle** is the circulation of water between the Earth, the oceans, and the atmosphere. Approximately 119,000 cubic miles of water evaporates into the atmosphere each year. The **atmosphere** is the layer of gases that surround the Earth.



CRITICAL THINKING

Analyze Cause and Effect What happens as the sun heats the Earth's atmosphere?

Landforms

KEY QUESTION How are landforms created?

Features on the Earth's surface formed by physical forces are called **landforms**. Landforms are produced by the internal and external forces that reshape the Earth. Internal forces push, move, and raise up parts of the Earth's crust. The result is the creation of new rock formations, such as mountains. External forces wear down these formations and transport the eroded materials to other locations. The eroded materials then become new landforms. These processes take a long time, but they are constantly at work. The location and size of landforms often affect where people choose to live.

Many of the same landforms found on dry land are also found under water. Those on the land are called continental landforms. Those on the sea floor are called oceanic landforms.

Continental Landforms The major continental landforms are mountains, hills, plains, and plateaus. A **plateau** is a broad area of land higher than the surrounding land. The same landforms are found on all of the continents. In fact, satellite photographs show a pattern on most continents: wide plains in the center and a narrow belt of mountains near the edge of the continent, where tectonic plates collide. For example, the landscape of the United States has the Rocky Mountains and coastal mountains in the west, the Appalachian Mountains in the east, and the Great Plains in the center.

The difference in the elevation of a landform from its lowest point to its highest point is called **relief**. Mountains show great relief compared to plains and plateaus. Many of the maps in this book have a relief indicator to show these differences in elevation.

Oceanic Landforms The landforms on the ocean floor are like an invisible landscape. Most cannot be seen from the surface of the water. But high mountains, vast plains, deep valleys, and coral reefs are present under the water's surface. Some are the result of the same tectonic forces that shape the continental landforms. The submerged

Monument Valley, Arizona

In this photograph, you can see dramatic examples of relief between the floor of the valley and the tops of the landforms.



SECTION
3

Reading for Understanding

▶ Key Ideas

BEFORE, YOU LEARNED

The Earth's surface is covered with both continental and oceanic landforms. The hydrologic cycle circulates the water.

NOW YOU WILL LEARN

The Earth's rotation and revolution influence weather, climate, and living conditions on Earth.

▶ Vocabulary

TERMS & NAMES

solstice the time during the year when the sun reaches the farthest northern or southern point in the sky

equinox one of the two times a year when the sun's rays are over the equator and days and night around the world are equal in length

weather the condition of the Earth's atmosphere at a given time and place

climate the typical weather conditions of a region over a long period of time

precipitation falling water droplets in the form of rain, snow, sleet, or hail

vegetation region an area that has similar plants

savanna a vegetation region with a mix of grassland and scattered trees

desert a region with plants specially adapted to dry conditions



Visual Vocabulary desert

▶ Reading Strategy

Re-create the diagram shown at right. As you read and respond to the **KEY QUESTIONS**, use the diagram to help you summarize information about the world's climate and vegetation.



See Skillbuilder Handbook, page R5

SUMMARIZE

CLIMATE

VEGETATION

Blank lines for summarizing climate information.

Blank lines for summarizing vegetation information.



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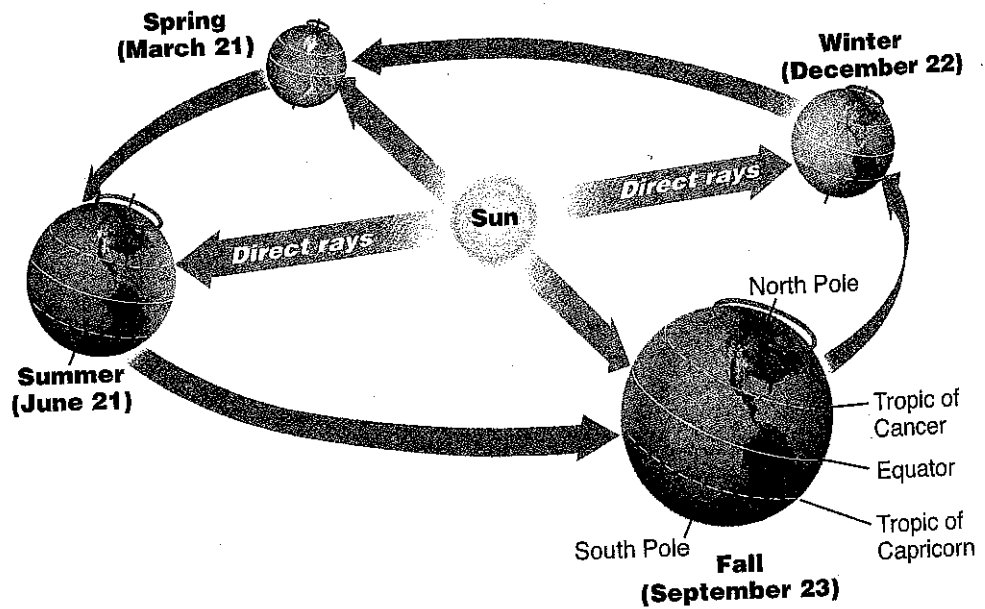
Seasons: Northern Hemisphere

Earth's Revolution

The seasons are related to the Earth's tilt and revolution around the sun.

CRITICAL THINKING

Compare and Contrast Which part of the Earth's surface doesn't experience seasons?



Seasons The term **solstice** is used to describe the time during the year when the sun reaches the farthest northern or southern point in the sky. In the Northern Hemisphere, the summer solstice is the longest day of the year and begins summer. The winter solstice is the shortest day of the year and begins winter. These dates are reversed in the Southern Hemisphere. The beginning of spring and autumn start on the **equinox**. On these two days, the sun's rays are directly over the equator, and days and nights around the world are equal in length. The Earth's revolution brings the temperature and weather changes we call seasons to many parts of the Earth. But in some regions there is little change. The illustration above shows the position of the Earth at the start of the four seasons in the Northern Hemisphere.

▲ **SUMMARIZE** What causes seasons on Earth?

Weather and Climate

▼ **KEY QUESTION** What is the difference between weather and climate?

People often confuse weather and climate. **Weather** is the condition of the Earth's atmosphere at a given time and place. For example, today may be sunny and warm. **Climate** is the term for the typical weather conditions of a certain region over a long period of time.

Causes of Weather Several factors interact to cause weather at a particular location. They include solar energy, wind, landforms,

bodies of water, water vapor, cloud cover, and elevation. The combination of all these factors varies from location to location, creating local weather conditions.

The most important weather factor is the amount of energy, in the form of heat from the sun, that a location receives. This is why, for example, the time of year influences the weather. In summer, much more solar energy is found in the atmosphere, and weather conditions change. Winds move the solar energy and moisture that air holds across the Earth. Also, land heats and cools more quickly than bodies of water do. So land located near a body of water has a different weather pattern from locations further inland.

Clouds and water vapor are connected to each other in weather patterns. Clouds hold water vapor in the atmosphere. Water vapor determines whether there will be **precipitation**, which is falling water droplets in the form of rain, snow, sleet, or hail.


Finally, as elevation above sea level rises, air becomes thinner and loses its ability to hold moisture, so it becomes cooler. The temperature drops by about 3.5°F for every 1,000-foot increase in elevation. So, you can find ice and snow on the tops of mountains even at the equator.

Causes of Climate There are many different climates around the world. A place's location on the Earth, especially its latitude, is important in determining climate. For example, climates are warmer near the equator and colder near the poles.

Wind and ocean currents help distribute the sun's heat from one part of the world to another. Ocean currents are like rivers flowing through the ocean. They move warm waters away from the equator and cold water from the poles. Air currents blowing over the ocean waters pick up heat and moisture and move them to other parts of the Earth.

 **COMPARE** Explain the difference between weather and climate.

Climate and Vegetation Regions

 **KEY QUESTION** What are climate and vegetation regions?

To categorize climate regions, geographers divide the Earth into three general zones of latitude: tropical, middle, and high. These zones are found on both sides of the equator. Tropical latitudes are found between the equator and Tropic of Cancer and between the equator and the Tropic of Capricorn where it is usually hot. Middle latitudes extend from the tropic lines to the lines of the Arctic and Antarctic circles. High latitude refers to the cold areas around the North and South Poles.



Fun Facts!

IT'S RAINING FROGS!


Yes, it's true—there are recorded instances of frogs raining down on the Earth, most recently in Serbia in 2005. The most logical explanation is a strong wind that can suck light objects out of the water and later deposit them somewhere else.

In 1981, a city in southern Greece experienced a rain of frogs that landed in trees and in the streets. The species of frog was native to North Africa. That's one strong wind!



Climate Regions As you can see on the map on the opposite page, the Earth has five general climate regions: tropical, mid-latitude, high latitude, dry, and highland. Tropical climates are always hot and can be rainy most of the year or only during one season. The middle latitudes have the greatest variety of climates, ranging from hot and humid to cool and fairly dry. Climates along the oceans are also included in this category. High latitude climates are cool to cold all year long. Dry climates can be found in every latitude region. Highland climates are based on the elevation of a particular place. So, for example, as you go up a mountain, the climate may change from warm to cooler to cold.

Vegetation Regions The term **vegetation region** refers to an area that has similar plants. A vegetation region is named for the types of trees, grasslands, and specially adapted plants found there. The four basic types of vegetation are: forest, savanna, grasslands, and desert. Forests can be cold, tropical, or temperate. **Savanna** is a mix of grasslands and trees. Grasslands can have short or tall grasses, depending on the amount of rain. Finally, a **desert**—which can be hot or cold—has plants specially adapted to very dry conditions.

 **SUMMARIZE** Identify the five main climate regions.



ONLINE QUIZ

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Section

3

Assessment

TERMS & NAMES

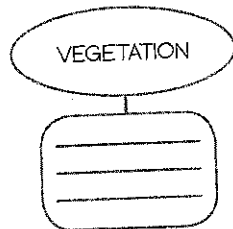
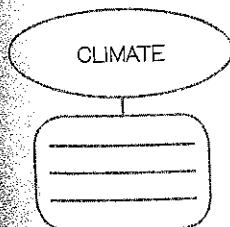
1. Explain the importance of

- weather
- climate
- precipitation
- vegetation region

USE YOUR READING NOTES

2. Summarize Use your completed chart to answer the following question:

What are the basic causes of weather and which factor is the most important?



KEY IDEAS

3. What causes the changing seasons?
4. What are the causes of climate?
5. How are vegetation regions named?

CRITICAL THINKING

6. **Analyze Causes and Effects** Why are the seasons reversed in the Northern and Southern Hemispheres?
7. **Draw Conclusions** How does location affect climate and vegetation?
8. **CONNECT to Today** What weather conditions have caused problems in the United States recently?
9. **WRITING Write a Description** Determine what climate and vegetation region you live in. Then write a paragraph describing the climate features and types of vegetation.

SECTION
4

Reading for Understanding

► Key Ideas

BEFORE, YOU LEARNED

Many different physical systems influence the way we live on Earth.

NOW YOU WILL LEARN

Human interference with physical systems can cause problems with the environment.

► Vocabulary

TERMS & NAMES

global warming an increase in the average temperature of the Earth's atmosphere

greenhouse effect the trapping of the sun's heat by gases in the Earth's atmosphere

greenhouse gas any gas in the atmosphere that contributes to the greenhouse effect

fossil fuels fuels such as coal, oil, and natural gas

desertification the process in which farmland becomes less productive because the land is degraded

sustainable using natural resources in a way that they exist for future generations

BACKGROUND VOCABULARY

carbon dioxide a gas composed of carbon and oxygen

emissions substances discharged into the air

degraded of lower quality



Visual Vocabulary desertification

► Reading Strategy

Re-create the chart shown at right. As you read and respond to the **KEY QUESTIONS**, use the chart to compare and contrast details about environmental challenges the world faces.



Skillbuilder Handbook, page R9

COMPARE AND CONTRAST

GLOBAL WARMING	DESERTIFICATION



GRAPHIC ORGANIZERS

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Environmental Challenges



3.01 Identify ways in which people of selected areas in Africa, Asia, and Australia have used, altered, and adapted to their environments in order to meet their needs, and evaluate the impact of their actions on the development of cultures and regions.

3.02 Describe the environmental impact of regional activities such as deforestation, urbanization, and industrialization and evaluate their significance to the global community.

Connecting to Your World

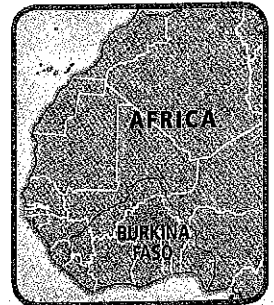
Have your parents or other adults ever told you that the climate seems to be changing? Maybe they said something like, "We never had hurricanes or tornados like these when I was a kid." They could be right—climates do change. Some changes take place naturally over many years, such as the build-up of ice during ice ages. But recently, scientists have noticed rapid climate changes that some believe is the result of human activity.

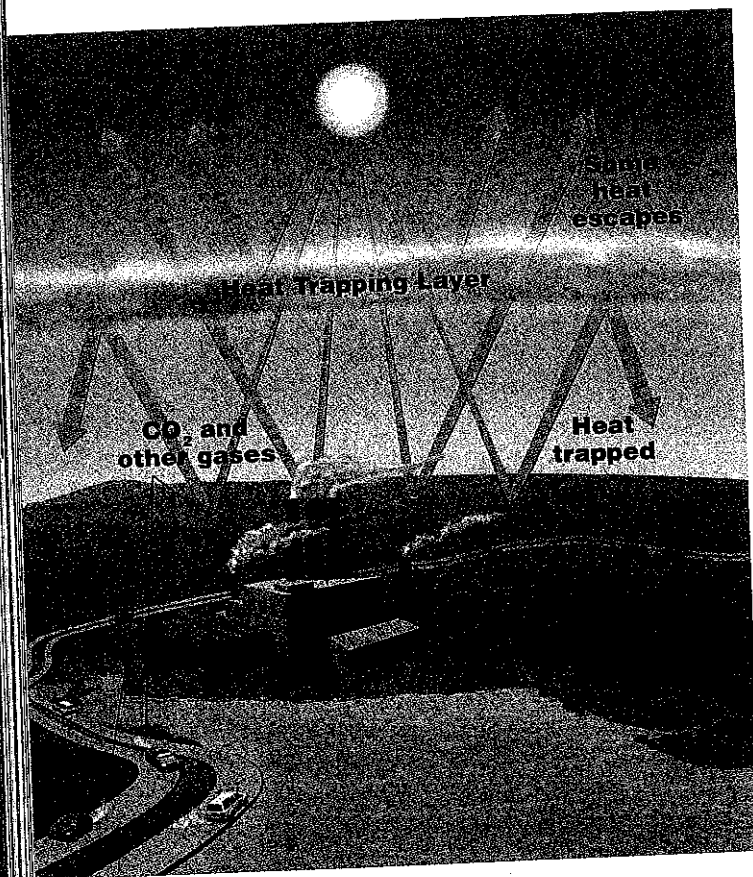
Global Warming

KEY QUESTION How are global warming and the greenhouse effect related?

Global warming and desertification are two possible threats to the environment. **Global warming** is an increase in the average temperature of the Earth's atmosphere. It refers to an increase large enough to cause changes in the Earth's overall climate. The Earth's average temperature has risen between 0.9 and 1.3°F since the late 1800s. Many scientists think that temperatures may rise another 2.5 to 10.4°F by the end of the century. Some scientists believe that this warming is part of the larger cycle of warm and cold periods in the Earth's history. Others suspect that it is caused by humans.

Dori, Burkina Faso Changes in the climate have caused drought in this region, leading to fewer crops.





Greenhouse Effect
Trapped gases and heat combine to change the Earth's temperature. **How do humans add to the greenhouse effect?**

The Greenhouse Effect The trapping of the sun's heat by gases in the Earth's atmosphere is called the **greenhouse effect**. These gases act like the glass roof of a greenhouse. They let in solar energy, which heats up the planet, but they trap much of the heat that rises from the Earth's surface. So, the Earth becomes warmer. Some greenhouse effect is necessary. Without it, you would be living on a freezing cold planet. The temperature would be about zero degrees Fahrenheit.

Any gas in the atmosphere that contributes to the greenhouse effect is called a **greenhouse gas**. Greenhouse gases include water vapor and **carbon dioxide**, a gas composed of carbon and oxygen. The burning of **fossil fuels**, such as coal, oil, and natural gas, has caused an increase in carbon dioxide in the atmosphere. As this gas builds in the atmosphere, the atmosphere becomes warmer and speeds up the heating effect.

The Impact on the Climate In theory, a more intense greenhouse effect could change the Earth's climate. Warmer temperatures could cause the ice caps and glaciers around the world to melt and sea levels to rise. Flooding could occur along coastal regions. Global land-use patterns would change. Some crops would no longer grow in certain areas. Some areas would become hotter and drier, with extreme heat waves, droughts, and more forest fires. These changes would alter the fragile relationships between living things and the environment.

Solutions Lowering the levels of greenhouse gases is a complex, worldwide goal. Some nations generate huge amounts of greenhouse gases. These gases affect not only those nations, but also the whole planet. So, humans need to take steps to reduce the levels of greenhouse gases. One solution might be to build more energy-efficient cars and factories. Another could be to use alternative energy sources such as energy produced by the sun, or the internal heat of the Earth.

In 1997, nations from around the world gathered at Kyoto, Japan, to discuss plans to reduce greenhouse gases. The result of their meeting was an agreement to cut emissions of carbon dioxide and other greenhouse gases. (**Emissions** are substances discharged into the air.) The agreement, called the Kyoto Protocol, went into effect in 2005.

SUMMARIZE Explain how global warming takes place.

Desertification

KEY QUESTION What causes desertification?

Desertification is the process in which farmland becomes less productive because the land is **degraded**. The land becomes more desert-like, that is, dry and unproductive. Desertification is a serious problem because it turns arid and semiarid areas into nonproductive wasteland. Each year, about 25,000 square miles of land—an area the size of West Virginia—is degraded. This process is happening in many parts of the world, including Africa, China, and the American West.

Causes and Effects In desertification, natural vegetation is removed or destroyed, and soil is exposed to wind. Without shade from the sun, the moisture in the soil evaporates more quickly. The dry top layers of soil particles then blow away. The soil becomes less able to support plant life. The loss of moisture and plants may in itself cause more desertification. But destructive practices in arid and semiarid regions have speeded up the process. Some of these practices are

overgrazing allowing animals to graze so much that plants are unable to grow back

cultivation of marginal land planting crops on fragile soil

deforestation cutting down trees and not replanting new trees

ONLINE PRIMARY SOURCE To read more of Wangari Maathai's writing, go to the Research & Writing Center @ClassZone.com

ANALYZING Primary Sources

Wangari Maathai (born 1940) won the 2004 Nobel Peace Prize for her work fighting deforestation in Africa. To combat desertification, she founded the Green Belt Movement, which has planted 30 million trees across Africa, including her native Kenya.

[The Green Belt Movement] encourages women to create jobs, prevent soil loss, slow the process of desertification and [to] plant and to eat indigenous [local] food crops.

Source: Speech to the 4th United Nations World Women's Conference, Beijing, China, 1995

DOCUMENT-BASED QUESTION

What is the goal of the Green Belt Movement?



Green Belt Movement

The Green Belt Movement, founded by Wangari Maathai in Kenya in 1977, is an example of a program of sustainable development. It started out as a jobs program to pay rural and urban women to plant trees. But it soon became a movement to improve the environment, slow deforestation, and halt desertification.



Solutions There are different solutions to the growing problem of desertification. Each depends on the underlying cause. Some simple solutions are to build sand fences that interrupt the wind, or to use straw mats to reduce evaporation so young plants can take root. Still another is to use solar ovens in place of open fires that require firewood. Planting tree fences and grass belts also reduces the spread of sandy areas. This practice is being used in China and Africa today.

Solutions like the ones above are examples of sustainable practices. **Sustainable** means that these practices use natural resources in such a way as to ensure that they exist for future generations. Sustainable practices work with the environment to protect the land, preserve wildlife, and repair the damage that has

been done to it. The practices allow people to live a better life and ensure that resources will be available both now and in the future.

DRAW CONCLUSIONS Explain what causes desertification.

Section 4 Assessment

ONLINE QUIZ
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TERMS & NAMES

1. Explain the importance of

- global warming
- greenhouse effect
- desertification
- sustainable

USE YOUR READING NOTES

2. Compare and Contrast Use your completed chart to answer the following question:

How does the greenhouse effect contribute to global warming?

GLOBAL WARMING	DESERTIFICATION

KEY IDEAS

3. Why is global warming a problem?
4. What are greenhouse gases?
5. What are three simple solutions to controlling desertification?

CRITICAL THINKING

6. **Evaluate** Which environmental problem, global warming or desertification, is a greater threat to the Earth? Why?
7. **Summarize** How does deforestation cause desertification?
8. **CONNECT to Today** What might happen if more gasoline-powered motor vehicles were used around the world?
9. **MATH Make a Chart** Use the Internet to find information about desertification. Then make a chart that shows locations and the percentage of land that has been degraded.

