Unit 1

Planet Earth

In this unit, you will look at the physical features of our planet and the different ways Earth grows and changes. In Chapter 1, you will see how Earth is a part of the universe. You will also discuss the ways in which our planet is unique, or different from, all the others. In Chapter 2, you will focus on various processes that help create and shape our planet.

Contents

In Unit 1, you will read and write about the following topics.

Skills

In Unit 1, you will practice the following skills.

Reading Skills	Writing Skills
Thinking about the topic Previewing art Asking and answering questions about a text Previewing key parts of a text Using headings to remember main ideas Building background knowledge Reading boxed texts Illustrating main ideas Reading for main ideas	Parts of speech Comparative adjectives Writing complete sentences Writing simple and compound sentences Writing definitions Pronoun reference Showing contrast Using correct paragraph form Using correct paragraph structure Writing first drafts
Vocabulary Skills	**Academic Success Skills**
Words from Latin and Greek Cues for finding word meaning Learning verbs with their prepositions Previewing key words Prefixes Prepositional phrases Using grammar, context, and background knowledge to guess meaning	Highlighting Making a pie chart Answering multiple-choice questions Labeling diagrams Reading maps Answering true/false questions

Learning Outcomes

Write an academic paragraph about a place on Earth you like

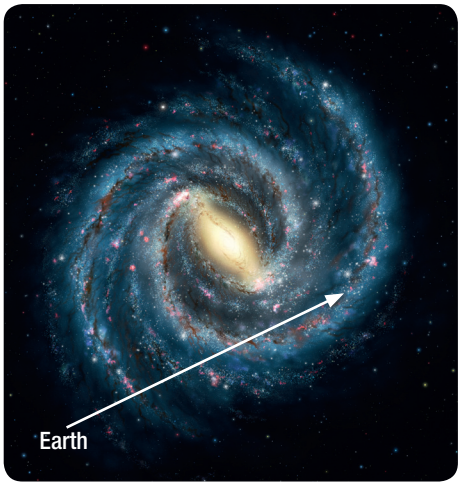
Previewing the Unit

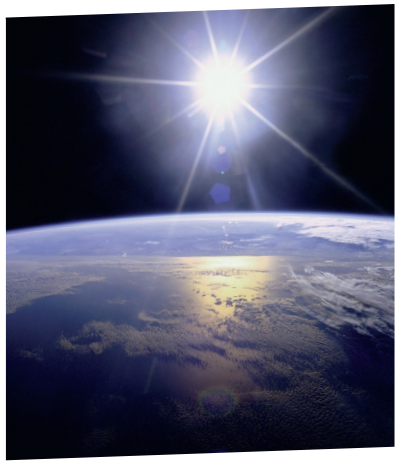
Previewing means looking at one thing before another. It is a good idea to preview your reading assignments. Read the contents page of every new unit. Think about the topics of the chapters. You will get a general idea of how the unit is organized and what it is going to be about.

Read the contents page for Unit 1 on page 2 and do the following activities.

Chapter 1: The Physical Earth

A How much do you know about our solar system and planet Earth? Look at the photographs. Then answer the questions below.





1. Earth is only one of the planets in the universe, but it is very special. What makes Earth unique, or different from, all the other planets?
2. What makes it possible for people to live on Earth? What does Earth provide so that we are able to live here?

B Compare your answers in a small group.

Chapter 2: The Dynamic Earth

A Discuss the following questions in a small group.

1. Earth is always moving in different ways. How does Earth move? Did you ever feel it move? Describe your experience.
2. Why do you think Earth moves?
3. Earth's surface is not flat. It has many natural features such as mountains and lakes. Make a list of the natural features on Earth. Choose two features from the list and answer this question: How was each feature created?

B Share your answers with the class.

Chapter 1
The Physical Earth

PREPARING TO READ

1 Thinking about the topic R

Thinking about the topic of a reading before you read can make a text easier to understand.

The text you are going to read is about the solar system. It discusses some of the objects we see in the sky. How much do you know about these objects? Discuss the following questions in a small group.

1. What are some things that you see in the sky during the day?
2. What are some things that you see in the sky at night?
3. Would you like to be a scientist who studies the sky? Why or why not?

2 Previewing art R

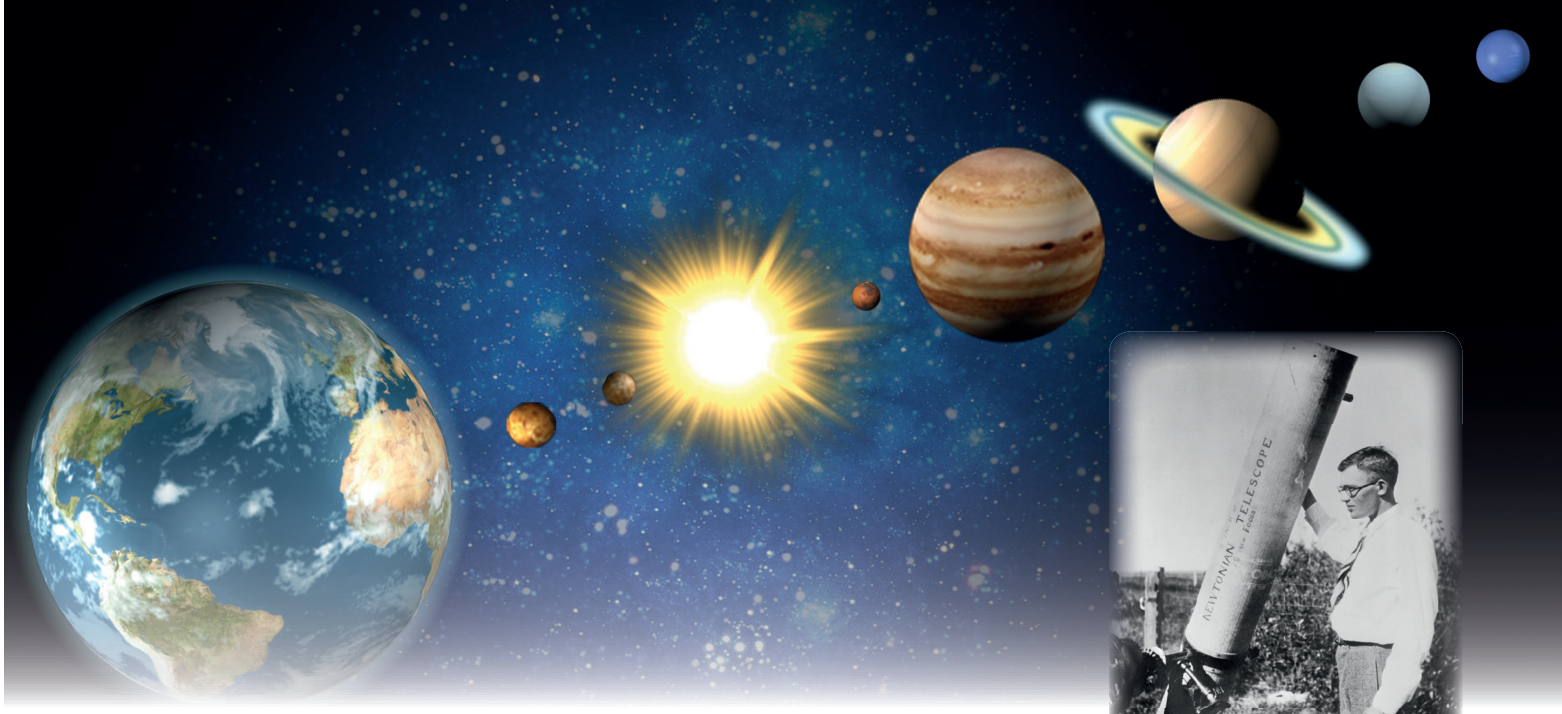
Art in textbooks illustrates ideas in a text. Previewing photographs and illustrations can help you quickly grasp these ideas.

A Look at the illustration of our solar system on page 5. Then discuss the following questions with a partner.

1. How many planets are there in the solar system? Do you know any of their names?
2. In what ways are the planets different from one another?
3. Can you find our planet, Earth? If you can, draw an arrow (➜) to it.
4. What is at the center of our solar system? Is it a planet?

B Look at the photograph at the top of page 5. Then discuss the following questions with a partner.

1. Who is the person in the photograph?
2. What is the name of the instrument with him?
3. What do these instruments do? Did you ever look through one? Describe your experience.



Clyde Tombaugh

Reading 1

OUR SOLAR SYSTEM

Our home in the universe is planet Earth. It is one of eight planets that **orbit**, or circle, the sun. The sun is a star, that is, a giant ball of hot gases. It is the center of our **solar system**. There are billions of other stars in the sky, but the sun is the star closest to Earth. Our solar system also includes moons, which orbit planets. The moon we see in the night sky orbits Earth.

We usually list our solar system's planets in order of their distance from the sun: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. We can divide the planets into two groups: terrestrial planets and gas giant planets.

Terrestrial, or Earthlike, planets have solid, rocky surfaces. Mercury, Venus, Earth, and Mars are **terrestrial planets**. Earth is the only planet that has large amounts of liquid water, and it is the only planet that has life. Astronomers (scientists who study the stars and planets) believe that a long time ago, Mars had rivers and oceans, just like Earth, but that now all the water is either frozen or underground.

Gas giant planets are much larger than terrestrial planets. All **gas giant planets** are made of gases, not solid rock. These planets have rings around them. The rings are made of tiny pieces of rock, dust, or ice. Jupiter, Saturn, Uranus, and Neptune are gas giant planets. Jupiter is the largest planet. It is about a thousand times bigger than Earth.

Outside of our solar system, there are billions of other stars. Astronomers now know that some of these stars have planets, and the planets orbit these stars. This means that there are other solar systems in the universe in addition to our own. Perhaps we will even find another planet with life on it someday.

orbit travel in a circle around a larger object

solar system the sun and the planets that move around it

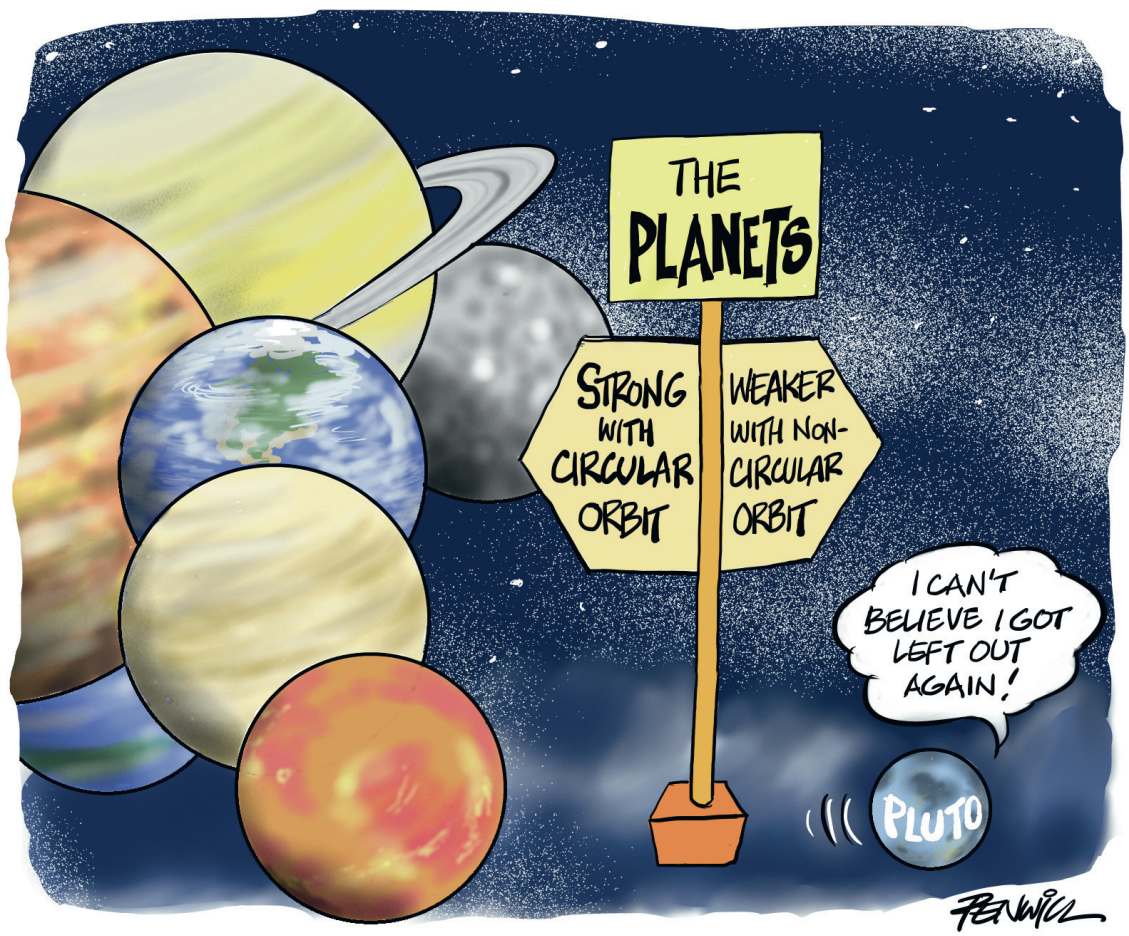
terrestrial planet a planet with a solid, rocky surface

gas giant planet a planet made of gases, not solid rock

The Story of Pluto

Are there eight or nine planets in our solar system? Before 1930, everyone thought there were eight. Then in 1930, a young man surprised the world. Clyde Tombaugh was 24 years old. He was not a professional astronomer. He even made his own telescope. He looked through his telescope and discovered a new planet in the solar system. He discovered Pluto. Pluto is very small, smaller than Earth's moon. It is also farther from the sun than the other planets, so it is colder and darker. After Tombaugh's discovery, people accepted it as fact that our solar system has nine planets.

Then, in 2006, the International Astronomical Union (IAU) changed the definition of "planet." According to the new definition, a planet has to have certain features. For example, it has to make a circular orbit around the sun. It also has to be big enough and strong enough to move objects in its path away. Pluto differs from the other planets in both these ways. First, it does not have a circular orbit, and it even crosses Neptune's orbit. In addition, it is not able to move objects out of its way as it orbits the sun. For these reasons, the IAU reclassified Pluto from a planet to a plutoid. So now scientists tell us once again that there are only eight planets.



AFTER YOU READ

1 Asking and answering questions about a text

Asking and answering questions about a text checks your understanding.
When you do this, you discover what you know and do not know about the reading.
You can do this alone or with a partner.

Work with a partner to complete the following activities.

A Reread paragraph 1 of the text "Our Solar System." Use the questions below to ask and answer questions about the text. Add at least two more questions to the list.

1. How many planets are there in our solar system?
2. What does *orbit* mean?
3. Is the sun a planet or a star?
4. (Add your own question.)
5. (Add your own question.)

B Now reread paragraph 2 of the text. Write two or three questions about the paragraph. Then take turns asking and answering the questions.

C Reread the rest of the text and the boxed text "The Story of Pluto." Continue asking and answering questions with your partner.

2 Words from Latin and Greek

Many English words, or parts of words, come from other languages. Words that come from Latin and Greek are especially common in science. Look at these examples:

terr- means "earth" or "land"

sol- means "sun"

astro- means "star"

Learning Greek and Latin word parts helps you put new words together.
You can then quickly guess the basic meanings of many new words in science texts.

A Go back to the text "Our Solar System" and the boxed text "The Story of Pluto." Find words that start with *terr-*, *sol-*, or *astro-* and put a check mark (✓) above them.

B Start a chart of word parts from Latin and Greek in your notebook. Follow this model:

Word part from Latin or Greek	Meaning	English example	Meaning
terr-	earth, land	terrestrial	relating to Earth

3 Cues for finding word meaning V

Academic texts will have many new words. However, when you read a text, do not stop to look up every unfamiliar word. The definition of a new word is often in the text. Learn to look for cues to its meaning.

Look at these sentences from "Our Solar System":

- It is one of eight planets that orbit, or circle, the sun.
- The sun is a star, that is, a giant ball of hot gases.
- Terrestrial, or Earthlike, planets have solid, rocky surfaces.
- Astronomers (scientists who study the stars and planets) believe that a long time ago, Mars had rivers and oceans, just like Earth.

Notice that the sentences use three cues to present definitions: *or*, *that is*, and parentheses ( ).

A Read the sentences below. Notice the key words in **bold** and the definitions. Find the cues that signal the definitions and circle them.

1. In ancient times, sailors often used **constellations** (groups of stars that form imaginary pictures and have names) to safely find their way across the ocean.
2. Astronomers have found more than 750 **extrasolar** planets, that is, planets outside of our solar system.
3. A **supernova**, or extremely bright explosion of a star, is a very rare occurrence.
4. The name of our **galaxy** (a group of stars, gas, and dust held together by gravity) is "the Milky Way."

B Write the key word from each sentence in Step A and its definition.

1. _____ :
   _____
2. _____ :
   _____
3. _____ :
   _____
4. _____ :
   _____

C Write three sentences with definitions of the following terms. Use *or*, *that is*, or parentheses ( ). Be sure to use correct punctuation. Write on a separate piece of paper.

1. telescope: *A telescope (an instrument that makes faraway objects look larger) is an important tool for an astronomer*.
2. solar system:
3. Mercury or Pluto:
4. gas giant planet:

4 Parts of speech W R V

Words are also parts of speech. Parts of speech say whether a word names, does, or describes. Understanding the parts of speech in English helps your writing and reading. You can write clearer, more logical sentences and better understand what you read. In this chapter, we review three parts of speech:

A noun names a person, place, thing, or idea (*planet*, *moon*, *belief*).

A verb does an action or is a state of being (*orbit*, *be*, *have*).

An adjective describes a noun or pronoun (*rocky*, *giant*, *hot, it*).

A Reread paragraph 1 of the text "Our Solar System." Then do the following.

1. Underline all of the nouns.
2. Draw two lines under all of the verbs.
3. Circle all of the adjectives.

Compare answers with a partner.

B Read the paragraph below. Label each noun (**n**), verb (**v**), and adjective (**adj**).

Mars is an interesting planet. In some ways, it is similar to Earth. It has weather and seasons. It also has canyons and mountains. However, Mars is a very different planet from Earth. It is much smaller than Earth, and it is much colder. In addition, there are no people on Mars.

C Read these sentences. There is a missing word in each one. Decide what part of speech is missing and write it in the first blank.

verb **1.** Pluto _____ two small moons.

_____ **2.** Mercury is a _____ planet.

_____ **3.** Saturn has many beautiful _____ .

_____ **4.** Earth has one _____ .

_____ **5.** Some people _____ that there is life on other planets.

D Now complete each sentence in Step C. Use an appropriate word.
Use the part of speech to help you. Compare your sentences with a partner's.

Example: verb Pluto has two small moons.

5 Comparative adjectives

A **comparative adjective** shows the difference between two people, places, or things. Sometimes a comparison includes a group of people, places, or things. Look at these examples:

- Tombaugh was **younger** than most other astronomers when he discovered Pluto.
- Jupiter is **farther** from the sun than Earth.
- Saturn's rings are **more beautiful** than Jupiter's rings.
- Venus is **hotter** than the other planets in our solar system.

To form comparative adjectives, follow these guidelines:

For **one-syllable** adjectives, add *-er*. If the adjective ends in *-e*, add only *-r*.

small ➜ smaller
dark ➜ darker
close ➜ closer

For **one-syllable adjectives that end with a single vowel and a consonant**, double the final consonant and add *-er*.

hot ➜ hotter
big ➜ bigger
red ➜ redder

For **adjectives with two or more syllables**, add *more* before the adjective. If the adjective ends in *-y*, change the *-y* to *-i* and add *-er*.

important ➜ more important
solid ➜ more solid
happy ➜ happier

Irregular adjectives do not follow patterns. Check your dictionary for a complete list.

good ➜ better
bad ➜ worse
far ➜ farther

To compare two nouns in the same sentence, use *than* after the comparative adjective and before the second noun.

noun 1		comparative adjective		noun 2
Earth	is	smaller	**than**	Jupiter.

A Go back to paragraph 4 of "Our Solar System" and to the boxed text "The Story of Pluto." Find the comparative adjectives. Underline them. How many did you find?

B Write the comparative form of each adjective.

1. dark _____
2. hot _____
3. solid _____
4. icy _____
5. small _____
6. big _____
7. strong _____
8. rocky _____

C Complete each sentence with a comparative adjective. Choose an adjective from the box. Use each word once. Use correct forms and add than. Be sure that each sentence is true, based on the information in the texts.

close	cold	far	hot	large	rocky

1. Uranus is farther from the sun than Mercury.
2. Pluto is _____ _____ Venus.
3. Mars is _____ _____ Pluto.
4. Earth is _____ to the sun _____ Neptune.
5. Mercury is _____ _____ Saturn.
6. Jupiter is _____ _____ Uranus.

D Compare Jupiter and Pluto. Write three or four sentences. Use comparative adjectives with *than*.

Example: Jupiter is closer to the sun than Pluto.

1. _____
2. _____
3. _____
4. _____

PREPARING TO READ

Previewing key parts of a text

Previewing key parts of a text tells you the main ideas of the text. To preview key parts, look carefully at the title, the introduction, and the headings. It is also a good idea to read the first sentence of each paragraph.

A Read these key parts of the text "Earth's Four Systems" on page 13.

- the title
- the short introductory paragraph at the beginning of the text
- the headings
- the first sentence of each paragraph

B Answer the following questions with a partner.

1. How many systems does Earth have?
2. What are their names?

C Now complete the chart.

1. Write the names of Earth's systems in the first column.
2. Then match the following key features to the systems. Write the feature next to the appropriate system:

living things
water
Earth's crust and the top layer of the mantle
air

Name of the system	Key feature(s)
lithosphere	Earth's crust and the top layer of the mantle

Reading 2

EARTH'S FOUR SYSTEMS

Think about Earth from the point of view of an astronaut. From outer space, Earth looks like one solid blue ball. In fact, our planet is much more complex. It is actually made up of four very different, but interconnected, systems: the lithosphere, the hydrosphere, the atmosphere, and the biosphere.

The lithosphere

The lithosphere is the hard surface of Earth. It has two layers. The first layer is the **crust**. The crust is a thin layer of rock that covers the whole planet. Its thickness ranges from about 5 to 80 kilometers. The second layer is called the mantle. The mantle is directly under the crust. The lithosphere is not one solid piece of rock. It is made up of many smaller pieces called plates.

crust Earth's hard outer layer

The hydrosphere

The hydrosphere is all the water on Earth, including oceans, lakes, rivers, **glaciers**, rain, and snow. Water covers more than 70 percent of Earth. Approximately 97 percent of Earth's water is saltwater from oceans, and 3 percent is freshwater from glaciers, lakes, rivers, and groundwater (water under the ground).

glacier a very large amount of ice that moves slowly over land

The atmosphere

The atmosphere is the air surrounding Earth. It is made up mostly of gases. The primary gases are nitrogen and oxygen. Gases in the atmosphere create air for us to breathe, and they protect Earth from the sun's **ultraviolet radiation**. The atmosphere is also where weather conditions, such as clouds and storms, form.

ultraviolet radiation a form of energy that comes from the sun in rays, or lines, that we cannot see

The biosphere

The biosphere is made up of all the living things on Earth. It includes humans, animals, and plants. Life on Earth is very diverse, but all living things share certain features. For example, they all eat, breathe, and grow.

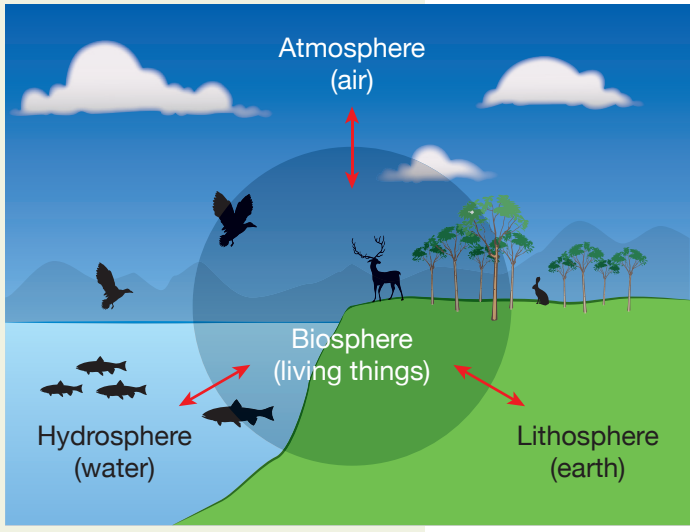


Figure 1.1 Earth's four systems

The interconnections of Earth's systems

The lithosphere, the hydrosphere, the atmosphere, and the biosphere connect with each other in important ways. We humans are part of the biosphere, but we live on the lithosphere. We depend on the atmosphere for air to breathe and on the hydrosphere for water to drink. In fact, these connections are so strong that a change in one system can affect the others. Consider this example: Driving a car contributes to air pollution in the atmosphere. Air pollution causes Earth to grow warmer. Warmer temperatures cause important changes in the hydrosphere: Glaciers melt and ocean levels rise. These changes to the hydrosphere affect the humans, animals, and plants of the biosphere. For example, people who live in coastal areas along the ocean are in danger of losing their homes because of **floods**. The polar bear is gradually losing its **natural habitat** because of warming temperatures in the Arctic. When you think about these interconnections among the systems, it is easy to see that our planet is very complex.

flood a large amount of water covering an area that is usually dry

natural habitat the place where an animal or a plant usually lives

AFTER YOU READ

1 Highlighting A V R

Highlight important information in a text. This is one way to remember what you read. Mark key words and ideas in colors that are easy to see. Remember to highlight only the important information. A text that has too many highlighted sentences is not useful.

A Go back to the text "Earth's Four Systems." Highlight the names of Earth's systems and the most important feature of each one.

B Go back to the text again. Find an explanation of how humans are connected to Earth's four systems. Use a different color and highlight the explanation.

C Compare your work with a partner's.

2 Words from Latin and Greek V

Remember that many words in science come from Latin or Greek. Knowing the meaning of all the parts can help you better grasp the exact meaning of the word. For example, *hemisphere* is made up of *hemi-* (half) and *sphere* (ball). Earth is shaped like a ball. The word *hemisphere* means "half of Earth."

A Match the word parts with the meanings. Use the information in the reading.

____ **1.** litho-	**a.** water
____ **2.** hydro-	**b.** life
____ **3.** atmo-	**c.** rock, stone
____ **4.** bio-	**d.** gas, vapor

B Circle the correct word in each sentence.

1. A spherical cloud is shaped like a (*square* / *circle* / *diamond*).
2. Lithology is the study of the physical qualities of (*rocks* / *water* / *gases*).
3. Countries that use hydropower to create energy are using (*water* / *rocks* / *air*).
4. Atmospherology is the study of (*water* / *rocks* / *gases*).
5. A biologist works with (*rocks* / *gases* / *living things*).

C Look at the sentences in Step B. Circle two words with *-logy*.

What do you think the word part *-logy* means? Write a short definition.

_____

Then add *-logy* to your chart of word parts from Latin and Greek.

D Add the new word parts from the box above and from step A on page 15 to your chart of word parts from Latin and Greek. Include the example words given in the box and in Step B. (Review "Words from Latin and Greek" on page 17 if necessary.)

3 Learning verbs with their prepositions V

Some verbs often occur with specific prepositions, for example: *benefit from*, *pay for*, *think about*. When you learn a new verb, notice if a preposition follows it. Try to learn the verb and the preposition together as a unit.

A The verbs in **bold** frequently occur with specific prepositions. Complete the sentences with the correct prepositions. Find the verbs in the reading, if needed.

1. Its thickness **ranges** _____ about 5 to 80 kilometers. (Par. 2)
2. Gases in the atmosphere create air for us to breathe, and they **protect** Earth _____ the sun's ultraviolet radiation. (Par. 4)
3. The lithosphere, the hydrosphere, the atmosphere, and the biosphere **connect** _____ each other in important ways. (Par. 6)
4. We **depend** _____ the atmosphere for air to breathe and on the hydrosphere for water to drink. (Par. 6)
5. Driving a car **contributes** _____ air pollution in the atmosphere. (Par. 6)

B Complete the sentences. First, add the correct preposition for each verb. Then choose an appropriate ending from the box.

the sun's dangerous rays	-238°C to -228°C	good health
other scientists all over the world	a cold environment	

1. Scientists use the Internet to connect ___with___ ___other scientists all over the world___ .
2. Sunscreen and sunglasses protect people _____ _____ .
3. The temperature on Pluto ranges _____ _____ .
4. Polar bears depend _____ _____ .
5. Drinking clean water and breathing clean air contribute _____ _____ .

C Complete these sentences with something that is true for you.

1. I depend _____ .
2. The summer temperature where I live ranges _____ .
3. I want to contribute _____ .

4 Making a pie chart A R

Textbooks often use statistics, that is, a group of facts that are stated as numbers. Sometimes it is helpful to organize a group of statistics in a pie chart. A pie chart shows the parts of a whole. Pie charts make the statistical information easier to read and understand.

A Read the following sentence from the text "Earth's Four Systems." Notice how the pie chart on the right organizes the information.

Water covers more than 70 percent of Earth.

Water and Land on Earth

B Reread paragraph 3 of the text. On a separate piece of paper, make a pie chart. Represent the amount of freshwater and saltwater on Earth in your chart. Look at your chart and write two sentences about the information. You can start this way:

Approximately _____ percent of the water on Earth is freshwater.

C Work in pairs or small groups. Survey your classmates and record their answers. You can use one of the questions below or ask your own question about our planet.

- *Do you think there is life beyond Earth?*
- *Which of Earth's four systems are you most interested in?*

D Make a pie chart to organize the results of your survey. Give the chart a title and write a few sentences about the information. For example, you might write sentences like these:

In our class, 75 percent of the students think there is life on other planets.

In our class, 40 percent of the students are most interested in learning more about the hydrosphere.

E Present your pie chart and information to the class.

PREPARING TO READ

1 Thinking about the topic R

Look at these photographs. Then discuss the questions below in a small group.

1. Do you know the names or locations of any of the places in the photographs?
2. What do they all have in common?
3. What are some other famous places made of rock?
4. What do people use rocks for? Try to think of at least three uses.
5. Did builders use any rocks to construct your school or your home? Are there any things inside your school or home that are made of rock?

2 Previewing key parts of a text R

A Read these key parts of the text "Rocks on Our Planet" on pages 19–20:

- the title
- the introductory paragraphs
- the headings
- the photographs and illustrations

B Answer these questions with a partner.

1. How many main types of rocks does Earth have?
2. What are their names?
3. What is the rock cycle?

Reading 3

ROCKS ON OUR PLANET

Earth is a terrestrial planet, that is, a planet with a rocky surface. It is covered with rocks of all ages. The oldest rocks in Earth's crust are more than three billion years old. The youngest ones are just a few minutes old. All rocks are made of minerals, or inorganic (nonliving) matter.

Different types of rocks form in different ways, but all rocks come from the same original hot material, **magma**, deep inside Earth. The three main types of rocks are igneous, sedimentary, and metamorphic.

magma very hot melted, or liquid, rock that is deep inside Earth

lava hot, melted rock that flows from a volcano

Main types of rocks

Igneous means "relating to fire." When the hot, fiery magma rises up through Earth's crust, it cools and becomes igneous rock. Sometimes the melted rock cools under the surface of Earth, but sometimes magma erupts from a volcano as **lava** and cools on Earth's surface. Granite, basalt, and pumice are examples of igneous rocks.

Rocks are very strong, but wind and rain over time can break off tiny pieces. These pieces of rock often end up at the bottom of a river or ocean. This layer of little rocks is called *sediment*. After thousands of years, many layers of sediment form on top of each other. The weight of all of the layers presses the sediment tightly together, and it becomes solid rock. Some common sedimentary rocks are limestone, sandstone, and shale.

The heat and pressure deep inside Earth can actually change one type of rock into another. This process is called *metamorphosis*, or the process of changing one thing into another. Rocks that form in this way are called *metamorphic rocks*. For example, great heat and pressure over a long time can change limestone, a sedimentary rock, into marble, a metamorphic rock.

The rock cycle

Over time, any type of rock can change into any other type. This process is called *the rock cycle*. Magma cools and forms igneous rocks. Igneous rocks break into small pieces and form

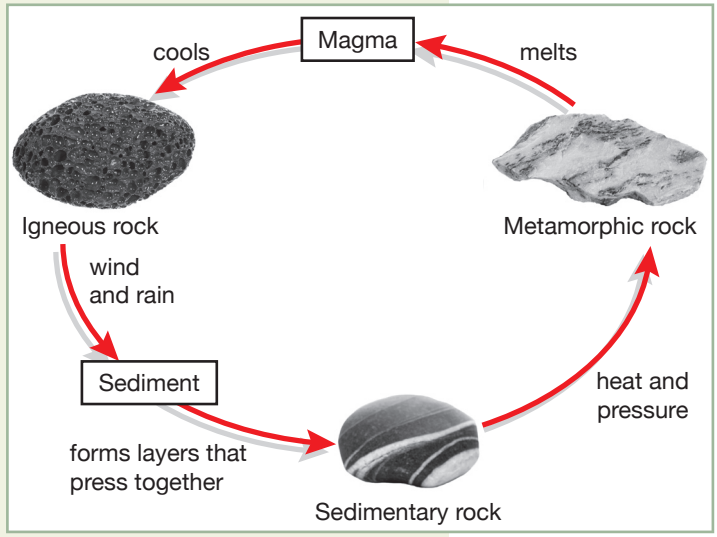


Figure 1.2 The rock cycle

sedimentary rocks. Deep inside Earth, great heat and pressure act on sedimentary and igneous rocks and change them into metamorphic
35 rocks. When all three kinds of rock move even deeper into Earth, they melt and become magma, and the rock cycle begins all over again. In this way, for millions of years, the rocks in Earth's crust have continuously changed form. Rocks are natural recyclers.

Save the Rocks!

There is something very unusual in Narendra Luther's living room – a giant, two-billion-year-old rock. The rock goes all the way up through the ceiling to the second floor. This rock is just one of many that formed in Hyderabad, India, billions of years ago. The people gave names to some of the rocks, such as Bear's Nose and Stone Heart. They used many of them to make temples and some to make billboards. They also had to destroy a large number of the rocks to make room for new buildings such as offices, apartments, hotels, and shopping malls. As the city develops, there is less and less room for these giant reminders of Earth's past.

Many people in Hyderabad want to save some of the rocks. The city now has a rock park, and several new buildings include rocks as part of their design, just like Mr. Luther's house. In this way, people can enjoy the new things that come with development, and they can also save part of their past.

AFTER YOU READ

1 Answering multiple-choice questions A R

One common type of question on tests and in textbooks is the multiple-choice question. Here are some strategies for answering this type of question:

- Read the question several times. Make sure you understand it before you try to choose an answer.
- Think of the correct answer and then look for it in the choices.
- Read all of the choices before you make a decision. Do not stop reading as soon as you think you have found the correct answer.

Answer the questions below based on the reading "Rocks on Our Planet." Then compare your answers with a partner's.

1. What are all rocks made of?
- **a.** lava
- **b.** water
- **c.** fire
- **d.** minerals

2. Which one of the following is a type of rock?
- **a.** sedimentary
- **b.** organic
- **c.** terrestrial
- **d.** metallic

3. Where do igneous rocks form?
- **a.** on Earth's surface
- **b.** under Earth's surface
- **c.** in a river
- **d.** both on and under Earth's surface

4. Where do many sedimentary rocks form?
- **a.** on Earth's surface
- **b.** under Earth's surface
- **c.** in a river
- **d.** in the wind

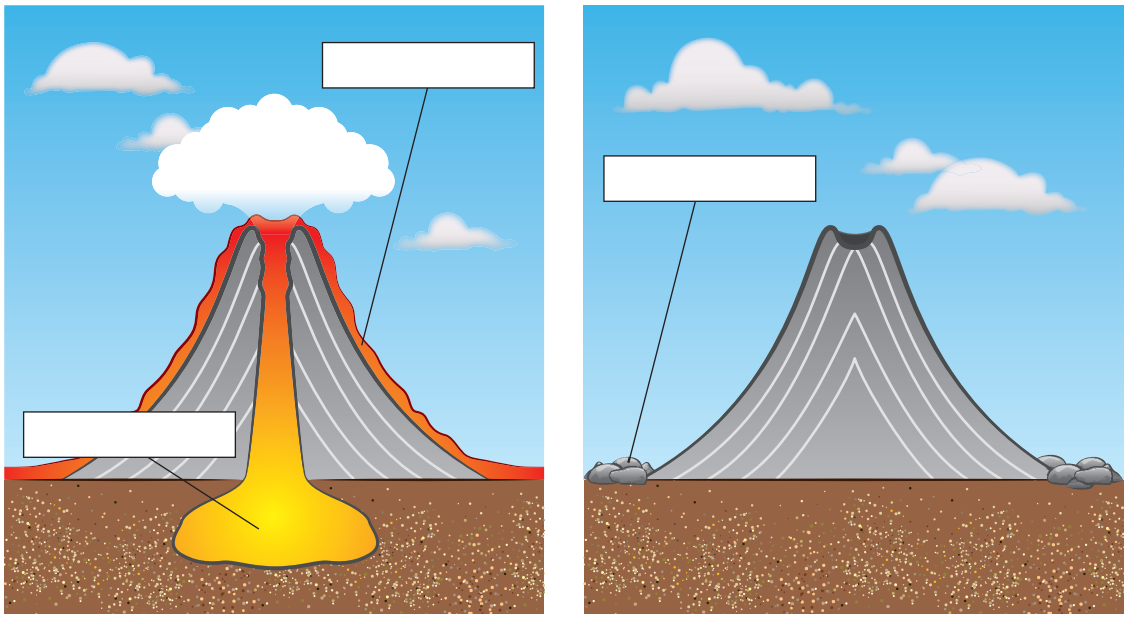
5. What forces create metamorphic rocks?
- **a.** wind and rain
- **b.** heat and pressure
- **c.** cooling and melting
- **d.** erupting and breaking

6. Which process causes rocks to change form continuously over time?
- **a.** the formation of sediment
- **b.** the rock cycle
- **c.** volcanic eruptions
- **d.** the cooling of magma

2 Labeling diagrams A R

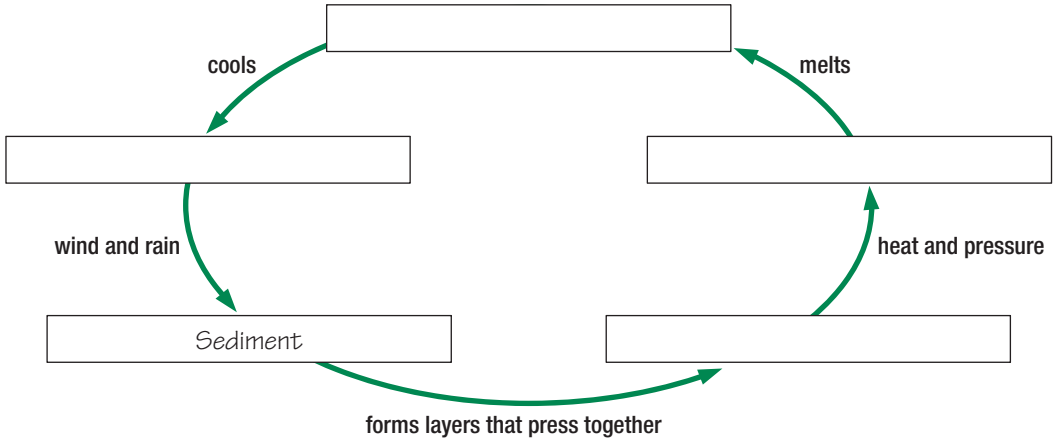
Labeling diagrams with key words helps you understand and remember complex information in a text. Science texts frequently discuss processes and parts of things, so this strategy is especially helpful when you read science texts.

A Look at the diagrams below. Review the following terms in the reading and label them in the diagram: *lava*, *magma*, and *igneous rock*.



A volcano during and after eruption

B Look at the diagram of the rock cycle below. Label the blanks with these terms: *metamorphic rock*, *sedimentary rock*, *igneous rock*, *sediment*, and *magma*.



The rock cycle

C Look at Figure 1.2 on page 19 to check your work for Step B.

3 Cues for finding word meaning V

A You learned that there may be cues to the meanings of words in a text.

1. These are three key terms in "Rocks on Our Planet." Find them in the text and circle them.
   - terrestrial planet
   - inorganic
   - metamorphosis
2. Underline the definition of each key term. Highlight the cue that helped you find the definition.
3. Compare your answers with a partner.

B Another cue to the meaning of new words is the phrase "X *is called* Y." Look at the example below. Notice the location of the key term *metamorphosis*. What is the meaning of *metamorphosis*?

The process of changing one thing into another is called metamorphosis.

C Reread the sections of the text below. Find and circle *sediment* and *the rock cycle*. Underline the cues to the meaning of these terms.

Rocks are very strong, but wind and rain over time can break off tiny pieces. These pieces of rock often end up at the bottom of a river or ocean. This layer of little rocks is called *sediment*. After thousands of years, many layers of sediment form on top of each other. The weight of all of the layers presses the sediment tightly together, and it becomes solid rock. Some common sedimentary rocks are limestone, sandstone, and shale.

Over time, any type of rock can change into any other type. This process is called *the rock cycle*. Magma cools and forms igneous rocks. Igneous rocks break into small pieces and form sedimentary rocks. Deep inside Earth, great heat and pressure act on sedimentary and igneous rocks and change them into metamorphic rocks. When all three kinds of rocks move even deeper into Earth, they melt and become magma, and the rock cycle begins all over again.

D Write a sentence for each term that explains the meaning of the term. You could begin your sentences this way:

Sediment is . . .

The rock cycle is . . .

Chapter 1 Academic Vocabulary Review

The following words appear in the readings in Chapter 1. They all come from the Academic Word List, a list of words that researchers have discovered occur frequently in many different types of academic texts. For a complete list of all the Academic Word List words in this chapter and in all the readings in this book, see the Appendix on page 206.

area	cycle	diverse	layer (n)	primary	professional
complex	design (n)	features	period	process (n)	ranges (v)

Complete the following sentences with words from the list.

1. A _____ marine biologist has studied at a university and has received a degree in marine science.
2. One of the unique _____ of the planet Mars is its reddish color.
3. The _____ of changing liquid water into ice requires a minimum temperature of 0° Celsius.
4. Earth is home to many _____ languages and cultures.
5. If an _____ is too cold, people may not want to live there.
6. Humans often have a _____ relationship with nature; they need it to survive but they don't always take care of it.
7. The _____ of a house is the overall plan of the house.
8. Similar to humans, stars are born, grow, exist, and then die; however, while most humans live less than 100 years, the life _____ of a star is billions of years.
9. The life span of a butterfly _____ from a few days to 12 months, depending on the species.
10. Two _____ uses of rocks are for building materials and decorative items.

Developing Writing Skills

In this section, you will learn to write complete sentences. Complete sentences are the building blocks of all academic writing. You will write eight to ten complete sentences. You will also use what you learn here to complete the writing assignment at the end of this unit.

Writing Complete Sentences

A sentence in English must have at least one subject. The subject of a sentence names who or what the sentence is about. It can be a single noun, a noun phrase (a noun + other words that give more information about the noun), or a pronoun. Pronouns are words that take the place of nouns. The subject pronouns are *I*, *you*, *he*, *she*, *it*, *we*, and *they*.

Common mistakes with subjects:

1. There is no subject in the sentence.

   INCORRECT: Discovered a new planet.

   To correct this sentence, add a subject.

   CORRECT: **An astronomer** discovered a new planet.

2. The same subject is written twice, usually both as a noun and as a pronoun. This is called a double subject. In English, sentences cannot have a double subject.

   INCORRECT: Earth it is a terrestrial planet.

   To correct this sentence, delete one of the subjects.

   CORRECT: **Earth** is a terrestrial planet.
   It is a terrestrial planet.

Sentences in English must also have at least one verb. Verbs are words of action (*erupt*, *press*, *move*) or being (*be*, *have*). Sometimes verbs are one word (*erupt*), sometimes they are two words (*is erupting*) or even three words (*has been erupting*).

Common mistakes with verbs:

1. There is no verb in the sentence.

   INCORRECT: Earth terrestrial planet.

   To correct this sentence, add a verb.

   CORRECT: Earth **is** a terrestrial planet.

2. There is only half of a verb. This often happens with the *-ing* form. A verb that ends in *-ing* cannot be a verb by itself. It needs a helping verb in order to be a complete verb.

   INCORRECT: The volcano erupting.

   To correct this sentence, add a helping verb or change the verb to a different form.

   CORRECT: The volcano **is** erupting.
   The volcano **erupted**.
   The volcano often **erupts**.

A Read the following paragraph. The subject of each sentence is underlined once and the verb is underlined twice.

The lithosphere is the hard surface of Earth. It has two layers. The first layer is the crust. The crust is a thin layer of rock. It covers the whole planet. The thickness of the crust ranges from about 5 to 80 kilometers. The second layer is called the *mantle*. The mantle is directly under the crust. The lithosphere is not one solid piece of rock. Instead, it is made up of many smaller pieces. Scientists call these pieces plates.

B Now read this paragraph and underline the subject of each sentence once and the verb twice.

The atmosphere is the air surrounding Earth. It is made up of gases. The primary gas is nitrogen. The gases in the atmosphere create air for us to breathe. They also protect Earth from the sun's ultraviolet radiation. Clouds form in the atmosphere. These clouds produce rain and snow.

C Each sentence in the paragraph below has one mistake. There are three mistakes with subjects and three mistakes with verbs. Mark the mistakes and correct them. Compare your answers with a partner. Then rewrite the paragraph on a separate piece of paper.

Narendra Luther having something very unusual in his house. Is a giant, two-billion-year-old stone. This rock just one of many in the city of Hyderabad, India. The people in the city they named some of the rocks. Used many to make temples or billboards. People destroying other rocks to make room for new development.

D Now write eight to ten complete sentences about planet Earth. Imagine that someone from another planet is coming to visit Earth and that you are the guide. What do you want to tell the visitor about our planet? Follow the steps below.

1. Have a short conversation with a partner. Talk about the information you want to share with the visitor. Make a list of your ideas.
2. Now write sentences that express your ideas. Be sure to:
   - **a.** Include information about the solar system, Earth's four systems, and rocks.
   - **b.** Include new vocabulary from this chapter.
   - **c.** Be sure that each sentence has a subject and a verb and that you use the correct parts of speech.
3. When you finish, exchange sentences with a partner and read each other's work.
   - **a.** Look at the structure of the sentences. Do they all have a subject and a verb? Find and underline the subjects in your partner's sentences. Draw two lines under the verbs.
   - **b.** Check (✓) your partner's three best sentences.
   - **c.** Discuss the best sentences. Explain your reasons for your choices. Then, talk about any problems with subjects and verbs in your partner's sentences.
4. Now reread your own sentences. Make changes to improve your sentences and rewrite them.

Chapter 2
The Dynamic Earth

PREPARING TO READ

Previewing key words

Learn the meaning of key words before you read. Key words are used to express important ideas in a text. Learning them before you read can make the text easier to understand.

A Read the following sentences. Think about the meanings of the words in **bold**. Use all the words in each sentence to help you.

_e_ **1.** Earth has seven **continents**. Asia is the largest continent, and Australia is the smallest.

____ **2.** The Pacific Ocean surrounds (goes all around) the **islands** of Hawaii.

____ **3.** The Pyrenees are mountains that form a **boundary** between France and Spain.

____ **4.** The Mid-Atlantic **Ridge** in the Atlantic Ocean is the longest mountain range on Earth.

____ **5.** The ocean floor is not flat. It has many tall ridges and deep **trenches**. For example, in the Pacific Ocean, the Mariana Trench is almost 11,000 meters below the surface of the ocean.

____ **6.** Earth's crust is not solid. It is made up of many different **plates**.

B Match the definitions with the words in **bold** above. Go back to Step A. Write the letter of each definition in the blank.

a. a line that divides two places or areas

b. large pieces of Earth's crust

c. a chain of mountains

d. areas of land completely surrounded by water

e. very large areas of land, often made up of many countries

f. long, narrow, deep holes

Reading 1

PLATE TECTONICS

Earth is always moving. You may not feel it, but our whole planet turns as it orbits the sun. There are movements on Earth's surface, too. Land moves, and mountains grow taller. For example, each year South America moves approximately two centimeters farther away from Africa, the islands of Hawaii move about seven centimeters to the northwest, and Mount Everest slowly rises five millimeters upward. Why are continents, islands, and mountains moving? For many years, scientists did not have an answer.

Look at the seven continents on a map of the world, and you may notice that they seem to fit together like pieces of a puzzle. In 1912, a German scientist named Alfred Wegener thought of an interesting idea. He suggested that millions of years ago, Earth had just one giant continent. He called it Pangaea (pan-GEE-uh). Pangaea means "all the Earth" in Greek. Wegener believed that as time passed, Pangaea broke apart, and the pieces drifted, or moved, to where the continents are today. He called his idea **continental drift theory**, but this idea did not explain how the continents moved. Wegener didn't know what scientists know today. Today, scientists know that the continents move because of **plate tectonics**.

continental drift theory the idea that, over time, the continents move toward or away from each other

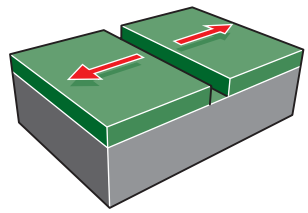
Tectonic plates and plate boundaries

In the 1960s, scientists discovered that Earth's crust is broken into large pieces. These pieces are called tectonic plates. No one knows the exact number of plates, but many scientists agree that there are about 12 large plates and several smaller ones. These plates are under the continents (continental plates) and under the oceans (oceanic plates). The plates, and the continents and oceans on top of them, move in different directions and at different speeds. Tectonic plates interact at places called plate boundaries. There are three types of plate boundaries: divergent boundaries, convergent boundaries, and transform boundaries.

plate tectonics the movement of large pieces of Earth's crust and the contact between them

Divergent boundaries

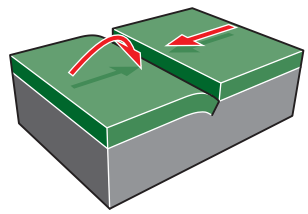
Divergent boundaries are where two plates *diverge*, or move away, from each other. When two oceanic plates diverge, the ocean floor grows wider, and an underwater ridge (mountain range) forms. A good example is the Atlantic Ocean. Millions of years ago, the Atlantic Ocean was a very small body of water. As the plates under it diverged, the ocean grew approximately two centimeters wider each year, and a ridge formed. Today the Atlantic is a huge ocean, and the Mid-Atlantic Ridge is the longest mountain range on Earth.



Divergent plate boundary

Convergent boundaries

Convergent boundaries are where two plates *converge*, or come together. When two oceanic plates converge, they form a trench and a group of islands, such as the Mariana Trench and the Mariana Islands in the Pacific Ocean. When an oceanic and a continental plate converge, they create a trench and a mountain range. The Peru-Chile Trench and the Andes Mountains formed in this way. When two continental plates converge, a mountain range forms. This process created the Himalayas, the great mountain range in Asia.

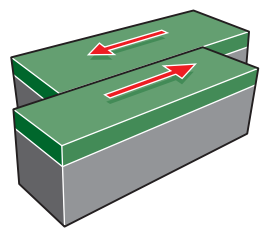


Convergent plate boundary

Transform boundaries

At transform boundaries, two plates slide past each other. As they move, they can bump, or hit, each other. This movement often causes an earthquake, which is a movement of Earth's crust. People who live along the coast of California often experience earthquakes. They are very common at the transform boundary between the Pacific Plate and the North American Plate.

Continental drift continues. Even though the plates move just a few centimeters a year, over a long period of time, they cause Earth to grow and change in dramatic ways.



Transform plate boundary

AFTER YOU READ

1 Using headings to remember main ideas R A

After you read a text, look back at the headings. The headings will help you remember the main ideas.

A Read these headings from the text "Plate Tectonics."

a. Tectonic plates and plate boundaries
b. Divergent boundaries
c. Convergent boundaries
d. Transform boundaries

B Work with a partner. Match the headings in Step A with the main ideas below. Write the letter of the correct heading in the blank.

____ **1.** Sometimes two plates move away from each other. This often creates ridges.
____ **2.** Sometimes two plates come together, creating mountains, islands, and trenches.
____ **3.** Earth's crust is divided into about 12 large pieces and several smaller ones that move and interact with each other.
____ **4.** When two plates slide by each other, they can bump. This often causes an earthquake.

2 Prefixes V

A **prefix** is a word part that comes at the beginning of a word. Each prefix has a meaning. For example, the prefix *re-* means "again." To *reread* a book means to read it again. To *rewrite* a letter means to write it again. Knowing the meaning of a prefix can often help you guess the meaning of a word.

Prefix	Meaning
con-	together, with
cent-	100
inter-	between two or more things or groups
mil-	1,000

A Work with a partner. Find these words in the text "Plate Tectonics": *centimeters*, *millimeters*, *converge*, *interact*. Circle them. Look at the prefixes and guess the meanings of these words. Use a dictionary if necessary.

B Here are some new words with the prefixes you learned.

century	convention	interplanetary	millennium

Complete the sentences with the correct words from the box.

1. Do you think that someday there will be _____ flights between Earth and Mars?
2. The most powerful earthquake of the past _____ happened in Chile in 1960. It was the strongest earthquake in the last 100 years.
3. This week there is a _____ of astronomers at the university. Hundreds of astronomers are meeting to talk about their research.
4. Many people had parties to celebrate the start of the new _____ in the year 2000.

C Think of more words that start with the prefixes *cent-*, *con-*, *inter-*, or *mil-*. Make a class list.

3 Prepositional phrases V

A **prepositional phrase** is a preposition + a noun (or noun phrase) or a pronoun.
Examples: *on Earth's surface, in the 1960s, at different speeds*

	preposition	noun phrase
Example:	**on**	**Earth's surface**

Prepositional phrases often answer the questions *Where?*, *When?*, or *How?*

A Find the following prepositional phrases in the text. Underline them. Decide what question each phrase answers. Write *Where?*, *When?*, or *How?* in the blank.

Where? **1.** on Earth's surface
_____ **2.** along the coast of California
_____ **3.** (millions) of years ago
_____ **4.** under the continents
_____ **5.** at different speeds
_____ **6.** in this way

B Work with a partner. Find six more prepositional phrases in the text and underline them. Decide if each phrase answers the question *Where?*, *When?*, *How?*, or none of these.

4 Reading maps A R

Maps show different places on Earth's surface. They can help you find the places you read about. Most maps have a key that includes information to help you read the map. In addition, the key often has a compass or a drawing that shows the directions: North, South, East, and West.

A Look at the map of the world's tectonic plates on page 28. Work with a partner and find these continents: Eurasia (Europe and Asia), North America, South America, Antarctica, Australia, Africa.

B Read the statements and answer *T* (true) or *F* (false). Use the information from the map.

____ **1.** The North American Plate is northeast of the Pacific Plate.
____ **2.** The Pacific Plate is smaller than the African Plate.
____ **3.** The Nazca Plate is east of the South American Plate.
____ **4.** The Australian Plate is south of the Indian Plate and the Philippine Plate.
____ **5.** There is no Atlantic Plate.

C Write three sentences about the map. They may be true or false. Exchange sentences with a partner. Decide if your partner's sentences are true or false.

5 Writing simple and compound sentences

You have learned that every English sentence must have at least one subject and one verb. A sentence with only one subject and one verb is called a **simple sentence**.

subject	verb	
Continental drift	continues	today.

A sentence with more than one subject, more than one verb, and a coordinating conjunction (connecting word) is called a **compound sentence**. The most common coordinating conjunctions are *and*, *or*, and *but*. There is always a comma before these conjunctions.

subject	verb		coordinating conjunction	subject	verb	
Some plates	are	under the continents,	and	some plates	are	under the oceans.

Try to use both simple and compound sentences in your writing. Vary the sentence structure, and you will make your writing more interesting to read.

A Go back to the text. Find three simple sentences and three compound sentences. Write these sentences on a separate piece of paper. Underline the subjects once and the verbs twice. Circle the coordinating conjunctions. Compare your answers with a partner's.

B Write four or five sentences about what you learned in the reading "Plate Tectonics." Try not to look back at the text. Include simple and compound sentences. You can use these words and phrases: *continental drift theory*, *continents*, *Pangaea*, *tectonic plates*, *divergent boundaries*, *convergent boundaries*, and *transform boundaries*. Compare your sentences in a small group.

PREPARING TO READ

Building background knowledge R

Learning basic facts about the topic of a text builds your knowledge of the topic. This can help tell you what kinds of terms and ideas you will read about.

A Read the following paragraph about volcanoes.

A volcano is a mountain with a hole at the top. When a volcano erupts, it throws smoke, gas, ashes, and lava (melted rock) out of the hole. Some volcanoes, like Mauna Loa in Hawaii, are active. This means that they are erupting or that they could erupt at any time. Other volcanoes are extinct, or dead. Scientists believe these volcanoes will not erupt again.

B Discuss these questions with a partner.

1. Are there any volcanoes where you live? Are they active or extinct?
2. Do you know the names of any famous volcanoes? If so, which ones?
3. Have you ever seen a volcano erupt? If so, where did you see it? What did you see?

C Test your knowledge of volcanoes. Answer these questions with a partner.

1. Which is not a volcano?
   - **a.** Mount Fuji (Japan)
   - **b.** Mount Everest (Nepal)
   - **c.** Mount Vesuvius (Italy)
   - **d.** Krakatau (Indonesia)
2. Which country has no active volcanoes?
   - **a.** Japan
   - **b.** Italy
   - **c.** The United States
   - **d.** Australia
3. Which island was not formed by volcanic activity?
   - **a.** Greenland
   - **b.** Iceland
   - **c.** The Hawaiian Islands (U.S.A.)
   - **d.** Honshu Island (Japan)
4. Which volcano is extinct?
   - **a.** Sangay (Ecuador)
   - **b.** Pinatubo (Philippines)
   - **c.** Kohala (Hawaii, U.S.A.)
   - **d.** Stromboli (Italy)

Reading 2

VOLCANOES

One afternoon in 1943, a farmer in Paricutín, Mexico, went to his cornfield. In the cornfield, he saw something unusual. It was a hole in the ground with smoke coming out of it. The next day, there was a 10-meter hill in the same place. Rocks were flying from the hilltop, and lava was flowing down its sides. After one year, the hill was 450 meters high, and it continued to erupt. The farmer was amazed, and frightened, too. He was watching the birth of a volcano.

The formation of volcanoes

When the magma under Earth's crust breaks through to the surface, it creates a volcano. Volcanoes usually form at plate boundaries, where the crust is the weakest. More than 75 percent of Earth's volcanoes are located around the Pacific Plate, in a region called the Ring of Fire. In the Atlantic Ocean, there are many volcanoes at the boundary between the North American Plate and the Eurasian Plate. Directly on top of the two diverging plates is the volcanic island of Iceland.

Figure 2.1 The ring of fire

Most volcanoes form near plate boundaries, but a few do not. Instead, they form in the middle of a plate over a hot spot (a stream of hot magma that is deep inside Earth). This magma flows up and breaks through the tectonic plate above it. The lava from the hot spot eventually creates a volcanic island. Hot spots do not move, but tectonic plates do. When the plate moves over the hot spot, the volcano also moves, so it stops erupting. Nearby, a new volcanic island forms over the hot spot. Over millions of years, this process results in a whole chain of islands. This is how the Hawaiian Islands were formed.

Active and extinct volcanoes

In the world today, there are approximately 1,500 active volcanoes. Active volcanoes are volcanoes that are erupting or that might erupt in the future. Active volcanoes can be extremely destructive. Lava, gases, **ash**, and rocks can suddenly erupt from a volcano and destroy everything around it. One active volcano is Mount Vesuvius. Mount Vesuvius erupted in 79 CE and buried the city of Pompeii, Italy, in ash. Mount Tambora (Indonesia, 1815), Mount Krakatau (Indonesia, 1883), and Mount Pelée (Martinique, 1902) also caused major destruction.

ash the soft gray or black powder that is left when something burns

Some volcanoes will not erupt again. These are called *extinct volcanoes*. Scientists generally agree that Hawaii's oldest volcano, Kohala, is extinct.

Volcanoes can be destructive and deadly. However, they can also have a positive effect on Earth. Volcanoes form new mountains, new islands, and new land. In this way, volcanic activity is an important natural process that contributes to our planet's growth.

The Year Without a Summer

Many scientists believe that the eruption of Mount Tambora in Indonesia in 1815 was the most destructive volcanic eruption in the past 10,000 years. People heard the explosion 2,600 kilometers away. One hundred fifty cubic kilometers of ash fell within the first 24 hours of the eruption. Huge amounts of ash filled the air. Over the next year, the large amount of ash in the air blocked the sun's rays from reaching Earth. This had a dramatic effect on weather patterns on the other side of the world.

In New England and Canada, snow fell during the summer of 1816. Cold weather killed farmers' crops and caused serious food shortages. In Europe, the situation was much worse. Cold weather and heavy rains caused famine, or great hunger, in France and Switzerland. In Ireland, cold rain fell almost every day that summer. Thousands of people were hungry, and many got a disease called typhus. This terrible illness spread to other parts of Europe, and all of this trouble started with the volcanic eruption.

AFTER YOU READ

1 Answering true / false questions A

True / false questions are common on tests and in textbooks. Here are some guidelines for answering this type of question:

- Most activities and tests with true / false questions have approximately the same number of true sentences and false sentences.
- Sentences with words like *never*, *always*, *only*, and *all* are often false.
- Sentences with words like *often*, *many*, and *sometimes* are often true.

A Write *T* (true) or *F* (false) for each statement. Find the answers in the reading "Volcanoes."

____	**1.** Volcanoes often form at places where Earth's crust is weak.	Par. ____
____	**2.** The Ring of Fire is in the Atlantic Ocean.	Par. ____
____	**3.** Iceland is directly on top of two divergent plates.	Par. ____
____	**4.** Hot spots are not located near plate boundaries.	Par. ____
____	**5.** One giant volcanic eruption formed the Hawaiian Islands.	Par. ____
____	**6.** Today the world has approximately 15,000 active volcanoes.	Par. ____
____	**7.** Mount Vesuvius in Italy is an active volcano.	Par. ____
____	**8.** Volcanoes always have a negative effect on Earth.	Par. ____

B Now go back to Step A. Write the number of the paragraph where you found each statement.

C Work with a partner. Find the sentences you marked false in Step A and correct them.

2 Writing definitions W

Writing the definition of a word helps you remember the word. Here are two common ways to write a definition:

1. (A) _____ is / are (a) _____ .
A plate **is a** large piece of Earth's crust.
Marble **is a** metamorphic rock.
Plates **are** large pieces of Earth's crust.

2. (A) _____ is / are a _____ that . . .
A planet **is a** large object **that** orbits the sun.
Planets **are** large objects **that** orbit the sun.

A Complete the definitions of the words in **bold** below. Use the definitions in Reading 2 "Volcanoes," but try not to look back at the text.

1. A **hot spot** is a _____ .
2. An **active volcano** is a volcano that _____ .

B Complete the definitions of the words in **bold** below. Use the definitions in Reading 1 "Plate Tectonics," but try not to look back at the text.

1. **Tectonic plates** are _____ .
2. A **ridge** is _____ .
3. An **earthquake** is a _____ .

C Compare your definitions in Steps A and B with a partner. Now look back at the texts to check your work.

3 Reading boxed texts

Many academic textbooks include boxed texts. Boxed texts usually contain interesting material that will add to your understanding of the main text.

Boxed texts can have different purposes. For example, they may:

- give interesting examples of ideas in the main text
- give more details about a topic in the main reading
- discuss a topic that is closely related to the topic of the main text
- help you apply the information from a text to your own life
- present a point of view, or way of thinking about something, that is different from the one in the main text

A Reread the boxed text "The Year Without a Summer" on page 35.

B In a small group, discuss the purpose of the boxed text. Does it match any of the purposes in the box above?

C Go back to the boxed texts in Chapter 1 on pages 6 and 20. What is the purpose of each boxed text? Write your answers below.

- "The Story of Pluto": _____ .
- "Save the Rocks!": _____ .

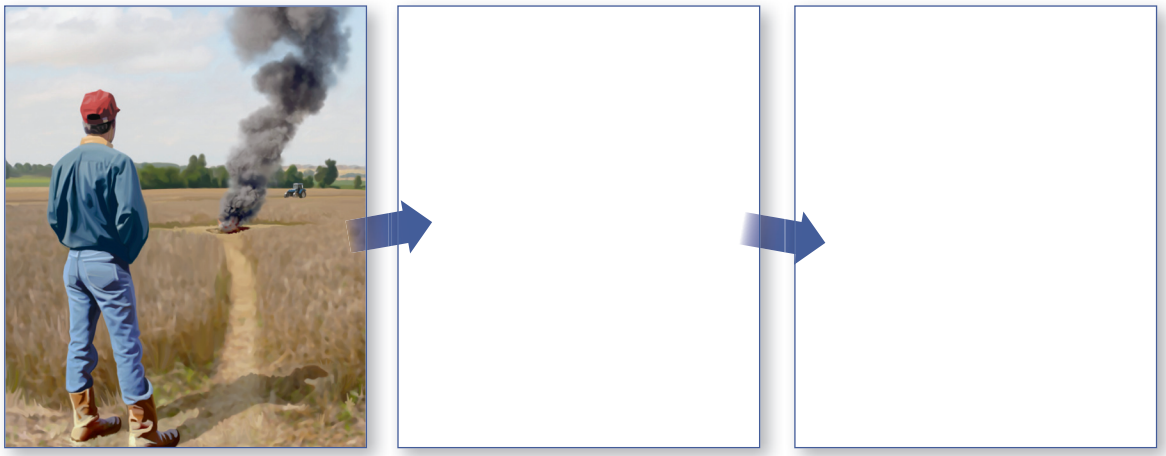
4 Illustrating main ideas R A

Drawing a picture of a key point from the text can be a useful way to take notes and check your understanding of the reading.

A Reread paragraph 1 of "Volcanoes."

B Look at the illustration below. This shows what happened the first day the farmer went into his cornfield.

Title: _____



the first day | the next day | one year later

C In the second box, draw a picture of what happened the next day. In the third box, draw what happened one year later. When you are finished, give your set of illustrations a title.

D Choose another section of the text to illustrate. Use a separate piece of paper to make your illustrations.

E Share your illustrations in a small group. Guess which idea each illustration represents. Do they help you understand the ideas in the text better? Which illustration do you like the best? Why?

PREPARING TO READ

Thinking about the topic R

A Work with a partner. Look at the photographs and answer the questions below.

1. What do you see in the photographs?
2. What do you think happened?
3. Where and when do you think the photographs were taken?

B Discuss the following questions in a small group.

1. What is an earthquake?
2. Why do some places, such as California and Japan, have so many earthquakes?
3. Does the place where you live have earthquakes?
4. Have you ever been in an earthquake? If so, describe your experience.
5. What are three things people can do to stay safe during an earthquake?

Reading 3

EARTHQUAKES

As 1974 came to an end and the new year began, animals in Haicheng, China, started acting strangely. Snakes normally hibernate underground during the winter, but they suddenly came out of their holes. Dogs began to bark and run around wildly, and horses became so upset that some ran away. Why were the animals acting like this? Many people think that the animals sensed what was coming: On February 4, 1975, the earth began to shake and buildings collapsed as a very large earthquake struck the city of Haicheng.

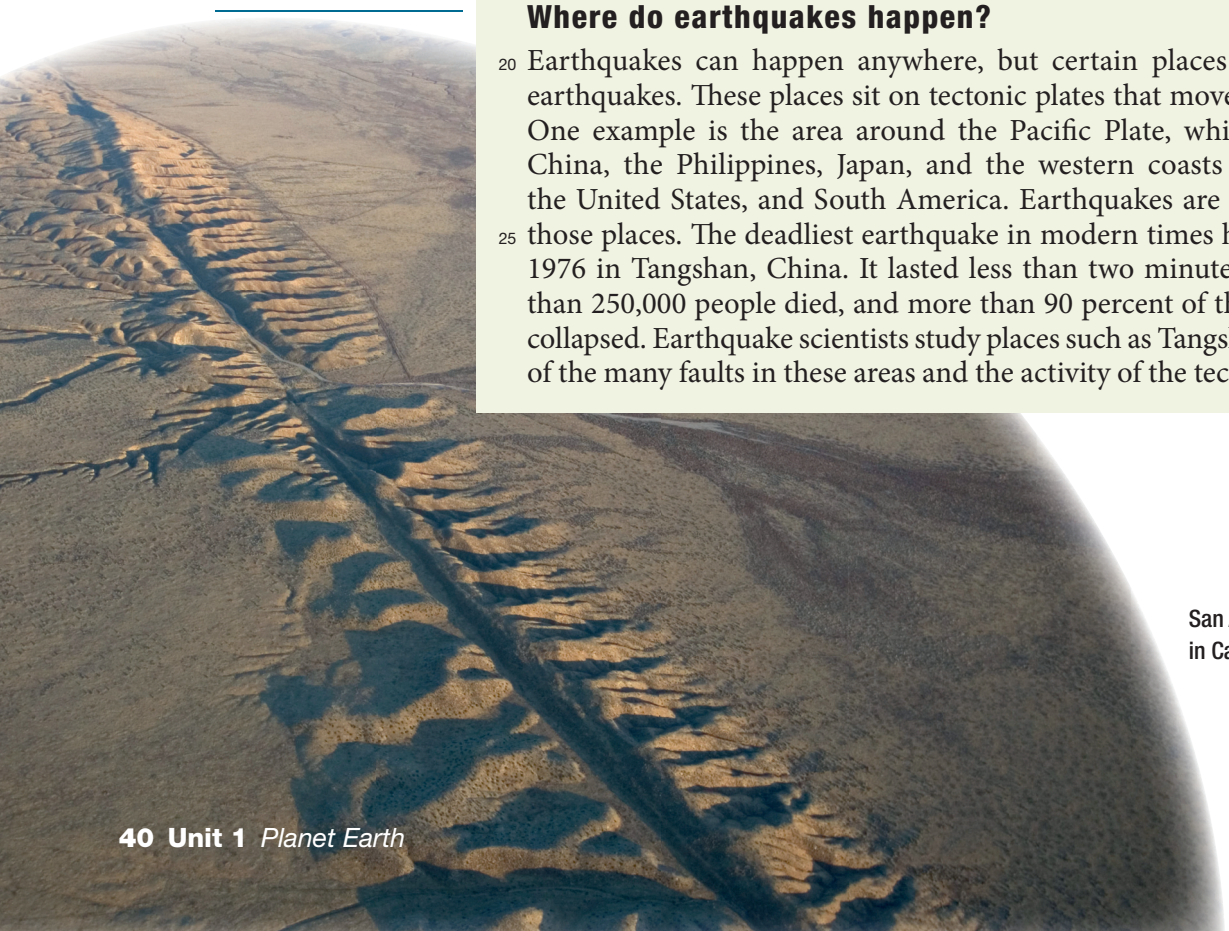
What causes earthquakes?

When the tectonic plates that make up Earth's crust move past each other, they often bump or rub against each other. The earth, or ground, above the plates moves as well. This movement is called an earthquake. Sometimes the plates get stuck. The pressure increases as the two plates try to move past each other but cannot. They finally move with a sudden and powerful jerk. This can also cause an earthquake. During a small earthquake, the ground simply shakes a little, and people may not even notice. However, a strong movement can cause the ground to shake and roll violently. It can make buildings and bridges fall. It can also cause the ground to split open and form a large **fault**, or crack.

fault a large break in the surface of the earth

Where do earthquakes happen?

Earthquakes can happen anywhere, but certain places have more earthquakes. These places sit on tectonic plates that move frequently. One example is the area around the Pacific Plate, which includes China, the Philippines, Japan, and the western coasts of Canada, the United States, and South America. Earthquakes are common in those places. The deadliest earthquake in modern times happened in 1976 in Tangshan, China. It lasted less than two minutes, but more than 250,000 people died, and more than 90 percent of the buildings collapsed. Earthquake scientists study places such as Tangshan because of the many faults in these areas and the activity of the tectonic plates.



San Andreas fault in California

Can people prepare for an earthquake?

Scientists cannot predict when an earthquake will happen. However, they are able to tell us the areas where earthquakes are most likely to happen. This information helps people in those areas to prepare. They can learn what to do before, during, and after an earthquake. Engineers in those areas can build bridges and buildings that are better able to survive earthquakes. We cannot stop tectonic plates from moving, but with accurate information and good planning, we can help people live more safely on our planet.

Still Standing: Earthquake-Resistant Buildings

Humans can be very daring. They swim with sharks and run with bulls. They fly to the moon and dive in the ocean. They also build very tall buildings. In 2010, the Burj Khalifa tower (828 meters) in the United Arab Emirates took the title of world's tallest building away from Taipei 101 (508 meters) in Taiwan. Most likely, someone will soon build a tower taller than Burj Khalifa. However, as people build taller and taller buildings, they must also consider how an earthquake might affect these enormous skyscrapers.

Earthquakes can be very destructive. Therefore, people who design buildings try to find ways to make even the tallest buildings stronger and more flexible. They hope their new designs will make the buildings more earthquake resistant. For example, Taipei 101 has a giant steel ball hanging in the middle of the building. If an earthquake causes the building to sway, the ball will move in the opposite direction. This keeps Taipei 101 balanced and helps stop it from falling down.

Another good example of an earthquake-resistant building is the Sabiha Gökçen International Airport in Turkey. The main building of the airport does not touch the ground. Instead, it sits on top of 300 rubber and steel bearings. When an earthquake shakes the ground, the balls let the tower move side to side and back and forth. Without the rollers, the walls of the building would shake, and it could collapse.

Inside Taipei 101

AFTER YOU READ

1 Reading for main ideas R

It is very important to learn how to find the main idea of a paragraph or longer text. To identify the main idea of a text, ask "What is it about?" or "What idea do all the sentences discuss?"

A Read the sentences. These are main ideas in "Earthquakes." Find each idea in the reading and then write the number of the paragraph that discusses it.

1. Some places experience more earthquakes than others. Par. ____
2. Animals may have predicted the earthquake that struck Haicheng, China, in February of 1975. Par. ____
3. Earthquakes happen when two tectonic plates bump or get stuck as they move past each other. Par. ____
4. Scientists cannot predict when an earthquake will happen, but their information can help people prepare for one. Par. ____

B Check (✓) the sentence that expresses the main idea of the whole text.

____ **1.** A serious earthquake occurred in Haicheng, China, in 1975.

____ **2.** Earthquakes, caused by the movement of tectonic plates, can happen anywhere, and people need to prepare for them.

____ **3.** It is impossible to prepare for earthquakes because no one knows when they will happen.

____ **4.** Earthquakes usually last a very short period of time, but they can kill thousands of people and cause buildings to collapse.

2 Using grammar, context, and background knowledge to guess meaning V

Sometimes you can use grammar, context, and background knowledge to guess the meaning of new words.

Grammar: Look at the part of speech. It tells you if the new word is a thing (noun), an action (verb), or a descriptive word (adjective).

Context: Look at the words and sentences before and after a new word. They often include a definition or a description that can help you guess the meaning.

Background knowledge: Consider what you might already know about a new word. You may recognize a word part or know something about the context's topic.

A Read the following paragraph from "Earthquakes."

As 1974 came to an end and the new year began, animals in Haicheng, China, started acting strangely. Snakes normally **hibernate** underground during the winter, but they suddenly came out of their holes. Dogs began to **bark** and run around wildly, and horses became so **upset** that some ran away. Why were the animals acting like this? Many people think that the animals **sensed** what was coming: On February 4, 1975, the earth began to shake and buildings **collapsed** as a very large earthquake struck the city of Haicheng.

B Work with a partner. Match the words in **bold** in Step A with the definitions below. Use the strategies for guessing meaning.

Example: Snakes normally **hibernate** underground during the winter.

Strategies

- grammar — You can guess that the word *hibernate* is a verb (an action).
- context — The other words in the sentence tell you that hibernate is something that animals do underground during the winter.
- background knowledge — You may know that some animals sleep during the winter.

hibernate **a.** sleep during the winter

_____ **b.** felt something without seeing or hearing it

_____ **c.** make a loud animal noise

_____ **d.** fell down

_____ **e.** worried, unhappy

C Discuss your answers in a small group. Tell which strategies you used to guess each word.

3 Pronoun reference

Pronouns are words that take the place of nouns. Read the sentence below. Notice that the pronoun *he* refers to "professor." The pronoun *it* refers to "test."

Next week, my professor will give us a test on plate tectonics. He told us that we should review our notes to prepare for it.

Skillful writers use pronouns to replace nouns. Pronouns can add interest and help connect sentences and ideas. Find the noun that a pronoun refers to, and you will understand the meaning of the pronoun.

Follow these rules to find the noun that a pronoun refers to:

- Look for the noun that comes before the pronoun. Pronouns usually come after the nouns that they refer to.
- Notice if the pronoun is singular or plural. That will tell you to look for a singular noun or a plural noun.

A Read these sentences from the text "Earthquakes." The pronouns are underlined. Draw an arrow from each pronoun to the noun or noun phrase it refers to.

1. When the tectonic plates that make up Earth's crust move past each other, they often bump or rub against each other.
2. The pressure increases as the two plates try to move past each other but cannot. They finally move with a sudden and powerful jerk.
3. However, a strong movement can cause the earth to shake and roll violently. It can make buildings and bridges fall. It can also cause the earth to split open and form a large fault, or crack.
4. The deadliest earthquake in modern times happened in 1976 in Tangshan, China. It lasted less than two minutes, but more than 250,000 people died, and more than 90 percent of the buildings collapsed.

B Compare your work with a partner's.

4 Showing contrast

Writers contrast (show the difference between) ideas with words such as *however* and *but*.

The word *however* often starts a sentence. There is always a comma after it.

An active volcano may not have erupted in thousands of years. However, it could erupt sometime in the future.

The word *but* is a coordinating connector. It comes in the middle of a sentence and has a comma before it. It contrasts two ideas in a compound sentence.

Most volcanoes form near plate boundaries, but a few do not.

A Complete these sentences with *but* or *however*. Then find the sentences in the text "Earthquakes" and check your answers.

1. During a small earthquake, the earth simply shakes a little, and people may not even notice. _____, a strong movement can cause the earth to shake and roll violently.
2. Earthquakes can happen anywhere, _____ certain places have more earthquakes because they sit on tectonic plates that move frequently.
3. Scientists cannot predict when an earthquake will happen. _____ , they are able to identify the areas where earthquakes are most likely to occur.
4. We cannot stop tectonic plates from moving, _____ with accurate information and good planning, we can help people live more safely on our planet.

B Write your own sentences with *but* and *however*. Follow the example. Use correct punctuation and capital letters where necessary. Use a separate piece of paper.

1. Volcanoes are destructive.

   Volcanoes are destructive, but they also create new land on Earth.

   Volcanoes are destructive. However, they also create new land on Earth.
2. California has earthquakes every day.
3. Small earthquakes do not shake the ground very much.
4. You may not feel the ground move.

Chapter 2 Academic Vocabulary Review

The following words appear in the readings in Chapter 2. They all come from the Academic Word List, a list of words that researchers have discovered occur frequently in many different types of academic texts. For a complete list of all the Academic Word List words in this chapter and in all the readings in this book, see the Appendix on page 206.

accurate	dramatic	major	region
collapsed	eventually	normally	survive
create	interact	predict	theory

Complete the sentences with words from the list.

1. One _____ of the world that has a lot of earthquakes is the west coast of South America.
2. Volcanic eruptions can _____ many problems for the people who live nearby. The lava can destroy houses, and the ash can cause breathing difficulties.
3. _____ people do not feel the earth move beneath their feet, but sometimes they do feel an earthquake shake the ground.
4. Did huge volcanic eruptions kill the dinosaurs on our planet? That is one idea. Another _____ is that the dinosaurs died because an asteroid hit Earth.
5. It is important not to panic in an earthquake. You can _____ an earthquake, but you must stay calm and get to a safe place.
6. When scientists collect data, it is important that the information is _____ . Incorrect information could ruin their research.
7. Scientists study the recent activity of a volcano to try to _____ when it will erupt.
8. The roof of the house _____ when a large rock fell on it.
9. It is often useful to _____ with your classmates outside of school. You can make new friends and help each other study.
10. There is one _____ problem with staying up all night to study for a test. You are often too tired to remember the information the next day!

Practicing Academic Writing

In Unit 1, you learned about planet Earth and its physical features. Based on everything you have read and discussed in class, you will write a paragraph about this topic.

A Special Place

You will write one academic paragraph about a place on Earth that you like. You might choose a place that you think is beautiful, interesting, or fun.

PREPARING TO WRITE

1 Using correct paragraph form

A **paragraph** is a group of sentences about the same topic. In general, paragraphs in English have six to ten sentences, but they can be shorter or longer. When you write a paragraph, follow these rules of form:

- Indent the first sentence of a paragraph. That means, start the first sentence five spaces from the left margin. Sometimes you will see paragraphs that do not follow this rule. However, in your writing, you should always indent the first sentence.
- Begin each sentence with a capital letter. End each sentence with punctuation such as a period or question mark.
- Write one sentence directly after another sentence. Do this until you get to the end of a line. Do not use a separate line for each sentence.

A Look at the following paragraph. With a partner, identify the three ways this paragraph uses correct form.

Look at the seven continents on a map of the world, and you may notice that they seem to fit together like pieces of a puzzle. In 1912, the German scientist Alfred Wegener suggested that millions of years ago, Earth had just one giant continent. He called it *Pangaea*, which means "all the Earth" in Greek.

B The following text does not follow the rules of correct paragraph form. Rewrite the text as a paragraph. Use a separate piece of paper. Use correct paragraph form and correct punctuation.

There are four basic types of volcanoes: shield volcanoes,
composite volcanoes, cinder cone volcanoes, and supervolcanoes.
shield volcanoes are generally very large, and lava usually flows down their sides.
Composite volcanoes are smaller than shield volcanoes.
They can have both small eruptions and big eruptions
The smallest type of volcano is the cinder cone volcano.
For example, the Paricutín volcano was a cinder cone volcano.
the largest and most dangerous volcanoes are supervolcanoes, and they can
cause a lot of destruction.
Scientists continue to study these four types of volcanoes to learn more about our planet.

C Compare your paragraph with a partner's.

2 Using correct paragraph structure

In addition to following correct paragraph form, academic paragraphs often have a specific structure:

- The first sentence of the paragraph is the **topic sentence**. It explains the main idea of the whole paragraph.
- The middle sentences of a paragraph are **supporting sentences**. They give details and examples that explain the main idea.
- The final sentence, or **concluding sentence**, ends the paragraph by reminding the reader about the main idea of the paragraph.

Not all academic paragraphs follow this structure, but many do. Be sure to learn this pattern. It will help you read and understand academic texts.

A Reread paragraph 3 of the text "Earthquakes." Underline and label the topic sentence (*TS*). Next, bracket ([ ]) and label the supporting sentences (*SS*). Then draw two lines under the concluding sentence and label it (*CS*).

B Read the following paragraph.

There is no way to stop an earthquake, but there are several things you can do to prepare and protect yourself. Before an earthquake happens, you should make an emergency plan. You should also prepare an emergency supply kit with a battery-powered radio, a flashlight, and enough food and water for three days. Remember to do these things during an earthquake: Stay away from windows and tall furniture inside a building. Get on the floor, cover your head, and hold on to something until the shaking stops. Find a place away from buildings and trees outside and get on the ground. After the earthquake stops, check for injuries – are you hurt? Listen to the radio for instructions. If you are in an unsafe building, go outside. An earthquake can be a frightening experience, but knowing what to do before, during, and after it will help you stay safe.

C Work with a partner. Answer these questions about the paragraph in Step B.

1. Does the paragraph have a topic sentence? If so, underline it, and label it (*TS*).
2. How many supporting sentences are there? Bracket ([ ]) and label them (*SS*).
3. Does the paragraph have a concluding sentence? If so, draw two lines under it, and label it (*CS*).

NOW WRITE

Writing first drafts

Your first piece of writing on a topic is a first draft. Very few people write a "perfect" first draft. A first draft gets some ideas and sentences down on paper so you can then read the paragraph and find ways to improve it.

A Think about your favorite place on Earth. It can be a continent, an island, a mountain range, a river, a lake, or some other place. Consider places that you visited or learned about in a book, a movie, or on the Internet.

B Write about this place on a piece of paper for five minutes. Do not stop to erase ideas or correct mistakes. Just freewrite about the place without stopping. The purpose of this task is to write down as many thoughts and ideas as you can.

C Have a short conversation with a partner. Tell each other about your favorite places.

D Now write a paragraph about your favorite place.

1. Use this topic sentence to begin. Choose the word that best describes your place.
   topic sentence: *The most* (*interesting* / *exciting* / *beautiful*) *place on Earth that I know is* _____ .
2. Write five or six **supporting sentences** that show why your topic sentence is true.
3. Complete this sentence to end your paragraph.
   concluding sentence: *For all these reasons*, _____ *is my favorite place*.
4. Remember to use correct paragraph form and structure.
5. Try to include some of the new vocabulary that you learned in this chapter.
6. Try to vary your sentence structure. Use simple and compound sentences. Try to include prepositional phrases, and use pronoun references correctly.

AFTER YOU WRITE

After you complete your first draft, you can revise it. When you revise, you find ways to make your writing better. Often, it helps to have another person read your writing and offer suggestions for improvement.

A Exchange paragraphs with a partner and read each other's work. Then discuss the following questions.

1. Are your favorite places similar or very different?
2. Does your partner's paragraph use correct paragraph form? Are there any problems with form that need to be corrected?
3. Does your partner's paragraph have a clear topic sentence at the beginning and a clear concluding sentence at the end? If not, help your partner write one.
4. Do the supporting sentences explain the topic sentence? Are there any sentences that do not? Cross off any sentences that do not support the topic sentence. Do you think the paragraph has enough supporting sentences? If not, help your partner write more sentences.

B Make any changes to your paragraph that you think will improve it.

C Rewrite your paragraph.