CHAPTER 4 Lesson 1

Earth's Changing Crust

Student Edition, pp. 68–73

1 FOCUS

Lesson Prep

Key Objectives

- **Identify** Earth's layers.
- **Recognize** that Earth's crust is separated into slowly moving plates.
- **Describe** features and events caused by plate movements.

Video Time

Total Running Time ▶ 10:59

VIDEO A ▶ 2:28

VIDEO B ▶ 2:18

VIDEO C ▶ 2:37

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Video Preview

VIDEO A **Earth's Layers Main Idea** Scientists have divided Earth into many layers.

VIDEO B **Plate Movement Main Idea** Earth's crust is separated into plates that are moving.

VIDEO C **Volcanoes and Earthquakes Main Idea** Plate movements cause sudden and gradual changes.

Vocabulary Preview

Academic Vocabulary **Evidence** is signs or proof of something. *Evidence* is used in the definition of the word *fault*. Ask students questions designed to help them find evidence of something. Is there any evidence that shows when it is time for lunch? (Yes, the lunch bell will ring, or stomachs may growl.)

VIDEO Fun Fact!

Both the lowest and highest points on Earth were formed by plate movements. The Mariana Trench in the Pacific Ocean formed when one plate sank beneath another. It is about 11,000 meters deep. Mount Everest in the Himalayas formed when two plates collided. It is more than 8,840 meters high.

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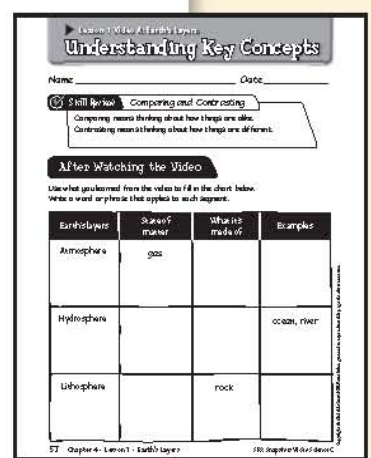
VIDEO A Earth's Layers ▶ 2:28

- **Identify** the layers of Earth's atmosphere. The atmosphere is divided into several layers based mainly on differences in temperature. Most weather occurs in the troposphere. The stratosphere contains ozone, which protects life on Earth from the sun's harmful UV rays.
- **Describe** the hydrosphere. The hydrosphere includes oceans, rivers, lakes, streams, glaciers, and groundwater.
- **Describe** Earth's structure. The lithosphere, which includes the crust and the upper mantle, is the outer layer of Earth. The asthenosphere is the fluid part of the mantle; it is located above the inner mantle. Beneath the mantle is Earth's core. It is divided into a molten outer core and a solid inner core. The fluid nature of Earth's structure below the crust is an important concept students need in order to understand the next two segments.


Understanding Key Concepts

Name _____ Date _____

Skill Review: Comparing and Contrasting

Comparing means thinking about how things are alike.
Contrasting means thinking about how things are different.

After Watching the Video

Use what you learned from the video to fill in the chart below.
Write a word or phrase that applies to each segment.

Earth's layers	State(s) matter	What it's made of	Examples
Atmosphere	gas		
Hydrosphere			ocean, river
Lithosphere		rock	

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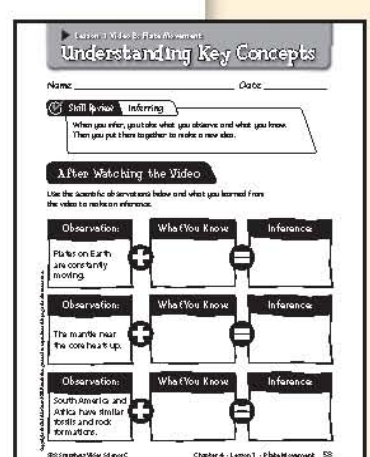
VIDEO B Plate Movement ▶ 2:18

- **Recognize** that Earth's crust is divided into plates that move continuously. Note that this theory is *not* the same as continental drift. Make sure that students realize that plates are not just landmasses.
- **Explain** why Earth's plates move. Plate movement is caused by convection currents deep within the mantle. Convection currents form when hot material in the mantle rises and then cools and sinks in an ongoing cycle that powers plate movement.
- **Discuss** how plate movement affects Earth's surface. The three types of plate boundaries are:

  Divergent - plates moving away from each other
  Convergent - plates moving toward each other
  Transform - plates sliding past each other

  Plate movement causes the following to form: mountains, volcanoes, earthquakes, and land and ocean ridges.


Understanding Key Concepts

Name _____ Date _____

Skill Review: Inferring

When you infer, you take what you observe and what you know. Then you put them together to make a new idea.

After Watching the Video

Use the scientific observations below and what you learned from the video to make an inference.

Observation:	What I/You Know	Inference
Plates on Earth are constantly moving.	+	=
Observation:	What I/You Know	Inference
The mantle near the core heats up.	+	=
Observation:	What I/You Know	Inference
South America and Africa have similar fossils and rock formations.	+	=

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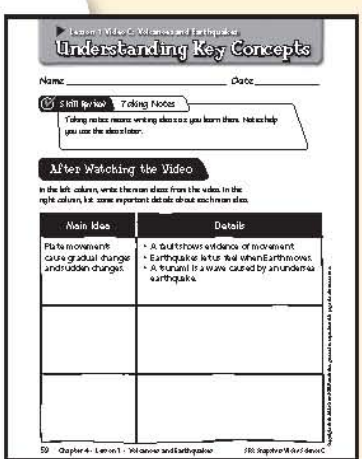
VIDEO C Volcanoes and Earthquakes ▶ 2:37

- **Model** plate movements. Show how divergent, convergent, and transform plate actions occur.
- **Relate** faults and earthquakes to pressure within Earth. When plates grind against one another, the rocks may break or shift abruptly. This abrupt movement causes an earthquake.
- **Relate** earthquakes and volcanoes to plate movements. Earthquakes and volcanoes are most common along plate boundaries such as the Ring of Fire in the Pacific Ocean.
- **Recognize** the magnitude of damage caused by natural hazards, such as the tsunami that occurred in December of 2004.


Understanding Key Concepts

Name _____ Date _____

Skill Builder: Taking Notes

Taking notes means writing ideas as you learn them. Notes help you use the ideas later.

After Watching the Video

In the left column, write the main ideas from the video. In the right column, list some important details about each main idea.

Main Idea	Details
Plate movements cause gradual changes and sudden changes.	• A fault shows evidence of movement. • Earthquakes occur when Earth moves. • A tsunami is a wave caused by an undersea earthquake.

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Differentiated Instruction Options

Enrichment

Convection Research

Tell students that Earth's mantle is not the only place where convection occurs. Explain that convection also occurs in Earth's atmosphere and that it affects weather. Have interested students do further research on convection in Earth's atmosphere and report their findings to the class. (For instance: What kind of weather does convection cause?; What is the Coriolis effect?; What are the global wind belts?)

Materials:
- library or Internet access

Remediation

Layers T-Chart

Direct students to make a three column chart with the headings Earth, Water, and Air. Have them list the vocabulary words under the correct heading. Challenge them to also classify these words from Lesson 1: *troposphere*, *stratosphere*, *mesosphere*, *ionosphere*, *thermosphere*, *exosphere*, *asthenosphere*, *crust*, *upper mantle*, *inner mantle*, *outer core*, and *inner core*. Tell students they can use the T-chart to help them study for tests.

Materials:
- paper
- pencils

Activities for All

Travelogue

Tell students to imagine that scientists have invented a vehicle in which people can travel safely to Earth's core. Have them write a description of what they would see, hear, and feel as they moved through Earth toward the core. Tell them to use the vocabulary words *lithosphere*, *plate*, and *fault* in their descriptions, as well as other words from the lesson. Have students record their travelogues on an audio recorder so they can practice saying the vocabulary words.

Materials:
- tape recorder

3 ASSESS

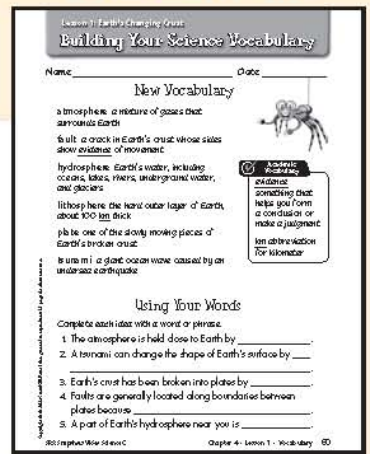
Wrap Up

Informal Assessment Ask students to infer what is happening to the plates along the San Andreas Fault. Point out the location of the fault on a map of California.

Answer: The San Andreas Fault occurs along a transform plate boundary. The plates are sliding past one another.

Play ***MindJogger Interactive Lesson Review Game***

Vocabulary Review


Building Your Science Vocabulary

Name _____ Date _____

New Vocabulary

atmosphere a mixture of gases that surrounds Earth

fault a crack in Earth's crust where sides show evidence of movement

hydrosphere Earth's water, including oceans, lakes, rivers, underground water, and glaciers

lithosphere the hard outer layer of Earth, about 100 km thick

plate one of the slowly moving pieces of Earth's broken crust

tsunami a giant ocean wave caused by an undersea earthquake

Academic Vocabulary
evidence something that helps you form a conclusion or make a judgment

km abbreviation for kilometer

Using Your Words

Complete each idea with a word or phrase.

1. The atmosphere is held close to Earth by _____.
2. A tsunami can change the shape of Earth's surface by _____.
3. Earth's crust has been broken into plates by _____.
4. Faults are generally located along boundaries between plates because _____.
5. A part of Earth's hydrosphere near you is _____.

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Answers

Answers to *Student Edition* questions on pages 72-73

Vocabulary Review

1. atmosphere
2. hydrosphere
3. fault
4. plate
5. lithosphere
6. tsunami

Word Study: Word Roots

Students should choose two words with the suffix *-sphere*, such as *hemisphere*, *troposphere*, or *stratosphere*. Students should write the words and their definitions.

Show What You Know

1. The main layers of Earth and the area around it include the atmosphere, the hydrosphere, the lithosphere, the mantle, and the core.
2. Earth's crust is moving because of convection currents in the mantle.
3. Plate movement causes volcanoes, earthquakes, mountains, and valleys.

Critical Thinking

1. Convection currents in the mantle cause the movement of plates in the crust.
2. An undersea earthquake can cause a tsunami. Monitoring of undersea earthquakes can provide advance warning for people to leave the area.

Math in Science

1/100 = 1% of earthquakes cause damage. 8000 × 1/100 = 80, or 1% of 8000 = 80 earthquakes cause damage in an average year.

Process Skill Quick Activity

North and South America and Asia are affected by the Ring of Fire. Buildings can be built to withstand earthquakes, and active volcanoes can be monitored.