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MINISTRY OF EDUCATION



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Education

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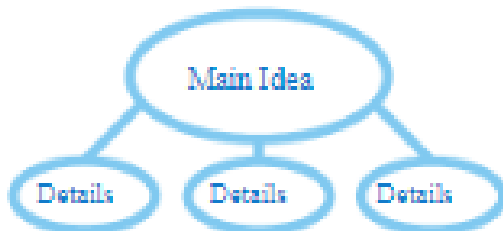
Careers in Science

Earth and Space Science



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CHAPTER 8 Planner

Lesson	OBJECTIVES AND READING SKILLS	VOCABULARY						
1 Earth's Features PACING: 2 days FAST TRACK: 1 day	- Identify Earth's landforms and the features of the ocean floor. - Describe the layers of Earth.  Reading Skill Main Idea and Details	ocean continent landform crust mantle core						
2 Sudden Changes to Earth PACING: 2 days FAST TRACK: 1 day	- Describe earthquakes and volcanoes and identify their effects. - Describe the effects of landslides and floods.  Reading Skill Cause and Effect	earthquake volcano magma lava landslide flood						
3 Weathering and Erosion PACING: 2 days	- Describe and identify the forces that cause weathering and erosion. - Analyze how people change the land. <table><tr><th>Text Clues</th><th>Conclusions</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> Reading Skill	Text Clues	Conclusions					weathering erosion glacier deposition
Text Clues	Conclusions							

Activity Planner

EXPLORE Activities

Explore PACING: 20 minutes

Objective Observe that most of Earth's surface is covered by water.

Skills experiment, observe, use numbers, infer

Materials globe

★  Borrow extra globes, or have students complete the activity as a class.

Explore PACING: 30 minutes

Objective Model changes that happen when land moves suddenly.

Skills make a model, communicate, experiment, infer

Materials aluminum pan, sand, assorted blocks, twigs

★  Caution students not to tap the pan hard enough to spill the sand.

Explore PACING: 30 minutes

Objective Model how moving water changes rocks.

Skills measure, use variables, observe, infer, experiment

Materials sandstone rocks, measuring cup, 3 plastic jars with lids, stopwatch, hand lens

★  Substitute siltstone or shale if necessary.

QUICK LAB Activities

Quick Lab PACING: 15 minutes

Objective Identify features of your country.

Skills make a model, observe

Materials maps of the country, large sheets of white paper, colored pencils

★  Obtain physical or political maps of your country.

Quick Lab PACING: 15 minutes

Objective Model volcanic eruptions.

Skills make a model, observe, communicate

Materials samples or travel tubes of toothpaste, newspapers, thumbtack

★  Cover desks with newspaper to protect them from the toothpaste and make cleanup easier.

Quick Lab PACING: 15 minutes

Objective Observe how various materials settle.

Skills make a model, interpret data, infer

Materials potting soil, sand, small pebbles, measuring cup, large plastic jar with lid, newspaper, water

★  Cover desks with newspaper before filling the jar. Do not use a glass jar due to the risk of breakage.



Academic Language

When learning, students need help in building their understanding of the academic language used in daily instruction and science activities. The following strategies will help to increase students' language proficiency and comprehension of content and instruction words.

Strategies to Reinforce Academic Language

- **Use Context** Academic language should be explained in the context of the task. Use gestures, expressions, and visuals to support meaning.
- **Use Visuals** Use charts, transparencies, and graphic organizers to explain key labels to help students understand classroom language.
- **Model** Use academic language as you demonstrate the task to help students understand instruction.

Academic Language Vocabulary Chart

The following chart shows chapter vocabulary and inquiry skills. **Vocabulary** words help students comprehend the main ideas. **Inquiry Skills** help students develop questions and perform investigations.

Vocabulary

ocean
continent
landform
crust
mantle
core
earthquake
volcano
magma
lava
landslide
flood
weathering
glacier
deposition
erosion

Inquiry Skills

experiment
observe
use numbers
infer
make a model
communicate
measure
use variables

Vocabulary Routine

Use the routine below to discuss the meaning of each word on the vocabulary chart. Use gestures and visuals to model all words.

Define: A *landform* is a feature of land on Earth's surface.

Example: A mountain is the tallest *landform*.

Ask: Look at the map in Lesson 1. Can you name two other *landforms*?

Students may respond to questions according to proficiency level with gestures, one-word answers, or phrases.

Vocabulary Activities

Help students understand the causes of change to Earth's landforms.

BEGINNING

Walk students through the pictures in Lesson 2. Students can use words and gestures to describe the pictures. Have them say the change being depicted. Then ask: *What does [an earthquake] look like?* Have students answer by pointing to the picture or acting it out.

INTERMEDIATE

Have two teams of students write short descriptions about each type of landform change discussed in the chapter. Then have the teams take turns reading a description as the other team guesses the word.

ADVANCED

Explain that earthquakes cause land to change fast, and weathering causes land to change slowly. Have students give one more example of a fast change and one example of a slow change. Students can use their own words to describe what the land would look like after those changes occur.

CHAPTER 8

Earth Changes



THE BIG IDEA What can cause Earth's features to change?

Chapter Preview Have student examine the graphics in each lesson. Ask them to predict what each lesson will be about.

Vocabulary

- Have a volunteer read the Vocabulary words aloud to the class. Ask students to find one or two words in the chapter. Add these words and their definitions to a class Word Wall.
- Encourage students to use the illustrated glossary in the Student Edition's reference section.

Earth Changes



What can cause Earth's features to change?

Answers will vary.

Vocabulary



ocean a large body of salt water



continent a great area of land on Earth



earthquake a sudden movement of the rocks that make up Earth's crust



volcano a mountain that builds up around an opening in Earth's crust



weathering the breaking down of rocks into smaller pieces



erosion the wearing away and movement of weathered rock

Differentiated Instruction

Instructional Plan

Chapter Concept Earth's surface is continually changing.

EXTRA SUPPORT Students who need to identify landforms and bodies of water should review the opening of **Lesson 1** before continuing with the chapter.

ON LEVEL Students who can identify Earth's basic features can go to the end of **Lesson 1** to look under the oceans and inside Earth and then go directly to **Lesson 2** to explore sudden changes.

ENRICHMENT For students who are ready, **Lesson 3** builds on processes of slow change from earlier grades by highlighting kinds of weathering and of erosion.

► Assess Prior Knowledge

Before reading the chapter, create a **KWL** chart with students. Read the **Big Idea** question and then ask:

- What are some of Earth's features?
- What can cause sudden changes to Earth?
- How do weathering and erosion change Earth's features?

Answers shown represent sample student responses.

Before reading this chapter, write down what you already know in the first column. In the second column, write down what you want to learn. After you have completed this chapter, write down what you learned in the third column.

Earth Changes		
What We K now	What We W ant to Know	What We L earned
Water covers much of Earth's surface.	What are some land features?	
Earthquakes cause sudden changes to Earth	How do volcanoes change Earth's features?	
Weathering breaks down rocks.	How does erosion change Earth's features?	

Plan Your Lesson

Lesson 1 Earth's Features

Essential Question

What shapes can the land take?

Objectives

- Identify Earth's landforms and the features of the ocean floor.
- Describe the layers of Earth.

Reading Skill **Main Idea and Details**



You will need a main idea and details graphic organizer.



FAST TRACK

Lesson Plan When time is short, follow the Fast Track and use the essential resources.

1 Introduce

Look and Wonder

2 Teach

Discuss the Main Idea

Use the Visuals

Use the Visuals

3 Close

Think, Talk, and Write

Teacher Notes

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Lesson 1 Earth's Features

Objectives

- Identify Earth's landforms and the features of the ocean floor.
- Describe the layers of Earth.

1 Introduce

► Assess Prior Knowledge

Have students discuss pictures that they have seen of Earth from space. Ask:

- What color is Earth from space? *mostly blue*
- What are the large land areas on Earth called? *continents*
- What is the water like in the oceans? *Possible answers: salty, cold*

Warm Up

Start with a Discussion

Have students discuss any unusual places they have traveled to. Ask those who have flown a long distance in an airplane to describe what they could see out of the window from high above Earth.

Encourage students to discuss what Earth's surface looks like from space or from an airplane. Ask:

- What features are seen in our area?
- What large bodies of water are nearby?

Look and Wonder

Both land and water cover Earth's surface. Which one covers more of Earth?

Students may know that water covers almost three-quarters of Earth's surface.

Essential Question What shapes can the land take?

Answers will vary. Accept any reasonable answer.

Look and Wonder

Invite students to share their responses to the Look and Wonder statement and question:

- Both land and water cover Earth's surface.
Which one covers more of Earth?

Write ideas on the board and note any misconceptions that students may have. Address these misconceptions as you teach the lesson.

Essential Question

Have children read the Essential Question. Tell them to think about it as they read through the lesson. Advise children that they will return to this question at the end of the lesson.



Plan Ahead Have any visually impaired students record the results of the spins. If there is only one globe in the classroom, complete the Explore as a class activity. Have students take turns spinning the globe. Assign one student to be in charge of the tally chart.

Purpose Students will collect evidence showing that most of Earth's surface is covered by water.

Structured Inquiry

Make a Prediction

- 2 Experiment** Make sure students have their eyes closed when they touch their fingers to the globe. **Be Careful!** Make sure students do not mark on the globe.
- 3 Observe** Make sure students record the results of all 10 of their spins. Make sure students are randomly touching different places on the globe. If they only touch places in the Northern Hemisphere, they will get more land results.
- 5 Use Numbers** Most students will touch water more often than land.

Explore

Does land or water cover more of Earth's surface?

Make a Prediction

Do you think that there is more land or more water on Earth's surface? Write your prediction.

Possible predictions: There is more water than land on Earth's surface.

Materials



- globe

Test Your Prediction

- 1 Make a table like the one shown for ten spins.
- 2 **Experiment** Slowly spin a globe. Do not look at it. Touch your finger to the globe to stop it.
- 3 **Observe** Did your finger stop on land or water? Record the information on the chart.
- 4 Repeat steps 2 and 3 nine more times.
- 5 **Use Numbers** How many times did you touch water? How many times did you touch land?

Answers will vary.

Step 1

Spin	Land	Water
1		
2		
3		
4		

Step 2



Draw Conclusions

- 6 Infer** Is there more land or more water on Earth? How do your results compare with the results of others?

Answers will vary. Most groups will discover that there is more water than land on Earth.

Explore More

Experiment Which covers more of Earth—rivers or oceans? Make a plan to find out.

Students' plans may vary, but they should determine that oceans cover more of Earth.

Open Inquiry

Design a plan to determine which ocean covers the largest area on Earth's surface.

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

- 6 Infer** Most groups will discover that there is more water than land on Earth.

Guided Inquiry

Explore More

Experiment Encourage students to use the globe to help them determine the answer to this question. Be sure students know how rivers are indicated on the globe.

Open Inquiry

Have students determine which ocean covers the largest area on Earth's surface. Have students come up with a method for answering this question other than by simply looking at the globe. Ask: What other way might there be to find which ocean covers the largest area?

What are some land features?

Materials globe, atlases, physiographic maps

Have students work in small groups. Have students in the groups carefully look at the features on the globe, maps, or atlases, and describe any features they see, such as mountains, plains, and valleys. Have students make a list of as many different landforms as they can. Give the groups 10–15 minutes to find the land features.

2 Teach

Read and Respond

Main Idea As students read the lesson, have them write down any land or ocean-bottom features that are new to them.

Vocabulary Have students write definitions of the lesson's vocabulary terms in their own words to use as a study guide.

Reading Skill **Main Idea and Details**

Graphic Organizer Have students fill in the Main Idea and Detail graphic organizer as they read through the lesson. They can use the Quick Check questions to identify each main idea and detail.



What covers Earth's surface?

► Discuss the Main Idea

Have students describe the different bodies of water they have visited. Ask:

- What are two water features on Earth, other than oceans? Possible answers: rivers, streams, lakes, ponds, glaciers
- What is the water in these bodies like? It is mostly freshwater. Some lakes have salt water.

Read and Respond

What covers Earth's surface?

If you could see Earth from space, it would look mostly blue. That is because almost three fourths of Earth is covered by water. Most of this water is in oceans (OH-shunz). **Oceans** are large bodies of salt water.

Rivers, streams, glaciers, and ponds are some other water features on Earth. These water features are made up of freshwater. *Freshwater* is water that is not salty. Lakes are another water feature. Most lakes have freshwater. Some have salt water.

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Oceans and Continents



Earth also has seven great areas of land called **continents** (KAHN•tuh•nunts). Asia is the continent you live on.

A map can show Earth's land and water features. To read a map, look at its key. A *key* shows what a map's colors and shapes mean. Can you find Asia on the map below?

Quick Check

1. About how much of Earth is covered by land?

one-fourth



▲ Ocean water covers most of Earth.

► Develop Vocabulary

ocean *Word Origin* The word ocean is from the Greek word *okeanos*, which the Greeks thought was the great river surrounding the disk of Earth.

continent *Word Origin* The word *continent* is from the Latin word *continentem*, which means “holding together,” “continuing.” A continent is a large continuous landmass.

► Address Misconceptions

A common misconception is that there are several oceans.

FACT

The oceans are really one big body of water.

The names of the oceans are used to help identify different ocean areas.

When many of the areas were named, people did not know what the entire Earth looked like. They only knew about a relatively small area near where they lived.

To show students that there is really one big ocean, have them look carefully at the southern half of Earth. Around Antarctica, they will see that the oceans are connected.

Differentiated Instruction

Leveled Questions

EXTRA SUPPORT What features cover Earth's surface? Use vocabulary words in your answer. Possible answer: oceans, rivers, glaciers, lakes, and continents What is a continent? a great area of land

ENRICHMENT Compare and contrast oceans with rivers, streams, ponds, and glaciers. All are examples of water that covers Earth's surface. Oceans contain salty water and cover most of Earth. Rivers, streams, ponds, and glaciers contain freshwater (water that is not salty).

What are some of Earth's land and water features?

► Discuss the Main Idea

Have student volunteers find examples of the different landforms discussed on a globe or map. Ask:

- What is an example of a mountain range in the United States? Possible answers: the Rocky mountains, the Appalachian mountains, the Cascade range, the Sierra Nevada range
- What river is the biggest in North America? the Mississippi River

► Develop Vocabulary

landform Point out to students that they can think of a *landform* as the “form of the land.”

► Use the Visuals

To help students remember what the different landforms look like, have volunteers find on a map or globe examples of each landform in the diagram. Ask:

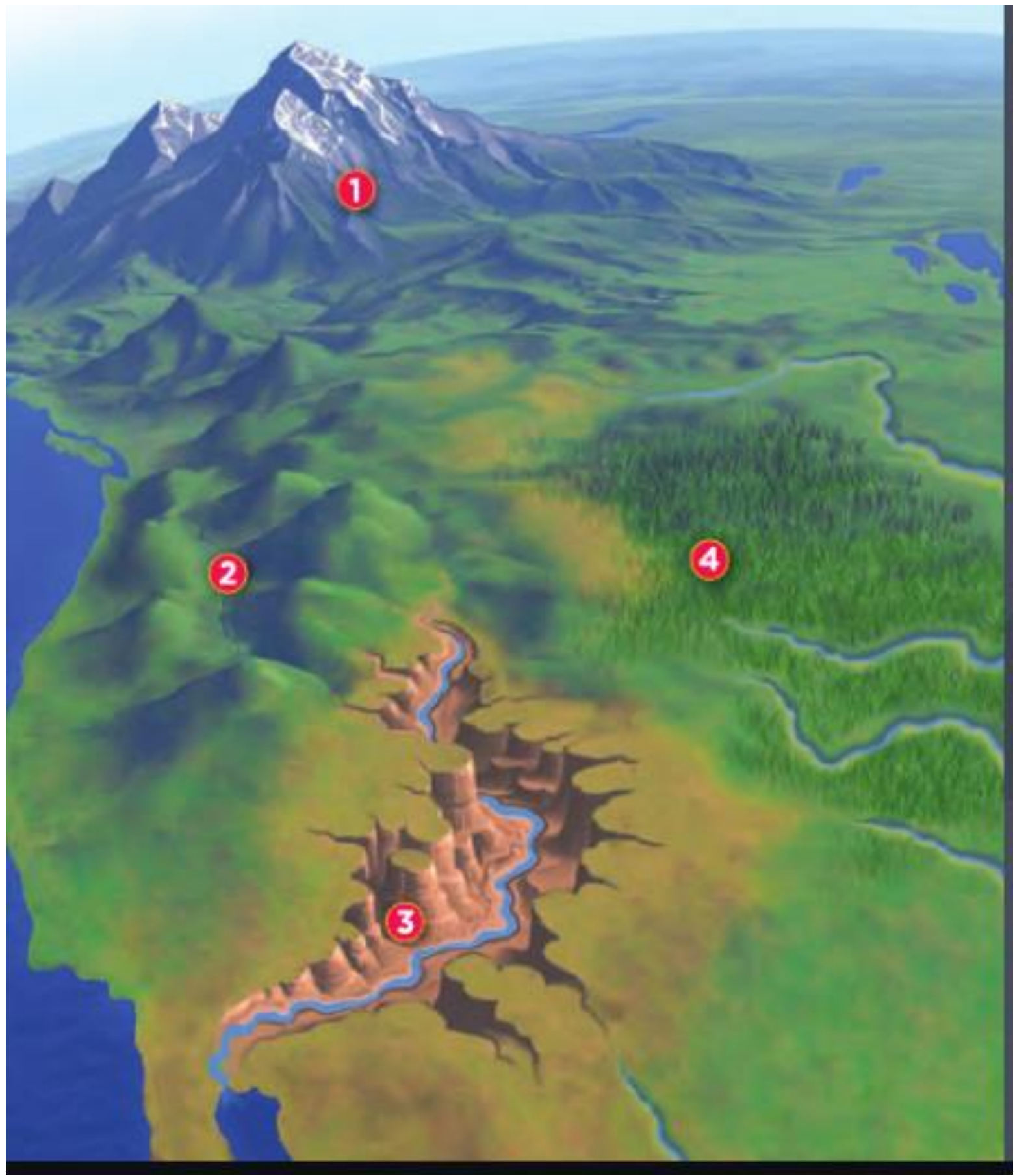
- How is a lake different from an ocean? A lake is smaller and usually has freshwater instead of salt water.
- How is a plateau different from a mountain? A plateau has a flat top.
- How is a canyon different from a valley? A canyon is deep with narrow sides.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Have students describe the different landforms in their own words. They should draw each landform next to its description.

ENRICHMENT Have students research more information about an example of one of the landforms. Have students make a poster showing the landform they researched. Ask volunteers to present their posters to the class.



Features of Earth

- 1 A *mountain* is the tallest landform. It often has steep sides and a pointed top.
- 2 A *valley* is the low land between hills or mountains.
- 3 A *canyon* is a deep valley with steep sides. Rivers often flow through them.
- 4 A *plain* is land that is wide and flat.
- 5 A *lake* is water that is surrounded by land.

Quick Lab

To learn more about your country's features, do the Quick Lab in the back of the book.

✓ Quick Check

2. **Critical Thinking** How could you tell a mountain from a plain?

Possible answer: A mountain has

steep sides and a pointed top; a

plain is wide and flat.

- 6 A *river* is a large body of moving water.
- 7 A *plateau* (pla•TOH) is land with steep sides and a flat top. It is higher than the land around it.
- 8 A *coast* is land that borders the ocean.
- 9 A *peninsula* is land surrounded by water on three sides.
- 10 An *island* is land with water all around it.



Your Country's Features

See the Quick Labs in the back of the book.

Objective Identify features in your country.

Materials maps of the country, large sheets of white paper, colored pencils

Plan Ahead Obtain physical or political maps of your country. White copy paper can be used instead of sheets of drawing paper.

- 1 Make sure students label the major land and water features on their maps. A key must be drawn in a bottom corner of the maps.
- 2 Students should accurately locate and label your town or city on the map. Answers will vary but should accurately list some of the major land and water features in your area. Comparisons with other features in the country will vary but should be clearly and accurately described.

LA Support

Ask Questions Ask students what an area of low land between hills is called. What is an area of land that is wide and flat? Discuss what valleys and plains are. For valleys, have students point down. For plains, have students trace an imaginary straight line with their hands. You may also sketch both landforms on the board and have students identify each one. Have them name other landforms or bodies of water. Write their responses on the board. Have the whole class repeat the words after you.

BEGINNING

Students can point to or name pictures of landforms or bodies of water.

INTERMEDIATE

Students can use phrases or short sentences to describe landforms and bodies of water.

ADVANCED

Students use complete sentences to describe landforms and bodies of water.

What land features are in the oceans?

► Discuss the Main Idea

Lead a discussion on what students know about the ocean floor. Many students may think the ocean floor is a flat, featureless plain. Ask:

- What does the ocean floor look like? Possible answer: The ocean floor has mountains, canyons, and plains that look like features on land.

► Explore the Main Idea

ACTIVITY Obtain a bathymetric map of one of the world's oceans. This type of map shows all the various depths of a body of water. Show students as a class the different features labeled on the map, including mountains (mid-ocean ridges), trenches, abyssal plains, seamounts, and islands. Help students see that a map of the ocean floor has features that are similar to a map of Earth's land surfaces.

► Use the Visuals

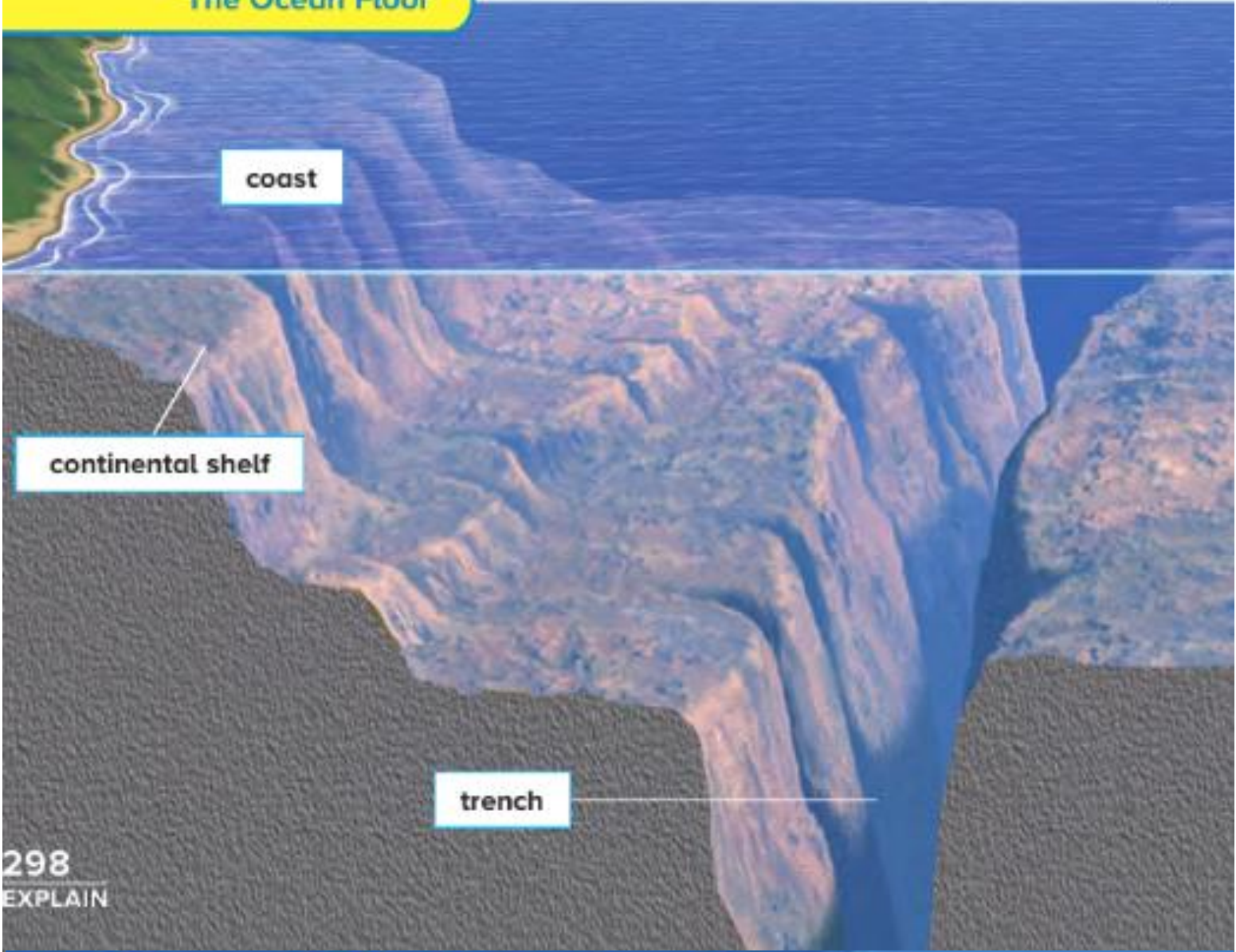
Have students refer to the visuals over the next two pages, which show examples of landforms and ocean floor features. Ask:

- What land feature is similar to an ocean trench? Possible answers: a valley or canyon
- Which ocean bottom feature is similar to a plain? an abyssal plain

What land features are in the oceans?

Did you know that there is land below the ocean? The land below the ocean is called the *ocean floor*. The ocean floor has many features similar to land features. If you could travel there, you would find mountains, valleys, and canyons. You would even see plains.

The ocean floor begins at a coast where dry land borders the water. Here you find a continental shelf. A *continental shelf* is like a huge plateau. It lies under the ocean at the edge of a continent. About 80 kilometers (50 miles) away from the coast, the continental shelf slopes down steeply.



coast

continental shelf

trench

298
EXPLAIN

Differentiated Instruction

Leveled Questions

EXTRA SUPPORT Which ocean floor feature begins at the coast? **the continental shelf** Which ocean floor feature follows the continental shelf as you continue to move away from a continent? **abyssal plain**

ENRICHMENT Over which ocean floor feature would the ocean be the shallowest? **over the continental shelves** Over which would the ocean be the deepest? **the trenches**

An abyssal plain (uh•BIH•sul PLAYN) begins a little farther out. An *abyssal plain* is wide and flat. It stretches thousands of kilometers across the ocean.

A trench is another feature you might recognize. A *trench* is a canyon on the ocean floor. Trenches are the deepest parts of the ocean floor. The deepest trench is the Mariana Trench in the Pacific Ocean. It is almost 11 kilometers (7 miles) deep.

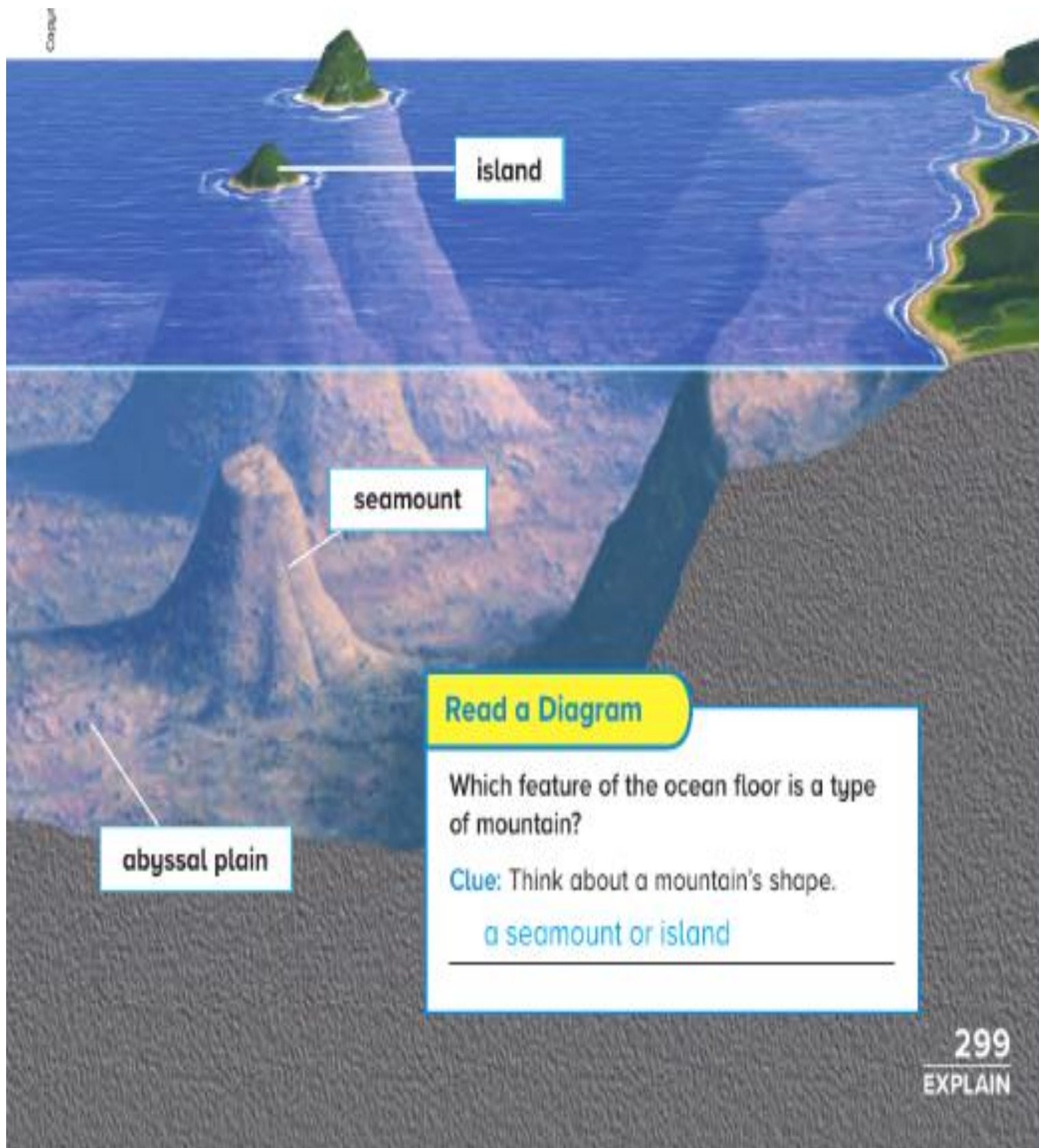


Quick Check

3. What do you think you would find on the abyssal plain? Hint: Think about what covers a river's bottom.

Possible answers: rocks; remains of dead

plants and animals that drift to the bottom



► Develop Vocabulary

Have students write a paragraph that uses the vocabulary words introduced in the lesson so far (*ocean, continent, landform*), and explain how they are related to the features on the ocean floor.

Classroom Equity

Encourage all students to get involved. To encourage more students to volunteer answers in this lesson, wait three to five seconds before calling on someone to answer a question. As an experiment, have students write their names on an index card, then take the deck, shuffle it, and turn up the cards one by one until you have called on each student.

What are the layers of Earth?

► Discuss the Main Idea

Use a peach cut in half to model Earth's layers. The peach skin is the crust, the fruit is the mantle, the outer pit of the peach is the outer core of Earth, and the peach seed is the inner core of Earth. Ask:

- What is the thickest layer of Earth? **the mantle**

► Develop Vocabulary

crust *Scientific vs. Common Use* A common use of the word *crust* is to describe the hard outer part of bread. The scientific use of *crust* is the thin, solid outer layer of Earth.

mantle *Scientific vs. Common Use* The scientific use of the word *mantle* means the thickest layer of Earth. A common use of the word is a cape or a cloak.

core *Word Origin* The word *core* is from the Latin word **cor**, which means "heart."

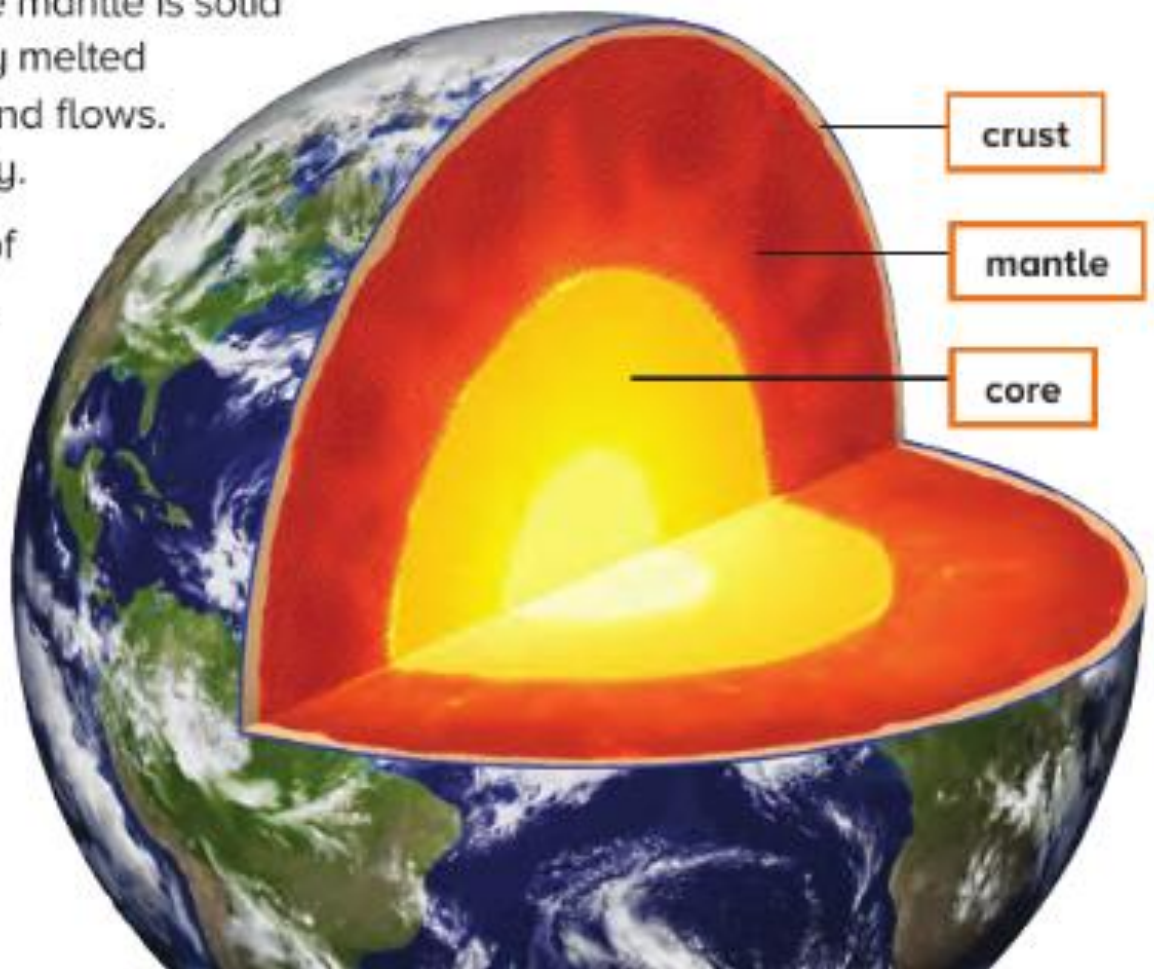
What are the layers of Earth?

Have you ever eaten a hard-boiled egg? If so, you know that an egg has several layers. It has a thin shell, a white part, and a yolk.

Like an egg, Earth has several layers. The continents and ocean floor make up Earth's outermost layer, called the **crust**. The crust is Earth's thinnest and coolest layer.

The layer below the crust is the **mantle**. Part of the mantle is solid rock. Part is nearly melted rock that is soft and flows. It is a lot like putty.

At the center of Earth is the core. The **core** is the deepest and hottest layer of Earth. The *outer core* is melted rock. The *inner core* is solid rock.



Quick Check

4. Which of Earth's layers is like the shell of an egg? Why?

the crust; because it is very thin like an
eggshell covering an egg

► Address Misconceptions

A common misconception is that all of Earth is molten except the crust. In fact, only the outer core is molten and liquid. The mantle is hotter than the crust and can flow like putty, but it is not liquid, molten rock.

Homework Activity

Earth's Interior

Have students draw a diagram of Earth's interior. Make sure they label all of the layers. Students might want to make the layers different colors. Have students research the characteristics and thicknesses of each of the layers to go along with their drawings. Students can use encyclopedias, or other reference materials.

3 Close

Lesson Review

► Discuss the Main Idea

Have students review their answers to the questions throughout the lesson. Address any remaining questions or misconceptions.

► Visual Summary

Have students summarize key points of the lesson in the Visual Summary. The titles in each box will help guide students to the topics they should summarize.

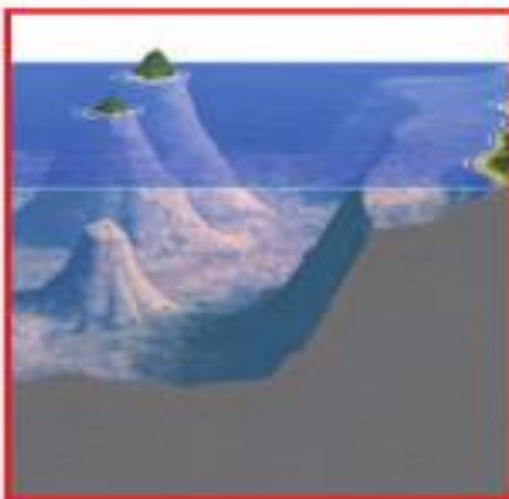
Visual Summary

Complete the lesson summary in your own words.



Earth has many land features and water features.

Most of Earth is covered by water.



The ocean floor has features similar to Earth's
land features.



Earth has three main layers—the crust, the
mantle, and the core.

Formative Assessment

Approaching Have students draw a picture of the inside of Earth.

On-Level Have students draw and label a picture of the layers inside Earth.

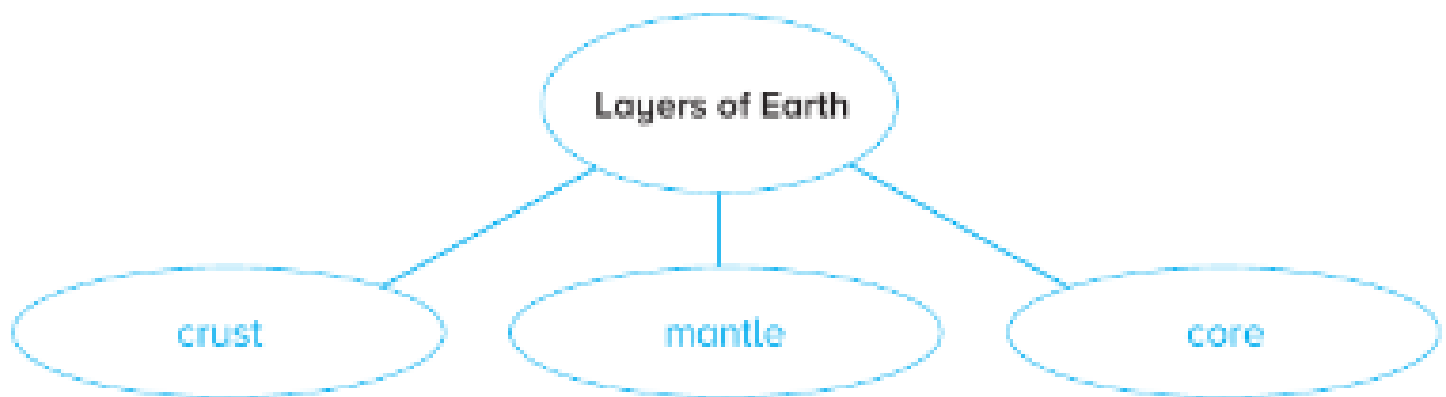
Challenge Have students include in their drawings the thickness of each layer and what material makes up each of Earth's layers.

Think, Talk, and Write

- 1 Vocabulary** Which landform is a deep, narrow valley with steep sides and a river flowing through it?

a canyon

- 2 Main Idea and Details** What are the layers of Earth?



- 3 Critical Thinking** Where would you be if you were at the deepest place on Earth's crust?

an ocean trench

- 4 Test Prep** All of the following are landforms except

- A an island.
- B a canyon.
- C a plain.
- D** mantle.

Essential Question What shapes can the land take?

Earth takes many different shapes. It forms mountains, valleys, plains, canyons, and plateaus.

Focus on Skills

Objective

- Make a model of a cave.

Materials centimeter ruler, scissors, several pieces of tan or white construction paper, black crayon, empty shoe box or other small box, clear tape

Plan Ahead Gather enough materials for each small group.

EXTEND This activity will teach students how to make a model of a cave.

Inquiry Skill: **Make a Model**

► **Learn It**

- Explain to students that a model is made to represent something that is otherwise too large, too small, or too difficult to study.
- Models can represent an object, an event, or a process.

Focus on Skills

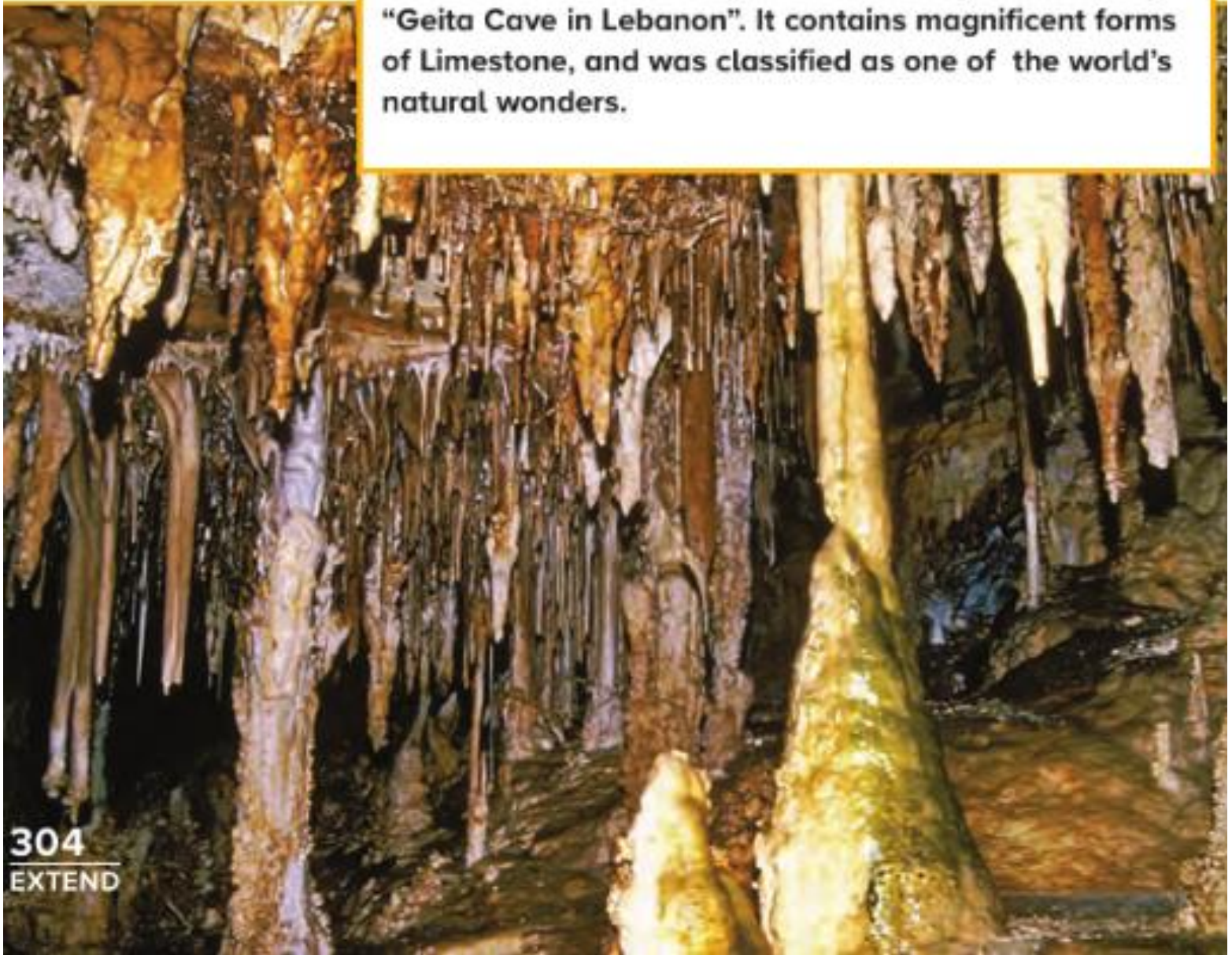
Inquiry Skill: **Make a Model**

You just learned about many landforms. Some of them are found on land. Some lie under the ocean. In some places a limestone cave forms below the ground. It forms when water seeps into the ground and changes rock. This can take millions of years. You can **make a model** to show a cave.

► Learn It

When you **make a model**, you build something to represent, or stand for, a real object or event. A model can be bigger or smaller than the real thing. Models help you learn about objects or events that are hard to observe directly. Maps and globes are two examples of models.

Caves are natural underground terrains, for example, "Geita Cave in Lebanon". It contains magnificent forms of Limestone, and was classified as one of the world's natural wonders.



Integrate Reading

Report on Cave Features

Ask students to research the features that are found in caves, such as stalagmites and stalactites. Ask:

- **What features commonly form in caves?**

Tell students to write a short report on their research. Have volunteers read their reports to the class.

► Try It

In this activity, you will **make a model** of a cave.

Materials ruler, scissors, tan or white construction paper, crayon, shoe box or other small box, clear tape

- 1  **Be careful.** Cut a piece of construction paper that is a little smaller than the size of the back wall of the box.
- 2 On the paper draw limestone rocks like the ones shown. Tape the paper to the box's back wall.
- 3 Draw more limestone rocks on another piece of construction paper. Draw a flap for each rock.
- 4  **Be careful.** Cut out each rock and its flap. Bend the flap for each rock. Tape each rock inside the box.

Now use your model to answer these questions:

- How would you describe the shapes of rocks in a limestone cave?

Some look like straws, others look like pillars.

- Where do the rocks form?

Rocks form mostly on the ceiling and floor of a cave.

► Apply It

Make a model of a landform that you learned about. It can be a landform on the ocean floor or one on land. What details do you want to show? Which materials will you use to help you model these details?

► Try It

- 1 **Be Careful!** Make sure students are very careful cutting the box and construction paper.
- 2 Encourage students to make their caves as realistic as possible.
- 4 Make sure students have drawn a flap on each rock.

► Apply It

Have students select another landform discussed in the lesson. They will then make a model of the landform. Tell students that after they have selected a landform, they need to gather all the materials needed to make their model. Before they begin building the model, they should decide what details they want to show. Help any students that are having problems finding materials for their models.

Plan Your Lesson

Lesson 2 Sudden Changes to Earth

Essential Question

How can Earth's surface change quickly?

Reading Skill Cause and Effect



You will need a cause-and-effect graphic organizer.

Objectives

- Describe earthquakes and volcanoes and identify their effects.
- Describe the effects of landslides and floods.



FAST TRACK

Lesson Plan When time is short, follow the Fast Track and use the essential resources.

1 Introduce

Look and Wonder

2 Teach

Use the Visuals

Discuss the Main Idea

3 Close

Think, Talk, and Write

Teacher Notes

Lesson 2 Sudden Changes to Earth

Objectives

- Describe earthquakes and volcanoes and identify their effects.
- Describe the effects of landslides and floods.

1 Introduce

► Assess Prior Knowledge

Ask students to discuss what they know about earthquakes, volcanoes, landslides, and floods. List any questions students have on the board. Ask:

- Which of these events can occur in our area? Answers will vary depending on the area of the country.

Sudden Changes to Earth



Warm Up

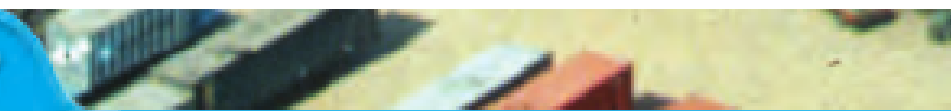
Start with a Visual

Have students study a picture of damage from an earthquake, volcanic eruption, landslide, or flood.

Encourage students to discuss what damage resulted from the event shown. Ask:

- How could this damage have occurred?
- How could this damage have been made less severe?

Look and Wonder



One minute, cars raced across this road in Oakland, California. Then the land shook. Part of the road collapsed. What might cause such a sudden change?

Possible answer: Shaking from an earthquake could cause the damage.

Essential Question

How can Earth's surface change quickly?

Answers will vary. Accept any reasonable answer.

Look and Wonder

Invite students to share their responses to the Look And Wonder statement and question:

- Part of the road collapsed. What might cause such a sudden change?

Have students think about what happens when an earthquake occurs. Ask:

- Why do you think an earthquake causes houses and buildings to shake and possibly fall? Parts of these buildings are underground or sitting right on the ground. When the ground moves, buildings on top of it move also.

Write ideas on the board and note any misconceptions that students might have. Address these misconceptions as you teach the lesson.

Essential Question

Have children read the Essential Question. Tell them to think about it as they read through the lesson. Advise children that they will return to this question at the end of the lesson.

Explore



whole
class



30
minutes

Plan Ahead The activity may be done in small groups of students if enough materials are available. Make sure students do not tap the pan hard enough to spill the sand.

Purpose To model what happens when land suddenly moves.

Structured Inquiry

- 1 Make a Model** If the sand will not easily form a mountain, dampen it slightly.
- 3 Communicate** Drawings should show the features of the land surface and the location of “trees.”

Explore

How does sudden movement change the land?

Purpose

Model what happens when the land suddenly moves.

Procedure

- 1 Make a Model** Fill a pan halfway with sand. Make a mountain with the sand.
- 2** Place blocks in the sand to model buildings. Add twigs to model trees.
- 3 Communicate** Draw the land's surface.
- 4 Experiment** What will happen if you tap the pan gently? Try it.

Answers will vary, but tapping the pan gently will cause some small changes.

- 5 Experiment** What will happen if you tap the pan harder? Try it.

Answers will vary, but tapping the pan harder will cause more changes.

Materials



- aluminum pan



- sand



- assorted blocks



- twigs

Draw Conclusions

6 Infer How can the sudden movement of land change the land?

Possible answers: Buildings and trees can fall. Hills and mountains can crumble.

Explore More

Experiment Different rocks and soils make up land. Does sudden movement change all land the same way? Make a plan to find out. Try it.

Open Inquiry

Design a test to discover if liquid is affected by sudden land movement.

My question is: Answers will vary.

How can I test it: Answers will vary.

My results are: Answers will vary.

Guided Inquiry**Explore More**

Experiment Students can replace the sand with a mixture of soil and rock and then tap it to compare how different materials are affected when land moves.

Open Inquiry

Ask students to think about whether liquid material will be affected differently by sudden movements of the land. Have them form a hypothesis and design an experiment to test it. Ask:

What might happen to water if the land moved suddenly?

Alternative Explore

How are buildings affected by movement?

Materials small blocks, glue, toothpicks, rubber bands

Have students build three “houses.” One will be made using the blocks alone, the second with blocks held together by rubber bands, and the third from toothpicks glued together. After the building models are done, have students test how the buildings are affected by sudden movements.

2 Teach

Read and Respond

Main Idea As students read the lesson, have them write how earthquakes, volcanoes, landslides, and floods can change the land.

Vocabulary As students read the lesson, have volunteers write definitions of each vocabulary word on the board.

Reading Skill Cause and Effect

Graphic Organizer Have students fill in the Cause and Effect graphic organizer as they read through the lesson. They can use the Quick Check questions to identify each cause and effect.

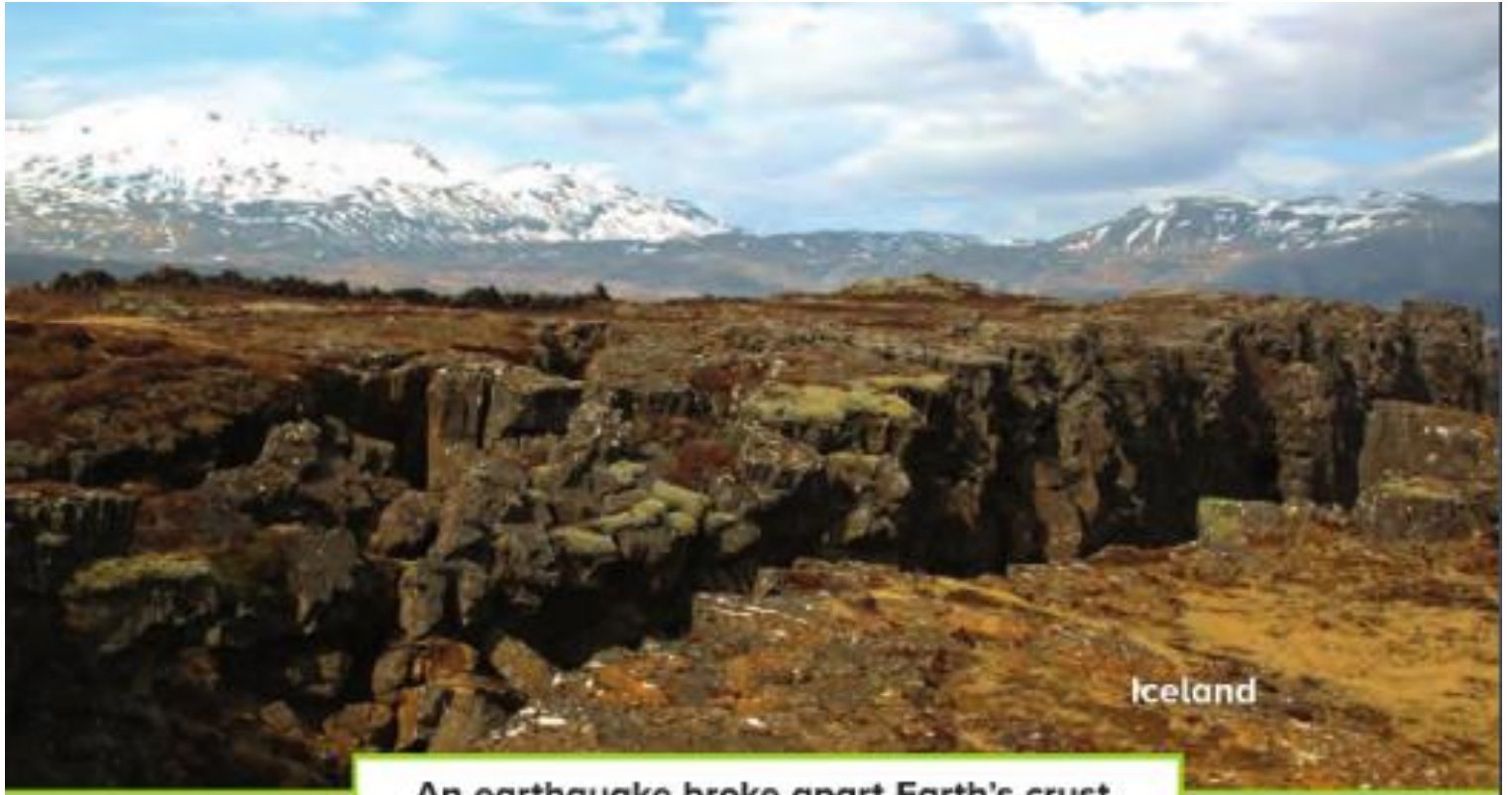


What are earthquakes?

► Discuss the Main Idea

Ask students if they have ever been in an earthquake or seen the effects of one on TV. Ask:

- What happens during an earthquake? Possible answers: The ground shakes; buildings and highways can move and crumble.
- Where do earthquakes happen? They can happen anywhere.



An earthquake broke apart Earth's crust.

Read and Respond

What are earthquakes?

Some events can change Earth's surface in less than a minute. One example is an earthquake (URTH•kwayk). What causes an earthquake? Why does it change the land? The answers are found under the ground.

Earth's Moving Crust

Earth's outside layer, the crust, is made up of huge slabs of rock. You might think that slabs of rock can not move. They do move, however. Rocks deep below the ground can slowly slide past each other. They can press against each other. They can pull apart too. These movements can cause rock to bend and snap back like a bent stick. This causes an earthquake. An **earthquake** is a sudden movement of the rocks that make up Earth's crust.



Quick Check

1. What can happen when huge slabs of rock in Earth's crust move?

Possible answer: An earthquake can happen.

When an earthquake happens, the ground shakes, or vibrates. The vibrations travel out from the earthquake's center through the land. Some earthquakes are very weak. They are not even noticed. Some feel like a truck rumbling by. Others are very strong. Earthquakes can crack roads. They can cause buildings and bridges to fall. They can even cause parts of mountains to collapse.



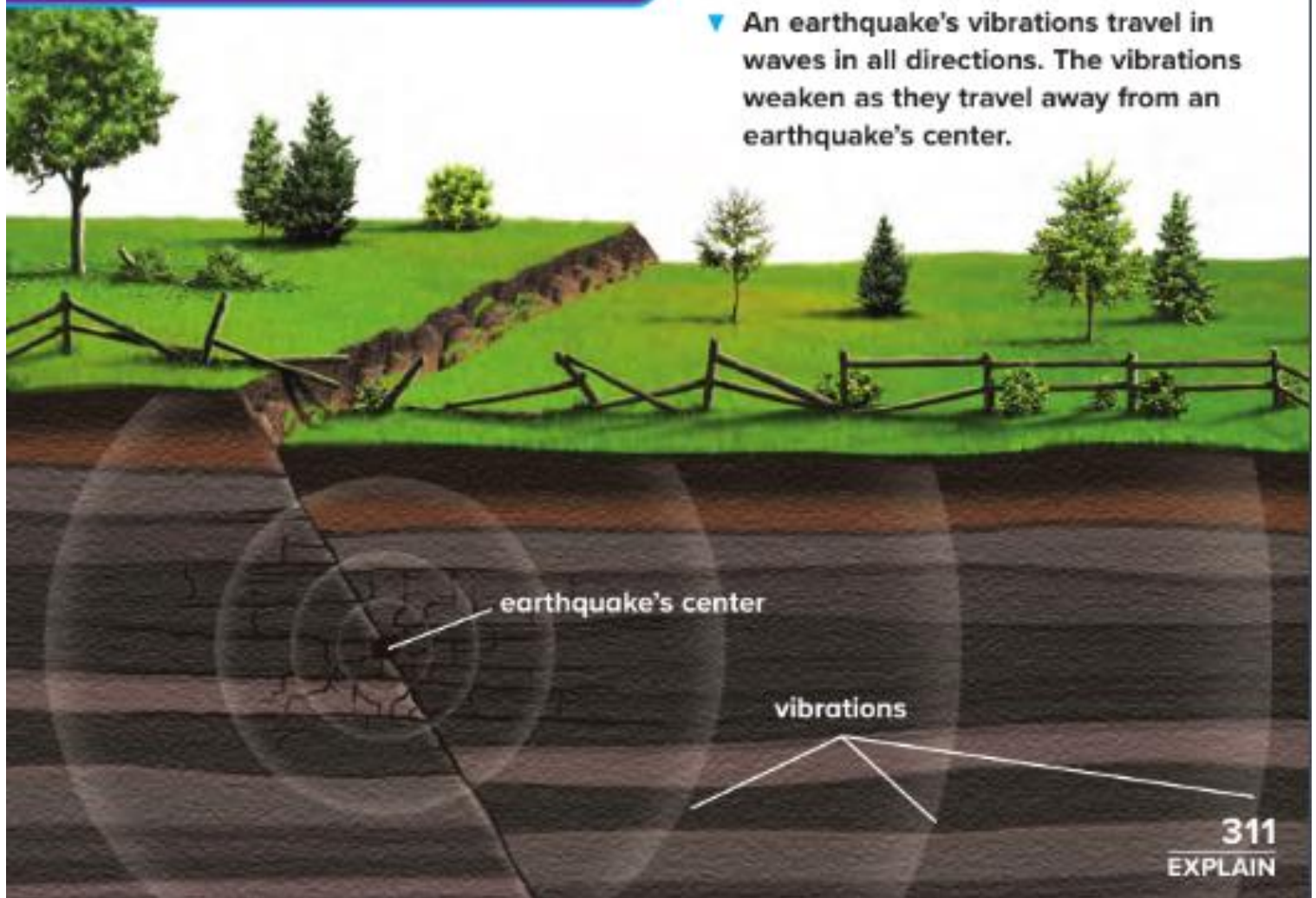
Quick Check

2. You drop a pebble in water. What happens to the water? How is this similar to what happens to the crust during an earthquake?

Possible answers: The water
moves in waves in all directions
from where the pebble hits
the water. In an earthquake,
vibrations move out from the
earthquake in all directions.

Where Earthquakes Start

- ▼ An earthquake's vibrations travel in waves in all directions. The vibrations weaken as they travel away from an earthquake's center.



Differentiated Instruction

Leveled Activities

EXTRA SUPPORT

Have students write in their own words what an earthquake is and how it can affect the land.

ENRICHMENT

Have students research a major earthquake in the world.

► Use the Visuals

Have students carefully study the diagram showing where an earthquake originates. Earthquakes begin at a point deep inside Earth where rocks break, usually along a fault. Waves of energy or vibrations travel outward from this point. The point where the earthquake starts is called the focus. Ask:

- Where do earthquakes start? Possible answer: deep inside Earth
- Where do the vibrations from an earthquake travel? in all directions away from the starting point of the quake

► Develop Vocabulary

earthquake Remind students that the word *quake* means “to shake.” The word *earth* means “ground or soil.” An *earthquake* shakes the ground.

What are volcanoes?

► Discuss the Main Idea

Have students discuss what they know about volcanoes. Ask:

- What is a volcano? Possible answer: a mountain that shoots out lava and ash
- What is the difference between magma and lava? Possible answer: Magma is melted rock inside Earth, and lava is melted rock that flows on the surface.

► Develop Vocabulary

volcano *Word Origin* The word *volcano* is from the Italian word *vulcano*, which means “burning mountain.”

magma Remind students that *magma* is melted rock inside Earth.

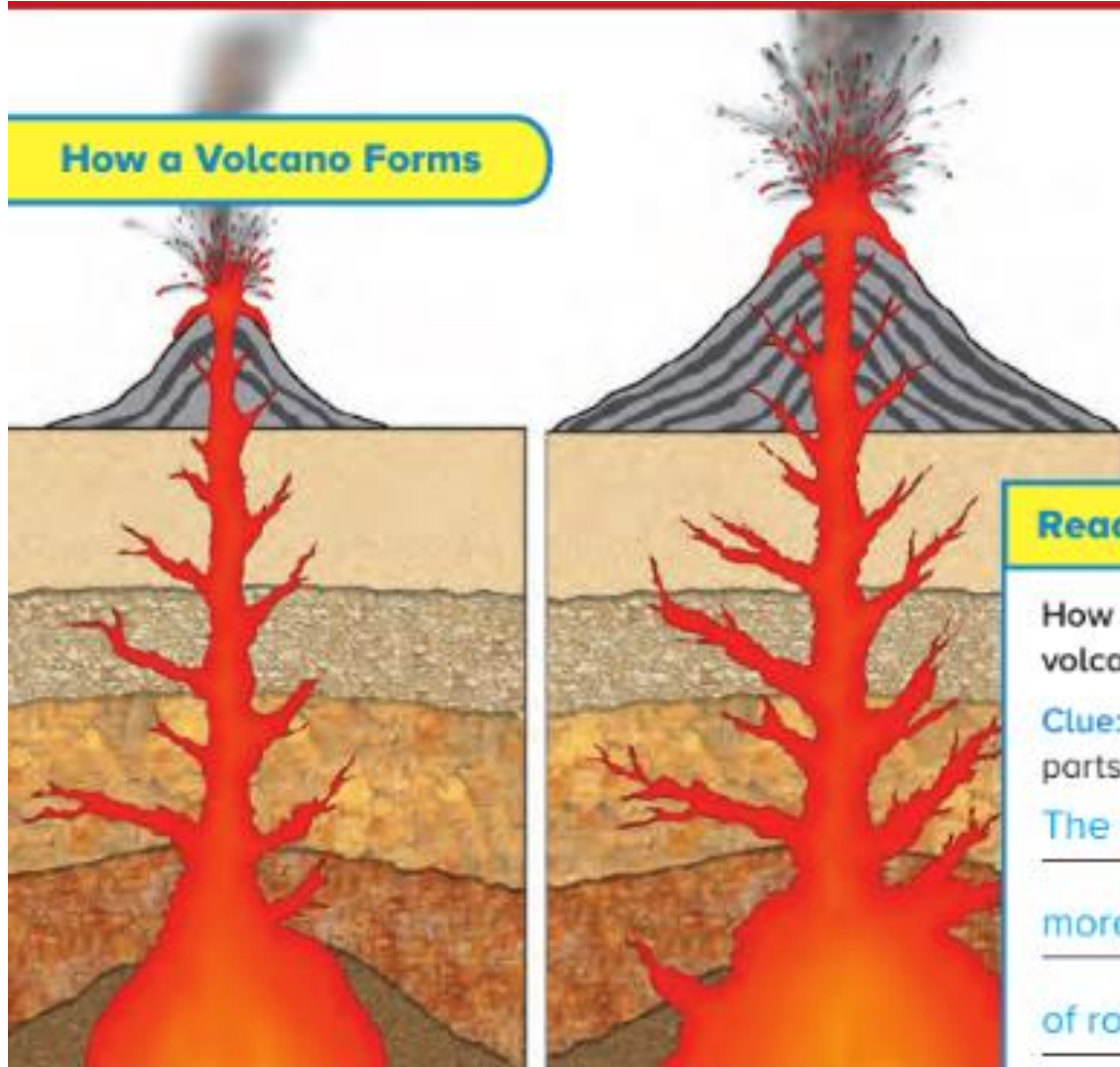
lava Remind students that once magma reaches Earth’s surface, it is known as *lava*.

► Address Misconceptions

A common misconception is that volcanoes are always active. In fact, many volcanoes on Earth have been inactive for very long periods of time. Some volcanoes also have relatively quiet eruptions, oozing lava slowly.

FACT Volcanoes are not always active.

How a Volcano Forms



Read a Diagram

How do you know that a volcano can get bigger?

Clue: Compare the two parts of the diagram.

The diagram shows that

more and more layers

of rocks and lava make

the volcano bigger.

What are volcanoes?

A **volcano** (vahl•KAY•noh) is a mountain that builds up around an opening in Earth's crust. Sometimes a volcano explodes. Like an earthquake, this event can change the land quickly.

Volcano Formation

You learned about Earth's layers, the crust, mantle, and core. Parts of the mantle and crust have melted rock called **magma**. Sometimes magma moves up through a large crack in the crust and flows onto land. Melted rock that flows onto land is called **lava**. Lava, rocks, and ash are forced out onto Earth's surface. They pile up in layers and form a mountain. Sometimes a volcanic mountain forms in just a few years.

FACT ▶ Volcanoes are not always active.

Effects of Volcanoes

Sometimes, lava oozes from a volcano slowly. The lava hardens and the mountain gets bigger. At other times, lava is forced out of a volcano in an explosion. When this happens, a large part of the mountain can be blown away. Materials from volcanoes can cause a lot of damage to buildings. They can harm living things too.

Quick Lab

To create a model of a volcano, do the Quick Lab in the back of the book.



Quick Check

3. What happens when lava flows out of an opening in Earth's crust?

A volcanic mountain forms.

4. Why are some volcanoes a danger to people?

Possible answers: Lava is very hot and can burn people. Ash and gases can be harmful to people.



◀ Lava shoots out of this volcano in Hawaii.

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EXPLAIN

Differentiated Instruction

Leveled Questions

EXTRA SUPPORT What is lava? melted rock that flows onto the land surface

ENRICHMENT How can volcanoes erupt? Possible answers: Some volcanoes slowly ooze lava. Others violently explode lava, rocks, gases, and ash.



A Model Volcano

See the Quick Labs in the back of the book.

Objective Model volcanic eruptions.

Materials samples or travel tubes of toothpaste, newspapers, thumbtack

Plan Ahead Obtain several samples or travel tubes of toothpaste. Cover desks with newspaper before handing out the toothpaste. Before handing out the toothpaste to each group, make a small hole near the bottom of the tube using the thumbtack. Pierce the tube gently to prevent the paste from oozing out.

Be Careful! Students should wear aprons and safety goggles.

- 3 Toothpaste leaves the tube; the toothpaste is a model of magma reaching Earth's surface and erupting.
- 4 Possible answer: Depending on how hard the tube is pressed, the toothpaste (lava) can either ooze from or explode from the hole (volcano).

What are landslides and floods?

► Discuss the Main Idea

Ask students to discuss what they know about landslides and floods. A review of how gravity pulls on all objects on Earth may help some students better understand landslides. Ask:

- What is a landslide? Possible answer: a rapid movement of rocks and soil down a hillside
- How can a flood cause damage? Possible answer: by washing away homes, buildings, bridges, and roads
- What force pulls a landslide down a hillside gravity

► Develop Vocabulary

landslide *Scientific vs. Common Use* This word is often used to indicate a huge victory, usually in an election. The scientific use of the word is to describe a rapid movement of rock and soil downhill.

flood *Word Origin* The word *flood* comes from the Old English word *flod*, which means “a flowing of water, river, sea.”

What are landslides and floods?

Have you ever seen a pile of rocks at the bottom of a mountain? How did the rocks get there? Part of the answer is gravity. *Gravity* is a pulling force that acts on all objects. Gravity can cause a landslide. A **landslide** is the rapid movement of rocks and soil down a hill. A landslide can cause a hill or mountain to change quickly.

Heavy rains and melting snow can quickly fill a river. When water flows over a river's banks, or sides, there is a flood. A **flood** is water that flows over land that is usually dry. Flood waters are very strong. They can change land quickly by washing it away.



- ▲ This mountain was quickly changed by a landslide.



✓ Quick Check

5. What effect do landslides have on land?

Possible answer: They can
cause mountains and hills to
become smaller.

Homework Activity

Locate Sudden Changes to Earth

Have students use magazines, newspapers, or reference books to find an example of a recent earthquake, a volcanic eruption, a landslide, and a flood. Have them write a brief description of each event. Students should include the date and location of each example. Students may want to include one map with all the locations on it. Pictures of the damage caused by the events would also be useful.

ENGAGE

EXPLORE

EXPLAIN

EVALUATE

EXTEND

3 Close

Lesson Review

► Discuss the Main Idea

Have students review their answers to the questions throughout the lesson. Address any remaining questions or misconceptions.

► Visual Summary

Have students summarize key points of the lesson in the Visual Summary. The titles in each box will help guide students to the topics they should summarize.

Visual Summary

Complete the lesson summary in your own words.



Earthquakes happen when rocks in the crust
move. They can change the land quickly.



When lava, ash, and rock are forced from a
volcano, the land can change quickly.



Landslides can quickly change the shape of a
hill or mountain. Floods can wash land away.

Formative Assessment

Approaching Have students list the four ways in which events mentioned in the lesson can cause sudden changes to Earth's surface.

On-Level Have students describe what an earthquake, a volcano, a flood, and a landslide are and how they change the land.

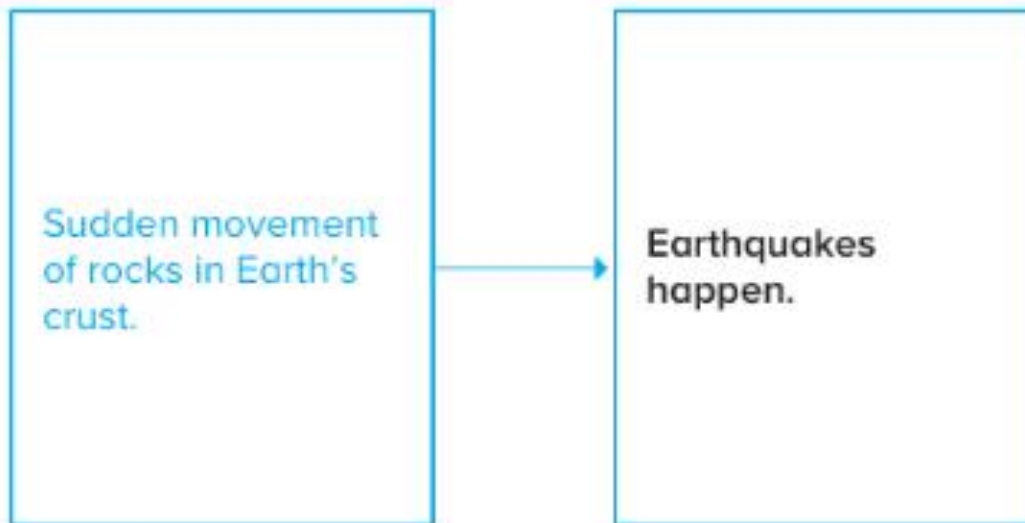
Challenge Have students research a recent earthquake or flood. Students should write a short report on the event.

Think, Talk, and Write

- 1 **Vocabulary** What is a volcano?

a mountain that forms from melted rock

- 2 **Cause and Effect** What causes earthquakes to happen?



- 3 **Critical Thinking** What do earthquakes, volcanoes, landslides, and floods have in common?

Possible answers: They all change the land, can damage property, and can be harmful to living things.

- 4 **Test Prep** Which event can be caused by heavy rains?

- ☒ A flood
☐ B earthquake
☐ C volcanic eruption
☐ D drought

Essential Question How can Earth's surface change quickly?

Earth's surface can change quickly because of an earthquake, a volcanic eruption, a landslide, or a flood.

Objective

- Identify cause and effect in an article.

Slide on the Shore

Genre: Nonfiction

- Why do you think the author wrote this article?
Possible answer: to tell about the things people do to prevent landslides

Before Reading

Have students share what they know about landslides. Have students look at the main photo. Ask:

- Why do you think landslides are dangerous to people who live on cliffs like this? Possible answer: because their houses can be damaged or destroyed by landslides
- Why do you think people build their homes on cliffs if there is a danger of landslides? Possible answers: because they like living near the ocean; because of the beautiful view

During Reading

Explain to students that they are reading about different methods people use to prevent landslides. Encourage students to think how each method helps to prevent landslides. Ask:

- Why do you think the rock wall might be used for landslide prevention? Possible answer: Because it stops the soil from moving.
- How do terraces help prevent landslides? The terraces keep rocks and water from flowing to the bottom of the cliff.
- How do shrubs prevent landslides? Shrubs and other plants help keep the soil in place.

Ask students to describe another method of landslide prevention.

SLIDE on the Shore

The western coast of the United States is a beautiful place to live. The views from its cliffs are awesome. Heavy rains, melting snow, and construction can weaken these cliffs, however. Then landslides may happen.

There are some things people can do to help prevent landslides. People can carve steps of land called terraces into the cliffs. Rocks and water stay on the terraces and do not flow to the bottom of the cliff.

People can also use drains and covers to keep the land dry. They can plant shrubs and other plants to help keep the soil in place.

People can build things to help keep the soil from moving down a hill. For example, walls of rock and concrete can support a cliff from below. Ditches can direct water around buildings. All of these things help keep people living on or around cliffs safe.



This rock wall will keep soil from moving down this hillside.

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EXTEND

LA Support

Decode Review cause and effect with students. Have students work together to pick three causes and their effects in the article. Explain terms students may not know, like *terraces*, *in place*, and *direct water*.

BEGINNING

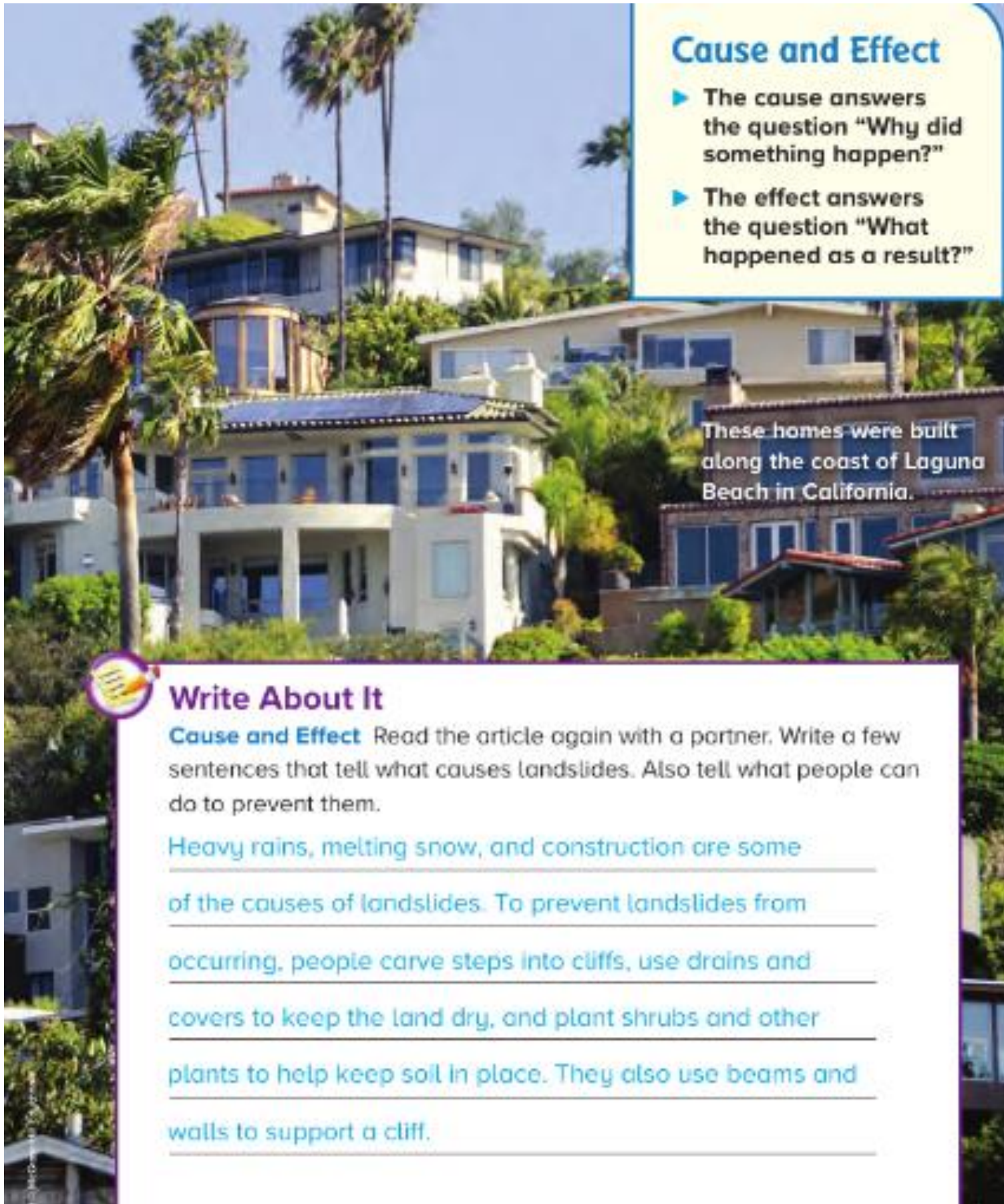
Students can give one- or two-word responses to questions about the photos, such as, *What is this wall made of? What can it prevent?*

INTERMEDIATE

Students can say a phrase or sentence about one thing people can do to prevent landslides.

ADVANCED

Students can explain the causes of landslides and explain at least one thing people can do to prevent them.



Cause and Effect

- ▶ The cause answers the question “Why did something happen?”
- ▶ The effect answers the question “What happened as a result?”

These homes were built along the coast of Laguna Beach in California.



Write About It

Cause and Effect Read the article again with a partner. Write a few sentences that tell what causes landslides. Also tell what people can do to prevent them.

Heavy rains, melting snow, and construction are some
of the causes of landslides. To prevent landslides from
occurring, people carve steps into cliffs, use drains and
covers to keep the land dry, and plant shrubs and other
plants to help keep soil in place. They also use beams and
walls to support a cliff.

After Reading

Remind students that the cause is what makes things change and the effect or effects are the changes that happen. Write *heavy rains*, *melting snow*, and *construction* on the board. Explain that these are causes. Ask students to identify the effect or effects. Possible answer: The cliffs weaken, landslides happen, rocks and water are pulled to the bottom of the cliff. Display a cause and effect graphic organizer. Use students' responses to complete the organizer.

Have students look through the article to find other cause-and-effect relationships to add to the chart.

Integrate Reading

Design a Home

Ask students to design and draw a coastal cliff home. Then have them write a sentence to tell how they will prevent landslides from damaging their home. Ask: **Why did you choose that method of landslide prevention? What are some of the problems you might face?**

Have students share their plans with the class, including the positive and negative aspects of using the prevention method they chose.

Lesson 3 Weathering and Erosion

Essential Question

How can Earth's surface change slowly?

Reading Skill Draw Conclusions

Text Clues	Conclusions

Objectives

- Describe and identify the forces that cause weathering and erosion.
- Analyze how people change the land.

You will need a draw conclusions graphic organizer.



FAST TRACK

Lesson Plan When time is short, follow the Fast Track and use the essential resources.

1 Introduce

Look and Wonder

2 Teach

Develop Vocabulary
Use the Visuals

3 Close

Think, Talk, and Write

Teacher Notes

Lesson 3 Weathering and Erosion

Objectives

- Describe and identify the forces that cause weathering and erosion.
- Analyze how people change the land.

1 Introduce

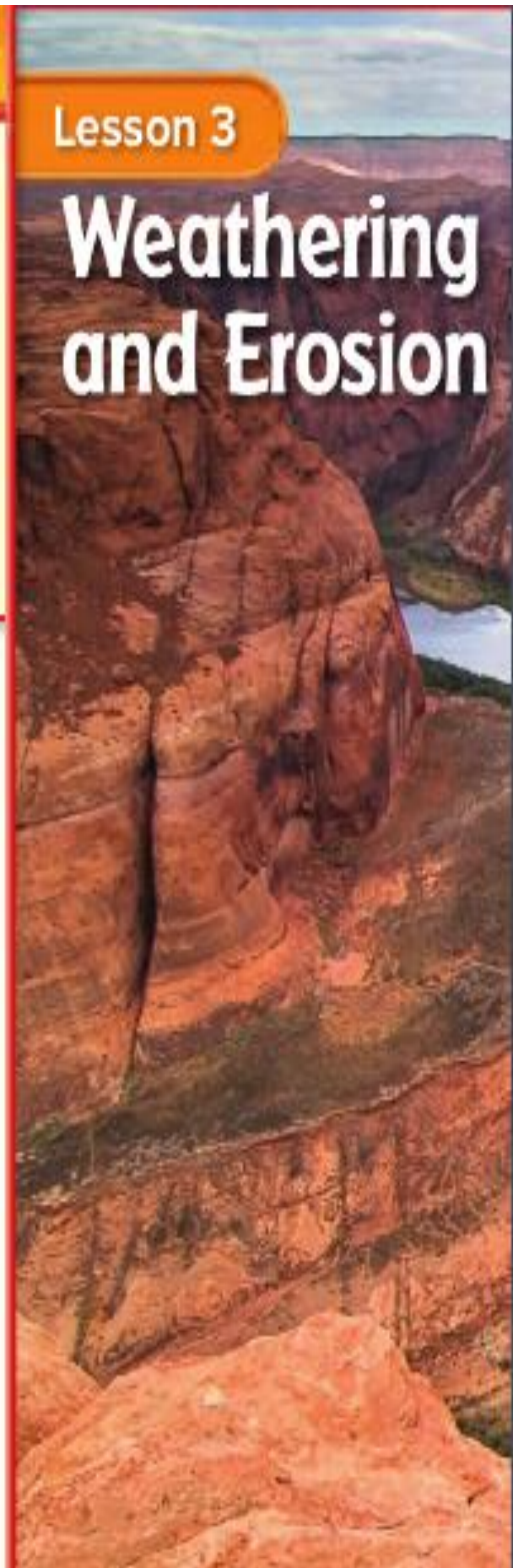
► Assess Prior Knowledge

Have students discuss how they think Earth's surface is changed by flowing water, wind, ice, and gravity. Ask:

- How can flowing water change Earth's surface? Possible answer: Flowing water can wash away loose rock and soil.
- What happens to an object that is left outside, exposed to rain, snow, sunlight, and freezing temperatures? Possible answer: It will become worn, rusted, or faded, depending on what it is made of.

Lesson 3

Weathering and Erosion



Warm Up

Start with a Demonstration

Prior to class, fill a plastic container full of water and seal the top in place. Freeze the container. As the water expands during freezing, the top should be displaced. For the class, place next to the frozen container an identical plastic container filled to the top with the same amount of water. Explain to students that both containers are the same size and contain the same amount of water. The frozen container was filled to the top with water, and when you sealed it, the top fit. Ask:

- **What happened when the water froze?** Possible answer: The water expanded. When the water expanded, it forced open the container top.
- **What do you think happens when water freezes in a crack in a rock?** Possible answer: When the water expands, the crack gets deeper, wider, or longer, increasing in size.

Look and Wonder

This canyon was once flat land. Today, parts of the Grand Canyon are nearly 1.6 kilometers deep. How do canyons form?

Possible answer: Moving water in the river cut the canyon.

Essential Question

How can Earth's surface change slowly?

Answers will vary. Accept any reasonable answer.

Look and Wonder

Invite students to share their responses to the Look and Wonder statement and question:

- This canyon was once flat land. Today, parts of the Grand Canyon are nearly one mile deep.
How do canyons form?

Write ideas on the board and note any misconceptions that students may have. Address these misconceptions as you teach the lesson.

Essential Question

Have children read the Essential Question. Tell them to think about it as they read through the lesson. Advise children that they will return to this question at the end of the lesson.

Explore



pairs



30
minutes

Plan Ahead Make sure the grains in the sandstone pieces are loose enough to break off when the rocks are shaken in the jars. Pieces of siltstone or shale may also be used. Make sure the plastic jars are transparent enough so that the students can see the rocks.

Purpose Shaking the jars simulates flowing water in a stream, weathering and eroding rocks.

Structured Inquiry

Form a Hypothesis

- 3 Use Variables** Make sure the jar lids are on tightly.
- 4 Use Variables** Have one student act as the timekeeper.

Explore

How can rocks change in moving water?

Form a Hypothesis

What happens to rocks when they move around in water?

Write your answer in the form "If I shake rocks in water, then..."

Possible hypothesis: If I shake rocks in water,

then the rocks will break into smaller pieces.

Test Your Hypothesis

- 1 Measure** Label three jars *A*, *B*, and *C*. Put the same number of similar-sized rocks in each jar. Using the measuring cup, fill each jar with the same amount of water. Put a lid on each jar.
- 2** Let jar *A* sit. Do not shake it.
- 3 Use Variables** Shake jar *B* hard for 2 minutes. Then let the jar sit.
- 4 Use Variables** Shake jar *C* hard for 5 minutes. Then let the jar sit.

Materials



- sandstone rocks



- measuring cup



- 3 plastic jars with lids



- stopwatch



- hand lens

- 5 Observe** Use a hand lens to observe the rocks in each jar. What happened? Did the results support your hypothesis?

Jar A: rocks were the same; Jar B: few

bits of broken rocks in water; Jar C: more

bits of broken rocks in water than in Jar

B. Answers about students' hypotheses

will vary.

Draw Conclusions

6 Infer How can rocks change in moving water?

Possible answer: Moving water can cause rocks to bang against each other, breaking off pieces.

Explore More

Experiment Would the results be the same if different rocks were used? Make a plan and try it.

Answers will vary.

Open Inquiry

Design a test to determine if rocks can break easier without water in the jar.

My question is: Answers will vary.

How can I test it: Answers will vary.

Guided Inquiry**Explore More**

Experiment Students should see that some types of rocks break apart more easily than others.

Open Inquiry

Ask students to think about whether rocks would break more easily without water in the jars. Have students formulate a question on this topic and then design and carry out an experiment to answer it. Ask:

Will the same kinds of rocks we used in this activity break apart more easily without water?

**Alternative
Explore****Do all rocks weather at the same rate?**

Materials plastic jar, lid, pieces of sandstone and granite, water

Have students test the weathering of soft rocks (sandstone or shale) compared with harder rocks (granite or marbles) in a stream. Place some softer rock pieces in the jar along with some harder rocks. Add water and shake the tightly closed jar for five minutes. Have students observe what happened to the various types of rocks.

2 Teach

Read and Respond

Main Idea As students read the lesson, have them write how weathering and erosion can cause changes to Earth's surface over time.

Vocabulary Have students compare and contrast weathering and erosion.

Reading Skill Draw Conclusions

Graphic Organizer Have students fill in a Draw Conclusions graphic organizer as they read through the lesson. They can use the Quick Check questions to identify each conclusion to draw.

Text Clues	Conclusions

What is weathering?

► Discuss the Main Idea

Have students discuss the changes they have observed in Earth's surface. Ask:

- What are some causes of weathering? Possible answers: running water, wind, rain, melting snow, ice, plants, animals
- How can plants and animals cause weathering? The roots of plants split rocks apart. Animals can uncover rocks while digging in the ground. Once uncovered, the rocks begin to weather.

Read and Respond

What is weathering?

You might think that hard rocks can not change or break, but they do. Large rocks break into smaller rocks. Small rocks break down into sand and soil. The breaking down of rocks into smaller pieces is called **weathering** (WETH•ur•ing). Weathering usually happens so slowly that you do not notice it. The weathering of rocks can take millions of years.

What causes weathering? Running water, wind, rain, and temperature changes are some things that break down rocks.

Running water and wind pick up small rocks. These rocks scrape against other rocks. This scraping slowly wears away rocks.



Quick Check

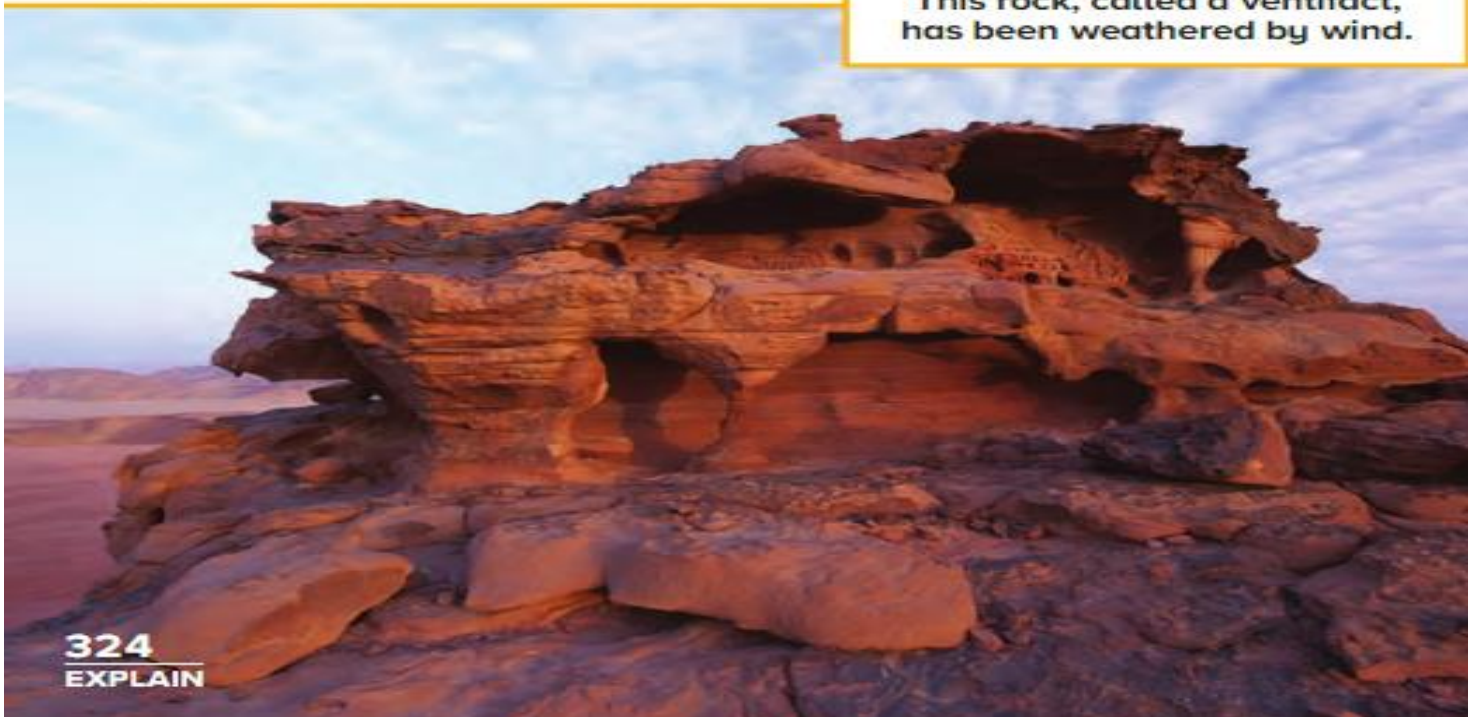
1. A sidewalk crack became wider during a cold winter. Why?

Rainwater or melted snow
got into the crack, froze, and
caused the crack to widen.

2. Explain how people can cause weathering.

Possible answer: People use
machines that dig into the
ground, break up rocks, and
expose them to weathering.

This rock, called a ventifact, has been weathered by wind.



► Develop Vocabulary

weathering *Scientific vs. Common Use* The word *weather* is commonly used to state what is happening in the atmosphere. In science, *weathering* describes how rocks are broken down into smaller pieces.

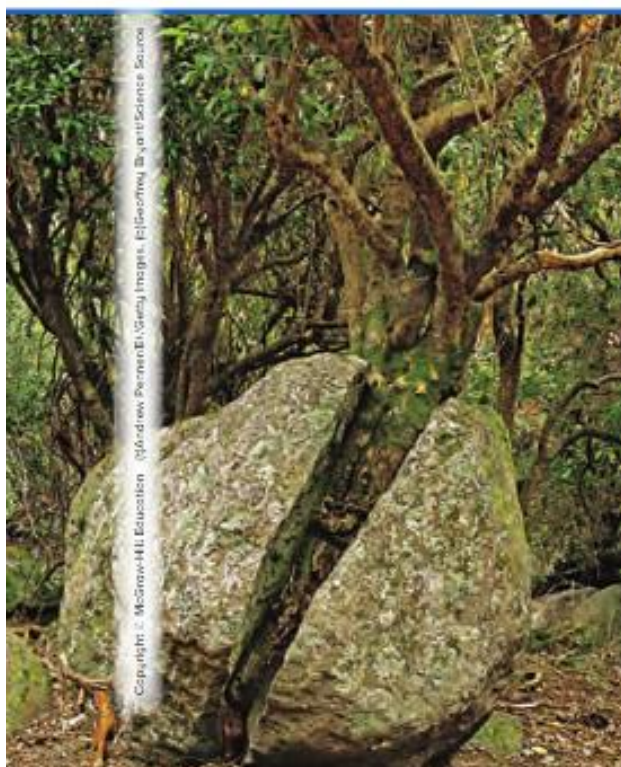
Science Background

Types of Weathering There are two types of weathering: physical weathering and chemical weathering. In physical weathering, rocks are broken into smaller pieces, but the chemical composition of the rocks stays the same. Freezing and thawing and abrasion cause physical weathering. In chemical weathering, the rocks' chemical composition changes. Oxidation or rusting is a form of chemical weathering.



These hoodoos have been worn mostly by water that freezes and then thaws inside cracks in the rocks.

This tree continues to break this rock apart. ▼



Rain and melting snow can enter the small cracks in rocks. When the water freezes, it *expands*, or takes up more space. This widens the cracks. Then the ice thaws and becomes liquid water again. Over time, repeated freezing and thawing breaks rocks apart.

Living things can cause weathering. Plants can grow in the cracks of rocks. Their roots eventually split rocks apart. When animals dig in the ground, they can uncover buried rocks. The uncovered rocks can then begin to weather.

► Explore the Main Idea

ACTIVITY Take students outside where they can see a sidewalk or parking lot that has been broken up by weathering. Explain that tree roots or freezing and thawing can, over time, break up the hard concrete or asphalt. Have students draw an example of tree roots breaking up a sidewalk.

► Address Misconceptions

Students may have a misconception that rocks are unchanging. In fact, over time, even hard rocks such as granite can be weathered. Abrasion by wind and rain, the chemicals in polluted air, and acid rain can dramatically weather even hard rocks.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Have students find examples of weathering around the school or their home. Have students describe in their own words at least three examples of weathering.

ENRICHMENT Have students research how sand blowing in deserts can weather rocks. Have students make a poster explaining weathering by wind. Ask volunteers to show the posters to the class.

What is erosion?

► Discuss the Main Idea

Ask students to discuss how they think rocks can be moved from one place to another over Earth's surface. Ask:

- What forces can move rocks on Earth's surface? Possible answers: moving water, wind, ice, and gravity
- When water flowing over the surface slows down, what happens to the rocks carried by the water? Possible answer: The rocks are dropped or deposited.

► Develop Vocabulary

erosion *Word Origin* The word *erosion* is from the Latin word **erodere**, which means to “gnaw away.”

glacier *Word Origin* The word *glacier* comes from the Latin word **glacies**, which means “ice.”

deposition *Word Origin* This word comes from the Old French word **deposer**, meaning “put,” “place.”

► Use the Visuals

Have students study the photographs. The photographs show examples of erosion by moving water, gravity, and glaciers. Ask:

- How does gravity cause erosion? Possible answer: Gravity pulls rocks and soil downhill.
- How does wind cause erosion? Wind can pick up some pieces of weathered rock and deposit them in a new place.

LA Support

Discuss Write *rivers* and *streams* on the board. Discuss the role rivers and streams play in the movement of rocks on Earth. Write words in random order on the board and have students put them into a sentence. For example: *moves, Flowing, small, water, rocks* becomes “Flowing water moves small rocks.”

BEGINNING

Students can point to or name pictures of rivers, streams, and oceans.

INTERMEDIATE

Students can use phrases or short sentences to describe rivers and streams.

ADVANCED

Students can use complete sentences to describe how rivers and streams move rocks, and how the size and amount of rocks carried by the stream would change if the stream began to flow faster.



- ▲ The rocks in this stream were carried here by moving water.

What is erosion?

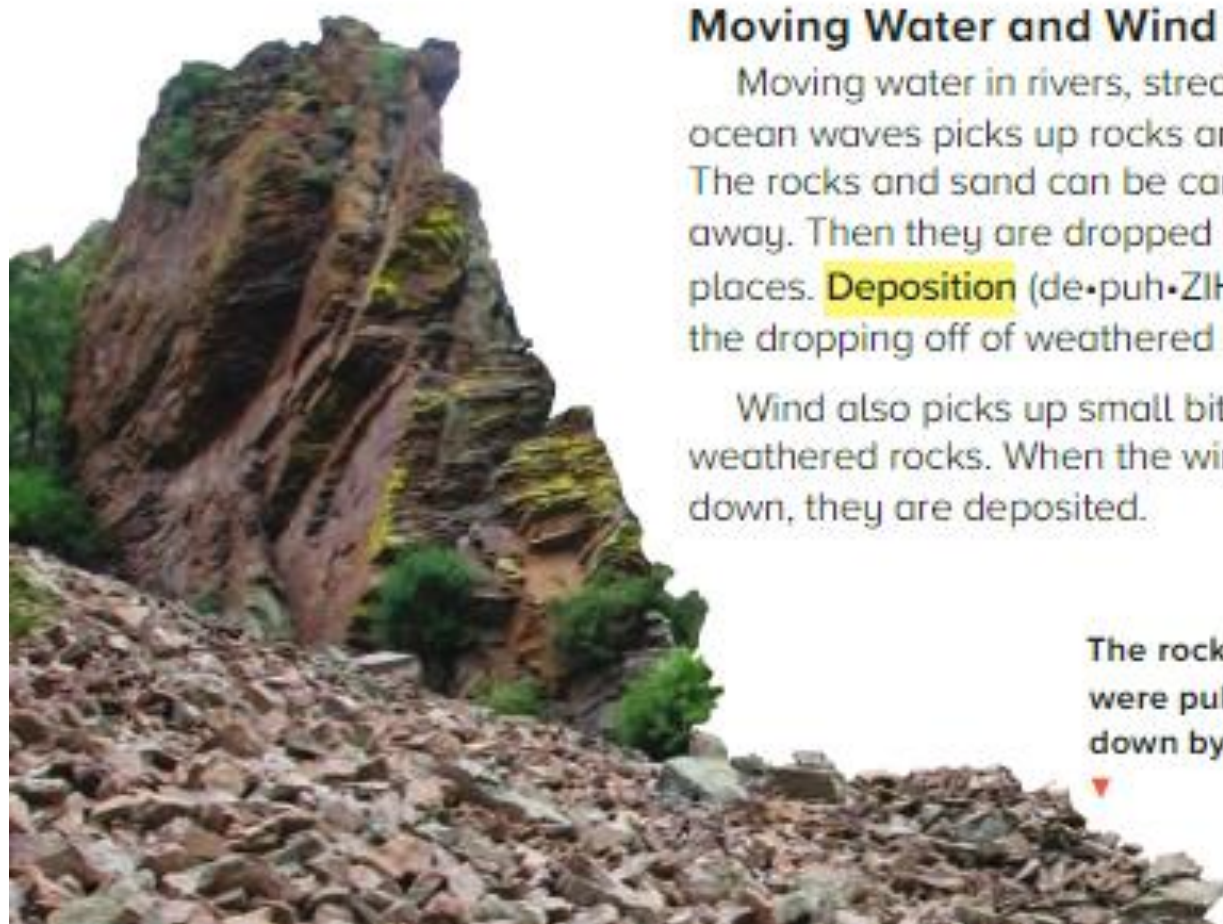
Broken rocks are sometimes moved to other places. **Erosion** (ih•ROH•zhun) is the wearing away and movement of weathered rock. Moving water, wind, and glaciers (GLAY•shurz) all cause erosion. A **glacier** is a mass of ice that moves slowly across the land. Gravity also causes erosion. Gravity pulls weathered materials downhill.

Erosion can happen slowly or quickly. Floods can cause erosion quickly when rivers overflow their banks. Glaciers cause erosion slowly as they move across the land.

Moving Water and Wind

Moving water in rivers, streams, and ocean waves picks up rocks and sand. The rocks and sand can be carried far away. Then they are dropped in new places. **Deposition** (de•puh•ZIH•shun) is the dropping off of weathered rock.

Wind also picks up small bits of weathered rocks. When the wind slows down, they are deposited.



The rocks here were pulled down by gravity.



Glaciers

As it moves, a glacier picks up and carries away rocks of all sizes. The ice at the bottom of a glacier freezes onto rocks. As the glacier moves, it tears rocks out of the ground. A glacier can move rocks the size of a house. As a glacier melts, it leaves the rocks in a new place.

Quick Lab

To learn how materials settle, do the Quick Lab in the back of the book.



Quick Check

3. Compare erosion and weathering.

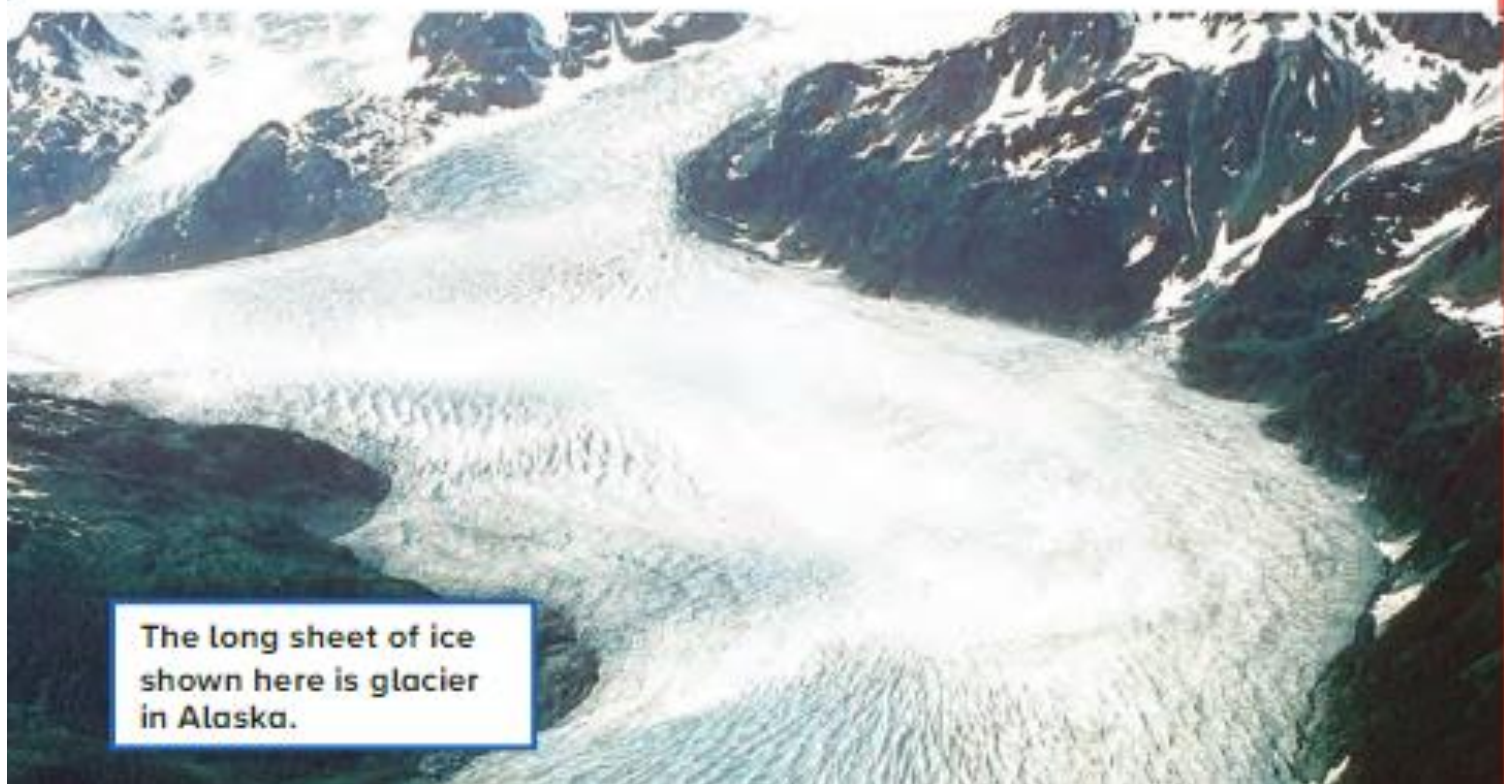
Both erosion and weathering

involve breaking down rock.

Erosion is the process of wearing

down and removing weathered

rock.



The long sheet of ice shown here is glacier in Alaska.



Materials Settle

See the Quick Labs in the back of the book.

Objective Observe how various materials settle.

Materials potting soil, sand, small pebbles, plastic measuring cup, large plastic jar with lid, newspaper, water

Plan Ahead The large plastic jar must have a wide mouth and be transparent. Cover the desk with the newspaper before filling the jar.

Be Careful! Do not use a glass jar. It might break when shaken.

- 3 Materials settle in layers on the bottom by weight. The heaviest materials settle out first on the bottom, and the lightest materials settle on top.
- 4 Eroded materials are dropped off as a river slows. The heaviest pieces are dropped off first. As the river slows more, lighter materials are dropped off.

► Explore the Main Idea

ACTIVITY Explain to students that a glacier erodes rock similarly to how a bulldozer scrapes up material. The ice scrapes up rocks and soil from underneath the glacier and from the sides of the glacier. Have students find pictures that show the piles of material along the sides and front of the ice.

Differentiated Instruction

Leveled Questions

EXTRA SUPPORT What happens to rocks carried by ice when a glacier melts? *They are dropped when the ice melts*

ENRICHMENT Suppose you see a giant granite boulder in an area where granite is not common. How could the boulder have been moved to that area? *Possible answer: by a glacier*

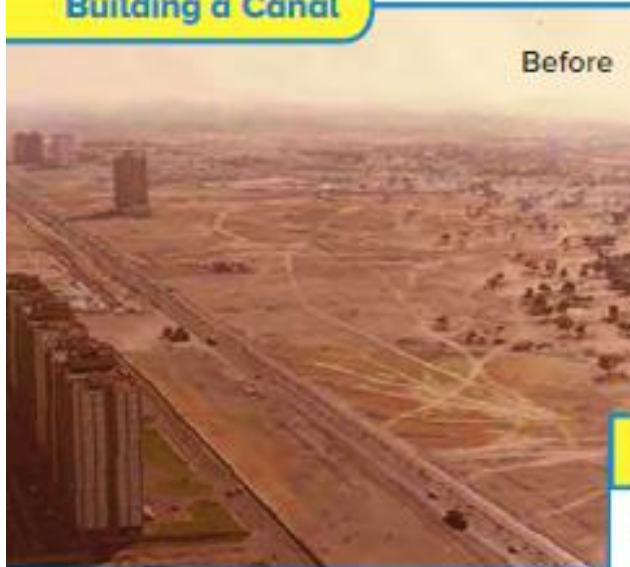
How can people change the land?

► Discuss the Main Idea

Have students discuss the ways people can change the land. Write a list of students' ideas on the board. Ask:

- What are some ways people can change the land? Possible answers: cutting down trees; building bridges, buildings, homes, and roads; draining ponds and swamps; plowing up land for farms; digging mines

Building a Canal



Before



After

- ▲ Sheikh Zayed Road in the early 1980s.

Read a Photo

How did people change the land here?

Clue: Compare the "after" photo with the "before" photo.

People carved out the land to build

a canal. After the land was changed,

water was allowed to fill the canal so

that boats could pass through it.

How can people change the land?

People change the land too. Some changes are very small, like digging a hole in your backyard. Other changes are much larger.

In some places trees are cut to build roads, stores, and homes. If trees are not replanted, soil can wash away. In other places ponds and swamps are drained. The dry soil left behind can blow away. In still other places, land is dug up to reach valuable rocks.

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EXPLAIN



Quick Check

4. What effect might planting trees have on the land?

Possible answer: It would help
to prevent soil erosion.

Homework Activity

Illustrate Erosion

Have students use magazines, newspapers, or reference books to find examples of erosion by moving water, wind, glaciers, and gravity. Have them write a brief description of each example of erosion. Students should draw a picture or use a copy of a photograph to illustrate each example of erosion. If possible, direct them to local examples, such as information about a nearby landslide.

3 Close

Lesson Review

► Discuss the Main Idea

Have students review their answers to the questions throughout the lesson. Address any remaining questions or misconceptions.

► Visual Summary

Have students summarize key points of the lesson in the Visual Summary. The titles in each box will help guide students to the topics they should summarize.

Formative Assessment

Approaching Have students draw a picture of a glacier.

On-Level Have students draw a picture of a glacier and label areas where erosion is taking place and where rocks are being dropped off.

Challenge Have students research how rocks frozen in a glacier scrape and erode the surface over which the glacier moves. Have them write a report on their findings.

Visual Summary

Complete the lesson summary in your own words.



Weathering breaks down larger rocks into
smaller rocks.



Erosion is the weathering and movement of
weathered rock from one place to another.



People change the land in many ways.

Think, Talk, and Write

- 1 **Vocabulary** What is deposition?

Deposition is the dropping off of weathered rock.

- 2 **Draw Conclusions** How do rocks and soil erode?

Text Clues	Conclusions
Rocks and sand may be carried far away by water and wind.	They build up Earth's surface in the new place.
Then they are dropped in new places.	They can become weathered and eroded even more.

- 3 **Critical Thinking** How do weathering and erosion together change land?

Weathering breaks down rocks into smaller pieces. Erosion moves the weathered pieces to another place by forces such as wind, water, ice, and gravity.

- 4 **Test Prep** All of the following can cause weathering to rocks except

- A ice.
- ☒ B light.
- C wind.
- D plants.

Essential Question

How can Earth's surface change slowly?

Earth's surface can change slowly from weathering, erosion, and deposition.

Math in Science

Objective

- Estimate the product of one- and two-digit numbers.

Estimate a Glacier's Change

Learn It

Review rounding to the nearest whole number with students. Tell them to look at the first digit after the decimal point. If it is a number less than 5, they simply remove the decimal part of the number. If the digit is 5 or greater, they remove the decimal part and increase the whole number by 1. Ask:

- If we multiply the rounded number instead of the exact number, what will we get? *an estimate of the exact answer*

Try It

Write each of the following problems on the board as you ask the questions:

- If we want to estimate the sum of 112 and 43, what should we add? *100 and 40*
- If we want to estimate the product of 24 and 9, what should we multiply? *20 and 10*

Integrate Math

Average Temperature

- Have students research to find Earth's average temperature last year and in several prior years.
- Tell them to use these numbers to write a math problem such as the one concerning the Mertz Glacier.
- Have students exchange papers and solve each other's problems.

Estimate a Glacier's Change

Sometimes a glacier reaches the ocean and floats on top of it. This long, thin mass of floating ice is called an ice tongue.

The Mertz Glacier is in Antarctica. It has a tongue. Since 1963, melting has caused the glacier's tongue to get longer. It "grows" about 0.9 kilometers each year. If this rate stays the same, about how much should the tongue grow over the next 5 years?



▲ The Mertz Glacier's tongue is about 50 km long.



Solve It

About how much should the glacier's tongue grow in 20 years? If the tongue grows longer than you estimated, what might this tell you about the rate at which the tongue is growing?

About 20 kilometers; the glacier
is melting faster than it has in
the past.

Make Estimations

- ▶ An estimate is a number that tells about how much or how many. To estimate the tongue's growth, round 0.9 to the nearest whole number: 0.9 km rounds to 1.0 km.
- ▶ To estimate the change over 5 years, multiply the amount of change per year by the number of years.

$$1 \text{ km per year} \times 5 \text{ years} = 5 \text{ km}$$

The glacier's tongue will grow about 5 km in 5 years.

ENGAGE

EXPLORE

EXPLAIN

EVALUATE

EXTEND

Apply It

- Write several similar problems on the board. Include all four operations.
- Tell students not to find answers to these problems or even estimates of the answers. Tell them to instead write down what numbers they would add, subtract, multiply, or divide in order to find an estimate of each answer. Have students write their responses on a sheet of paper and then exchange papers with a partner.

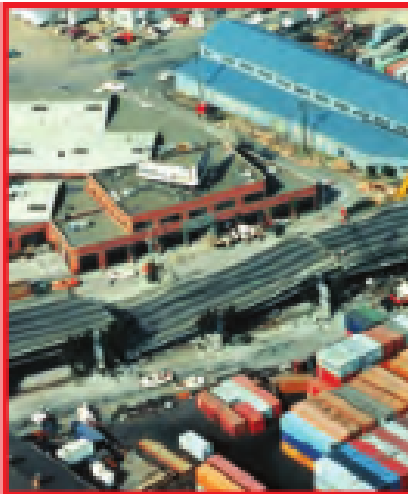
CHAPTER 8 Review

Visual Summary

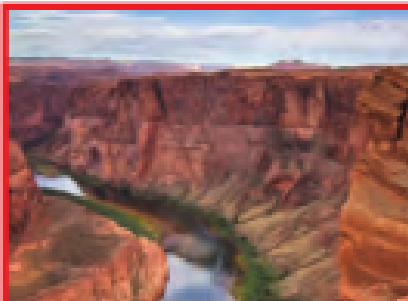
Summarize each lesson in your own words.



Lesson 1 Earth's surface has many land and water features.



Lesson 2 Earthquakes, volcanoes, landslides, and floods cause Earth's surface to change quickly.



Lesson 3 Weathering and erosion usually cause slow changes to Earth's surface.

Vocabulary

Fill each blank with the best term from the list.

continent

earthquake

landslide

volcano

core

erosion

magma

weathering

crust

landform

1. Each of the seven great land areas on Earth is called a continent.
2. The breaking down of rocks into smaller pieces is called weathering.
3. A mountain is an example of a landform.
4. A mountain that builds up around an opening in Earth's crust is a volcano.
5. The sudden movement of rocks in Earth's crust might cause an earthquake.
6. Melted rock below Earth's crust is called magma.
7. The movement of weathered rock by such things as wind, moving water, and glaciers is known as erosion.
8. Earth's deepest, hottest layer is the core.
9. Earth's cool, thin top layer is called the crust.
10. The rapid movement of rocks and soil downhill is a landslide.

Depth of Knowledge

Level 1 Recall Level 1 requires memory of a fact, a definition, or a procedure. At this level, there is only one correct answer.

Level 2 Skill/Concept Level 2 requires an explanation or the ability to apply a skill. At this level, the answer reflects a deep understanding of the topic.

Level 3 Strategic Reasoning Level 3 requires the use of reasoning and analysis, including the use of evidence or supporting information. At this level, there may be more than one correct answer.

Level 4 Extended Reasoning Level 4 requires the completion of multiple steps and requires synthesis of information from multiple sources or disciplines. At this level, the answer demonstrates careful planning and complex reasoning.

CHAPTER 8 Review

Skills and Concepts

Answer each of the following.

- 11. Cause and Effect** What causes landslides?

Possible answer: Wet weather can loosen soil. The pull of gravity on loose rock and soil can cause the rock and soil to fall.

- 12. Descriptive Writing** Describe what the ocean floor looks like.

Responses will vary. Student responses may include descriptions of features such as trenches, seamounts, and abyssal plains.

- 13. Make a Model** Suppose you want to show the difference between a plateau and a mountain. Explain how you could build a model to show the difference.

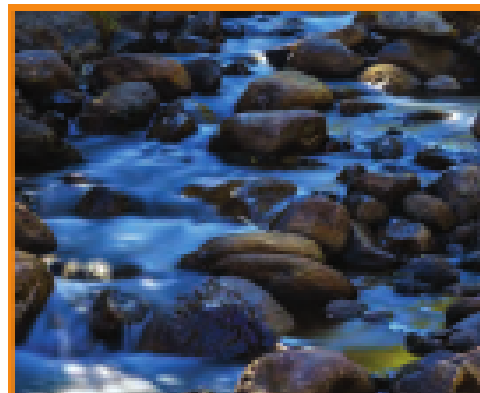
Possible answer: I could build models using clay. My plateau model would have steep sides and a flat top. My mountain model would be tall but would not have a flat top.

- 14. Critical Thinking** What might cause a volcanic mountain to form quickly?

Possible answer: If a volcano erupts continuously or gives off a lot of lava, a volcanic mountain could form quickly.

- 15.** How can erosion be caused by a stream or a river?
Answers should mention that the force

of moving water can carry rocks and sediment away from the bank of a river or stream.



- 16. Experiment** Would clay or sand be washed away more easily by rain? Make a prediction. How could you test your prediction?

Experiment Sand; a possible experiment would be to put samples of clay and sand in the raised end of a tilted container and then pour water over the clay and sand to see which washes away faster.

- 17. True or False** *All mountains are volcanoes.* Is this statement true or false? Explain.

False; some mountains are not volcanic.

- 18. True or False** *Earth's core has melted and solid rock.* Is this statement true or false? Explain.

True; the inner core is solid rock. The outer core is melted rock.

- 19.** Which of the following most likely causes weathering?

A animals C wind
B rocks D soil



- 20.** What can cause Earth's features to change?

Answers will vary. Students should use information from the chapter to answer.

Circle the best answer for each question.

1. Look at the diagram below.



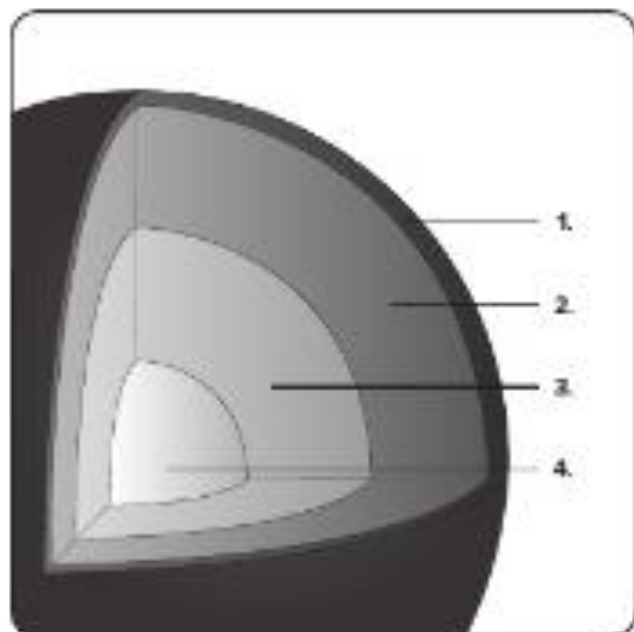
The arrow points to which landform?

- A** mountain
 - B** plateau
 - C** peninsula
 - D** valley
2. Which of these is most likely a slow process?
- A** a beach flooding
 - B** a volcano erupting
 - C** a rock weathering
 - D** an earthquake
3. Which bodies of water cover most of Earth's surface?
- A** oceans
 - B** lakes
 - C** rivers
 - D** ponds

4. The melted rock under Earth's crust is called

- A** lava.
- B** rocks.
- C** ash.
- D** magma.

5. Look at the diagram showing Earth's layers.



In which layer does an earthquake happen?

- A** 1
- B** 2
- C** 3
- D** 4

6. Which landform has steep sides with a flat top?

A a peninsula
B an island
C a plateau
D a valley

7. A scientist recorded the number of earthquakes in the United States for four years. She recorded this information in a chart.

Earthquakes in the United States	
Strength	Number of Earthquakes
great	0
major	1
strong	2
moderate	32
light	245
minor	800

Which inference can she make from this information?

- A** A minor earthquake is likely to happen somewhere in the United States every year.
B A great earthquake is likely to happen somewhere in the United States every year.
C A moderate earthquake is not likely to happen anywhere in the United States.
D A light earthquake can never happen in the United States.

8. Which feature of the ocean floor is like a canyon?

A seamount
B abyssal plain
C continental slope
D trench

Answer the following questions.

Use the picture below to answer questions 9–10.



9. The land along this beach is eroding. Name two possible causes of the erosion shown here.

Possible answers: ocean waves,
gravity

10. Describe one way that this erosion could be slowed down.

Possible answers: planting
trees, building a seawall

