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Correlation to Science Standards
For information on alignment to state science standards and NGSS, visit https://sallyridescience.com/learning-products/product-standards

Correlation to Common Core
Sally Ride Science’s *Key Concepts* and *Cool Careers* book series provide students with authentic literacy experiences aligned to Common Core in the areas of Reading (informational text), Writing, Speaking and Listening, and Language as outlined in *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects*. *Weathering and Erosion: Wind, Water, and Waves* and the accompanying activities align to the following standards:

**Reading Standards for Informational Text K-5 (RI), Grades 3-5**

**Key Ideas and Details**
1. Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. **Grade 3**  
   Refer to details and examples in a text when explain what the text says explicitly and when drawing inferences from the text. **Grade 4**  
   Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **Grade 5**

2. Determine the main idea of a text; recount the key details and explain how they support the main idea. **Grade 3**  
   Determine the main idea of a text and explain how it is supported by key details; summarize the text. **Grade 4**  
   Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. **Grade 5**

3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in a technical procedure in a text, using language that pertains to time, sequence, and cause/effect. **Grade 3**

**Craft and Structure**
4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade appropriate topic or subject area. **Grades 3-5**

5. Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently. **Grade 3**

**Integration of Knowledge and Ideas**
7. Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). **Grade 3**  
   Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. **Grade 4**

**Range of Reading and Level of Text Complexity**
10. By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts. **Grades 3-5**

**Writing Standards K-5 (W), Grades 3-5**

**Text Types and Purposes**
2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly. **Grade 3 a.-d., Grade 4 a.-e., Grade 5 a.-e.**

**Production and Distribution of Writing**
4. With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose. **Grade 3**
Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. **Grades 4 and 5**

Research to Build and Present Knowledge
7. Conduct short research projects that build knowledge about a topic. **Grade 3**
   Conduct short research projects that build knowledge through investigation of different aspects of a topic. **Grade 4**
   Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. **Grade 5**

8. Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. **Grade 3**
   Recall relevant information from experiences or gather relevant information form print and digital sources; take notes and categorize information, and provide a list of sources. **Grade 4**
   Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. **Grade 5**

9. Draw evidence from literary or informational texts to support analysis reflection, and research. **Grade 4 b., Grade 5 b.**

Range of Writing
10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. **Grades 3-5**

**Speaking and Listening Standards K-5 (SL), Grades 3-5**

Comprehension and Collaboration
1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade appropriate topics and texts, building on others’ ideas and expressing their own clearly. **Grades 3-5 a.-d.**

2. Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. **Grade 3**
   Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. **Grade 4**
   Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. **Grade 5**

**Language Standards K-5 (L), Grades 3-5**

Knowledge of Language
3. Use knowledge of language and its conventions when writing, speaking, reading, or listening. **Grade 3 a.-b., Grade 4 a.-c., Grade 5 a.-b.**

Vocabulary Acquisition and Use
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade appropriate reading and content, choosing flexibly from a range of strategies. **Grade 3 a.-d., Grade 4 a.-c., Grade 5 a.-c.**

6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that:
   signal spatial and temporal relationships. **Grade 3**
   signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation.) **Grade 4**
   signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition). **Grade 5**

*Book pages pictured in the Teacher Guides are from eBook editions. Some pages in the print books have different images or layouts.

Cool Careers

Cool Careers in Biotechnology
Cool Careers in Earth Sciences
Cool Careers in Engineering (Upper Elementary)
Cool Careers in Engineering (Middle School)
Cool Careers in Environmental Sciences (Upper Elementary)
Cool Careers in Environmental Sciences (Middle School)

Cool Careers in Green Chemistry
Cool Careers in Information Sciences
Cool Careers in Math
Cool Careers in Medical Sciences
Cool Careers in Physics
Cool Careers in Space Sciences

Key Concepts in Science

Adaptations
Biodiversity
The Biosphere
Cells
Earth’s Air
Earth’s Climate
Earth’s Energy
Earth’s Natural Resources
Earth’s Water
Elements and Compounds
Energy Basics
Energy Transformations

Flowering Plants
Food Webs
Forces
Genetics
Geologic Time
Gravity
Heat
Life Cycles
Light
Motion
Organic Molecules
Photosynthesis and Respiration

Physical Properties of Matter
Plant and Animal Systems
Plate Tectonics
The Rock Cycle
Solids, Liquids, and Gases
Sound
Space Exploration
Sun, Earth, and Moon
Units of Measurement
Vertebrates
The Water Cycle
Weathering and Erosion

Sally Ride Science provides professional development and classroom tools to build students’ passion for STEM fields and careers. Founded by Dr. Sally Ride, America’s first woman in space, the company brings science to life for upper-elementary and middle school students.

Visit us at SALLYRIDESCIENCE.COM for more information.
Weathering and Erosion: Wind, Water, and Waves introduces students to the processes of weathering and erosion that shape and reshape Earth’s surface. Students learn how these processes work hand-in-hand—once weathering has broken rock down into sediments, erosion carries the sediments away. Students also learn that a third major process—deposition—lays down these sediments in new places. Together these processes constantly change the landscape around us. At the end of each two-page spread, a brief statement called The Bottom Line sums up the key ideas covered in those pages.

In Your World sparks students’ interest with a dramatic example of weathering and erosion—the Grand Canyon. Students peek over the rim and view the Colorado River far below. They contemplate how the constant grinding of the river over the eons carved the natural marvel before them. The scenario sets the stage for the chapters to follow by inviting students to see how the processes that continue to shape the Grand Canyon are also at work right outside their front doors.

Chapter 1 uses everyday examples to open students’ eyes to the dynamic, changing nature of Earth’s surface. From cracked sidewalks and pitted bricks to ever-changing riverbanks and mountain ranges, students learn that weathering, erosion, and deposition constantly reshape Earth’s surface. Students also learn that time plays a key role in these changes—just as a crumbling sidewalk used to look different, so too did a valley or a mountain range.

Chapter 2 opens with a mystery: What happened to the Old Man of the Mountain? This famous stony profile formed by a series of ledges on a New Hampshire mountain had stood for thousands of years. But on May 3, 2003, it collapsed into a heap of rubble. Students learn that one cause of the Old Man’s demise was mechanical weathering, which breaks rocks into pieces without changing the chemical makeup of the rock. Chemical weathering, on the other hand, breaks up rock by changing the chemical makeup of the minerals in the rock. Students learn that both kinds of weathering work together to break down rock.

Chapter 3 introduces erosion by placing students in the rapids of a rushing stream. Students learn that rivers shape the landscape more than any other agent of erosion. They discover that a river includes tons and tons of sediment. This sediment settles on floodplains and deltas, providing rich farmland. Students also learn about other agents of erosion—wind and glaciers.

Thinking Like a Scientist describes one way geologists study rivers—by using stream tables. In one experiment, geologists use a stream table to find out how well plants hold riverbanks in place. Students analyze data from this experiment to make predictions about the model and about a real river.

How Do We Know? introduces Abby Sallenger, an oceanographer who studies how storms affect coastlines. Students learn that hurricanes can quickly erode low-lying islands. In Invention Connection, students design a house that can withstand the effects of storms.

Hey, I Know That! allows students to assess their own learning through a variety of assessment tasks relating to the key concepts covered in Weathering and Erosion.
WEATHERING AND EROSION: GETTING STARTED

In Your World

Preview the book
Ask students to browse through Weathering and Erosion. Encourage them to look at the cover, table of contents, chapter titles, special features, photographs, and diagrams. Explain that paying attention to these different parts of the book will clue them in to what the text is about and help them understand it better as they read.

Read In Your World (pages 4 and 5) and discuss key concepts
Tell students to read In Your World. After students have finished reading the text, ask these questions:

How did the Grand Canyon form? [The moving water and bits of rock of the Colorado River have cut through many layers of rock over millions of years to form the canyon.]

Is the Grand Canyon done forming? Why or why not? [The Grand Canyon is still forming because the Colorado River still flows through the canyon and continues to grind against the canyon floor.]

The processes that form the Grand Canyon are at work everywhere. Where have you seen these processes happening around here? [Sample answer: Our local river carved the valley it is in, and the river continues to carve the valley. Also, whenever it rains, little streams of water run over the bare ground near the school and carve little valleys.]

Call on two or three students to share their ideas with the rest of the class.

SCIENCE BACKGROUND
The grinding, erosive power of the winding Colorado River has carved out the Grand Canyon over millions of years. Yet other factors also are responsible for the dramatic landscape we see at the Grand Canyon. One of these factors is climate. The semi-arid climate affects the canyon’s width. Even though the Grand Canyon is a mile wide in places, it would probably be a much wider and less steep river valley if it were in a moist climate. The moisture would speed up the weathering of the exposed valley walls, accelerating the erosion of the canyon away from both sides of the river. The dry climate also limits the amount of vegetation in the area. This results in bare rock and a stark, dramatic landscape.

Another factor responsible for how the Grand Canyon appears is the hardness of the rock layers that make up the canyon. The layers of hard limestone and sandstone erode into steep cliffs. The layers of softer shale crumble more easily and form slopes. This difference in hardness and resistance to erosion creates the pattern of slopes and cliffs in the canyon’s profile.
Read Chapter 1: *Earth’s Changing Surface*

**Before reading: Model summarizing with a concept map**

Give students the Chapter 1: *Earth’s Changing Surface* handout. Point out that the handout has a place to summarize key ideas in the chapter with a concept map. To get students started, draw a circle near the top of the board. Read the title of the chapter: *Earth’s Changing Surface*. Say,

*The title tells us what this chapter is about. I’m going to write Earth’s Changing Surface in the main circle of my concept map.*

Then draw two more circles below the top circle. Use lines to connect the two circles to the top circle. Ask a student to read aloud the text on page 7. Say,

*I want to use the second level of circles for the two main types of processes that change Earth’s surface. This page tells us about one of the processes. What is it?*

Listen to students’ responses and then write *Destructive processes* in one of the circles. Tell students that as they read, they should fill in the second kind of process in the other circle. Then draw several circles below with *Destructive processes* circle and connect them with lines. Say,

*You can use this next level of circles to add information about different kinds of destructive processes.*

Tell students to copy the concept map on their handouts and add to it as they read the chapter.

**Read Chapter 1: *Earth’s Changing Surface* (pages 6-9)**

Ask students to read Chapter 1: *Earth’s Changing Surface*. As they read, they should take notes on their handout and complete the concept map of the main ideas in the chapter.

**After reading: Discuss key concepts**

Pair up students and ask them to look at the photographs in Chapter 1. Assign one of the photos to each student pair. Ask,

*How will the objects shown in the photo change over time?*

Give pairs time to discuss the question. Then call on them to explain how they think the objects in their photo will change over time.

*[Sample answers:]*

**Page 6:** The wall and doorframe will continue to wear away and crumble.

**Page 7:** The river will carve a deeper and deeper canyon as the water continues to flow. Rocks on the sides of the canyon will continue to weather and erode and tumble into the river.

**Page 8:** Forces inside Earth will continue to push up the mountains. At the same time, wind and ice will continue to weather and erode the mountains.

**Page 9:** The waterfalls will continue to wear away the edge of the cliff. Rocks from the top will fall into the water at the bottom of the falls. So the new edge of the cliff will be a little farther upstream. As this continues, the falls will move farther and farther upstream. Also, the rocks at the bottom of the falls will break up as water continues to pound them.*
Read Chapter 2: *Weathering*

**Before reading: Model summarizing with a sequence chart**

Give students the Chapter 2: *Weathering* handout. Point out that it has a space for them to make a sequence chart summing up some of the ideas in Chapter 2. To get students started, model how to start a sequence chart. Have students look at the images and captions on pages 10 and 11. Say,

*We can use a sequence chart to sum up what made the Old Man of the Mountain collapse.*

Draw a rectangle on the board. In the rectangle, write, *The Old Man stood for 10,000 years.* Then draw an arrow to the second box. Say,

*Based on the captions, what should I write to show the next step in the Old Man’s collapse?*

Listen to students’ suggestions and agree on what to write in the second box, such as, *A cave behind the old man’s chin let in water.* Then draw an arrow to a third box. Tell students to copy the sequence chart on their handouts. As they read the chapter, they should add boxes to show the sequence of processes that led to the Old Man’s fall.

**Read Chapter 2: *Weathering* (pages 10-17)**

Ask students to read Chapter 2: *Weathering*. As they read, they should take notes on their handouts and complete the sequence chart of the Old Man’s fall.

**Sample sequence chart**

*The Old Man stood for 10,000 years ➔ A cave behind the Old Man’s chin let in water ➔ The water froze and pushed on the chin block ➔ The water thawed ➔ The water froze and thawed again and again ➔ The chin block got pushed farther out of place ➔ Rainwater mixed with carbon dioxide to form carbonic acid ➔ Carbonic acid turned the feldspar in the granite rocks into clay ➔ The rocks weakened ➔ The chin block toppled ➔ The slabs on top toppled ➔ The rocks broke into thousands of pieces.*

**After reading: Discuss key concepts**

Have students work in pairs to think of as many examples of weathering as they can. Tell them to think of at least five examples that they have seen in person. Give them a couple of minutes to jot down their examples. Then call on several pairs to share their examples. For each example, ask,

*Does everyone agree that this is weathering and not erosion or something else? Why is this weathering? Is this an example of mechanical weathering or chemical weathering, or both? Why do you say that?*

The examples of weathering that students give will likely spark other examples. Discuss them as time allows. Then ask,

*What’s a product of weathering that we couldn’t do without? [Soil is a product of weathering that we need.] What is in soil besides weathered pieces of rock? [Soil also includes air, water, and organic material such as decaying leaves, insects, and worms.] Why is soil so important? [Plants grow in soil, and without plants, there would be no source of food.]*
Students might mistakenly believe that weathering processes produce a noticeable result after occurring only once. For example, they might think that ice wedging splits apart a rock after water freezes in the cracks one time. Emphasize that the processes of weathering usually happen very slowly and continuously, repeating many times before showing a noticeable result. Refer students to the first paragraph on page 11, which says, “After many freeze-thaw cycles, the cracks become large enough to split the rock.” Ask students how many times they think water froze, melted, and froze again in the rocks of the Old Man of the Mountain in any given year. [It probably happened dozens of times.] Then tell them to multiply that by 10,000 years or more, and that gives them an idea of the kind of repeated weathering actions that were necessary to make the rocky cliff break.
Read Chapter 3: *Erosion*

Before reading: Model how to ask questions while reading

Before students read Chapter 3: *Erosion*, tell them that asking questions as they read is one way to increase their understanding of key ideas in the chapter. Have students turn to page 18. Read aloud the chapter title and subtitle: *Erosion: Getting Carried Away*. Then say,

*This subtitle makes me wonder: What exactly is getting carried away? I’ll write down that question.*

On the board, write, *What gets carried away during erosion?* Then call on a student to read aloud the text on page 18. Say,

*There’s the answer to my question. A river carries away sediment—gravel, sand, and small pebbles. But what happens to all that sediment? That’s another question.*

Explain to students that asking themselves questions as they read will help focus their attention on important points in the reading. The questions and the answers may come from images or text.

Read Chapter 3: *Erosion* (pages 18-23)

Have students read Chapter 3: *Erosion*. Provide them with a copy of the Chapter 3 handout. Explain that they should use the handout to record any questions and ideas that occur to them as they are reading. Suggest that they pause after each page, think about what they have read, and jot down any questions the text raises. They also can record information that helped answer any previous questions.

After reading: Elaborate on key concepts

Explain to students that every river is part of a river system. The system includes the main river and all the tributaries that flow into it. Explain also that every river system has a drainage basin, which is the area of land over which water drains into that river system. This basin is also called a watershed.

Show students a map of the United States. Point out the Mississippi River. Ask,

*How big do you think the Mississippi River drainage basin is? In other words, how much of the U.S. do you think it covers?*

Let students examine the map. Call on several students to give responses about what percentage of the U.S. is drained by the Mississippi River. Then point out the river’s major tributaries, including the Missouri, Ohio, Arkansas, and Red rivers. Trace the area of the country that these rivers cover. Ask students if they want to revise their answers. Explain that about 40 percent of the country is drained by the Mississippi River system, including all or part of 32 states. To check students’ understanding, ask,

*Some rainwater and sediment from Montana ends up in the Gulf of Mexico. How can that be? [Some rain that falls in Montana washes into streams that lead to bigger rivers, such as the Missouri River. The rainwater and rivers also carry away sediment. The water and sediment eventually enter the Mississippi River, which empties into the Gulf of Mexico.]*
Erosion

Weathered materials—sediments—move from place to place during a process called erosion. This process wears down the land as sediment is picked up and carried away to be deposited elsewhere. Here are the main agents, or methods, of erosion:

> **Water:** Rainwater and melting snow flow over the land and carry sediment away. Much of this sediment flows into streams and rivers, which carry more sediment as the flowing water wears away the riverbanks and riverbed. Most rivers eventually empty into lakes and oceans. The waves in these bodies of water pound the shoreline and rework the sediment. Water also trickles through the ground, weathering and eroding rock, sometimes resulting in magnificent caverns and dangerous sinkholes.

> **Wind:** Winds can be a significant agent of erosion for smaller sediments—sand and dust. Dust can travel long distances—even around the globe. Sand grains usually hop and roll along the ground, though the winds of sandstorms are strong enough to make sand airborne.

> **Ice:** Running water shapes the landscape more than any other agent of erosion, but ice, in the form of glaciers, is the most powerful eroding force. Continental glaciers in the past, often a mile or more thick, were powerful enough to reshape mountains as the ice advanced and retreated many times. Today, glaciers high in the mountains gouge out the valleys in which they form. Glacial ice can move boulders more easily than liquid water or wind can.

> **Gravity:** The force of gravity pulls loose sediment down a slope. The most dramatic examples are rockslides and mudflows. But sometimes the pull of gravity may move soil or rock just 1 or 2 mm per year. Evidence of this creep can be seen in old tilted telephone poles and gravestones.
WEATHERING AND EROSION
Science Writing

Write about the Old Man of the Mountain

Give students the Science Writing handout. They will write two paragraphs in answer to prompts about the rocky formation that used to be the Old Man of the Mountain. Tell students to review their handouts for Chapter 2 and the text on pages 10, 11, and 14 to get information for their paragraphs.

ANSWER KEY

1. How did the Old Man of the Mountain collapse? Write a paragraph describing the different kinds of weathering that were involved.
   [Sample paragraph: More than one kind of weathering was involved in the fall of the Old Man of the Mountain. Mechanical weathering attacked the rocks as water from rain and melting snow seeped between the rocks and froze. The freezing water expanded, prying rocks apart a little bit each time. The rock was further weathered as water mixed with carbon dioxide in the air and made a weak acid. The acid slowly turned hard minerals in the rock into soft clay. The rock weakened. This combination of mechanical and chemical weathering eventually caused the Old Man of the Mountain to collapse.]

2. Write a paragraph describing how part of the Old Man of the Mountain could end up on a beach due to natural processes.
   [Sample paragraph: After the Old Man of the Mountain collapsed, both mechanical and chemical weathering would continue to break down the rocks that tumbled to the bottom of the cliff. Over many years, large chunks of rock would break down into smaller and smaller pieces. Eventually the pieces would become stones small enough so that rainwater flowing over the land could wash them into a stream. As the stones flow with the water, they bang against other rocks and break apart further. Sand-sized grains break off. The water carries this sediment from the stream into a river that empties into the ocean. There the river’s flow stops, and the sediment gets deposited along the shoreline, where it becomes part of a beach.]
Read *Thinking Like a Scientist* (pages 24-25)

Ask students to read *Thinking Like a Scientist*. Give them the *Thinking Like a Scientist* handout and tell them they will use it to answer the questions on page 25.

Tell students that they will answer the questions based on the data in the table, shown here. Tell them their handout has a place for them to graph the data to make it easier to analyze.

**Make a graph of stream table data**

To get students started on their graphs, draw an X-axis and a Y-axis on the board. Label the X-axis *Time (hours)* and the Y-axis *Erosion (centimeters)*. Tell students to draw the graph on their handouts along with you. Mark off the X-axis every 0.5 hours and the Y-axis every 0.5 cm. Then say,

*We want to show two things on the same graph—how the riverbank with plants eroded and how the riverbank without plants eroded. How can we show these things clearly?*

Call on one or two students to share ideas about how to display the two types of data on the graph. They might suggest labeling the two lines that will result from the graphed data, or using lines of two different colors with a key to explain what each color stands for. Choose a method. Then plot the first point for the erosion of the riverbank with plants, (0.5, 0.3). Have students finish plotting the points and draw one line connecting the points for erosion of the riverbank with plants and another line connecting the points for erosion of the riverbank without plants. Tell them to extend both lines for 2.5 hours and 3.0 hours. Then ask,

*How far do you think the riverbank with plants would erode after 2.5 hours? [It would probably erode about 1.2 or 1.3 cm.]*

*How about for the riverbank without plants? [It would probably erode about 3.8 or 3.9 cm.]*

Have students work in small groups to discuss the questions and come to agreement on the answers. Then ask each group to present to the class. Each group should take one question and show how they arrived at their answer.
ANSWER KEY

1. Which riverbank eroded the least? [The riverbank with plants eroded the least. The riverbank with plants eroded 1 centimeter after 2 hours, while the riverbank without plants eroded 2.8 centimeters.]

2. How much erosion do you think might happen on the riverbank with plants after 3 hours? [The riverbank would probably erode about 1.5 cm after 3 hours. I can tell this by analyzing the data in the table and seeing how much the erosion increases every half hour. Then I can continue that trend for the next two half hours. I can see this trend more easily when I graph the data.]

3. Suppose the stream table was tilted slightly higher. How do you think this would affect the results of the experiment? [If the end of the table was tilted up, more erosion would happen along the riverbanks with and without plants. Erosion would increase because the water would be moving faster and have more power to erode.]

4. How might the results of this experiment be applied to real life? [Sample answer: People could apply the results of this experiment by planting grass and other plants along riverbanks to slow erosion, or by preserving plants that are already growing on riverbanks. People might want to slow erosion so that houses and other buildings built along a river are kept safe from cracking or falling that could occur if the ground under them washes away.]
Read *How Do We Know?* (pages 26-29)

Give students the *How Do We Know?* handout for *Weathering and Erosion*. Ask students to look over the questions for the first section of *How Do We Know?, The Issue* (page 26), and then read that section and answer the questions. Have them complete the rest of the sections (*The Expert*, page 27; *In the Field*, page 28; *Technology*, page 29) in the same way. Tell students to share their answers in pairs. Then go over each question as a class. Call on two or three students to share their answers to each question.

**ANSWER KEY**

1. Why were the Chandeleur Islands important to the coast of Louisiana? *[For many years, the islands served as a barrier or protection for the mainland by blocking waves and storm surges.]*

2. Describe what has happened to the Chandeleur Islands since 2002. *[A series of hurricanes hit the islands. Waves pushed over the islands and eroded some of them away completely.]*

3. What does Abby Sallenger do, and why is his work important? *[Abby Sallenger assesses the damage that major storms do to the coastline. Then he figures out which places will be most vulnerable when the next big storm hits. His work is important because it helps protect people and property from storms. If they know which areas of the coastline are most vulnerable to damage, people can decide to build and live in other places.]*

4. One of the scientists states that Katrina “erased” the lighthouse and the island it stood on. What does the scientist mean by this statement? *[The violent waves swept over the island, destroyed the lighthouse, and eroded away the entire island so that it was no longer visible.]*

5. What is the advantage of Abby Sallenger and other scientists being able to measure changes to coastlines faster than they could years ago? *[Scientists can gather information faster so they’re able to give this information to people faster. Then individuals, companies, and governments can use this information in time to prepare for the next storm.]*
Do the Invention Connection activity

Give students the Invention Connection handout. Tell them to work in pairs to design and draw a beach house on their handouts. Remind them to use the listed specifications when they create their designs.

If time permits, allow students to build scale models of their beach houses using paper and toothpicks.

**Invention Connection: Build a Beach House**

You’re an architect. Design a family beach house with these must-haves.

> Will withstand 200-kilometer (125-mile) per-hour winds
> Will not collapse if sand erodes
> Will stay dry if swamped by storm surge

Make a sketch of your design and describe its features.

**ANSWER KEY**

What features of your design will protect your beach house from damage during a storm?  

*Sample answers: Possible design features to limit storm damage include constructing walls from insulated concrete and attaching the roof to the house with metal hurricane straps. Windows can be made from thick glass and protected by storm shutters. Doors can be reinforced with additional bolts. Special heavy-duty hinges and supports can be installed on garage doors. Possible steps to limit flood damage include selecting an elevated site or building the house on reinforced stilts.*
Picturing weathering, erosion, and deposition

Give students the *Create a Science Poster* handout. Have them work in pairs to brainstorm ideas for a poster that explains one or more of the key concepts they have learned about mechanical and chemical weathering, erosion, and deposition.

Remind students that the *Bottom Line* statements, shown on their handouts, summarize the key concepts in the book. Explain that they could use these statements, or phrases from them, to create an engaging poster with drawings or diagrams, labels, and captions.

The handout has a space for students to design their posters. Then give them poster board and colored pencils or markers and allow them to complete their final posters.

Have each pair of students present and explain their ideas about weathering, erosion, and deposition. Allow time for questions from the class.

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**Key Concepts in Chapter 1**

> Weathering and erosion are very slow processes that wear down the land.

> Weathering, erosion, and deposition slowly but constantly shape and reshape Earth’s surface.

**Key Concepts in Chapter 2**

> One kind of weathering happens when water freezes in the cracks of rocks and eventually splits the rock.

> Mechanical weathering breaks rocks into smaller pieces without changing the chemical makeup of the rock.

> Chemical weathering breaks up rock by changing the minerals in the rock.

> All kinds of weathering work together to break down rock, which produces the soil we need for life.

**Key Concepts in Chapter 3**

> Rivers shape the landscape more than any other kind of erosion.

> When rivers slow or winds die down, they deposit sediments that build up the land.

> Glaciers slowly shape the land by eroding valleys, depositing sediment, and forming lakes.
Complete the *Hey, I Know That!* study guide (page 30)

Have students use the *Hey, I Know That!* handout to answer the questions on page 30 of *Weathering and Erosion*. Have pairs of students discuss their answers. Then call on student pairs to share their answers and explain how they arrived at those answers.

**ANSWER KEY**

1. Look at this drawing. Describe what is happening at each part of the river from A to E. (pages 19 and 20)

   [A: Snow is melting and feeding a river that is flowing down from the mountains. The force of the water flowing along the river cuts a steep, narrow valley in the bedrock.
   
   B: Smaller streams, called tributaries, join the river as it flows along.
   
   C: As the land grows flatter, the river begins to erode the land in wide loops called meanders.
   
   D: A wide, flat plain called a floodplain forms where the river floods when it overflows its banks.
   
   E: Where the river meets the sea, it slows down and deposits sediments, forming a delta.]

2. What letter on the drawing shows where the river flows fastest? What else is happening here? (page 19) [The river is flowing fastest at point A, where it is rushing down a mountain. As it flows, the river is carving a narrow valley. When the river reaches flatter land, it slows down.]

3. What two places show where deposition is happening? (pages 19 and 20) [Deposition is happening at point D, on the floodplain, where the river overflows its banks and deposits sediments to form rich soil. Deposition is also happening at point E, where the water slows as it meets the ocean, dumping sediment and building up a delta.]

4. Make a Venn diagram showing how mechanical weathering and chemical weathering are alike and different (pages 12 and 15) [Students’ diagrams should show that mechanical weathering and chemical weathering both break down rock, and both processes happen slowly over long periods of time. The circle for mechanical weathering should show that this form of weathering breaks rock into smaller pieces without changing its composition. The circle for chemical weathering should indicate that this form of weathering involves chemical changes that transform rock into other substances.]

5. How does mechanical weathering make chemical weathering occur faster? (page 16) [Mechanical weathering can break rock apart into smaller pieces. This exposes more surface area, and chemical weathering can then weather more of the rocks’ surface, breaking down the rock faster.]
6. Describe a natural place, such as a nearby river, park, or mountain. Explain how weathering and erosion are affecting that place. Then predict how that place may change over the next 10,000 years. [Sample answer: A natural place near where I live is Sunset Cliffs. These sandstone cliffs along the Pacific Ocean are constantly being weathered and eroded by the action of waves. Wind and rain also weather and erode the cliffs. Sometimes pieces of the cliffs collapse into the ocean. That exposes new parts of the sandstone to weathering. Over the next 10,000 years, this weathering and erosion will continue. The west-facing cliffs will keep crumbling, and their location will gradually move farther to the east.]
Earth’s Changing Surface: Notes for Chapter 1

As you read Chapter 1, write down the most important information you come across. Resist the urge to write down everything that you read. Instead, focus on the big ideas, or gist, of what you are reading.

CAN’T KEEP STILL

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__________________________________________________________________________________________

BREAK IT UP, MOVE IT OUT!

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__________________________________________________________________________________________
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CONSTRUCTION ZONE AHEAD

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A WORK IN PROGRESS

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PICTURE THIS
Review your notes for Chapter 1. Summarize your notes by making a concept map that makes sense to you. You might start with a circle near the top of the page that includes the chapter’s main idea. Extending from this circle might be two other circles labeled *Destructive processes* and *Constructive processes*. Other circles might name and describe destructive and constructive processes and give examples.

PUT IT ALL TOGETHER
Use your notes and concept map to help you identify and list the most important ideas—the key concepts—in Chapter 1.
Weathering: Notes for Chapter 2

As you read Chapter 2, write down the most important information you come across. Resist the urge to write down everything that you read. Instead, focus on the big ideas, or gist, of what you are reading.

THAT’S HOW THE ROCK CRUMBLES

BREAKING UP IS HARD TO DO

MECHANICALLY MINDED

PLANT POWER

THE REST OF THE STORY

CHEMICAL CHANGES
TEAMWORK

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THE BAD, THE GOOD, AND THE... DIRTY

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PICTURE THIS

Create a sequence chart showing the steps that caused the Old Man of the Mountain to collapse. Start with a rectangle labeled *The Old Man stood for 10,000 years*. Draw a series of arrows and rectangles showing the order of the processes that led to the Old Man’s collapse.

```
THE OLD MAN STOOD FOR 10,000 YEARS

APPLICATIONS

- The Old Man collapsed

FAILURE

- The Old Man collapsed

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PUT IT ALL TOGETHER

Use your notes and sequence chart to help you identify and list the most important ideas—the key concepts—in Chapter 2.

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Erosion: Notes for Chapter 3

As you read, write down any questions that occur to you. Also write down any information that helps you answer your questions.

GETTING CARRIED AWAY

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RIVERS OF CHANGE

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JUST DROP IT

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THERE’S SOMETHING IN THE WIND

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GLACIER GOUGING

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LAKES GREAT AND SMALL

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PICTURE THIS

Review your notes for Chapter 3. Summarize your notes by making a drawing or diagram to illustrate each of the three Bottom Line statements in Chapter 3. Use labels as needed on your drawings, and write a caption for each one.

PUT IT ALL TOGETHER

Use your notes and drawings to help you identify and list the most important ideas—the key concepts—in Chapter 3.
Science Writing: The Old Man of the Mountain

1. How did the Old Man of the Mountain collapse? Write a paragraph describing the different kinds of weathering that were involved.

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2. Write a paragraph describing how part of the Old Man of the Mountain could end up on a beach due to natural processes.

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Thinking Like a Scientist: Modeling Erosion with a Stream Table

Read Thinking Like a Scientist on pages 24 and 25 of Weathering and Erosion. Then look at the table. It shows data that scientists collected using a stream table. The data show how far back a riverbank with plants eroded. It also shows how far back a bare riverbank without plants eroded.

Use this sheet to make a graph of the data.

Then use the table and graph to answer the questions.

1. Which riverbank eroded the least?

_______________________________________________________________________________________

_______________________________________________________________________________________

2. How much erosion do you think might happen on the riverbank with plants after 3 hours?

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3. Suppose the stream table was tilted slightly higher. How do you think this would affect the results of the experiment?

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4. How might the results of this experiment be applied to real life?

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Stream Table Data

<table>
<thead>
<tr>
<th>Time passed (hours)</th>
<th>Riverbank with plants (erosion in centimeters)</th>
<th>Riverbank without plants (erosion in centimeters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.3</td>
<td>0.7</td>
</tr>
<tr>
<td>1.0</td>
<td>0.5</td>
<td>1.2</td>
</tr>
<tr>
<td>1.5</td>
<td>0.8</td>
<td>1.9</td>
</tr>
<tr>
<td>2.0</td>
<td>1.0</td>
<td>2.8</td>
</tr>
</tbody>
</table>
How Do We Know? Islands of Change

Review the questions below for each section of How Do We Know? Then read each section in the book and answer the questions.

THE ISSUE

1. Why were the Chandeleur Islands important to the coast of Louisiana?
_______________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________

2. Describe what has happened to the Chandeleur Islands since 2002.
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THE EXPERT

3. What does Abby Sallenger do, and why is his work important?
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_______________________________________________________________________________________
_______________________________________________________________________________________

IN THE FIELD

4. One of the scientists states that Katrina “erased” the lighthouse and the island it stood on. What does the scientist mean by this statement?
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TECHNOLOGY

5. What is the advantage of Abby Sallenger and other scientists being able to measure changes to coastlines faster than they could years ago?
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_______________________________________________________________________________________
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Invention Connection: Build a Beach House

You’re an architect. Design a family beach house with these must-haves.

> Will withstand 200-kilometer (125-mile) per-hour winds
> Will not collapse if sand erodes
> Will stay dry if swamped by storm surge

Make a sketch of your design and describe its features.

What features of your design will protect your beach house from damage during a storm?

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__________________________________________________________________________________________
Create a Science Poster:
Picturing weathering, erosion, and deposition

Create a science poster that explains one or more of the key concepts you have learned about mechanical and chemical weathering, erosion, and deposition.

The Bottom Line statements, shown here, summarize the key concepts in the book. Use these statements, or phrases from them, to create an engaging poster with drawings or diagrams, labels, and captions.

Design your poster here. Then make your final poster on poster board supplied by your teacher.

Key Concepts in Chapter 1

> Weathering and erosion are very slow processes that wear down the land.
> Weathering, erosion, and deposition slowly but constantly shape and reshape Earth’s surface.

Key Concepts in Chapter 2

> One kind of weathering happens when water freezes in the cracks of rocks and eventually splits the rock.
> Mechanical weathering breaks rocks into smaller pieces without changing the chemical makeup of the rock.
> Chemical weathering breaks up rock by changing the minerals in the rock.
> All kinds of weathering work together to break down rock, which produces the soil we need for life.

Key Concepts in Chapter 3

> Rivers shape the landscape more than any other kind of erosion.
> When rivers slow or winds die down, they deposit sediments that build up the land.
> Glaciers slowly shape the land by eroding valleys, depositing sediment, and forming lakes.
1. Look at this drawing. Describe what is happening at each part of the river from A to E. (pages 19 and 20)

_______________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________
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2. What letter on the drawing shows where the river flows fastest? What else is happening here? (page 19)

_______________________________________________________________________________________
_______________________________________________________________________________________

3. What two places show where deposition is happening? (pages 19 and 20)

_______________________________________________________________________________________
_______________________________________________________________________________________
4. Make a Venn diagram showing how mechanical weathering and chemical weathering are alike and different (pages 12 and 15)

5. How does mechanical weathering make chemical weathering occur faster? (page 16)

6. Describe a natural place, such as a nearby river, park, or mountain. Explain how weathering and erosion are affecting that place. Then predict how that place may change over the next 10,000 years.