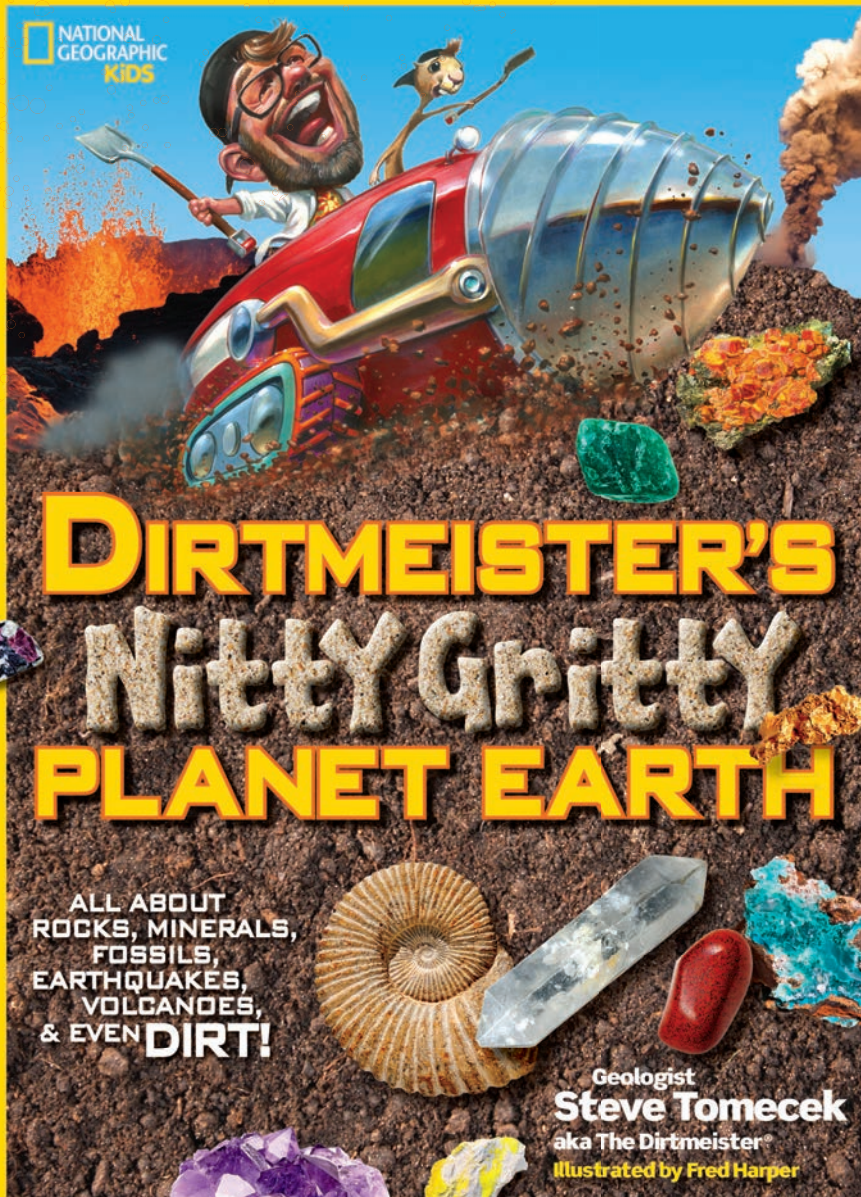


CLASSROOM SCIENCE ACTIVITIES



INSTRUCTIONAL NOTE

From a peek at fossilized poop to a rare glimpse inside an erupting volcano, Steve “The Dirtmeister®”

Tomecek and his pal Digger take kids on a geologic journey around and inside planet Earth.

Hilarious illustrations are mixed together with hard science and all served up in a conversational tone that is just right for junior geologists.

The Next Generation Science Standards (NGSS) are built on the Core Disciplinary Ideas (CDIs) of the Framework for K-12 Science Education. In this Educator’s Guide, activities introduce, review, or otherwise address one or more of the CDIs used as the basis for the NGSS performance expectations for each grade level.



PERFORMANCE EXPECTATION

GRADE
3

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. (3-LS4-1)

MATERIALS: WHAT YOU’LL NEED

Glossy paper
Finger paints of multiple colors
Newspapers

FOSSIL FOOTPRINTS: WHAT YOU’LL DO

Read Chapter 8 aloud, “Digging Old Dead Things.” As you read, pause to discuss relationships between the text, photos, diagrams, and illustrations.

After reading, return to the section “What Is a Fossil?” on pages 94-95. List the different types of fossils scientists find. Identify what scientists can learn from each.

Draw students’ attention to the photo of dinosaur footprints at the bottom of the page. What does the caption say scientists can learn from footprints (how big the animal was and how fast it moved)? Then ask students what else footprints might reveal about dinosaurs. Record students’ responses.

Assign each student a partner. Give each pair two different colors of finger paints and newspapers to cover the work area. Give each student a piece of glossy paper.

Scientists can use dinosaur footprints to calculate how big the animal was and how fast it moved.



Encourage students to dip the tips of their fingers in the paint and move across the paper in different ways. If necessary, prompt them to make their fingers “walk,” “run,” and “hop.” Suggest that they try using different numbers of “feet.”

Stop to give partners a moment to analyze and interpret the results. Challenge them to recognize connections between patterns in the markings and how their fingers moved. Invite students to share what they learned with the class.

Encourage partners to think about what might happen if two dinosaurs met. Then give each pair another piece of glossy paper. Have them illustrate that moment using two

different colors of “footprints” on the paper.

Instruct students to set their papers in a designated area to dry. Have them wash their hands and clean up their work areas.

Display each example. Invite students to analyze and interpret each encounter. Guide students to recognize that footprints can also reveal how dinosaurs interacted with one another.

PERFORMANCE EXPECTATION

Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (4-ESS1-1)

GRADE
4

MATERIALS: WHAT YOU'LL NEED

Copies of the map on page 65
Index cards
Access to research resources, such as the Internet

TECTONIC PLATES: WHAT YOU'LL DO

Read Chapter 5 aloud, "Shifting Plates and Drifting Continents." As you read, pause to discuss relationships between the text, photos, diagrams, and illustrations.

After reading, ask students how the maps on pages 59 and 65 are connected. (The map on page 59 shows what the continents looked like when they were all together. The map on page 65 shows the continents after they pushed and pulled apart.)

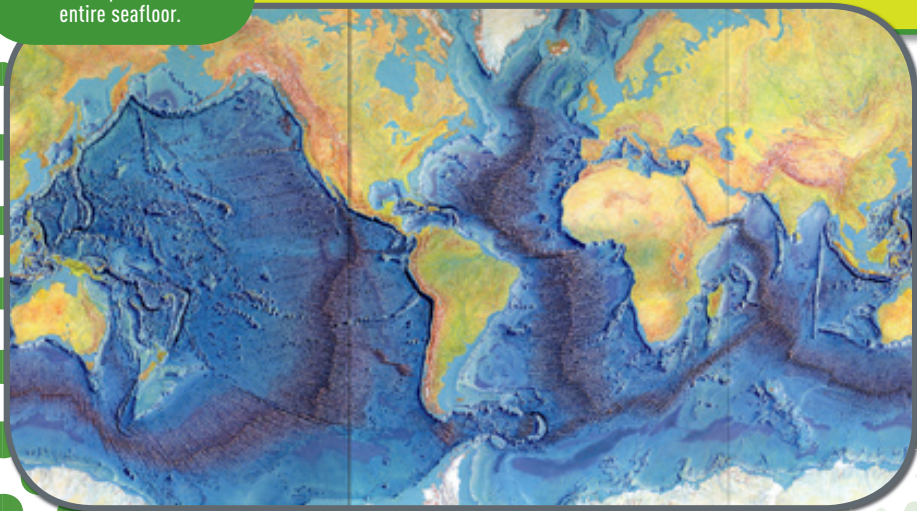
Give each student a copy of the map. Ask student what the dotted lines indicate (plate boundaries). What do the arrows show (the direction plates are moving)? Discuss what happens along plate boundaries. (Plates push apart and smash together.) Challenge students to identify different types of geologic features they might see in these locations.

Divide the class into small groups. Instruct groups to conduct research to identify ten or more natural features located along a plate boundary. Have students map each feature they find.

Tell students to download or draw a picture of each geologic feature they mapped. Challenge them to write an explanation of how plate movement caused each feature to form.

Rejoin as a class. Invite groups to share what they learned. Discuss how plate movement continually changes Earth's landscape.

This map produced by Marie Tharp in 1977 was the first accurate map of the Earth's entire seafloor.



PERFORMANCE EXPECTATION

Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1)

GRADE
4

MATERIALS: WHAT YOU'LL NEED

Art supplies
Toothpicks
Shoe boxes
Digital cameras

WEATHERING AND EROSION: WHAT YOU'LL DO

Invite students to read Chapter 6, "What Goes Up Must Come Down," in pairs, small groups, or on their own. As they read, instruct students to pause and discuss relationships between the text, photos, and illustrations.

After reading, ask students to share what they learned about weathering and erosion. Guide the class to recognize that the section "Weathering Away" on pages 70-71 discusses weathering. The rest of the chapter deals with erosion. If need be, discuss these two processes in more detail so students understand how they are different.

Divide the class into small groups. Give each group a digital camera. Take the class outside. Challenge groups to find examples of weathering and erosion in the area around the school. Tell them to take a photo and record detailed notes about each example they find.

Return to the classroom. Invite groups to create a diorama of the area they observed. Tell them to insert small photos to show where they saw weathering and erosion taking place.

These mountain peaks in Navarre, Spain, formed as the rocks slowly weathered away.



Instruct students to write a caption for each photo similar to those on page 71.

Have them attach each caption to a toothpick and insert it next to the appropriate photo in their dioramas.

Invite students to share their dioramas with the class. Discuss how weathering and erosion are changing the landscape where they live.

PERFORMANCE EXPECTATION

Make observations and measurements to identify materials based on their properties. (5-PS1-3)

GRADE
5

MATERIALS: WHAT YOU'LL NEED

Very hot water
Sugar
Salt
String
Spoons
Pencils

Glass jars
Measuring cups
Small pieces of cardboard
Small metal pans
Magnifying glasses

GROW AND COMPARE CRYSTALS: WHAT YOU'LL DO

Invite students to read Chapter 2, "Magnificent Minerals," in pairs, in small groups, or on their own. As students read, encourage them to pause to discuss relationships between the text, photos, and illustrations.

After reading, review pages 22-23 to discuss crystals and crystal habits in more detail. Discuss how crystal habits can be used to identify different types of minerals.

Divide the class into small groups. Designate half of the groups as "salt" and the other half as "sugar."

Give the "salt" group a small metal pan and a piece of cardboard. Pour about 1 cup of hot water and $\frac{1}{4}$ cup of salt into each group's pan. Advise students to carefully stir the solution. Add salt until the solution becomes saturated. Then have students place the cardboard in the pan, making sure it gets soaked. Set the pans in a sunny location.

Give the "sugar" group a piece of string, a pencil, and a glass jar. Instruct students to tie the string around the pencil. Pour about $1\frac{1}{2}$ cups of hot water in each jar. Add about $\frac{3}{4}$ cup of sugar. Instruct students to carefully stir the solution. Continue adding sugar until the solution becomes saturated. Then have students lay their pencils across the top of the jars. The string should dangle in the sugar water. Set the jars in a safe place.

After several days, pair up "salt" and "sugar" groups. Using a magnifying glass, encourage students to observe and compare the crystals they grew. What do the salt crystals look like? (cubes) What shape are the sugar crystals? (hexagon)

Instruct students to draw both crystals. Have them write a short summary explaining what crystal habit is and how it can help identify each of these minerals.

These spectacular crystals are of the mineral amethyst, a type of purple quartz.



PERFORMANCE EXPECTATION

Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3)

MIDDLE
SCHOOL

MATERIALS: WHAT YOU'LL NEED

Colored pencils or markers
Drawing paper
Pencils
Rulers

COMICS SOILS: WHAT YOU'LL DO

Invite students to read Chapter 9, "The Dynamics of Dirt," in pairs, small groups, or on their own. As students read, encourage them to pause to discuss relationships between the text, photos, diagrams, and illustrations.

After students finish reading and discussing the chapter, have them turn to pages 104-105. Examine how the author uses the comic book format to relay important information about soils.

Divide the class into small groups. Tell groups that they will each write a comic about the chapter on soil.

Instruct groups to review the chapter and decide how best to cover the key ideas it contains. Tell groups that they can continue the scenario featuring Dirtmeister, Digger, and Tamisha in the chapter opener or they can create an entirely new comic of their own.

Each color represents a different type of soil.



Provide access to pencils, paper, and other supplies. Then give students time to create their comics. When they're finished, invite groups to share their comics with the class. After all groups are finished sharing, discuss how matter cycles through the soil ecosystem.

NEXT GENERATION SCIENCE STANDARDS



	Grade 3	Grade 4	Grade 5	Middle School
Chapter 2: MAGNIFICENT MINERALS			Make observations and measurements to identify materials based on their properties. (5-PS1-3)	
Chapter 5: SHIFTING PLATES AND DRIFTING CONTINENTS		Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time. (4-ESS1-1)		
Chapter 6: WHAT GOES UP MUST COME DOWN		Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1)		
Chapter 8: DIGGING OLD DEAD THINGS	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. (3-LS4-1)			
Chapter 9: THE DYNAMICS OF DIRT				Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3)