

Science Concept:

The motions and forces of Earth shape its surface.

Objectives:

The student will:

- describe how the motions and forces of Earth build mountains;
- infer and make generalizations about the effects of the movement that shape Earth's surface; and
- write a short, illustrated report with labels and a caption describing how the forces and motions of Earth shape its surface.

GLEs Addressed:

Science

- [5] SB4.1 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by investigating that the greater the force acting on an object, the greater the change in motion will be.
- [5] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

Writing

- [5] W2.1.1 The student writes about a topic by writing more than one paragraph stating and maintaining a focused idea and including details that support the main idea of each paragraph.

Vocabulary:

anticline (mountain) – an arch-shaped formation of layers of sedimentary rock folded upward by movements in Earth's crust

core – the central or innermost part of Earth

crust – the thin outermost layer of Earth, approximately one percent of Earth's volume that varies in thickness and has a different composition than the interior

dikes – vertically shaped rock

force – a physical influence that tends to change the position of an object with mass, equal to the rate of change in momentum of the object

mantle – the layer of Earth's interior between the crust and the core

mountain – a high and often rocky area of a landmass with steep or sloping sides

pressure – the applying of a firm regular weight or force against something

strata (layers or levels) – layers or levels of Earth

volcano – a naturally occurring opening in the surface of Earth through which molten, gaseous, and solid material is ejected

Materials:

- Chocolate (enough to melt and cover each marshmallow)
- Microwave-safe bowl and access to microwave, or crock pot to melt chocolate
- Spatula
- Marshmallow (one per student)
- Toothpick (one per student)
- Cinnamon candy (one per student)
- Wax paper (one 5 inch x 5 inch piece per student)
- Napkin (one per student)

- Small wooden blocks (two per pair)
- Modeling clay, two different colors (approximately 12 inches by 2 inches, cut or molded into a long rectangular shape, per pair of students)

Activity Preparation:

1. Teacher should be knowledgeable about Science GLE (4) SD2.2
2. Melt chocolate in microwave or crock pot.
3. Create a KWL chart (what we **Know**, what we **Want** to find out, and what we've **Learned**) about the forces and motion of Earth.

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up

Process Skills: questioning, communicating, classifying, and describing

1. Explain how each student will build a model of Earth. Distribute a cinnamon candy and marshmallow to each student. Instruct students to take the cinnamon candy, which represents the core of Earth, and squeeze it into the center of the marshmallow, which represents the mantle.
2. Distribute a toothpick to each student. Assist them in dipping the marshmallow into the chocolate using the toothpick. The chocolate represents the thin crust of Earth. Place the chocolate-covered marshmallows on wax paper until they harden. As students finish dipping their marshmallow in chocolate, ask them to add to the first two rows of the KWL chart and place their initials by their contribution.
3. Ask students the following questions and discuss as a class:
 - a) What forces and motions on Earth would change its surface?
 - b) Where have you seen evidence of changes in Earth's surface?
4. While Earth models harden, review what students wrote on the KWL chart and ask if they want to add anything else to what they **Know** about the structure of Earth. Call on specific students who didn't write on the chart to check their understanding.
5. When the marshmallows are hardened, tell students to press on the chocolate to make cracks all around the marshmallow. Ask students what the cracks in the surface represent on their model of Earth. If needed, point out how the cracked surface is similar to Earth.
6. Allow students to eat their model of Earth.

Explore

Process Skills: observing, predicting, investigating, and making models

7. Divide students into pairs.
8. Distribute modeling clay and two wooden blocks to each pair.
9. Instruct students to lay the modeling clay flat in alternating layers. These layers of clay will represent layers (strata) in Earth's crust. A wooden block will be placed at each end of the clay layers. Ask students to predict what will happen when they push the blocks toward each other.
10. Students should take turns or work together to push the blocks toward each other very, very slowly. The pushing of the blocks represents movement of the continental plates. Students should see the folding process in action as they build their own mountain (anticline). Instruct students to draw what has happened in their journals.
11. After students have built their mountains they can cut the clay mountains in the middle; this represents plates moving apart at a fault zone. This is what happened to South America and Africa. Students should put the model mountains back together, looking for the similarities between the layers.

COME ON LET'S DO THE LOCOMOTION!

INSTRUCTIONS Grade 5



12. Allow students to continue to explore movement and force using the blocks and the clay layers. Students can cut the clay into pieces and manipulate them to understand the movements and forces that change Earth.

Generalize

Process Skills: questioning, describing, inferring, and making generalizations

13. Ask students the following questions and discuss as a class:
 - a. What happened to the clay when it was pushed together?
 - b. What happened when you and your partner both pushed hard on the blocks?
 - c. What shape did this pushing and force result in?
 - d. Ask if any student knows what this is called. Explain to students this mountain making is called anticline.
 - e. What does this show about how mountains are formed?
 - f. What do you know about the forces that shape Earth's surface?
 - g. What did you observe when you cut the clay apart?
 - h. Ask if any student knows the vocabulary term strata, if not, define it for students.
 - i. What physical changes happen because of the forces that move Earth?
 - j. What forces make a volcano erupt?
 - k. How do we know Earth is moving? What is this movement called?

Apply

Process Skills: modeling, describing, communicating, and making generalizations

14. Instruct students to take the clay and use the force and pressure of their fingers and hands to create other land formations (e.g., valleys, canyons, islands).

References:

The marshmallow activity was adapted in part from a similar activity by Anita Lander, Reminton-Traditional School, St. Louis Missouri published in the Idea Exchange section *NEA Today*, May 1996, pg. 22.

The Pushing Up Mountains Experiment was modified and adapted from John Farndon's book *How the Earth Works*, Reader's Digest Books, Dorling Kindersley Limited, 1992: London, pg. 67.



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RUBRIC

Assessment Task:

Write a short, illustrated, two-paragraph report with labels and a caption describing how the forces and motions of Earth build mountains. Include at least three details. Include a minimum of two inferences and two generalizations about the effects of the movements that shape Earth's surface.

Rubric:

Objective	GLE	Below Proficient	Proficient	Above Proficient
The student describes how the motions and forces of Earth build mountains.	[5] SB4.1	The student does not attempt or describes less than three details in their description about how the motions and forces of Earth build mountains.	The student describes and includes three details about how the motions and forces of Earth build mountains.	The student makes describes and includes more than three details about how the motions and forces of Earth build mountains.
The student infers and make generalizations about the effects of the movements that shape Earth's surface.	[5] SA1.1	The student does not attempt or may make fewer than two inferences and two generalizations about the effects of the movements that shape Earth's surface.	The student makes two inferences and makes two generalizations about the effects of the movements that shape Earth's surface.	The student makes more than two inferences and more than two generalizations about the effects of the movements that shape Earth's surface.
The student writes a short report and illustrates with labels and a caption describing how the forces and motions of Earth shape its surface.	[5] W2.1.1	The student does not attempt or may not write paragraphs nor include an illustration with labels and a caption about the motions and forces of Earth shape its surface.	The student writes two paragraphs with three details and includes an illustration with labels and a caption about the motions and forces of Earth shape its surface.	The student writes more than two paragraphs with four or more details and includes a detailed illustration with labels and a caption about the motions and forces of Earth shape its surface.