FORCES FROM BENEATH

INSTRUCTIONS
Grade 8

Science Concept:

Convection currents drive surface movement.

Objectives:

The student will:

- describe the relationship between convection currents and surface movements;
- make generalizations about convection currents and surface movement; and
- create a poster with labeled diagrams describing the relationship between convention and surface movements.

GLEs Addressed:

Science

[8] SD2.2 The student demonstrates an understanding of the forces that shape Earth by using models to show the relationship between convection currents within the mantle and the large-scale movement of the surface.

[8] 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

[8] W3.2.2 The student writes for a variety of purposes and audiences by writing in a variety of nonfiction forms (e.g., letter, report, biography, and/or autobiography) to inform, describe, or persuade.

Vocabulary:

convection - (1) heat transfer in a gas or liquid by the circulation of currents from one region to another; also fluid motion caused by an external force such as gravity. (2) The phenomenon occurring where large masses of warm air, heated by contact with a warm land surface and usually containing appreciable amounts of moisture, rise upward from the surface of Earth

convergent plate movement - a boundary in which two plates collide. The collision can be between two continents (continental collision), a relatively dense oceanic plate and a more buoyant continental plate (subduction zone) or two oceanic plates (subduction zone)

current - (1) the portion of a stream or body of water that is moving with a velocity much greater than the average of the rest of the water. The progress of the water is principally concentrated in the current. (2) The swiftest part of a stream; (3) A tidal or nontidal movement of lake or ocean water; (4) Flow marked by force or strength

divergent plate movement - a boundary in which two tectonic plates move apart. Almost all Earth's new crust forms at divergent boundaries, but most are not well known because they lie deep beneath the oceans. These are zones where two plates move away from each other, allowing magma from the mantle to rise up and solidify as new crust

spreading centers – where a divergent boundary causes two plates to move away from one another resulting in spreading. As the plates move apart, new material wells up and cools onto the edge of the plates; what happens at the mid-oceanic ridge of the sea floor, also called sea floor spreading

Materials:

- Glass casserole dish (one per group)
- Heat sources, such as candles, Bunsen™ burners, hotplates, alcohol burners, etc. (three per group)
- Various floating materials, such as sponges, wooden blocks, plastic foam, etc. that are different sizes and shapes
- Food coloring
- Water

- Device to hold containers above heat source (one per group)
- Safety goggles (one pair per student)
- Heat gloves (one pair per student)
- World map
- Science journals

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: observing and inferring

1. Ask students to write what they know about convection currents driving surface movement in their science journals. When they are finished ask them to share what they wrote.
2. Divide students into small groups. Distribute the glass dish, heating source, floating objects, and food coloring to each group. Instruct groups to fill their dishes three-quarters full with water and add four drops of food coloring.
3. Instruct them to place a point-source heat source under the center of the dish, and then gently place two floating objects side by side on the surface of water in the center of the dish.
4. As the water heats, students should observe the behavior of their floating object and record their results in their science journals.
5. Discuss the following questions:
   a. What did the water do? Why?
   b. What happened to the floating object? Why?
   c. What might the water in represent?
   d. What might the floating object represent?
   e. What might your heat sources represent? Explain.
6. Introduce or review vocabulary words and definitions.

Explore

Process Skills: developing models, observing, and communicating

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Teacher's Note: All students must wear safety goggles. Be sure students are aware of lab safety procedures. This activity involves using and handling hot materials. Use oven mitts when handling hot objects. Be sure materials are wrapped securely and completely in foil or placed in the can before heating.

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7. Ask a representative from each group to design and build a convection current model using the materials from Gear Up and the following guidelines:
   a. Move the heat source and/or add another heat source under the glass dish.
   b. Try using different floating objects.
   c. Record your observations by using diagrams and labels in your journal.

Generalize

Process Skills: inferring, describing, and making generalizations

8. Ask representative from each group to share their observations with the class.
9. Ask the following questions and discuss:
   a. How might the size of the floating objects affect their response to convection currents?
   b. How might the shape of the floating objects affect their response to convection currents?
   c. Why might the position of floating objects affect the movement of the objects?
   d. How might the heat source placement affect the movement of the objects?
   e. What might two heat sources represent?

f. Where on Earth might you find convergent boundaries?
g. Where on Earth might you find divergent boundaries?
h. Where on Earth might you find a spreading center?

Apply

Process Skills: inferring, generalizing, and describing

10. On a world map show Europe and North America and explain that they are moving apart creating an undersea mountain range. India is also crashing into China creating the world's tallest mountains. Ask students to describe which type of boundaries each of these represent and why this movement is occurring in their science journals.

FORCES FROM BENEATH

RUBRIC

Assessment Task:

Create a poster with labeled diagrams showing the relationship between convection currents and surface movements. At the bottom of the poster, describe at least two different convection conditions that affect movement of the surface. Include at least two generalizations about convection currents and surface movement.

Rubric:

Objectives	GLEs	Below Proficient	Proficient	Above Proficient
The student describes how different convection conditions affect surface movements.	[8] SD2.2	The student describes less than two different convection conditions that affect movement of the surface.	The student describes two different convection conditions that affect movement of the surface.	The student describes more than two different convection conditions that affect movement of the surface.
The student makes generalizations about convection currents and surface movement.	[8] SA1.1	The student makes one generalization about convection currents and surface movement.	The student makes two generalizations about convection currents and surface movement.	The student makes greater than two generalizations about convection currents and surface movement.
The student creates a poster with labeled diagrams describing the relationship between convention and surface movements.	[8] W3.2.2	The student does not create a poster or poster has less than two labeled diagrams.	The student creates a poster with two labeled diagrams.	The student creates a poster with three or more labeled diagrams.