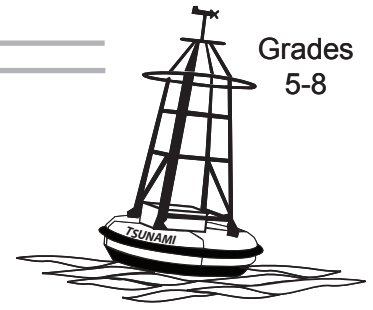


Convection Current

Grades
5-8



Overview:

During this lesson students observe convection currents by performing a lab experiment. As a result of this activity, students develop an understanding of the process of convection as it relates to the movement of molten rock in Earth.

Targeted Alaska Grade Level Expectations:

Science

- [5-8] 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.
- [5] SA1.2 The student demonstrates an understanding of the processes of science by using quantitative and qualitative observations to create inferences and predictions.
- [8] SD2.2 The student demonstrates an understanding of the forces that shape Earth by using models to show the relationships between convection currents within the mantle and the large-scale movement of the surface.

Objectives:

The student will:

- model convection current;
- draw convection current;
- explain convection currents can occur in any liquid substance;
- identify Earth's outer core as the heat source driving convection currents in Earth's mantle; and
- describe how the movement of Earth's plates is driven by convection currents within the mantle.

Materials:

- Clear glass beaker that can be placed on a hot plate
- Hot plate
- Water
- Paper dots or confetti
- Safety goggles
- STUDENT WORKSHEET: "Convection Current"

Science Basics:

Heat in Earth's outer core powers convection currents inside Earth. Because material close to Earth's surface is cool and heavy, it sinks. When this sinking material gets close to Earth's outer core, high temperatures heat it up again. This hot material is pushed back up to the surface because heat rises. This cycle of sinking and rising repeats, creating a convection current. The convection currents in Earth's mantle drive the motion of Earth's plates, resulting in geologic processes that cause volcano formation and earthquakes. These in turn can generate tsunamis.

Activity Procedure:

1. Explain convection current occurs when temperature differences cause fluid material to move.
2. Explain heat in Earth's core powers convection currents inside Earth. Because material close to Earth's surface is cool and heavy, it sinks. When this sinking material gets close to Earth's outer core, high temperatures heat it up again. This hot material is pushed back up to the surface because heat rises. This cycle of sinking and rising repeats, creating convection current.
3. Distribute the STUDENT WORKSHEET: "Convection Current," and ask students if convection can occur in water. Ask students to record their predictions in the hypothesis section of the worksheet. Explain students will perform an experiment to determine whether convection occurs in water.
4. Divide students into groups and distribute supplies. If confetti is unavailable, ask students to use hole punches to create a mound of paper dots. Ask students to follow the instructions on the worksheet to perform the experiment. NOTE: Some hotplates have heating elements on the outside of the plate. If that is the case, the convection currents may be different than shown in the diagram.
5. Discuss student observations and results. Students should understand that as the water in the bottom of the beaker warmed and rose to the surface, the paper dots also began to rise. At the surface, the water cooled. Warm water rising from the bottom pushed cool water toward the edges of the beaker. At these cool edges, the water began to sink again, carrying the paper dots with it. Any fluid substance (air, gas, water, etc.) can be heated and experience convection.
6. Discuss the similarities and differences between convection currents in Earth's mantle and the convection current illustrated by this water and beaker model. Ask students to complete the remaining sections of the worksheet. Perform the critical thinking activity.

Critical Thinking: One-minute Paper Method: Check student progress and understanding by asking them the question: How do convection currents within Earth's mantle impact the plates that make up Earth's crust? Explain they may use observations of how the paper dots behaved on the surface of the heated water to help answer this question. Allow students one minute to write down any knowledge or ideas they have about this. Answers will vary but should reflect that convection currents in Earth's mantle drive the motion of Earth's plates.

Answers:

Data: See diagrams at right

Analysis of Data:

1. d
2. c

Conclusion: Convection will occur when water is heated.

Other answers will vary

Further Questions:

1. c
2. a
3. c
4. Yes (rest of answer will vary)

Diagram 1: No Heat Source

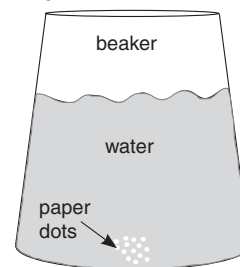
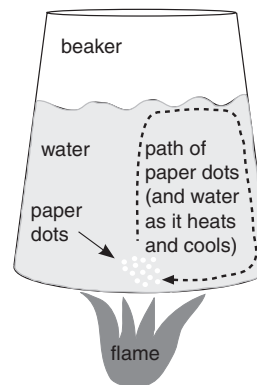


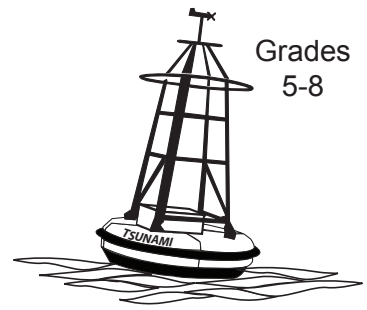
Diagram 2: Active Heat Source



Name: _____

Convection Current

Student Worksheet (page 1 of 3)



Testable Question:

When water is heated, does convection occur?

Background Information:

Convection currents occur when temperature differences cause fluid material to move. The heat in Earth's core powers convection currents inside Earth. Because material close to Earth's surface is cool and heavy, it sinks. When this sinking material gets close to Earth's core, high temperatures heat it up again. This hot material is pushed back up to the surface because heat rises. This cycle of sinking and rising repeats, creating convection current.

Hypothesis:

Place a check next to your hypothesis:

- Convection will occur when water is heated.
- Convection will not occur when water is heated.

Materials:

- Clear glass beaker
- Hot plate
- Water
- Paper dots
- Safety goggles

Procedure:

1. Put on safety goggles.
2. Pour 250-300 milliliters of water into the beaker.
3. Sprinkle paper dots over the top of the water. If the dots do not sink, push them under the water with a pencil until they rest on the bottom of the beaker.
4. Observe the beaker of water. Complete Diagram 1: "No Heat Source," in the Data section of this worksheet.
5. Turn on the hot plate to the low setting, and place the beaker of water on the burner. Heat the water slowly.
6. Observe the beaker of water as it heats for 10 minutes. Complete Diagram 2: "Active Heat Source," in the Data section of this worksheet.

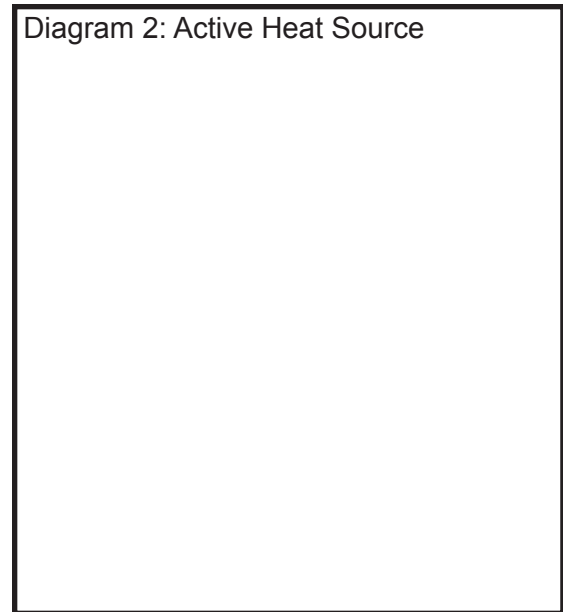
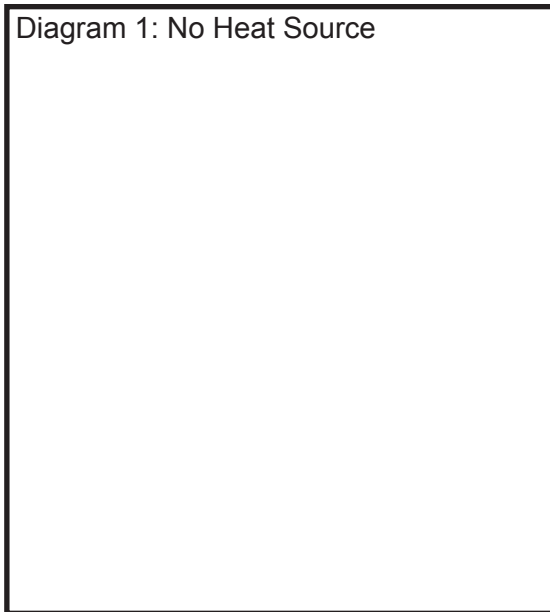
Name: _____

Convection Current

Student Worksheet (page 2 of 3)

Data:

In the boxes below, draw the beaker of water with the paper dots in it. Be sure to label the beaker, water, paper dots, heat source (if applicable), and the path of movement of the paper dots (if any).



Analysis of Data:

1. Circle the correct answer: What are the differences between your observations for Diagram 1 and Diagram 2?
 - a. In Diagram 1 the paper dots remained still, while in Diagram 2 the paper dots moved.
 - b. In Diagram 1 the paper dots moved, while in Diagram 2 the paper dots remained still.
 - c. In Diagram 1 there was no heat source, while in Diagram 2 there was a heat source beneath the beaker.
 - d. Both a and c.
2. Circle the correct answer: What are the differences between your observations for Diagram 1 and Diagram 2?
 - a. As the water warmed, the paper dots floated to the surface and remained on top of the water.
 - b. As the water warmed, the paper dots remained motionless on the bottom of the beaker.
 - c. As the water warmed, the paper dots were carried by rising water to the surface, where the water cooled and began to sink again, carrying the paper dots with it back to the bottom of the beaker.
 - d. As the water warmed, the paper dots were shifted by hot water to the bottom outer edges of the beaker, where they remained, fluttering gently on the current.

Name: _____

Convection Current

Student Worksheet (page 3 of 3)

Conclusion:

Place a check next to your conclusion:

- _____ Convection will occur when water is heated.
_____ Convection will not occur when water is heated.

Was your hypothesis proved or disproved? Use a complete sentence.

Briefly explain how you came to your conclusion.

Further Questions:

1. What did the path of paper dots in Diagram 2 represent?
 - a. The movement of the water
 - b. Convection current
 - c. Both a and b
 - d. None of the above
2. What powers convection current in Earth?
 - a. Different temperatures in Earth's layers
 - b. Volcanic eruptions
 - c. Different elements in Earth's layers
 - d. Earthquakes
3. This experiment is a model for processes that occur within Earth's mantle. What is the heat source driving convection currents in Earth's mantle?
 - a. the crust
 - b. the mantle
 - c. the outer core
 - d. the inner core
4. Can convection current occur within all fluids? Explain using a complete sentence.
