

# Convection Current

**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.

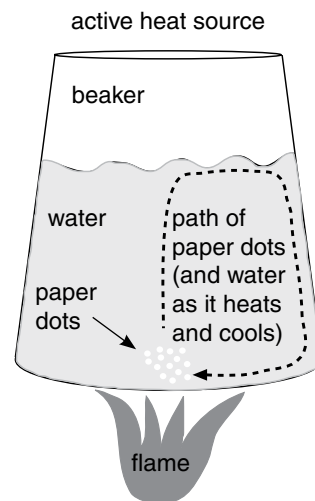
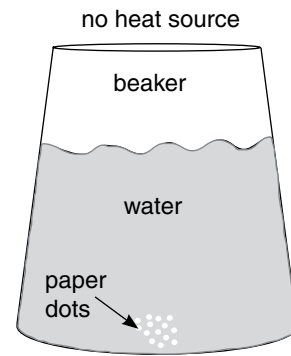
**Objectives:**

The student will learn:

- to draw or define convection current;
- that convection currents can occur in any liquid substance;
- that hot liquids rise, and cool liquids sink; and
- that convection currents occur within Earth.

**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”



**Answers to Student Worksheet:**

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)

## Convection Current

### *Activity Procedure:*

1. Explain that a convection current occurs when temperature differences cause fluid material to move.

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**Note:** Convection currents in the mantle drive the motion of Earth's plates, resulting in geological processes that cause volcanoes. The concepts addressed in this lesson are fundamental to student understanding of later lessons.

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2. Explain that 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 a 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 that 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.

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**Note:** Some hot plates 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.

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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.

## Convection Current

### *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 a 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 ml 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.

## Convection Current

### *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).

Diagram 1: No Heat Source

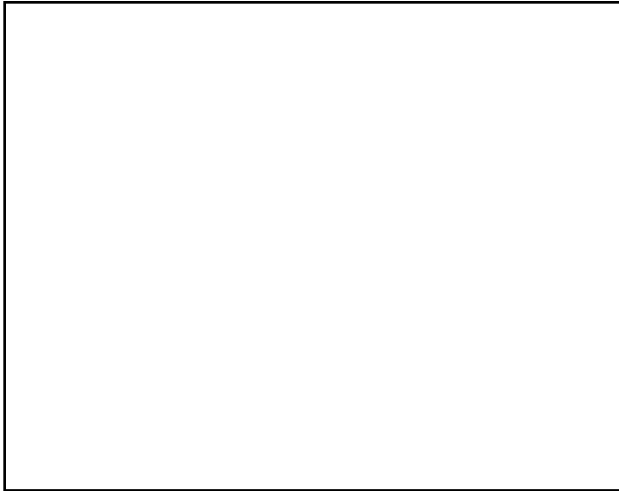
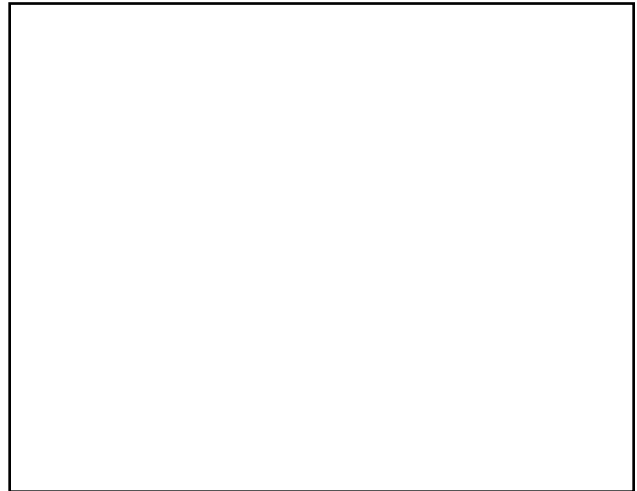


Diagram 2: Active Heat Source



### *Analysis of Data:*

1. What are the differences between your observations for Diagram 1 and Diagram 2. Circle the correct answer.
  - 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. What are the differences between your observations for Diagram 1 and Diagram 2. Circle the correct answer.
  - 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.

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**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.

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Briefly explain how you came to your conclusion.

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**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.

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