

Convection Detection

Investigation Set Teaching Guide

This Investigation Set is designed for students to explore convection currents and their effect on plate tectonics. The instruction in this set encourages students to synthesize evidence from multiple sources to explain their own observations from experiments as well as phenomena in the natural world. As students progress through this set, they will learn why convection influences the motion of Earth's plates and why the Earth's plates move in the first place.

Target Grades & Subject(s): Grades 6-12; Science

Learning Objectives

- Next Generation Science Standards (NGSS)
 - Analyze and interpret data on the distribution of rocks, continental shapes and seafloor structures to provide evidence of plate motions. (MS-ESS2-3)
 - Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. (HS-ESS2-3)
- Science and Engineering Practices (SEP)
 - Use and construct models for representing ideas and explanations. (NGSS, SEP 2)
 - Construct explanations that are supported by multiple sources of evidence and consistent with scientific principles. (NGSS, SEP 6)
 - Use appropriate and sufficient evidence and scientific reasoning to defend claims and explanations about the natural world. (NGSS, SEP 7)

Before teaching Part 1: [Download texts [here](#)]

- To introduce the investigation set, show students [this](#) video. As students are watching the video, have them record their observations and answer the following question: "What is happening below the surface that explains your observations?" Have students share out their responses in small groups and with the whole class.

Text 1: 3-08: Tectonic Plate Motions (1 page)	
<p>The first text in this set provides an overview of tectonic plates and convection currents. As students read, they should consider how temperature changes create convection currents and ultimately explain the motion of tectonic plates.</p>	<p><u>Discussion Question:</u> - How could convection currents be used to explain weather patterns like wind?</p>

Before teaching Part 2: Investigation: Colorful Convection [Download texts [here](#)]

- Plan for this activity to take 15-20 minutes.
- Students should know how to safely use a hot plate to heat up liquids.
- Reiterate and emphasize proper lab safety prior to beginning the investigation.
- Print a class set of the data table for the investigation (on 3rd page below).
- Ensure you have the following materials (enough for 30 students, can be reused each class):

**Note: These materials are reusable and can be used for multiple class periods*

Lab Specific Materials*	Common Lab Materials
<ul style="list-style-type: none"> ● Food coloring (red and blue, or 2 different colors) ● Styrofoam cups (5/group) ● Plastic pipets (2/group) ● Ice (to cool water) 	<ul style="list-style-type: none"> ● Small plastic tub (1/group) [Example] ● Hot plate to heat water (2-4 per class) ● Beaker for hot water (1/group)

Text 2: Investigation: Colorful Convection <i>*Note: This <u>is</u> an assignment in Actively Learn* (2 pages)</i>	
<p><u>What This Could Look Like:</u></p> <p>In this activity, students will model convection currents using colored water in order to explain how these currents cause the motion of tectonic plates.</p> <p>First, have students read the background information in the assignment in Actively Learn. Encourage them to annotate the first paragraph and identify the main idea.</p> <p>If needed, model the procedure and clearly state expectations for using equipment and materials safely and appropriately prior to releasing students to begin the investigation.</p> <p><u>To make this an inquiry activity:</u></p> <p><i>Give your students the materials listed in the table above and ask them to design their own experiment to create a convection current that would explain the motion of tectonic plates. Have them compare their models with other groups.</i></p>	<p><u>Teaching Tips (Best Practices):</u></p> <ul style="list-style-type: none"> - Watch this video for an overview of the procedure. - In Part 1, it may take a few minutes before the colors create a convection current. Have students place a small piece of aluminum foil (or another material that floats) on the surface of the water to more easily see the motion that occurs. - Tight on space or materials? Have half of your class begin by reading Text 1 and half completing the Investigation. At a certain time point, have students switch to complete the other half. - Encourage students to model their observations as drawings in order to support their explanations and demonstrate deeper understanding.

Text 3: Massive asteroid may have kickstarted the movement of continents (2 pages)	
<p>The final text in this set extends students' thinking by providing evidence and an explanation for what led to the motion of tectonic plates in the first place. As they read, students should think how the evidence presented in the text supports the theory of plate tectonics and convection.</p>	<p><u>Extension Activities:</u></p> <ul style="list-style-type: none"> - Have students research other applications of convection cells (e.g. wind power). In small groups, have students share out their findings with their peers.

