

Thermal Convection Currents

A Carolina Essentials™ Demonstration

Student Worksheet



Overview

Many diagrams of convection currents show only one convection cell. It is drawn in one plane, so you are observing it from the side, and the heat source is absent. It's a very simplistic model for a far more complex phenomenon. On Earth, thermal convection currents drive our weather, ocean currents, and tectonic plate movement.

In this demonstration, you will observe a visual model of thermal convection currents in three dimensions with the heat source identified. You will develop a model for mantle convection currents and then apply your model to a current plate tectonic map.

Phenomenon

Thermal convection currents are a natural phenomenon observed in the Earth's mantle, the oceans, and atmosphere that result from unequal heating and temperature-related changes in density.

Essential Question

How is matter cycled and energy transferred through the oceans, atmosphere, and mantle?

Activity Objectives

1. Develop a model of thermal convection currents in the Earth's mantle.
2. Apply the model to explain current tectonic plate motion.

Safety Procedures and Precautions

The glass dish will get hot. Handle with heat resistant gloves. Wear safety glasses.

Analysis

1. Observe the convection currents in the glass dish with the convection fluid. Draw what you observe.

SAFETY REQUIREMENTS



MATERIALS

Plate Tectonics

Pyrex baking dish or other colorless, heat resistant dish, 13" x 9" x 2"

Hot plate

Carolina Convection Fluid

5–6 wooden splints or coffee stirrers

Document camera or overhead projector

Food coloring (optional)

Ocean Currents

Pyrex baking dish or other colorless, heat resistant dish, 13" x 9" x 2"

Heat lamp or 100-W incandescent bulb in a utility lamp

Waterproof tape

Carolina Convection Fluid, 1 bottle

2–3 heavy barriers

Document camera or overhead projector

Food coloring (optional)

Atmospheric Currents

Pyrex baking dish or other colorless, heat-resistant dish, 13" x 9" x 2"

Heat lamp or 100-W incandescent bulb in a utility lamp

Waterproof tape

Carolina Convection Fluid

Document camera or overhead projector

Food coloring (optional)

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2. Observe the motion of the wood splints in the glass dish with the convection fluid. Draw what you observe.

3. What do the wood splints represent? What does the convection fluid represent?

4. Use your observations to propose a model for tectonic plate movement. You may explain or illustrate your model.

Explain

Illustrate

Continued on the next page.

5. Apply your model to the map of tectonic plate movement below by adding thermal convection currents to explain plate movements. Identify where you hypothesize the heat source(s) may be for the convection currents.

Reference Map

Named Tectonic Plates and Their Motion

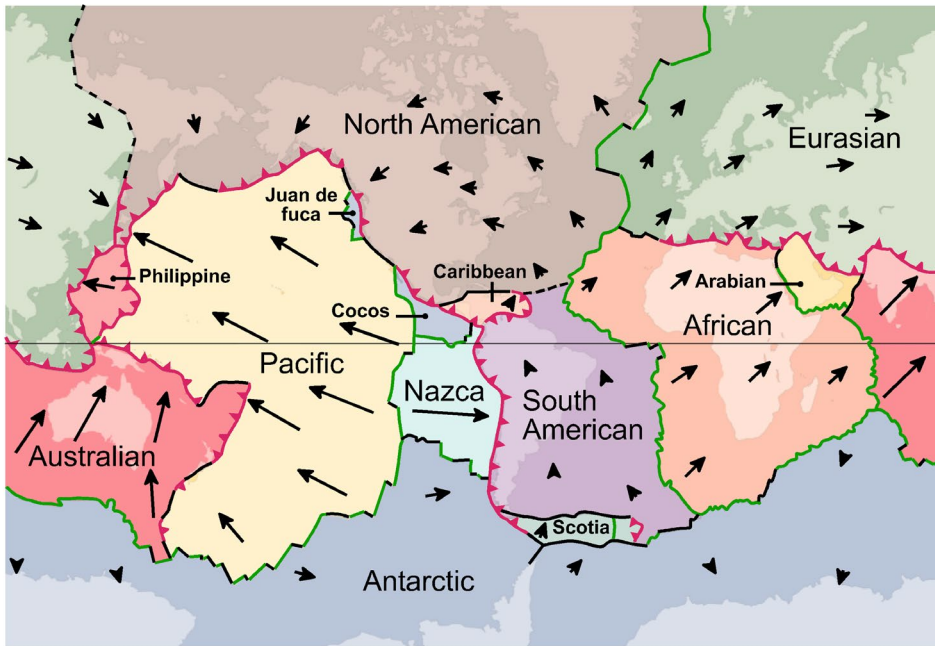


Plate boundary: divergent — transform — convergent — 10 cm/yr

Image from [Wikimedia Commons](https://commons.wikimedia.org/wiki/File:Tectonic_plates_and_their_motion.png).

Explain

Illustrate