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Modelling Convection

Grade Level:

- 6
- 7
- 8
- 9
- 10
- 11
- 12

Lesson Time:

40 minutes

Objective:

Students will be able to:

- Understand how convection moves many Earth processes by simulating the convection process with beets and water

Preparation

Before going to the classroom, you will need to:

1. Contact the teacher to find out the length of the class period, as well as how many sets of materials you need to bring.
2. Alert the teacher that this investigation is set up for groups of two.
3. Alert the teacher that you will need an overhead projector (if you decide to use it).
4. Collect all the materials in the materials list and organize them into one Tool Bag for each group of two students
5. Collect any giveaways for the students, such as plate tectonic posters or weather posters.
6. Run through the investigation yourself and record the data, just to see how long it takes. Adjust the timing to the class period, remembering that you will need time to introduce the investigation, clean up afterwards and re-set up for the next class.

Materials:

For preparation right before starting the activity:

- Knife to pare and cut beets into cubes
- Fresh beets (not canned)

For each student group of two:

- 1 cube of fresh beet
- Metric ruler
- Clear 10 oz plastic cup
- Supply of hot water in foam cup
- Foam cup full of ice cubes
- Paper towels and soap
- Piece of blank white paper
- Pen or pencil

For instructional purposes:

- (optional) Overhead of directions for the convection model.

Purpose

Background:

Convection is the density-driven movement of a fluid material. Often, convection is driven by either heating from below or cooling from above the fluid. When a liquid is heated, it expands slightly, which makes it less dense. The fluid with lower density rises up, in the same way that a party balloon filled with helium rises up. When the heated liquid reaches cool surroundings, it shrinks, making it density greater. It then sinks down toward where it was first heated.

Many Earth processes are driven by convection. Convection moves ocean currents, weather currents, and tectonic plates.

Purpose:
In this investigation, participants will model convection on a small scale using beets and water.

Safety

Make sure you cube the beet, so participants will not use the knife. Remind students to wash their hands after they handle the beet.

Investigation Question

How does the weather move?

What to do

1. **(5 minutes)** Introduce the concept of convection by starting a short discussion. Be sure to accept as many explanations as you can. Questions you might want to use are:
    - How does the weather move?

- Why do you think the weather can/cannot move?
- What evidence do you have that supports your answer?

2. **(2 minutes)** Explain to the participants that they will be modeling convection with beets and water.
3. **(2-5 minutes)** Demonstrate what each group will do (*You could put these instructions on an overhead or flipchart so that participants can refer to them as they do their own convection model.*):
    - Fill the cup 2/3 full of hot water and quickly put a layer of ice cubes on the top. The beet cube needs to go into the cup immediately after the ice goes on.
    - Observe what happens to the color coming from the beet cube.
4. **(2-5 minutes)** Pass out materials to each student pair. Each pair of participants should have a clear plastic cup, paper towels, a 1 cm cube of fresh beet, a supply of ice and a supply of hot water, pen or pencil, and blank piece of paper.
5. **(10-20 minutes)** Instruct participants to start the investigation when they have their materials. Have participants observe what happens to the color coming from the beet cube. Instruct students to draw a picture of what they observe.
6. **(5 minutes)**Discuss the results with the class. Be sure to accept as many explanations as you can. Questions you might want to use are:
    - In which direction does the color move first?
    - What happens when the color hits the layer of floating ice?
    - How well does this model what happens in deep ocean convection?
7. **(2 minutes)** Remind participants to wash their hands when they finish, as the color from beets can stain their skin temporarily. Thank students for their time and attention. You can leave giveaways behind for the classroom teacher to distribute.
