Convection Currents

Summary

Convection currents are observed in a container of water on a hot plate and are related to other convection currents.

Time Frame

1 class periods of 45 minutes each

Group Size

Large Groups

Materials

For the Teacher:

- Hotplate
- Clear Pyrex Jar
- Water
- Pencil Shavings or Parsley Flakes

For the Students:

- Drawing Paper or Science Journal
- Blue Colored Pencil or Crayon
- Red Colored Pencil or Crayon

Background for Teachers

Convection currents can occur in any fluid, such as air or a liquid. When a fluid heats up, it expands, making it less dense and therefore lighter than the fluid around it. Warm fluids rise while cold fluids sink, setting up a circular pattern of flow toward and away from a heat source until all of the fluid reaches the same temperature.

Intended Learning Outcomes

- Observe simple objects, patterns, events, and report their observations.
- Compare things, processes, and events.
- Predict results of investigations based on prior data.
- Describe or explain observations carefully and report with pictures, sentences, and models.

Instructional Procedures

The day before the activity, fill a clear Pyrex jar with water. Leave some space at the top. Put the pencil shavings (or parsley) in the water and let them settle to the bottom. You may consider placing three of these set ups in central locations around the room so more students can observe this demonstration at once.

Have the students make and record observations of the container on the hot plate as you turn on the heat.

So that the students don’t get bored, assign related questions or continue other heat related class instruction as the water warms. A few questions are suggested below.

- What happens to molecules as you add energy to them in the form of heat?
- When you open the refrigerator, does the cold air that comes out rise to the top of the room or fall to the floor?
- In winter, what happens to the hot air produced in your heater; does it rise to the ceiling or

fall to the floor of the room?

In the summertime, is it cooler to sleep in an upstairs room or in a basement?

As the water becomes warm, have the students make observations of the moving material. Can they see a pattern of movement? (They should see the pencil shavings moving in a circular pattern which forms a convection current.)

Direct the students to draw the convection currents that result.

Have students use arrows to record the movement of warm and cold water by color coding the arrows red for warm and blue for cold water.

In a whole group discussion, have your students relate these convection currents to those in the air.

In this discussion, remind students that by adding heat, you are adding energy. Molecules with a lot of energy tend to move quickly and take up more space (so they become less dense).

How is this fact related to the currents they saw in the water?

What kind of air (water) rises?

What kind of air (water) falls?

What makes the hot air (water) fall when it moves away from the heat source?

After completing this activity, divide the class into three smaller groups. Assign each group a question to be answered with the concepts they learned in the convection activity.

Why do builders place heating grates (the ducts that bring in hot air) in the floors? Would your heating system work better if you placed these grates in the ceiling? Why or why not?

It's a summer night and you are too hot to sleep well. Would you be more comfortable (temperature wise) if you moved off your bed and slept on the floor? Why or why not?

Janet owned an older home that she decided to remodel. She remodeled the low ceiling in the living room and exposed the older ceiling which was very high. The next winter, Janet noticed that her heating bills increased significantly from the previous year. What accounts for this increased heating cost?

After the small group discussions, have the students present and justify their answers to the class.

Assessment Plan

Review student science journals to check for accurate drawings of convection currents.

Review answers to the questions posed in #9 to assess for correct understanding of heat transfer.

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