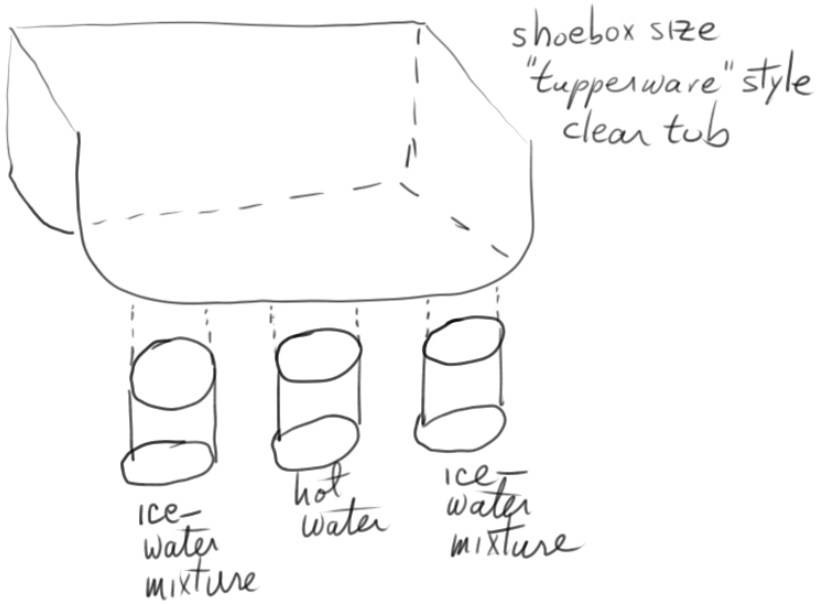
LAB: INVESTIGATING CONVECTION

Water is a fluid. Fluids have the ability to flow. This experiment is designed to illustrate this phenomenon. As you conduct this, you are encouraged to consider how the experiment models the "real Earth".
To begin, you will need the following:

- One "Tupperware" type tub, preferably "see-through". The size of a shoebox is ideal.
- 2 – 1000mL beakers
- Beaker tongs or a hot glove
- One hot plate
- Source of ice (approximately 1 pound)
- 3 – 400 mL beakers or 6 coffee cups
- A few crystals of potassium permanganate, blue ink or blue food coloring.

1. Fill the tub about 60% full with water.
2. Heat water in a 1000-mL beaker to boiling
3. Fill two 400-mL beakers with a mixture of ice and water or 4 coffee cups with a mixture of ice and water. The mixture should fill the container up to the lip of the container.
4. Place the tub of water (carefully) on top of the two beakers filled with ice water. (See the illustration on the next page.)
5. Carefully slide a beaker (or two coffee cups) filled with hot water (obtained from the 1000-mL beaker and transferred using beaker tongs or a hot-glove) under the center of the tub (See the illustration on the next page).
6. Allow the water in the tub to become completely still then add a few drops of dye (preferably potassium permanganate) directly over the center of the tub. The crystals will sink immediately to the bottom of the tub (they are denser than water). A deep purple solution forms as the crystals dissolve. Observe its behavior.

LAB: INVESTIGATING CONVECTION (continued)



Analysis:

1. The dye you used acts as a "tracer" for otherwise hidden movement of water within the tub. Create a diagram illustrating the movement observed within the tub.
2. Is there any evidence of a "circulation" occurring within the tub? If so, what could be causing the circulation?
3. Convection is defined as "energy transfer via the flow of a fluid". Describe the energy transfer occurring within this tub.
4. What region of Earth does the hot water beaker (cup) represent? What region of Earth do the cold water beakers (cups) represent?
5. If we study Earth's energy budget, regions on the poleward side of 37 degrees latitude have more outgoing energy than incoming from the Sun. This means that these regions experience an annual energy deficit which should result in each year being cooler than the next. Considering your findings in the first two experiments, what prevents polar regions from becoming colder and colder over time?