

Experiment: Heavy Water

(10 CLC Points)

Purpose: To experimentally determine how changing the temperature affects the properties of water.

Instructions: This experiment can be done at home or in the chemistry lab. If doing this in the chemlab, all materials will be provided for you: just bring a copy of this labsheet.

Materials:

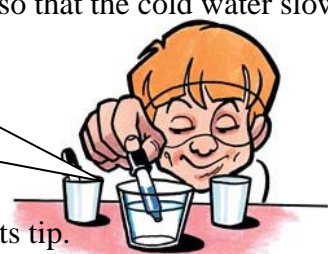
- 2 Clear Cups
- 1 Tall Coffee Mug
- 1 Tall Cup/Glass of any kind
- Food Coloring
- Medicine (Eye) Dropper
 - (A straw can be used instead if an eyedropper is not available)

Preparation:


1. Obtain 2 clear cups and fill them room temperature water to a level of 1.5 to 2 inches high. Allow these cups to sit out in the room for at least 15 minutes.
2. Obtain 1 cup and fill it with cold water so that the water level is at least 3 inches high. Put several drops of blue food coloring in it so that the blue is pretty dark. Next, place this cup in the refrigerator for at least 15 minutes.
3. Fill the coffee mug with water to a height of at least 3 inches and put several drops of red food coloring in it. (Again, you want the color to be pretty dark)

Procedure:

1. Heat up the water in the coffee mug for approx 1 minute so that it is hot, but not boiling..
2. Fill the eye dropper with cold water colored blue. Poke the end of the dropper a little beneath the surface of the colorless room-temperature water (see picture below)
3. While observing carefully from the side, gently squeeze the dropper so that the cold water slowly flows into the room-temperature water.
Note: If using the straw, fill the straw by placing it all the way in to the bottom of the blue water, then cap it with your thumb. Dispense in the colorless water by removing your thumb.
4. Clean the eyedropper (or straw) so that no food coloring remains in its tip.
5. Repeat this process with the red hot water, dispensing it just beneath the surface of this same cup of room-temperature water.
6. Dispense the blue and red water again as above into the second cup of room temperature water, but this time hold the tip all the way underneath the water when you dispense the colored waetr.



Notice how the tip is just below the surface when dispensing.



Notice how the tip is near the cup bottom when dispensing.

Data Table: Use drawings and sentences in the chart below to record your observations of this experiment.

Hot and Cold Water Dispensed at the Surface	Hot and Cold Water Dispensed at the Bottom
Labeled Drawing of What Happened	Labeled Drawing of What Happened
Sentences Describing What Happened	Sentences Describing What Happened

Conclusions and Applications:

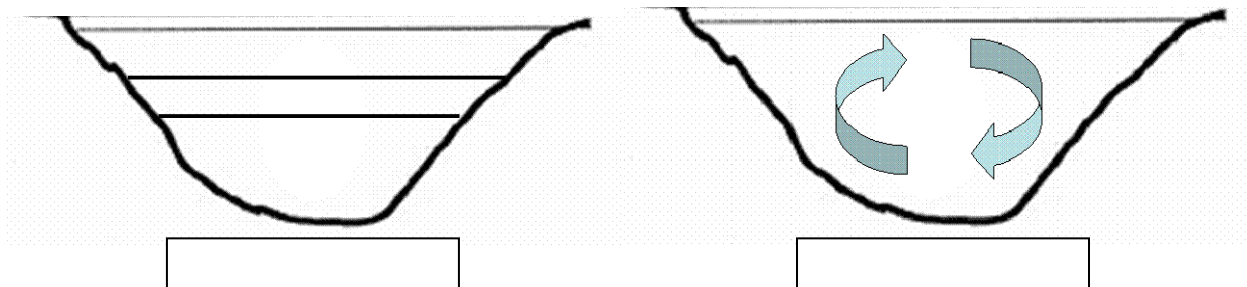
1. Why do you think the cold water behaved differently than the hot water?

2. Which temperature of water do you think was most dense? Use the data from this experiment to show how you came to this conclusion.

3. Predict how the mass of 25 mL of cold water would compare to 25mL of hot water. Explain.

4. If you went scuba diving, would you expect the water temperature to get warmer or colder as you dove deeper beneath the surface? What evidence from your experiment do you have to support this?

5. Water in a lake behaves differently depending on what season it is. At certain times in the year, the water is in stagnant layers, which means that the water on top stays on top and the water at the bottom stays at the bottom. At other times of the year, there is a turnover in the lake where water from the top and bottom of the lake mix and switch places. Look at the two diagrams below and label one “Summer” and one “Fall”. (Hint: think about sunshine and the temperature of the air)



6. Explain your reasoning for choosing the labels you did on the lakes above. Be sure to use the word “density” in your answer. Describe what is causing the one lake to “turnover”.