LAD B2 (pg 1 of 2) The Effect of Temp on Liquid Particles Name_____Per____

Introduction

In this activity you are going to make observations of a flask of water when the water is at three different temperatures – room temperature, warm water 50 – 60ºC, and cold water 0–10ºC. You will use the *particle theory of matter*, to explain your observations of the effect of temperature on the volume of water.

Procedure You MUST put on goggles whenever you are in the lab area.

Drops of food coloring have been added to the flask to make the column of water in the narrow tube easier to see.

A. Fill the flask to overflowing with tap water, then gently twist to insert the stopper and glass tube into the flask.

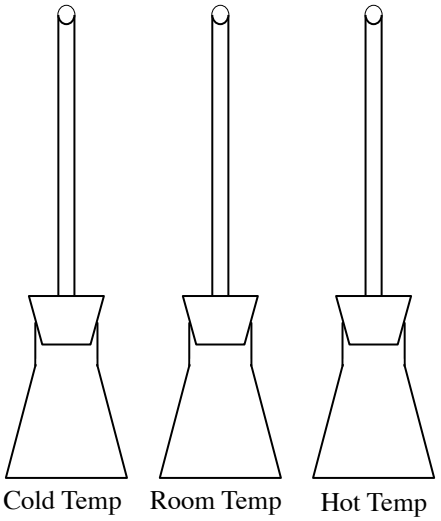
B. The water should extend approximately **halfway** up the plastic graduated tube. If not, twist the stopper in a bit tighter or a bit looser.

C. Consult the teacher if you are still having problems.

D. Note the water level on the graduated tube at room temperature, and make a mark on the diagram to the right in the appropriate relative position.

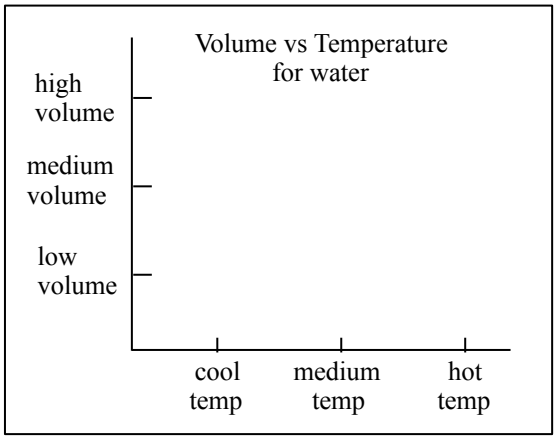
E. Put the flask in the the ice water bath.Wait a few minutes to allow the water in the flask to cool down, and observe any changes in the water level. Note the water level on the graduated tube, and make a mark on the diagram to the right in the appropriate relative position.

F. Take the flask out of the cold water, wipe the outside of the flask off with the sponge and place the flask on the hot plate. Allow time for the water in the flask to warm up, then note the water level on the glass tube. (STOP heating before the water pushes all the way out the top of the tube.) Again, make a mark on the diagram to the right in the appropriate relative position.



Processing the Data

1. On the graph to the right, make a sketch of three points that plots volume of water (y-axis) vs the temperature (x-axis) from the data you gathered above.



2. In the class demonstration with the two large beakers with food coloring added to hot and cold water, you learned that even in water that appears to be not moving at the *macro-level*, the molecules are moving at the *nano-level*. What happens to the speed of the water molecules when the temperature is increased?

3. You may have learned in the past that *kinetic energy is the energy of motion*. When heat is added to the water from the hot plate, what happens to the kinetic energy of the water molecules?

4. Association statements compare two actions or variables that are related to each other.
   - An example of a *direct* association statement might be: Studying *more* effectively produces *higher* chemistry grades.
   - An example of an *inverse* association statement might be: Brushing teeth *more* often results in *less* cavities.

   What is the difference between an *direct* and an *inverse* association?

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5. Temperature is a measurement that is directly proportional to kinetic energy of particles which is directly proportional to the velocity of particles. The equation below is used to represent this relationship. Label all the symbols in this equation. What does it mean to be "directly proportional?"

$$T \propto KE = \tfrac{1}{2} mv^2$$

6. From the data you gathered in the lab, write an association statement that compares temperature to volume. Is this a direct or inverse association?

7. Draw a particulate diagram of the 16 water particles in the flasks at the other two temperatures to demonstrate why the volume changed at the hotter and colder temperatures.
In words, explain briefly what happens to the water molecules at the three temperatures to cause the increase in temperature.