Chemistry – Lab Thermometers

Name:_____ Per:_____ Date:_____

PURPOSE: To examine how the volumes of a liquid and a gas change in response to temperature.

BACKGROUND: In 1724, German physicist, Daniel G. Fahrenheit, invented the first modern thermometer—the mercury thermometer. In 1747, Anders Celsius, a Swedish astronomer, developed a thermometer with a different scale. Degrees Celsius and degrees Fahrenheit both measure the same thing—temperature.

$$°F = \frac{9}{5}(°C) + 32$$

A **degree** is the increment of temperature that corresponds to one unit on a thermometer.

On the Celsius scale, the temperature at which the volume of a gas is theoretically equal to 0 is 273 - °C.

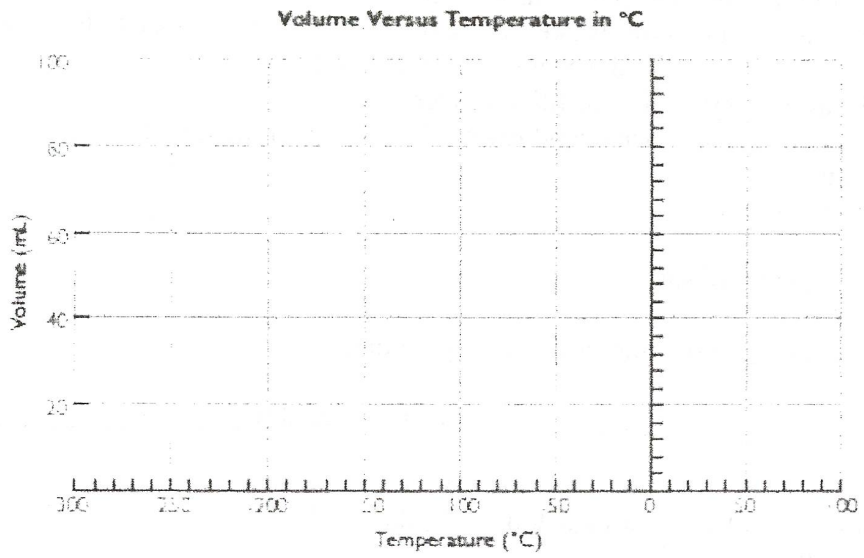
$$K = °C + 273$$
$$°C = K - 273$$

A temperature of 0 K is referred to as **absolute zero.**

PRE-LAB QUESTIONS:

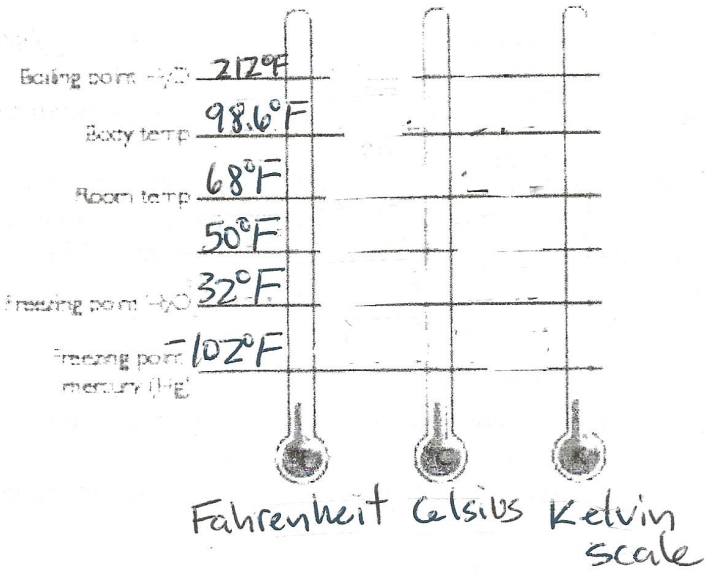
1. Plot the points on the graph provided.

Temperature	Volume
10°C	50 mL
50°C	57 mL
100°C	60 mL



2. Draw a line of best fit on your graph.
3. What is the temperature if the volume were zero?

4. Fill in the corresponding Kelvin temperatures of °C and °F.



PROCEDURE:

Part 1:

1. Obtain an ethylene glycol thermometer from your teacher.
2. Place about 250 mL of water in a 400 mL beaker. Place the beaker on a hot plate to begin warming up.
3. Use 2 250 mL beakers to obtain ice. Fill the beakers about half full with ice.
4. Place three pinches of salt into one of the ice-filled beakers.
5. Put your thermometer under the following conditions. Mark the level the liquid reaches in the straw.
    a. Room Temperature
    b. Vial warmed by your hand
    c. Ice water
    d. Ice water with 3 pinches of salt
    e. Boiling water
6. Measure the level of the liquid with a ruler and record your data.

Independent Variable:_____Dependent Variable:_____

Part 2:

1. Put one or two drops of food coloring into the 400 mL beaker.
2. Cool the water to about 80°C.
3. Hold the 10 mL graduated cylinder with a test tube holder and invert it in the hot water for at least a minute. Make sure the mouth of the cylinder is almost touching the bottom of the beaker. Record your observations.
4. Quickly move the other graduated cylinder to the room temperature water. Make sure the mouth of the cylinder is almost touching the bottom of the beaker. Record your observations.
5. Keep the graduated cylinder in the second beaker as you add ice to the water. Record your observations.

Independent Variable:_____Dependent Variable:_____

DATA: Record all measurements in a table like the one below.

Part 1
Height of Liquid in Thermometer

	Height (cm)
Room Temperature	
Vial Warmed By Hand	
Ice Water	
Ice Water with Salt	
Boiling Water	

Part 2
Observations of Gas Thermometer

	Observations
Hot Water	
Room Temp Water	
Ice Water	

INTERPRETATION: For each of the problems below, you must **show your work.**

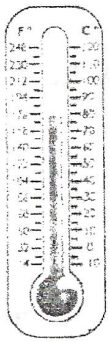
1. What did you generally observe when you warmed and cooled the liquid thermometer (part 1)?

2. What is happening to the liquid in the vial to make it move up and down in the straw?

3. Create a scale for the thermometer in part 1.
   a. Assign numbers for the places you marked on the straw for boiling water and ice water. What numbers did you choose and why?

   b. Based on your newly created temperature scale, estimate the temperature in the room. How did you arrive at your answer?

4. Which is hotter, 30°C or 30 °F? Explain your reasoning.



5. Explain how you can use the air sample trapped inside the graduated cylinder in part 2 as a thermometer.

6. Describe how a thermometer works.

CONCLUSION: What did you learn? What were possible sources of error in this experiment? How could you improve? *Write you conclusion below.*