Pre-Assessment: Derivation of the Celsius to Fahrenheit Conversion Equation Using Experimental Methods

Name: _____ Date: _____ Period: _____

1. Why should the thermometer be suspended in the water during the entire experiment?

2. What is temperature a measure of?

3. Why shouldn't you allow the end of the digital thermometer to sit on the bottom of the beaker while on the hotplate in this experiment?

4. Which temperature scale has "finer" (more closely spaced) graduations? Explain?

5. By what method will you derive the conversion equation in this experiment?

Notes:

Derivation of the Celsius to Fahrenheit Conversion Equation Using Experimental Methods

Name(s): _____, _____,

_____ Date: _____ Period: _____

Purpose: In this experiment you will be heating a sample of water and taking the temperature in Celsius and Fahrenheit at various time intervals. You will then derive the Celsius to Fahrenheit conversion equation by plotting your data points on a graph and determining the line equation of the form $y = mx + b$.

Equipment:

Hot plate, 250mL beaker, stirring rod, digital thermometer(s) calibrated in Celsius and Fahrenheit, 200mL deionized water, timer (or clock with sweep hand)

IMPORTANT NOTES:

- If using a digital thermometer with a ^{o}F to ^{o}C switch, use care so as not to break the switch
- Take temperatures as quickly as possible so that the temperature doesn't change between ^{o}F and ^{o}C readings. Do not wait for the readings to "stabilize".
- **DO NOT** leave the thermometer unattended in the beaker while on the hot plate. The heat from the hotplate can melt the plastic housing on the thermometer.
- **DO NOT** allow the end of the digital thermometer to sit on the bottom of the beaker while on the hotplate as the beaker glass, in direct contact with the hotplate, will give a false reading.

Procedure:

1. Place 200mL of deionized water into a clean 250mL beaker. Place the thermometer in the beaker and allow to sit on the lab table until the temperature becomes stable. Record the initial temperature in the chart below.
2. While performing the following task, gently and continuously stir the water to maintain consistent distribution of the heat in the water. Place the beaker on the hotplate and at 2 minute intervals record the Fahrenheit and Celsius temperatures in the data table below. Be sure to keep the thermometer suspended in the water the entire time so it doesn't have to "come up to temperature" each time.

Be sure to **TURN OFF** the digital thermometer when you are finished. It does not have an auto-off function.

3. Using your collected data, use the information in *Producing an XY Scatter Graph Using Microsoft Excel* on page 16 to plot the data and determine the best-line equation for the graph. **Print your graph**.

	^{o}C (X axis, abscissa)	**^{o}F (Y axis, ordinate)**
Initial Temperature		
2 minutes		
4 minutes		
6 minutes		
8 minutes		
10 minutes		

Post-Lab

1. Write the equation for the line graph you plotted on the Excel worksheet.

2. What is the significance of the slope of the line on the graph?

3. What is the significance of the y-intercept on the graph?

4. How did Fahrenheit determine the 0^o point (y = 0 on your graph) on his temperature scale? How did Celsius determine the 0^o point (x = 0 on your graph) on his temperature scale? Explain your answers.

5. Using your equation, determine "room temperature", 72^oF on the Celsius scale. Show your work.

6. Using your equation, determine the temperature at which ^oF and ^oC are the same value. Show your work.

7. What is unique about the location on your graph for the temperature that you determined in the question above? Explain.

8. Rearrange your equation to solve for Celsius from Fahrenheit.

9. Suppose a new temperature scale, known as the Mercron, is developed based on the melting and boiling point of the element mercury. If the freezing point of water (in Mercrons) is numerically equal to the value of the freezing point of mercury in Celsius (rounded to the nearest whole number) and the boiling point of water (in Mercrons) is numerically equal to the value of the boiling point of mercury in ^oC (rounded to the nearest whole number), derive an equation that allows you to convert from Celsius (^oC) to Mercrons (^oM). Show your work.

TURN IN ONE GRAPH WITH EVERYONE'S NAME ON IT AND STAPLE TO ONE OF THE LABS.