Name:		Date	e:	HURBAN
<b>Chemistry</b> ~ Ms. Hart	<u>Class:</u>	Anions or	Cations	SCHOOL FOR CRIMI

#### EURBAN ASSEMBLY SCHOOL FOR CRIMINAL

## Lab #4: Phase Changes of Water – Generating a Heating Curve

#### **Purpose:**

1. Describe melting and boiling phase changes on a molecular level.

2. Measure, plot, and interpret the graph of the temperature versus time of an ice-water mixture under slow heating, through melting and boiling.

STOP and JOT:	
What is melting?	
What is boiling? _	

### Introduction/Background:

In lesson 2.3, we learned that mass is conserved which is the idea that matter cannot be created or destroyed. Instead, it can only be changed in form. Can you give an example of matter changing in form?

Similarly to the conservation of mass, energy can be transformed (changed from one form to another), but cannot be created or destroyed. This leads into the concept of how different substances can change from one phase to another by absorbing (taking in) or releasing (giving off) energy. When a system (like an ice cube or a chocolate bar) is heated, energy is transferred into it. In response to the energy it receives, the system changes, for example by increasing its temperature. A plot of the time versus temperature is called **the heating curve**\*\*.

Water is a common substance. Ice is the stable phase below 0°C. Both solids and liquids coexist at exactly 0°C. What does it mean to coexist?

When heat is put into the system, more solid will melt. Thus, the temperature does not change at 0°C during the phase change. The normal boiling point is 100°C. As heat is absorbed, some water will boil off but the temperature is kept at 100°C. This change in temperature may be observed and measured against time in an effort to visualize the heat curve for water.

**Hypothesis:** As you watch ice turn from a solid to a liquid to a gas, which process do you expect to take the longest and why? (solid to liquid? Or liquid to gas? Include the names of the phase changes!)

NOTE: Sometimes a hypothesis does not need to be written in the form IF, THEN, BECAUSE. In this case, write your hypothesis in the form, of: (phase change) will take the longest because

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### Materials:

clock hot plate 250 mL beaker 50 mL grad. cylinder thermometer graph paper ice

# **Procedure:**

- 1. Set up a data chart to record time and temperature. The time column starts with 0. The temperature column is blank. You will record the temperatures in the temperature column during the investigation every 20 seconds.
- 2. Turn the hot plate on high (setting 5 or \_\_\_\_\_°C). Let hot plate heat up to temperature.
- 4. Have one lab member hold the thermometer so that the bulb of the thermometer does not touch the bottom of the beaker.
- 5. Place the beaker of ice on the hot plate and immediately start to record the temperature after every 20 seconds. DO NOT remove the thermometer from the beaker to read the temperature. SAFETY: (DO NOT TOUCH THE HOT PLATE!!! KEEP THERMOMETER OFF THE BOTTOM OF THE BEAKER!!)
- 6. Continue to record the temperature on the chart every 20 seconds until 2 minutes after the water has started to boil.
- 7. Please a star \* at the time when the ice has melted and when the water begins boiling.

# Data:

a) Create a table below to record time (s or min) and temperature (°C).

b) Prepare a graph from your data that includes the following information: ASK FOR HELP! <u>Be sure to provide</u>:

- An appropriate title
  A label for each axis with appropriate units
  An appropriate number scale
  Correctly plotted data



Finish your graph:

- 1. Label the 5 areas on your graph: solid (S), liquid (L), gas (G), freezing point/melting point FP/MP and condensation/boiling point (CP/BP).
- 2. Trace, with colored pencils, the following parts of the line on your graph: slowest molecular motion (in red), fastest molecular motion (in green).

# Conclusion/Reflection Questions: Answer these questions in paragraph form as your conclusion.

- 1. Was your hypothesis correct? Which process took the longest (s→l or l→g)? Why did it take the longest? (Explain using information about particles and energy).
- 2. Explain what is happening to the water molecules in the flat areas of the line on your graph during the phase changes from solid to liquid and liquid to gas.
- 3. When the ice is melting is it releasing heat or absorbing heat? Explain your answer. What is this process called?
- 4. If you put the liquid water into the freezer and recorded its temperature as it refroze, would it be absorbing heat or releasing heat? Explain your answer. What is this process called?

