**Name:_____ Per:___**

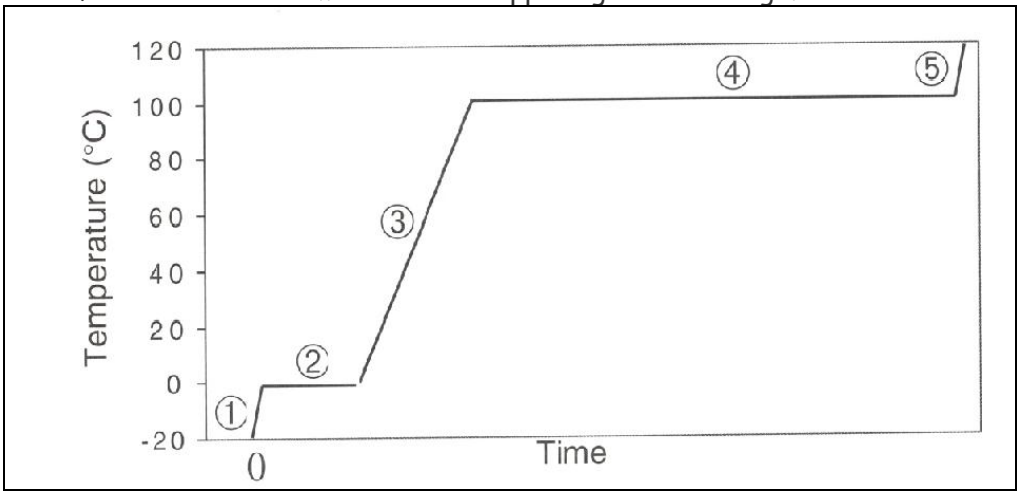
**Worksheet- Heating Curve of Water/Calculations Involving Phase Changes**

Write all answers on your own answer sheet. Redraw all graphs and label them. Restate questions in your answers.

**Purpose:** Examine the heating curve of water and determine what is happening at each stage.

**Heating curve of water**

The graph is not to scale but it is drawn to emphasize differences in the amount of time required for each of the 5 steps




1. For each of the five stages shown on the graph, list what phase or phases are present (s, l, g?):

   Stage 1: Stage 2: Stage 3:

   Stage 4: Stage 5:

2. **Label each** of the numbers on the graph with the correct term: **Phase Change or Temp Change**

3. a) At what point on the graph (° C) is all of the ice gone?

   b) At what point on the graph (° C) is all of the liquid gone?

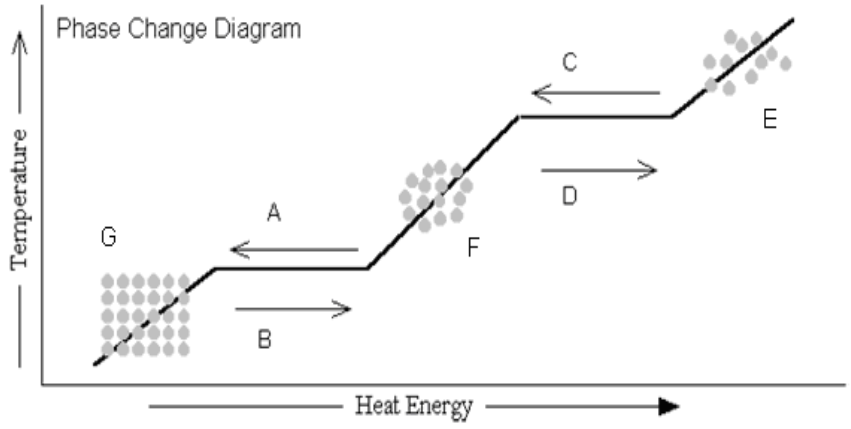
4. Do you think heating other substances and plotting temperature vs. time would result in a similar heating curve as the graph above? Why or why not?

5. **Heat** and **temperature** are related, yet different. The graph shows it's possible to add **heat** the water continuously, yet the **temperature** does not always increase. What is the added heat energy being used to do in the water if it's not making the temperature increase/making molecules move faster?

6. Looking at the graph above. For the same amount of water, **does it take more heat to melt ice**, or **to boil water completely**? Explain your thinking.

7. **Label** precisely the points that are on the diagram below with the following terms:
   - vaporization
   - condensation
   - melting
   - freezing
   - solid, liquid, & gas

8. L**abel** Endothermic or Exothermic on the diagram, above each of the arrows indicating a phase change.



**Calculations Involving Phase Changes**

**Water vapor $C_{sp}$ = 1.9 J/g°C**
**Liquid water $C_{sp}$ = 4 J/g°C**
**Solid water $C_{sp}$ = 2.1 J/g°C**
**$\Delta H_{fus}$ = +/-334J/g**
**$\Delta H_{vap}$ = =/-2260J/g**
**$q_{fus} = m \times \Delta H_{fus}$**
**$q_{vap} = m \times \Delta H_{vap}$**
**$q = m \times C_{sp} \times \Delta T$**

**For the next problems; 1st draw a phase change graph that represent the process in that problem. 2nd write out all equations you are using for EACH portion of the process/graph. 3rd, identify variables. 4th, show the work including units on all numbers.**

9. How much heat (Joules) is released when 1255 g of water vapor condenses to a liquid at 100 °C?

10. **A sample of water with a mass of 23.0 grams at a temperature of -46.0°C increases to 40°C.** a) Make a phase change diagram to indicate the changes water will undergo in this problem & label each step. b) How much total heat (Joules) is needed to do the problem above? (remember, there are to do all the steps).

11. Suppose that you are camping in the winter. **You have 30g of ice at 0 °C that you need to melt and heat up so that you'll have some warm drinking water (40 °C).**
a. Make a phase change diagram to indicate the changes water will undergo in this problem & label each step
b. How much total heat (Joules) is needed to do the problem above?

12. **10.0 g of steam at 120.0 °C are converted into ice at -20.0°C.**
a. Make a graph to indicate this change.
b. Calculate the total energy released (J) needed to do the problem above.

13. You have 2 beakers: one contains 30 g of water (l) at 60°C & the other has 30 g of ethyl alcohol (l) at 60°C. **How many Joules of heat is required to heat each beaker up to 85 °C?**
(*Specific heat of alcohol: 2.44 J/(g×°C), Boiling point = 78.4 °C, Latent heat of Vap. = 841 J/g*)
a. Make a phase change diagrams for each substance
b. Clearly show each calculation that is needed.