

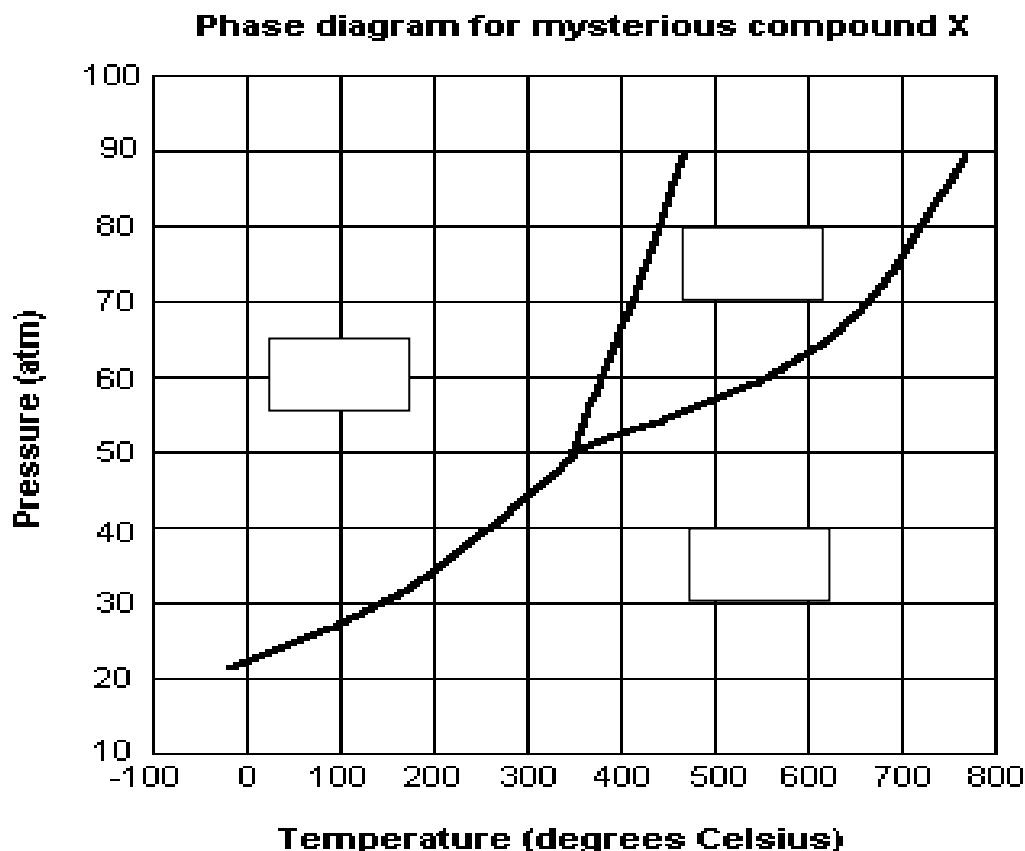
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## States of Matter Application Questions

### GRAPHS/DIAGRAMS

#### 1. Phase Diagrams

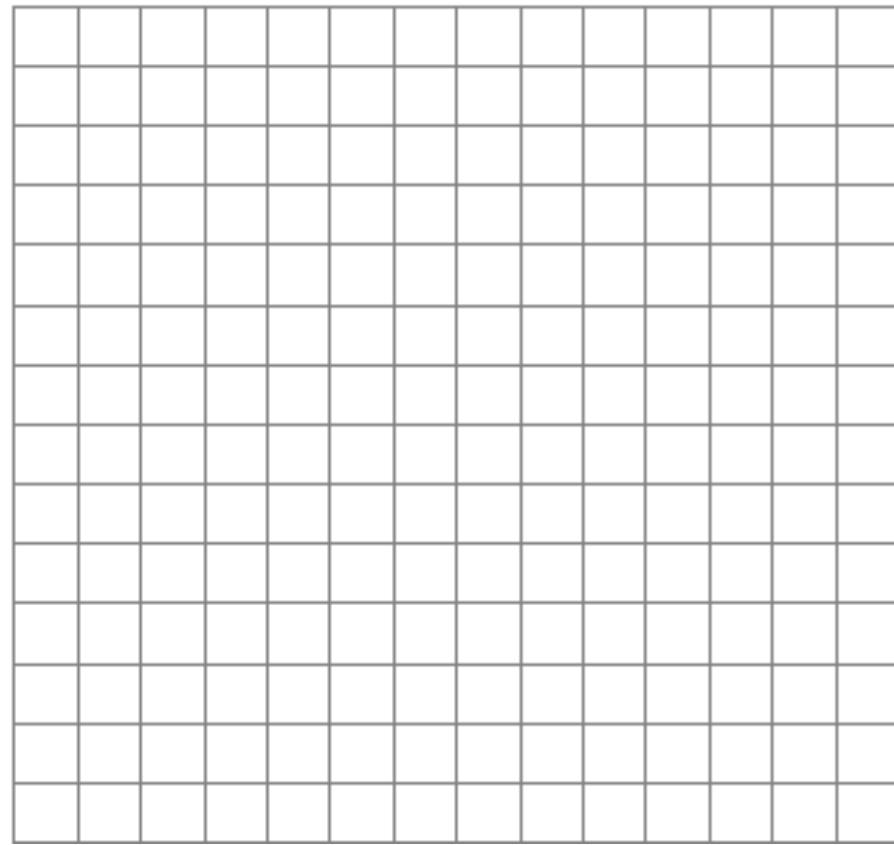
- Go to the 3 whiteboard scenarios. Read each scenario. Use the whiteboard scenarios as a guide to answer the following questions.
- Questions:
  1. What measurement is plotted on the y-axis of a phase diagram?
  2. What measurement is plotted on the x-axis of a phase diagram?
  3. On the phase diagram below, label the following: solid, liquid, gas, and triple point.



- 4. On the phase diagram above, create a scenario #4 that would show the substance freezing at constant pressure.

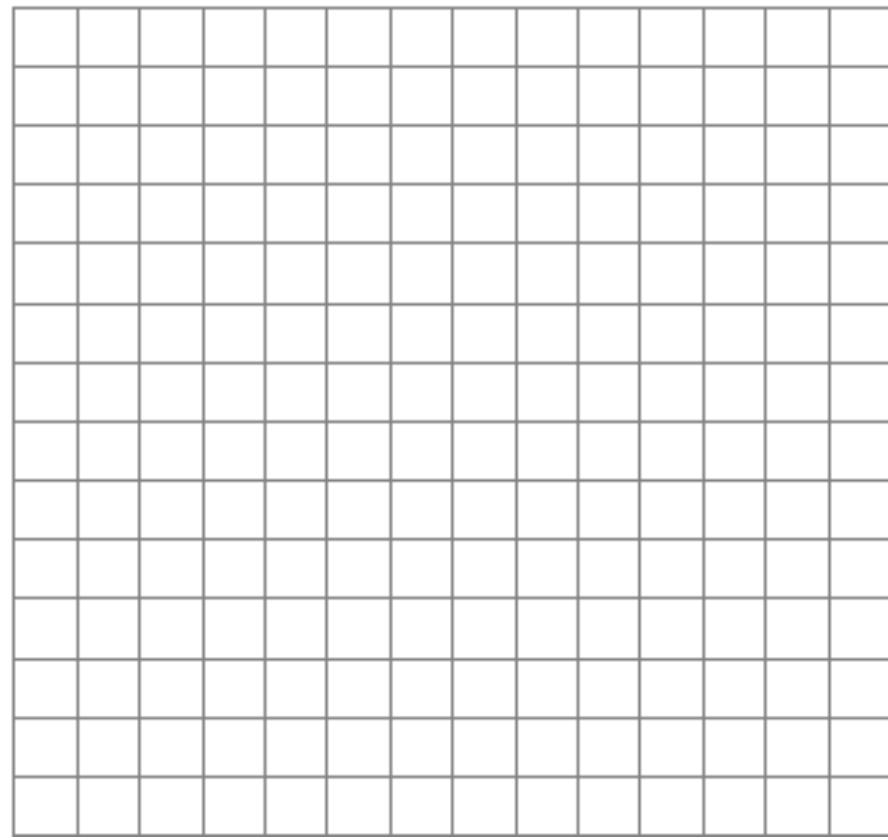
2. Vapor Pressure Curves

- Go to the 3 vapor pressure whiteboards. Read each whiteboard. Use the whiteboards to help you answer the following questions.
- Questions:
  1. What measurement is plotted on the y-axis of a vapor pressure curve?
  2. What measurement is plotted on the x-axis of a vapor pressure curve?
  3. What creates vapor pressure?
  4. When does boiling occur?
  5. What would you observe in a liquid as it is boiling?
  6. What happens to a liquid's vapor pressure as temperature increases?
  7. Which substance has the highest boiling point? Diethyl ether, ethanol, or water?
  8. Which substance has the strongest intermolecular forces (i.e. liquid particles are attracted the most to one another)? Diethyl ether, ethanol, or water?
  9. On the graph paper below, draw and label 2 vapor pressure curves.
    - a. Liquid A whose normal boiling point at 760 torr is 50°C.
    - b. Liquid B whose normal boiling point at 760 torr is 75°C.



3. Heating Curve

- Go to the heating curve whiteboard. Read the whiteboard. Use the whiteboard to help you answer the following questions.
- Questions:
  1. What measurement is plotted on the y-axis of the heating curve?
  2. What measurement is plotted on the x-axis of the heating curve?
  3. What do diagonal (sloped) lines represent?
  4. What do the flat lines represent?
- 5. On the graph below, draw a heating curve for a substance with a melting point of 30°C and a boiling point of 80°C. On your graph, label the following: solid, liquid, gas, melting point and boiling point.



CALCULATIONS – Complete on a separate sheet of paper. Staple your work to this paper.

1. Temperature

- Units = Kelvin, K      **Kelvin = °C + 273**
  1. Convert 22°C to Kelvin.
  2. Convert 150°C to Kelvin.

2. Pressure Conversions

- Pressure is measured in many different units. Most common units include:
  - Atmospheres, atm
  - Millimeters of mercury,  
mmHg
  - Kilopascals, kPa
  - torr, Torr
- **1 atm = 760 mmHg = 101.3 kPa = 760 torr**
  3. Convert 901 mmHg to atm.
  4. Convert 2.5 atm to kPa.

3. Energy

- Energy, such as heat, is measured in joules, J.      **1000 joules (J) = 1 kilojoule (kJ)**
  5. Convert 10.3 joules to kilojoules.
  6. Convert 82 kilojoules to joules.
  7. Convert 4.8 kilojoules to joules.

4. Heat of Fusion,  $\Delta H_{\text{fus}}$

- Fusion = Melting = Solid turns into liquid
- Heat of fusion = amount of heat needed to melt a substance
  8. Aluminum has a heat of fusion,  $\Delta H_{\text{fus}}$ , value of 8.66 kJ/mol
    - a. Thus 8.66 kilojoules of heat = 1 mole of aluminum.
    - b. How many kilojoules of heat are needed to melt 3.5 moles of aluminum?
  9. Iron has a  $\Delta H_{\text{fus}}$  of 11.7 kJ/mol.
    - a. Thus \_\_\_\_\_ kilojoules heat = \_\_\_\_\_ moles iron.
    - b. How many kilojoules of heat are needed to melt 2.8 moles of iron?
  10. Sodium has a  $\Delta H_{\text{fus}}$  of 113 J/g.
    - a. Thus \_\_\_\_\_ joules heat = \_\_\_\_\_ grams sodium.
    - b. How many grams of sodium can be melted with 23 kJ of heat?

5. Heat of Vaporization,  $\Delta H_{\text{vap}}$

- Vaporization = Liquid turns into gas
- Heat of vaporization = amount of heat needed to vaporize a substance
  13. Nitrogen has a heat of vaporization,  $\Delta H_{\text{vap}}$ , value of 5.60 kJ/mol.
    - a. Thus \_\_\_\_\_ kilojoules heat = \_\_\_\_\_ moles nitrogen.
    - b. How many moles of nitrogen can be vaporized with 899 joules of heat?
  14. Lead has a  $\Delta H_{\text{vap}}$  of 180.5 kJ/mol.
    - a. Thus \_\_\_\_\_ kilojoules heat = \_\_\_\_\_ moles lead.
    - b. How many grams of lead can be vaporized with 323 kilojoules of heat?
  15. Copper has a  $\Delta H_{\text{vap}}$  of 1578 J/g.
    - a. Thus \_\_\_\_\_ joules heat = \_\_\_\_\_ grams copper.
    - b. How many joules of heat are required to vaporize 5.02 grams of copper?