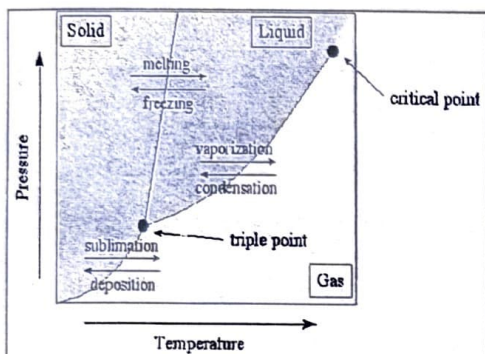


Phase Diagram Worksheet

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A **phase diagram** is a graphical way to depict the effects of **pressure** and **temperature** on the phase of a substance:

The **CURVES** indicate the conditions of **temperature** and **pressure** under which "equilibrium" between different phases of a substance can exist. **BOTH** phases exist on these lines:



Melting/Freezing: Any point on this line (pressure & temperature) the substance is both **solid** and **liquid**

Sublimation/Deposition: Any point on this line (pressure & temperature) the substance is both **solid** and **gas**

Vaporization/Condensation: Any point on this line (pressure & temperature) the substance is both **liquid** and **gas**

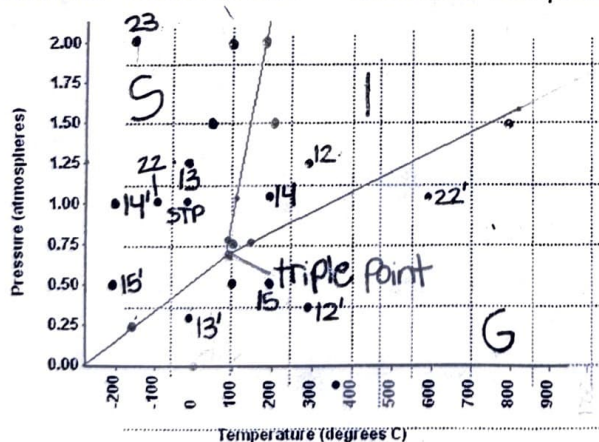
NOTE: the vapor pressure curve ends at the **critical point**, the temperature above which the gas cannot be liquefied no matter how much pressure is applied (the kinetic energy simply is too great for attractive forces to overcome). Any substance beyond this critical point is called a **supercritical fluid** — indistinguishable between gas or liquid (neither one)

The **TRIPLE POINT** is the condition of temperature and pressure where ALL THREE phases exist in equilibrium (solid, liquid, gas)

Remember that pressure can be expressed in many units where: **1 atm = 101.3 kpa = 760 mmHg**

Refer to the phase diagram below when answering the questions on the back of this worksheet:

NOTE: "Normal" refers to STP – Standard Temperature and Pressure.



- 1) What are the values for temperature and pressure at STP? T = 0°C, P = 1.00 atm
- 2) What is the normal freezing point of this substance? 110°C
- 3) What is the normal boiling point of this substance? 400°C
- 4) What is the normal melting point of this substance? 110°C

- 5) What is the phase (s, l, g) of a substance at **2.0 atm** and **100 °C**? S
- 6) What is the phase (s, l, g) of a substance at **0.75 atm** and **100 °C**? l
- 7) What is the phase (s, l, g) of a substance at **0.5 atm** and **100 °C**? g
- 8) What is the phase (s, l, g) of a substance at **1.5 atm** and **50 °C**? S
- 9) What is the phase (s, l, g) of a substance at **1.5 atm** and **200 °C**? l
- 10) What is the phase (s, l, g) of a substance at **1.5 atm** and **800 °C**? g
- 11) What is the condition of the **triple point** of this substance? T= 90°C, P= 0.70 atm
- 12) If a quantity of this substance was at an initial pressure of **1.25 atm** and a temperature of **300° C** was lowered to a pressure of 0.25 atm, what phase transition(s) would occur? Evaporation
- 13) If a quantity of this substance was at an initial pressure of **1.25 atm** and a temperature of **0° C** was lowered to a pressure of 0.25 atm, what phase transition(s) would occur? Sublimation
- 14) If a quantity of this substance was at an initial pressure of **1.0 atm** and a temperature of **200° C** was lowered to a temperature of -200° C, what phase transition(s) would occur? Freezing
- 15) If a quantity of this substance was at an initial pressure of **0.5 atm** and a temperature of **200° C** was lowered to a temperature of -200° C, what phase transition(s) would occur? Deposition
- 16) If this substance was at a pressure of **2.0 atm**, at what temperature would it **melt**? 175°C
- 17) If this substance was at a pressure of **2.0 atm**, at what temperature would it **boil**? N/A
- 18) If this substance was at a pressure of **0.75 atm**, at what temperature would it **melt**? 100°C
- 19) If this substance was at a pressure of **0.75 atm**, at what temperature would it **boil**? 150°C
- 20) At what temperature do the gas and liquid phases become indistinguishable from each other? 350°C
- 21) At what pressure would it be possible to find this substance in the gas, liquid, **and** solid phase? 0.70 atm
- 22) If I had a quantity of this substance at a pressure of **1.00 atm** and a temperature of **-100° C**, what phase change(s) would occur if I **increased the temperature to 600° C**? At what temperature(s) would they occur? (**NOTE: multiple answers needed for this question**)
Melting at ~110°C, evaporation at 400°C
- 22) If I had a quantity of this substance at a pressure of **2.00 atm** and a temperature of **-150° C**, what phase change(s) would occur if I **decreased the pressure to 0.25 atm**? At what pressure(s) would they occur? (**NOTE: multiple answers needed for this question**)
Sublimation at 0.25 atm