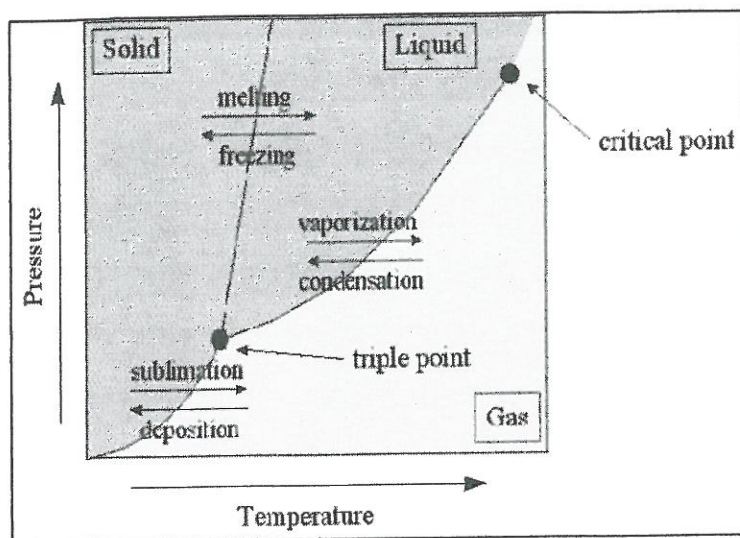# Phase Diagram Worksheet

Name: _____

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.
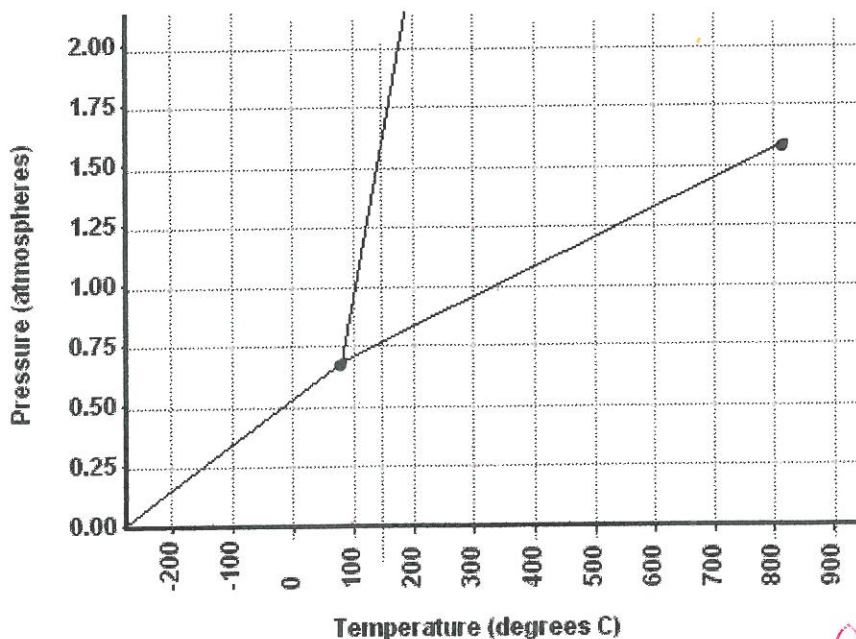
1) What are the values for temperature and pressure at STP? T= _273 K_ (0°C), P= _1 atm (760 mm Hg)_

2) What is the *normal* freezing point of this substance? _100°C_

3) What is the *normal* boiling point of this substance? _≈ 325°C_

4) What is the *normal* melting point of this substance? __100°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= __.7 atm__

12) If a quantity of this substance was at an initial pressure of 1.25 atm and a temperature of **300⁰ C** was <u>lowered to a pressure of 0.25 atm</u>, what phase transition(s) would occur? __vaporization__

13) If a quantity of this substance was at an initial pressure of 1.25 atm and a temperature of **0⁰ C** was <u>lowered to a pressure of 0.25 atm</u>, 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 200⁰ C was <u>lowered to a temperature of -200⁰ C</u>, what phase transition(s) would occur? __Solidify (freeze)__

15) If a quantity of this substance was at an initial pressure of **0.5 atm** and a temperature of 200⁰ C was <u>lowered to a temperature of -200⁰ C</u>, 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**? __810°C__

18) If this substance was at a pressure of 0.75 atm, at what temperature would it **melt**? __90°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 <u>indistinguishable</u> from each other? __810°C__

21) At what <u>pressure</u> would it be possible to find this substance in the gas, liquid, <u>and</u> solid phase? __.7 atm__

22) If I had a quantity of this substance at a pressure of 1.00 atm and a temperature of -100⁰ C, <u>what phase change(s)</u> would occur if I **increased the temperature** to <u>600⁰ C</u>? At what temperature(s) would they occur? (***NOTE***: *multiple answers needed for this question*)

     1ˢ – melt at 100°C   then   boil at 325°C

22) If I had a quantity of this substance at a pressure of 2.00 atm and a temperature of -150⁰ C, <u>what phase change(s)</u> would occur if I **decreased the pressure** to <u>0.25 atm</u>? At what pressure(s) would they occur? (***NOTE***: *multiple answers needed for this question*)

     deposition would occur at .35 atm