Name_____ H Chem, Period _____

**Phase Diagram Worksheet**

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

**The lines not only separate the matter by phases, but additionally 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**

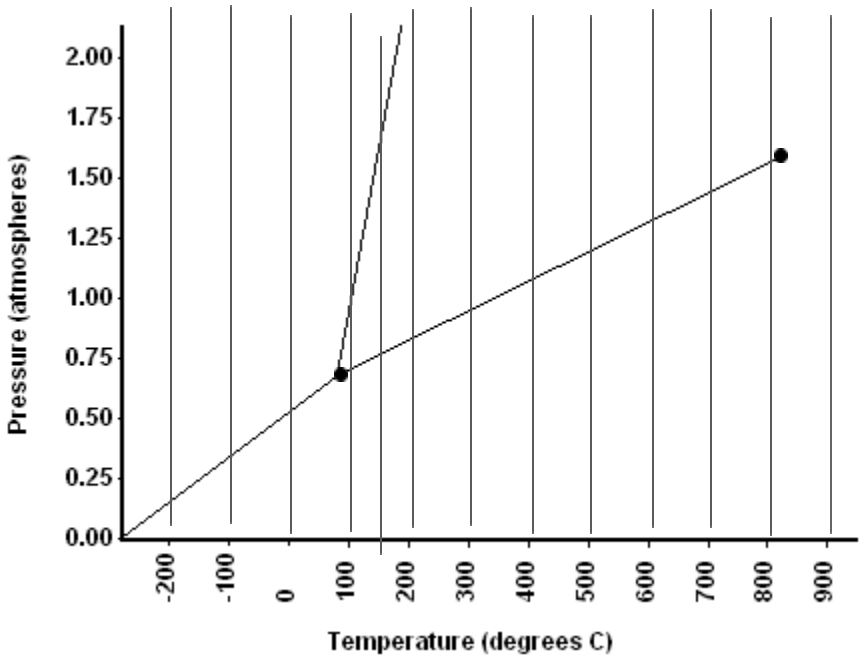
**Vaporization/Condensation**: Any point on this line (pressure & temperature) the substance is both **liquid** and **gas**

**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.

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

Normal melting and normal boiling points are the temperature at which the pressure equals 1 atm, 101.3 kPa, or 760 mmHg

Refer to the phase diagram below when answering the questions:




1. What is the *normal* freezing point of this substance? _____
2. What is the *normal* boiling point of this substance? _____
3. What is the *normal* melting point of this substance? _____
4. What is the phase (s, l, g) of a substance at **2.0 atm** and 100 °C? _____
5. What is the phase (s, l, g) of a substance at **0.75 atm** and 400 °C? _____
6. What is the phase (s, l, g) of a substance at 1.25 atm and **50 °C**? _____
7. What is the phase (s, l, g) of a substance at 1.25 atm and **200 °C**? _____
8. What is the phase (s, l, g) of a substance at 1.25 atm and **800 °C**? _____
9. What is the condition of the **triple point** of this substance? T= _____, P= _____
10. If a quantity of this substance was at an initial pressure of 1.25 atm and a temperature of **$300^0$ C** was lowered to a pressure of 0.25 atm, what phase transition(s) would occur? _____
11. If a quantity of this substance was at an initial pressure of 1.25 atm and a temperature of **$0^0$ C** was lowered to a pressure of 0.25 atm, what phase transition(s) would occur? _____
12. If a quantity of this substance was at an initial pressure of **1.0 atm** and a temperature of $200^0$ C was lowered to a temperature of **$-200^0$ C**, what phase transition(s) would occur? _____
13. If a quantity of this substance was at an initial pressure of **0.5 atm** and a temperature of $200^0$ C was lowered to a temperature of **$-200^0$ C**, what phase transition(s) would occur? _____

14. If this substance was at a pressure of 2.0 atm, at what temperature would it **melt**? _____

15. If this substance was at a pressure of 2.0 atm, at what temperature would it **boil**? _____

16. If this substance was at a pressure of 0.75 atm, at what temperature would it **melt**? _____

17. If this substance was at a pressure of 0.75 atm, at what temperature would it **boil**? _____

18. At what temperature do the gas and liquid phases become indistinguishable from each other?

    _____

19. At what pressure would it be possible to find this substance in the gas, liquid, **and** solid phase?

    _____

20. Draw a phase diagram given the following information:

    a. The triple point of sulfur dioxide is at $-73^0$C and 0.17 kPa.
    b. The critical point is at $158^0$C and $7.87 \times 10^3$ kPa.
    c. The normal boiling point occurs at $-10^0$C.
    d. At $-83.15^0$C and 0.1016 kPa the solid and gas phases are in equilibrium.
    e. Label the following: Title, x and y-axes with appropriate units, phases, triple point, and critical point.