Reading HW7

7.1) Real Gases and Ideal Gases
  - P-V-T relationship of a real gas is the same
  as that for an ideal gas at low densities & high
  Temp

7.2) Equations of State of Real Gases and Their range of
  applicability
  Most iden: Van der Waals Equation

$$\cancel{PV} - P = \frac{RT}{V_m - b} - \frac{a}{V_a} = \frac{nRT}{V - nb} - \frac{n^2 a}{V^2}$$

7.3) The Compression factor
  . Termed Z and applies to compressibility

$$Z = \frac{V_m}{V_{ideal}} = \frac{PV}{RT}$$

7.4) The Law of Corresponding States
- 2 gases having same T, P, and V means
they're in a corresponding state.

$$P_r = \frac{8T_r}{3V_{mr}-1} - \frac{3}{V_{mr}^2}$$

$$T_r = \frac{T}{T_c}$$

$$P_r = \frac{P}{P_c}$$

$$V_{mr} = \frac{V_m}{V_{mc}}$$

8.1) What Determines the Relative Stability of the Solid,
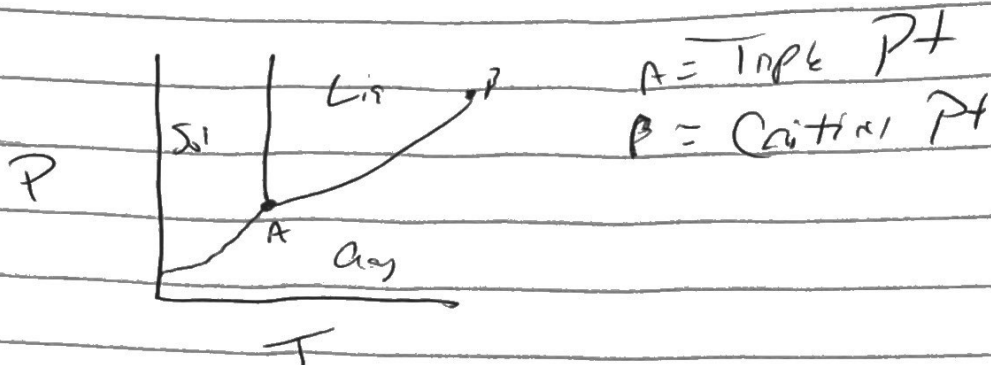Liquid, and Gas Phase?
- we find this through chemical potential
changes w/ Pressure & Temperature

$$\left(\frac{\partial \mu}{\partial T}\right)_P = -S_m$$

$$\left(\frac{\partial \mu}{\partial P}\right)_T = V_m$$

$$S_m^{gas} > S_m^{liquid} > S_m^{solid}$$

8.2) The Pressure Temperature Phase Diagram

$A = $ Triple Pt
$\beta = $ Critical Pt

8.3) The Phase Rule
- ~~formed~~ by J. W. Gibbs

$$F = 3 - P$$

degrees of freedom ↗

# of phases ↓

8.4) The Pressure - Volume & Pressure - Volume - Temperature Phase Diagram
- This is a 3-D diagram with pressure, volume, and temperature on x-y-z axes.

8.6) Using the Clausius-Clapeyron Equation to calculate Vapor Pressure

$$\frac{dP}{P} = \frac{\Delta H_{vap}}{R} \frac{dT}{T^2}$$

$$\ln \frac{P_f}{P_i} = -\frac{\Delta H_{vap}}{R} \times \left(\frac{1}{T_f} - \frac{1}{T_i} \right)$$

8.7) The Vapor Pressure of a Pure Substance

$$\mu_{liquid} (T, P) = \mu_{gas} (T, P)$$

$$RT \ln \left(\frac{P}{P_0} \right) = V_m^{liquid} (P - P_0)$$

8.8) Surface Tension
 - measured J/m^2 or N/m

$$dA = \gamma d\sigma$$

"From force & surface tension, we get

$$4\pi r^2 P_{outer} + 8\pi \gamma r = 4\pi r^2 P_{inner}$$

$$P_{inner} = P_{outer} + \frac{2\gamma}{r}$$

8.9) Chemistry in Supercritical Fluids
- Supercritical liquids
  - has a density between of liquid-phase
  - Supercritical water is a nonpolar solvent at high T

8.10) Liquid Crystal Displays
A. Liquid crystals
  - glasses
    - liquids with high velocity
  - Life crystals
    - Liquid-Solid intermediate