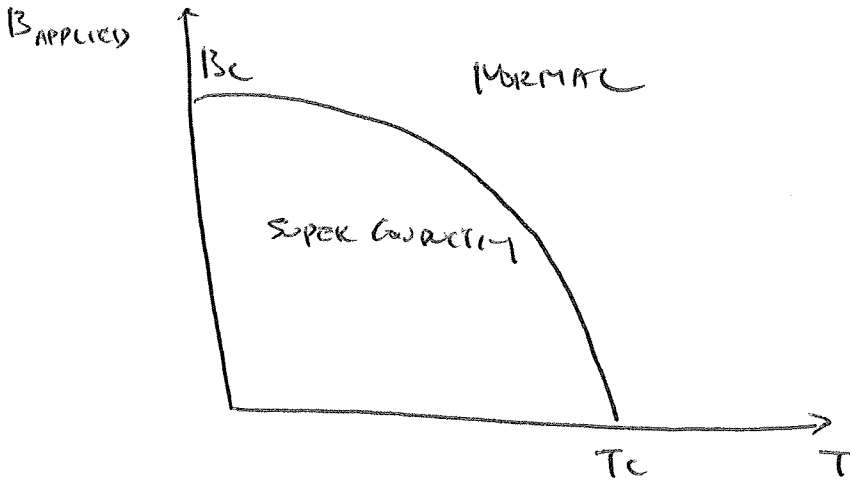
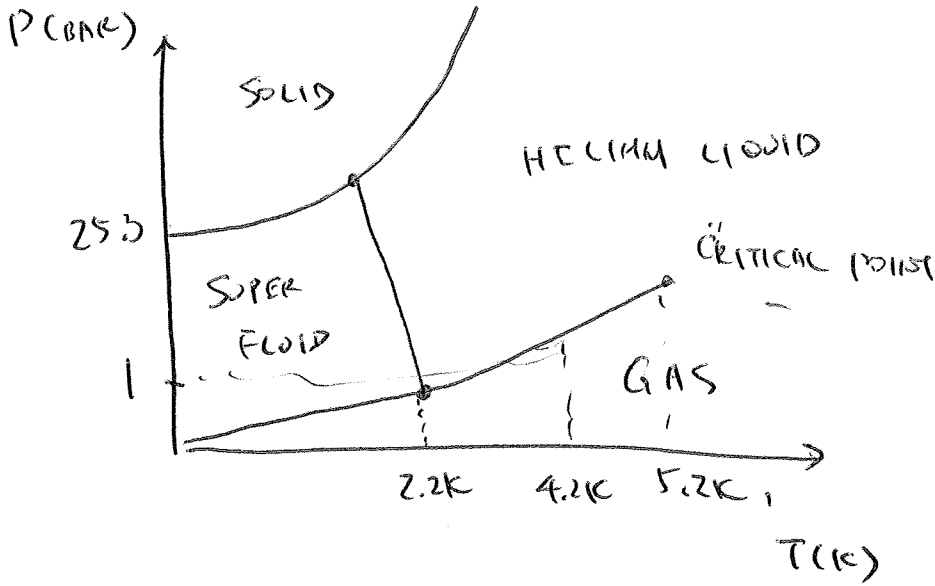
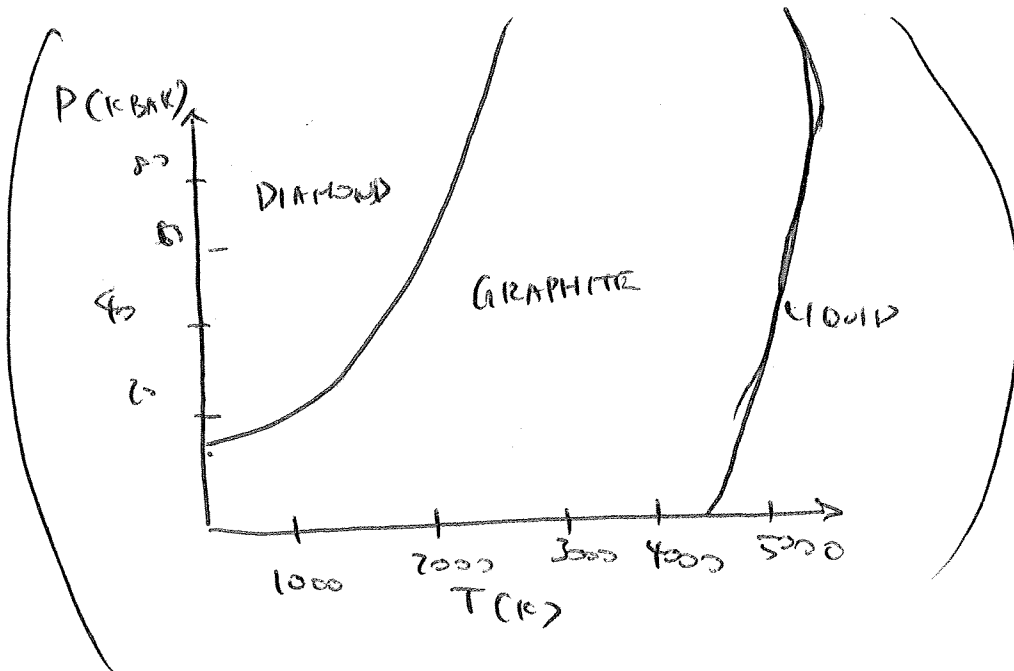
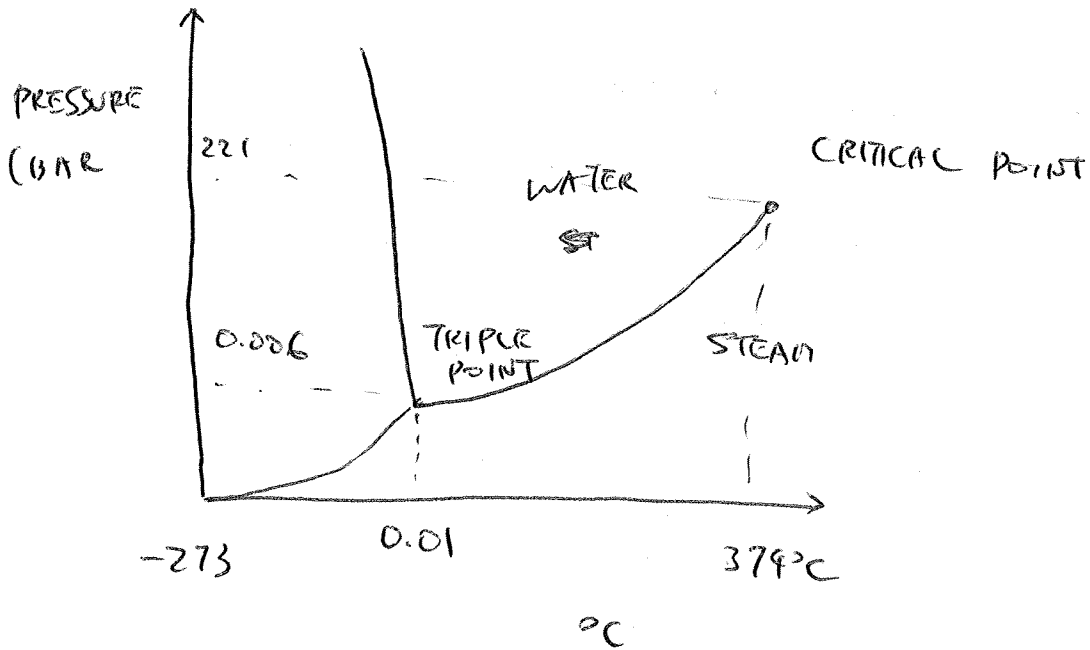


BOSE CONDENSATION



PHASE TRANSITIONS

WATER CAN BE ICE WATER OR STEAM



$$H = U + PV$$

$$G = H - TS$$

$$G_L = G_S \text{ AT PHASE BOUNDARY}$$

$$dG_L = dG_S$$

$$-S_L dT + V_L dp = -S_S dT + V_S dp$$

$$\frac{dp}{dT} = \frac{S_S - S_L}{V_S - V_L}$$

$$S_S - S_L = \frac{L}{T} \quad \frac{dp}{dT} = \frac{L}{T \Delta V}$$

CLAUSIUS - CLAPEYRON RELATION

$$\Delta G = \Delta H - T\Delta S = 0$$

$$\frac{\Delta H}{T} = \Delta S$$

$$\frac{dp}{dT} = \frac{\Delta S}{\Delta V} = \frac{\Delta H}{T\Delta V}$$

$$\Delta H = L \quad \text{LATEST HEAT}$$

$$dp = \frac{\Delta H}{\Delta V} \frac{dT}{T}$$

$$pV = nRT$$

$$\ln p_2 - \ln p_1 = \frac{\Delta H}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$p_2 - p_1 = \frac{\Delta H}{T\Delta V} (\ln T_1 - \ln T_2)$$

vs $v_s T = nRT$

EXAMPLE BENZENE Boiling point 353.25K

$$\Delta H = 30.8 \text{ kJ/mol}$$

WHAT IS VAPOR PRESSURE AT 298K?

$$\ln p_2 - \ln 101325 = \frac{30.8 \times 10^3}{8.314} \left(\frac{1}{353.25} - \frac{1}{298.15} \right)$$

$$p_2 = 14600 \text{ Pa}$$

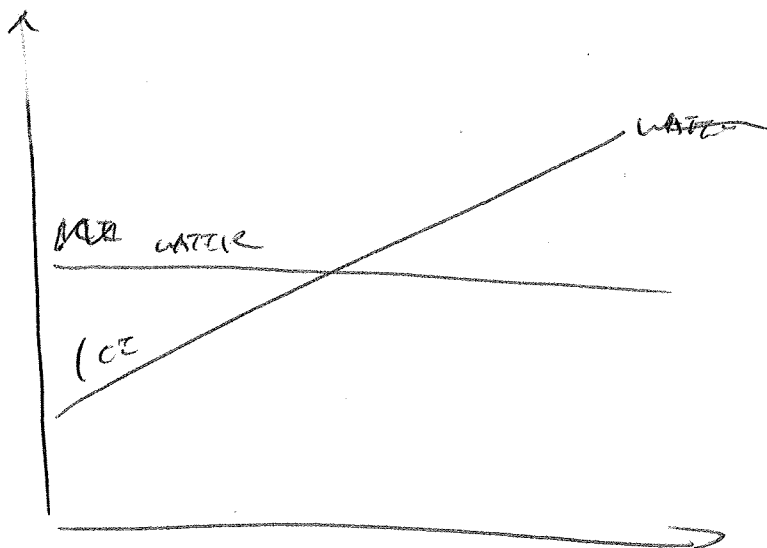
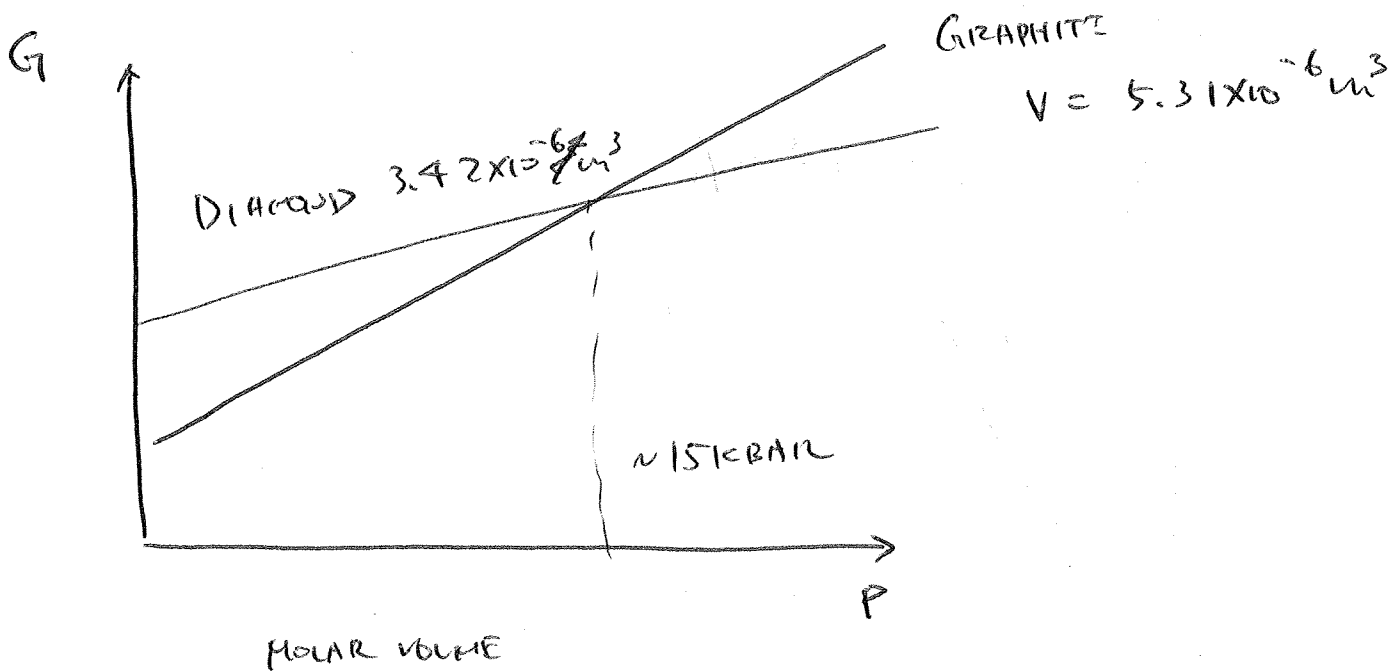
$$\frac{dp}{p} = \frac{\Delta H}{R} \frac{dT}{T^2}$$

$$d \ln p = \frac{\Delta H}{R} \frac{dT}{T^2}$$

$$\ln p_2 - \ln p_1 = \frac{\Delta H}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$dG = -SdT + vdp + \mu dn$$

$$\left(\frac{\partial G}{\partial p}\right)_{T, n} = v$$



DIAMOND \rightarrow GRAPHITE

$$\Delta S = 3.4 \text{ J/K}$$

$$\Delta V = + 1.9 \times 10^{-6} \text{ m}^3$$

$$\frac{dp}{dT} = 1.8 \times 10^6 \text{ Pa/K}$$

