North Carolina State University Physical Chemistry 331 Quiz #5
Name _____ Section _____ Thursday, Sept. 23

Solve the following problems. Write the numerical answer on the blank space provided. Please show your work.

$$P_2 = P_1 + \frac{\Delta_{trs}H_m}{\Delta_{trs}V_m}\ln\left(\frac{T_2}{T_1}\right) \quad , \quad \ln\left(\frac{P_2}{P_1}\right) = \frac{\Delta_{trs}H_m}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\ln\left(\frac{K_2}{K_1}\right) = \frac{\Delta H_m}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\Delta S = -R\sum_{i=1}^{N} x_i \ln x_i \text{ where } N \text{ is the number of components}$$

$$\Pi = cRT \quad , \quad \rho = mgh \quad , \quad P = \rho gh \quad , \quad DT_{fus} = K_f m \quad , \quad K_f = \frac{1000RT_{fus}^2}{\Delta H_{fus}M}$$

1. What is the total pressure above a solution of ethanol ($x_{ethanol}$ = 0.4) and methanol as it begins to boil? ($P_{ethanol}$* = 58 torr and $P_{methanol}$* = 159 torr)

Answer _____

2. Calculate the mole fraction of ethanol in the vapor phase under the conditions above.

Answer _____

3. Earlier in the course we calculated that the pressure on the top of Mt. Mitchell is ~ P = 0.8 atm. Given this pressure calculate the temperature at which water boils on the top of Mt. Mitchell.
   A. Write the Clausius-Clapeyron equation in a form where you solve for T_2.

Answer _____

B. Using the data given below calculate the boiling point of water on the top of Mt. Mitchell.

T_{fus} = 273.15 K $\Delta_{fus}H$ = 6.0 kJ/mol
T_{vap} = 373.15 K $\Delta_{vap}H$ = 40.65 kJ/mol
ρ_{ice} = 0.917 gm/cm^3 ρ_{water} = 1.000 gm/cm^3
Triple point T = 273.16 K P = 0.006 bar
Critical point T_c = 647.3 K P_c = 218 bar

Answer _____