Q4001 Thermodynamics of Materials **November, 2019**
Homework 10

1. The vapor pressure of neon as a function of temperature is shown in the following table:

$T/°\mathrm{C}$	-228.7	-233.6	-240.2	-243.7	-245.7	-247.3	-248.5
$P/\mathrm{mm\,Hg}$	19800	10040	3170	1435	816	486	325

   Find the normal boiling point and the evaporation enthalpy and entropy for neon.

2. The vapor pressure of solid NaF varies with temperature as

$$\ln P = -\frac{34450}{T} - 2.01 \ln T + 33.74$$

   and the vapor pressure of liquid NaF varies with temperature as

$$\ln P = -\frac{31090}{T} - 2.52 \ln T + 34.66$$

   (a) The normal boiling temperature of NaF
   (b) The temperature and pressure at the triple point
   (c) The molar enthalpy of evaporation of NaF at its normal boiling temperature
   (d) The molar enthalpy of melting of NaF at the triple point
   (e) The difference between the constant-pressure molar heat capacities of liquid and solid NaF

3. Confirm that the values of the ebulloscopic constants (K_b) for water and benzene are 0.51 and 2.63, respectively.

4. Knowing that at the melting temperature of a solution with a solute's mole fraction x_B

$$\mu_\mathrm{A}^\mathrm{s} = \mu_\mathrm{A}^{\mathrm{l},\bullet}$$

   Demonstrate that:

   (a) $\Delta_\mathrm{fus}\mu_\mathrm{A}^\bullet = -RT \ln x_A$

   (b) $\dfrac{\Delta_\mathrm{fus}H^\bullet}{RT^2} = \dfrac{d \ln x_A}{dT}$

   (c) $\dfrac{\Delta_\mathrm{fus}H^\theta}{R}\dfrac{\Delta T_m}{T_m^2} = -\ln x_A \quad \text{where} \quad \Delta T_m = T_m^\circ - T_m^\bullet$

   (d) $\Delta T_m = \dfrac{RT_m^2}{\Delta_\mathrm{fus}H^\theta} x_B$

   (e) $K_f = \dfrac{RT_m^2 M_\mathrm{A}}{\Delta_\mathrm{fus}H^\theta}$ where M_A is the molar mass of A and $\Delta T_m = K_f m_\mathrm{B}$, in which m_B is the molality of B.

Due date: Tuestday, november 5th.