Handin Homework 12: Solutions

1. At 30.0°C the vapor pressure of pure toluene and pure benzene are 36.7 and 118.2 torr, respectively. The two liquids form nearly an ideal solution. (a) For a solution containing 50.0 mole % of toluene, calculate the total vapor pressure and the mole % of each component in the vapor phase. (b) What is the composition of a solution of benzene and toluene that will boil at 30.0°C at a pressure of 50.0 torr?

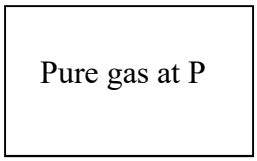
2. When 640. mg of naphthalene is dissolved in 40.0 g of chloroform, the boiling point of the solution is 0.455°C higher than that of pure solvent (61.2°C). Calculate (a) the molal boiling point elevation constant, and (b) the molar enthalpy of vaporization of chloroform.

3. 3. At 1105. K, the value of K_P for the reaction SO_2 (g) + ½ O_2 (g) = SO_3 (g) is 0.630 (with a 1 bar standard state).
(a) Calculate the standard Gibb's Free Energy change at 1105. K for this reaction.

(b) Calculate the Gibb's Free Energy change at 1105. K for the reaction:
SO_2 (1.00 bar) + 1/2 O_2 (25.0 bar) = SO_3 (2.00 bar)

4. Fill in the following "beakers" with appropriate mole fractions and partial pressures. In other words, does the chemical potential equation apply to a one phase or two phase system, pure substance, gas mixture, or solution? The first and 4th boxes are done for you as examples. (Hint: some of the diagrams are identical, the relationships just take a different reference state or are specific to an ideal case rather than the general case.)

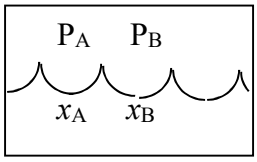
$\mu(g) = \mu^\circ(g) + RT \ln P/P^\circ$



$\mu_A(g) = \mu_A^\circ(g) + RT \ln P_A/P^\circ$

$\mu_A^*(l) = \mu_A^\circ(g) + RT \ln P_A^*/P^\circ$

$\mu_A(x_A) = \mu_A^\circ(g) + RT \ln P_A/P^\circ$



$\mu_A(x_A) = \mu_A^*(l) + RT \ln P_A/P_A^*$

$\mu_A(x_A) = \mu_A^*(l) + RT \ln x_A$