Course: CHM202

Energetics and dynamics of chemical reactions

Assignment – VII

Q.1 Given that p*(H_2O) = 0.02308 atm and p(H_2O) = 0.02239 atm in a solution in which 0.122 kg of a non-volatile solute (M = 241 g mol^{-1}) is dissolved in 0.920 kg water at 20 °C. Evaluate the activity and activity coefficient of water in the solution.

Q.2 The vapor pressure of pure liquid A at 20 °C is 68.8 kPa, and that of pure liquid B is 82.1 kPa. These two compounds form an ideal liquid and gaseous mixtures. Consider the equilibrium composition of a mixture in which the mole fraction of A in the vapor is 0.612. Calculate the total pressure of the vapor and the composition of the liquid mixture.

Q.3 It is found that the boiling point of a binary solution of A and B with x_A = 0.4217 is 96 °C. At this temperature, the vapour pressures of pure A and B are 110.1 kPa and 76.5 kPa, respectively. (a) Is this solution ideal? (b) What is the initial composition of the vapour above the solution?

Q.4 Molecular bromine is 24% dissociated at 1327 °C and 1.00 bar in the equilibrium $Br_2(g) \rightleftharpoons 2Br(g)$. Calculate (a) K at 25 °C, (b) $\Delta_r G^0$, (c) K at 2000 °C given that $\Delta_r H^0$= +112 kJ mol^{-1} over the temperature range.

Q.5 If α is the degree of dissociation of NH_3 at pressure P, find α in terms of P and equilibrium constant K_p.

Q.6 What are the contributions that account for the difference between activity and concentration?

Q.7 Find the relation between the standard and biological standard Gibbs energies of a reaction of the form $A \rightarrow B+3H^+$ aq.).

Q.8 At what temperature would CO_2 have a fugacity of 400 atm when its pressure is 400 atm?.