

Course: CHM202

Energetics and dynamics of chemical reactions

Assignment – VII

- Q.1** Given that $p^*(\text{H}_2\text{O}) = 0.02308 \text{ atm}$ and $p(\text{H}_2\text{O}) = 0.02239 \text{ atm}$ in a solution in which 0.122 kg of a non-volatile solute ($M = 241 \text{ g mol}^{-1}$) 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 $\text{Br}_2(\text{g}) \rightleftharpoons 2\text{Br}(\text{g})$. Calculate (a) K at 25°C , (b) $\Delta_r G^0$, (c) K at 2000°C given that $\Delta_r H^0 = +112 \text{ kJ mol}^{-1}$ 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 $\text{A} \rightarrow \text{B} + 3\text{H}^+ \text{aq.}$.
- Q.8** At what temperature would CO_2 have a fugacity of 400 atm when its pressure is 400 atm?