B. Tech.
(SEM. IV) EXAMINATION, 2006-07
CHEMISTRY - II

Time : 3 Hours] [Total Marks : 100

Note : (1) Attempt all questions.
(2) All questions carry equal marks.
(3) In case if numerical problem assume data wherever not provided.

I. Attempt any two of the following : 10×2=20

(a) In following reaction

\[
\begin{array}{c}
\text{A} \\
\text{K}_1 \\
\text{B} \\
\text{K}_2 \\
\text{C}
\end{array}
\]

how the values of \( K_1 \) and \( K_2 \) can be determined?

(b) Discuss ‘Flow Techniques’ for studying Fast reactions.

(c) Explain the terms, chain carrier, chain length, stationary chain and nonstationary chain. By applying state state approximation, derive the rate law for any gas phase chain reaction.

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2. Attempt any **two** of the followings:  

(a) In enzyme catalysed reaction prove that Michaelis – Menten constant is equal to concentration of substrate at which initial rate is half of its maximum value.

(b) Discuss the kinetics of heterogeneous catalysis when a single substance is absorbed at the surface.

(c) For a OH\(^{-}\) catalysed reaction the rate constants for uncatalysed and catalysed path and \(0.5 \times 10^{-3}\) and \(3.50 \times 10^{-3} \text{ min}^{-1}\) respectively at pH = 12.0. Calculate the observed rate constant.

3. Attempt any **two** of the followings:  

(a) Derive Langmuir adsorption isotherm. How it can be tested experimentally?

(b) What is electrophoresis? How does this phenomenon provide information about the sign of charge on colloidal particles?

(c) What is meant by electrical double layer and zeta potential? Discuss with origin of charge on colloidal particles.

4. Attempt any **four** of the followings:  

(a) A heat engine is working between 150\(^{o}\) and 50\(^{o}\) C. What is minimum heat withdrawal from heat source to yield 2.36 kJ work?
(b) Two moles of an ideal gas are compressed isothermally at 300K from $2.0 \times 10^5$ to $4.0 \times 10^5$ Nm$^{-2}$ pressure. Calculate free energy change.

(c) Calculate $K_p$ for reaction

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

at $25^\circ C$ if $\Delta G^\circ$ for $NH_3(g)$ is $-16.5 \text{kJ mol}^{-1}$.

(d) Define work function and Gibb’s free energy change and explain relation between them.

(e) What do you mean by thermodynamic engine? How does it work?

(f) What do you mean by spontaneous process? How the free energy and entropy will change in a spontaneous process?

5. Attempt any four of the following : $5 \times 4$

(a) Derive a equation relating osmotic pressure and molecular weight of solute.

(b) A 10% solution of sucrose (mol. wt. = 342) is isotonic with 20% solution of a unknown sugar. Find the relative mass of unknown sugar.

(c) Find the percentage ionization of HF in 0.1 M aqueous solution if the depression in freezing point of solution is $-0.197^\circ C$. $K_f$ for water is 1.86.
(d) What do you mean by liquid function potential? Why it exists and how it can be eliminated?

(e) Establish relations between \( \Delta H \) and \( \Delta S \) with E.M.F. of cell where \( \Delta H \) and \( \Delta S \) are heat enthalpy change and entropy change, respectively for cell reaction.

(f) Calculate the equilibrium constant at 25°C for reaction occurring in cell

\[
\text{Zn}_2 \text{(s)} | \text{ZnCl}_2(aq) || \text{CdSO}_4(aq) | \text{Cd}_2(s)
\]

given, \( E^{\circ}_{\text{Zn}^{++}/\text{Zn}} = -0.7618 \text{Volt} \) and \( E^{\circ}_{\text{Cd}^{++}/\text{Cd}} = -0.403 \text{Volt} \).