

M.Sc.(Chem.) Semester - 1 (CBCS) Examination**Nov/Dec-2023 (SYLLABUS YEAR JUNE-2023)****Physical Chemistry (Core)****Time: 2:30 Hours****Marks: 70****Instructions:**

1. Figures to the right indicate marks.
2. All questions are compulsory.

Que.1(A) Answer the following. (04)

- 1) Define the terms: Microcanonical, Canonical and Grand canonical ensemble.
- 2) Explain the term Molar partition function.

Que.1(B) Answer any two questions out of three. (10)

- 1) Derive a relation between entropy and probability.
- 2) Derive appropriate relation for Bose-Einstein distribution laws.

$$n_i = \frac{g_i}{e^{\alpha + \beta \epsilon_{i-1}}}$$

- 3) Calculate the rotational partition function of the H₂ gas at 27°C. The following data are given, Moment of inertia of molecular H₂ = 0.459 X 10⁻⁴⁰ gm cm², k = 1.38 x 10⁻¹⁶ erg/degree/mole, h = 6.624x10⁻²⁷ erg sec, R = 82.06 cc atm/ degree/mole, σ=2

Que.2(A) Answer the following. (04)

- 1) Write a short note on Ostwald dilution law.

Que.2(B) Answer any two questions out of three. (10)

- 1) At 27°C temperature Hg cathode and Pb anode are electrolyte by a natural aqueous solution H₂ and O₂ evolved. Calculate reversible and actual decomposition potential for this electrolysis.

Given, Hydrogen over voltage on Hg = 0.780 volt, Oxygen over voltage on Pb = 0.312 volt, E_{O₂(ox)} = - 0.403 volt

- 2) Describe Debye-Huckel theory of mean ionic activity co-efficient.
- 3) Write a short note on nickel iron accumulator.

Que.3(A) Answer the following. (04)

- 1) Prove the composition of liquid and vapour in equilibrium.

$$P = \frac{P_1^0 P_2^0}{P_1^0 + X_I(P_2^0 - P_1^0)}$$

Que.3(B) Answer any two questions out of three. (10)

- 1) The melting point of p- Chlorobenzen is 53.2°C and that of naphthalene is 80.3°C the authentic temp. Is 30.2°C when the mole fraction of naphthalene in liquid phase is 0.392. Calculate the molar heat of fusion of the two components of the system, consuming ideal behavior.
- 2) Explain vapour pressure curves of non ideal solution. Describe the effect of temperature on solid -liquid equilibrium.
- 3) What are ideal and non-ideal solutions? Derive the Duhem-Margules equation.

Que.4(A) Answer the following. (04)

- 1) Explain Influence of temperature on heterogeneous reactions.

Que.4(B) Answer any two questions out of three. (10)

- 1) Derive an expression for chemical equilibrium constant.
- 2) Describe equilibrium in homogeneous gaseous system.
- 3) The standard free energy change for the reaction CO(g) + 2H₂(g) = CH₃OH(g) is -5.85 kcal. at 27 °C. Calculate the standard free energy of the formation of liquid methanol at 27 °C, the vapour pressure being 126 mm. at that temperature.

Que.5(A) Answer the following. (04)

- 1) Explain the mechanism of Enzyme catalysis.
- 2) Give a general characteristics of catalytic reaction.

Que.5(B) Answer any two questions out of three. (10)

- 1) Give a brief explanation about Nano-catalysis.
- 2) Explain the kinetics of unimolecular surface reaction of heterogeneous catalysis.
- 3) Write a short note on types of acid-base catalyst.
