

M.Sc.(Chem.) Semester - 1 (CBCS) Examination
OCT/NOV-2025 (AS PER SYLLABUS YEAR JUNE-2023)
Physical Chemistry (Core (New-23))

Time: 2:30 Hours**Marks:70****Instructions:**

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

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- Q.1 (A) Answer the following (04)**
(1) Explain: molar partition function
(2) Define the terms: Canonical ensemble and Grand canonical ensemble
- Q.1 (B) Answer any two questions out of three. (10)**
(1) Derive the Maxwell- Boltzmann distribution law of energy.
(2) Explain vibrational and rotational partition function for diatomic gases.
(3) Calculate the translational partition function of the N₂ molecule confined to a 100 cm³ vessel 25°C (mass of N₂ molecule = 16 x 3.348 x 10⁻²⁷ kg, h= 6.624x10⁻³⁴ Js, k = 1.381 x 10⁻²⁷ Jk⁻¹).
- Q.2 (A) Answer the following (04)**
(1) Explain: Commercial cell
(2) Calculate the H⁺ ion concentration of a 0.01 N acetic acid. The value of dissociation constant is 4.02 × 10⁻¹⁰.
- Q.2 (B) Answer any two questions out of three. (10)**
(1) Explain Oswald dilution law.
(2) Write a note on decomposition potential.
(3) Describe Fuel cell and its applications.
- Q.3 (A) Answer the following (04)**
(1) Discuss the properties of an ideal solution.
(2) Describe the effect of temperature on solid -liquid equilibrium.
- Q.3 (B) Answer any two questions out of three. (10)**
(1) The melting point is phenyl urea 148°C and that of indole is 116 °C the othentic temperature is 31.2°C. When mole fraction of phenyl urea is liquid phase 0.394. Calculate the molar heat fusion of two component system consuming ideal behavior.
(2) Explain Henry law and prove the composition of liquid and vapour in equilibrium.
(3) What are ideal and non-ideal solutions? Explain vapour pressure curves of ideal solution.
- Q.4 (A) Answer the following (04)**
(1) Explain the direction of chemical change.
(2) Explain: Integration of the van't Hoff equation
- Q.4 (B) Answer any two questions out of three. (10)**
(1) Derive an expression for chemical equilibrium constant.
(2) Describe homogeneous reactions in dilute solutions.
(3) Explanation the following
i. Reaction isotherm
ii. Variation of standard free energy with temperature
- Q.5 (A) Answer the following (04)**
(1) Give the comparison between homogeneous and heterogeneous catalysis.
(2) Explain the types of acid-base catalysis.
- Q.5 (B) Answer any two questions out of three. (10)**
(1) Write a note on Nanocatalysis.
(2) Explain the mechanism of the enzyme catalysis and its kinetics.
(3) Explain the kinetics of surface reaction of heterogeneous catalysis.
