

M.Sc.(Chem.) Semester - 1 (CBCS) Examination
OCT/NOV-2025 (AS PER SYLLABUS YEAR JUNE-2018)
PHYSICAL CHEMISTRY(CORE)

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

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

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

- (1) Discuss the thermodynamic entropy and probability
- (2) Define molar partition function.

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

- (1) Derive appropriate relation for Bose-Einstein distribution laws.

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

- (2) Explain the electronic and Translational partition function for diatomic molecules.
- (3) Calculate the value of equilibrium constants in term of partition function.

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

- (1) Explain the term Activity and activity coefficient
- (2) An aqueous solution of MeOH, in which mole fraction of MeOH is 0.054 gave partial pressures of water and MeOH as 22.1 and 10.07 mm. respectively. The vapour pressures in the pure state are $P_{\text{MeOH}} = 21.55$ mm. and $P_{\text{water}} = 23.78$ mm. at the same temperature. Calculate the activity and activity coefficient of water and MeOH.

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

- (1) Describe the generalized method for the determination of fugacity.
- (2) Describe mixture of ideal gases and real gases.
- (3) Define term fugacity and write a short note on Variation of fugacity with temperature and pressure.

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

- (1) Discuss the Henry's law.
- (2) Explain Liquid and Vapor Compositions for Non-ideal Systems.

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

- (1) The M.P. is Phenyl urea 146°C and that of indole is 116°C the othentic temperture is 30.2°C . When mole fraction of phenyl urea is liquid phase 0.395. Calculate the molar heat fusion of two component system consuming ideal behavior .
- (2) Write a short note on
 - i. Vapor Pressure Curves for Non-ideal Systems
 - ii. General equation for liquid mixture.
- (3) Explain Effect of temperature on vapor liquid equilibrium for ideal solution.

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

- (1) Derive an expression for chemical equilibrium constant.
- (2) Explain simultaneous equilibria.

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

- (1) Explain the variation of equilibrium constant with temperature and Pressure
- (2) Write a short note on
 - i. Integration of the van't Hoff Equation
 - ii. Homogeneous reactions in gaseous systems.
- (3) The standard free energy change for the reaction $\text{CO(g)} + 2\text{H}_2\text{(g)} = \text{CH}_3\text{OH(g)}$ is -5.87 k cal. at 30°C. Calculate the standard free energy of the formation of liquid methanol, the vapour pressure being 123 mm. at that temperature.

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

- (1) Explain the mechanism of Enzyme catalysis.
- (2) Explain: activators

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

- (1) Explain Heterogeneous catalyst and its kinetics.
- (2) Give a brief explanation about Acid-Base catalyst.
- (3) Write a short note on catalytic coefficient.
