

M.Sc.(Chem.) Semester - 1 (CBCS) Examination
OCT/NOV-2024 (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) Define the term specific heat.
- (2) Explain: molar partition function

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

- (1) Derive Bose-Einstein distribution law of energy.
- (2) Describe electronic and vibrational partition functions of diatomic gases.
- (3) Calculate the value of equilibrium constant in terms of partition function.

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

- (1) Define the term fugacity.
- (2) An aqueous solution of MeOH, in which mole fraction of MeOH is 0.66 gave partial pressures of water and MeOH as 23.2 and 10.8 mm. respectively. The vapour pressures in the pure state are $P_{\text{MeOH}} = 21.77$ mm. and $P_{\text{water}} = 23.9$ 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 mixture of ideal gases and real gases.
- (2) Describe the generalized method for the determination of fugacity value.
- (3) Write a short note on activity and activity coefficients in liquid solution.

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

- (1) Discuss the Duhem-Margules equation

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

- (1) Explain three pair systems formation of partially miscible liquids
- (2) (i) Explain: Henry law
(ii) Describe the effect of temperature on solid -liquid equilibrium.
- (3) Prove the composition of liquid and vapour in equilibrium. $P = \frac{P_1^0 P_2^0}{P_1^0 + X_I(P_2^0 - P_1^0)}$.

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

- (1) Explain Influence of temperature on heterogeneous reactions
- (2) Explain standard free energies and entropy changes and their applications.

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

- (1) Describe homogeneous reactions in liquid solutions and gaseous systems.
- (2) Derive standard free energy of reaction and the reaction isotherm.
- (3) The ΔG° for the reaction $\text{CO(g)} + 2\text{H}_2\text{(g)} = \text{CH}_3\text{OH(g)}$ is -5.98 k cal. at 30°C. Calculate the ΔG° of the formation of liquid MeOH at 30°C, the vapour pressure being 144 mm. at same temperature.

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

- (1) Define activators with suitable examples.
- (2) Explain the characteristics of heterogeneous and homogeneous catalysis.

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

- (1) Write a short note on
 - i. Catalytic coefficient
 - ii. Autocatalyst.
- (2) Give a brief explanation about the enzyme catalysis with suitable examples.
- (3) Explain the kinetics of acid-base catalyst.
