

M.Sc.(Chem.) Semester - 1 (CBCS) Examination

Nov/Dec - 2022 [NEW COURSE]

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) Explain the electronic partition function for diatomic molecules.

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

- (1) Define molar partition function. Derive the values of the following terms of molar partition function.
 - i. Internal energy
 - ii. Entropy
 - iii. Free energy
 - iv. Heat capacity
- (2) Calculate the value of equilibrium constants in term of partition function.
- (3) Derive appropriate relation for Bose-Einstein distribution laws.

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

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

- (1) Explain the term Activity and activity coefficient
- (2) An aqueous solution of alcohol, in which mole fraction of alcohol is 0.052 gave partial pressures of water and alcohol as 22.1 and 10.07 mm. respectively. The vapour pressures in the pure state are $P_{\text{alco.}} = 21.55$ mm. and $P_{\text{water}} = 23.78$ mm. at the same temperature. Calculate the activity and activity coefficient of water and alcohol.

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

- (1) Define term fugacity and write a short note on fugacity function.
- (2) Describe mixture of ideal gases and real gases.
- (3) Describe the equation state method for the determination of fugacity.

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

- (1) Discuss the properties of an ideal solution.
- (2) Explain Liquid and Vapor Compositions for Non-ideal Systems.

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 orthentic temperature is 30.2°C When mole fraction of phenyl urea is liquid phase 0.395 calculate the molar heat fusion of two component system assuming ideal behavior .
- (2) Explain Effect of temperature on vapor liquid equilibrium for ideal solution.
- (3) Write a short note on
 - i. Vapor Pressure Curves for Non-ideal Systems
 - ii. General equation for liquid mixture.

- 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) Describe 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 27°C. Calculate the standard free energy of the formation of liquid methanol at 27°C, the vapour pressure being 123 mm. at that temperature.
- Q.5 (a) Answer the following** **04**
- (1) Explain the mechanism of Enzyme catalysis.
 - (2) Define Anticatalyst.
- Q.5 (b) Answer any two questions out of three.** **10**
- (1) Explain Heterogeneous catalyst and its kinetics.
 - (2) Write a short note on catalytic coefficient.
 - (3) Give a brief explanation about Acid-Base catalyst.
