

M.Sc.(Chem.) Semester - 1 (CBCS) Examination
Oct/Nov. -2019 - [NEW COURSE]
PHYSICAL CHEMISTRY (CORE)

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**4**

- (1) Define Molar partition function.
- (2) Define: ensemble, canonical ensemble, microcanonical ensemble, grand canonical ensemble.

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

- (1) Derive Maxwell- Boltzmann distribution law of energy

$$n_i = \frac{g_i}{e^{\alpha + \beta \epsilon_i}}$$

- (2) Calculate the value of equilibrium constant in terms of partition function.
- (3) Write a note on
 - i. Monoatomic solid
 - ii. Rotational partition functions of diatomic gases

Q.2 (a) Answer the following**4**

- (1) Explain: Fugacity
- (2) Explain the variation of fugacity with pressure.

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

- (1) Describe the equation state method for the determination of fugacity value.
- (2) Describe Mixture of ideal gases and real gases.
- (3)
 - i. Write a note on activity and activity coefficient.
 - ii. Vapour pressure of a pure liquid is 101 torr at 25°C while its vapour pressure from a 95 mole per cent solution at the same temperature is only 90 torr. Calculate the activity and activity coefficient of the liquid in the solution.

Q.3 (a) Answer the following**4**

- (1) Discuss the properties of the ideal solution.
- (2) Prove the composition of liquid and vapour in equilibrium.

$$P = \frac{P_A^0 P_B^0}{P_A^0 + X_A (P_B^0 - P_A^0)}$$

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

- (1) Discuss the determination of molecular weights from freezing point measurements of dilute solution.
- (2) Answer the following:
 - i. Derive the Duhem-Margules equation.
 - ii. The melting point of naphthalene is 80.3°C and its molar heat of fusion at the temperature is $4540 \text{ Cal. mol}^{-1}$. Determine its ideal solubility at 20°C .
- (3) Discuss the deviation from ideal behavior.

Q.4 (a) Answer the following

Write a short note on integration of the Van't Hoff equation.

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

- (1) Describe homogeneous reactions in liquid solutions and gaseous systems.
- (2) Explain the variation of equilibrium constant with temperature.
- (3) Answer the following:
 - i. Explain standard free energy of the reaction.
 - ii. The standard free energy change for the reaction $\text{CO}_{(g)} + 2\text{H}_{2(g)} = \text{CH}_3\text{OH}_{(g)}$ is -5.88 k cal. at 25°C . Calculate the standard free energy of the formation of liquid methanol at 25°C , the vapour pressure being 122 mm. at that temperature.

Q.5 (a) Answer the following 4

- (1) Define Promoters with suitable examples.
- (2) Explain about negative catalysis.

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

- (1) Give a brief explanation about the Enzyme catalysis with suitable examples.
- (2) Write a short note on:
 - i. Heterogeneous catalyst.
 - ii. Catalytic coefficient.
- (3) Describe Acid-Base catalyst and its Mechanism.
