647510 **Msc1CheC0310** **Seat No :_____**

M.Sc.(Chem.) Semester - 1 (*CBCS*) Examination
Nov/Dec - 2022 [OLD 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 Answer any seven of the following ten questions. **[14]**

1. Define term thermodynamic probability, and statistical weight factor.
2. Calculate the internal energy of a mono atomic gas and diatomic gas at 25°C.
3. Explain effect of temperature on solid –liquid equilibrium.
4. Explain the Mixture of ideal gases and real gases.
5. Discuss the briefly the properties of ideal solutions.
6. Explain classification of electrochemical cells.
7. Explain Dry cell.
8. Explain the influence of temperature on gas solubility.
9. Explain application of Debay –Huckel theory.
10. Calculate the free energy change accompanying the compressing 2 mole of a gas at 45°C temperature from 25 to 300 atmospheres. The fugacity of the gas at 45°C may be taken as 23 and 92.4 atmospheres respectively.

Q.2; Answer the following (Answer any two) **[14]**

1. (a) Write a short note on vibrational Partition function.
   (b) Explain partition function and thermodynamic function.
2. Define term fugacity. How it is related to Activity? Discuss the graphical method used to determine fugacity value.
3. Derive equilibrium constant for the dissociation of weak acid;

   $\log K = \log K\ + 2A\sqrt{\alpha C}$ using the Debay –Huckel equation.

Q.3 Answer the following questions. **[14]**

1. Prove the addition of inert electrolyte increases the solubility of sparingly soluble salt.
2. Derive an expression for third law of thermodynamics in terms of partition function.
3. Explain mean ionic activity coefficient.

OR

Q.3 Answer the following questions. **[14]**

1. (a) Write a short note on activity and activity co-efficient.
   (b) A solution of 1 mole of NaOH in 4.5 moles of water has a vapour pressure of 4.465mm at 27°C, whereas the vapour pressure of a pure water is 12.783 mm. Assuming that the activity coefficient of pure water is unity, calculate **(i)** the activity coefficient of the water in the solution, and **(ii)** the difference between the chemical potential of water in the solution and in pure water.
2. Describe the depression boiling point of the dilute solutions.

Q.4 (a) Answer the following questions. (Any two) **[10]**

1. Discuss Bose-Einstein statistics.
2. Derive the expression for the derivation of liquid junction potential.
3. Write note on zinc silver accumulator.

(b) Answer the following questions. (Any one) **[04]**

1. Explain Variation of fugacity with temperature and pressure.
2. Explain Duhem-Margules equation

Q.5 Answer any two of the following four questions. **[14]**

1. Evaluate the Debay –Huckel constant X and Y for alcohol and water at 27°C. The Dielectric constant being 33.5 and 77.53 respectively.
2. Derive the chemical cell with and without transference.
3. Mixture of benzene and toluene almost behave ideally at 25°C. The vapour pressure of pure benzene is 128.2 mm and that of pure toluene is 32.7 mm. Determine the partial pressure and weight composition of the vapour in equilibrium with a liquid mixture containing an equal weight of the two constituents.
4. (a) Explain translation partition function.
   (b) Calculate the rotational partition function for water at 25°C. (T_A = 1.02 x 10^{-40} g.cm^2, T_B = 1.92 x 10^{-40}g.cm^2, T_C = 2.95 x 10^{-40}g.cm^2, k = 1.3803x 10^{-16} ergs/K and σ = 2).

****