

2217**M.Sc. (Previous) Examination, 2022****CHEMISTRY****Paper - IV****(Physical Chemistry)***Time : Three Hours] [Maximum Marks : 100*

Note : (i) The question paper is divided into three sections. Attempt **All** questions from Section-A, All Questions from Section-B and Two Questions from Section-C.

(ii) Marks for each Question are indicated at the Right Hand Margin.

(iii) Give Answer of each Question in about 50-words from Section-A, 200-words from Section-B and 500-Words from Section-C.

P.T.O.**(2)
Section-A****2×10=20**

1. (a) What do you mean by classical and Quantum Mechanics?
- (b) What is the Relation between the Particle and Wave-properties of a moving Material Particle?
- (c) Write the Eigenvalue form of Schrodinger's Wave Equation.
- (d) What are the Van't Hoff Equations for a Reversible Gaseous Reaction?
- (e) What is Onsager's Reciprocal Relation in Non-Equilibrium Thermodynamics?
- (f) What is Partition Function of a Diatomic Molecule and How is it related to its Translational, Rotational, Vibrational & Electronic Partition Function?

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(3)

- (g) What do you mean by Electrode Kinetics?
- (h) What are the Methods of determining Rate Laws?
- (i) What is standard Electrode Potential?
- (j) What are Number and Mass Average Molecular Masses of Macro-Molecules?

Section-B 5×10=50

2. Calculate the Energy and Wave Function of a Particle moving in one Dimensional Box.

OR

- Derive Equation for Internal Energy and Entropy in terms of Partition Function.
3. State briefly the Postulates of Quantum Mechanics.

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P.T.O.

(4)

OR

Using Third Law of Thermodynamics, show that :

$$(a) \lim_{T \rightarrow 0} \left(\frac{\partial V}{\partial T} \right)_P = 0$$

$$(b) \lim_{T \rightarrow 0} \left(\frac{\partial P}{\partial T} \right) = 0$$

4. Define Excess Thermodynamics Formulations. Derive Expressions for Excess Volume (V^E), Excess Heat Content (H^E), Excess Entropy (S^E) and Excess Free Energy (G^E).

OR

What are concentration Cell? Derive an Expression for the E.M.F. of a concentration cell.

5. Describe the Thermodynamic Formulations of the Theory of Absolute Reaction Rate.

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(5)

OR

Define Activity and Activity coefficient of strong Electrolytes. How would you determine the Activity coefficient of such Electrolytes from E.M.F. Measurement?

6. What do you understand by Gibbs Adsorption Isotherm? Discuss the BET Equation.

OR

Discuss Methods for study of Phase Diagram of Systems exhibiting the Formation of Simple Eutectics in a Binary Condensed System.

Section-C 2×15=30

7. Give an Account of Huckel's π -Electron Theory. How would you apply this theory to Benzene Molecules to calculate its Delocalization Energy and Bond Order of Carbon-Carbon Bonds.

(6)

8. Derive Rate Expression on the basis of collision Theory of Reaction Rates. How does the Rate Expression accounts for the Steric Factor and Activation Energy?
9. Give an account of Electro-Kinetic Phenomenon. What do you mean by :
- (1) Electro-Osmosis
 - (2) Electro-phoresis
 - (3) Streaming Potential
10. Derive Gibbs-Helmholtz Equation. Using Gibbs Free Energy (G) and Work Function (F) Relations. How would you use this Equation to calculate the heat of Reaction (ΔH) in Galvanic cells from its E.M.F.
11. Write short notes on any **Three** of the followings :
- (a) Uncertainty Principle
 - (b) Spin-Orbit Coupling

(7)

- (c) Joule-Thomson Effect
- (d) Maxwell-Boltzmann Distribution Law
of Energy
- (e) Kinetics of Enzyme Reaction
- (f) Irreversible Electrode Process.

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