

Roll No. ....

Total Pages : 3

**751408**

**May, 2023**

**M.Sc. (Chemistry) IV Semester  
PHYSICAL CHEMISTRY SPECIAL-III (CH-422B)**

Time : 3 Hours

Max. Marks : 75

*Instructions :*

- 1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
- 2. Answer any four questions from Part -B in detail.*
- 3. Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) Explain DNA-Drug Intercalation with a suitable example. (1.5)  
(b) What is the significance of primary and secondary plots in enzyme catalysis? Explain with a suitable example. (1.5)  
(c) Differentiate induced reactions with metal-ion catalysis using a suitable example. (1.5)  
(d) Define ortho and para hydrogen states and their thermodynamics. (1.5)

- (11)
- (e) What are the advantages of relaxation techniques in chemical dynamics? (1.5)
- (f) Explain the kinetic salt effect with a suitable example. (1.5)
- (g) Write a note on the partition function. (1.5)
- (h) Show derivation/calculation for determination of Helmholtz and Gibbs free energy. (1.5)
- (i) Sketch absorption and circular dichroism spectra of optical active organic molecule and compare the spectra. (1.5)
- (j) Sketch the reaction mechanism diagram for Ping-Pong Mechanism. (1.5)

### PART-B

2. (a) Explain the Kinetics of Metal-ion catalyzed reactions and discuss the reaction mechanism and order of reaction with respect to catalyst and substrate. (10)
- (b) Write a short note on the kinetics of hydroformylation reaction. (5)
3. Differentiate kinetics of sequential and ping-pong mechanism of enzyme kinetics of one-enzyme two-substrate and sketch respective kinetics plots. (15)

4. Using Transition State Theory, show the calculation of rate constant for reactions with collision for :
- (i) atom + linear molecule  $\rightarrow$  linear molecule.
  - (ii) atom + linear molecule  $\rightarrow$  non-linear molecule. (15)
5. Write short notes on :
- (a) Debye's Theory of Heat Capacities of Monatomic Solids. (5)
  - (b) Thermoelectric Effects. (5)
  - (c) Onsager's Reciprocal Relations. (5)
6. (a) Explain the properties and role of water in biological systems with a minimum of one suitable example of each property. (8)
- (b) Provide a detailed description of the structure and functions of the cell membrane and their significance in biophysical chemistry. (7)
7. Discuss active/passive transport across the cell membrane and describe irreversible thermodynamics treatment of membrane transport. Sketch  $\text{Na}^+ - \text{K}^+$  pump and explain its importance in the living system. (15)
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