Avinashilingam Institute for Home Science and Higher Education for Women

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Master's Degree Examination – May 2025
II Semester

Class : I P.G . **Time: 3 Hours**
Major : Chemistry **Max. Marks: 100**

23MCHC09 Physical Chemistry - II

Course Outcomes:
CO1: Understanding of kinetics and mechanistic aspects of chemical reactions
CO2: Understanding of kinetics and mechanistic aspects of fast reactions
CO3: Ability to distinguish the various adsorption isotherms
CO4: Identify the steps involved in studying a system quantum mechanically
CO5: Generalize the HMO treatment of simple and conjugated π electron systems

Part A **10 x 1 = 10**
Choose the Correct Answer

1. The addition of a catalyst during a chemical reaction alters which of the following quantities? CO1K1
   a. Enthalpy b. E_a c. Entropy d. Internal energy

2. The minimum amount of energy needed to start a reaction is called the CO1K2
   a. Activation b. Potential c. Kinetic d. Threshold

3. The unit of time selected for the fast reactions is, CO2K3
   a. seconds b. mille seconds c. micro seconds d. nano seconds

4. According to relaxation process the reaction CO2K4
   a. Attain new equilibrium b. Slow down the reaction speed
   c. Produce radicals d. Quickly mix the reactant

5. Which of the following value tell us about the strength of binding of a substrate by an enzyme? CO3K2
   a. V_{max} b. K_m c. [S] d. [C]

6. BET isotherm is an example of CO3K1
   a. monolayer adsorption b. multilayer adsorption
   c. chemisorption d. physisorption

7. All quantum mechanical operators are _____in nature. CO4K3
   a. commutatore b. linear c. non-linear d. unitary

8. Well behaved function is always, CO4K3
   a. single valued b. multi valued c. non continuous d. infinite

9. If the length of the 1D box is doubled, the energy of the ground state is CO5K1
   a. doubled b. reduced to half c. reduced to one fourth d. quadrupled

10. Delocalization energy of cyclobutadiene system is CO5K2
    a. 0 b. 2β c. 4β d. -2β

Part B **5 x 6 = 30**
Answer ALL questions
Each answer should not exceed 400 words or two pages

11.a. Derive kinetics equation for a bimolecular reaction using ARRT . CO1K4

(or)

11.b. Discuss the followings i) Steady state approximation ii) parallel reactions CO1K3

12.a. Explain the relaxation method for the study of kinetics of fast reactions. CO2K4

(or)

12.b. What is salt effect? Compare primary and secondary kinetic salt effect. CO2K4

13.a. Derive Freundlich adsorption isotherm for the gas adsorption on solid surface. CO3K5

(or)

13.b. Differentiate chemisorption and physisorption. CO3K4

14.a. Discuss photoelectric effect and Compton effect. CO4K3

(or)

14.b.i. What are linear and non-linear operators? Give examples. CO4K2

ii. List out the postulates of quantum mechanics. CO4K2

15.a. Derive the energy of simple harmonic oscillator. CO5K5

(or)

15.b. Explain the variation theory and its application to hydrogen atom. CO5K4

Part C **5 x 12 = 60**

Answer ALL questions

Each answer should not exceed 800 words or four pages

16.a. Derive the rate equation for a bimolecular reaction using collision theory. CO1K5

(or)

16.b. List the characteristics of chain reactions. Derive the kinetics H_2-Br_2 chain reaction. CO1K5

17.a. Illustrate top-flow and photolysis methods to study the fast reactions. CO2K4

(or)

17.b. Derive Michaelis – Menton equation for enzyme catalysis reaction. CO2K5

18.a. Derive BET adsorption isotherm. Give its applications. CO3K5

(or)

18.b. Explain the mechanism of surface reactions occurring during chemisorption. CO3K4

19.a. Derive time independent Schrodinger wave equation. CO4K5

(or)

19.b. Describe the Hermitian properties of operators. Construct the Hamiltonian operator. CO4K4

20.a. Construct Schrodinger equation for a particle in a 1D box and derive the energy and wave function equations. CO5K5

(or)

20.b. State Huckel Molecular Orbital theory . Explain its application to Butadiene system. CO5K4

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