STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86
(For candidates admitted during the academic year 2023-24)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2023
BRANCH IV- CHEMISTRY
FIRST SEMESTER

COURSE : CORE
PAPER : ADVANCED PHYSICALCHEMISTRY
SUBJECT CODE : 23CH/PC/PC14
TIME : 3 HOURS MAX.MARKS :100

SNO	SECTION A (10 x 1 = 10 marks) **Answer ALL Questions**	K LEVEL
1.	In an adsorption process if an unimolecular layer is formed then it is a) Physisorption b) Chemisorption c) ion exchange d) None	K1
2.	Solvents can influence reaction rates, conversion and product selectivity by a) directly participating in the reaction steps b) competing with the reactant for interaction with the catalysts, c) changing the relative stabilization of the reactant, the transition state (TS) and/or the product, d) all of these	
3.	According to molecular collision theory, the reaction is subjected to _____ a) Number of molecular collisions of reactant b) Number of collisions between Transition state and reactants c) Number of effective collisions or reactants d) None	K1
4.	The ionic strength of a solution of molality m_i and valency of the ion Zi is ____ a) $\mu = 1/2\, miZi^2$ b) $\mu = \sum miZi^2$ c) $\mu = 1/2 \sum Zi^2$ d) $\mu = 1/2 \sum miZi^2$	
5.	Physisorption _____ with increase in temperature a) Increases b) decreases c) remains unchanged d) none of these	
6.	_____ phenomena arise from movement of ions in the electric double layer under a pore pressure gradient. a) Electrokinetic b) double layer c) Osmosis d) none of these	
7.	The_____ mechanism explains unimolecular reactions that take place in the gas phase. a) Lindemann-Hinshelwood b) Pre-Equilibria c) transition state d) none of these	
8.	In a Hydrogen Oxygen fuel cell, Hydrogen enters through the anode. a) True b) False	
9.	Catalyst changes the equilibrium constant of the reaction a) True b) False	
10.	In a complex photochemical reaction involving a secondary process the quantum yield might exceed 1 a) True b) False.	

SNO	SECTION – B (10 x 1 = 10 marks) **Answer ALL Questions**	K LEVEL
11.	Explain Zeta potential.	K2
12.	Explain the hydrogenation reaction with an example.	K2
13.	What is the significance of exchange current density?	K2
14.	Illustrate chain reaction with an example.	K2
15.	What is a Phenomenological Equation?	K2
16.	Explain microstate	K2

..2

17.	What are distinguishable systems?	K2
18.	Rephrase Electrochemical Interface.	K2
19.	Given example to illustrate Chemisorption.	K2
20.	What are consecutive reactions.	K2

SNO	SECTION C (4 x 6 = 24 marks) ANSWER ANY FOUR QUESTIONS	K LEVEL
21.	Show pre-equilibrium approximation and steady-state approximation	K3
22.	Demonstrate the physical origin of the kinetic salt effect	K3
23.	How is ensemble applied in statistical thermodynamics,	K3
24.	Clasify electrocapillary measurements and electrocapillary curves? Write the application of electrocapillary curves.	K3
25.	Present Gibbs adsorption isotherm.	K3

SNO	SECTION – D (4 x 8 = 32 marks) ANSWER ANY FOUR QUESTIONS	K LEVEL
26.	Compare Guoy Chapman and Stern Models of double layer.	K4
27.	Outline Potential Energy Surfaces and analyse the following statement: 'Reaction with attractive potential energy surfaces proceeds more efficiently if the energy is translational.'	K4
28.	Investigate Boltzmann parameters using Lagrange's method of undetermined multipliers.	K4
29.	Derive and examine Sackur Tetrode equation for the monoatomic gas.	K4
30.	Examine the explosion behavior of a chain reaction. $H_2 + O_2 \longrightarrow 2H_2O$	K4

SNO	SECTION – E (2 x 12 = 24 marks) ANSWER THE FOLLOWING	
31a	Derive Butler- Volmer Equation for one electron transfer and explain the significance of symmetry factor **β.** **(OR)**	K5
31b	Compare Maxwell- Boltzmann, Bose-Einstein and Fermi - Dirac statistics.	
32a	Deduce the postulates BET theory. How will you determine the surface area of a solid using BET theory and explain the limitations of this method. **(OR)**	K5
32b	a) Explain Lindemann-Hinshelwood mechanism for unimolecular reactions. (8 Marks) b) Using steady state approximation devise the rate law for the decomposition of N_2O_5 (4 Marks) $N_2O_5 \longrightarrow NO_2 + NO_3 \quad k_a$ $NO_2 + NO_3 \longrightarrow N_2O_5 \quad k'_a$ $NO_2 + NO_3 \longrightarrow NO_2 + O_2 + NO \quad k_b$ $NO + N_2O_5 \longrightarrow NO_2 + NO_2 + NO_2 \quad k_c$	

****