22CHP315N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch - **CHEMISTRY**

CHEMICAL KINETICS AND STATISTICAL THERMODYNAMICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which is the rate-determining step in Lindemann's mechanism? A. Formation of A* B. Collisions between A and M C. Decomposition of A* D. None of the above	K2	CO1
	2	Which constant is NOT present in the ARRT rate expression? A. Boltzmann constant B. Planck's constant C. Universal gas constant D. Avogadro's number	K1	CO1
2	3	In acid-base catalysis, the catalyst is usually A. Metal ion B. Organic compound C. Proton donor or acceptor D. Radical species	K1	CO2
	4	What is the effect of increasing internal pressure on the rate of a chemical reaction in solution? A. It decreases the rate B. It has no effect C. It increases the rate D. It stops the reaction	K2	CO2
3	5	Which type of light initiates the photochemical reaction between H_2 and Cl_2? A. Infrared B. Visible C. Ultraviolet D. Microwave	K1	CO3
	6	Which of the following statements best distinguishes BET from Langmuir isotherm? A. BET explains monolayer adsorption only B. Langmuir is used to determine the total pore volume C. BET accounts for multilayer adsorption D. Langmuir isotherm is better at low pressure	K2	CO3
4	7	Which of the following describes a canonical ensemble? A. Fixed N, V, E B. Fixed T, V, N C. Fixed T, P, N D. Fixed T, μ, V	K1	CO4
	8	For indistinguishable particles, the number of microstates is calculated by: A. Simple permutation N! B. Boltzmann formula without correction C. Permutations divided by N! D. Sum of macrostates	K2	CO4
5	9	In Einstein's model of solids, each atom is treated as A. A free particle B. A classical oscillator C. An independent quantum harmonic oscillator D. A rigid rotator	K1	CO4
	10	Which particle type obeys Fermi-Dirac statistics? A. Photons B. Electrons C. Helium-4 atoms D. Phonons	K2	CO4

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SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Compare collision theory and ARRT.	K2	CO1
		(OR)		
	11.b.	Discuss the mechanism and kinetics of the H_2–Br_2 chain reaction.		
2	12.a.	What are primary and secondary salt effects? Explain Primary salt effect with an example.	K3	CO1
		(OR)		
	12.b.	With a neat diagram, describe the stopped flow technique for the determination of kinetics of fast reaction.		
3	13.a.	Explain Langmuir adsorption isotherm.	K3	CO3
		(OR)		
	13.b.	Discuss the role of radiation chemistry in biology and industry.		
4	14.a.	Derive an equation for translational partition function.	K4	CO4
		(OR)		
	14.b.	Derive Sekur -Tetrode equation.		
5	15.a.	Explain Einstein theory for heat capacity of solids.	K4	CO4
		(OR)		
	15.b.	Discuss Bose – Einstein statistics and derive an expression for the same.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Explain the postulates of Lindemann theory of unimolecular reactions. Derive the rate equation. Write the limitations.	K4	CO1
2	17	Discuss the influence of dielectric constant and hydrostatic pressure on reaction rates in solution.	K4	CO2
3	18	Explain Langmuir-Hinshelwood and Langmuir-Rideal mechanisms for heterogeneous catalysis.	K4	CO3
4	19	Derive an equation for rotational partition function.	K4	CO4
5	20	Maximizing the thermodynamic probability of macro state and invoking Lagrange's undetermined multipliers derive an expression for Fermi – Dirac statistics.	K4	CO4

Z-Z-Z END