Reg. No ..... Name **23P134**

M. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023

SEMESTER 1 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY

COURSE : **21P1CHET03 / 21P1CPHT03 : PHYSICAL CHEMISTRY - I**

(For Regular - 2023 Admission and Improvement/Supplementary -2022/2021 Admissions)

Duration : Three Hours Max. Weights: 30

PART A

Answer any 8 questions **Weight: 1**

1.	State Clausius inequality and explain its significance.	(U, CO 1)
2.	Give the differences between first-order and higher-order phase transitions.	(U, CO 1)
3.	Show that the entropy change for an irreversible process in an isolated system is greater than zero.	(U, CO 1)
4.	Differentiate between macrostates and microstates with reference to ensemble.	(U, CO 4)
5.	Calculate the value of 10! and 50! and their logarithm to the base 10 using Stirlings approximation.	(U, CO 1)
6.	Draw the phase diagram of a ternary liquid system A-B-C, where two of them are partially miscible pairs.	(U)
7.	How does Fermi-Dirac statistics differ from Bose-Einstein statistics?	(R, CO 4)
8.	Applying partition function,show that the translational energy of an Ar molecule is 1.5kT.	(U, CO 4)
9.	What is effusion? Can this be used in enrichment of isotopes?	(U, CO 3)
10.	Draw the phase diagram of a ternary liquid system A-B-C, where A-C and B-C are completely miscible pairs and A-B is is a partially miscible pair.	(U, CO 2)

(1 x 8 = 8)

PART B

Answer any 6 questions **Weights: 2**

11.	What do you mean by fugacity? How does it vary with temperature and pressure?	(U, CO 1)
12.	Calculate the thermal de Broglie wavelength of hydrogen atom confined to a vessel of volume 2.494 x 10^5 cm^3 at 3000 K. Given the translational partition function is 7.58 x 10^{30}.	(A, CO 4)
13.	Define thermionic emission. Derive Richardson equation for the current density of thermionic emission.	(R, CO 4)
14.	Derive the expression for the partition function of an ideal monoatomic gas that contains N molecules confined to a vessel of volume 'V'.	(A, CO 4)
15.	Derive the expression for the translational partition function of a molecule of mass '*m*' moving in a vessel of volume '*V*'.	(A, CO 4)
16.	Construct and explain the phase diagram of the ternary liquid system, water-phenol-aniline.	(U, CO 2)
17.	Describe the phase transitions and characteristic properties of liquid Helium.	(U, CO 1)
18.	Obtain an expression for most probable velocity of gases.	(R, CO 3)

(2 x 6 = 12)

PART C

Answer any 2 questions **Weights: 5**

19. Explain transport properties of a gas with reference to viscosity and diffusion. (A, CO 3)

20. Derive an expression for the equilibrium law for ideal gases. Also derive expressions and compare different equilibrium constants. (U, CO 2)

21. a) Discuss the physical significances of partition function.
b) Obtain expressions for internal energy (E), heat capacity (C_V), entropy (S) and Helmholtz free energy (A) related to partition function of a system. (U)

22. Discuss the molecular partition function of a monoatomic gas and derive expressions for internal energy (E), Helmholtz free energy (A) and entropy (S) of an ideal monoatomic gas. (U, CO 2)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Explain the fundamental principles of classical and statistical thermodynamics.	U	1, 2, 3, 5, 11, 17	8
CO 2	Apply methods of chemical thermodynamics and mathematical tools to describe equilibrium processes.	A	10, 16, 20, 22	13
CO 3	Describe the collision parameters and transport phenomena of gases.	U	9, 18, 19	8
CO 4	Correlate the macroscopic properties of a system with microscopic behaviour by applying the principles of statistical thermodynamics.	A	4, 7, 8, 12, 13, 14, 15	11

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;