Name ....

24P1037

M.Sc. DEGREE END SEMESTER EXAMINATION - NOVEMBER 2024
SEMESTER 1 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY
COURSE : **24P1CHET03 /24P1CPHT03 : PHYSICAL CHEMISTRY – 1**
(For Regular - 2024 Admission)

Duration : Three Hours

Max. Weights: 30

PART A
Answer any 8 questions

Weight: 1

1. Comment on the nature of particles and wave functions covered by the Fermi-Dirac distribution. — (R)

2. Explain the consequence of indistinguishability of particles in quantum statistics. — (U)

3. Define mean free path and explain its dependence on temperature and pressure. — (U, CO 1)

4. Calculate the value of 10! and 50! and their logarithm to the base 10 using Stirlings approximation. — (U, CO 2)

5. A gas diffuses through an opening at a rate one third as fast as that of Helium gas. What is the molar mass of the unknown gas? — (U, CO 1)

6. Give the expression for the Helmholtz free energy function of an ideal mono atomic gas in terms of partition function. — (U, CO 2)

7. State and explain Dulong and Petit's law? — (R, CO 2)

8. Distinguish between Bosons and Fermions. — (U)

9. Explain the physical significance of entropy. — (U)

10. What are the limitations of Debye theory of solids? — (U, CO 2)

(1 x 8 = 8)

PART B
Answer any 6 questions

Weights: 2

11. Illustrate the idea of equipartiton of energy for the various modes of motion associated with a molecule using partition function. — (A, CO 2)

12. One mole of He at 100 $^\circ$C is mixed with 0.5 mole of Ne which is at 0 $^\circ$C. Calculate the entropy of mixing, if the mixing is isobaric (P = 1 atm) and gases behave ideally. [$C_{p,m}$(*He*) = $C_{p,m}$(*Ne*) = 2.5R] — (A)

13. Explain the statistical formulation of the third law of thermodynamics. — (U, CO 2)

14. What do you mean by fugacity? How does it vary with temperature and pressure? — (U)

15. Calculate the root mean square velocities of the molecules in a sample of oxygen gas at 0 °C and 100 °C. — (U, CO 1)

16. (i) Explain the phase diagram of acetic acid-chloroform-water.
    (ii) Explain the double salt (compound AB) formation in the system A-B-C. — ()

17. Describe the isothermal-isobaric evaporation of unsaturated solution A-B-C at 15 ^{0}C, where both A and B forms hydrates. — (U,CO1)

18. Describe the phase transitions and characteristic properties of liquid Helium. — (U)

(2 x 6 = 12)

PART C
Answer any 2 questions   **Weights: 5**

19. Derive the Debye theory of heat capacity of solids. How does it differ from Einstein's theory? What are the advantages of the Debye theory?   (R, CO 2)

20. Discuss the qualitative and quantitative basis of Le Chatelier's principle for a reaction.   (U, CO 1)

21. Explain transport properties of a gas with reference to viscosity and diffusion.   (A, CO 1)

22. (a) Write a note on partition function.
    (b) Derive the expression for the rotational partition function of a heteronuclear diatomic and unsymmetrical linear polyatomic molecule at different conditions of temperature relative to characteristic rotation temperature, Θr.   (R, CO 2)

                                                                               (5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Application of mathematical tools to calculate thermodynamic and kinetic properties.	A	3, 5, 15, 18, 19	14
CO 2	Explain the relationship between microscopic properties of molecules with macroscopic thermodynamic observables.	U	4, 6, 7, 10, 11, 13, 17, 20	18

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