Reg. No ..... Name **18P133**

M.Sc DEGREE END SEMESTER EXAMINATION - NOVEMBER 2018

SEMESTER 1 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY

COURSE : **16P1CHET03 / 16P1CPHT03 : PHYSICAL CHEMISTRY - I**

(For Regular - 2018 Admission & Supplementary - 2016 / 2017 Admissions)

Time : Three Hours Max. Marks: 75

Section A
Answer any 10 (2 marks each)

1. Explain the difference between diffusion and effusion?
2. Define collision diameter and collision cross-section.
3. Comment on the effect of pressure on viscosity of gases.
4. Calculate the temperature at which the average velocity of H_2 gas becomes 1.69×10^3 m/s.
5. How will you experimentally verify Maxwell's distribution Law of molecular velocities?
6. Calculate the number of ways in which 6 distinguishable particles can be arranged in to groups of 3, 2, 1
7. Give a brief explanation of Bose-Einstein condensation.
8. What is the symmetry number in case of a) N_2 and b) NO?
9. Briefly explain the need of quantum statistics.
10. Define the term uncompensated heat and explain its significance.
11. What do you meant by phosphate group transfer potential?
12. State Nernst heat theorem. Give its significance.
13. Derive the following relation:

$$\left(\frac{\partial S}{\partial P}\right)_T = -V\alpha$$

where, a is the co-efficient of thermal expansion.

(2 x 10 = 20)

Section B
Answer any 4 (5 marks each)

14. Derive an expression for thermal conductivity of gases.
15. Prove that the complete partition function for a system is the product of translational, rotational, vibrational and electronic partition function.
16. Derive the Sackur Tetrode equation for the entropy of an ideal monoatomic gas.
17. Plot the phase diagram of the system NaCl-Na_2SO_4-H_2O, where a hydrate $Na_2SO_4.10H_2O$ is formed and describe various phases and degrees of freedom.

(5 x 4 = 20)

Section C
Answer any 1 (5 marks each)

18. Calculate the mean free path of a gas taking the diameter of a molecule as 2×10^{-8} cm. At NTP, one mole of a gas occupies 22.4 liters and Avogadro's number is 6.02×10^{23}.

19. Calculate the partition function of a unit in which the energies associated with various levels are 0, 2kT, 4kT, 6kT and 8kT etc at temperature T. Assume that the levels are not degenerate. If there are 1000 particles, calculate the number in each level.

20. Caculate the Fermi energy of silver. Given: Molar mass of Silver = 0.179 $kgmol^{-1}$, Density of Silver = 10.5×10^3 kgm^{-3} and mass of electron = 9.1×10^{-31} kg.

21. The emf of a thermocouple, one junction of which is at 0 ^0C is given by;
$E = 1600t - 4t^2$
where, t is the temperature of the hot junction expressed in ^0C. Calculate Peltier coefficient at 27 ^0C.

(5 x 1 = 5)

Section D
Answer any 2 (15 marks each)

22. Describe the applications of Fermi-Dirac statistics in electron gas and thermionic emission.

23. 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?

24. Prove Onsager reciprocal relationship applying the principle of microscopic reversibility.

25. Derive Gibbs-Duhem-Margules equation and prove Konovalov's laws.

(15 x 2 = 30)