19P1033

Reg. No ..... Name .....

M. Sc DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER 1 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY

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

(For Regular - 2019 Admission and Supplementary - 2016/2017/2018 Admissions)

Time : Three Hours Max. Marks: 75

Section A
Answer any 10 (2 marks each)

1. What is the mean relative speed of hydrogen molecules with respect to oxygen molecules at 298 K?
2. Comment on the effect of temperature on viscosity.
3. Define (i) RMS and (ii) Most probable velocities of a gas. Give the formula to calculate each of them.
4. How will you experimentally verify Maxwell's distribution Law of molecular velocities?
5. What is Stirlings Approximation?
6. Mention the physical significance of partition function
7. Define the term 'symmetry number 'used in statistical mechanics with suitable example.
8. State and explain Onsager reciprocal relations.
9. Give the equation for the rate of entropy production in chemical reactions. Explain its significance.
10. State the principle of microscopic reversibility. Mention its application in non-equilibrium thermodynamics.
11. Draw the phase diagram of a ternary liquid system A-B-C, where all the three are partially miscible pairs.
12. Derive an expression for the entropy change, when 1 mole of an ideal gas changes from state 1 to state 2.
13. State and explain Henry's law.

(2 x 10 = 20)

Section B
Answer any 5 questions by attempting not more than 3 questions from each of the following bunches (5 marks each)

Bunch I (Short Essay Type)

14. Derive a relation for most probable velocity of gases.
15. Compare the three distribution laws and discuss the limit of applicability.
16. Derive the Sackur Tetrode equation for the entropy of an ideal monoatomic gas.
17. Give a brief account of thermoelectric phenomena.

Bunch II (Problem Type)

18. At N T P, the viscosity of Hydrogen is 8.4×10^{-5} poise and the average velocity of the molecule is 1.5×10^5 cm/sec. Calculate the mean free path and the molecular diameter ($\rho = 9 \times 10^{-5}$)
19. Calculate the rotational partition function for hydrogen molecules at 300K. Moment of inertia of hydrogen molecule is 4.59×10^{-47} kgm^2 and the symmetry number is $\sigma = 2$.
20. Calculate the thermal de Broglie wavelength of hydrogen atom confined to a vessel of volume 2.494×10^5 cm^3 at 3000 K. Given the translational partition function is 7.58×10^{30}.
21. Calculate the entropy change when 5 moles of an ideal gas is changed from the initial state of 1.013×10^5 Nm^{-2} and 300 K to the final state of 10.13×10^5 Nm^{-2} and 600 K. The molar heat capacity at constant pressure Cp = 29.10 JK^{-1}. Assume that Cp is independent of temperature.

(5 x 5 = 25)

Section C
Answer any 2 (15 marks each)

22. Explain Einstein's theory of heat capacity. Comment on Debye's modification on it.
23. Derive the Boltzmann distribution law for a system of N distinguishable particles having a total energy E with allowed energy levels E_1, E_2.....having degeneracies g_1, g_2.....
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)