[This question paper contains 4 printed pages.]

1910 *Your Roll No.* .....

B.Sc. Prog. / II E

CH-203 – Physical Chemistry

(Admissions of 2008 and onwards)

Time : 2 Hours *Maximum Marks : 50*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt total **four** *questions.*
First *question is compulsory.*
Scientific calculator/log tables are allowed but candidates are not allowed to exchange among themselves.
Useful constants $R=8.314\ JK^{-1}mol^{-1}$
$k=1.38\times10^{-23}\ JK^{-1}$ $amu=1.66\times10^{-27}kg$

Use of simple calculators is allowed but they cannot be shared. Logarithmic tables can be provided if required.

1. Explain the following :

   (a) Viscosity of gases increases with increase in temperature but that of liquids decreases with temperature.

P.T.O.

(b) Angle of contact between a wetting solid-liquid pair is acute whereas that for a non wetting solid-liquid pair is obtuse.

(c) Abnormal transference numbers with examples.

(d) Working of a calomel electrode with diagram. (4×3.5=14)

2. (a) Derive van der Waals equation of state for 'n' moles of a real gas.

(b) Derive a relationship between collision diameter 'σ' and mean free path 'λ' of a gaseous molecule.

(c) Calculate the number of collisions per sec per cm^3 at 273K in Hydrogen gas at a pressure of one atm, molecular diameter for Hydrogen gas is 276 pm and number density of gas is 2.7×10^{29} molecules. (5,4,3)

3. (a) Using the concept of chemical potential derive an equation expressing the elevation in boiling point of a solution in terms of concentration of a solute.

(b) What is abnormal molecular mass of solute and how it is related to vant Hoff factor? How it is calculated from colligative properties measurements.

(c) A solution containing 4.0 g of polyvinyl chloride polymer in 1.0 liter of dioxane was found to have an osmotic pressure of 6.4×10^{4} atm at 300.0 K. Calculate the approximate molecular mass of the polymer. (5,4,3)

4. (a) Neatly draw the phase diagram of Sulphur. Label it properly and explain the various curves.

(b) State Gibbs phase rule and explain (i) degrees of freedom and (ii) components by giving at least two examples in each case.

(c) State Le-Chatelier's principle as applicable to chemical reactions. Using this principle discuss the effect of temperature and pressure on the following reactions :

$$\frac{1}{2}N_2\,(g) + \frac{3}{2}H_2\,(g) \rightarrow NH_3\,(g) \qquad \Delta_r H^0 = -46\ \text{kJ/mol}$$

(4,4,4)

5. (a) Define (i) conductance, (ii) specific conductance, (iii) molar conductance and (iv) equivalent conductance and write their SI units.

(b) Determine equilibrium constant of the following reaction at 298K.

$2Fe^{+3}(aq) + Sn^{+2}(aq) \leftrightarrow 2Fe^{+2}(aq) + Sn^{+4}(aq)$

Given E^0 Fe+3/Fe+2 = 0.77 V and E^0 Sn^{+4}/Sn^{+2} = 0.15 V

P.T.O.

(c) Explain what transference number of an ion is. How it is experimentally determined using moving boundary method ? Explain using a neat & clear diagram. (4,4,4)

6. Write short notes on the following :

(a) Maxwell Boltzmann distribution law of molecular velocities.

(b) Drop number method for the determination of surface tension of a liquid.

(c) Critical solution temperature for partially miscible pair of liquids with examples.

(d) Strong acid- strong base titrations using a potentiometer. (3,3,3,3)