Q.P.Code: 38707

2½ hours Total Marks:75

N.B: (1) All questions are compulsory.
(2) Figures to the right indicate full marks.
(3) Use of logarithmic table/non programmable calculator is allowed.

Physical Constants

N=6.022x10 ^{23}	c = 3.0 X 10^{8} m s^{-1}
k =1.38 X 10^{-23} K^{-1}	F = 96500 Coulombs
R = 8.314 J mol^{-1}K^{-1}	π =3.142
h = 6.626X10^{-34} j s	2.303 R T/ nF = 0.05916 at 293 K

1. Attempt any **three** of the following:

(A) Define: Freezing point. A solution containing1.44g of non-volatile solute in 100g of water boils at 373.12K.Calculate the molecular weight of the solute. (Given: Boiling point of water=373K, K_b=0.512K.Kg.mol^{-1}) 5

(B) State Gibb's Phase Rule and explain the terms involved in it. 5

(C) Explain the triangular phase diagram for a three component system. 5

(D) Discuss the application of the phase rule to the water system with the help of a neat labelled diagram. 5

(E) Derive Van't Hoff equation for Osmotic pressure. 5

(F) What concentration of a substance in water is needed, so that the resulting solution boils at372.09 K. (Given: Boiling point of water=373K, K_b=0.512K.Kg.mol^{-1}) 5

2. Attempt any **three** of the following:

(A) Explain the kinetics of acid catalysed reactions. 5

(B) Define adsorbate. Explain any two types of adsorption isotherms. 5

(C) The volume of gas adsorbed reduced to STP was found to be 126 cm^3 g^{-1} of the adsorbent. Assuming that molecules are closely packed in the first layer, calculate the surface area of the adsorbent if each gas molecule occupies 16.18x10^{-20} m^2. 5

(D) Name the four electrokinetic phenomena and explain in detail any one of them. 5

(E) (i) Draw the diagram for Stern's model of the electrical double layer and give the expression for zeta potential. 3

(ii) Explain the terms homogenous and heterogenous catalysis. 2

(F) Give a detailed classification of surfactants. 5

3. Attempt any **three** of the following:

(A) Give a detailed classification of cells with suitable examples. 5

(B) State any three merits and two demerits of quinhydrone electrode. 5

Turn Over

(C) A solution is 0.02m with respect to KCl and K_2SO_4 each.Calculate the activity coefficient of KCl in this aqueous solution (A=0.509 at 298 K) 5

(D) Derive an expression for emf of electrode concentration cell without transference reversible to cations. 5

(E) What is meant by liquid junction potential? How does it arise? How is it eliminated? 5

(F) Calculate the solubility of $PbSO_4$ in mol dm^{-3} in pure water,if the standard oxidation potentials of $Pb|Pb^{+2}$ and $Pb\text{-}PbSO_4|SO_4^{-2}$ are –0.124V and – 0.352V respectively. 5

4. Attempt any **three** of the following:

(A) Derive Bragg's equation. 5

(B) In a polymer sample 20 % of the molecules have molecular weight 20,000, 30 % have 45,000 and the rest have molecular weight 40,000. Calculate weight average and number average molecular weights. 5

(C) Write a short note on light emitting polymers. 5

(D) Name the laws of crystallography. Write with the help of diagrams, explain (i) Axis of Symmetry. (ii) Centre of symmetry. 5

(E) The angle of reflection for first order diffraction pattern from (110) plane of a cubic crystal is 9.4^o . Calculate the inter planar distance between two (110) planes, if the wavelength of the incident X-ray front is $2X10^{-10}$ m. 5

(F) Explain the terms (i) relative viscosity (ii) specific viscosity (iii) intrinsic viscosity (iv) Mark-Houwink Equation. 5

5.(A) State **True** or **False**:- 4

(a) Sulphur has four triple points.

(b) When solute particles associate i is less than unity.

(c) In Pb-Ag system the eutectic composition of Ag is 2.6% at 303°C

(d) $CaCO_3$ system is a three component system.

OR

(A) Match the following:- 4

Column A	Column B
(p) Isotonic solution	(i) boiling point elevation
(q) freezing point depression	(ii) F= C –P +1
(r) Condensed phase rule	(iii) same osmotic pressure
(s) Colligative property	(iv) K_f m
(v) F = C-P+2	

(B)State **True** or **False:-** **4**

(a) Lyophilic colloids are more stable than lyophobic colloids.

(b) A catalyst lowers the energy of activation.

(c) Alkyl sulphonic acids are an example of colloidal electrolytes.

(d) Promoters when added improve the catalytic activity of the catalyst.

OR

(B) Match the following:- 4

Column A	Column B
(p) Langmuir's adsorption isotherm	(i) Michaelis constant
(q) BET	(ii) monomolecular adsorption
(r) acid catalysis	(iii) multimolecular adsorption
(s) Enzyme catalysis	(iv) Boltzmann constant
(v) Hydrolysis of methyl acetate	

(C) State **True** or **False**:- 4

(a) Salt bridge is used to eliminate liquid junction potential.

(b) Activity = Concentration x Activity coefficient.

(c) Debye Huckel limiting law is applicable to strong and weak electrolytes.

(d) In chemical cell the two electrodes are chemically different.

OR

(C) Match the following:- 4

Column A	Column B
(p) glass electrode	(i) KCl
(q) quinhydrone electrode	(ii) μ =4 m
(r) salt bridge	(iii) ion selective electrode
(s) $CuSO_4$	(iv) redox electrode
(v) μ = 3m	

(D) State True or False:- 3

(a) Polydispersity Index = (weight average molecular weight)/(number average molecular weight).

(b) In Frenkel defect hole is formed in the lattice.

(c) KCl shows a simple cubic structure.

OR

(D) Match the following:- 3

Column A	Column B
(p) X-rays	(i) 23 elements of symmetry
(q) Cubic crystal	(ii) Coolidge tube
(r) Body Centred Cubic lattice	(iii) Four atoms belong to unit cell
	(iv) Two atoms belong to unit cell
