(2½ Hours) **[Total Marks : 60]**

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.

$N = 6.022 \times 10^{23}$
$k = 1.38 \times 10^{-23}$ J/K
$F = 96{,}500$ C
$R = 8.314$ J/mol/K
$h = 6.625 \times 10^{-34}$ J.s
$c = 3.0 \times 10^{8}$ m/s

$\frac{2.303RT}{F} = 0.0592$ at 298K

$\pi = 3.142$

1. a) A solution containing 0.46 g of a solute (molecular weight : 58) in 23.5 g of solvent gave a boiling point elevation of 0.172K. Calculate the molal elevation constant of solvent. 4

OR

a) A solution containing 0.402 g of solute in 100g of water freezes at 272.66K. Calculate the Van't Hoff factor '*i*'. 4
($Kf = 1.82$ K $mol^{-1}kg$, Molecular weight = 42, Freezing point of water = 273K)

Attempt any **two** of the following.

b) Draw a neat labelled diagram of water system and describe the application of phase rule to it. 4

c) Derive the relation between Van't Hoff factor 'i' and degree of association of solute in solution. 4

d) State the salient features of a triangular plot used for three component system. 4

e) i) State and explain Raoult's law. 2

ii) Give graphical represention of the depression in freezing point of a solvent due to addition of a non-volatile solute. 2

2. a) Adsorption of a certain gas on silicagel adsorbent was studied at -195^0C. The volume of the gas adsorbed reduced to STP was found to be 116.2 cm^3 per g of adsorbent. Assuming that the gas molecules are closely packed in the first adsorbed layer, calculate the surface area of the adsorbent. The area occupied by each gas molecule is 0.16×10^{-18} m^2. 4

OR

a) In order to determine the surface area of nickel, hydrogen gas was used as an adsorbate. Calculate the surface area of nickel assuming that monolayer is formed by the spherically shaped hydrogen molecule 4
given (i) Radius of hydrogen molecule $= 2.3 \times 10^{-10}m$
(ii) Number of hydrogen molecules $= 4.02 \times 10^{19}$

Attempt any **two** of the following.

b) Explain any two types of adsorption isotherms with suitable diagrams. 4

c) With the help of a suitable diagram, explain the phenomenon of electro-osmosis. Give the relation between electroosmotic pressure and zeta potential. 4

d) Explain the kinetics of acid catalysed reactions. 4

e) Give the applications of surfactants in detail. 4

3. a) Calculate the mean ionic activity coefficient of 0.02m zinc chloride ($ZnCl_2$) in aqueous solution. (A = 0.509 for water at 298K.) 4

OR

a) Calculate the emf of the following cell with transference at 298K if the transport number of H^+ ion in the given range of concentration is 0.85. 4

$$\ominus \quad \oplus$$
$$Pt\,H_{2\,(g)},1atm\left|HCl\begin{pmatrix}m=0.12\\ \gamma=0.789\end{pmatrix}\right|HCl\begin{pmatrix}m=0.2\\ \gamma=0.765\end{pmatrix}\left|H_{2\,(g)},1atm\,Pt\right.$$

Attempt any **two** of the following.

b) Derive an expression for the emf of the electrolyte concentration cell without transference reversible to cations. 4

c) Explain the solubility and solubility product of sparingly soluble salt using chemical cell. 4

d) What is a salt bridge ? Where is it used ? What are its functions ? 4

e) Give any two advantages of the following electrodes : 4

i) Glass electrode

ii) Quinhydrone electrode

4. a) A polymer sample has 50g and 100g of polymers of molecular weights 12500 and 15000 respectively. Calculate the number average and weight average molecular weights of the sample. 4

OR

a) i) Draw a suitable diagram for face centred cubic lattice. 1

ii) The angle of reflection for the first order diffraction pattern from (110) plane of a cubic crystal is 9.4^0. Calculate the interplanar distance between two (110) planes if the wavelength of the incident X-ray front is 2.5×10^{-10} m. 3

Attempt any **two** of the following.

b) What are light emitting polymers ? Give their advantages. 4

c) Give the classification of polymers based on the structure of polymer chain. 4

d) Name the laws of crystallography and state any two of them. 4

e) What are the defects in the crystals ? Explain any one of them with a neat diagram. 4

5. Attempt any **four** of the following.

a) Define the terms : i) Phase ii) Eutectic Point iii) Triple Point 3

b) Explain the process of desilverisation of lead. 3

c) State three postulates of the Langmuir's adsorption isotherm. 3

d) Explain with suitable diagram, Helmholtz model of electrical double layer. 3

e) Distinguish between chemical cell and concentration cell with suitable example. 3

f) Give one example each of gas concentration cell reversible to cations and anions. 3

g) Explain the terms : i) Specific viscocity ii) Intrinsic viscocity 3

h) Prove that a unit cell of sodium chloride contains four molecules of NaCl. 3