

QP Code : 12860

(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.

$$N = 6.022 \times 10^{23}$$

$$k = 1.38 \times 10^{-23} \text{ K}^{-1}$$

$$F = 96500 \text{ Coulombs}$$

$$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

$$c = 3.0 \times 10^8 \text{ ms}^{-1}$$

$$\pi = 3.142$$

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

1. Attempt any three of the following:-

- (A) (i) A solution containing 0.220 g of a certain compound in 100g of water was found to freeze at -0.06°C . Calculate the molecular weight of the compound. Freezing point of water is 0°C . ($K_f = 1.86 \text{ K.Kg mol}^{-1}$) 3
(ii) Why is vapour pressure of the solvent lowered when a non-volatile solute is dissolved in it? 2
- (B) With a neat labelled diagram, explain three component system exhibiting formation of one pair of partially miscible liquids. 5
- (C) Define Van't Hoff factor. 5
Derive the relation between Van't Hoff factor i and degree of association of solute in solution.
- (D) Explain application of phase rule to sulphur system. 5
- (E) (i) State and explain Raoult's law. 3
(ii) Give graphical representation of the elevation in boiling point of a solvent due to addition of a non-volatile solute. 2
- (F) (i) State Gibbs Phase Rule. Define any one term involved in it. 2
(ii) What are colligative properties? Give suitable examples. 3

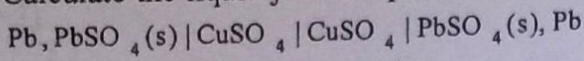
2. Attempt any three of the following:-

- (A) (i) Explain with suitable examples homogeneous and heterogeneous catalysis. 3
(ii) Explain the application of surfactants in detergents. 2
- (B) Adsorption of a certain gas forms a complete monolayer on charcoal. The volume of the gas adsorbed reduced to N.T.P. conditions was found to be 125 cm^3 per g of adsorbent. Calculate the surface area of the adsorbent. The area occupied by each gas molecule is $14.6 \times 10^{-20} \text{ m}^2$. 5
- (C) Derive Langmuir adsorption isotherm. 5
- (D) Explain phenomenon of electro-osmosis with a neat labelled diagram. Give the relationship between electro-osmotic pressure and zeta potential. 5
- (E) Derive Michaelis-Menten equation for enzyme catalysis. 5
- (F) Explain colloidal electrolytes with special reference to 5
(i) Micelles (ii) Electrical conductance

[TURN OVER

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

- (A) Calculate the mean activity coefficient of 0.02 m HCl in 0.002m H_2SO_4 . 5
(A= 0.509 at 298 K for water)
- (B) Derive the expression for emf of the electrolyte concentration cell without transference and reversible to cation 5
- (C) With the help of neat labelled diagram, give the working, representation and any two advantages of glass electrode. 5
- (D) What is liquid junction potential? Explain its origin. How is it eliminated? 5
- (E) With suitable examples, explain the classification of electrochemical cells. 5
- (F) Calculate the liquid junction potential for the following cell 5



$$\left(\begin{array}{l} m = 0.2 \\ \gamma = 0.11 \end{array} \right) \left(\begin{array}{l} m = 0.02 \\ \gamma = 0.32 \end{array} \right)$$

if the transport number of Cu^{+2} is 0.368 at 298K. ($n = 2$)

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

- (A) Give the classification of polymers based on source and physical properties. Give suitable examples. 5
- (B) A substance crystallizes in a form like that of NaCl. Its density is $1.984 \times 10^6 \text{ gm}^{-3}$ and its molecular weight is 74.5 gmol^{-1} . What is length of the edge of a single cell? 5
- (C) Define number average molecular weight. For a solution of a polymer in chloroform of concentration 3.0 g/dl, the specific viscosity is found to be 0.121. Calculate the molecular weight of the polymer. Given $[\eta] = 3.2 \times 10^{-6}$, $\alpha = 0.85$ 5
- (D) Explain the term 'light emitting polymers'. What are their advantages? 5
- (E) Explain Frenkel and Schottky defects in crystal lattice. 5
- (F) Draw neat labelled diagrams of 5
- Bragg's X-ray spectrometer
 - Unit Cell of NaCl
 - Plane of symmetry

5. (A) State True or False: 4

- Colligative property depends on chemical nature of species present.
- Van't Hoff equation is given by $\pi = nkT$.
- Boiling point elevation of a solute on addition of a non-volatile solute is inversely proportional to mole fraction of solute.
- In phase diagram for water, on any curve $F=2$.

OR

[TURN OVER

(A) Match the columns

- | | |
|---------------------------------|-------------------------|
| p) Condensed(Reduced)phase rule | 1) $F = 0$ |
| q) Triple point | 2) Lead - Silver system |
| r) Eutectic point | 3) $F = C - P + 1$ |
| s) Binodal curve | 4) $F = C + P - 1$ |
| | 5) $F = 1$ |
| | 6) Ternary system |

(B) Fill in the blanks with correct alternative:-

- (a) In adsorption isotherm amount of adsorbate is plotted against _____
(temperature, pressure, adsorbent)
- (b) Trace substance added to improve the catalytic activity of catalyst is called _____
(inhibitor, promoter, poison)
- (c) A catalyst _____ the energy of activation of a reaction.
(enhances, lowers, maintains)
- (d) In Chemical adsorption only _____ of adsorbate molecules is possible
(multilayer, monolayer, bilayer)

OR

(B) Choose the correct alternative

- (p) A plot of $\log K$ versus pH for a acid catalysed reaction has _____ slope.
(i) negative (ii) positive (iii) zero
- (q) If excess of silver nitrate is added to a dilute solution of potassium iodide, the colloidal silver iodide system will have _____ charge
(i) +ve (ii) -ve (iii) zero
- (r) The potential difference between the fixed double layer and diffuse double layer is called _____
(i) zeta potential (ii) sedimentation potential (iii) Streaming potential
- (s) For a colloidal solution, the particle size is _____
(i) $\geq 100\text{nm}$ (ii) $1\text{nm} - 100\text{mm}$ (iii) $< 1\text{nm}$

(C) Match the following columns:-

- | | |
|----------------------------------|--------------------------------|
| (a) AlCl_3 | 1) $\text{m}^2 \gamma^2$. |
| (b) Na_2SO_4 | 2) $108 \text{m}^5 \gamma^5$. |
| (c) KCl | 3) $27 \text{m}^4 \gamma^4$. |
| (d) $\text{Ca}_3(\text{PO}_4)_2$ | 4) $4 \text{m}^3 \gamma^3$. |
| | 5) $12 \text{m}^2 \gamma^3$. |
| | 6) $100 \text{m}^4 \gamma^4$. |

OR

(C) State whether the following statements are True or False.

- (p) Debye Huckel law is applicable for weak electrolytes.
- (q) Quinhydrone electrode gives good results with solution having pH greater than 8.
- (r) Calomel electrode is used in the determination of solubility product of sparingly soluble salts, by using concentration cell.
- (s) In chemical cells, the two electrodes are chemically different.

[TURN OVER

- (D) Choose the correct alternative.
- (a) Bakelite is an example of _____
- (i) Thermoplastic polymer (ii) Thermosetting polymer
(iii) Natural polymer
- (b) nylons and polyesters are examples of _____
- (i) Linear chain polymers (ii) Branched chain polymers
(iii) Graft copolymers
- (c) The ratio of weight average molecular weight to number average molecular weight is called _____
- (i) Degree of polymerisation (ii) Polydispersity index
(iii) Viscosity average molecular weight

OR

- (D) Fill in the blanks with correct alternative:-
- (p) For simple cubic lattice, number of atoms belonging to unit cell are _____
(1, 2, 3)
- (q) For _____ ratio $d_{100}:d_{110}:d_{111}$ is 1:0.707:0.577
(BCC, FCC, Simple Cube)
- (r) In Coolidge tube, cathode is made up of _____
(Tungsten or Aluminium, Bronze or Silver, Rubidium or Gold)

AN THAKUR CHARITABLE TRUST'S BHASKAR WAMAN THAKUR COLL