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.

$N = 6.022 \times 10^{23}$
$k = 1.38 \times 10^{-23} \, K^{-1}$
$F = 96500 \, Coulombs$
$R = 8.314 \, J \, mol^{-1} \, K^{-1}$
$h = 6.626 \times 10^{-34} \, J \, s$
$c = 3.0 \times 10^{8} \, ms^{-1}$
$\pi = 3.142$

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

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   3
   to freeze at -0.06⁰c.Calculate the molecular weight of the compound. Freezing point
   of water is 0⁰C.(K_f=1.86 K.Kg mol^{-1})
   (ii) Why is vapour pressure of the solvent lowered when a non-volatile solute is   2
   dissolved in it?
   (B) With a neat labelled diagram, explain three component system exhibiting formation   5
   of one pair of partially miscible liquids.
   (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   2
   to addition of a non-volatile solute.
   (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 hetrogeneous 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   5
   the gas adsorbed reduced to N.T.P. conditions was found to be 125 cm³ per g of
   adsorbent. Calculate the surface area of the adsorbent. The area occupied by each gas
   molecule is $14.6 \times 10^{-20} \, m^{2}$.
   (C) Derive Langmuir adsorption isotherm.   5
   (D) Explain phenomenon of electro-osmosis with a neat labelled diagram. Give the   5
   relationship between electro-osmotic pressure and zeta potential.
   (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

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3. Attempt any **three** of the following:- 5

(A) Calculate the mean activity coefficient of 0.02 m HCl in 0.002m H_2SO_4.
(A= 0.509 at 298 K for water)

(B) Derive the expression for emf of the electrolyte concentration cell without transference 5
and reversible to cation

(C) With the help of neat labelled diagram, give the working, representation and any two 5
advantages of glass electrode.

(D) What is liquid junction potential? Explain its origin. How is it elliminated? 5

(E) With suitable examples, explain the classification of electrochemical cells. 5

(F) Calculate the liquid junction potential for the following cell 5

$Pb, PbSO_4(s) | CuSO_4 | CuSO_4 | PbSO_4(s), Pb$
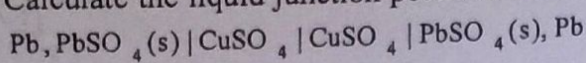
$$\begin{pmatrix} m = 0.2 \\ \gamma = 0.11 \end{pmatrix} \begin{pmatrix} m = 0.02 \\ \gamma = 0.32 \end{pmatrix}$$

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 5
examples.

(B) A substance crystallizes in a form like that of NaCl. Its density is 1.984×10^6 gm^{-3} and 5
its molecular weight is 74.5 gmol^{-1}. What is length of the edge of a single cell?

(C) Define number average molecular weight. For a solution of a polymer in chloroform 5
of concentration 3.0 g/dl, the specific viscosity is found to be 0.121. Calculate the
molecular weight of the polymer. Given $K = 3.2 \times 10^{-6}$, $\alpha = 0.85$

(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

    (a) Bragg's X-ray spectrometer

    (b) Unit Cell of NaCl

    (c) Plane of symmetry

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

    (a) Colligative property depends on chemical nature of species present.

    (b) Van't Hoff equation is given by $\pi = nkT$.

    (c) Boiling point elevation of a solute on addition of a non-volatile solute is inversely
proportional to mole fraction of solute.

    (d) In phase diagram for water, on any curve F=2.

<div align="center">OR</div>

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(A) Match the columns   4

         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:-   4

  (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   4

  (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) $\geq 100nm$ (ii) 1 nm - 100mm   (iii) < 1nm

(C) Match the following columns:-   4

        (a) $AlCl_3$ 1) $m^2\gamma^2$.

        (b) Na_2SO_4 2) $108\ m^5\gamma^5$.

        (c) KCl   3) $27m^4\gamma^4$.

        (d) $Ca_3(PO_4)_2$ 4) $4\ m^3\gamma^3$.

                               5) $12m^2\gamma^3$.

                                 6) $100\ m^4\gamma^4$.

OR

(C) State whether the following statements are **True** or **False**.   4

  (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.

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(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)

3

3

_____