

QP Code : 77095

(2 ½ 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

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

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

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

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

$$c= 3 \times 10^8 \text{ ms}^{-1}$$

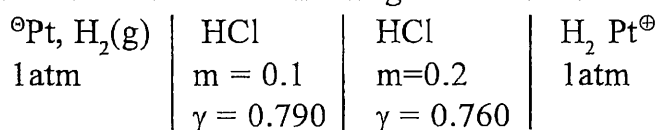
$$\pi = 3.142$$

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

1. Attempt **any three** of the following :-
- (A) Derive the equation  $\Delta T_b = K_b \cdot m$  5
  - (B) Derive the Vant Hoff's equation for osmotic pressure. 5
  - (C) State the phase rule and explain the terms involved. 5
  - (D) A solution containing 2g of solute in 100g  $\text{CCl}_4$  gave boiling point elevation of 0.7K. If the molal elevation constant of  $\text{CCl}_4$  is  $5.02 \text{ K kg m}^{-1}$ , calculate the molecular weight of the solute. 5
  - (E) Explain the application of phase rule to water system. 5
  - (F) What is condensed phase rule? Explain its application to lead-silver system. 5
2. Attempt **any three** of the following -
- (A) State the BET equation and explain the terms involved. 5
  - (B) Derive Langmuir's adsorption isotherm. 5
  - (C) Describe the characteristic features of catalyst. 5
  - (D) The volume of gas absorbed on 1g silica gel at S.T.P. required to form a monolayer was  $0.130 \text{ dm}^3$ . Calculate the surface area of silica gel if area occupied by each molecule is  $16.5 \times 10^{-20} \text{ m}^2$ . 5
  - (E) Write a note on electro-osmosis 5
  - (F) Explain the Donnan membrane equilibrium. 5

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

- (A) Explain the origin of liquid junction potential. How is it eliminated? 5
- (B) Calculate the mean activity coefficient of 0.1m HCl in 0.01m H<sub>2</sub>SO<sub>4</sub> (A = 0.509 at 298K) 5
- (C) Derive an expression for the emf of an electrolyte concentration cell without transference reversible to anion. 5
- (D) Describe the use of quinhydrone electrode in the determination of pH. 5
- (E) Derive an expression for the emf of an electrolyte concentration cell with transference reversible to cation. 5
- (F) Calculate the emf of the following cell at 298 K. 5



Give  $t_{\text{H}^+} = 0.850$

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

- (A) How are polymers classified on the basis of physical properties? 5
- (B) Write a note on applications of light emitting polymers. 5
- (C) Equal number of polymer molecules each of molecular weight 20,000gmol<sup>-1</sup> and 40,000 gmol<sup>-1</sup> are mixed. Calculate the number average molecular weight and weight average, molecular weight. 5
- (D) Derive Bragg's equation 5
- (E) Define (i) plane of symmetry (ii) axis of symmetry (ii) centre of symmetry. 5
- (F) The first order reflection of a beam of x-rays from a given crystal occurs at 6°. At what angle will be the third order reflection? 5

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

- (a) Osmotic pressure varies inversely with volume at constant pressure. 4
- (b)  $K_f$  is cryoscopic constant.
- (c) Sulphur exists in four phases.
- (d) Pure lead melts at 600 K

**OR**

(A) Match the following :-

- |                                  |                             |
|----------------------------------|-----------------------------|
| (p) Phase rule                   | (i) Semi-permeable membrane |
| (q) Water                        | (ii) Gibb's                 |
| (r) Depression in freezing point | (iii) One component system  |
| (s) Osmosis                      | (iv) $\Delta T_f$           |
|                                  | (v) $\Delta T_b$            |

[TURN OVER]

- (B) State whether **True** or **False** : 4
- (a) Adsorption is a surface phenomenon.
  - (b) Promoters increase activity of catalyst.
  - (c) Detergents are surfactants.
  - (d) Oil in water is an emulsion.

**OR**

- (B) Match the following :- 4
- |                             |                                |
|-----------------------------|--------------------------------|
| (p) Enzyme catalysis        | (i) Absorbent                  |
| (q) Chemisorption           | (ii) Michaelis-Menten equation |
| (r) Electrical double layer | (iii) Chemical bond            |
| (s) Silica gel              | (iv) Helmholtz                 |
|                             | (v) Absorbate                  |

- (C) State whether **True** or **False** : 4
- (a) Daniel cell is a galvanic cell.
  - (b) KCl solution is used in salt bridge .
  - (c) Quinhydrone is a redox electrode.
  - (d) Glass electrode is an ion-selective electrode.

**OR**

- (C) Choose the correct answer. 4
- (p) Pt / Fe<sup>+2</sup>, Fe<sup>+3</sup> is a \_\_\_\_\_ electrode
- (i) metal-metal ion    (ii) redox    (iii) gas
- (q) activity coefficient is denoted as \_\_\_\_\_
- (i) m    (ii) a    (iii)  $\gamma$
- (r) The activity of uni-univalent electrolyte is \_\_\_\_\_
- (i)  $m^2\gamma^2$ ,    (ii)  $4m^3\gamma^3$     (iii)  $27m^4\gamma^4$
- (s) Glass electrode contains \_\_\_\_\_ solution
- (i) HCl    (ii) H<sub>2</sub>SO<sub>4</sub>    (iii) HNO<sub>3</sub>

- (D) State whether **True** or **False** : 3
- (a) Wool is a synthetic polymer.
  - (b) Fibres have high tensile strength.
  - (c) Bragg's x-ray spectrometer consist of circular table and a detecting device.

**OR**

- (D) Match the following :- 3
- |                     |                        |
|---------------------|------------------------|
| (p) Elastomer       | (i) FCC                |
| (q) Ultracentrifuge | (ii) Vulcanized rubber |
| (r) Cubic lattice   | (iii) Quartz cell      |
|                     | (iv) LEP               |