

Q.P. Code : 12863

(2½ Hours)

[Total Marks : 75

- N.B. : (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.
 (3) Use of Logarithmic tables/Non-programmable calculator is allowed.
 (4) Answers to the two sections must be written in two separate answer books and tied together.

Physical Constants :-

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

$$K = 1.38 \times 10^{-23} \text{ J/K}$$

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

$$R = 8.314 \text{ J/mol/K}$$

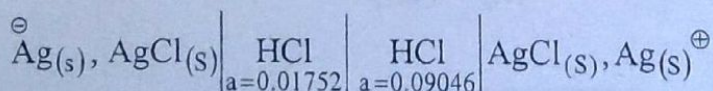
$$h = 6.625 \times 10^{-34} \text{ Js}$$

$$c = 3.0 \times 10^8 \text{ m/s}$$

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

SECTION - I

- Attempt any **three** of the following.
 - By how much would the normal boiling point 353.1 K be raised on dissolving 1.2g of n-hexane (C_6H_{14}) in 100 g of benzene. Ebullioscopic constant of benzene is $2.62 \text{ k kg mol}^{-1}$. 5
 - With a neat labelled diagram, explain application of phase rule to water system. 5
 - (i) State and explain the Raoult's law. 2
 (ii) Show graphically the elevation in boiling point of a solvent due to addition of non volatile solute. 3
 - Derive Vant' Hoff's equation for osmotic pressure. 5
 - What do you understand by eutectic point ? Explain the phase diagram of lead-silver system. 5
 - Describe the salient features of a triangular phase diagram for three component system. 5
- Attempt any **three** of the following.
 - Calculate the ionic strength of the solution containing $0.01 \text{ mol.dm}^{-3} \text{ Zn Cl}_2$ and 0.2 mol.dm^{-3} of FeCl_3 . 5
 - Derive an expression for the emf of an electrolyte concentration cell without transference reversible to anion. 5
 - Calculate the liquid junction potential of the following cell 5



if the transport number of H^+ is 0.83 at 298 K.

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- (D) Describe how the solubility product of a sparingly soluble salt can be determined by using a chemical cell. 5
- (E) State any three merits and any two demerits of the glass electrode. 5
- (F) What is a salt bridge? Where is it used? What are its functions? 5

3. (A) State true or false :- 4

- (i) When two solutions have same osmotic pressure at a given temperature they are said to be isotonic.
- (ii) CaCO_3 system is a typical example of a one component system.
- (iii) Osmotic pressure of a solution is a colligative property.
- (iv) At triple point $F = 1$

OR

(A) Fill in the blanks with correct alternative. 4

- (i) Mathematical expression of Gibb's phase rule is _____. ($F = C - P + 2$, $F = C + P - 2$, $F = C - P + 1$)
- (ii) When solute particles associate 'i' is _____ unity. (equal to, less than, greater than)
- (iii) When a non volatile solute is dissolved in a solvent, vapour pressure of the solvent _____ (decreases, increases, remains same)
- (iv) Sulphur exist in _____ phases. (two, three, four)

(B) State true or false. 4

- (a) Quinhydrone contains equimolar amount of quinone and hydroquinone.
- (b) According to Debye Huckal limiting law $\log \gamma = AZ_i^2 \sqrt{\mu}$
- (c) In chemical cell, the emf is due to a chemical reaction occurring within the cell.
- (d) $\text{Pt}, \text{H}_2(\text{g}) | \text{HCl} | \text{AgCl}(\text{s}), \text{Ag}$
_{aq}
 is an example of a concentration cell.

OR

(b) Match the following :- 4

- | | |
|----------------------------------|--------------------------------|
| (a) CuSO_4 | (i) $108 \text{ m}^5 \gamma^5$ |
| (b) K_2SO_4 | (ii) $4 \text{ m}^2 \gamma^2$ |
| (c) Na_3PO_4 | (iii) $9 \text{ m}^2 \gamma^4$ |
| (d) $\text{Al}_2(\text{SO}_4)_3$ | (iv) $\text{m}^2 \gamma^2$ |
| | (v) $27 \text{ m}^4 \gamma^4$ |
| | (vi) $4 \text{ m}^3 \gamma^3$ |

SECTION - II

4. Answer any **three** of the following. 5
- (A) Explain the following terms giving one example for each 5
- (i) Proper rotation axis (ii) Mirror plane
- (B) Explain the point group assigned to water molecule. 2
- (C) Explain (i) Importance of molecular symmetry 3
- (ii) Inversion centre
- (D) Define 'Point group'. Explain point group assigned to trans dichloro ethylene. 5
- (E) Draw the molecular orbital diagram for BeH_2 molecule. Explain its magnetic property. 5
- (F) What is Walsh correlation diagram? Explain its use in the determination of structure of H_3^+ ion 5
5. Answer any **three** of the following. 5
- (A) What are the oxoanions? How are they classified? 5
- (B) Give the hydrolysis reactions of Cr^{3+} ions in aqueous medium. 5
- (C) Write Latimer equation? Explain its significance. 5
- (D) What is predominance diagram? Explain predominance diagram for (i) strongly basic anions (ii) weakly basic anions. 5
- (E) Explain Acidic Basic and Amphoteric solvents with suitable examples. 5
- (F) With respect to liquid N_2O_4 as solvent answer the following: 5
- (i) Auto ionization reaction
- (ii) Reactions with metals
- (iii) Acid base reactions
6. Answer the following: 4
- (A) Select and write the most appropriate answer.
- (a) Doing nothing operation is same as _____.
- (i) centre of symmetry (ii) identity (iii) reflection
- (b) In ammonia molecule the principal axis is _____ axis.
- (i) C_2 (ii) C_3 (iii) C_4
- (c) Point group assigned to HCl is _____.
- (i) $D_{\infty h}$ (ii) C_{2v} (iii) $C_{\infty v}$
- (d) Photo electron spectrum of water molecule shows _____ bands
- (i) 2 (ii) 3 (iii) 4

OR

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

- (p) Water is linear molecule.
- (q) Point group assigned to H_2 molecule is C_{2v}
- (r) Order of point group D_{3h} is 6.
- (s) On the basis of symmetry symbol 't' denotes triply degenerate orbitals.

(B) Select and write the most appropriate answer.

- (a) _____ is non ionizing solvent
 - (i) HF
 - (ii) NH_3
 - (iii) C_6H_6
- (b) In auto ionization of liquid NH_3 , species not obtained is _____
 - (i) NH_4^+
 - (ii) NH_2^-
 - (iii) N^+
- (c) As the number of oxo groups increases basicity _____
 - (i) increases
 - (ii) decreases
 - (iii) does not change.

OR

(B) State whether the following statements are TRUE or FALSE.

- (p) CCl_4 is ionizing solvent
 - (q) Liquid CH_3COOH exist as dimer.
 - (r) Dilute solution of sodium metal in liquid NH_3 is green in colour.
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