

QP Code : 77101

(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.
(4) Answers to the **both** the sections should be written in the separate answer-book and tied together.

Physical constants :

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

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

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

$$\pi = 3.142$$

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

$$\frac{2.30 RT}{F} = 0.0592 \text{ at } 298 \text{ K}$$

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

$$F$$

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

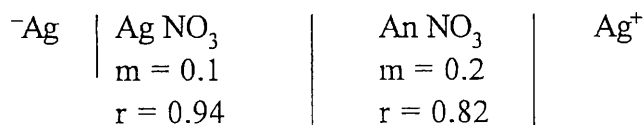
SECTION-I

1. Attempt any **three** of the following :-
- (A) Derive the equation $\Delta T_b = k_b \cdot m$ 5
 - (B) Explain the application of phase rule to water system. 5
 - (C) What is Vant Hoff's factor? Explain it with respect to NaCl, starch, and glucose solution. 5
 - (D) A solution containing 3g of solute in 120g CCl_4 gave boiling point elevation of 0.8 K. If $K_b = 5.02 \text{ K kg m}^{-1}$, calculate the molecular weight of the solute. 5
 - (E) Define the terms (i) Phase (ii) Number of components (iii) Degree of freedom. 5
 - (F) Explain the phase diagram of lead-silver system. 5
2. Attempt any **three** of the following :-
- (A) Derive an expression for emf of electrode concentration cell reversible to cation. 5
 - (B) Explain the origin of LJP. 5
 - (C) Derive an expression for emf of electrolyte concentration cell without transference receivable to cation. 5
 - (D) Calculate the ionic strength of a solution containing 0.1 m KCl and 0.2m BaCl_2 . 5
 - (E) Write a note on quinhydrone electrode 5

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(F) Calculate the emf for the cell 5



Given $t_{\text{NO}_3^-} = 0.512$

3. (A) State whether True or False :- 4

- (a) K_b is molal elevation constant
- (b) Vant Hoff's osmotic pressure equation is give as $\pi V = RT$
- (c) In sulphur system, at triple points, $F = 0$
- (d) Water system is a one component system

OR

(A) Match the following : 4

- | | |
|--------------------|----------------------------------|
| (p) Raoult's | (i) Cryoscopic constant |
| (q) K_f | (ii) Lowering of vapour pressure |
| (r) Ternary system | (iii) Rhombic |
| (s) Sulphur | (iv) Plait point |
| | (v) Dipole moment |

(B) State whether True or False :- 4

- (a) Glass electrode has a silver wire coated with AgCl
- (b) Quinhydrone electrode can be used for entire pH range
- (c) Daniel cell is a galvanic cell
- (d) Salt bridge contains agar-agar

OR

(B) Match the following : 4

- | | |
|-----------------------------|--|
| (p) Uni-trivalent electrode | (i) Si O ₂ |
| (q) Glass electrode | (ii) K NO ₃ |
| (r) Quinhydrone electrode | (iii) Q7 m ⁴ r ⁴ |
| (s) Salt bridge | (iv) Redox system |
| | (v) Gas electrode |
| | (vi) KBr |

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SECTION-II

4. Attempt any **three** of the following :-
- (A) Explain the following with suitable examples. 5
 (i) Principal and subsidiary axis (ii) Identity
- (B) Identify the symmetry elements and assign a point group in NH_3 molecule with suitable diagram. 5
- (C) Distinguish between symmetry elements and symmetry operation give examples. 5
- (D) Give an account of improper rotation axis. Explain the same with suitable example. 5
- (E) Draw a neat labelled M O diagram for H_2O molecule. Give its structure and magnetic property. 5
- (F) Write the wave equations for the formation of molecular orbitals in BeH_2 molecule. 5
5. Attempt any **three** of the following :-
- (A) Discuss the hydrolysis reaction for Cr^{3+} ion. 5
- (B) Explain the predominance diagram for feebly and weakly basic anions. 5
- (C) Write a brief note on polyatomic cations. 5
- (D) Explain Protic and Aprotic Solvents with suitable examples. 5
- (E) Give the autoionisation of liquid NH_3 , liquid N_2O_4 and liquid Acetic acid. 5
- (F) With reference to liquid NH_3 as a solvent, explain the following with two balanced equations— 5
 (i) Acid-base reactions
 (ii) Redox reactions
6. Answer the following :-
- (A) Select and write the most appropriate answer. 4
- (a) The principal axis associated with H_2 molecule is _____.
 (i) C_∞ (ii) C_2 (iii) C_3
- (b) The molecule having inversion centre is _____.
 (i) HCl (ii) $[\text{PtCl}_4]^{2-}$ (iii) NH_3
- (c) The angle of rotation for C_2 axis is _____.
 (i) 120° (ii) 180° (iii) 60°

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- (d) On the basis of symmetry rules label 'e' denotes _____ degenerate orbitals.
(i) doubly (ii) non (iii) triply

OR

- (A) State whether the following statements are **true** or **false** :- 4

- (p) The point group associated with HCl molecule is $C_{\infty v}$
(q) Boron trichloride molecule has $D_{\infty h}$ point group.
(r) H_3^+ ion molecule has only two valence electrons.
(s) Walsh diagram shows the change in energy of molecular orbitals with variation in bond angle.

- (B) Select and write the most appropriate answer. 3

- (a) pH range for strongly acidic cations is in between _____.
(i) 1-6 (ii) 6-11.5 (iii) 11.5-14
(b) The basicity of oxoanions _____ with increase in number of oxogroups.
(i) increases (ii) decreases (iii) remains same
(c) _____ is a non-ionising solvent.
(i) N_2O_4 (ii) SO_2 (iii) CCl_4

OR

- (B) State whether the following statements are **true** or **false** :- 3

- (p) Hydrolysis of hydrated cation renders the solution basic.
(q) Acetic acid in liquid N_2O_4 acts as a strong acid.
(r) Acid solvents are proton donors.
- _____