Physical & Inorganic Chem 15/10

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

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

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

$F = 96500$ C
$R = 8.314$ J/mol/K
$h = 6.625 \times 10^{-34}$ Js
$c = 3.0 \times 10^{8}$ m/s

SECTION - I

1. Attempt any **three** of the following.
   (A) 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 k kg mol^{-1}. 5
   (B) With a neat labelled diagram, explain application of phase rule to water system. 5
   (C) (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
   (D) Derive Vant' Hoff's equation for osmotic pressure. 5
   (E) What do you understand by eutectic point ? Explain the phase diagram of lead -silver system. 5
   (F) Describe the salient features of a triangular phae diagram for three component system. 5

2. Attempt any **three** of the following.
   (A) Calculate the ionic strength of the solution containing 0.01 $mol.dm^{-3}$ $Zn Cl_2$ and 0.2 $mol.dm^{-3}$ of $FeCl_3$. 5
   (B) Derive an expression for the emf of an electrolyte concentration cell without transference reversible to anion. 5
   (C) Calculate the liquid junction potential of the following cell 5

$$\overset{\ominus}{Ag_{(s)}}, AgCl_{(s)} \left| \underset{a=0.01752}{HCl} \right| \underset{a=0.09046}{HCl} \left| AgCl_{(s)}, Ag_{(s)}^{\oplus} \right.$$

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 determind 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 occuring within the cell.

(d) $Pt, H_{2(g)} | \underset{aq}{HCl} | AgCl_{(s)}, Ag$

is an example of a concentration cell.

OR

(b) Match the following :- 4

(a)	$CuSO_4$	(i)	$108\ m^5\gamma^5$
(b)	K_2SO_4	(ii)	$4\ m^2\gamma^2$
(c)	Na_3PO_4	(iii)	$9\ m^2\gamma^4$
(d)	$Al_2(SO_4)_3$	(iv)	$m^2\gamma^2$
		(v)	$27\ m^4\gamma^4$
		(vi)	$4\ m^3\gamma^3$

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SECTION - II

4. Answer any **three** of the following.
   (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. — 5
   (C) Explain (i) Importance of molecular symmetry — 2
   (ii) Inversion centre — 3
   (D) Define 'Point group'. Explain point group assigned to trans dichloro ethylene. — 5
   (E) Draw the moleculer 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.
   (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 Amphiprotic 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∞h (ii) C_{2v} (iii) C∞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**. 4

(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. 3

(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^{4-}

(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**. 3

(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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