Class : 12

SECOND MID TERM TEST - 2024

Time Allowed : 1.30 Hours] **CHEMISTRY** **[Max. Marks : 50**

PART – I

I. Answer all the questions. **10x1=10**

1. IUPAC name of the complex $K_3[Al(C_2O_4)_3]$ is --------
   a) potassium tri oxalato aluminium (III) b) potassium tri oxalato aluminate (II)
   c) potassium tris oxalato aluminate (III) d) potassium tri oxalato aluminate (III)
2. The sum of primary valence and secondary valence of the metal M in the complex $[M(en)_2Ox]Cl$ is ----------
   a) 3 b) 6 c) -3 d) 9
3. The product formed by the reaction an aldehyde with a primary amine is ----
   a) carboxylic acid b) aromatic acid c) schiff 's base d) ketone
4. Among the following cells, the Primary cells are
   I) Leclanche cell II) Nickel – Cadmium cell
   III) Lead storage battery IV) Mercury cell
   a) I and IV b) I and III c) III and IV d) II and III
5. A certain current liberated 0.504 gm of hydrogen in 2 hours. How many grams of copper can be liberated by the same current flowing for the same time through copper sulphate solution?
   a) 31.75 b) 15.8 c) 7.5 d) 63.5
6. When aniline reacts with acetic anhydride the product formed is ------
   a) o – amino aceto phenone b) m-amino aceto phenone
   c) p – amino aceto phenone d) acetanilide
7. **Assertion :** Pure iron when heated in dry air is converted with a layer of rust.
   Reason : Rust has the composition Fe_3O_4
   a) if both assertion and reason are true and reason is the correct explanation of assertion.
   b) if both assertion and reason are true but reason is not the correct explanation of assertion.
   c) assertion is true but reason is false
   d) both assertion and reason are false.
8. Which of the following reagent can be used to convert nitrobenzene to aniline?
   a) Sn / HCl b) ZnHg / NaOH c) Zn/NH_4Cl d) All of these
9. The structure of $[Fe_2(CO)_9]$ consists of ------ bridging CO ligands, ----- terminal CO groups
   a) three & two b) three & six c) two & six d) six & three
10. Which of the following amines does not undergo acetylation?
    a) t – butylamine b) ethylamine c) diethylamine d) triethylamine

PART – II

II. Answer any 5 questions. Question number 17 is compulsory. **5 X 2 = 10**

11. Write Gabriel phthalimide synthesis
12. What are ionisation isomers? Give an example.
13. What is crystal field stabilization energy (CFSE)?

14. State Faraday's second law of electrolysis.
15. The complexes of central metal atom such as Sc^{3+}, Ti^{4+},Cu^{+} are colourless. Why?
16. Write Mustard oil reaction.
17. Identify A and B.

$\xrightarrow[AlCl_3]{CH_3Cl}$ A $\xrightarrow{HNO_3/H_2SO_4}$ B (Major product)

PART – III

III. Answer any 5 questions, Question number 24 is compulsory. **5x3=15**

18. Give the difference between double salts and coordination compounds.
19. What are the limitations of VB theory?
20. Write IUPAC name of the following compounds.
    a. $H_2N\text{-}(CH_2)_6\text{-}NH_2$ b. Isopropylamine
21. Explain Galvanic cell notation.
22. Write a note on sacrificial protection.
23. Write Gomberg reaction.
24. Calculate the molar conductance of 0.025M aqueous solution of calcium chloride at 250C. The specific conductance of calcium chloride is 12.04×10^{-2} Sm^{-1}.

PART – IV

IV. Answer all the questions. **3X5=15**

25. a) In the complex, $[Co(en)_2Cl_2]Cl$, identify the following
    i) IUPAC name ii) Central metal ion iii) Ligand(s)
    iv) Geometry v) Coordination number

    (OR)

    b) Explain the postulates of Werner's theory of coordination compounds.
26. a) State Kohlrausch Law. How is it useful to determine the molar conductivity of weak electrolyte at infinite dilution.

    (OR)

    b) i) Explain Standard Hydrogen Electrode (SHE)? (3)
    ii) Why is AC current used instead of DC in measuring the electrolytic conductance? (2)
27. a) How will you distinguish between primary secondary and tertiary aliphatic amines.

    (OR)

    b) Derive an expression for Nernst equation.

Tirupathur District – Second Mid Term Examination – Nov - 2024

12th Std Chemistry – Answer Key

Time: 1.30 Hours **Total marks: 50**

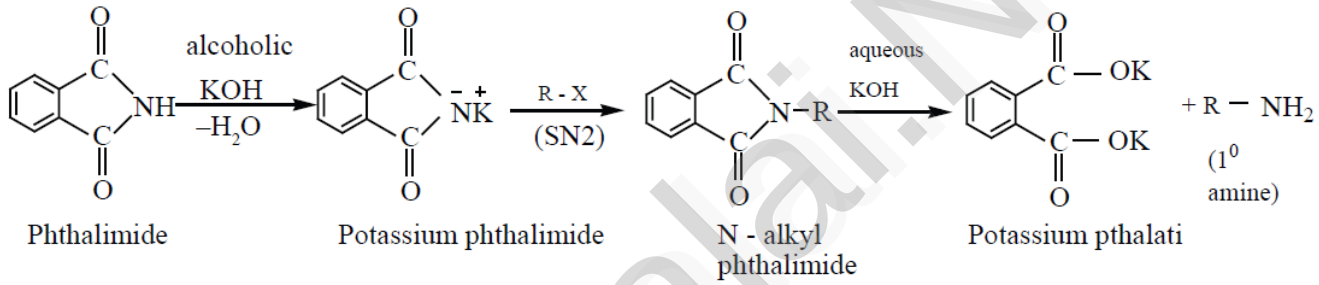
Part – I **10 x 1 = 10**

Q. No	Answer	Q. No	Answer
1	d) potassium tri oxalate aluminate (III)	6	d) acetanilide
2	d) 9	7	d) both assertion and reason are false
3	c) schiff's base	8	a) Sn / HCl
4	a) I and IV	9	b) three & six
5	b) 15.8	10	d) triethylamine

Part **– II**

Answer any 5 questions and question No. 17 is compulsory. **5 x 2 = !0**

11 **Write Gabriel phthalimide synthesis .**



12 **What are ionisation isomers? Give an example.**

This type of isomers arises when an ionisable counter ion (simple ion) itself can act as a ligand. The exchange of such counter ions with one or more ligands in the coordination entity will result in ionisation isomers. These isomers will give different ions in solution.

Eg: $[Cr(NH_3)_4ClBr]NO_2$ and $[Cr(NH_3)_4Cl\ NO_2]Br$ **(or any other example)**

13 **What is crystal field stabilization energy (CFSE)?**

Crystal Field stabilization energy (CFSE) is defined as the energy difference of electronic configurations in the ligand field (E_{LF}) and the isotropic field/bary centre (E_{iso}).

$$CFSE = \{ E_{LF}\} – \{ E_{iso}\}$$

$$= \{[n_{t2g}\ (-0.4) + n_{eg}\ (0.6)]\ \Delta_o + n_p\ P\} – \{n'_p\ P\}$$

n_{t2g} = No. of electrons in t_{2g} orbitals

n_{eg} = No. of electrons in e_g orbitals

n_p = No. of electron pairs in the ligand field

n'_p = No. of electron pairs in the isotropic field (bary centre)

P = pairing energy

14 **State Faraday's second Laws of electrolysis?**

$$\mathbf{m \propto Z}$$

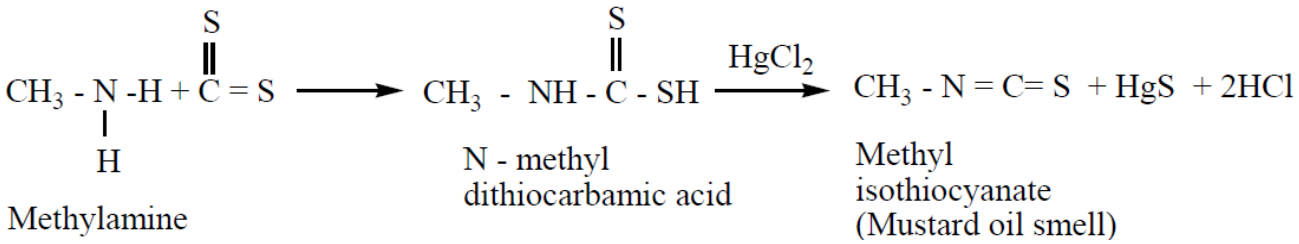
When the same quantity of charge is passed through the solutions of different electrolytes, the amount of substances liberated at the respective electrodes are directly proportional to their electrochemical equivalents.

Prepared by Dr.R.Karthic, PG Assistant (Chemistry), GHSS – Vallipattu

15 **The complexes of metal atoms such as Sc^{3+}, Ti^{4+}, Cu^{+} are colourless. Why?**

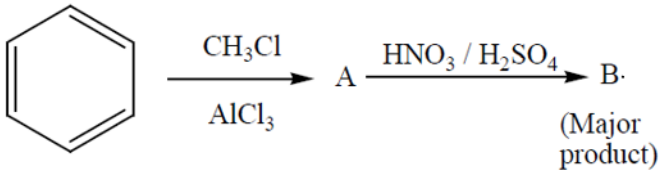
The complexes of central metal atom such as of Sc^{3+}, Ti^{4+}, Cu^{+} are colourless. This is because the d-d transition is not possible in complexes with central metal having d^0 or d^{10} configuration.

16 **Write Mustard oil reaction?**

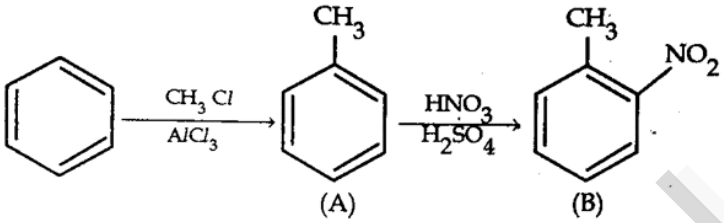


Methylamine — N - methyl dithiocarbamic acid — Methyl isothiocyanate (Mustard oil smell)

17 **Identify A and B.**



Ans:



Compound	Name
A	Toluene
B	o – nitro toluene

Part – III

Answer any 5 questions and question No. 24 is compulsory. **5 x 3 = 15**

18 **Give the difference between double salts and coordination compounds.**

	Double salt	Coordination compound
1.	Double salts lose their identity in aqueous solution by completely dissociating in to ions in the solvent	They don't lose their identity in aqueous solution as they do not ionize completely (the complex ion further doesnot get ionized)
2.	They give test for all the constituent ions	They do not show test for all their constituent ions for example in $K_4[Fe(CN)_6]$, it does not show the test for Fe^{2+} and CN^-
3.	Example: $K_2SO_4.Al_2(SO_4)_3.24H_2O$	Example: $K_4[Fe(CN)_6]$

19 **What are the limitations of VB theory?**

- it does not explain that colour of the complex.
- it considers only there spin only magnetic moments and does not consider the other components of magnetic moments.
- it does not provide a quantitative explanation as to why certain complexes are inner orbital complexes and the other or outer orbital complexes for the same metal.

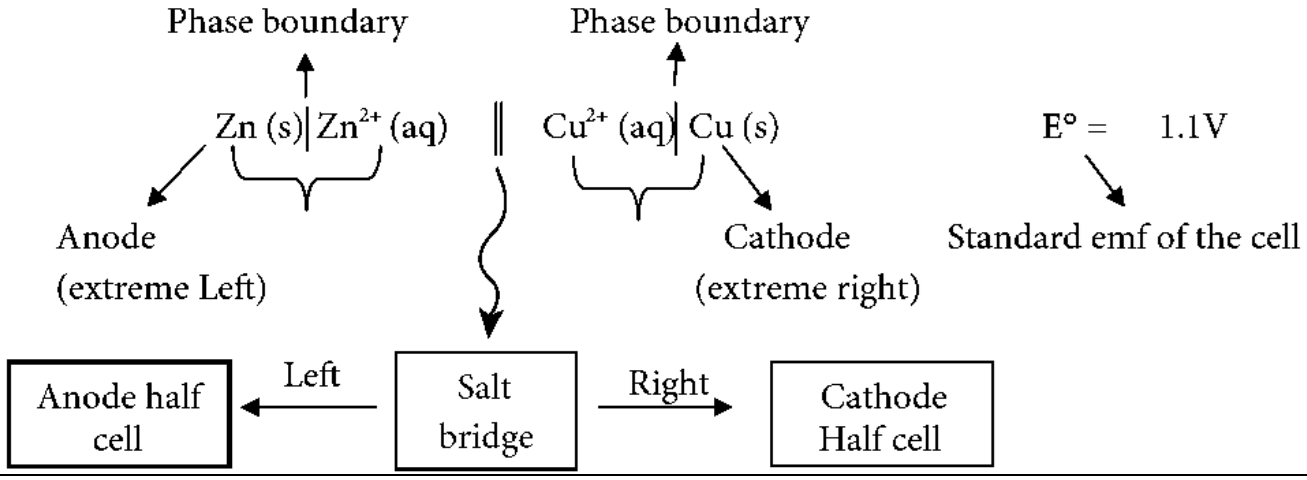
20 **Write IUPAC name of the following compounds.**

a) $H_2N – (CH_2)_6 – NH_2$ = Hexane – 1,6 – diamine

b) Isopropylamine = Propan – 2 – amine

Prepared by Dr.R.Karthic, PG Assistant (Chemistry), GHSS – Vallipattu

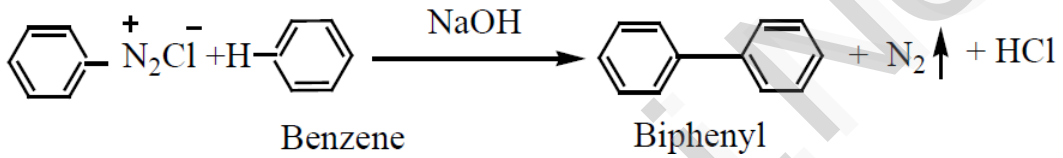
21 **Explain Galvanic cell notation?**



22 **Write a note on sacrificial protection.**

Metals such as Mg or zinc which is corroded more easily than iron can be used as a sacrificial anode and the iron material acts as a cathode. So iron is protected, but Mg or Zn is corroded.

23 **Write Gomberg reaction.**



24 Calculate the molar conductance of 0.025M aqueous solution of calcium chloride at 25°C. The specific conductance of calcium chloride is 12.04×10^{-2} Sm^{-1}.

$$\text{Molar conductance} = \Lambda_m = \frac{\kappa\ (Sm^{-1}) \times 10^{-3}}{M}\ mol^{-1}m^3$$

$$= \frac{(12.04 \times 10^{-2}\ Sm^{-1}) \times 10^{-3}\ (mol^{-1}m^3)}{0.025}$$

$$= 481.6 \times 10^{-5}\ Sm^2mol^{-1}$$

Part – **IV**

Answer all the questions. **3 x 5 = 15**

25 **a) In the complex $[Co(en)_2Cl_2]$ Cl identify the following. (5)**

i) IUPAC name = Dichloridobis(ethane-1,2-diamine)cobalt(III) chloride

ii) Central metal ion = Cobalt (III)

iii) Ligand(s) = ethane-1,2-diamine and chlorido

iv) Geometry = Octahedral

v) Coordination number = 6

(or) b) Explain the postulates of werner's theory of coordination compounds. (5)

1. Most of the element's exhibit, two types of valences.
   - Primary valence
   - Secondary valence

	Primary valence	Secondary valence
2	It denotes oxidation state of the metal atom.	It denotes the coordination number.
3	It is positive in most of the cases and zero in certain cases. They are always satisfied by negative ions.	It is satisfied by negative ions, neutral molecules, positive ions or the combination of these.
4	It is non directional	It is directional

5. According to Werner, there are two spheres of attraction around a metal atom/ion in a complex.

- The inner sphere is known as coordination sphere.
- The outer sphere is called ionisation sphere.

6. The geometry of the complex is determined by the spacial arrangement of the groups which satisfy the secondary valence. If the secondary valency is,

Six - octahedral geometry.

Four -either tetrahedral or square planar geometry.

Limitation: it does not explain their colour and the magnetic properties.

26

a) State Kohlrausch Law. How is it useful to determine the molar conductivity of weak electrolyte at infinite dilution? (5)

Kohlrausch Law: At infinite dilution, the limiting molar conductivity of an electrolyte is equal to the sum of the limiting molar conductivities of its constituent ions.

The molar conductance of a weak electrolyte cannot be calculated directly, but it can be calculated using kohlrausch law.

Eg: The molar conductance of CH_3COOH can be calculated using the experimentally determined molar conductivities of strong electrolytes HCl, NaCl and CH_3COONa.

$$\Lambda^\circ_{CH3COONa} = \lambda^\circ_{Na^+} + \lambda^\circ_{CH_3COO^-} \quad \ldots. (1)$$

$$\Lambda^\circ_{HCl} = \lambda^\circ_{H^+} + \lambda^\circ_{Cl^-} \quad \ldots. (2)$$

$$\Lambda^\circ_{NaCl} = \lambda^\circ_{Na^+} + \lambda^\circ_{Cl^-} \quad \ldots. (3)$$

Equation (1) + (2) - (3) gives,

$$(\Lambda^\circ_{CH3COONa}) + (\Lambda^\circ_{HCl}) - (\Lambda^\circ_{NaCl}) = \lambda^\circ_{H^+} + \lambda^\circ_{CH3COO^-}$$

$$= \Lambda^\circ_{CH3COOH}$$

(or) b) i) Explain standard hydrogen electrode (SHE)? (3)

- Standard Hydrogen Electrode is used as a reference electrode.
- Its emf is assigned as an arbitrary value of zero volt.
- It consists of a platinum electrode in contact with 1M HCl and 1 atm hydrogen gas.
- SHE can act as a cathode as well as an anode.
- If she is used as an anode, the oxidation reaction is

$$H_2 \longrightarrow 2H^+ + 2e^- \quad E^\circ = 0V$$

- If SHE is used as cathode, the reduction reaction is

$$2H^+ + 2e^- \longrightarrow H_2 \quad E^\circ = 0V$$

ii) Why is AC current used instead of DC in measuring the electrolytic conductance? (2)

If DC current is used to measure electrolytic conductance, it will lead to the electrolysis of the solution taken in the cell. So, AC current is used for this measurement to prevent electrolysis.

a) i) How will you distinguish between primary, secondary and tertiary alphatic amines. (5)

	Reaction	1° amine	2° amine	3° amine
1	**With HNO_2**	forms alcohol	forms N-nitroso amine	forms salt
2	**With $CHCl_3$ / KOH**	forms carbylamine	no reaction	no reaction
3	**With CS_2 / $HgCl_2$**	forms alkyl isothiocyanate	no reaction	no reaction
4	**With acetyl chloride**	forms N-alkyl acetamide	forms N,N - dialkyl acetamide	no reaction
5	**With Diethyl oxalate**	forms solid dialkyloxamide	forms liquid N,N - dialkyl oxamic ester	no reaction
6	**With Alkyl halide**	forms quarternary ammonium salt with three moles of alkyl halide	forms quarternary ammonium salt with two moles of alkyl halide	forms quarternary ammonium salt with one moles of alkyl halide

27 **(or) b) Derive an expression for Nernst equation. (5)**

$$xA + yB \rightleftharpoons lC + mD$$

$$Q = \frac{[C]^l\,[D]^m}{[A]^x[B]^y}$$

$$\Delta G = \Delta G^\circ + RT\ln Q$$

$$\Delta G = -nFE,\ \Delta G^\circ = -nFE^\circ$$

$$-nFE = -nFE^\circ + RT\ln \frac{[C]^l\,[D]^m}{[A]^x[B]^y}$$

÷ - nF

$$E = E^\circ - \frac{RT}{nF} \ln \frac{[C]^l\,[D]^m}{[A]^x[B]^y}$$

$$\boxed{E = E^\circ - \frac{2.303RT}{nF} \log \frac{[C]^l\,[D]^m}{[A]^x[B]^y}}$$

$$\boxed{E = E^\circ - \frac{0.0591}{n} \log \frac{[C]^l\,[D]^m}{[A]^x[B]^y}}$$

R = 8.314 J K^{-1} mol^{-1}
T = 298 K
1 F = 96500 C mol^{-1}