Class XII Session 2025-26
Subject - Chemistry
Sample Question Paper - 6

Time Allowed: 3 hours **Maximum Marks: 70**

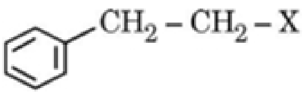
General Instructions:

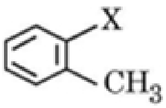
Read the following instructions carefully.

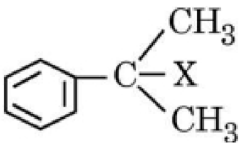
1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. **All questions are compulsory.**
8. **Use of log tables and calculators is not allowed.**

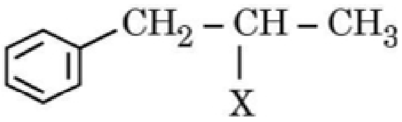
Section A

1. Which of the following is a benzylic halide? **[1]**

a) 

b) 

c) 

d) 

2. **Night-Blindness** is caused by the deficiency of Vitamin: **[1]**

a) C
b) K
c) A
d) B

3. CH_3 - O - CH_3 when treated with excess HI gives: **[1]**

a) $CH_3 - OH + CH_3 - I$
b) CH_3 - I + CH_4
c) $2CH_3$ - OH
d) $2CH_3$ - I

4. Which of the following compounds will undergo self-condensation in the presence of dilute NaOH solution? **[1]**

a) CH_3CH_2CHO
b) C_6H_5CHO
c) H-CHO
d) $(CH_3)_3C$ - CHO

5. Rate of reaction does not remain constant throughout because **[1]**

a) The density of reactants keep on changing
b) Volume of reactants keep on changing

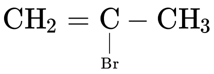
c) Concentration of reactants keep on changing
d) Temperature of reactants keep on changing

6. Match the items of column I with appropriate entries of column II. **[1]**

Column I	Column II
(a) For electrolyte $CaSO_4$	(i) i = 5
(b) For ideal Solution	(ii) i = 2
(c) For electrolyte $Al_2(SO_4)_3$	(iii) i = 4
(d) For electrolyte Na_3PO_4	(iv) i = 1

a) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv).
b) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii).
c) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii).
d) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i).

7. Which of the following belongs to the class of Vinyl halides? **[1]**

a) $CH_2 = CH - CH_2 - Br$
b) 
$CH_2 = \underset{\overset{|}{Br}}{C} - CH_3$
c) $CH_2 = CHCH_2CH_2Cl$
d) $CH \equiv C - Br$

8. The magnetic nature of elements depends on the presence of unpaired electrons. Identify the configuration of transition element, which shows highest magnetic moment. **[1]**

a) $3d^7$
b) $3d^8$
c) $3d^2$
d) $3d^5$

9. The half-life periods of a reaction at initial concentration of 0.1 mol/L and 0.5 mol/L are 200 s and 40 s respectively. The order of the reaction is **[1]**

a) 0
b) 1
c) 2
d) $\frac{1}{2}$

10. The compound which forms acetaldehyde when heated with dilute NaOH is: **[1]**

a) 1 chloroethane
b) 1, 1, 1 trichloroethane
c) 1, 2 dichloroethane
d) 1, 1 dichloroethane

11. $(CH_3)_2CH-O-CH_3$ reacts with HI to give: **[1]**

a) $(CH_3)_2CH-I + CH_3-OH$
b) $(CH_3)_2CH-OH + CH_3-I$
c) $(CH_3)_2CH-I + CH_3-I$
d) $(CH_3)_2CH-OH + CH_3-OH$

12. In order to prepare a 1^o amine from an alkyl halide with simultaneous addition of one CH_2 group in the carbon chain, the reagent used as source of nitrogen is ________. **[1]**

a) Potassium phthalimide, $C_6H_4(CO)_2N^-K^+$
b) Ethanolic NaCN
c) Sodium amide, $NaNH_2$
d) Sodium azide, NaN_3

13. **Assertion (A):** Uracil base is present in DNA. **[1]**
Reason (R): DNA undergoes self-replication.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Carbonyl compounds do not show intermolecular hydrogen bonding. **[1]**

Reason (R): Boiling points of carbonyl compounds are lower than alkanes.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion (A):** Chlorobenzene is resistant to nucleophilic substitution reaction at room temperature. **[1]**

Reason (R): C–Cl bond gets weaker due to resonance.

a) Both (A) and (R) are true and (R) is the correct explanation of (A).

b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

c) (A) is true, but (R) is false.

d) (A) is false, but (R) is true.

16. **Assertion (A):** Boiling point of butan-1-ol is higher than that of butan-1-amine. **[1]**

Reason (R): Being more polar, butan-1-ol forms stronger intermolecular hydrogen bonds as compared to butan-1-amine

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

17. 4% solution of sucrose is isotonic with 3% solution of an unknown organic substance. Calculate the molecular mass of unknown substance. **[2]**

OR

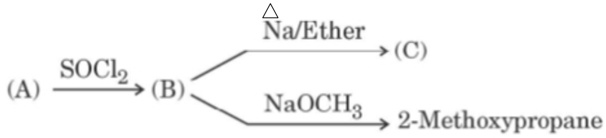
Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water?

i. Phenol
ii. Toluene
iii. Formic acid
iv. ethylene glycol
v. chloroform
vi. pentanol

18. Complete the following reactions: **[2]**

a. $CH_3CH_2CH_2Br \xrightarrow[\triangle]{\text{Alc. KOH}} (A) \xrightarrow{\text{HBr}} (B)$

b.



19. Give reasons for the following: **[2]**

a. The only oxidation state shown by Scandium is +3.

b. $[Ti(H_2O)_6]^{4+}$ is colourless.

c. MnO is basic while Mn_2O_7 is acidic.

20. **Answer the following:** **[2]**

(a) If the rate equation is given below: **[1]**

Rate = $k[A]^2[B]$

then what will be the unit of its rate and rate constant?

(b) Define half life period of a reaction. **[1]**

21. Give a test to distinguish between propan-2-one and pentan-3-one. **[2]**

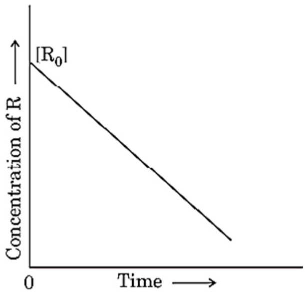
Section C

22. On the basis of the following data, explain why Co -(III) is not stable in aqueous solution? **[3]**

$Co^{3+} + e^- \rightarrow Co^2 +$, $E^0 = +1.82V$

$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$, $E^0 = 1.23V$

23. The variation in the concentration (R) vs. time (t) plot is given below. Answer the following questions on the basis of the given figure: **[3]**



i. Predict the order of the reaction.
ii. What is the slope of the curve indicate?
iii. What are the units of the rate constant k?

24. How the following conversions can be carried out? **[3]**

i. Toluene to benzyl alcohol
ii. Benzene to 4-bromonitrobenzene
iii. Benzyl alcohol to 2-phenylethanoic acid

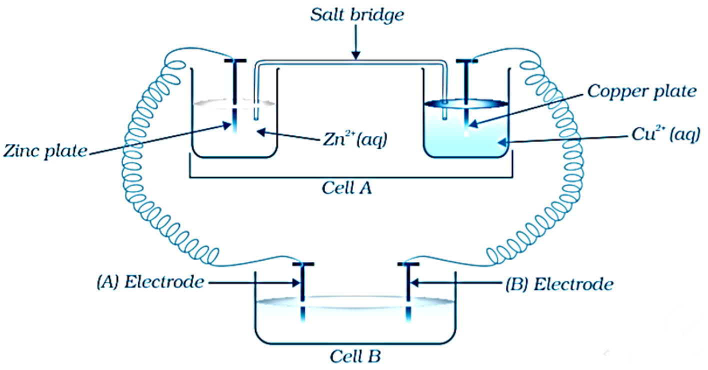
OR

What is meant by hydroboration-oxidation reaction? Illustrate it with an example.

25. Write the structures of the following compounds: **[3]**

i. $\propto -$ methoxypropionaldehyde
ii. 3-Hydroxylbutanol
iii. 2-Hydroxycylopentane carbaldehyde
iv. 4-Oxopentanal
v. Di-Sec. butyl ketone

26. Consider the given Figure and answer the following questions. **[3]**



i. Cell **A** has E_{Cell} = 2V and Cell **B** has E_{Cell} = 1.1V. Which of the two cells **A** or **B** will act as an electrolytic cell? Which electrode reactions will occur in this cell?

ii. If cell **A** has E_{Cell} = 0.5V and cell **B** has E_{Cell} = 1.1V then what will be the reactions at anode and cathode?

27. What are haloarenes? How are they classified? Give one method each for the preparation of nuclear and side chain substituted halorenes. **[3]**

28. **[3]**

a. The standard Gibbs energy (ΔrG°) for the following cell reaction is -300 kJ mol^{-1}:

$Zn(s) + 2Ag^+ (aq) \rightarrow Zn^{2+} (aq) + 2Ag(s)$

Calculate E°_{cell} for the reaction. (Given: 1F = 96500 mol^{-1})

b. Calculate λ^o_m for $MgCl_2$ if λ^o values for Mg^{2+} ion and Cl^- ion are 106 S cm^2mol^{-1} and 76.3 S cm^2mol^{-1} respectively.

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

The involvement of (n - 1)d electrons in the behaviour of transition elements impart certain distinct characteristics to these elements. Thus, in addition to variable oxidation states, they exhibit paramagnetic behaviour, catalytic properties and tendency for the formation of coloured ions. The transition metals react with a number of non-metals like oxygen, nitrogen and halogens. $KMnO_4$ and $K_2Cr_2O_7$ are common examples.

The two series of inner transition elements, lanthanoids and actinoids, constitute the f-block of the periodic table. In the lanthanoids, there is regular decrease in atomic size with increase in atomic number due to the imperfect shielding effect of 4f-orbital electrons which causes contraction.

Answer the following questions:

a. Why do transition metals and their compounds act as good catalysts? **(1)**

b. What is the cause of contraction in the atomic size of lanthanoids? **(1)**

c. Define lanthanoid contraction. How does it affect the atomic radii of the third transition series and the second transition series? **(2)**

OR

c. In aqueous media, which is a stronger reducing agent - Cr^{2+} or Fe^{2+} and why? **(2)**

30. **Read the following text carefully and answer the questions that follow:** **[4]**

The colligative properties of electrolytes require a slightly different approach than the one used for the colligative properties of non-electrolytes. The electrolytes dissociate into ions in solution. It is the number of solute particles that determines the colligative properties of a solution. The electron solutions, therefore, show abnormal colligative properties. To account for this effect we define a quantity called the van't Hoft factor, given by

$$i = \frac{Actual\ number\ of\ particles\ in\ solution\ after\ dissociation}{Number\ of\ formula\ units\ initially\ dissolved\ in\ solution}$$

i = 1 (for non-electrolytes);

i > 1 (for electrolytes, undergoing dissociation)

i < 1 (for solutes, undergoing association).

i. 0.1M $K_4[Fe(CN)_6]$ is 60% ionized. What will be its van't Hoff factor? (1)

ii. When a solution of benzoic acid dissolved in benzene such that it undergoes in molecular association and its molar mass approaches 244. In which form Benzoic molecules will exist? (1)

iii. How does van't Hoff factor **i** and degree of association **a** are related if benzoic acid undergoes dimerisation in benzene solution? ($i = 1\frac{-\alpha}{2}$ or $i = 1 + \alpha$) (2)

OR

What do you mean by colligative properties of solutions? (2)

Section E

31. **Attempt any five of the following:** **[5]**

(a) Why are polysaccharides considered non-sugars? **[1]**

(b) What type of bonds hold a DNA double helix together? **[1]**

(c) The two strands in DNA are not identical but are complementary. Explain. **[1]**

(d) Which one of the following is a polysaccharide? **[1]**

Sucrose, Glucose, Starch, Fructose

(e) Define the following as related to proteins: **[1]**

a. Primary Structure
b. Denaturation

(f) What is anomeric carbon? **[1]**

(g) Give reaction of glucose with the following: **[1]**

a. HCN
b. Conc. HNO_3

32. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers: **[5]**

i. k $[Cr(H_2O)_2(C_2O_4)_2]$
ii. $[Co(en)_3]\ Cl_3$
iii. $[Co(NH_3)_5\ (NO_2)\ (NO_3)_2]$
iv. $[Pt(NH_3\ (H_2O)\ Cl_2$

OR

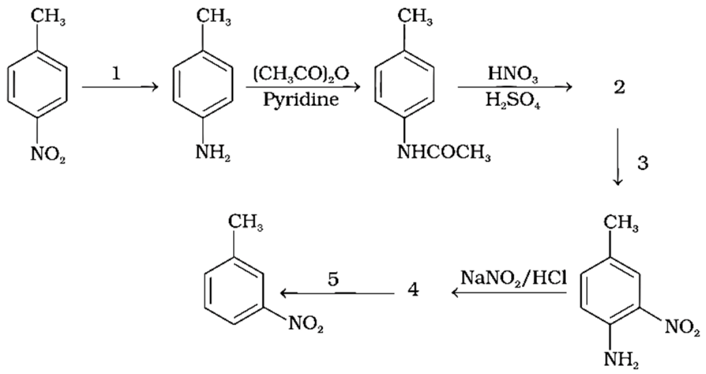
a. A metal ion M^{n+} having d^4 valence electronic configuration combines with three bidentate ligands to form a complex compound. Assuming $\Delta_o > P$.

   i. Write the electronic configuration of d^4 ion.
   ii. What type of hybridization will M^{n+} ion has?
   iii. Name the type of isomerism exhibited by this complex.

b. Using IUPAC norms, write the formula for the following complexes:

   i. Tetraaminediaquacobalt(III) chloride
   ii. Dibromidobis(ethane-1, 2-diamine)platinum(IV) nitrate

33. Predict the reagent or the product in the following reaction sequence. **[5]**



OR

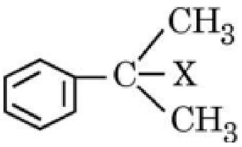
Write short notes on the following:

i. Carbylamine reaction
ii. Diazotisation
iii. Hofmann's bromamide reaction
iv. Coupling reaction
v. Ammonolysis

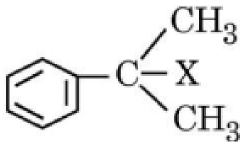
Solution

Section A

1.

(c) 

Explanation:



2.

(c) A

Explanation:

A

3.

(d) $2CH_3$ - I

Explanation:

$2CH_3$ - I

4.

(b) C_6H_5CHO

Explanation:

C_6H_5CHO

5.

(c) Concentration of reactants keep on changing

Explanation:

Rate of reaction is dependent on the concentration of reactants if the concentration of reactants change then the rate of reaction become non-uniform.

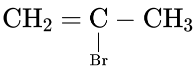
6.

(c) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii).

Explanation:

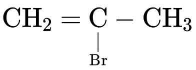
(a) - (ii), (b) - (iv), (c) - (i), (d) - (iii).

7.

(b) 

$CH_2 = \underset{\substack{|\\ Br}}{C} - CH_3$

Explanation:



$CH_2 = \underset{\substack{|\\ Br}}{C} - CH_3$ belongs to vinyl halides

8.

(d) $3d^5$

Explanation:

The greater the number of the unpaired electrons, the higher will be its value of the magnetic moment. Since $3d^5$ has 5 unpaired electrons hence highest magnetic moment as compared to others.

$\mu = \sqrt{5(5+2)}$

$= \sqrt{35}$

= 5.95 BM

9.

(c) 2

Explanation:

As initial concentration has increased half-life is decreasing so the order of the reaction is 2.

for second-order reaction, $rate \propto \frac{1}{[R]}$

10.

(d) 1, 1 dichloroethane

Explanation:

$CH_3CHCl_2 + OH^- \rightarrow CH_3CH(OH)_2 \rightarrow CH_3CHO + H_2O$

Gem diols like ($CH_3CH(OH)_2$) are generally not stable. The 2 -OH group attached to the same C removes H_2O and forms carbonyl compounds.

11.

(b) $(CH_3)_2CH\text{-}OH + CH_3\text{-}I$

Explanation:

$(CH_3)_2CH\text{-}OH + CH_3\text{-}I$

12.

(b) Ethanolic NaCN

Explanation:

KCN is used to increase the number of carbon atoms.

$RX + NaCN \rightarrow RCN + KX$

$R - \text{CN} + 4\text{H} \xrightarrow{H_2/Raney\ Ni} \text{RCH}_2 NH_2$

13.

(d) A is false but R is true.

Explanation:

A is false but R is true.

14.

(c) A is true but R is false.

Explanation:

The boiling points of carbonyl compounds are higher than corresponding alkanes due to dipole-dipole attraction between polar carbonyl groups.

15.

(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

Explanation:

Both (A) and (R) are true, but (R) is not the correct explanation of (A).

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

Section B

17. isotonic solutions will have same osmotic pressure .Solutions having same concentrations will have same osmotic pressure. So,

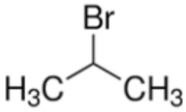
$$M_{sucrose} = M_{unknown}$$
$$\frac{3}{342} \times \frac{1000}{100} = \frac{3}{x} \times \frac{1000}{10}$$
$$x = \frac{3 \times 342}{4}$$
$$= 256.5\, g\, mol^{-1}$$

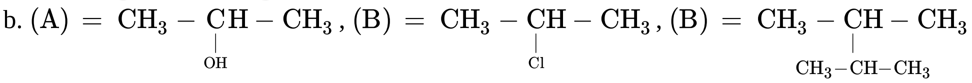
OR

i. Phenol - Partially soluble in water
ii. Toluene - Insoluble in water
iii. Formic acid - Soluble in water
iv. Ethylene glycol - Soluble in water
v. $CHCl_3$ - Insoluble in water
vi. Pentanol - Partially soluble in water

18. Compound

a. (A) = CH_3-CH=CH_2,

(B) = 

b. 
$$(A) = CH_3 - \underset{\substack{|\\ OH}}{CH} - CH_3\,,\ (B) = CH_3 - \underset{\substack{|\\ Cl}}{CH} - CH_3\,,\ (B) = CH_3 - \underset{\substack{|\\ CH_3 - CH - CH_3}}{CH} - CH_3$$

19. a. At + 3 oxidation state, Stable d^o is obtained
b. Absence of unpaired electron / no d-d transition occurs
c. MnO has Mn in +2 Oxidation State
Mn_2O_7 has Mn in +7 Oxidation State. Higher the Oxidation State, Higher is the acidic character.

20. Answer the following:

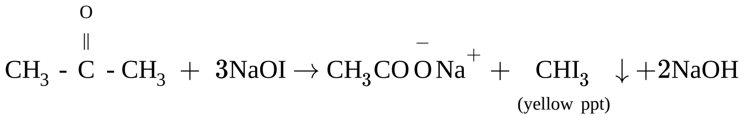
(i) Unit of rate = mol $L^{-1}s^{-1}$

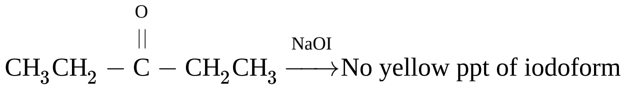
Unit of rate constant (k) = $\frac{\text{Unit of rate}}{\text{Unit of } \left[A^2\right] \times \text{Unit of } [B]}$

$$= \frac{molL^{-1}s^{-1}}{\left(molL^{-1}\right)^2\left(molL^{-1}\right)}$$
$$= mol^{-2}L^2s^{-1}$$

(ii) Half-life of a reaction is the time in which the concentration of a reactant is reduced to half of its original value.

21. On heating with NaOH+ I_2 or [NaOI], propan-2-one being a methyl ketone forms yellow ppt of iodoform, whereas pentan-3-one does not.


$$CH_3 - \overset{\substack{O\\ \|}}{C} - CH_3 + 3NaOI \rightarrow CH_3CO\bar{O}Na^+ + \underset{(yellow\ ppt)}{CHI_3} \downarrow + 2NaOH$$


$$CH_3CH_2 - \overset{\substack{O\\ \|}}{C} - CH_2CH_3 \xrightarrow{NaOI} \text{No yellow ppt of iodoform}$$

Section C

22. Adding the two half reactions, e.m.f. comes out to positive.

emf = $E_{cathode}$ - E_{anode}

emf = 1.82 - 1.23 = +0.59

This means that Co (III) in aqueous solution has the tendency to change to Co (II). Hence, Co (III) is not stable in aqueous solution.

23. i. First order reaction

ii. Rate constat (k) of reaction

iii. The unit of rate constant is time^{-1}

24. i. Toluene to benzyl alcohol

a. Chlorine, sunlight
b. aq KOH, heat

ii. Benzene to 4-bromonitrobenzene

a. Bromine, ferric bromide,
b. Conc. HNO_3 + conc. H_2SO_4

iii. Benzyl alcohol to 2-phenylethanoic acid

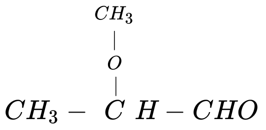
a. Thionyl chloride
b. alc KCN (c) H^+/water

OR

The addition of borane followed by oxidation is known as the hydroboration-oxidation reaction.

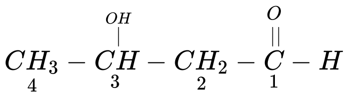
For example, propan-1-ol is produced by the hydroboration-oxidation reaction of propene. In this reaction, propene reacts with diborane $(BH_3)^2$ to form trialkyl borane as an addition product. This addition product is oxidized to alcohol by hydrogen peroxide in the presence of aqueous sodium hydroxide.

25. i. $\propto -$ methoxypropionaldehyde



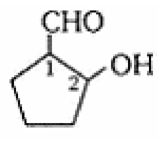
$$CH_3 - \overset{\begin{array}{c}CH_3\\|\\O\\|\end{array}}{C}\,H - CHO$$

ii. 3-Hydroxylbutanol

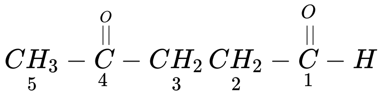


$$\underset{4}{CH_3} - \underset{3}{\overset{\overset{OH}{|}}{CH}} - \underset{2}{CH_2} - \underset{1}{\overset{\overset{O}{||}}{C}} - H$$

iii. 2-Hydroxycylopentane carbaldehyde

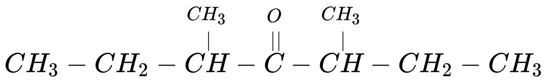


iv. 4-Oxopentanal



$$\underset{5}{CH_3} - \underset{4}{\overset{\overset{O}{||}}{C}} - \underset{3}{CH_2}\,\underset{2}{CH_2} - \underset{1}{\overset{\overset{O}{||}}{C}} - H$$

v. Di-Sec, butyl ketone



$$CH_3 - CH_2 - \overset{\overset{CH_3}{|}}{CH} - \overset{\overset{O}{||}}{C} - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CH_3$$

26. i. Cell 'B' will act as an electrolytic cell because the electrode potential of 'B' is less than that of 'A'. Electrode process in the cell 'B' may be given as

$Zn^{2+} + 2e^- \longrightarrow Zn(s)$ (at Cathode)

$Cu(s) \longrightarrow Cu^{2+} + 2e^-$ (at Anode)

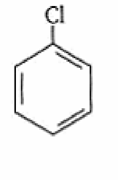
ii. Cell 'B' at higher potential will act as the galvanic cell. The electrode process may be given as,

At anode: $Zn(s) \longrightarrow Zn^{2+} + 2e^-$

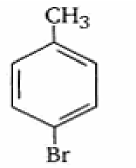
At Cathode $Cu^{2+} + 2e^- \longrightarrow Cu(s)$

27. **Haloarenes:** The replacement of hydrogen atoms in a aromatic hydrocarbon by halogen atoms results in the formation of aryl halide (haloarene). Haloarenes contain halogen atoms attached to sp^2 hybridized carbon atoms of an aryl group. They are classified as:

i. **Nuclear halogen derivatives:** Halogen derivatives of aromatic hydrocarbons in which the halogen atom (F, Cl, Br, or I) is directly attached to an aromatic ring are called nuclear halogen derivatives. Some examples are:

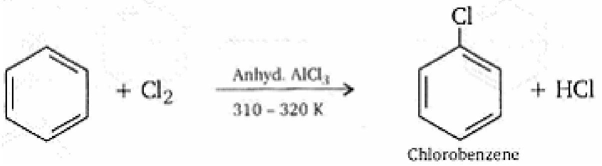


Chlorobenzene

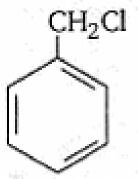


p-bromotoluene.

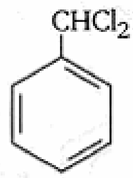
It is prepared by the direct chlorination of aromatic hydrocarbon.



ii. **Side chain halogen derivatives:** Halogen derivatives of aromatic hydrocarbons in which the halogen atom is linked to one of the carbon atoms of the side chain carrying the aryl group are called side chain halogen derivatives. For example,

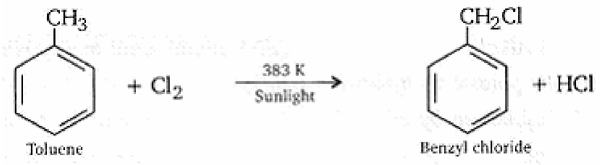


Benzylchloride
Chlorophenylmethane



Benzaldichloride
1, 1, Dichloro 1-phenylmethane

Preparation: By the direct halogenation of a suitable arenes.



28. a. $Zn(s) + 2Ag^{+}(aq) \longrightarrow Zn^{2+}(aq) + 2Ag(s)$

The number of moles of electrons transferred (n) is 2, as two moles of electrons are involved in the reduction of two moles of $Ag^{\wedge}$ + ions.

Now, you are given $\Delta G^\circ = -300\frac{kJ}{mol}$, but you need to convert it to joules (J) by multiplying by 1000 (since 1 kJ = 1000 J):

$\Delta G^\circ = -300\frac{kJ}{mol} \times 1000\frac{J}{kJ} = -300{,}000\frac{J}{mol}$

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

Now, plug in the values into the equation and solve for E^o:

$-300{,}000\ \frac{J}{mol} = -(2\ mol \times 96500\ \frac{C}{mol}) \times E^o$

Given the cell reaction:

Let's calculate E^o:

$$E^o = \frac{-300{,}000\frac{J}{mol}}{-(2\ mol \times 96500\frac{C}{mol})} \approx 3.11\ V$$

So, the standard cell potential E^o for the given cell reaction is approximately 3.11 V.

b. $MgCl_2 \longrightarrow Mg^{2+} + 2Cl^-$

$\Lambda^0_m(MgCl_2) = \lambda^0_m(Mg^{2+}) + 2\lambda^0_m(Cl^-)$

$\Lambda^0_m(MgCl_2) = 106S \cdot \frac{cm^2}{mol} + 2 \times 76.3S \cdot \frac{cm^2}{mol} = 258.6S \cdot \frac{cm^2}{mol}$

The limiting molar conductivity of $MgCl_2$ is 258.6 S $\cdot \frac{cm^2}{mol}$

Section D

29. a. Due to their ability to show multiple oxidation states and to form complexes / provide large surface area.

b. Due topoor shielding effect of 4f orbital.

c. The overall decrease in atomic and ionic radii from La to Lu is known as lanthanoid contraction. Atomic radii of second and third transition series are very similar.

OR

c. Cr^{2+} is stronger reducing agent than Fe^{2+}

Reason: $d^4 \rightarrow d^3$ occurs in case of Cr^{2+} to Cr^{3+}

But $d^6 \rightarrow d^5$ occurs in case of Fe^{2+} to Fe^{3+}

In a medium (like water) d^3 is more stable as compared to d^5

30. i. We know, $x = \frac{i-1}{n-1}$

Where, n = 5 and x = 0.6 ($\because$ 60% = $\frac{60}{100}$ = 0.6 ionized)

So, $0.6 = \frac{i-1}{5-1}$

$0.6 \times 4 = i - 1$

2.4 = i - 1

2.4 + 1 = i

i = 3.4

ii. Benzoic molecules exist as a dimer.

iii. $i = 1\frac{-\alpha}{2}$

OR

The properties of solutions that depend on the ratio of the number of solute particles to the number of solvent molecules in a solution and not on the nature of the chemical species is termed as colligative properties.

Section E

31. Attempt any five of the following:

(i) Polysaccharides are not sweet in taste & hence are called non-sugars.

(ii) Hydrogen bonding

(iii) In the helical structure of DNA, the two strands are held together by hydrogen bonds between specific pairs of bases. Cytosine forms hydrogen bond with guanine, while adenine forms hydrogen bond with thymine. As a result, the two strands are complementary to each other.

(iv) Starch

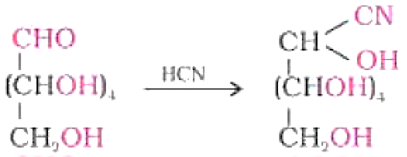
(v) a. **Primary structure:** Each polypeptide in a protein molecule having amino acids which are linked with each other in a specific sequence.

b. **Denaturation:** When a protein is subjected to physical change like change in temperature or chemical change like change in pH, protein loses its biological activity.

(vi) An anomeric carbon can be identified as the carbonyl carbon (of the aldehyde or ketone functional group) in the open-chain form of the sugar. It can also be identified as the carbon bonded to the ring oxygen and a hydroxyl group in the cyclic form.

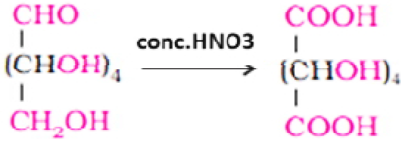
(vii)

a.



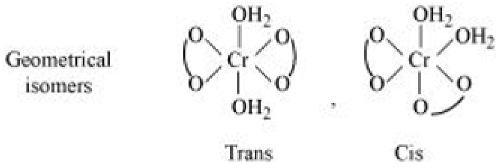
$$CHO-(CHOH)_4-CH_2OH \xrightarrow{HCN} CH(CN)(OH)-(CHOH)_4-CH_2OH$$

b.

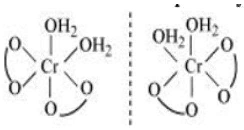


$$CHO-(CHOH)_4-CH_2OH \xrightarrow{conc.HNO3} COOH-(CHOH)_4-COOH$$

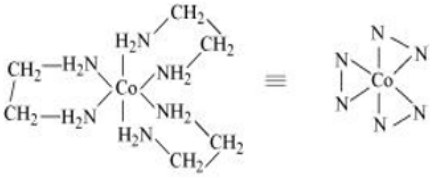
32. i. Both geometrical (cis-, trans-) isomers for k $[Cr(H_2O)_2(C_2O_4)_2]$ can exist. Also, optical isomers for cis-isomer exist.



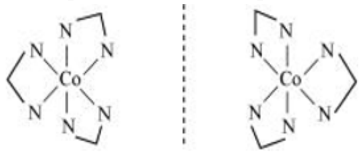
Trans-isomer is optically inactive. On the other hand, cis-isomer is optically active.



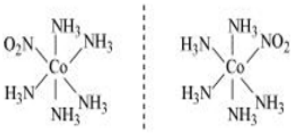
ii. Two optical isomers for $[Co(en)_3]Cl_3$ exist.



Two optical isomers are possible for this structure.

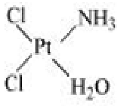


iii. $[CO(NH_3)_5(NO_2)](NO_3)_2$ $[Co(NH_3)_5(NO_2)(NO_3)_2]$ A pair of optical isomers:

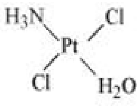


It can also show linkage isomerism. $[Co(NH_3)_5(NO_2)(NO_3)_2]$ and $[CO(NH_3)_5(ONO)](NO_3)_2$ It can also show ionization isomerism. $[Co(NH_3)_5(NO_2)(NO_3)_2]$ $[CO(NH_3)_5(NO_3)](NO_3)(NO_2)$

iv. Geometrical (cis-, trans-) isomers of $[Pt(NH_3(H_2O)Cl_2$ can exist.



Cis



Trans

OR

a. i. $t_{2g}^4 e_g^0$

ii. sp^3d^2

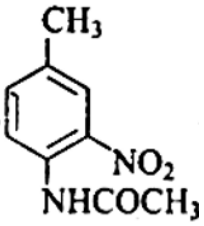
iii. optical isomerism

b. i. $[Co(NH_3)_4(H_2O)_2]CI$

ii. $[Pt\,Br_2(en)_2](NO_3)_2$

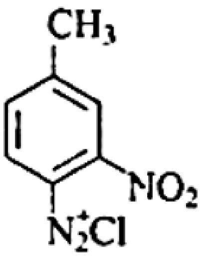
33. 1. Sn/HCl or Fe / HCl, H_2/Pd

2.

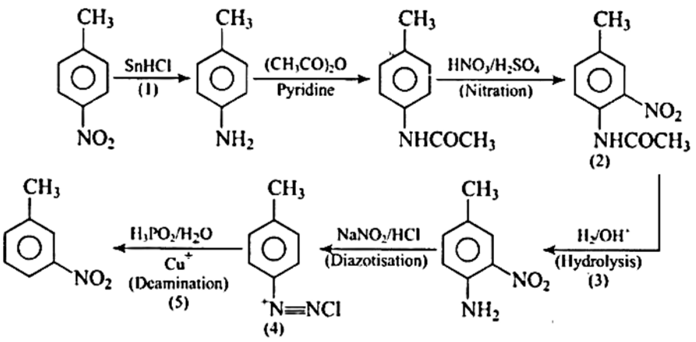


3. OH^-/H^+

4.



5. H_3PO_2/H_2O

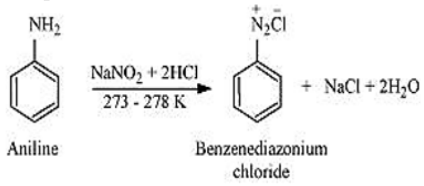


OR

i. **Carbylamine reaction:** Carbylamine reaction is used as a test for the identification of primary amines. When aliphatic and aromatic primary amines are heated with chloroform and ethanolic potassium hydroxide, carbylamines (or isocyanides) are formed. These carbylamines have very unpleasant odours. Secondary and tertiary amines do not respond to this test. For example,

$$\underset{Methana\min e}{CH_3-NH_2} + CHCl_3 + 3KOH(alc.) \xrightarrow{\Delta} \underset{Methyl\ carbyla\min e}{CH_3-NC} + 3KCl + 3H_2O$$

ii. **Diazotisation:** Aromatic primary amines react with nitrous acid (prepared in situ from $NaNO_2$ and HCl) at 273 - 278 K to form diazonium salts. This conversion of aromatic primary amines into diazonium salts is known as diazotization. For example,

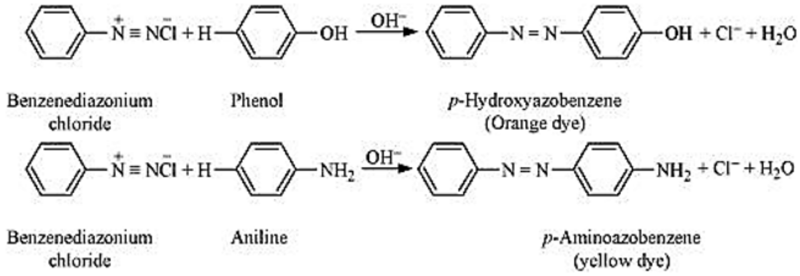


iii. **Hoffmann bromamide reaction:** When an amide is treated with bromine in an aqueous or ethanolic solution of sodium hydroxide, a primary amine with one carbon atom less than the original amide is produced. This degradation reaction is known as Hoffmann bromamide reaction. This reaction involves the migration of an alkyl or aryl group from the carbonyl carbon atom of the amide to the nitrogen atom. For example,

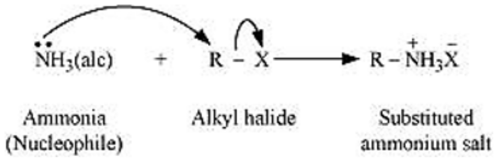
$$\underset{Ethanamide}{CH_3-\overset{\overset{O}{||}}{C}-NH_2} + Br_2 + 4NaOH \rightarrow \underset{Methana\min e}{CH_3-NH_2} + Na_2CO_3 + 2NaBr + 2H_2O$$

$$\underset{Benzamide}{C_6H_5-\overset{\overset{O}{||}}{C}-NH_2} + Br_2 + 4NaOH \rightarrow \underset{Aniline}{C_6H_5-NH_2} + Na_2CO_3 + 2NaBr + 2H_2O$$

iv. **Coupling reaction:** The reaction of joining two aromatic rings through the - N = N - bond is known as coupling reaction. Benzene diazonium salt reacts with phenol or aromatic amines to form coloured azo compounds.



v. **Ammonolysis:** When an alkyl or benzyl halide is allowed to react with an ethanolic solution of ammonia, it undergoes nucleophilic substitution reaction in which the halogen atom is replaced by an amino $(-NH_2)$ (-NH_2) group. This process of cleavage of the carbon-halogen bond is known as ammonolysis.



When this substituted ammonium salt is treated with a strong base such as sodium hydroxide, amine is obtained.

$$R-\overset{+}{N}H_3\overset{-}{X} + NaOH \rightarrow \underset{A\min e}{R-NH_2} + H_2O + NaX$$

Though primary amine is produced as the major product, this process produces a mixture of primary, secondary and tertiary amines, and also a quaternary ammonium salt as shown.

$$\underset{(1^\circ)}{RNH_2} \xrightarrow{RX} \underset{(2^\circ)}{R_2NH} \xrightarrow{RX} \underset{(3^\circ)}{R_3N} \xrightarrow{RX} \underset{Quaternary\ ammonium\ salt}{R_4\overset{+}{N}\overset{-}{X}}$$