

Solution

CHEMISTRY

Class 12 - Chemistry

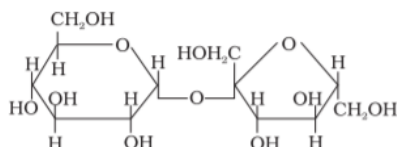
Section A

1. (d) S_N2 reaction

Explanation:

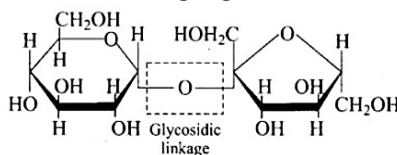
Inversion of configuration occur in S_N2 reaction

2. (a)



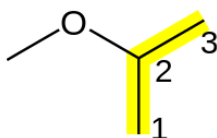
Explanation:

This structure represents sucrose(diasaccharides) in which α -D glucose and β -D-fructose is attached to each other by C_1 - C_2 glycosidic linkage. Since reducing groups of glucose and fructose are involved in glycosidic bond formation, this is considered as a non-reducing sugar.



3. (b) 2 – methoxypropane

Explanation:



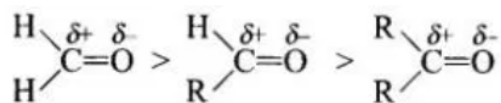
2-methoxypropane
(isopropyl methyl ether)

If the oxygen is not attached to the end of the main alkane chain, then the whole shorter alkyl-plus-ether group is treated as a side-chain and prefixed with its bonding position on the main chain. Thus $CH_3OCH(CH_3)_2$ is 2-methoxypropane.

4. (a) $CH_3 - \overset{O}{\parallel} C - H$

Explanation:

CH_3CHO is most reactive towards nucleophilic addition reactions. Carbonyl compounds are polar with the positive charge on a carbon atom which is attacked by nucleophiles. Two electron releasing alkyl groups in ketones make carbon less electron deficient than aldehydes. Benzene(C_6H_6) ring exhibits +R-effect which thereby decreases the ease of nucleophilic addition reaction in benzaldehyde and acetophenone. Hence the reactivity order is as follows



5. (a) 20 kJ/mol

Explanation:

$$\Delta H = E_{af} - E_{ab}$$

$$\Rightarrow 40 = 60 - E_{ab}$$

$$\Rightarrow E_{ab} = 60 - 40 = 20 \text{ KJ mol}^{-1}$$

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$$\Rightarrow 40 = 60 - E_{ab}$$

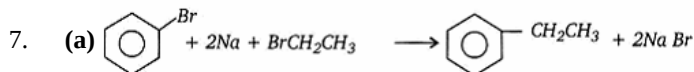
$$\Rightarrow E_{ab} = 60 - 40 = 20 \text{ KJ mol}^{-1}$$

6.

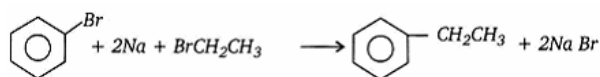
(d) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

Explanation:

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



Explanation:



A mixture of an alkyl halide and aryl halide gives an alkylarene when treated with sodium in dry ether and is called Wurtz-Fittig reaction. In above reaction ethyl bromide and bromobenzene react with sodium in dry ether to give ethyl benzene.

8.

(d) Charge transfer

Explanation:

The oxidation state of Mn in MnO_4^- is +7. Which means that Mn does not have any unpaired d-electrons left. However, MnO_4^- is deep purple in colour because of charge transfer from the ligand (O^{2-}) to the metal center. This is called a ligand-to-metal charge transfer.

9. (a) 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.

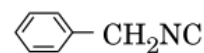
(b) NH_2OH

Explanation:

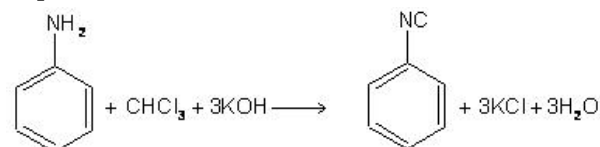
Aldehydes and ketones react with NH_2OH (hydroxylamine) to form oximes as shown in the given reaction.

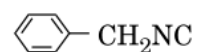


11. (a)



Explanation:



 gives foul smell.

12.

(c) $IV < III < I < II$

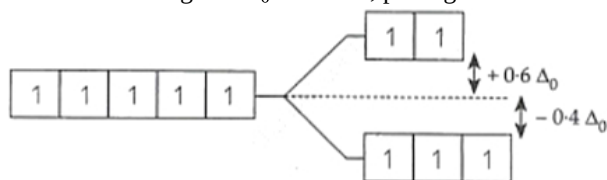
Explanation:

$IV < III < I < II$

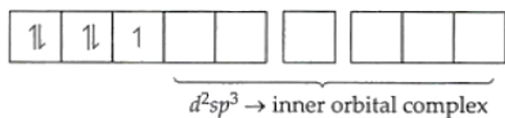
13. **(d)** If both Assertion and Reason are wrong.
Explanation:
 If both Assertion and Reason are wrong.
14. **(d)** A is false but R is true.
Explanation:
 The α -hydrogen atom in carbonyl compounds is more acidic.
15. **(d)** A is false but R is true.
Explanation:
 Vinylic halides are very less reactive towards nucleophilic substitution reactions because of the resonance effect. Resonance gives rise to partial double bond character to the carbon-halogen bond making it stronger and therefore more difficult to cleave than a $C\ sp^3 - X$ bond. It also reduces the polarity of the carbon-halogen bond thereby making heterolysis difficult.
- $$\text{CH}_2=\text{CH}-\ddot{\text{X}}: \longleftrightarrow \overset{-}{\text{C}}\text{H}_2-\text{CH}=\overset{+}{\text{X}}:$$
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.
17. **(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.
18. **(c)** A is true but R is false.
Explanation:
 A is true but R is false.

Section B

19. i. **Paramagnetic:** $[\text{CoF}_6]^{3-}$
 ii. **More stable:** $[\text{Co}(\text{en})_3]^{3+}$
 iii. **Inner orbital complex:** $[\text{Co}(\text{en})_3]^{3+}$
 iv. **High spin complex:** $[\text{CoF}_6]^{3-}$
20. a. For weak field ligand $\Delta_0 < P$ i.e., pairing will not occur for d^5 ion.

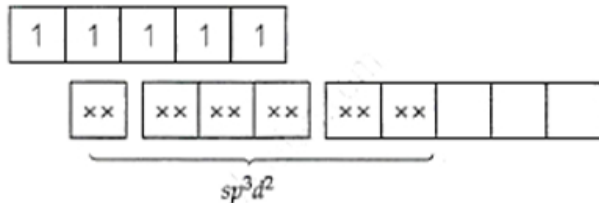


- b. $[\text{Fe}(\text{CN})_6]^{3-}$
 Fe = 3 oxidation state
 i.e., electronic configuration = $3d^5$
 CN^- = strong field ligand
 i.e., $\Delta_0 > P$ pairing will take place
 Electronic configuration of $\text{Fe}^{3+} = 3d^5$ inner orbit complex.

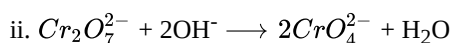


Fe = +3 oxidation state

F⁻ = Weak field ligand $\Delta_0 < P \rightarrow$ Pairing will not take place.



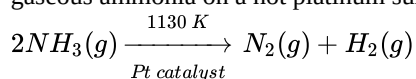
sp^3d^2 = Outer orbital complex.



22. The decrease in atomic and ionic size with increase in atomic number among lanthanoids is called lanthanoid contraction. The elements after lanthanoids closely resemble with the elements exactly above them due to similar ionic size for example Zr and Hf have similar sizes.

23. Answer the following:

(i) Zero order reactions are relatively uncommon but they occur under special conditions, for example the decomposition of gaseous ammonia on a hot platinum surface is a zero order reaction at high pressure.



and Rate = $k [\text{NH}_3]^0 = k$.

(ii) Second order reaction

(iii) Rate = $k [\text{NO}]^x [\text{O}_2]^y$

order of a reaction = $x + y$

So order = $\frac{1}{2} + \frac{3}{2} = 2$, i.e., second order of reaction.

(iv) Molecularity of a reaction means the number of molecules of the reactants taking place in an elementary reaction. Since at least one molecule must be present, so that molecularity will be at least one.

24. Henry's Law states that "the partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution" and is expressed as:

$$p = K_H \cdot x$$

Here K_H is the Henry's law constant.

Given, $T = 298 \text{ K}$, $K_H = 1.25 \times 10^6$, $p = 760 \text{ mm Hg}$

We know by Henry's Law, $p = K_H \times x$, where x is mole fraction of the gas in the solution.

$$760 = 1.25 \times 10^6 \times x$$

$$x = \frac{760}{1.25 \times 10^6}$$

$$x = 6.08 \times 10^{-4}$$

OR

It is done to lower the freezing point of water so, that it does not freeze in a hill station.

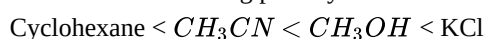
OR

The mixing of chloroform and acetone shows a negative deviation from Raoult's law. The decrease in vapor pressure is due to strong intermolecular interactions between chloroform and acetone molecules, leading to the formation of hydrogen bonds or dipole-dipole interactions, which reduce the overall vapor pressure of the mixture.

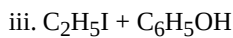
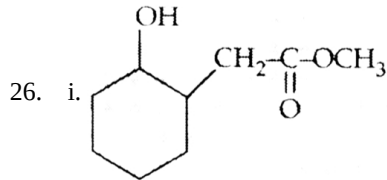
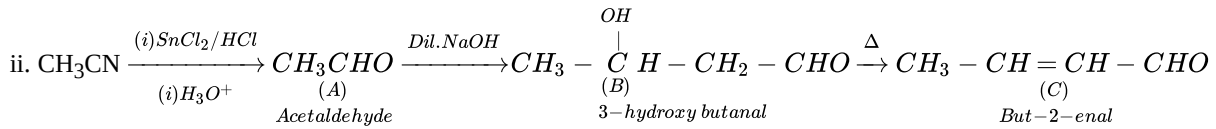
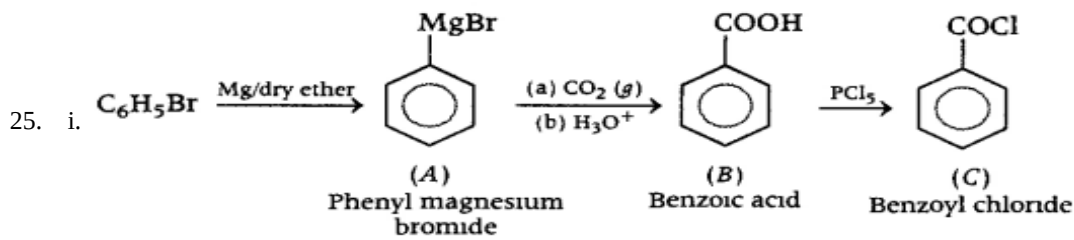
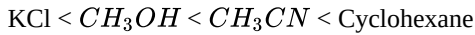
OR

n-octane is a non-polar solvent. Therefore, the solubility of a non-polar solute is more than that of a polar solute in the n-octane.

The order of increasing polarity is:



Therefore, the order of increasing solubility is:



Section C

27. Here, $n = 6$, $T = 273 + 25^\circ\text{C} = 298 \text{ K}$

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$$

$$= -0.40 - (-0.74) = 0.34 \text{ V}$$

$$\Delta_r G^\circ = -nFE^\circ_{\text{cell}}$$

$$\Delta_r G^\circ = -6 \times 96500 \times 0.34 = 196860 \text{ J mol}^{-1}$$

$$\Delta_r G^\circ = -2.303RT \log K_c$$

$$\log K_c = -\frac{\Delta_r G^\circ}{2.303RT} = \frac{196860}{2.303 \times 8.314 \times 298}$$

$$\log K_c = 34.5014$$

$$K_c = \text{antilog } 34.5014$$

$$K_c = 3.173 \times 10^{34}$$

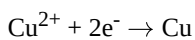
28. Steady current = 2A

copper deposited at cathode of cell B = 2g

Cell B contains CuSO_4 and reaction may be represented as,



The reaction happens at cathode as,



So, 1 mol Cu deposited by 2F charge

$$63.5 \text{ g Cu} \rightarrow 2 \times 96500$$

$$2 \text{ g Cu} \rightarrow x$$

$$x = \frac{2 \times 2 \times 96500}{63.5} = 6078.74 \text{ C}$$

we know formula

$$Q = It$$

$$6078.74 = 2 \times t$$

$$t = \frac{6078.74}{2} = 3039.37 \text{ Sec}$$

From faraday's second law of electrolysis,

$$\frac{\text{wt of Cu}}{\text{wt of Zn}} = \frac{\text{Eq wt Cu}}{\text{Eq wt Zn}}$$

$$\frac{2}{x} = \frac{63.5/2}{65/2}$$

$$x = \frac{2}{0.9769} = 2.047 \text{ g}$$

weight of Zn deposited = 2.047 g

29. Here $K_1 = 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1}$

$K_2 = 2.39 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1}$

$T_1 = 650 \text{ K}, T_2 = 700 \text{ K}$ and

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

Using the formula

$$\log \frac{K_2}{K_1} = \frac{E_a}{2.303R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$$

$$\log = \frac{2.39 \times 10^{-7}}{2.15 \times 10^{-8}} = \frac{E_a}{2.303 \times 8.314} \left(\frac{700 - 650}{650 \times 700} \right)$$

$$\log 1.11 \times 10 = \frac{E_a}{19.147} \times \frac{50}{455000}$$

$$1.0457 = \frac{E_a}{19.147} \times \frac{1}{9100}$$

$$E_a = 182200.365 \text{ J mol}^{-1}$$

30. $k = \frac{2.303}{t} \log \frac{(R)_0}{(R)}$

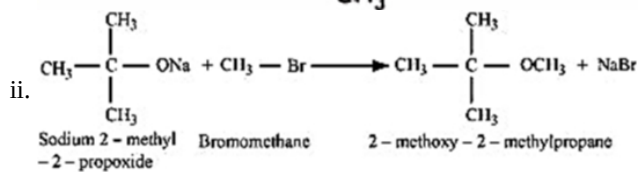
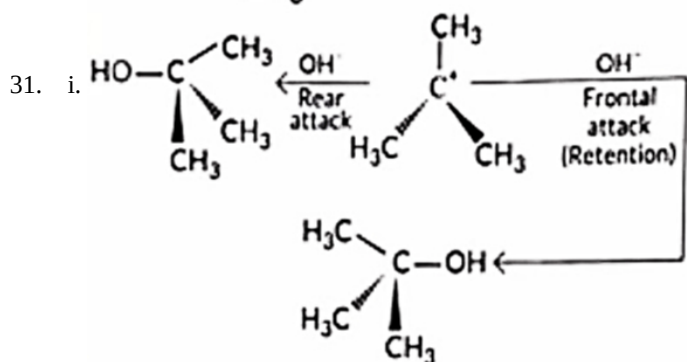
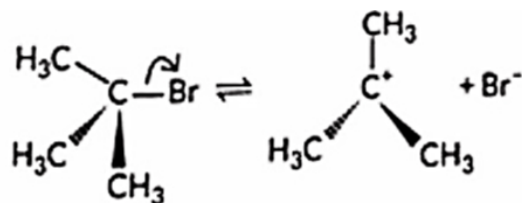
$$k = \frac{2.303}{30} \log \frac{100}{25}$$

$$k = \frac{2.303}{30} \log 4 = 0.046 \text{ min}^{-1}$$

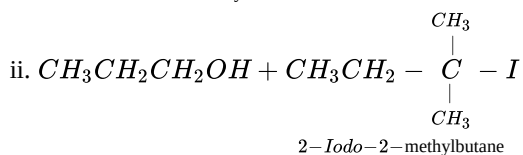
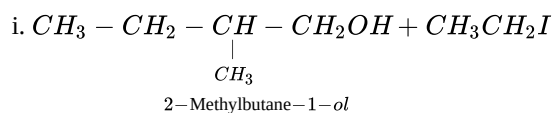
$$t_{\frac{1}{2}} = \frac{0.693}{k}$$

$$= \frac{0.693}{0.046}$$

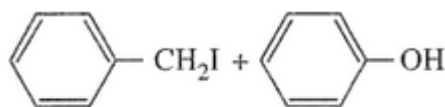
$$t_{\frac{1}{2}} = 15 \text{ min}$$



OR



iii.

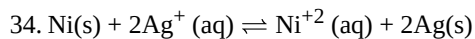
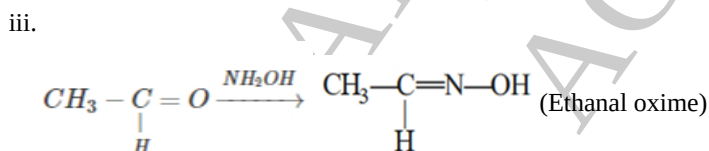
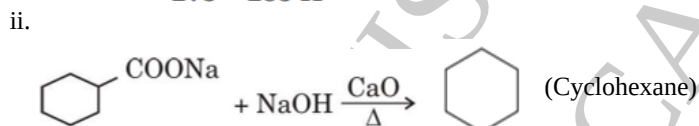
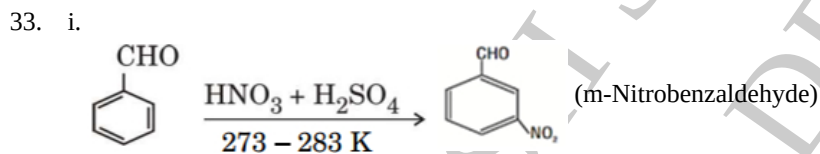
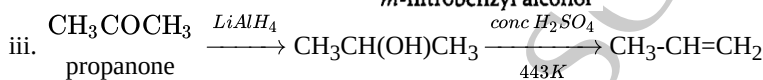
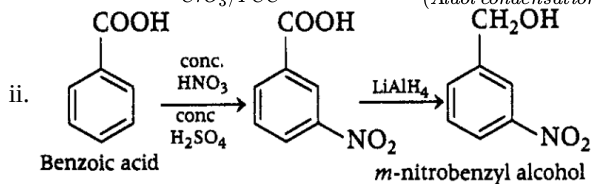
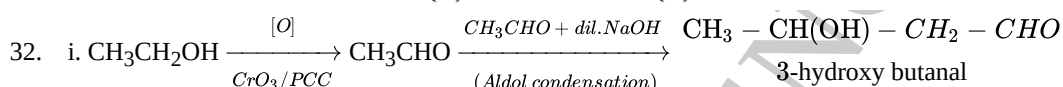
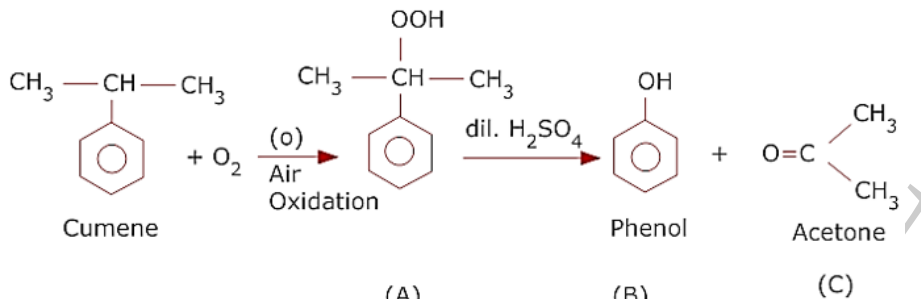


Benzyl iodide

OR

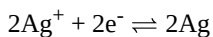
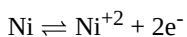
- A: $(\text{CH}_3)_2\text{C}=\text{CH}_2$
 B: $(\text{CH}_3)_2\text{CBrCH}_3$
 C: $(\text{CH}_3)_3\text{C}-\text{C}(\text{CH}_3)_3$
 D: $(\text{CH}_3)_2\text{CHCH}_2\text{MgBr}$
 E: $(\text{CH}_3)_2\text{CHCH}_3$
 F: $(\text{CH}_3)_2\text{CHCH}_2\text{OC}_2\text{H}_5$

OR



Given:

$$E_{\text{Ni}^{2+}/\text{Ni}}^0 = -0.25 \text{ V}, E_{\text{Ag}^+/\text{Ag}}^0 = 0.80 \text{ V}$$



$$E_{\text{Cell}}^0 = E_{\text{Cathode}}^0 - E_{\text{Anode}}^0$$

$$E_{\text{Cell}}^0 = E_{\text{Ag}^+/\text{Ag}}^0 - E_{\text{Ni}^{2+}/\text{Ni}}^0$$

$$E_{\text{Cell}}^0 = 0.80 - (-0.25)$$

$$E_{\text{Cell}}^0 = 1.05 \text{ V}$$

$$\Delta G = -nFE_{\text{Cell}}^0$$

$$= -2 \times 96500 \times 1.05$$

$$= -202650 \text{ kJ/mol}$$

$$E_{\text{Cell}}^0 = \frac{2.303RT}{nF} \log K_c$$

$$\begin{aligned} \text{The value of } \log K_c &= \frac{nFE_{\text{cell}}^{\circ}}{2.303RT} \\ &= \frac{2 \times 96500 \times 1.05}{2.303 \times 298 \times 8.314} \\ &= 35.516 \end{aligned}$$

35. Kohlrausch's law of independent migration of ions states that the limiting molar conductivity of an electrolyte can be expressed as the sum of the individual contributions of the anion and the cation of the electrolyte, e.g.

$$\Lambda_m^{\circ}(\text{CH}_3\text{COOH}) = \lambda_{\text{CH}_3\text{COO}^-}^{\circ} + \lambda_{\text{H}^+}^{\circ}$$


The conductivity of a solution is related to the number of ions present per unit volume of the solution. When the solution is diluted, the number of ions per unit volume decreases. Hence, conductivity or specific conductance of the solution decreases.

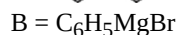
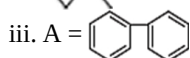
36. In S_N2 reaction, steric factors determine the reactivity. more reactive alkyl halides have less steric hindrance. Hence, the

decreasing order of the reactivity of alkyl halides is $1^{\circ} > 2^{\circ} > 3^{\circ}$. The order of reactivity as follows:

- 1-bromopentane > 2-bromopentane > 2-bromo-2-methylbutane
- 1-bromo-3-methylbutane > 3-bromo-2-methylbutane > 2-bromo-2-methylbutane
- 1-bromobutane > 1-bromo-3-methylbutane > 1-bromo-2-methylbutane > 1-bromo-2, 2 dimethylpropane

37. i. $(\text{CH}_3)_3\text{C} - \text{C}(\text{CH}_3) = \text{CHCH}_3$

ii.  is chiral



38. The given cell is , $\text{Ag}(\text{s}) | \text{Ag}^+(10^{-3}\text{M}) || \text{Cu}^{2+}(10^{-1}\text{M}) | \text{Cu}(\text{s})$

At anode $\text{Ag}(\text{s}) \rightarrow \text{Ag}^+(\text{aq}) + \text{e}^- \times 2$

At cathode, $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$

Overall reaction; $2\text{Ag}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow 2\text{Ag}^+(\text{aq}) + \text{Cu}(\text{s})$

Now, applying Nernst equation, $E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{2} \log \frac{[\text{Ag}^+]^2}{[\text{Cu}^{2+}]} = 0.46 - \frac{0.0591}{2} \log \frac{(10^{-3})^2}{10^{-1}} = 0.46 - \frac{0.0591}{2} \log 10^{-5}$

Therefore, $E_{\text{cell}} = 0.608\text{ V}$

39. i. For the cell; $\text{Zn}(\text{s}) | \text{Zn}^{2+}(2\text{M}) || \text{Cu}^{2+}(0.5\text{M}) | \text{Cu}(\text{s})$.

The cell reactions are:

Oxidation half cell reaction; $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$ (**At Anode**)

Reduction half cell reaction; $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$ (**At Cathode**)

ii. $E_{\text{cell}}^{\circ} = E_{\text{right}}^{\circ} - E_{\text{left}}^{\circ}$

$$E_{\text{cell}}^{\circ} = 0.34\text{ V} - (-0.76\text{ V}) = 1.10\text{ V}$$

By applying Nernst equation;

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{n} \log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}$$

$$E_{\text{cell}} = 1.10 - \frac{0.0591}{2} \log \frac{2}{0.5}$$

$$E_{\text{cell}} = 1.10 - \frac{0.0591}{2} \times 0.6021$$

$$E_{\text{cell}} = 1.10 - 0.0178 = 1.0822\text{ V}$$

Section D

40. a. Due to their ability to show multiple oxidation states and to form complexes / provide large surface area.
- b. Due to poor 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

41. i. It is because neither they nor their ions have incompletely filled d-orbitals.
 ii. Scandium (Sc) and Zinc (Zn).
 iii. It is because they show variable oxidation state, can form intermediate complexes and have large surface area for adsorption of gases.

OR

It is due to strong interatomic forces of attraction due to presence of unpaired electrons.

42. i. Solution shows a negative deviation from Raoult's law / A-A and B-B interactions are weaker than A-B interactions.
 ii. Carbon disulphide and acetone, Ethanol and acetone.
 iii. According to Raoult's law:

$$p_1 = p_1^0 x_1 \text{ or } x_1 = \frac{p_1}{p_1^0}$$

$$x_1 = \frac{750}{760} = 0.987$$

$$x_2 = 1 - x_1$$

$$= 1 - 0.987 = 0.013$$

OR

NaCl is a non-volatile solute, when it is added to water the vapour pressure decreases and hence boiling point increases.

Methanol is a volatile solute and its addition to water increases the total vapour pressure of the solution and hence boiling point decreases.

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

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

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

$$0.6 \times 4 = i - 1$$

$$2.4 = i - 1$$

$$2.4 + 1 = i$$

$$i = 3.4$$

- ii. Benzoic molecules exist as a dimer.

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

OR

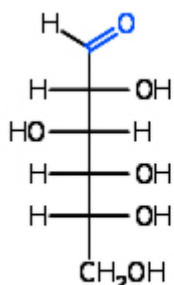
The properties of solutions that depend on the ratio of the number of solute particles to the number of solvent molecules in a solution and not on the nature of the chemical species is termed as colligative properties.

Section E

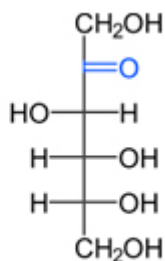
44. Attempt any five of the following:

- (i) i. A linkage between two monosaccharide units through oxygen atom.
 ii. Protein having a unique three-dimensional structure and biological activity.
 (ii) Glucose has aldehydic group. Glucose is called as aldose
 Fructose has ketonic group. Fructose is called as ketose.

Structures:



Glucose



Fructose

- (iii) Glycosidic linkage

- (iv) a. A linkage which joins two amino acids through -CONH-bond. / The amide linkage (-CO-NH) which is formed when amino group of one alpha amino acid combines with carboxylic group of another amino acid.
 b. Amino acids which cannot be synthesised in the body and must be obtained through diet.
 (v) Uracil, cytosine, guanine and adenine are present in RNA. Among these, uracil is not present in DNA.

(vi) **Glycosidic linkage:** It is the linkage which joins two monosaccharides through oxygen atom. It is present in carbohydrates.

Peptide Linkage: It is the linkage which joins two amino acids through -CO-NH- bond. It is present in proteins.

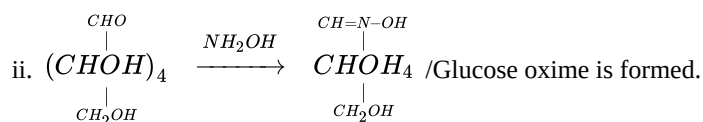
(vii) Glycosidic linkage

(viii) i. Thymine is present in DNA.

ii. Uracil is present in RNA.

(ix) Starch

(x) i. Due to the presence of both acidic (-COOH) and basic (-NH₂) groups in the same molecule/they form zwitter ion which react with both acid and base.

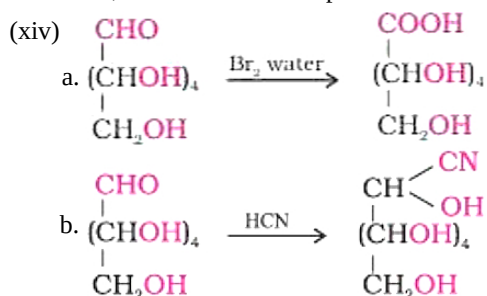


(xi) A starch has two components: amylose and amylopectin. Amylose is water soluble.

(xii) Hydrolysis of sucrose brings about a change in sign of rotation from dextro (+) to laevo (-) and hence, it is known as invert sugar.

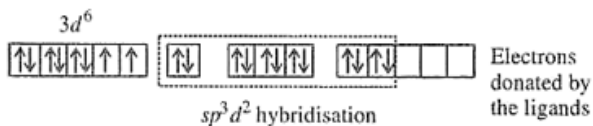
(xiii) Amino acids contain both amino (-NH₂) and carboxyl (-COOH) groups, thus they react with both acids and bases.

Hence, amino acids are amphoteric in nature.

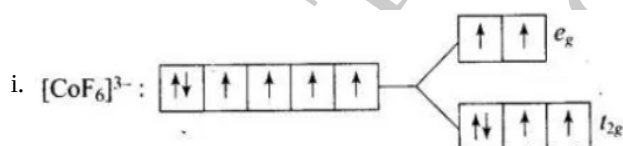


45. Electronic configuration of Ni : 4s²3d⁸

Electronic configuration of Ni²⁺: 4s⁰3d⁸



OR

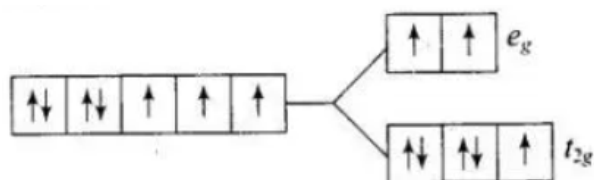


$$\text{Co}^{2+} = 3d^7$$

Number of unpaired electrons = 4

$$\text{Magnetic moment} = \sqrt{n(n+2)} = \sqrt{4(4+2)} = 4.9 \text{ B.M}$$

[Co(H₂O)₆]²⁺ :

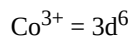
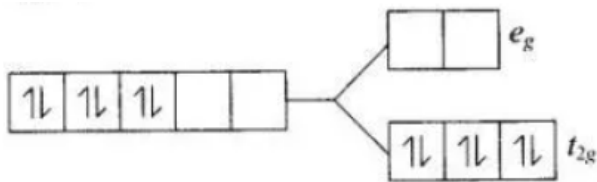


$$\text{Co}^{2+} = 3d^7$$

Number of unpaired electrons = 3

$$\text{Magnetic moment} = \sqrt{3(3+2)} = 3.87 \text{ B.M}$$

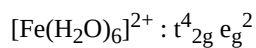
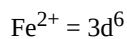
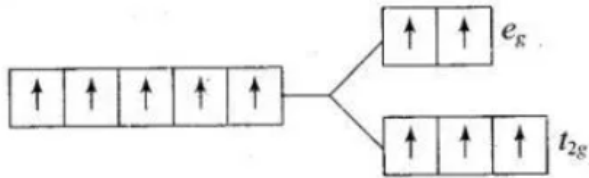
[Co(CN)₆]³⁻ :



Number of unpaired electrons = 0

Diamagnetic in nature.

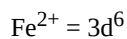
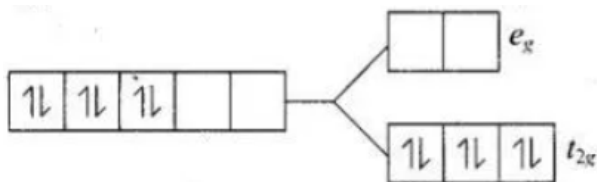
ii. FeF_6^{3-} :



Number of unpaired electrons = 4

Magnetic moment = $\sqrt{4(4+2)} = 4.9$ B.M

$[\text{Fe}(\text{CN})_6]^{4-}$:



Diamagnetic in nature.

OR

- The formula of Tetraammineaquachloridocobalt(III) chloride is $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$.
- The formula of Potassium tetrahydroxidozincate(II) is $\text{K}_2[\text{Zn}(\text{OH})_4]$.
- The formula of potassium trioxalatoaluminate(III) is $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3]$.
- The formula of Dichloridobis(ethane-1, 2-diamine)cobalt(III) is $[\text{CoCl}_2(\text{en})_2]^+$.
- The formula of Tetracarbonylnickel(0) is $[\text{Ni}(\text{CO})_4]$.

OR

i. $\text{K}_3[\text{Co}(\text{C}_2\text{O}_4)_3]$

The central metal ion is Co.

Its coordination number is 6.

The oxidation state can be given as:

$$x - 6 = -3$$

$$x = +3$$

The d orbital occupation for Co^{3+} is $t_{2g}^6 e_g^0$

ii. $\text{cis}[\text{Cr}(\text{en})_2\text{Cl}_2]\text{Cl}$

The central metal ion is Cr.

The coordination number is 6.

The oxidation state can be given as:

$$x + 2(0) + 2(-1) = +1$$

$$x - 2 = +1$$

$$x = +3$$

The d orbital occupation for Cr^{3+} is t_{2g}^3 .

iii. $(\text{NH}_4)_2[\text{CoF}_4]$

The central metal ion is Co.

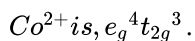
The coordination number is 4.

The oxidation state can be given as:

$$x - 4 = -2$$

$$x = +2$$

The d orbital occupation for



iv. $[Mn(H_2O)_6]SO_4$

The central metal ion is Mn.

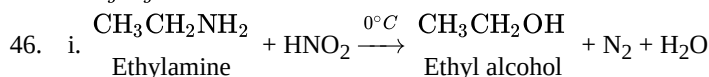
The coordination number is 6.

The oxidation state can be given as:

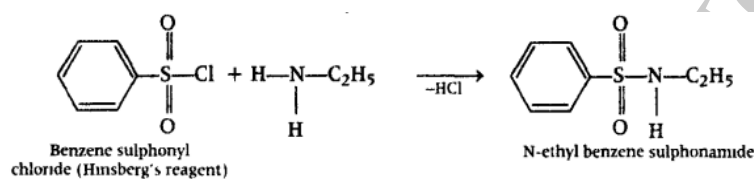
$$x + 0 = +2$$

$$x = +2$$

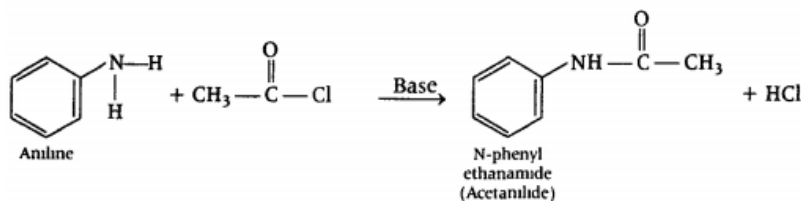
The d orbital occupation for Mn is



ii.



iii.



OR

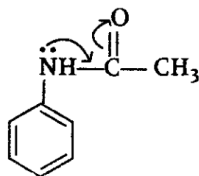
- i. a. Nitration is carried out in acidic medium. In an acidic medium, aniline is protonated to form the anilinium ion which is meta directing. That is why besides the ortho and para derivatives, a substantial amount of meta derivative (m-nitroaniline) is also formed.
- b. $(CH_3)_2NH$ is a secondary amine and $(CH_3)_3N$ is a tertiary amine. Tertiary amine due to the presence of three alkyl groups is more hindered than secondary amine which has only two alkyl groups attached to it. Therefore formation of ammonium ion is easier in secondary amine than the tertiary amine. Therefore, it makes secondary amine less basic than the tertiary amine.
- c. The ammonolysis of alkyl halide leads to the formation of the mixture of primary, secondary and tertiary amine along with the formation of quaternary salt. It is very difficult to separate pure primary amine from this mixture.

ii. a.	Test	$CH_3CH_2NH_2$	$(CH_3CH_2)_2NH$
	Carbylamine test (add chloroform and alcoholic KOH to both the compounds separately in a test tube)	Forms a foul-smelling compound (gives positive test)	No reaction take place (gives negative test)
b.	Azo dye Test	Aniline	Methyl Amine (CH_3NH_2)
	Add a small amount of nitrous acid with aq. HCl	Forms a yellow coloured dye (gives positive test)	No dye is formed (gives negative test)

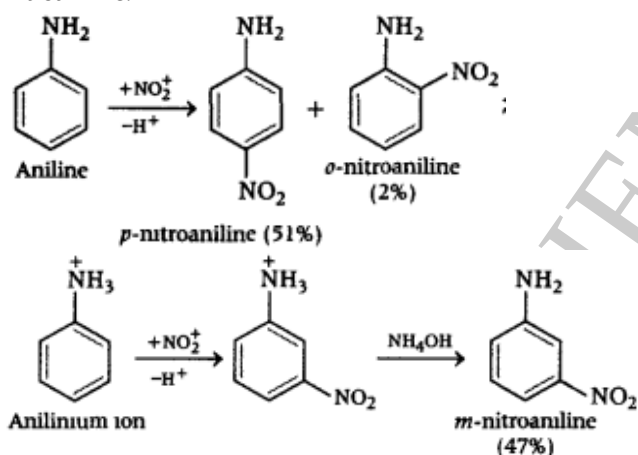
OR

- a. i. Due to the electron-withdrawing effect of the acetyl group, the lone pair of electrons on N-atom is attracted by the acetyl group. As a result, the lone pair of electrons on N-atom is not exclusively available for donation to the benzene ring and

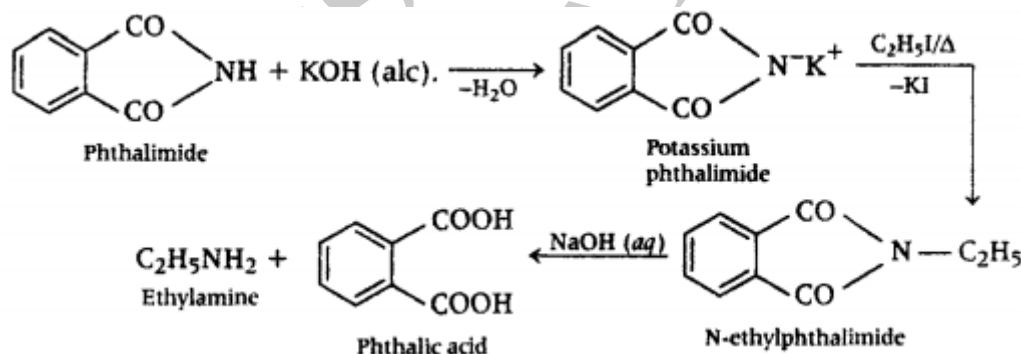
hence, activating the effect of the -NH₂ group is reduced.



- ii. In aromatic amines, the lone pair of electrons present on nitrogen takes part in resonance and hence, not available for donation. Also aniline is more stable than anilinium ion. Hence aniline has a very little tendency to accept a proton to form anilinium ion. However, in aliphatic amines, the lone pair is easily available for donation. That's why aliphatic amines are more basic than aromatic amines.
- iii. Nitration is usually carried out with a mixture of conc. HNO₃ and cone. H₂SO₄. So in the presence of these acids, aniline gets protonated to form anilinium ion. Therefore, the reaction mixture consists of aniline + and anilinium ion. -NH₂ group in aniline is o,p-directing and activating, whereas the ⁺NH₃ group in anilinium is m-directing and deactivating. Now, nitration of aniline mainly gives p-nitroaniline due to steric hindrance at a-position and the nitration of anilinium ion gives m-nitroaniline.



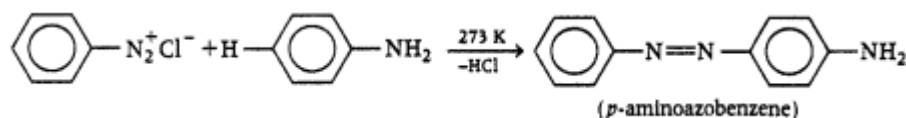
- b. i. Gabriel phthalimide reaction Phthalimide on treatment with ethanolic KOH gives potassium phthalimide which on heating with a suitable alkyl halide gives N-substituted phthalimide, which upon subsequent hydrolysis with alkali gives primary amines.



This reaction is called Gabriel phthalimide reaction.

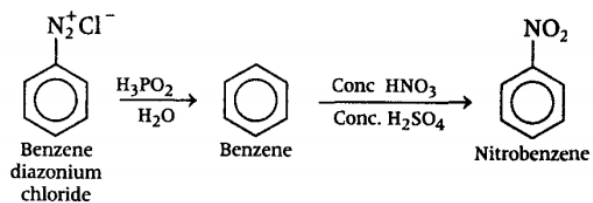
- ii. Coupling reaction Arenediazonium salts react with highly reactive (i.e. electron-rich) aromatic compounds such as aniline, phenols to form brightly coloured azo compounds, Ar-N=N-Ar. This reaction is called a coupling reaction. e.g. Benzene diazonium chloride reacts with aniline in faintly acidic medium (pH 4- 5) at 273-278K, in which the molecule at its para-position is coupled with the diazonium salt to form p-aminoazobenzene.

This is an example of a coupling reaction.

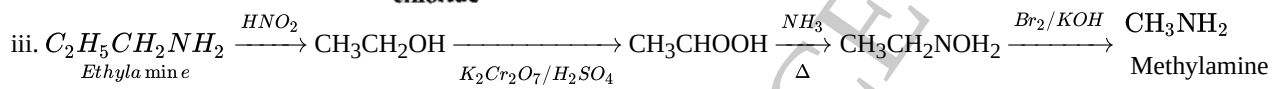
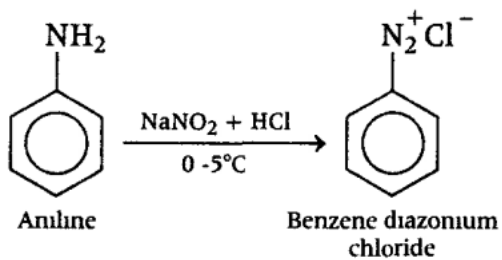


OR

i.



ii.



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