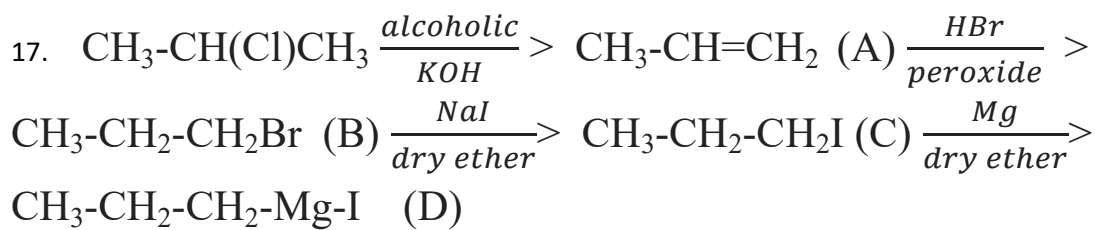


CLASS – 12(CHEMISTRY)

MARKING SCHEME FOR PREBOARD 1(2020-2021)

- 1.(i) A
- 1.(ii) C
- 1.(iii) C
- 1.(iv) C OR A
- 2.(i) C
- 2.(ii) B OR D
- 2.(iii) C
- 2.(iv) D
3. B
4. C OR A
5. C
6. D OR C
7. A OR B
8. A OR C
9. B
10. A
11. B
12. C
13. A
14. E OR A
15. E
16. D



(1/2 mark for each compound)

OR

The reasons are:

(i) Due to resonance/diagrammatic representation, C – Cl bond acquires a partial double bond character. As a result, the C – Cl bond in chlorobenzene is shorter and hence stronger. Thus, cleavage of C –

Cl bond in benzene becomes difficult which makes it less reactive towards nucleophilic substitution.

(ii) Due to repulsion between nucleophile and electron rich arenes.

(1+1)

18. . Given : $w_2 = 1.25$ g, $w_1 = 99$ g

$$\Delta T_b = 80.31 - 80.10^\circ\text{C} = 0.21^\circ\text{C}$$

1/2

$$K_b = 2.53^\circ\text{C kg mol}^{-1}$$

According to the formula :

$$\Delta T_b = K_b \times m$$

1/2

$$\Delta T_b = K_b \times \frac{w_2 \times 1000}{w_1 \times M}$$

$$M_2 = \frac{1000 K_b w_2}{w_1 \times \Delta T}$$

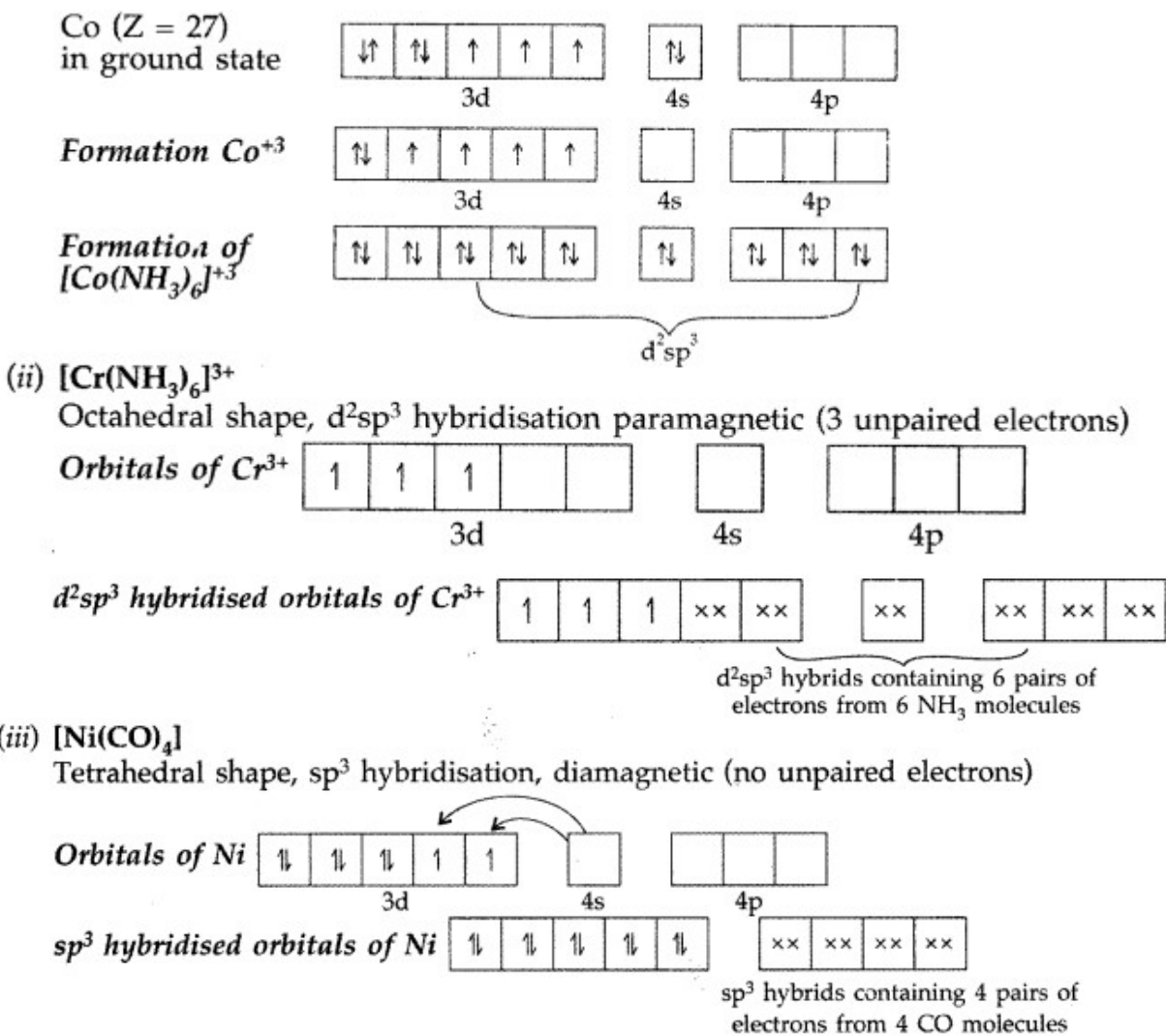
Substituting these values in the formula, we get

1

$$\begin{aligned} M_2 &= \frac{1000 \times 2.53 \times 1.25}{99 \times 0.21} = 3162.5 / 20.79 \\ &= 152 \text{ g mol}^{-1} \end{aligned}$$

19. (i) $[\text{Co}(\text{NH}_3)_6]^{+3} \rightarrow$ Octahedral shape, d^2sp^3 hybridisation, diamagnetic

Formation of $[\text{Co}(\text{NH}_2)_6]^{+3} \rightarrow$ oxidation state of Co is +3.



(2)

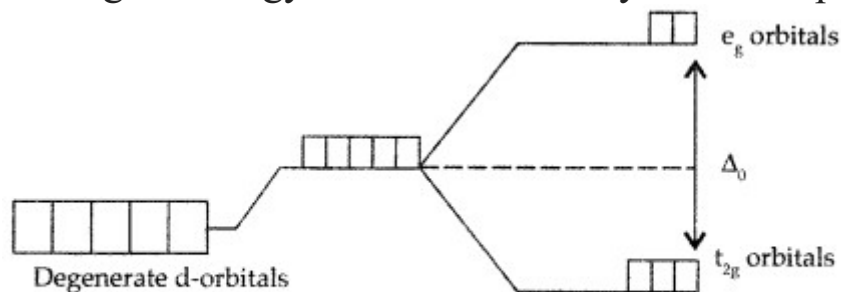
Or

19. (i) Ambidentate ligand : The monodentate ligands with more than one coordinating atoms is known as ambidentate ligand. Monodentate ligands have only one atom capable of binding to a central metal atom or ion. For example, the nitrate ion NO_2^- can bind to the central metal atom/ion at either the nitrogen atom or one of the oxygen atoms.
Example : — SCN thiocyanate, — NCS isothiocyanate

1

(ii) Crystal field splitting: It is the splitting of the degenerate energy levels due to the presence of ligands. When ligand approaches a

transition metal ion, the degenerate d-orbitals split into two sets, one with lower energy and the other with higher energy. This is known as crystal field splitting and the difference between the lower energy set and higher energy set is known as crystal field splitting energy (CFSE)



Splitting of d-orbitals in an octahedral complex

1

20. For a zero order reaction,

1

$$\text{Time, } t = \frac{1}{K} [(A)_0 - (A)]$$

$$\text{or, } t = \frac{1}{0.003} (0.10 - 0.075)$$

$$\therefore \text{Time, } t = \frac{1}{0.003} \times \frac{0.025}{1} = \frac{25}{3} = 8.3 \text{ seconds}$$

1

OR

Using formula :

$$t_{1/2} = \frac{0.693}{K} \Rightarrow 693 \text{ s} = \frac{0.693}{K}$$

$$\therefore K = \frac{0.693}{693} \quad \therefore K = 0.001 \text{ s}^{-1}$$

Using formula :

$$K = \frac{2.303}{t} \log \frac{a}{a-x} \Rightarrow t = \frac{2.303}{K} \log \frac{a}{a-x}$$

$$\Rightarrow t = \frac{2.303}{0.001} \log \frac{a}{a-0.9a} \Rightarrow t = \frac{2.303}{0.001} \log \frac{1}{0.1}$$

$$\Rightarrow t = 2303 \log 10 \quad \Rightarrow t = 2303 \times 1$$

$$\therefore t = 2303 \text{ s}$$

(1mark for calculating K and 1 mark for calculating t)

21. (a) According to the formula : $r = k[A]^{1/2} [B]^2$

Order w.r.t. A = $\frac{1}{2}$, Order w.r.t B = 2

$$\therefore \text{Overall order} = \frac{1}{2} + \frac{2}{1} = \frac{5}{2}$$

(b) For first order reaction, $t_{1/2} = \frac{0.693}{k}$

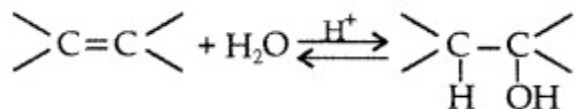
Given: $k = 5.5 \times 10^{-14} \text{ s}^{-1}$

$$\text{Thus, } t_{1/2} = \frac{0.693}{5.5 \times 10^{-14} \text{ s}^{-1}}$$

Hence $t_{1/2} = 1.26 \times 10^{13} \text{ s}$

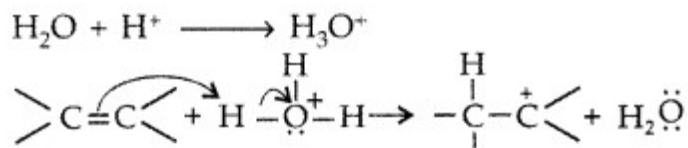
(1mark for each part)

22. Acid catalysed hydration : Alkenes react with water in the presence of acid as catalyst to form alcohols

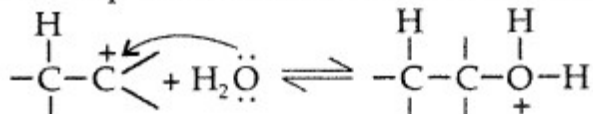


Mechanism : It involves three steps :

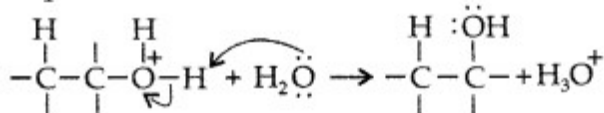
(i) Protonation of alkene to form carbocation by electrophilic attack of H_3O^+



(ii) Nucleophilic attack of water on carbocation

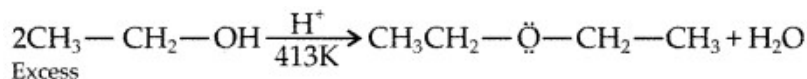


(iii) Deprotonation to form an alcohol

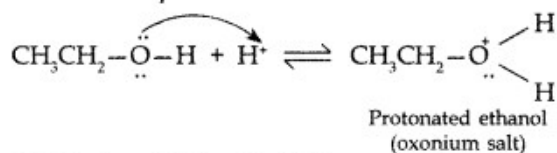


(2)

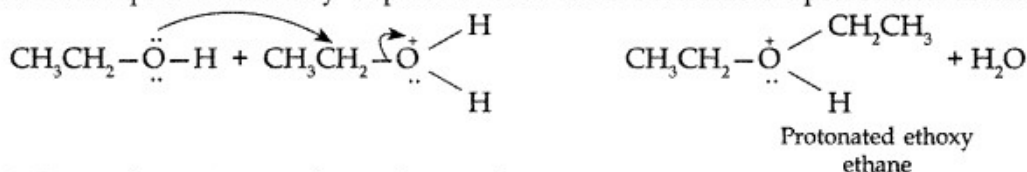
OR



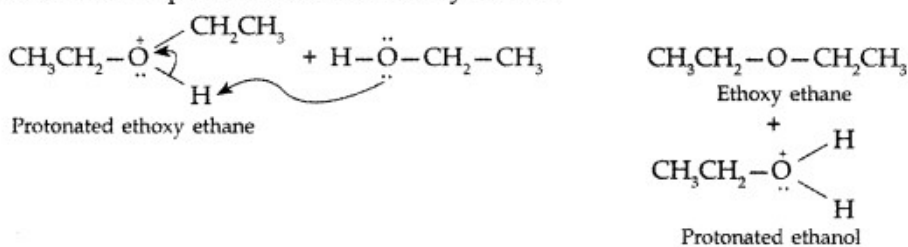
Mechanism: Step 1: Protonation of alcohol



Step 2: Nucleophilic attack by unprotonated alcohol molecule on protonated alcohol molecule

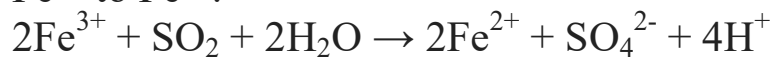


Step 3: Loss of a proton to form ethoxy ethane

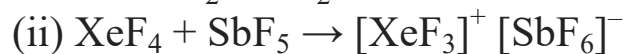


(2)

23. (i) In this sulphur dioxide acts as a reducing agent and reduces Fe^{3+} to Fe^{2+} .

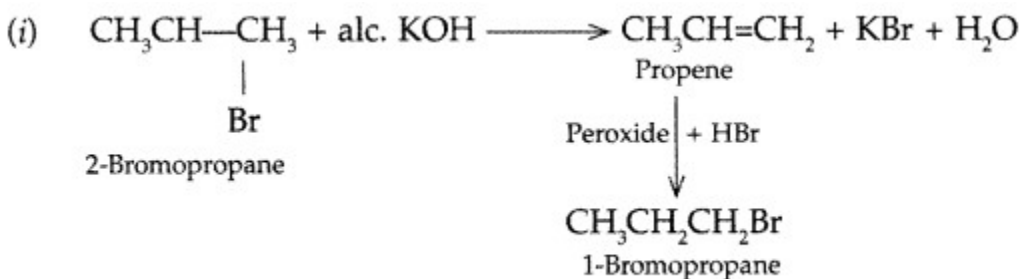


1

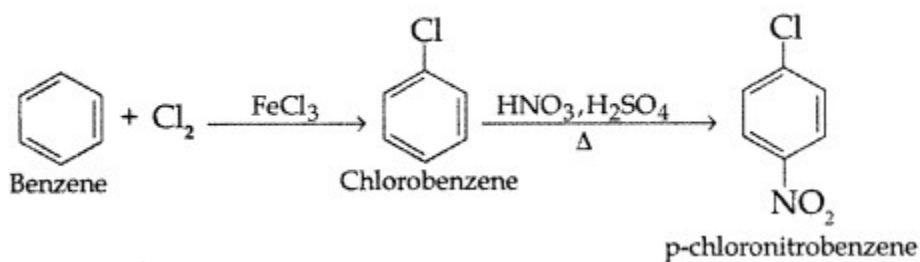


1

24. Answer:



(ii) Benzene to p-chloronitrobenzene



(1+1)

25. Given : $\rho = 11.2 \text{ g cm}^{-3}$, $a = 4 \times 10^{-8} \text{ cm}$

For fee lattice, $Z = 4$

Using formula,

$$M = \frac{\rho \times a^3 \times N_A}{Z}$$

$$M = \frac{(11.2)(4 \times 10^{-8})^3(6.022 \times 10^{23})}{4}$$

$$= \frac{4316.56 \times 10^{-1}}{4}$$

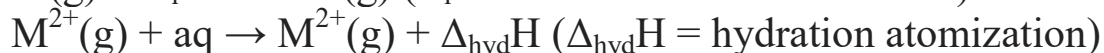
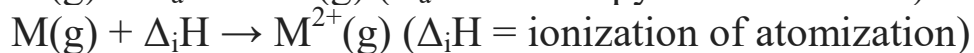
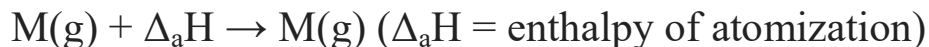
$$= 107.91 \text{ g/mol}^{-1}$$

(1/2 mark for value of Z, 1/2 for formula and 1 mark for calculation)

26. (i) Zn^{2+} salts are colourless due to absence of unpaired electrons in its ground state and ionic state i.e. $\text{Zn}^{2+} = [\text{Ar}] 3d^{10}4s^04p^0$

(1 mark)

(ii) The E_M^0/M for any metal is related to the sum of the enthalpy changes taking place in the following steps :



Copper has high enthalpy of atomization (i.e. energy absorbed) and low enthalpy of hydration (i.e. energy released). Hence $E^0_{M^{2+}/M}$ for copper is positive. The high energy required to transform Cu(s) to Cu²⁺(aq) is not balanced by its hydration enthalpy. (1 mark)

(iii) Because of very small energy gap between 5f, 6d and 7s subshells all their electrons can take part in bonding and shows variable oxidation states.

(1 mark)

OR

(i) Copper exhibits + 1 oxidation state more frequently i.e., Cu⁺ because of its electronic configuration 3d¹⁰4s¹. It can easily lose 4s¹ electron to give stable 3d¹⁰ configuration. (1 mark)

(ii) Sc³⁺ = 4s⁰ 3d⁰ = no unpaired electron

V³⁺ = 3d² 4s⁰ = 2 unpaired electron

Ti⁴⁺ = 3d⁰ 4s⁰ = no unpaired electron

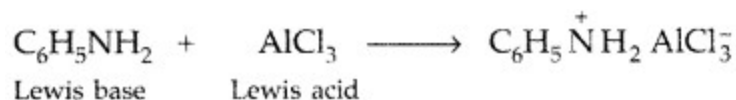
Mn²⁺ = 3d⁵ 4s⁰ = 5 unpaired electron

Thus V³⁺ and Mn²⁺ are coloured in their aqueous solution due to presence of unpaired electron. (2 mark)

27. (i) Due to presence of two H-atoms on N-atom of primary amines, they undergo extensive intermolecular H-bonding while tertiary amines due to the absence of a H-atom on the N-atom, do not undergo H-bonding. As a result, primary amines have higher boiling points than 3° amines.

(ii) Aniline being a Lewis base reacts with Lewis acid AlCl₃ to form a

salt.



As a result, N of aniline acquires positive charge and hence it acts as a strong deactivating group for electrophilic substitution reaction.

Consequently, aniline does not undergo Friedel Craft reaction.

(iii) Due to more steric hindrance in $(\text{CH}_3)_3\text{N}$ it is less basic than $(\text{CH}_3)_2\text{NH}$.

(1+1+1)

OR

Answer:

(i)

(a) In aniline, the lone pair of electrons on the N-atom is delocalised over the benzene ring. As a result, the electron density on the nitrogen decreases.

But in cyclohexylamine, the lone pair of electrons on N-atom is readily available due to absence of π -electrons. Hence aniline is weaker base than cyclohexylamine.

(b) Because the primary amine formed by ammonolysis itself acts as a nucleophile and produces further 2° and 3° alkyl amine.

(ii) p-Nitroaniline < Aniline < p-Toluidine

(1+1+1)

28. (i) This is due to metal excess defect due to anionic vacancies in which the anionic sites are occupied by unpaired electrons (F-centres).

(1)

(ii) 98 Ni-atoms are associated with 100 O – atoms. Out of 98, Ni-atoms, suppose Ni present as $\text{Ni}^{2+} = x$

Then Ni present as $\text{Ni}^{3+} = 98 - x$

Total charge on $x \text{Ni}^{2+}$ and $(98 - x) \text{Ni}^{3+}$ should be equal to charge on 100 O^{2-} ions.

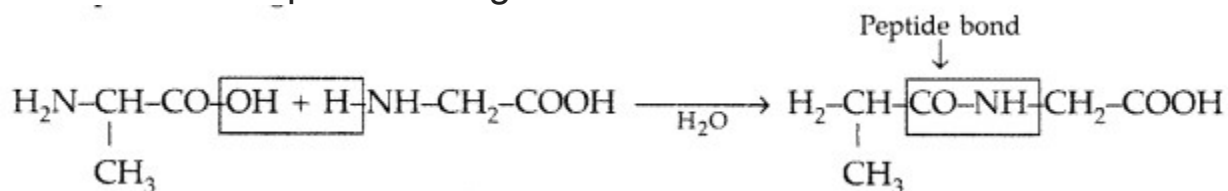
Hence, $x \times 2 + (98 - x) \times 3 = 100 \times 2$ or $2x + 294 - 3x = 200$ or $x = 94$

\therefore Fraction of Ni present as $\text{Ni}^{2+} = (94/98) \times 100 = 96\%$

Fraction of Ni present as $\text{Ni}^{3+} = (4/98) \times 100 = 4\%$

(2)

29. (i) Peptide linkage : A peptide linkage is an amide linkage formed between – COOH group of one α -amino acid and NH_2 group of the other α -amino acid by loss of a molecule of water. The CO-NH -bond formed is called peptide linkage.

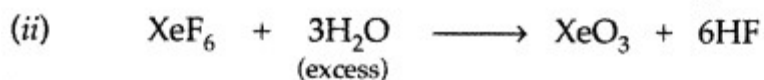
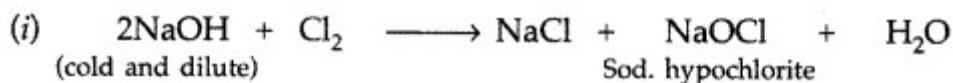


(ii) Primary structure : Proteins may have one or more polypeptide chains. Each polypeptide in a protein has amino acids linked with each other in a specific sequence and it is this sequence of amino acids that is called the primary structure of that protein.

(iii) Denaturation : Due to coagulation of globular protein under the influence of change in temperature, change in pH etc., the native shape of the protein is destroyed and biological activity is lost and the formed protein is called denaturated proteins and the phenomenon is denaturation.

(1+1+1)

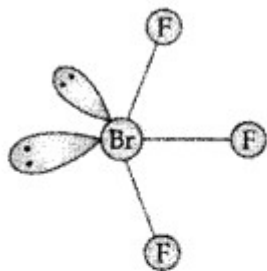
30. (a)



(1)

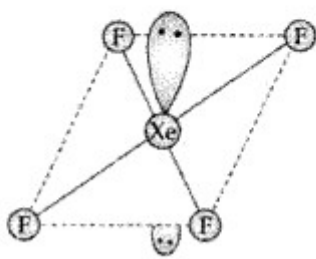
(b)

(i) BrF_3



T-shape

(ii) XeF_4



Square planar

(2)

31. (i) Because in NH_4^+ ion there is no lone pair of electrons which is present in NH_3 due to which lone pair-bond pair repulsion occurs and bond angle decreases from $109^\circ 28'$ to 107.3° .

(ii) Because I-Cl bond is weaker than I-I bond as a result of which ICl breaks easily to form halogen atoms which readily bring about the reaction, hence more reactive.

(iii) Due to smaller size of F than Cl as a result of which electron-electron repulsions between the lone pairs of electrons are very large than that of Cl, hence bond dissociation energy of F_2 is less than that of Cl_2 .

(iv) Since the size of sulphur is more than oxygen, S-H bond length increases and hence bond dissociation energy of S-H is less than O-H. Therefore S-H easily loses H^+ and thus is more acidic than H_2O .

(v) Because SF_6 is showing steric hindrance due to 6 (six) fluorine atoms which make it unable to react further with any other atom.

(1+1+1+1+1)

OR

(i) $BiCl_3$ is more stable than $BiCl_5$ due to inert pair effect because as we move down the group, the stability of +3 oxidation state increases and of +5 decreases.

(ii) Chlorine bleaches the material by oxidation hence it is permanent while SO_2 bleaches the material by reduction and as the material is exposed to air, it gets oxidised and the colour is restored, hence it is temporary.

(iii) Due to presence of weak Van der waal forces of attraction, noble gases have very low boiling point. Helium has the lowest boiling point (4.2K).

(iv) Because sulphur in vapour state has two unpaired electrons in the antibonding π^* orbitals like O_2 .

(v) $Cl_2 + 3F_2$ (excess) \rightarrow $2ClF_3$ (1+1+1+1+1)

32.

(i) $2Fe^{3+} (aq) + 2I^- (aq) \rightarrow 2Fe^{2+} (aq) + I_2 (s)$
For the given reaction, $n = 2$, $E^\circ = 0.236 V$

Using formula

$$\begin{aligned}\Delta G^\circ &= -nF E^\circ_{\text{cell}} \\ &= -2 \times 96,500 \text{ C mol}^{-1} \times 0.236 \text{ V} \\ \therefore \Delta G^\circ &= -45.55 \text{ kJ mol}^{-1}\end{aligned}\quad (2)$$

(ii) For hydrogen electrode, $\text{H}^+ + \text{e}^- \rightarrow 1/2\text{H}_2$

Applying Nernst equation,

$$\begin{aligned}E_{(\text{H}^+ / 1/2 \text{H}_2)} &= E^\circ_{(\text{H}^+ / 1/2 \text{H}_2)} - \frac{0.0591}{n} \log \frac{1}{[\text{H}^+]} \\ &= 0 - \frac{0.0591}{1} \log \frac{1}{(10^{-10})} \\ &= 0 - \frac{0.0591}{1} \times (10 \log 10) = -0.591 \text{ V}\end{aligned}\quad [\text{pH} = 10 ; [\text{H}^+] = 10^{-10} \text{ M}]$$

(2)

(iii) A is a strong electrolyte and B is a weak electrolyte. (1)

OR

(i) The reaction takes place in cell as

$$\begin{aligned}\text{Cu} + 2\text{Ag}^+ &\longrightarrow \text{Cu}^{2+} + 2\text{Ag} \\ (0.001 \text{ M}) & \quad (0.10) \\ \text{Cu}/\text{Cu}^{2+} (0.10) & \parallel \text{Ag}^+ (0.001\text{M})/\text{Ag}\end{aligned}$$
$$\begin{aligned}E_{\text{cell}} &= E^\circ_{\text{cell}} - \frac{0.059}{n} \log \frac{[\text{Cu}^{2+}]}{[\text{Ag}^+]^2} \\ E_{\text{cell}} &= 0.46 - \frac{0.059}{2} \log \frac{0.1}{(0.001)^2} \\ &= 0.46 - \frac{0.059}{2} \log 10^5 \\ &= 0.46 - \frac{0.059}{2} \times 5 \log 10 \\ &= 0.46 - \frac{0.059}{2} \times 5 \\ &= 0.46 - 0.1475 = 0.3125\end{aligned}\quad (2.5)$$

(ii) Concentration is 2.5×10^{-4} M

$$K = 5.25 \times 10^{-5} \text{ Scm}^{-1}.$$

$$\begin{aligned}\Lambda_c^m &= K \times \frac{1000}{\text{concentration}} \\ &= \frac{5.25 \times 10^{-5} \times 1000}{2.5 \times 10^{-4}} \text{ Scm}^2 \text{ mol}^{-1} \\ &= \frac{5.25 \times 10^2}{2.5} = \frac{525}{2.5} = 210 \text{ Scm}^2 \text{ mol}^{-1}\end{aligned}$$

Molar conductivity at infinite dilution,

$$\begin{aligned}\Lambda_m^0 &= \lambda^0 \text{H}^+ + \lambda^0 \text{HCOO}^- = (349.5 + 50.5) \\ &= 400 \text{ Scm}^2 \text{ mol}^{-1}\end{aligned}$$

Degree of dissociation,

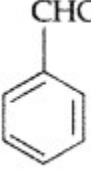
$$\alpha = \frac{\Lambda_m^c}{\Lambda_m^0} = \frac{210}{400} = \frac{21}{40} = 0.525$$

$$\text{Dissociation constant} = C\alpha^2/(1-\alpha)$$

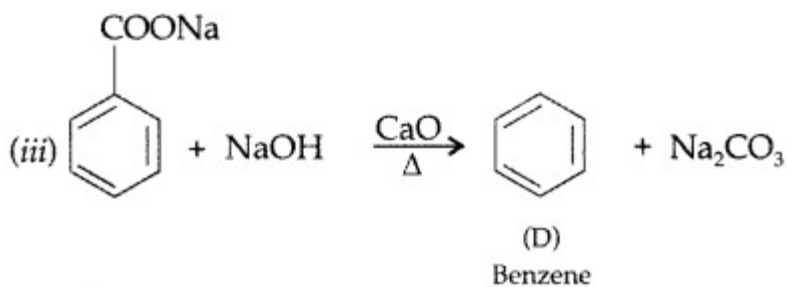
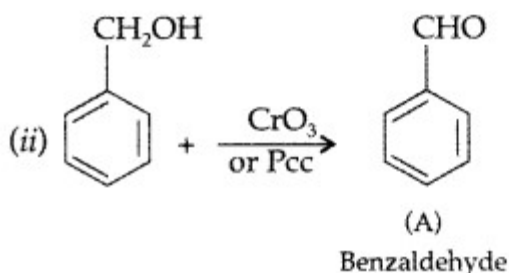
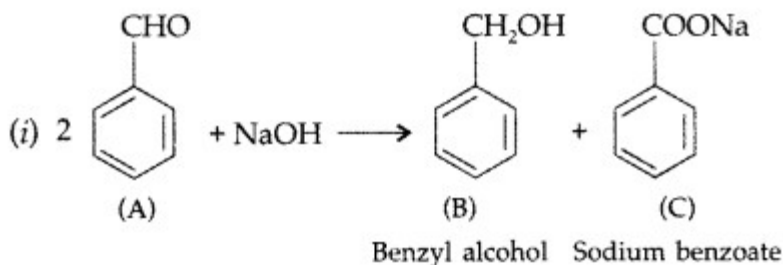
$$= 2.5 \times 10^{-4} \times (0.525)^2 / (1-0.525)$$

$$= 1.45 \times 10^{-4} \text{ mol L}^{-1} \quad (2.5)$$

33. (i) (A) gives characteristic odour which on treatment with NaOH and forms two compounds B and C.

∴ (A) should be benzaldehyde 
(A)

Reactions :



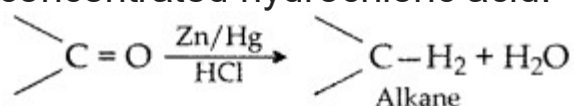
(4)

(ii) The benzene ring of benzoic acid undergoes electrophilic substitution reaction such as nitration, sulphonation etc. Since the —COOH group in benzene is an electron withdrawing group, therefore it is meta directing group. (1)

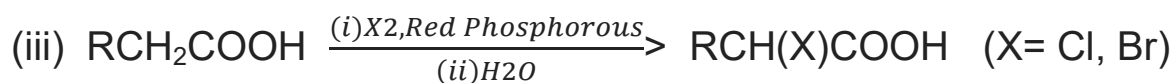
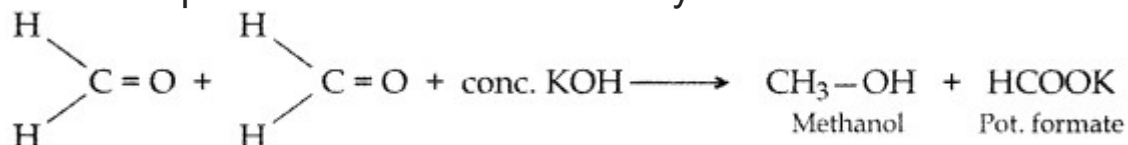
OR

(i) Clemmensen reduction. The carbonyl group of aldehyde and ketones is reduced to CH₂ group on treatment with zinc amalgam and

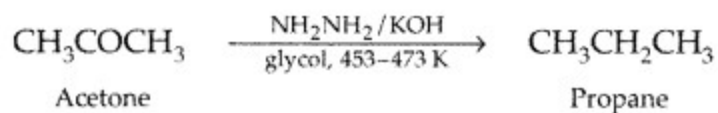
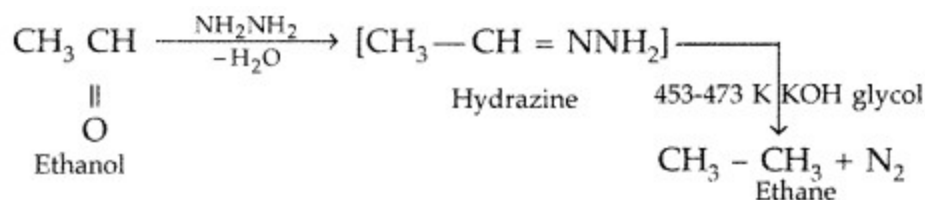
concentrated hydrochloric acid.



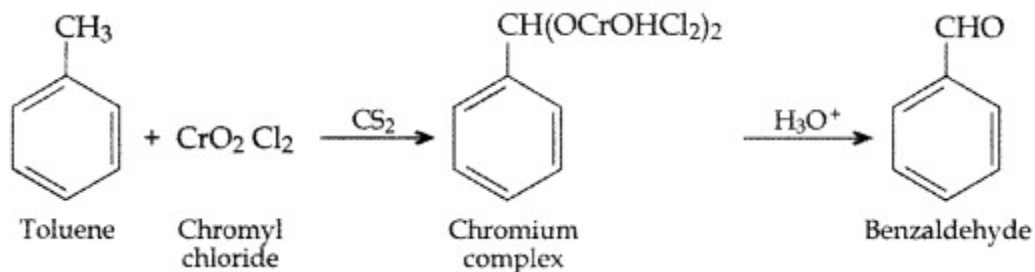
(ii) Cannizzaro reaction. Aldehydes, which do not have an α -hydrogen atom undergo self oxidation and reduction on treatment with conc. alkali and produce alcohol and carboxylic acid salt.



(iv) Wolff-Kishner reduction



(v) Etard reaction



(1+1+1+1+1)

