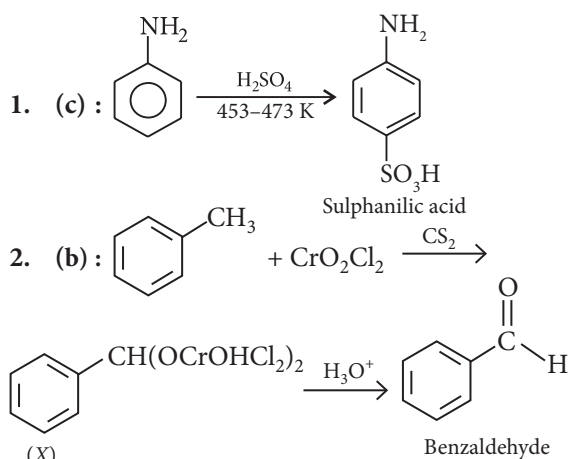
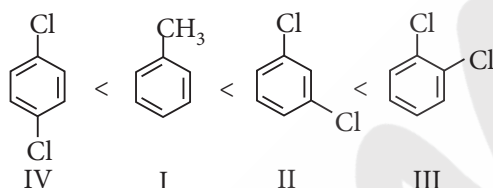


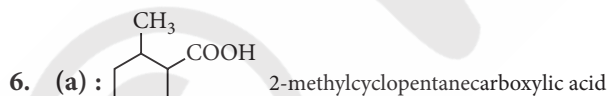


3. (d)

4. (b) : In *p*-dichlorobenzene, the two equal dipoles are in opposite direction, hence the molecule has zero dipole moment. In *o*- and *m*-dichlorobenzenes, the two dipoles are aligned at 60° and 120° respectively, and the resultant dipole moment of *o*-dichlorobenzene is obtained to be much higher than that of *m*-isomer. Lastly, toluene with a +I group possesses little dipole moment. Thus, the overall order is



5. (b) : $\text{Rate} = \frac{1}{4} \frac{d[\text{NO}_2]}{dt}$
 $= \frac{1}{4} \times 0.0125 = 0.0031 \text{ mol L}^{-1} \text{ s}^{-1}$



7. (a)

8. (d) : Isomers that differ only in configuration at C-1 are called anomers.

9. (a) : Mn^{2+} has 5 unpaired electrons.

10. (d) : $k = \frac{0.693}{1386} = 0.5 \times 10^{-3} \text{ s}^{-1}$

11. (b) : Dye test is used to distinguish between primary aromatic amines and primary aliphatic amines.

12. (a) : Greater the number of alkyl groups attached to the carbonyl group, lower will be its reactivity. $\text{III} > \text{II} > \text{I}$.

13. (b) : $[\text{Fe}(\text{CN})_6]^{3-}$ possess one unpaired electron to show paramagnetic nature while $[\text{Fe}(\text{CN})_6]^{4-}$ possess no unpaired electron and thus shows diamagnetic nature.

14. (a)

15. (b)

16. (b) : $t_{1/2} = \frac{2.303}{k_1} \log 2$

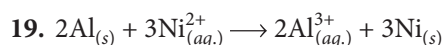
17. (a) As KCl is an electrolyte and one formula unit of KCl dissociates to give two ions (K^+ and Cl^-), therefore molar concentration of particles in the solution $= 0.1 \times 2 \text{ M} = 0.2 \text{ M}$

As elevation of boiling point (or any colligative property) is directly proportional to number of particles in solution, hence 0.1 M KCl has higher boiling point than that 0.1 M glucose.

(b) Salting is used because most bacteria, fungi and other potentially pathogenic organisms cannot survive in a highly salty environment, due to the hypertonic nature of salt. Any living cell in such an environment will become dehydrated through osmosis and die or become temporarily deactivated.

18. (a) Sc^{3+} has $3d^0$ outer electronic configuration, therefore it is diamagnetic in nature whereas Cr^{3+} has $3d^3$ outer electronic configuration. So, it is paramagnetic due to presence of unpaired electrons.

(b) Chromium has higher melting and boiling points. In a particular series, the metallic strength increases upto middle with increasing number of unpaired electrons, i.e., upto d^5 configuration. After Mn, the number of unpaired electrons goes on decreasing. Accordingly, the m.pt and b.pt. decrease after middle because of increasing pairing of electrons.



$E_{\text{cell}}^{\circ} = E_{\text{Ni}^{2+}/\text{Ni}}^{\circ} - E_{\text{Al}^{3+}/\text{Al}}^{\circ} = -0.25 - (-1.66) = 1.41 \text{ V}$

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{n} \log \frac{[\text{Al}^{3+}]^2}{[\text{Ni}^{2+}]^3}$$

$$= 1.41 - \frac{0.0591}{6} \log \frac{(0.001)^2}{(0.1)^3} = 1.41 - \frac{0.0591}{6} \log 10^{-3}$$

$$= 1.41 + \frac{0.0591}{6} \times 3 \times 1 = 1.439 \text{ V}$$

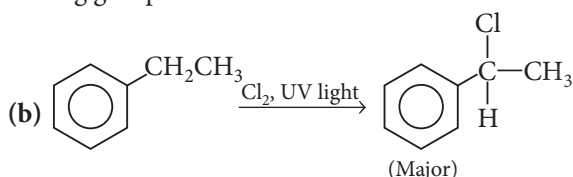
20. The C-Cl bond in $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ is longer than C-Cl bond in $\text{C}_6\text{H}_5\text{Cl}$.

Reason :

- The C-Cl bond in chlorobenzene has a partial double bond character due to resonance. So, the C-Cl bond in chlorobenzene is shorter than in $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$.

OR

(a)  will show faster $\text{S}_{\text{N}}2$ reaction as I^- is a better leaving group than Br^- .



21. (a) The —OH group present on the C-5 atom in the glucose molecule forms a six-membered ring with the —CHO group to form a cyclic hemiacetal structure. Thus, glucose does not give a positive result with the Schiff's reagent in the Schiff's test.

(b) The carbonyl group present in glucose is aldehydic.

22. According to first law of electrolysis,

$$w = ZIt$$

$$w = \frac{\text{Eq. wt.}}{F} \times It$$

$$w_{\text{Cu}} = 2 \text{ g}; I = 2 \text{ A}$$

$$2 = \frac{31.75}{96500} \times 2 \times t \Rightarrow t = \frac{96500 \times 2}{2 \times 31.75} = 3040 \text{ sec}$$

$$\text{Eq. wt. of } \text{Cu}^{2+} = 31.75$$

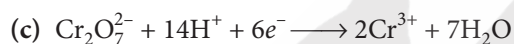
According to second law of electrolysis,

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

$$\frac{w_{\text{Zn}}}{2} = \frac{32.5}{31.75}; w_{\text{Zn}} = \frac{32.5 \times 2}{31.75} = 2.047 \text{ g}$$

23. (a) Outer electronic configuration of chromium is $3d^5 4s^1$ whereas outer electronic configuration of zinc is $3d^{10} 4s^2$. Due to stable completely filled electronic configuration, zinc has higher first ionisation enthalpy than chromium. Also chromium achieves stable half-filled configuration after losing one electron.

(b) Due to the presence of one unpaired electron, K_2MnO_4 is paramagnetic. KMnO_4 is diamagnetic due to the absence of unpaired electron.

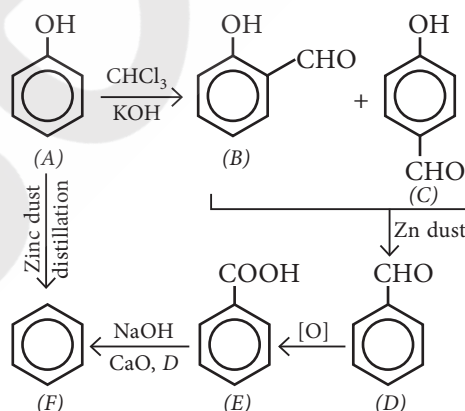


(d) Formula of oxoanion of manganese is MnO_4^- .

Oxidation state of Mn in this oxoanion = + 7

Group number of Mn is 7.

24. Molecular formula of (E) is $\text{C}_7\text{H}_6\text{O}_2$ and reaction of its sodium salt with soda lime (decarboxylation) to form (F) indicates that (E) and (F) should be $\text{C}_6\text{H}_5\text{COOH}$ and C_6H_6 respectively. Since (F) is also obtained from (A) by reaction with Zn dust, it indicates that (A) should be phenol.

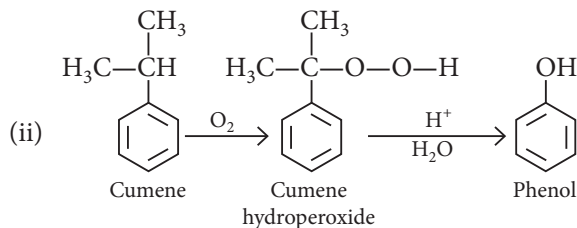
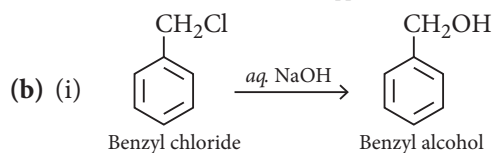
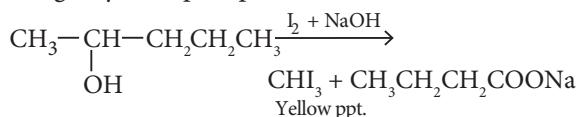


25. (a) As amino acids have both acidic (carboxy group) and basic groups (amino group) in the same molecule, they react with both acids and bases. Hence, they show amphoteric behaviour.

(b) In α -helix structure, intramolecular H-bonding takes place whereas in β -pleated structure, intermolecular H-bonding takes place.

(c) Acidic amino acids are those which contain more number of carboxyl groups as compared to amino groups whereas basic amino acids are those which contains more number of amino groups than carboxyl groups.

26. (a) On adding I_2 and $NaOH$, 2-pentanol will give yellow precipitate of iodoform whereas 3-pentanol will not give yellow precipitate.



27. (a) 1-Bromopentane

(b) 2-Bromopentane

(c) 2-Bromo-2-methylbutane

28. (a) $\Delta G^\circ = -nFE^\circ_{\text{cell}}$

$$E^\circ_{\text{cell}} = \frac{-\Delta G^\circ}{nF} = \frac{300 \times 1000 \text{ J mol}^{-1}}{2 \times 96500 \text{ C mol}^{-1}} = 1.55 \text{ V}$$

$$\begin{aligned} (b) \Lambda_m^\circ(\text{MgCl}_2) &= \lambda_m^\circ(\text{Mg}^{2+}) + 2\lambda_m^\circ(\text{Cl}^-) \\ &= 106 \text{ S cm}^2 \text{ mol}^{-1} + 2 \times 76.3 \text{ S cm}^2 \text{ mol}^{-1} \\ &= 258.6 \text{ S cm}^2 \text{ mol}^{-1} \end{aligned}$$

29. (a) For a first order reaction,

$$t_{1/2} = \frac{0.693}{k} = 77.78 \text{ min}$$

$$k = 8.90 \times 10^{-3} \text{ min}^{-1}$$

Time required for 30% completion,

$$t = \frac{2.303}{k} \log \left(\frac{100}{70} \right) = \frac{2.303}{8.90 \times 10^{-3} \text{ min}^{-1}} \log 1.43$$

$$t = 40 \text{ min}$$

$$(b) (ii) : \text{Rate} = k[A]^{\frac{1}{2}}[B]^{\frac{3}{2}}$$

Because reaction is an elementary reaction, hence order

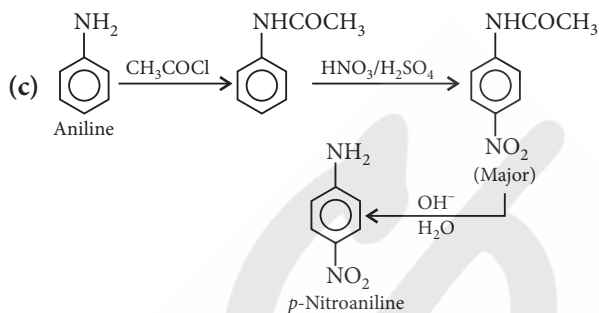
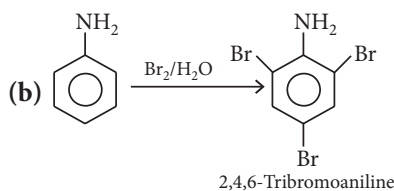
$$\text{of reaction will be } \frac{1}{2} + \frac{3}{2} = 2$$

OR

(iii) : Rate of reaction increases with increase in temperature.

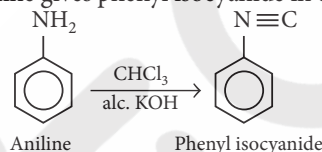
(c) (iii)

30. (a) Azo dye test is used to distinguish between cyclohexylamine and aniline.

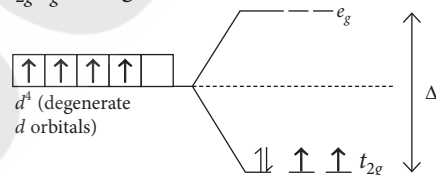


OR

Aniline gives phenyl isocyanide in carbylamine reaction.



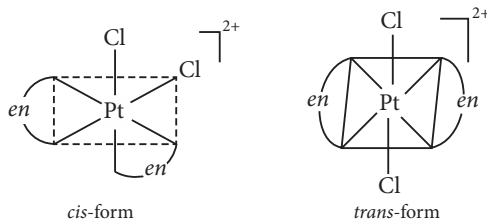
31. (a) On the basis of CFT, if strong field ligand is present for d^4 orbit with $\Delta_o > P$, the energy gap between t_{2g} and e_g will be more and thus the electron will pair up giving $t_{2g}^4 e_g^0$ configuration.



(b) $[\text{Pt}(\text{en})_2\text{Cl}_2]$

Dichloridobis (ethylenediamine) platinum(II)

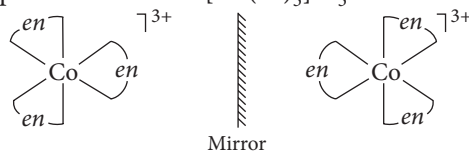
Geometrical isomers of $[\text{Pt}(\text{en})_2\text{Cl}_2]$ are



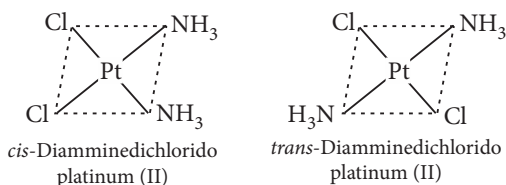
OR

(a) (i) Linkage isomerism : $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$ and $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$

(ii) Optical isomerism : $[\text{Co}(\text{en})_3]^{3+}$

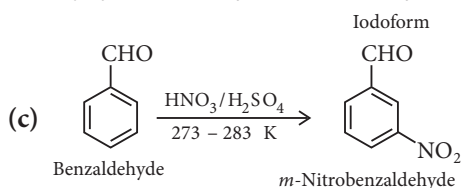
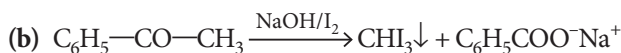
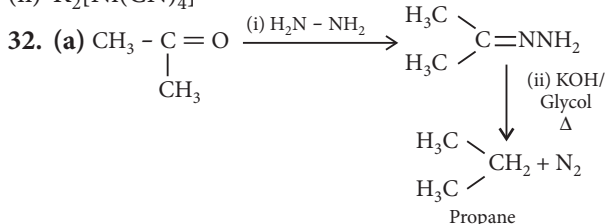


(iii) Geometrical isomerism : $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$



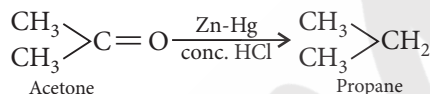
(b) (i) $[(\text{OCNH}_3)_5(\text{ONO})]\text{Cl}_2$

(ii) $\text{K}_2[\text{Ni}(\text{CN})_4]$



OR

(a) **Clemmensen reduction** : The carbonyl group of aldehydes and ketones is reduced to $>\text{CH}_2$ group on treatment with zinc-amalgam in conc. HCl.



(b) **Cannizzaro reaction** : Aldehydes without α -hydrogen atom undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali.



33. (a) **Raoult's law** : For a solution of volatile liquids, the partial pressure of each component in the solution is directly proportional to its mole fraction. Thus, for any component, partial vapour pressure, $p \propto x \Rightarrow p = p^\circ \cdot x$

where, p° = vapour pressure of pure component

x = mole fraction of that component

Let a solution consists of two volatile liquids A and B with their mole fractions x_A and x_B respectively. If p_A and p_B are their partial vapour pressures,

then, $p_A \propto x_A \Rightarrow p_A = p_A^\circ x_A$ and $p_B \propto x_B \Rightarrow p_B = p_B^\circ x_B$ where p_A° and p_B° represent the vapour pressures of pure liquid components A and B.

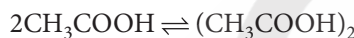
$$P_{\text{total}} = p_A + p_B$$

Ideal solutions obey Raoult's law at all concentrations and temperature.

(b) Positive deviation from ideal behaviour is observed for the solution of ethanol and acetone.

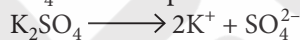
OR

(a) The value of van't Hoff factor for ethanoic acid in benzene is close to 0.5 as two molecules of ethanoic acid associate to form a dimer in benzene solution.



$$i = \frac{\text{Number of solute particles in solution}}{\text{Theoretical number of solute particles}} = \frac{1}{2} = 0.5$$

(b) It has been given that K_2SO_4 is completely dissociated. When K_2SO_4 is dissolved in water, K^+ and SO_4^{2-} ions are produced as shown:



Total number of ions produced = 3

$$\therefore i = 3$$

Given, $w = 2.32 \times 10^{-2} \text{ g}$

$V = 2 \text{ L}$

$$R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$$

$$T = 25^\circ\text{C} = (25 + 273) \text{ K} = 298 \text{ K}$$

$$\text{Molar mass of } \text{K}_2\text{SO}_4 = (2 \times 39) + (1 \times 32) + (4 \times 16) = 174 \text{ g mol}^{-1}$$

Applying the following relation,

$$\pi = i \frac{n}{V} RT = i \times \frac{w}{M} \times \frac{1}{V} RT$$

$$= 3 \times \frac{2.32 \times 10^{-2}}{174} \times \frac{1}{2} \times 0.082 \times 298 = 4.8 \times 10^{-3} \text{ atm}$$

$$(c) \Delta T_f = i K_f m$$

$$\Rightarrow 0.512 = \frac{i \times 5.12 \times 25.6 \times 1000}{32 \times 1000}$$

$$\Rightarrow i = \frac{0.512 \times 32 \times 1000}{5.12 \times 25.6 \times 1000}$$

$$i = \frac{1}{8} = 0.125$$

As ' i ' is less than 1, therefore S is associated, i.e., 8 moles of S are associated as shown $8\text{S} \leftrightarrow \text{S}_8$.

Therefore, the molecular formula of sulphur is S_8 .

