ANSWER OF PRACTICE PAPER 4

1. I- A, II- B or A, III- C, IV-D

2. V-B, VI- A or A, VII-B, VIII- B

3. B

4. D

5. B

6. B or A

7. D

8. C

9. A

10. B

11. A or C

12. C

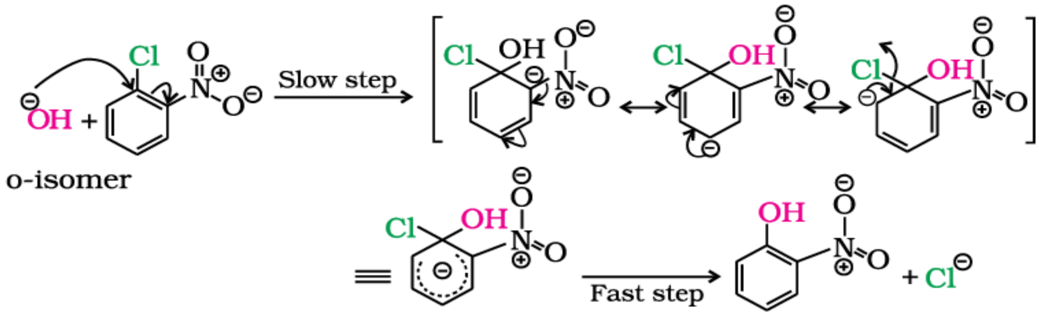
13. C

14. A

15. D or A

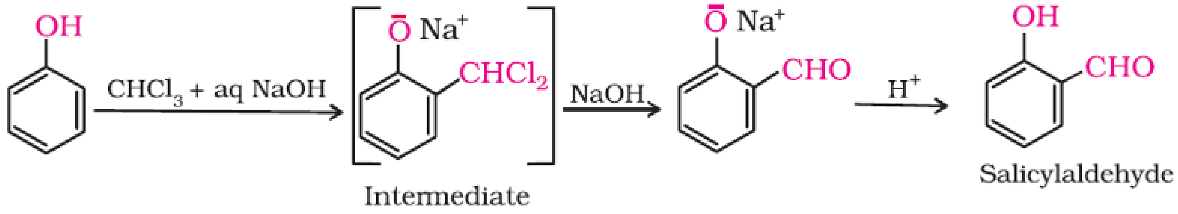
16. A

17. Presence of nitro group at ortho position withdraws electron density from the benzene ring and thus facilitates the attack of nucleophile on haloarene.



OR

Riemer-Tiemann Reaction-



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

Where molality $= \dfrac{\text{no. of moles of glucose}}{\text{Weight of solvent (in kg)}} = \dfrac{18/180 \text{ moles}}{1 \text{ k.g}} = 0.1$ molal

$\Delta T_b = 0.52 \text{ K kg mol}^{-1} \times 0.1 \text{ mol kg}^{-1}$

$T_f - T_i = 0.052$

$T_f - 373.15 = 0.052$

$T_f = 373.202\text{K}$

19. (i) The oxidation state of Ni in $[NiCl_4]^{2-}$ is +2 and the oxidation state of Ni in $[Ni(CO)_4]$ is 0. The presence of strong field ligand CO in $[Ni(CO)_4]$ pairs all the electrons of Ni to give d^{10} configuration in which no unpaired electron is available and hence $[Ni(CO)_4]$ is diamagnetic in nature whereas the presence of weak field ligand Cl^- have d^8 configuration in which 2 unpaired electron is available and hence $[NiCl_4]^{2-}$ is paramagnetic.

(ii) In $[Co(NH_3)_6]^{3+}$, Co is in +3 state and has d^6 configuration. In the presence of NH_3, 3d electrons pair up leaving 2 d-orbitals empty. Hence, the hybridization is d^2sp^3 forming an inner orbital complex whereas Ni has +2 oxidation state in $[Ni(NH_3)_6]^{2+}$ and d^8 configuration which do not pair up. Hence, the hybridization is sp^3d^2 forming an outer orbital complex.

OR

20. **(a)** Rate of reaction = $\frac{-1}{2}\frac{\Delta(N2O5)}{\Delta t} = \frac{-(0.289 - 0.4)\ M}{2\ (20\text{-}0)\ min} = \frac{0.111\ M}{40\ min}$

$= 2.775 \times 10^{-3}\ M\ min^{-1}$

(b) For the 1st order kinetics,

$\log[R_o/R] = kt/2.303$

$\log[0.4/0.289] = k(20\ min)/2.303$

$k = 1.625 \times 10^{-2}\ min^{-1}$

OR

21. For the 1st order kinetics,

$\log[R_o/R] = kt/2.303$

$\log[100/75] = k(20\ min)/2.303$

$k = 1.4 \times 10^{-2}\ min^{-1}$

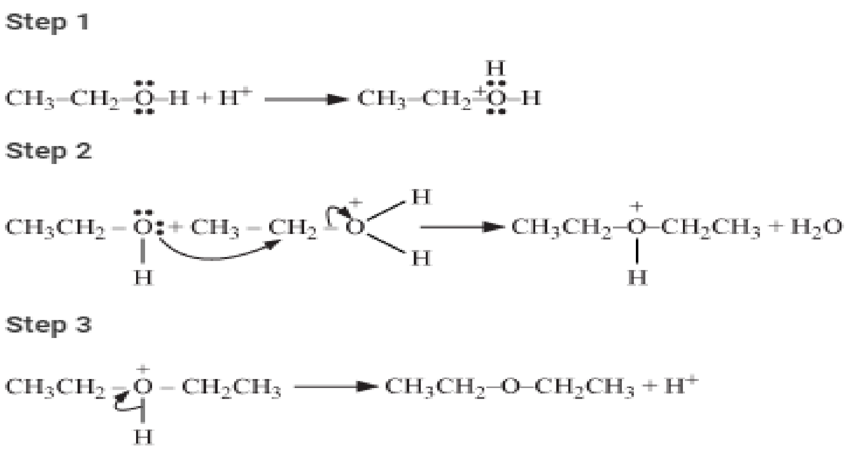
Substituting for 75% completion of reaction-

$\log[R_o/R] = kt/2.303$

$\log[100/25] = 1.4 \times 10^{-2}\ min^{-1}(t)/2.303$

$t = 99\ min$

22. Mechanism for the conversion of ethanol to ethoxy ethane in the presence of H_2SO_4 at 413K.



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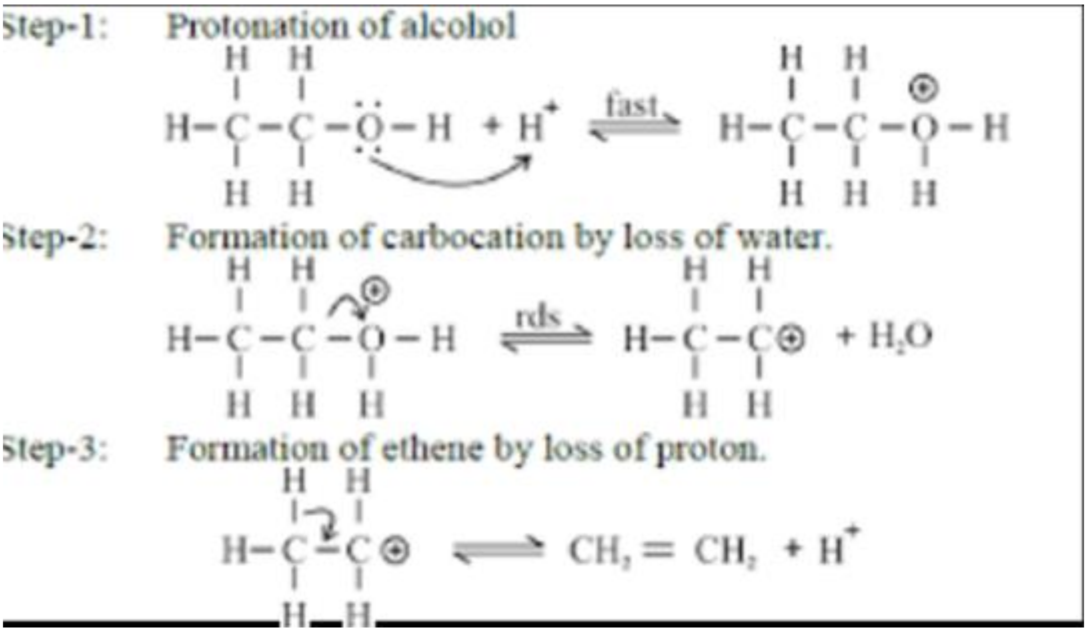
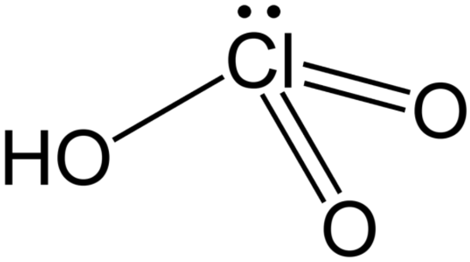
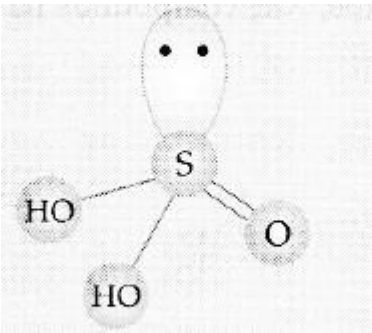


23. (i)



(ii)



24. Total no. of tetrahedral voids = 2 x Total no. of octahedral voids = 2 x Total no. of particles

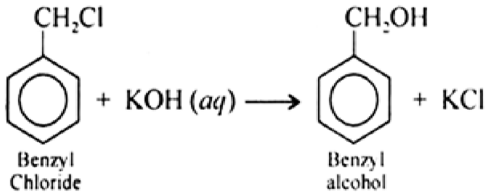
Total no. of tetrahedral voids = 2 x 0.5 mol = 1 mol = 6.022 x 10^{23} voids

Total no. of octahedral voids = 0.5 mol = 0.5 x 6.022 x 10^{23} = 3.011 x 10^{23} voids

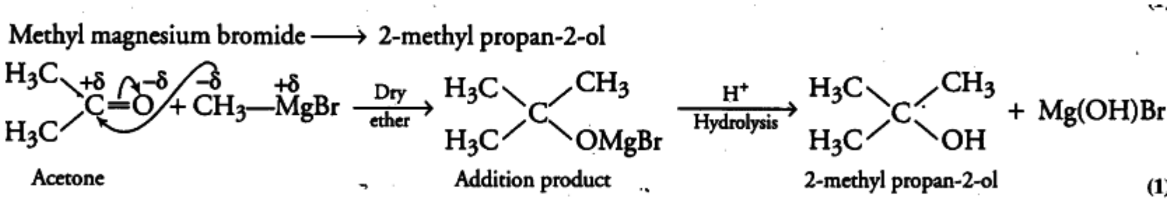
Total no. of voids = Total no. of octahedral voids + Total no. of tetrahedral voids

= 9.033×10^{23} voids

25. (i)



(ii)



26. (i) There are vacant spaces in the lattice of transition metals which can be filled by small atoms like H, C, N etc

(ii) Cr^{2+} has $3d^4$ configuration & It loses electron to form $3d^3$ which has stable half -filled t_{2g} level whereas Mn^{3+} also has $3d^4$ configuration but it gains electron to form Mn^{2+} which has stable half – filled $3d^5$ configuration.

(iii) They have large number of valence electron to form strong metallic bonds.

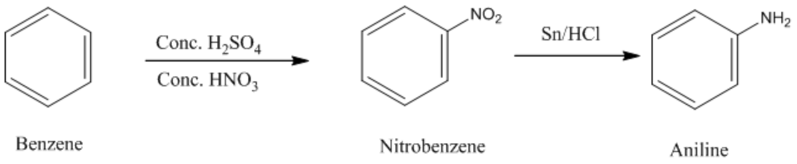
27. i) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

ii)

$$\underset{\text{Methyl amine}}{CH_3NH_2} + CHCl_3 + 3KOH \xrightarrow{\text{Heat}} \underset{\substack{\text{Methyl}\\ \text{isocyanide}\\ \text{(offensive smell)}}}{CH_3N \rightleftarrows C} + 3KCl + 3H_2O$$

$$\underset{\text{Dimethylamine}}{(CH_3)_2NH} + CHCl_3 + 3KOH \xrightarrow{\text{Heat}} \text{No smell}$$

iii)



28.

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

$$\Rightarrow \quad 8 = \frac{2 \times M}{(250 \times 10^{-10})^3 \times (6.022 \times 10^{23})}$$

$$\Rightarrow \quad M = \frac{(250 \times 10^{-10})^3 \times (6.022 \times 10^{23})}{2} \times 8$$

$$\Rightarrow \quad M = \frac{9.409 \times 8}{2} = 37.64 \text{ g mol}^{-1}$$

For *bcc* unit cell,

$$4r = \sqrt{3}a$$

radius,

$$r = \frac{\sqrt{3}a}{4} = \frac{1.732 \times 250}{4}$$

$$= 108.25 \text{ pm}$$

OR

(*i*) $r = 125 \times 10^{-12}$ m,

$$4r = \sqrt{2}a$$

$$\Rightarrow \quad a = \frac{4r}{\sqrt{2}} = r \times 2\sqrt{2} = 125 \times 10^{-12} \times 2\sqrt{2} = 354 \text{ pm}$$

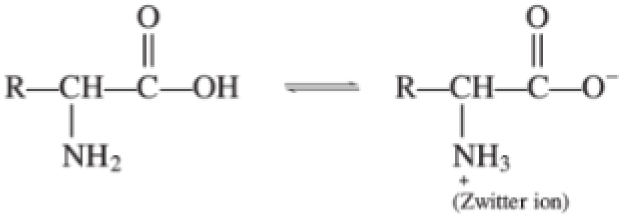
(*ii*) $a^3 = (354)^3 \times (10^{-12})^3 \text{ m}^3 = 44.36 \times 10^{-30} \text{ m}^3$

Number of unit cells in 1 cm^3,

$$= \frac{\text{Total volume}}{\text{Volume of one unit cell}}$$

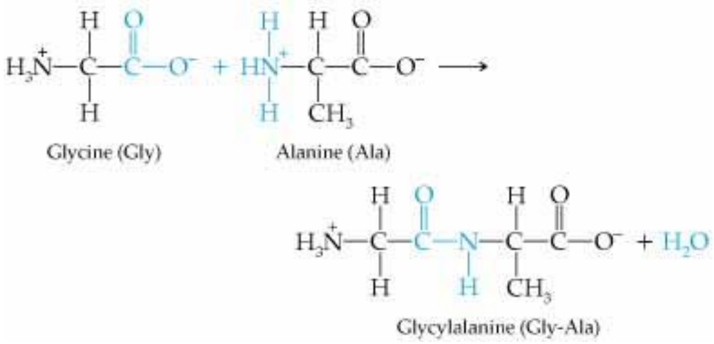
$$= \frac{10^{-6}\text{m}^3}{44.36 \times 10^{-30}\text{ m}^3} = 2.254 \times 10^{22} \text{ unit cells.}$$

29. (i) Due to the formation of zwitter ion



(ii) During denaturation, hydrogen bonds are disturbed due to this globules unfold and helix gets uncoiled and protein losses its biological activity.

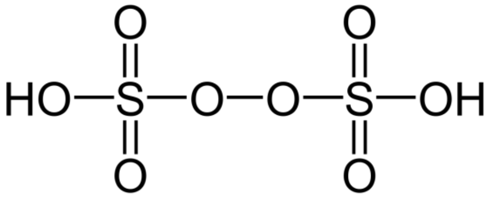
(iii)



30. (i). SF_6 is sterically protected by 6 F-atoms.

(ii) Bleaching action of chlorine is based on oxidation while that of sulphur is based on reduction. Chlorine reacts with water to produce nascent oxygen. This oxygen combines with coloured substance and makes it colourless

(iii)



31. (a) **(i)** $XeF_4 + H_2O \rightarrow Xe + HF + XeO_3 + O_2$

(ii)

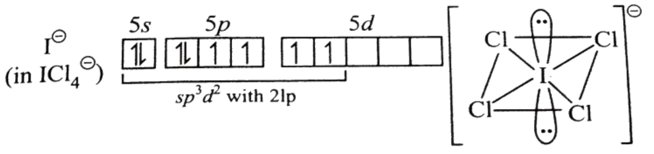
$$3Cl_2 + \underset{\text{(hot \& conc.)}}{6NaOH} \rightarrow 5NaCl + NaClO_3 + 3H_2O$$

(b) ‘X’ is Helium.
It is used as a diluent for oxygen in modern diving apparatus because of its very low solubility in blood.

It is monoatomic having no interatomic forces except weak dispersion forces and has second lowest mass therefore lowest boiling point.

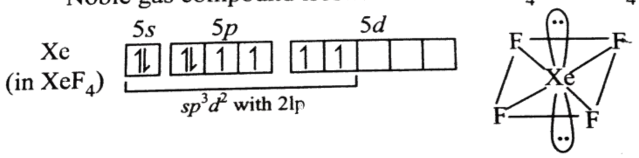
OR

(a) (i)

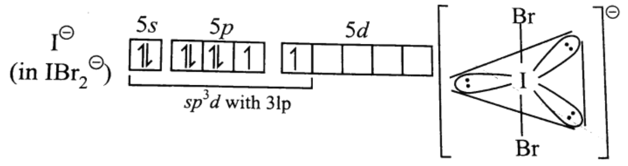


Square planar structure

Noble gas compound isostructural with $ICl_4^{\ominus}$ is XeF_4.

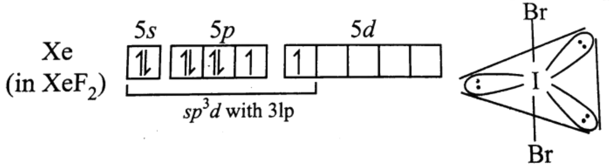


(ii)

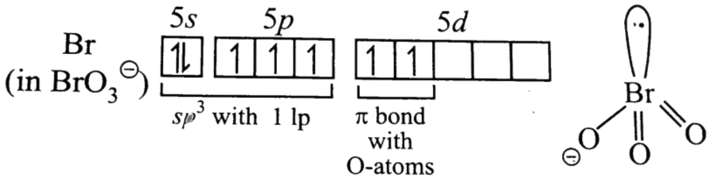


Linear structure

Noble gas compound isostructural with $IBr_2^{\ominus}$ is XeF_2.

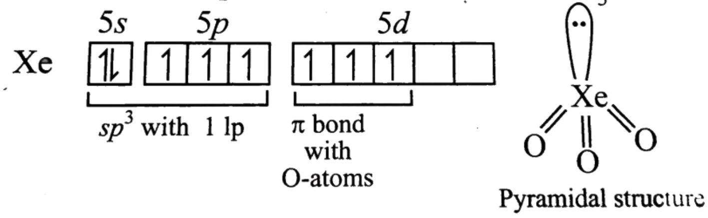


(iii)



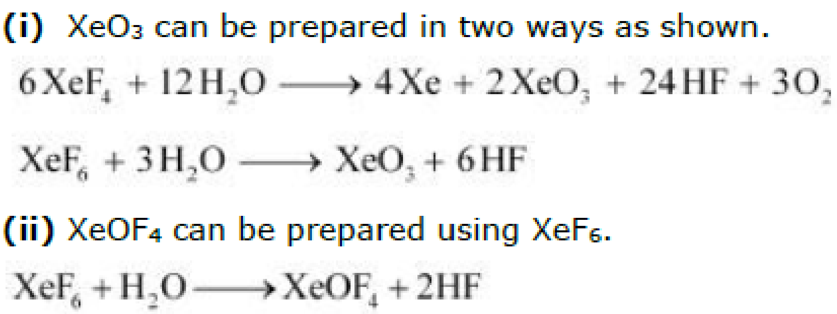
Pyramidal structure

Noble gas compound isostructural with $BrO_3^{\ominus}$ is XeO_3.



Pyramidal structure

(b)



(i) XeO_3 can be prepared in two ways as shown.

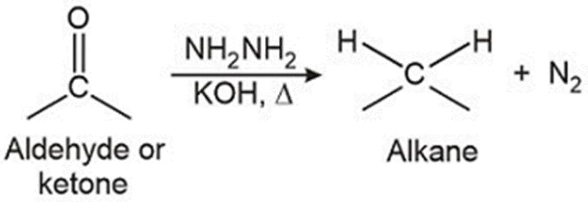
$$6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$$

$$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$$

(ii) $XeOF_4$ can be prepared using XeF_6.

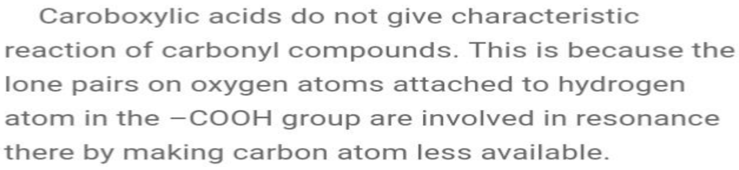
$$XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$$

32. (a)

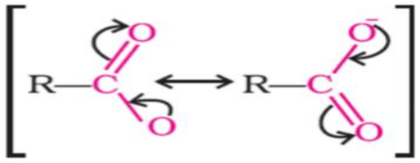


(b) $CH_3—CHO < CH_3COCH_3 < C_6H_5COCH_3$

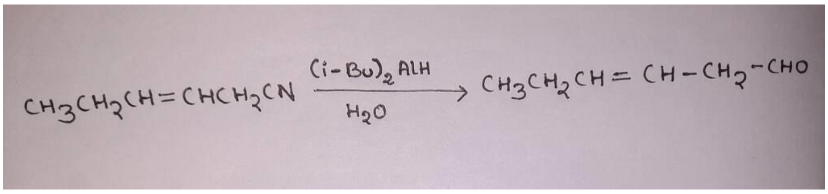
(c)



Caroboxylic acids do not give characteristic reaction of carbonyl compounds. This is because the lone pairs on oxygen atoms attached to hydrogen atom in the −COOH group are involved in resonance there by making carbon atom less available.

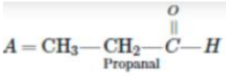


(d)

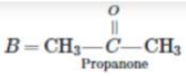


$$CH_3CH_2CH=CHCH_2CN \xrightarrow[H_2O]{(i-Bu)_2 ALH} CH_3CH_2CH=CH-CH_2-CHO$$

(e)

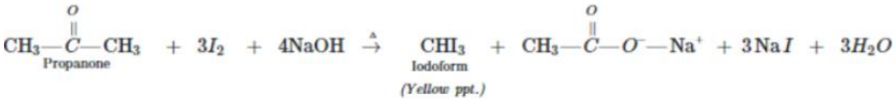


$A = \mathrm{CH_3{-}CH_2{-}\overset{\overset{\large O}{\|}}{C}{-}H}$ Propanal



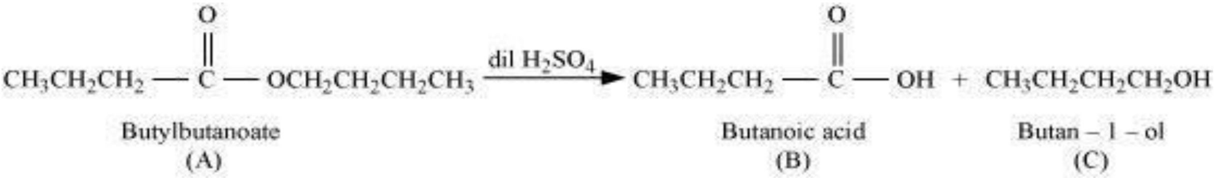
$B = \mathrm{CH_3{-}\overset{\overset{\large O}{\|}}{C}{-}CH_3}$ Propanone

Reaction involved:

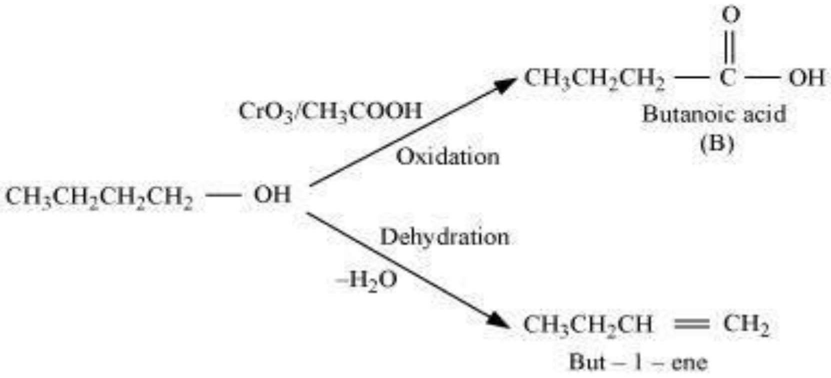


$$\underset{\text{Propanone}}{\mathrm{CH_3{-}\overset{\overset{O}{\|}}{C}{-}CH_3}} + 3I_2 + 4\mathrm{NaOH} \xrightarrow{\Delta} \underset{\substack{\text{Iodoform}\\ \text{(Yellow ppt.)}}}{\mathrm{CHI_3}} + \mathrm{CH_3{-}\overset{\overset{O}{\|}}{C}{-}O^-{-}Na^+} + 3\mathrm{Na}I + 3H_2O$$

OR



$$\underset{\substack{\text{Butylbutanoate}\\ \text{(A)}}}{\mathrm{CH_3CH_2CH_2-\overset{\overset{O}{\|}}{C}-OCH_2CH_2CH_2CH_3}} \xrightarrow{\text{dil } H_2SO_4} \underset{\substack{\text{Butanoic acid}\\ \text{(B)}}}{\mathrm{CH_3CH_2CH_2-\overset{\overset{O}{\|}}{C}-OH}} + \underset{\substack{\text{Butan}-1-\text{ol}\\ \text{(C)}}}{\mathrm{CH_3CH_2CH_2CH_2OH}}$$



33.(i)

$$\Lambda_m = \frac{1000 \times K}{M} \mathrm{S\ cm^2\ mol^{-1}}$$

$$\Lambda_m = \frac{1000 \times 5.25 \times 10^{-5}}{2.5 \times 10^{-4}} \mathrm{S\ cm^2 mol^{-1}}$$

$$= 210\ \mathrm{S\ cm^2 mol^{-1}}$$

$$\wedge_m^0\ \mathrm{HCOOH} = \lambda^\circ\ \mathrm{HCOO^-} + \lambda^\circ\ \mathrm{H^+}$$

$$= (50.5 + 349.5)\ \mathrm{S\ cm^2 mol^{-1}}$$

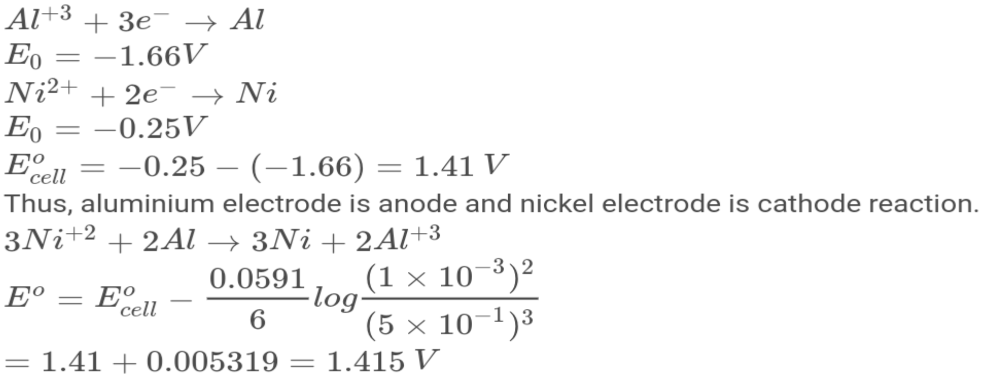
$$= 400\ \mathrm{S\ cm^2 mol^{-1}}$$

$$\alpha = \Lambda_m / \Lambda^\circ_m$$

$\alpha = 210\ Scm^2mol^{-1}/400\ Scm^2mol^{-1}$

$\alpha = 0.525$

(ii)



$$Al^{+3} + 3e^- \rightarrow Al$$
$$E_0 = -1.66V$$
$$Ni^{2+} + 2e^- \rightarrow Ni$$
$$E_0 = -0.25V$$
$$E^o_{cell} = -0.25 - (-1.66) = 1.41\ V$$

Thus, aluminium electrode is anode and nickel electrode is cathode reaction.

$$3Ni^{+2} + 2Al \rightarrow 3Ni + 2Al^{+3}$$
$$E^o = E^o_{cell} - \frac{0.0591}{6} log \frac{(1 \times 10^{-3})^2}{(5 \times 10^{-1})^3}$$
$$= 1.41 + 0.005319 = 1.415\ V$$

OR

(i) Here conductivity (K) = $0.146 \times 10^{-3} Scm^{-1}$

Resistance (R) =1500Ω

Cell constant = Conductivity × Resistance

Therefore, Cell constant =$0.146 \times 10^{-3} \times 1500$

= $0.219 cm^{-1}$

(ii) $\Delta G = -nFE^\circ$

$= -2 \times 96500 \times 0.236 = -45.548 kJ$

$\log K = nFE^o/2.303RT$

$= 2 \times 0.236/0.059$

$= 7.986$

K = antilog (7.986)

$= 9.68 \times 10^7$