

Class-XII

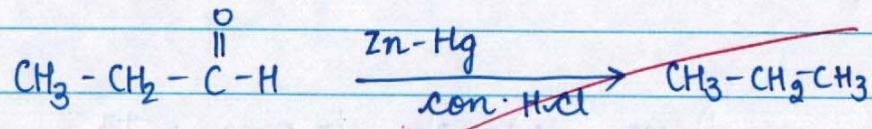
Chemistry(043)

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CHEMISTRY

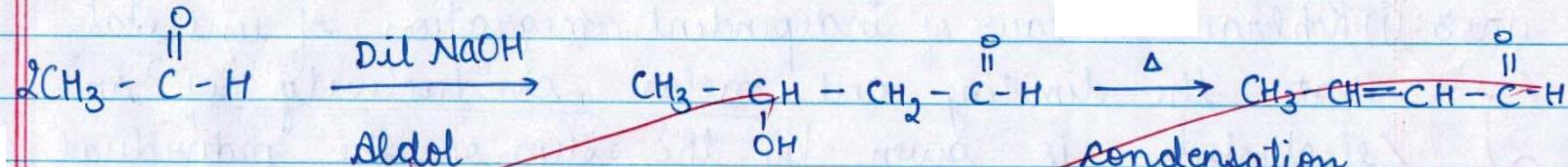
Section A

Ans 1: (i) Propanal to propane



i.e reduction of propanal to propane using Clemmensen reduction

(ii) Ethanal to But-2-enal



i.e. Aldol condensation to form but-2-enal

Ans 2: $\text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g)$

given $\frac{\Delta[\text{NH}_3]}{\Delta t} = 3.6 \times 10^{-4} \text{ mol L}^{-1} \text{s}^{-1}$

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$$(i) \text{ rate of reaction} = -\frac{\Delta[N_2]}{\Delta t} = -\frac{\Delta[H_2]}{3\Delta t} = \frac{\Delta[NH_3]}{2\Delta t}$$

$$\therefore \text{rate} = \frac{\Delta[NH_3]}{2\Delta t} = \frac{3.6 \times 10^{-4}}{2} \text{ mol L}^{-1} \text{s}^{-1} = \cancel{1.8 \times 10^{-4} \text{ mol L}^{-1} \text{s}^{-1}}$$

$$(ii) -\frac{\Delta[H_2]}{3\Delta t} = \frac{\Delta[NH_3]}{2\Delta t}$$

$$\Rightarrow \text{Rate of disappearance of } H_2 = -\frac{\Delta[H_2]}{\Delta t} = \frac{3}{2} [3.6 \times 10^{-4}] \\ = \cancel{5.4 \times 10^{-4} \text{ mol L}^{-1} \text{s}^{-1}}$$

Ans 3: (i) Kohlrausch's law of independent migration of ions states that the limiting and molar conductivity of an electrolyte is given by the sum of the individual molar conductivities of the cation and anion
 i.e $\Lambda_m^{\circ}(Mx^-) = \Lambda_m^{\circ}(M^+) + \Lambda_m^{\circ}(x^-)$

This law is valid for both strong and weak electrolyte

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$$(ii) \alpha = \frac{\Delta m}{\Delta^{\circ}m} \Rightarrow \text{given } \Delta m = 48 \text{ S cm}^2 \text{ mol}^{-1} \text{ or } \Delta^{\circ}m = 400 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\therefore \alpha = \frac{48}{400} = \boxed{12 \times 10^{-2}}$$

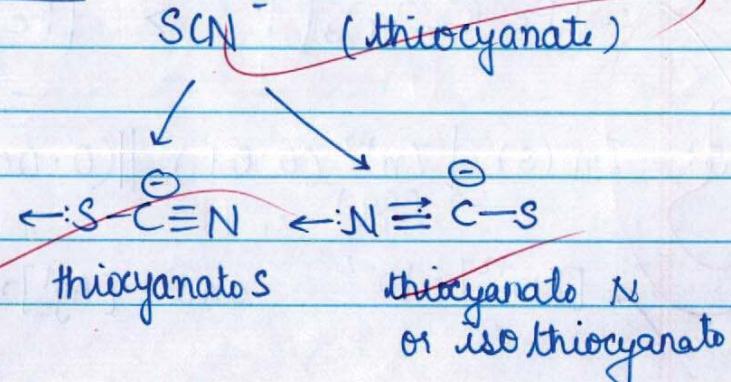
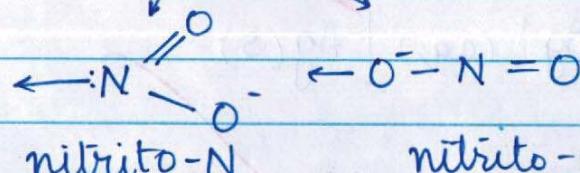
Section B

Ans 4. (b) (i) $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$

~~Tetraammine aqua chloride Cobalt (III) chloride~~

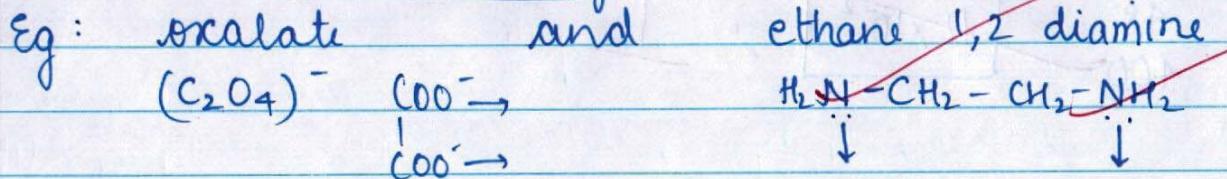
(ii) An ambidentate ligand has 2 ligating atoms out of which at a time only one bonds with the central metal atom

E.g.: NO_2^- (Nitrite) SCN^- (Thiocyanate)

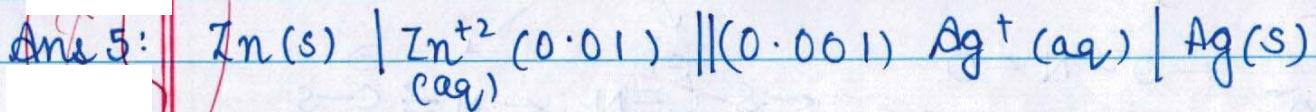
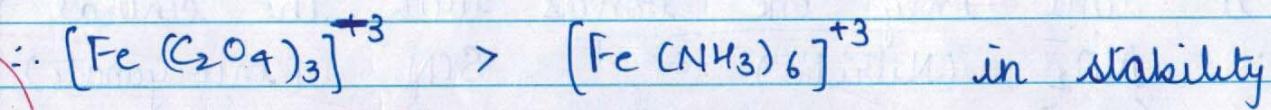


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whereas a bidentate ligand has 2 ligating sites with which it simultaneously bonds to central metal atom



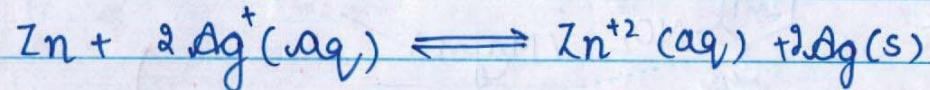
(III) Although ammonia is a strong field ligand but out of $[\text{Fe}(\text{NH}_3)_6]^{+3}$ and $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{-3}$; $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{-3}$ is more stable because oxalate is a bidentate ligand and therefore forms a chelating complex which provides it more stability as compared to the unidendated complex of similar structure.



$$\therefore [\text{Zn}^{+2}] = 10^{-2} \text{ and } [\text{Ag}^+] = 10^{-3}$$

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overall equation of the cell



using Nernst equation, (At 298K)

$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.0591}{2} \log_{10} Q$$

then $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{Anode}} = E^\circ_{\text{Ag}^+/\text{Ag}} - E^\circ_{\text{Zn}^{+2}/\text{Zn}}$

$$\therefore E^\circ_{\text{cell}} = 0.8 - [-0.76] = 1.56 \text{ V}$$

$$n = 2 e^-$$

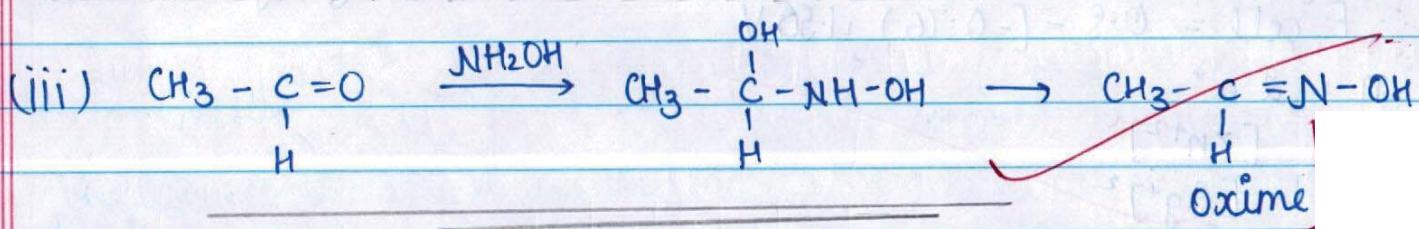
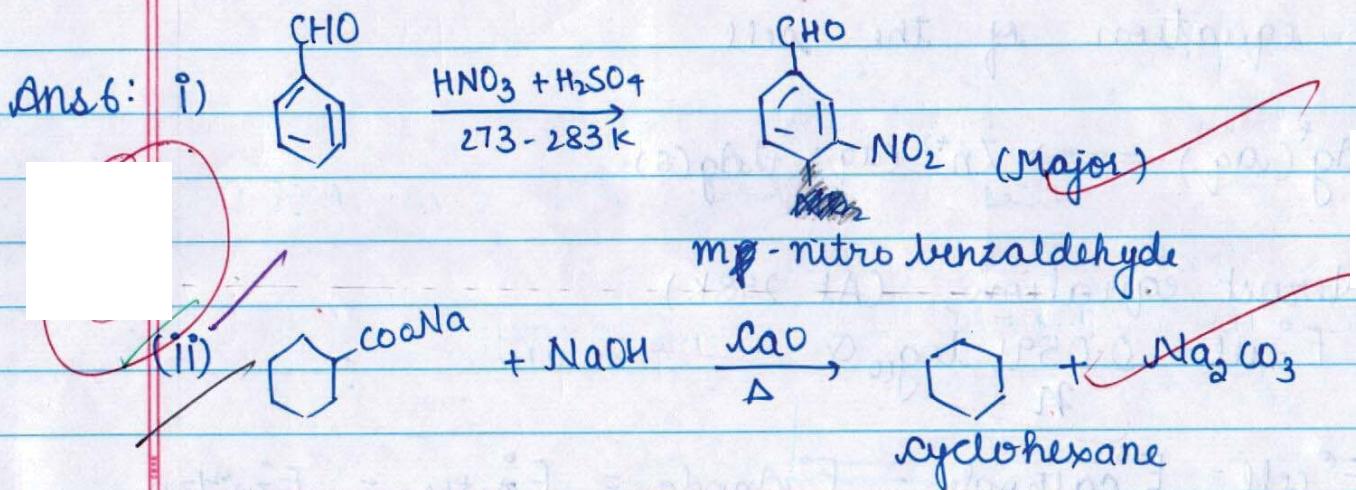
$$Q = \frac{[\text{Zn}^{+2}]}{[\text{Ag}^+]^2}$$

$$\therefore E_{\text{cell}} = 1.56 - \frac{0.0591}{2} \log_{10} \left(\frac{10^{-2}}{(10^{-3})^2} \right) = 1.56 - \frac{0.0591}{2} \log_{10} 10^4$$

$$= 1.56 - \frac{0.0591}{2} \times 4 = 1.56 - 0.1182 = 1.4418 \text{ V}$$

$$\boxed{E_{\text{cell}} = 1.4418 \text{ V}}$$

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Ans 7: order of rxⁿ = 1st

Given; for 75% completion / decomposition

i.e. $\frac{[A]_t}{[A]_0} = \frac{1}{4}$ $t = 30 \text{ mins}$

$$K = \frac{2.303}{t} \log_{10} \left(\frac{A_0}{A_t} \right)$$

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$$K = \frac{2.303}{30 \text{ mins}} \times \log_{10} 4$$

$$t'/_2 = \frac{0.693}{K} \text{ or } \frac{\ln 2}{K}$$

$$\left[t'/_2 = \frac{2.303}{K} \times \log_{10} \left(\frac{A_0}{A_t} \right) \text{ or } \frac{A_0 - A_t}{A_0} = 2 \right]$$

$$\therefore t'/_2 = \frac{0.693}{2.303 \times 2 \log_{10} 2} \times 30 \text{ mins}$$

$$= \frac{0.693}{2 \times 0.693} \times 30 \text{ mins} = \boxed{15 \text{ mins}}$$

(Ans 8)

Lyophilic

Liquid loving sols
stable and difficult to coagulate

Lyophobic

(1) Liquid repelling sols
(2) unstable and coagulate on adding small amount of electrolyte

(3) Prepared by mixing dispersed phase with dispersion medium

(3) cannot be prepared by mixing with dispersion med.

(4) If dispersion medium is separated for eg by evaporation; sol can be reconstituted by remixing the medium

(4) After separation of sol particles from medium, sol will not be reformed by mixing it with medium

\therefore called Reversible sols

\therefore called Irreversible sols

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Lyophilic

(5.) They are highly solvated

(6.) Eg gum, starch, rubber, clay aqueous sols

Lyophobic

(5.) Not solvated in great amounts

(6.) Eg metals and their sulphides in water

Ans 9: (i) The negative value of $E^\circ \text{Mn}^{+2}/\text{Mn}$ suggests that +2 oxidation state is relatively more stable for Manganese.

Mn^{+2} : d⁵

1	1	1	1	1
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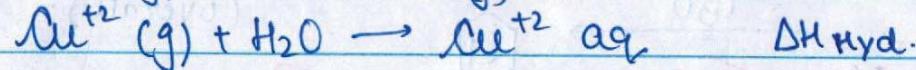
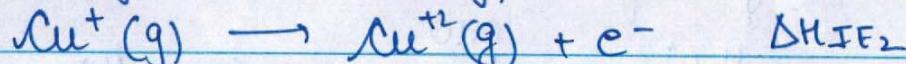
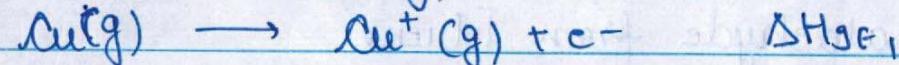
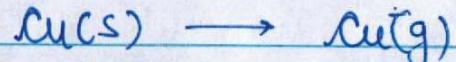
d⁵ configuration is more stable due to half filled d orbitals. (leading to its high exchange energy also.)

(ii) The irregularities arise due to :-

- (a) variation in ionisation energy of these elements
- (b) variation in ionic sizes across a series
- (c) Difference in hydration enthalpies

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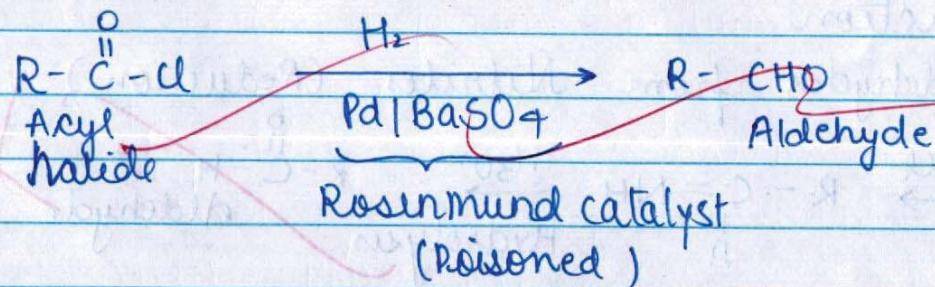
(iii) The electrode potential values involve :-



For Copper, The second ionisation enthalpy is very high and thus hydration enthalpy does not compensate for the stabilisation of Cu^{+2}aq
 $\therefore \text{Cu}^{+2}\text{aq} \rightarrow \text{Cu(s)}$ has a +ve E°

Ques 10: (a) i) Rosenmund reaction

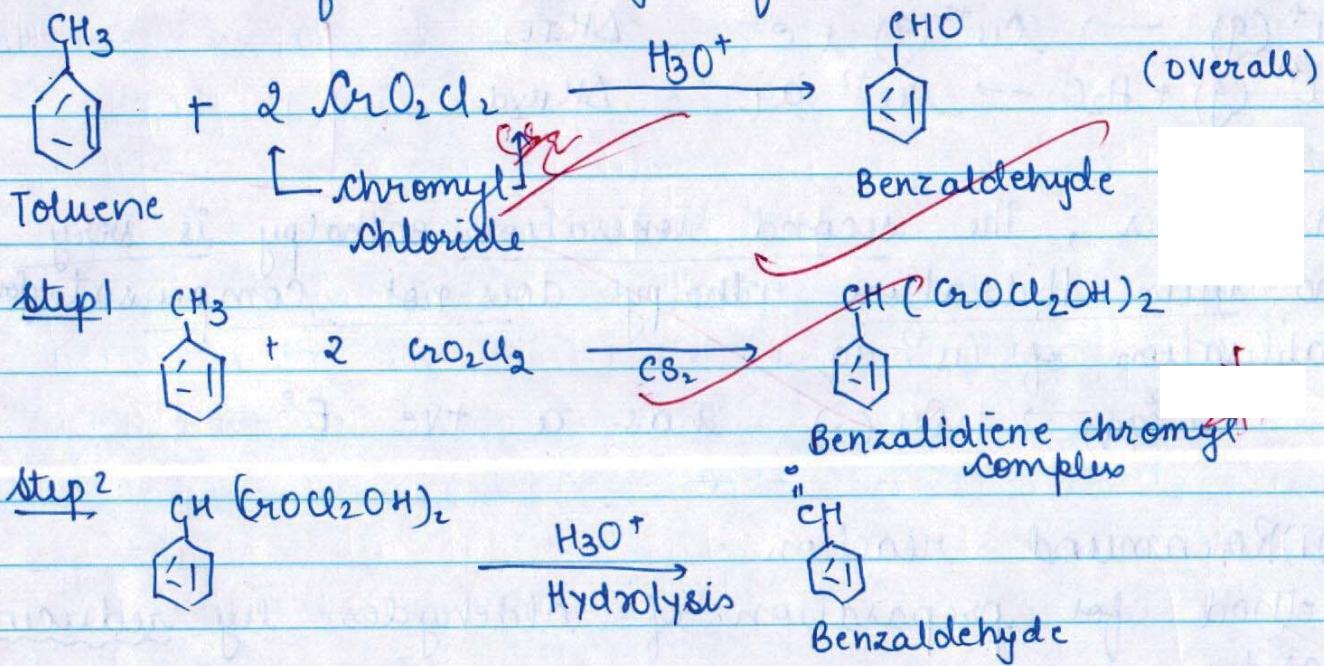
Method for preparation of aldehydes by reducing acyl halides



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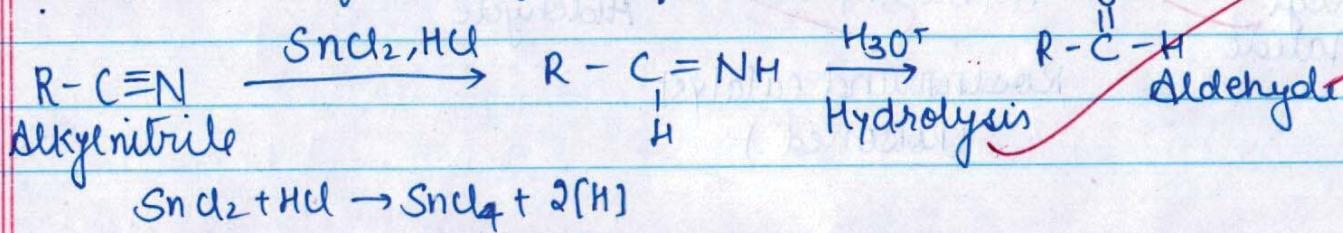
ii) Etard reaction

Formation of Benzaldehyde from Toluene



(iii) Stephen reaction

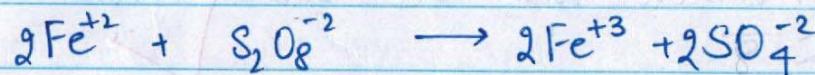
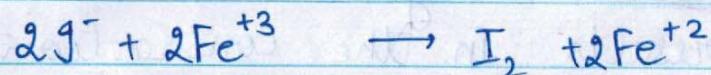
Formation of Aldehydes from Nitriles (Reduction)



Ans 11:

- (i) Transition metals due to presence of variable number of oxidation states can act as catalysts for various reactions by accepting or donating their σ -orbital electrons.

For Eg: In the reaction: $2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$
 Fe^{+3} acts as a catalyst in its $+3$ or $+2$ states

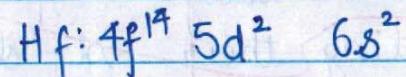


- (ii) According to IUPAC, transition elements are defined as the elements which contain unpaired electrons either in their ground or excited state.

Zn, Cd, Hg have $(n) d^{10} ns^2$ configuration in ground state and $(n+1) d^{10}$ in excited state. Therefore do not contain

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any unpaired electrons. Thus are not transition elements



In Hf, before the filling of 5d orbitals; 4f orbitals are filled (called lanthanoid series). The f orbitals have poor screening or shielding effect; therefore they do not shield the outer electrons effectively which leads to increase in effective nuclear charge.

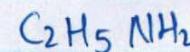
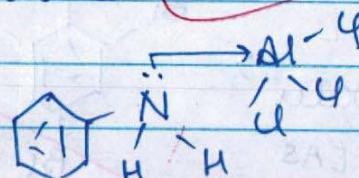
This increased Z_{eff} results in the contraction of the shells due to which the 5d series has a smaller radius than ^{to} 4d series

\therefore Radii of Zr \approx Hf

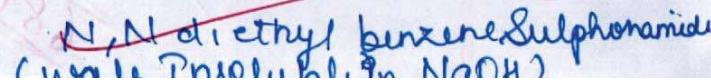
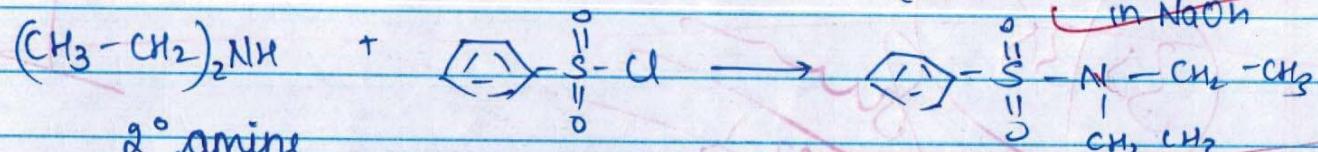
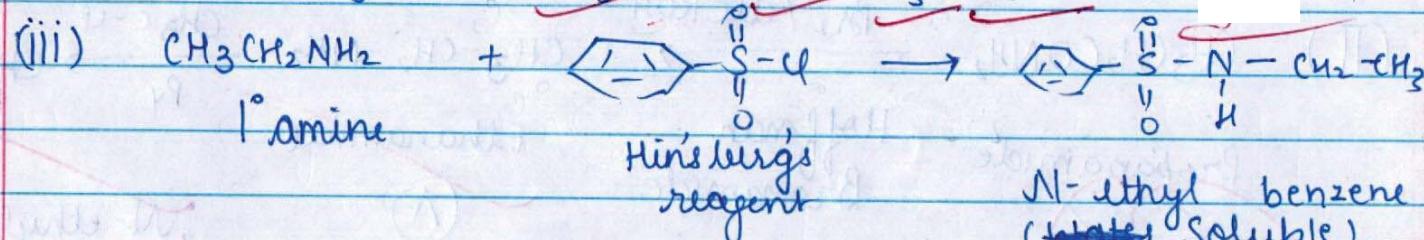
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Section C

- Ans12: i) Aniline does not give Friedel-Crafts reaction because,
it donates its lone pair to the Lewis Acid used as
a catalyst in the reaction. Therefore no electrophile is
generated



- (ii) Order of P_{K_b} : $C_6H_5NH_2 > NH_3 > (CH_3)_3N > (CH_3)_2NH$
 P_{K_b} increasing order: $(CH_3)_2NH < C_6H_5NH_2 < NH_3 < (CH_3)_3N$



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the compound formed with 1° amine is soluble in NaOH due to the presence of Acidic H whereas compound formed with 2° amine is Insoluble in NaOH due to absence of any Acidic H

(IV) (a)

