HINTS & SOLUTIONS

Hydrocarbons

[Set-1]

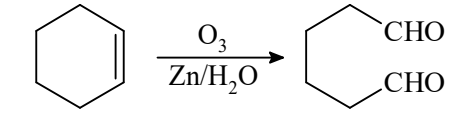
SECTION-A

1. (iv): $CH_3CH=CH-CH_3 \xrightarrow[Zn/H_2O]{O_3} CH_3CHO$ only

But - 2 - ene

$$CH_3-\underset{\underset{CH_3}{|}}{C}=\underset{\underset{CH_3}{|}}{C}-CH_3 \xrightarrow[Zn/H_2O]{O_3} CH_3COCH_3 \text{ only}$$

2, 3-Dimethyl but-2-ene



Cyclohexene

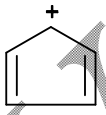
2. (i) More the stability of carbocation formed after addition of H^+, more the reactivity of an alkene

$$(CH_3)_2C=C(CH_3)_2 \xrightarrow{H^+} CH_3-\underset{\underset{CH_3}{|}}{\overset{+}{C}}-C(CH_3)_2 \quad (3°)$$

$$CH_2=CH_2 \xrightarrow{H^+} CH_3-\overset{+}{C}H_2 \quad (1°)$$

$$CH_3-CH=CH_2 \xrightarrow{H^+} CH_3-\overset{+}{C}H-CH_2 \quad (2°)$$

$$CH_3-CH=CH-CH_3 \xrightarrow{H^+} CH_2-CH_2-\overset{+}{C}HCH_2 \quad (2°)$$

3. (ii)  is not satisfying the Huckel's (4n + 2) rule.

4. (ii) halogenation of benzene is an example of electrophilic substitution reaction in which X^+ replaces H^+ of benzene

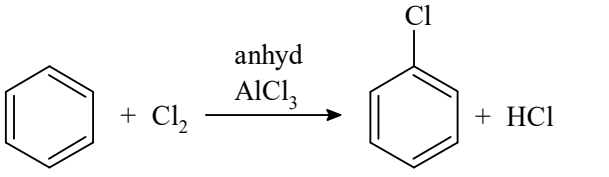
$$3X_2 + 2Fe \longrightarrow 2FeX_3$$

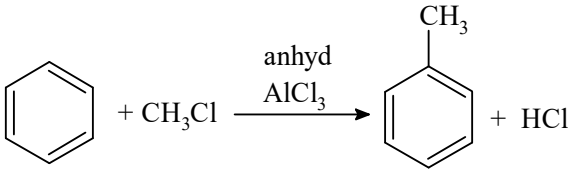
(X = Cl, Br)

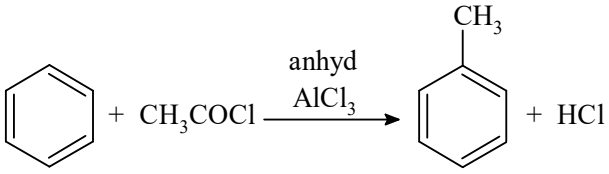
$$X_2 + FeX_3 \longrightarrow X^+ + FeX_4^-$$

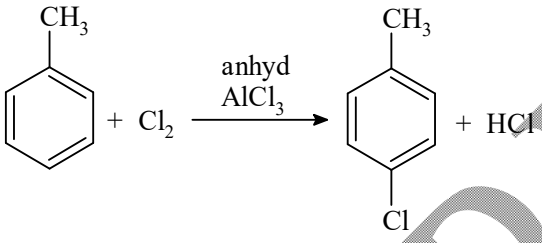
$$Cl_2 + FeCl_3 \longrightarrow Cl^+ + FeCl_4^-$$

5. (ii):

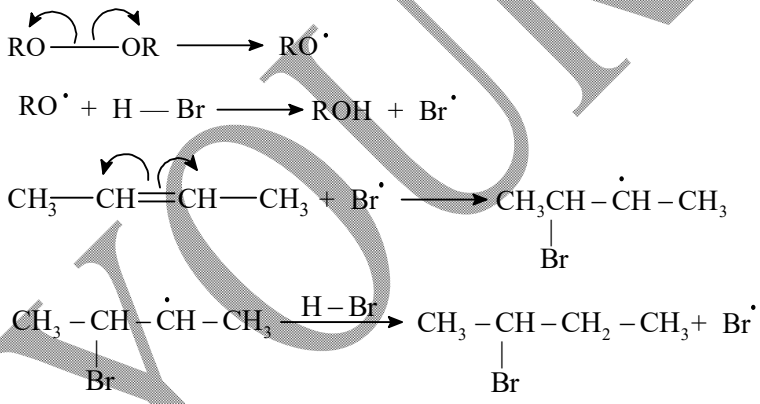




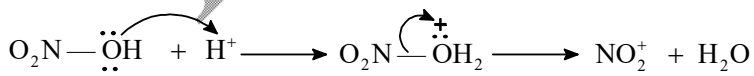




6. (iii): The reaction with HBr in the presence of organic peroxide follows free radical mechanism (Peroxide or Kharasch effect)



7. (i): $H_2SO_4 \rightleftharpoons H^+ + HSO_4^-$

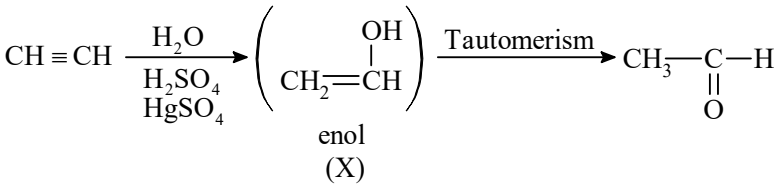


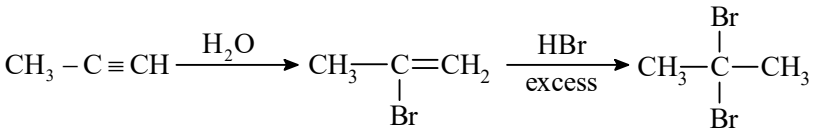
8. (iv): Hydrogen becomes more acidic as the hybridization of the carbon to which hydrogen is attached changes from sp^3 to sp^2 to sp.

Alkynes having triple bond at the terminal position contain acidic hydrogen

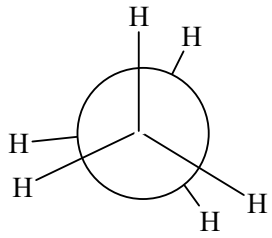
$HC \equiv CH$ is more acidic than $CH_3C \equiv CH$, more acidic than $CH_3CH_2C \equiv CH$ as +I effect of an alkyl group increases.

9. (i):

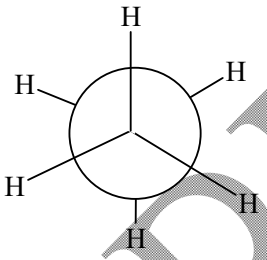




11.

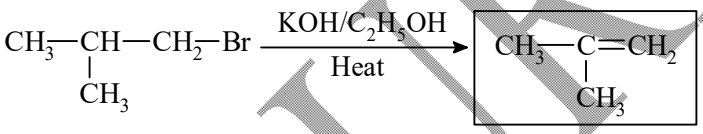


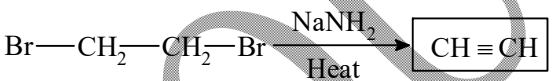
Eclipsed



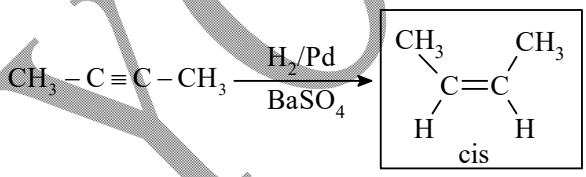
Staggered

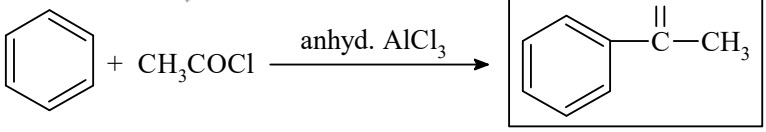
The staggered conformer is more stable than eclipsed beacause the hydrogen atoms are far apart with a dihedral angle of 60° and have minimum repulsion.

12. (i) 

(ii) 

OR

(i) 

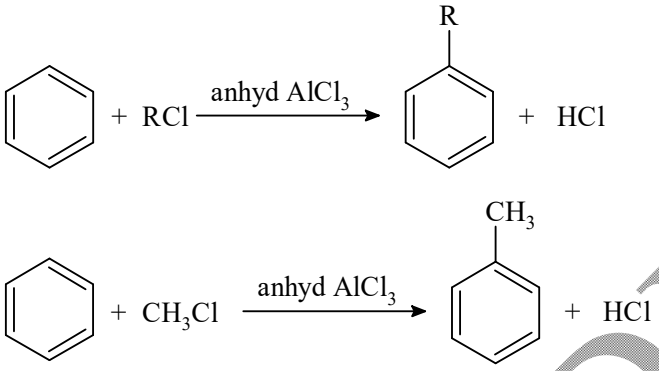
(ii) 

13. (i) **Kolbe electrolysis** is a method to prepare alkanes by the electrolysis of an aqueous solution of potassium or sodium salt of carboxylic acid. This reaction involves the loss of – COOH group as sodium carbonate or potassium carbonate. The reaction is called **decarboxylation**

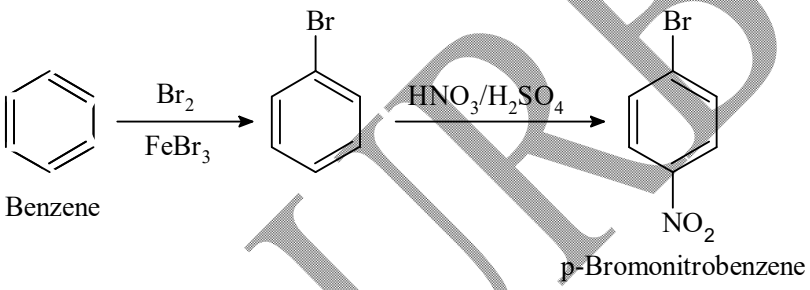
$$RCOOK + H_2O \xrightarrow{\text{electrolysis}} R - R + K_2CO_3 + H_2$$

$$\underset{\text{potassium acetate}}{CH_3COOK} + H_2O \xrightarrow{\text{electrolysis}} \underset{\text{ethane}}{CH_3 - CH_2} + K_2CO_3 + H_2$$

(ii) **Friedel-Craft alkylation** is a method to prepare alkyl benzene by reacting benzene with RCl in the presence of anhyd. AlCl.



14. (i)

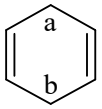


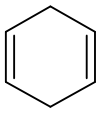
(ii) $\underset{\text{Propene}}{CH_3 - CH = CH_2} \xrightarrow[\text{Dark}]{HBr} \underset{\substack{\text{2-Bromopropane}\\ \text{Br}}}{CH_3 - \underset{\text{Br}}{CH} - CH_3}$

(iii) $\underset{\text{Ethyne}}{CH \equiv CH} \xrightarrow{\text{Na/liq. } NH_3} CH \equiv C^-Na^+ \xrightarrow{CH_3CH_2Cl} \underset{\text{But-1-yne}}{CH_3 - CH_2C \equiv CH}$

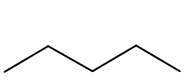
OR

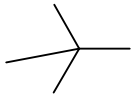
(i) In ethyne, carbon atom is sp hybridized with 50% s-character and is sp^2 hybridised (33%) in ethene. More the percentage s-character, more the electronegativity. The sp carbon attract the electron pair of the C – H towards itself more strongly. As a result, electron density around hydrogen of C–H bond decreases and hydrogen can be liberated as H+ ion. Hence, ethyne hydrogen is more acidic than ethene.

(ii) 

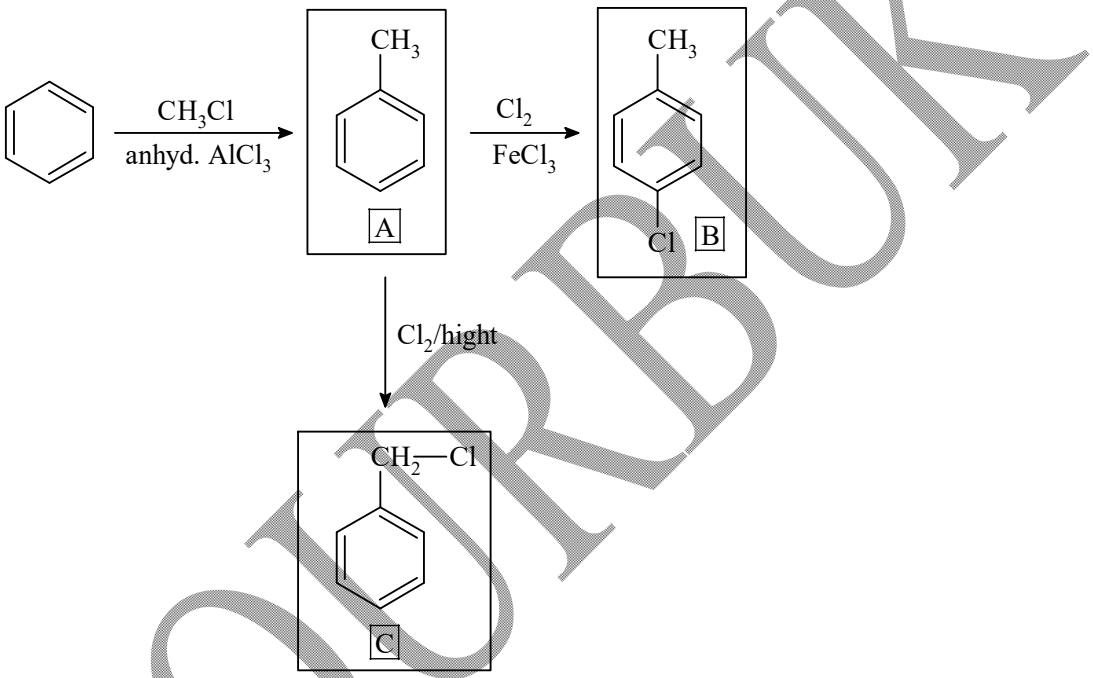
is non-aromatic since two carbon atoms (a and b) have sp^3 hybridisation. The  is non-planar and have non-aromatic.

(iii) n-pentane has more expanded and unsymmetrical structure. So, n-pentane cannot fit tighly into the crystal lattice. Hence, n-pentane has a lower melting point than neoentane.


n-pentane


neo-pentane

15. (i)



(ii) (a) Structure of A is $CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$

IUPAC name of A is 2-Methyl but-2-ene

(b) $H_3C-\underset{\underset{CH_3}{|}}{C}=CH-CH_3 \xrightarrow[\text{dark}]{HBr} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{Br}{|}}{C}}-CH_2-CH_3$

OR

(i) (a) $CH_4 \xrightarrow[\text{light}]{Cl_2} CH_3Cl \xrightarrow[\text{dry ether}]{Na} \underset{\text{ethane}}{CH_3-CH_3}$

(b) $CH_3-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow[KOH]{\text{hot \& eth.}} CH_3-CH=CH_2 \xrightarrow[\text{peroxide}]{\text{organic}\ HBr} \underset{\text{1-Bromo propane}}{CH_3-CH_2-CH_2-Br}$

2-Bromo propane

(ii) Limitations of using **Wurtz reaction**

(a) Methane cannot be prepared by this method

(b) Wurtz reaction is used to prepare alkanes with even number of carbon atoms.

(iii) Alkene A is $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH_2$

IUPAC name: 3-Methyl but-1-ene

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH_2 \xrightarrow{[O]} CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH + CO_2 + H_2O$$

