HINTS & SOLUTIONS

Hydrocarbons

[Set-2]

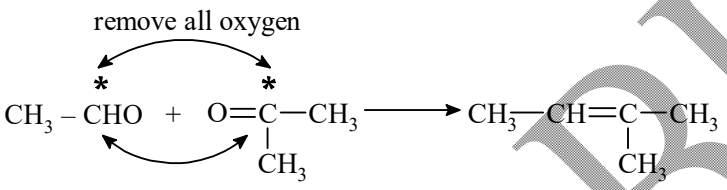
SECTION-A

1. (ii): CH_3 group on the benzene is an electron donating group and increases the electron density on benzene ring, making it more suceptable to attack by an electrophile, NO_2^+.

2. (i): This is hydration of alkynes

$$HC\equiv CH \xrightarrow{\text{dil. } H_2SO_4} \underset{\substack{\text{geminal diol}\\(X)}}{CH_3-CH(OH)_2} \xrightarrow[-H_2O]{\text{Heat}} CH_3-CHO$$

3. (i)



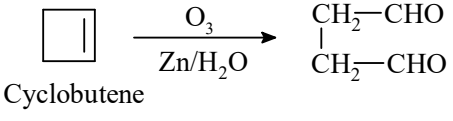
4. (iii): Down the homologous series, boiling pont increases with increase in molecule mass. For the same molecular formula, as branching increases, the molecule becomes more compact, tends to acquire a spherical shape. The surface area decreases and van der Waal's forces becomes weak, boiling point decreases.

5. (iv):

$$\underset{\text{But-1-ene}}{CH_2=CH-CH_2CH_3} \xrightarrow[Zn/H_2O]{O_3} CH_3CH_2CHO + HCHO$$

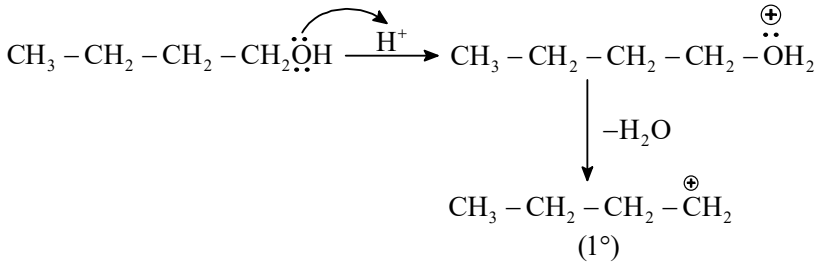
$$\underset{\text{But-2-ene}}{CH_3-CH=CH-CH_3} \xrightarrow[Zn/H_2O]{O_3} 2CH_3CHO$$

$$\underset{\substack{\text{2-Methyl propene}}}{CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2} \xrightarrow[Zn/H_2O]{O_3} CH_3-COCH_3 + HCHO$$

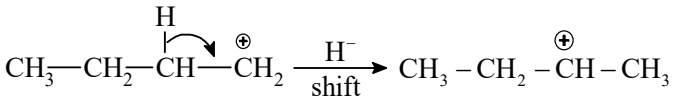


6. (ii): Benzene does not decolouriese bromine. Benzene has extra stability due to resonance, so difficult to add bromine to pi bonds of benzene.

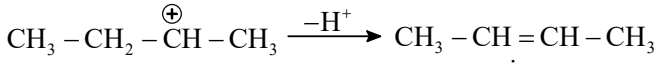
7. (i)



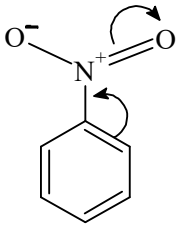
(1°)



(2°)

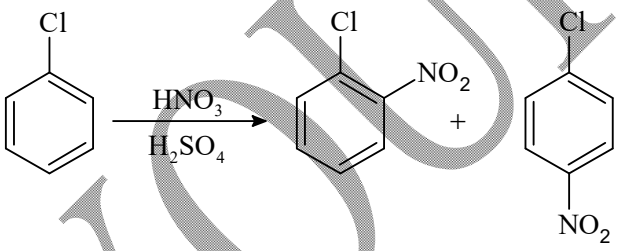


major

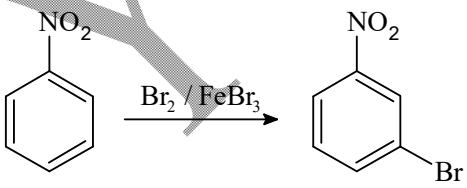


8. (i) NO_2 group has –R effect and decreases the electron density more at o- and p-position than at m-position. All other three groups have +R effect.

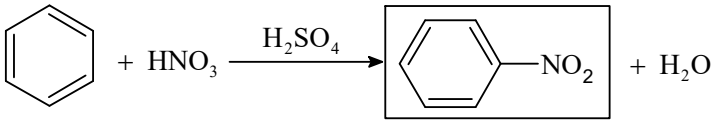
9. (iv) Cl on the benzene ring exerts + R effect and is o, p directing.



10. (i) NO_2 group is meta directing group.

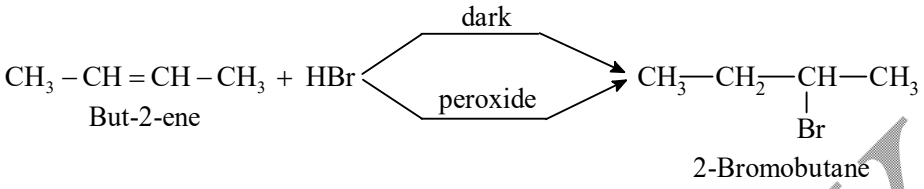


11. (i) $CH_3CH_2COO^-K^+ + H_2O \xrightarrow{\text{electrolysis}} \boxed{CH_3CH_2 - CH_2CH_3} + K_2CO_3 + H_2$

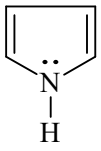
(ii) 

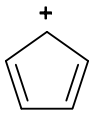
12. (i) n-pentane and neo pentane both are chain isomers but n-pentane has a higher boiling point than neo pentane. This is due to its large surface area, more van der Waal forces.

(ii) But-2-ene is a symmetrical alkene. That's why its gives same product 2-bromobutane with HBr in the absence or presence of peroxide.

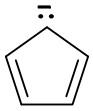


OR

(i)  → Aromatic

 is non-aromatic and is not satisfying Huckel's (4n+2) rule.

 is non-aromatic and one of the atom is sp^3 hybridised (non-planar)

 is aromatic.

(ii) Otherwise sodium will react explosively with moisture to liberate H_2 gas

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

$$CH_3CH_2Cl + Na \xrightarrow{\text{dry ether}} CH_3CH_2 - CH_2CH_3 + NaCl$$

13. (i) **Peroxide effect:** The addition of HBr to unsymmetrical alkenes in the presence of organic peroxide takes place according to anti-Markovnikov's rule. This anti markovnikov addition of HBr is known as **peroxide effect** or **Kharasch effect.**

$$CH_3 - CH = CH_2 + HBr \xrightarrow[\text{Peroxide}]{\text{Organic}} CH_3 - CH_2 - CH_2 - Br$$

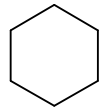
(ii) **Wurtz reaction:** This is the reaction of alkyl halide with sodium metal in the presence of dry ether to form alkane.

$$RX + Na \xrightarrow{\text{dry ether}} R - R + NaX$$

$$CH_3Br + Na \xrightarrow{\text{dry ether}} CH_3 - CH_3 + NaBr$$

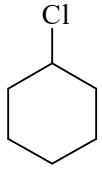
OR

A →



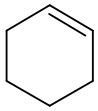
Cyclohexane

B →

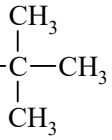
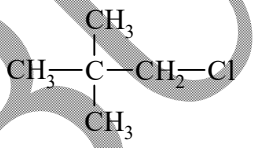


Chlorocyclohexane

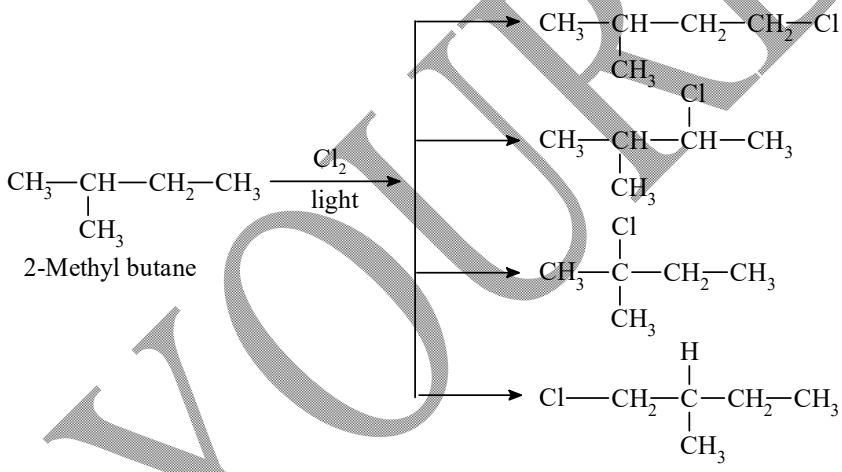
C →

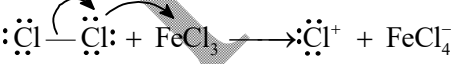


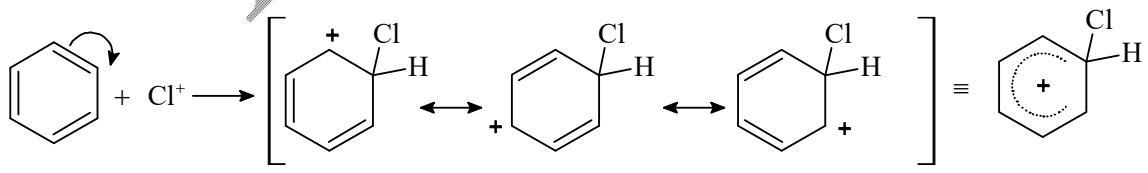
Cyclohexene

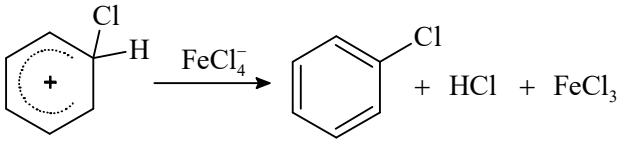
14. (i) A →  B → 

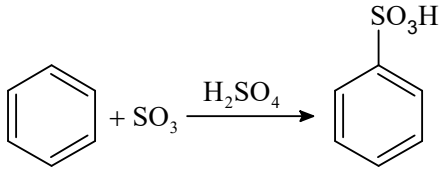
(ii) Isomer of A which gives four monochloro products with Cl_2/light is 2-methyl butane



15. (i) 



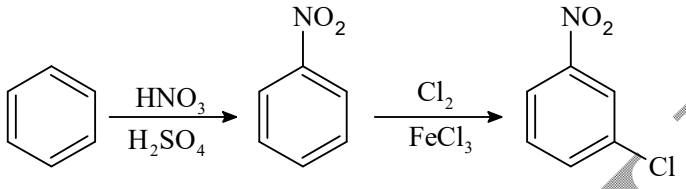


(ii) (a) 

Benzene — Benzene sulphonic acid

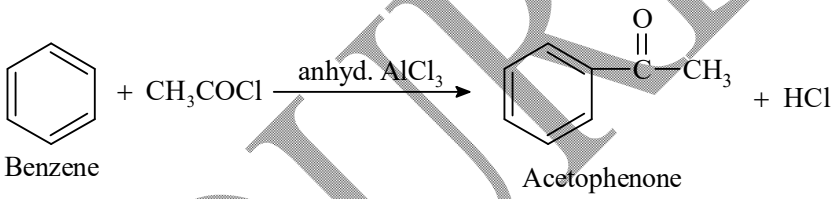
(b) $CH \equiv CH \xrightarrow{Na} Na^+C^- \equiv CH \xrightarrow{CH_3Cl} CH_3 - C \equiv CH$

Ethyne — Propyne

(c) 

OR

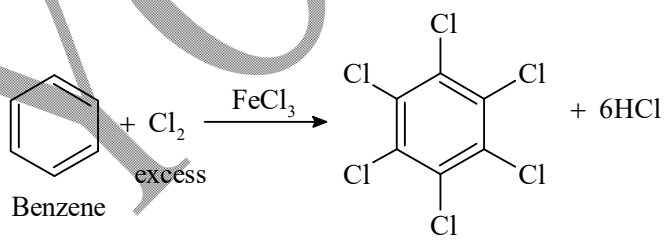
(i) **Friedel-Craft** acetylation is an example of electrophilic substitution reaction involving replacement of hydrogen of benzene by $-\overset{O}{\overset{\|}{C}}-CH_3$ group using $CH_3 - COCl$ in the presence of anhyd. $AlCl_3$.



Benzene — Acetophenone

(ii) (a) $CH_3 - CH = CH_2 \xrightarrow[\text{Benzoyl peroxide}]{HBr} CH_3 - CH_2 - CH_2 - Br$

Propene

(b) 

Benzene — Hexachlorobenzene

(c) $CH_3 - CH_2 - Cl + Na \xrightarrow{\text{dry ether}} CH_3 - CH_2 - CH_2 - CH_3$

Chloroethane — Butane

