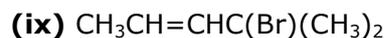
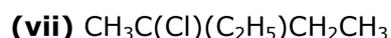
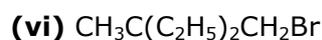
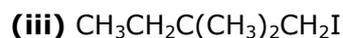
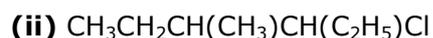


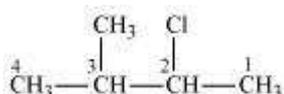
**Question 10.1:**

Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:



Answer

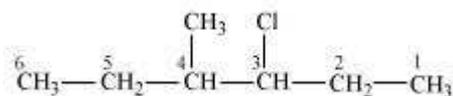
(i)



2-Chloro-3-methylbutane

(Secondary alkyl halide)

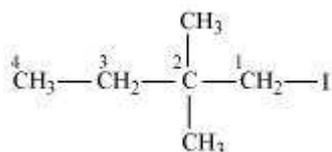
(ii)



3-Chloro-4-methylhexane

(Secondary alkyl halide)

(iii)

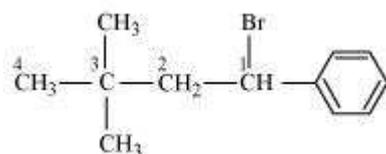


1-Iodo-2, 2 -dimethylbutane



(Primary alkyl halide)

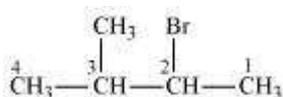
(iv)



1-Bromo-3,3-dimethyl-1-phenylbutane

(Secondary benzyl halide)

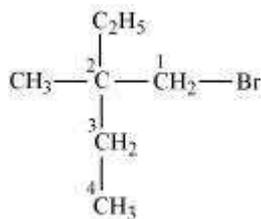
(v)



2-Bromo-3-methylbutane

(Secondary alkyl halide)

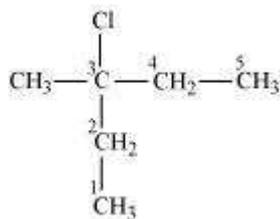
(vi)



1-Bromo-2-ethyl-2-methylbutane

(Primary alkyl halide)

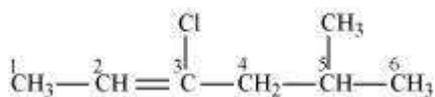
(vii)



3-Chloro-3-methylpentane

(Tertiary alkyl halide)

(viii)

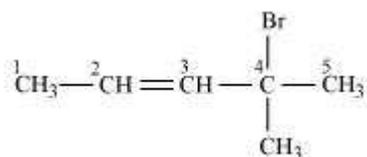




3-Chloro-5-methylhex-2-ene

(Vinyl halide)

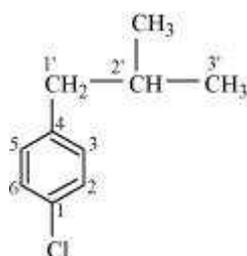
(ix)



4-Bromo-4-methylpent-2-ene

(Allyl halide)

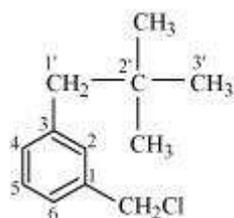
(x)



1-Chloro-4-(2-methylpropyl) benzene

(Aryl halide)

(xi)



1-Chloromethyl-3-(2,2-dimethylpropyl) benzene

(Primary benzyl halide)

(xii)

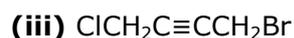
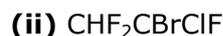


1-Bromo-2-(1-methylpropyl) benzene

(Aryl halide)

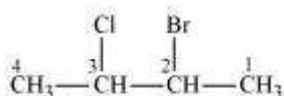
**Question 10.2:**

Give the IUPAC names of the following compounds:



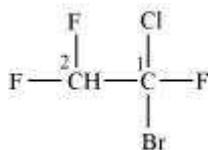
Answer

(i)



2-Bromo-3-chlorobutane

(ii)



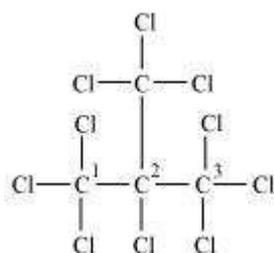
1-Bromo-1-chloro-1, 2, 2-trifluoroethane

(iii)



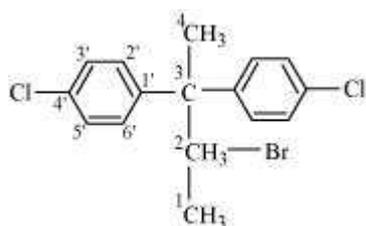
1-Bromo-4-chlorobut-2-yne

(iv)



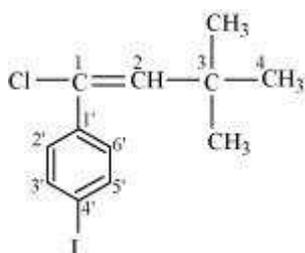
2-(Trichloromethyl)-1,1,1,2,3,3,3-heptachloropropane

(v)



2-Bromo-3,3-bis(4-chlorophenyl) butane

(vi)



1-chloro-1-(4-iodophenyl)-3,3-dimethylbut-1-ene

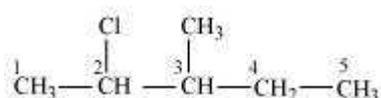
### Question 10.3:

Write the structures of the following organic halogen compounds.

- (i) 2-Chloro-3-methylpentane
- (ii) *p*-Bromochlorobenzene
- (iii) 1-Chloro-4-ethylcyclohexane
- (iv) 2-(2-Chlorophenyl)-1-iodooctane
- (v) Perfluorobenzene
- (vi) 4-tert-Butyl-3-iodoheptane
- (vii) 1-Bromo-4-sec-butyl-2-methylbenzene
- (viii) 1,4-Dibromobut-2-ene

Answer

(i)



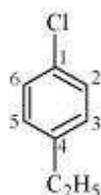
2-Chloro-3-methylpentane

(ii)



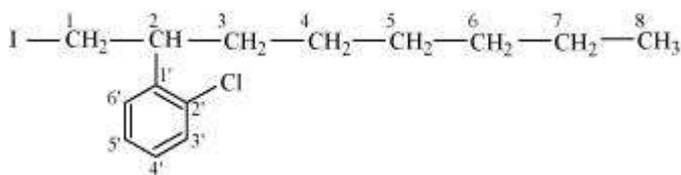
*p*-Bromochlorobenzene

(iii)



1-Chloro-4-ethylcyclohexane

(iv)



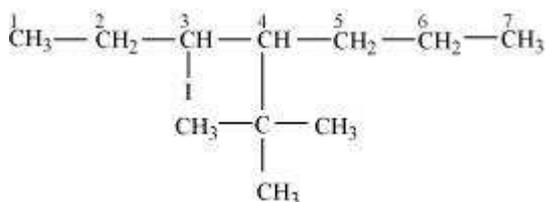
2-(2-Chlorophenyl)-1-iodooctane

(v)



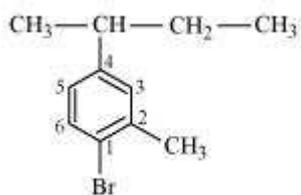
Perfluorobenzene

(vi)



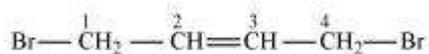
4-Tert-Butyl-3-iodoheptane

(vii)



1-Bromo-4-sec-butyl-2-methylbenzene

(viii)



1,4-Dibromobut-2-ene

**Question 10.4:**

Which one of the following has the highest dipole moment?

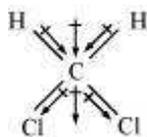
(i)  $\text{CH}_2\text{Cl}_2$

(ii)  $\text{CHCl}_3$

(iii)  $\text{CCl}_4$

Answer

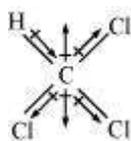
(i)



Dichloromethane ( $\text{CH}_2\text{Cl}_2$ )

$\mu = 1.60\text{D}$

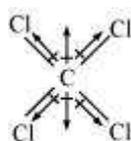
(ii)



Chloroform ( $\text{CHCl}_3$ )

$\mu = 1.08\text{D}$

(iii)





Carbon tetrachloride ( $\text{CCl}_4$ )

$$\mu = 0\text{D}$$

$\text{CCl}_4$  is a symmetrical molecule. Therefore, the dipole moments of all four C–Cl bonds cancel each other. Hence, its resultant dipole moment is zero.

As shown in the above figure, in  $\text{CHCl}_3$ , the resultant of dipole moments of two C–Cl bonds is opposed by the resultant of dipole moments of one C–H bond and one C–Cl bond. Since the resultant of one C–H bond and one C–Cl bond dipole moments is smaller than two C–Cl bonds, the opposition is to a small extent. As a result,  $\text{CHCl}_3$  has a small dipole moment of 1.08 D.

On the other hand, in case of  $\text{CH}_2\text{Cl}_2$ , the resultant of the dipole moments of two C–Cl bonds is strengthened by the resultant of the dipole moments of two C–H bonds. As a result,  $\text{CH}_2\text{Cl}_2$  has a higher dipole moment of 1.60 D than  $\text{CHCl}_3$  i.e.,  $\text{CH}_2\text{Cl}_2$  has the highest dipole moment.

Hence, the given compounds can be arranged in the increasing order of their dipole moments as:



#### Question 10.5:

A hydrocarbon  $\text{C}_5\text{H}_{10}$  does not react with chlorine in dark but gives a single monochloro compound  $\text{C}_5\text{H}_9\text{Cl}$  in bright sunlight. Identify the hydrocarbon.

Answer

A hydrocarbon with the molecular formula,  $\text{C}_5\text{H}_{10}$  belongs to the group with a general molecular formula  $\text{C}_n\text{H}_{2n}$ . Therefore, it may either be an alkene or a cycloalkane.

Since hydrocarbon does not react with chlorine in the dark, it cannot be an alkene. Thus, it should be a cycloalkane.

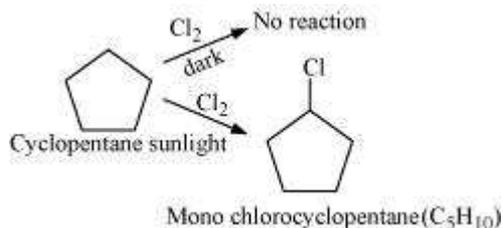
Further, the hydrocarbon gives a single monochloro compound,  $\text{C}_5\text{H}_9\text{Cl}$  by reacting with chlorine in bright sunlight. Since a single monochloro compound is formed, the hydrocarbon must contain H–atoms that are all equivalent. Also, as all H–atoms of a cycloalkane are equivalent, the hydrocarbon must be a cycloalkane. Hence, the said compound is cyclopentane.



Cyclopentane ( $\text{C}_5\text{H}_{10}$ )



The reactions involved in the question are:



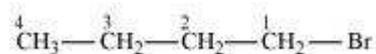
**Question 10.6:**

Write the isomers of the compound having formula  $\text{C}_4\text{H}_9\text{Br}$ .

Answer

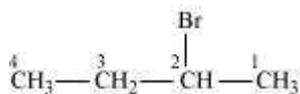
There are four isomers of the compound having the formula  $\text{C}_4\text{H}_9\text{Br}$ . These isomers are given below.

(a)



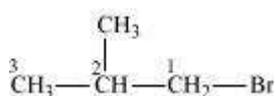
1-Bromobutane

(b)



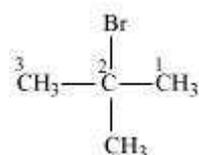
2-Bromobutane

(c)



1-Bromo-2-methylpropane

(d)



2-Bromo-2-methylpropane

**Question 10.7:**

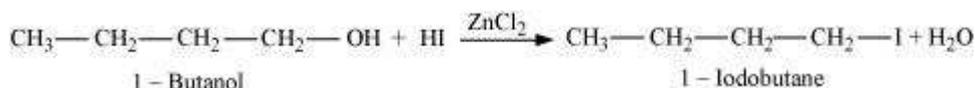
Write the equations for the preparation of 1-iodobutane from



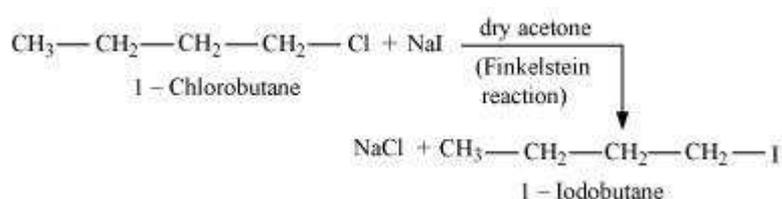
- (i) 1-butanol  
(ii) 1-chlorobutane  
(iii) but-1-ene.

Answer

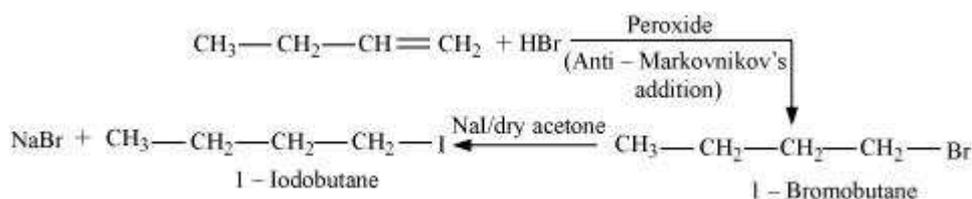
(i)



(ii)



(iii)



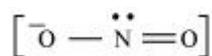
### Question 10.8:

What are ambident nucleophiles? Explain with an example.

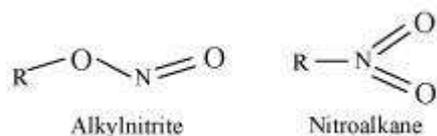
Answer

Ambident nucleophiles are nucleophiles having two nucleophilic sites. Thus, ambident nucleophiles have two sites through which they can attack.

For example, nitrite ion is an ambident nucleophile.



Nitrite ion can attack through oxygen resulting in the formation of alkyl nitrites. Also, it can attack through nitrogen resulting in the formation of nitroalkanes.



**Question 10.9:**

Which compound in each of the following pairs will react faster in  $S_N2$  reaction with  $\text{OH}^-$ ?

(i)  $\text{CH}_3\text{Br}$  or  $\text{CH}_3\text{I}$

(ii)  $(\text{CH}_3)_3\text{CCl}$  or  $\text{CH}_3\text{Cl}$

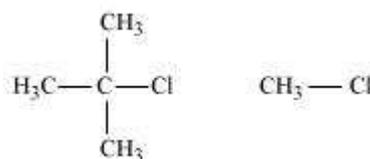
Answer

(i) In the  $S_N2$  mechanism, the reactivity of halides for the same alkyl group increases in the order. This happens because as the size increases, the halide ion becomes a better leaving group.

$\text{R-F} \ll \text{R-Cl} < \text{R-Br} < \text{R-I}$

Therefore,  $\text{CH}_3\text{I}$  will react faster than  $\text{CH}_3\text{Br}$  in  $S_N2$  reactions with  $\text{OH}^-$ .

(ii)



The  $S_N2$  mechanism involves the attack of the nucleophile at the atom bearing the leaving group. But, in case of  $(\text{CH}_3)_3\text{CCl}$ , the attack of the nucleophile at the carbon atom is hindered because of the presence of bulky substituents on that carbon atom bearing the leaving group. On the other hand, there are no bulky substituents on the carbon atom bearing the leaving group in  $\text{CH}_3\text{Cl}$ . Hence,  $\text{CH}_3\text{Cl}$  reacts faster than  $(\text{CH}_3)_3\text{CCl}$  in  $S_N2$  reaction with  $\text{OH}^-$ .

**Question 10.10:**

Predict all the alkenes that would be formed by dehydrohalogenation of the following halides with sodium ethoxide in ethanol and identify the major alkene:

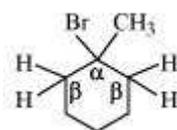
(i) 1-Bromo-1-methylcyclohexane

(ii) 2-Chloro-2-methylbutane

(iii) 2,2,3-Trimethyl-3-bromopentane.

Answer

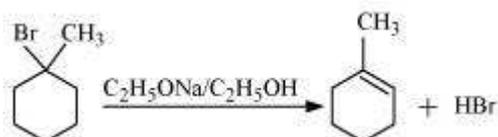
(i)



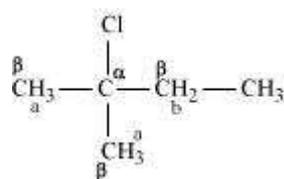


## 1-bromo-1-methylcyclohexane

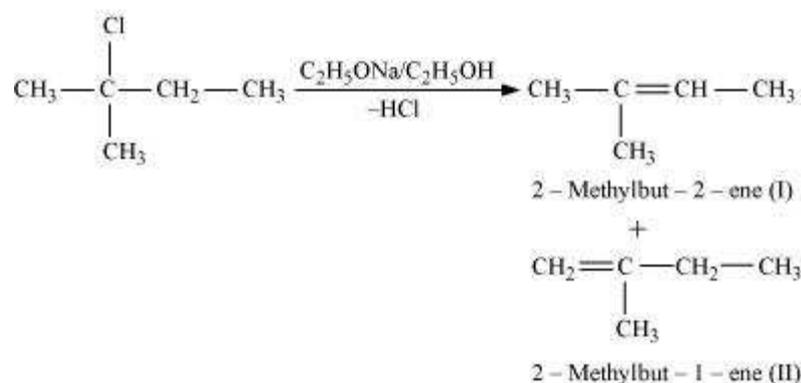
In the given compound, all  $\beta$ -hydrogen atoms are equivalent. Thus, dehydrohalogenation of this compound gives only one alkene.



## (ii)



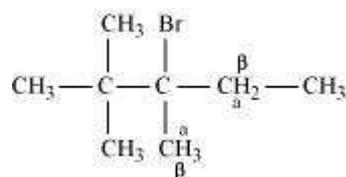
In the given compound, there are two different sets of equivalent  $\beta$ -hydrogen atoms labelled as *a* and *b*. Thus, dehydrohalogenation of the compound yields two alkenes.



Saytzeff's rule implies that in dehydrohalogenation reactions, the alkene having a greater number of alkyl groups attached to a doubly bonded carbon atoms is preferably produced.

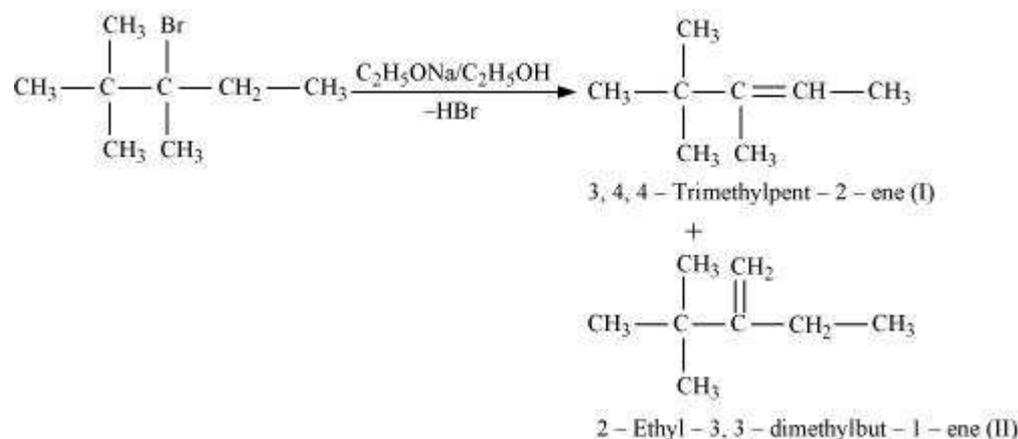
Therefore, alkene (I) i.e., 2-methylbut-2-ene is the major product in this reaction.

## (iii)



2,2,3-Trimethyl-3-bromopentane

In the given compound, there are two different sets of equivalent  $\beta$ -hydrogen atoms labelled as *a* and *b*. Thus, dehydrohalogenation of the compound yields two alkenes.



According to Saytzeff's rule, in dehydrohalogenation reactions, the alkene having a greater number of alkyl groups attached to the doubly bonded carbon atom is preferably formed.

Hence, alkene (I) i.e., 3,4,4-trimethylpent-2-ene is the major product in this reaction.

**Question 10.11:**

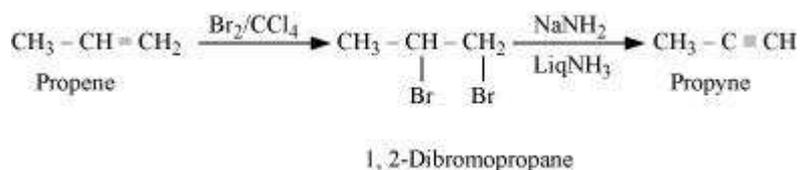
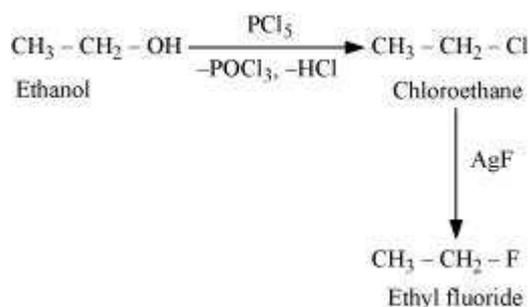
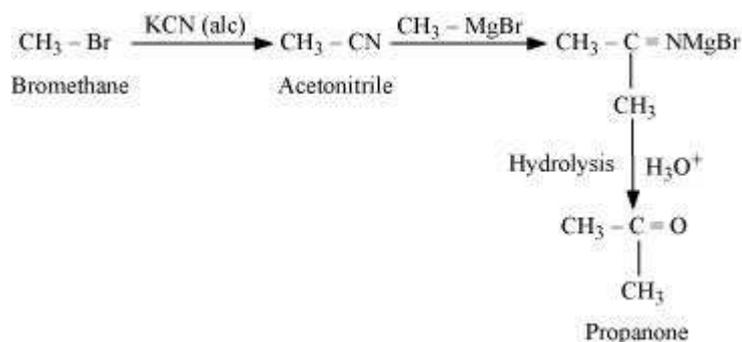
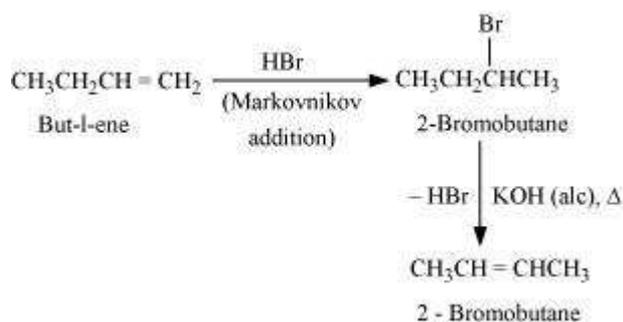
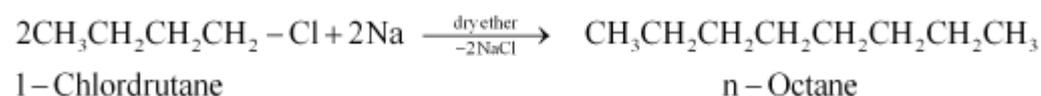
How will you bring about the following conversions?

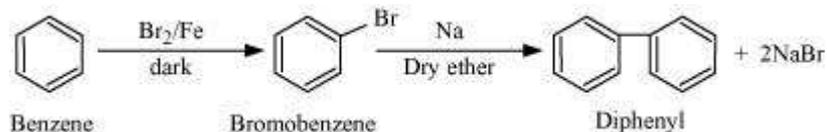
- (i) Ethanol to but-1-yne
- (ii) Ethane to bromoethene
- (iii) Propene to 1-nitropropane
- (iv) Toluene to benzyl alcohol
- (v) Propene to propyne
- (vi) Ethanol to ethyl fluoride
- (vii) Bromomethane to propanone
- (viii) But-1-ene to but-2-ene
- (ix) 1-Chlorobutane to n-octane
- (x) Benzene to biphenyl.

Answer

- (i)



**(vi)****(vii)****(viii)****(ix)****(x)**

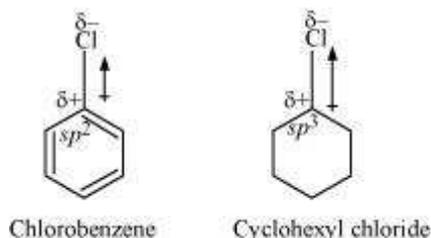
**Question 10.12:**

Explain why

- (i) the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride?
- (ii) alkyl halides, though polar, are immiscible with water?
- (iii) Grignard reagents should be prepared under anhydrous conditions?

Answer

(i)

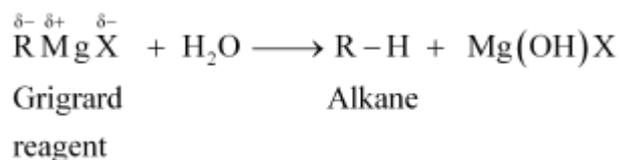


In chlorobenzene, the Cl-atom is linked to a  $sp^2$  hybridized carbon atom. In cyclohexyl chloride, the Cl-atom is linked to a  $sp^3$  hybridized carbon atom. Now,  $sp^2$  hybridized carbon has more s-character than  $sp^3$  hybridized carbon atom. Therefore, the former is more electronegative than the latter. Therefore, the density of electrons of C–Cl bond near the Cl-atom is less in chlorobenzene than in cyclohexyl chloride.

Moreover, the –R effect of the benzene ring of chlorobenzene decreases the electron density of the C–Cl bond near the Cl-atom. As a result, the polarity of the C–Cl bond in chlorobenzene decreases. Hence, the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

(ii) To be miscible with water, the solute-water force of attraction must be stronger than the solute-solute and water-water forces of attraction. Alkyl halides are polar molecules and so held together by dipole-dipole interactions. Similarly, strong H-bonds exist between the water molecules. The new force of attraction between the alkyl halides and water molecules is weaker than the alkyl halide-alkyl halide and water-water forces of attraction. Hence, alkyl halides (though polar) are immiscible with water.

(iii) Grignard reagents are very reactive. In the presence of moisture, they react to give alkanes.



Therefore, Grignard reagents should be prepared under anhydrous conditions.

**Question 10.13:**

Give the uses of freon 12, DDT, carbon tetrachloride and iodoform.

Answer

**Uses of Freon – 12**

Freon-12 (dichlorodifluoromethane,  $\text{CF}_2\text{Cl}_2$ ) is commonly known as CFC. It is used as a refrigerant in refrigerators and air conditioners. It is also used in aerosol spray propellants such as body sprays, hair sprays, etc. However, it damages the ozone layer. Hence, its manufacture was banned in the United States and many other countries in 1994.

**Uses of DDT**

DDT (*p, p*-dichlorodiphenyltrichloroethane) is one of the best known insecticides. It is very effective against mosquitoes and lice. But due its harmful effects, it was banned in the United States in 1973.

**Uses of carbontetrachloride ( $\text{CCl}_4$ )**

- (i) It is used for manufacturing refrigerants and propellants for aerosol cans.
- (ii) It is used as feedstock in the synthesis of chlorofluorocarbons and other chemicals.
- (iii) It is used as a solvent in the manufacture of pharmaceutical products.
- (iv) Until the mid 1960's, carbon tetrachloride was widely used as a cleaning fluid, a degreasing agent in industries, a spot reamer in homes, and a fire extinguisher.

**Uses of iodoform ( $\text{CHI}_3$ )**

Iodoform was used earlier as an antiseptic, but now it has been replaced by other formulations-containing iodine-due to its objectionable smell. The antiseptic property of iodoform is only due to the liberation of free iodine when it comes in contact with the skin.

**Question 10.14:**

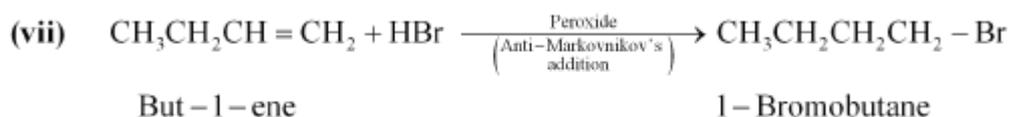
Write the structure of the major organic product in each of the following reactions:



- (i)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{NaI} \xrightarrow[\text{heat}]{\text{acetone}}$
- (ii)  $(\text{CH}_3)_3\text{CBr} + \text{KOH} \xrightarrow[\text{heat}]{\text{ethanol}}$
- (iii)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{CH}_3 + \text{NaOH} \xrightarrow{\text{water}}$
- (iv)  $\text{CH}_3\text{CH}_2\text{Br} + \text{KCN} \xrightarrow{\text{aq. ethanol}}$
- (v)  $\text{C}_6\text{H}_5\text{ONa} + \text{C}_2\text{H}_5\text{Cl} \longrightarrow$
- (vi)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{SOCl}_2 \longrightarrow$
- (vii)  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 + \text{HBr} \xrightarrow{\text{Peroxide}}$
- (viii)  $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2 + \text{HBr} \longrightarrow$

Answer

- (i)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{NaI} \xrightarrow[\text{heat}]{\text{acetone}} \text{CH}_3\text{CH}_2\text{CH}_2\text{I} + \text{NaCl}$   
1-Chloropropane  $\left( \begin{array}{c} \text{Finkelstein} \\ \text{reaction} \end{array} \right)$  1-Iodopropane
- (ii)  $(\text{CH}_3)_3\text{CBr} + \text{KOH} \xrightarrow[\text{heat}]{\text{ethanol}} \text{CH}_3-\underset{\text{CH}_3}{\text{C}}=\text{CH}_2 + \text{KBr} + \text{H}_2\text{O}$   
2-Bromo-2-methylpropane (Dehydrohalogenation) 2-Methylpropene
- (iii)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{CH}_3 + \text{NaOH} \xrightarrow{\text{water}} \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3 + \text{NaBr}$   
2-Bromobutane Butan-2-ol
- (iv)  $\text{CH}_3\text{CH}_2\text{Br} + \text{KCN} \xrightarrow[\text{(Nucleophilic substitution)}]{\text{aq. ethanol}} \text{CH}_3\text{CH}_2\text{CN} + \text{KBr}$   
Bromobutane Cyanoethane
- (v)  $\text{C}_6\text{H}_5\text{ONa} + \text{C}_2\text{H}_5\text{Cl} \xrightarrow[\text{(Williamson synthesis)}]{} \text{C}_6\text{H}_5-\text{O}-\text{C}_2\text{H}_5 + \text{NaCl}$   
Sodium phenoxide Chloroethane Phenetole
- (vi)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{SOCl}_2 \longrightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{SO}_2 + \text{HCl}$   
1-Propanol 1-Chloropropane



**(viii)**



**Question 10.15:**

Write the mechanism of the following reaction:

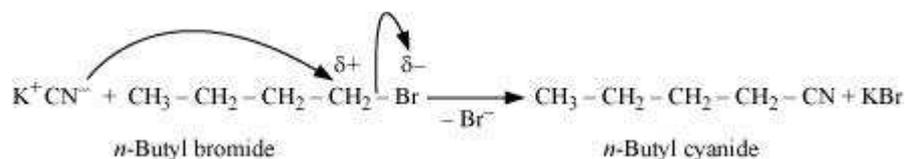


Answer

The given reaction is:



The given reaction is an  $\text{S}_{\text{N}}2$  reaction. In this reaction,  $\text{CN}^-$  acts as the nucleophile and attacks the carbon atom to which Br is attached.  $\text{CN}^-$  ion is an ambident nucleophile and can attack through both C and N. In this case, it attacks through the C-atom.



**Question 10.16:**

Arrange the compounds of each set in order of reactivity towards  $\text{S}_{\text{N}}2$  displacement:

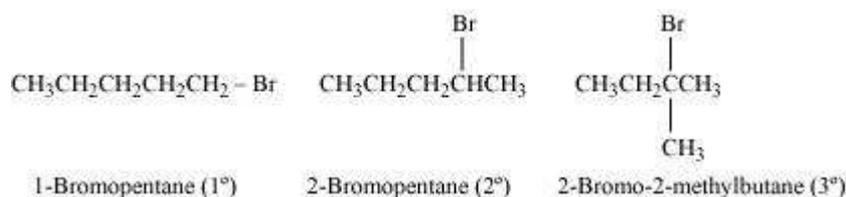
**(i)** 2-Bromo-2-methylbutane, 1-Bromopentane, 2-Bromopentane

**(ii)** 1-Bromo-3-methylbutane, 2-Bromo-2-methylbutane, 3-Bromo-2-methylbutane

**(iii)** 1-Bromobutane, 1-Bromo-2,2-dimethylpropane, 1-Bromo-2-methylbutane, 1-Bromo-3-methylbutane.

Answer

**(i)**



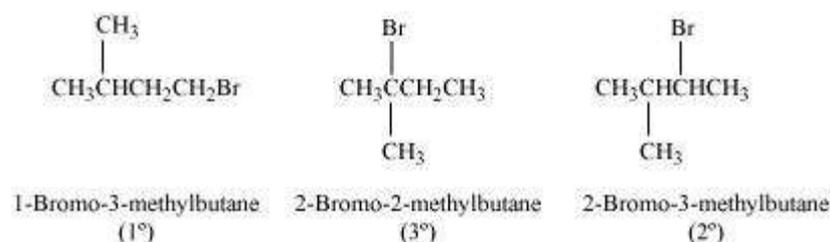
An  $\text{S}_{\text{N}}2$  reaction involves the approaching of the nucleophile to the carbon atom to which the leaving group is attached. When the nucleophile is sterically hindered, then the reactivity towards  $\text{S}_{\text{N}}2$  displacement decreases. Due to the presence of substituents, hindrance to the approaching nucleophile increases in the following order.

1-Bromopentane < 2-bromopentane < 2-Bromo-2-methylbutane

Hence, the increasing order of reactivity towards  $\text{S}_{\text{N}}^2$  displacement is:

2-Bromo-2-methylbutane < 2-Bromopentane < 1-Bromopentane

(ii)



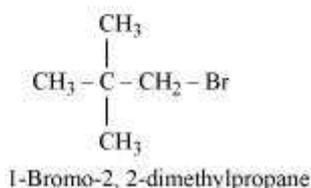
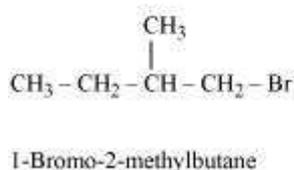
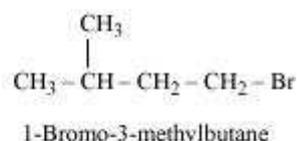
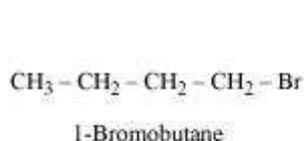
Since steric hindrance in alkyl halides increases in the order of  $1^\circ < 2^\circ < 3^\circ$ , the increasing order of reactivity towards  $\text{S}_{\text{N}}2$  displacement is  $3^\circ < 2^\circ < 1^\circ$ .

Hence, the given set of compounds can be arranged in the increasing order of their reactivity towards  $\text{S}_{\text{N}}^2$  displacement as:

2-Bromo-2-methylbutane < 2-Bromo-3-methylbutane < 1-Bromo-3-methylbutane

[2-Bromo-3-methylbutane is incorrectly given in NCERT]

(iii)



The steric hindrance to the nucleophile in the  $S_N2$  mechanism increases with a decrease in the distance of the substituents from the atom containing the leaving group. Further, the steric hindrance increases with an increase in the number of substituents. Therefore, the increasing order of steric hindrances in the given compounds is as below:

1-Bromobutane < 1-Bromo-3-methylbutane < 1-Bromo-2-methylbutane  
< 1-Bromo-2, 2-dimethylpropane

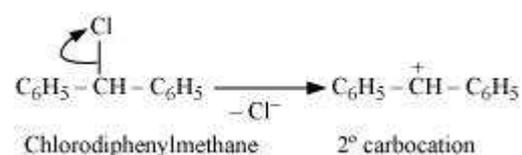
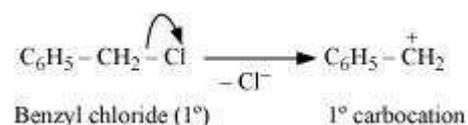
Hence, the increasing order of reactivity of the given compounds towards  $S_N2$  displacement is:

1-Bromo-2, 2-dimethylpropane < 1-Bromo-2-methylbutane < 1-Bromo-3-methylbutane  
< 1-Bromobutane

#### Question 10.17:

Out of  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  and  $\text{C}_6\text{H}_5\text{CHClC}_6\text{H}_5$ , which is more easily hydrolysed by aqueous KOH?

Answer



Hydrolysis by aqueous KOH proceeds through the formation of carbocation. If carbocation is stable, then the compound is easily hydrolyzed by aqueous KOH. Now,  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  forms  $1^\circ$ -carbocation, while  $\text{C}_6\text{H}_5\text{CHClC}_6\text{H}_5$  forms  $2^\circ$ -carbocation, which is

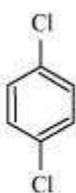


more stable than  $1^\circ$ -carbocation. Hence,  $\text{C}_6\text{H}_5\text{CHClC}_6\text{H}_5$  is hydrolyzed more easily than  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  by aqueous KOH.

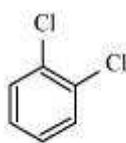
**Question 10.18:**

*p*-Dichlorobenzene has higher m.p. and lower solubility than those of *o*- and *m*-isomers. Discuss.

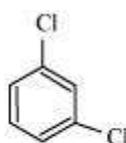
Answer



*p*-Dichlorobenzene



*o*-Dichlorobenzene



*m*-Dichlorobenzene

*p*-Dichlorobenzene is more symmetrical than *o*- and *m*-isomers. For this reason, it fits more closely than *o*- and *m*-isomers in the crystal lattice. Therefore, more energy is required to break the crystal lattice of *p*-dichlorobenzene. As a result, *p*-dichlorobenzene has a higher melting point and lower solubility than *o*- and *m*-isomers.

**Question 10.19:**

How the following conversions can be carried out?

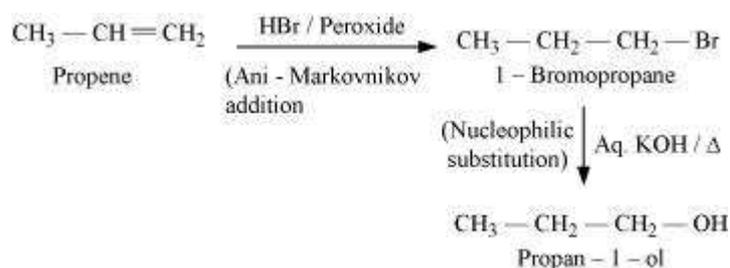
- (i) Propene to propan-1-ol
- (ii) Ethanol to but-1-yne
- (iii) 1-Bromopropane to 2-bromopropane
- (iv) Toluene to benzyl alcohol
- (v) Benzene to 4-bromonitrobenzene
- (vi) Benzyl alcohol to 2-phenylethanoic acid
- (vii) Ethanol to propanenitrile
- (viii) Aniline to chlorobenzene
- (ix) 2-Chlorobutane to 3, 4-dimethylhexane
- (x) 2-Methyl-1-propene to 2-chloro-2-methylpropane
- (xi) Ethyl chloride to propanoic acid
- (xii) But-1-ene to n-butyliodide
- (xiii) 2-Chloropropane to 1-propanol



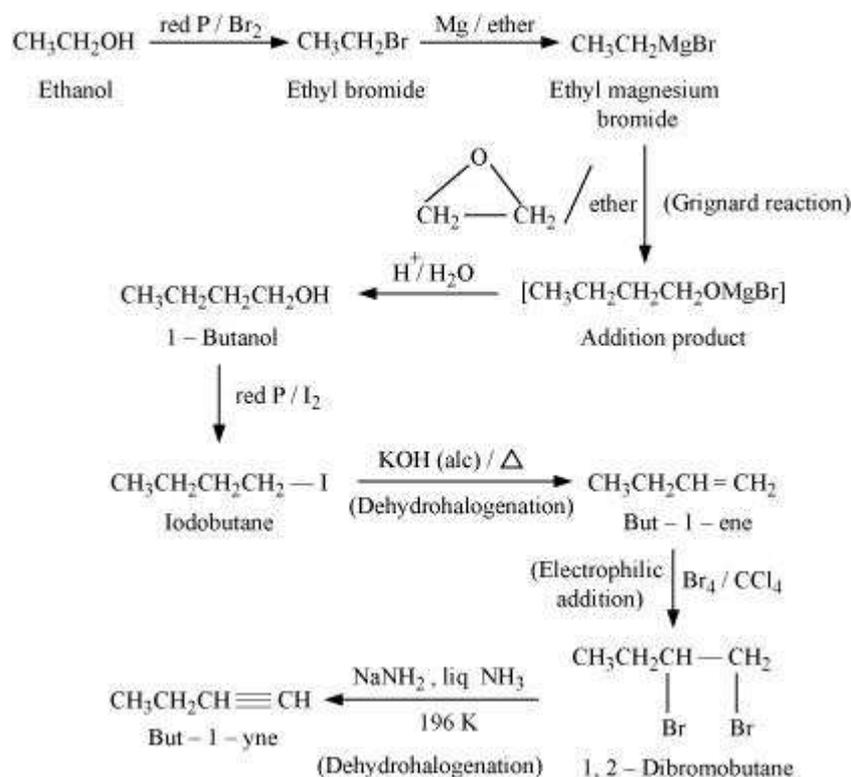
- (xiv) Isopropyl alcohol to iodoform  
(xv) Chlorobenzene to *p*-nitrophenol  
(xvi) 2-Bromopropane to 1-bromopropane  
(xvii) Chloroethane to butane  
(xviii) Benzene to diphenyl  
(xix) *tert*-Butyl bromide to isobutyl bromide  
(xx) Aniline to phenylisocyanide

Answer

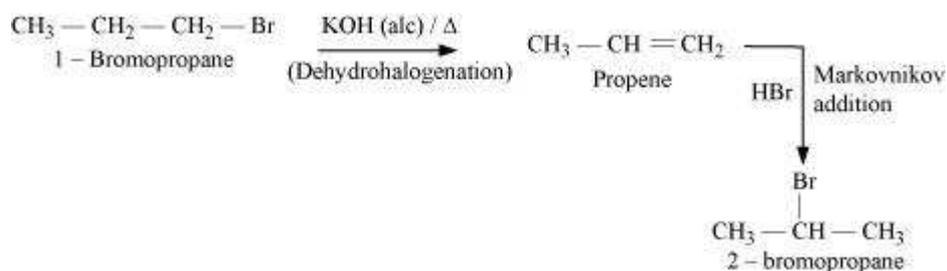
(i)



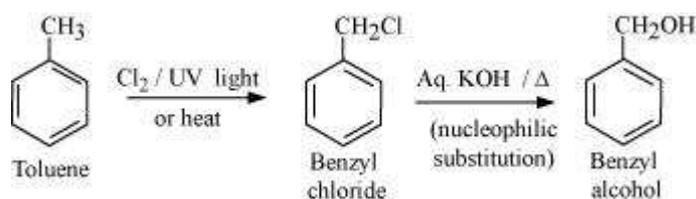
(ii)



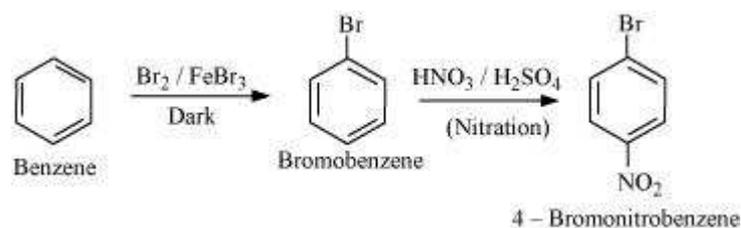
(iii)



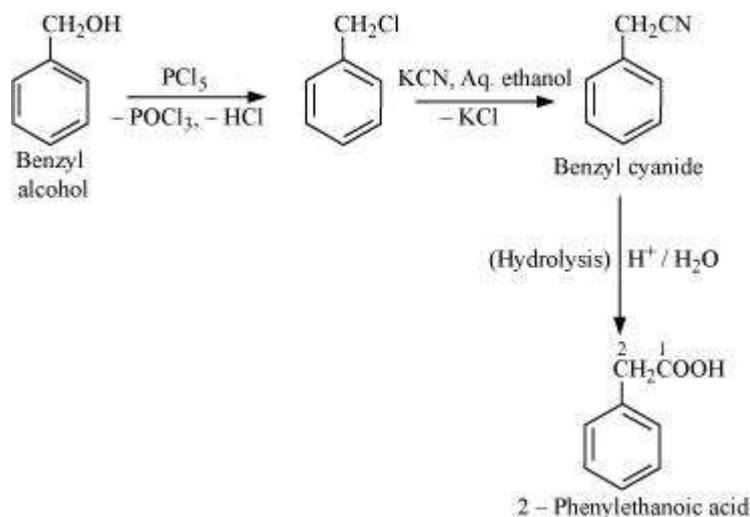
(iv)



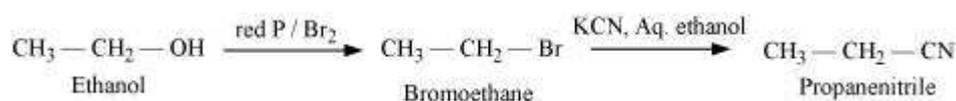
(v)



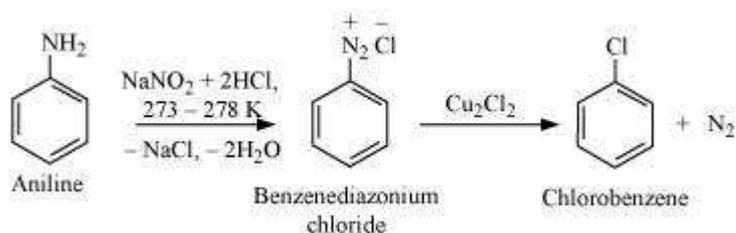
(vi)



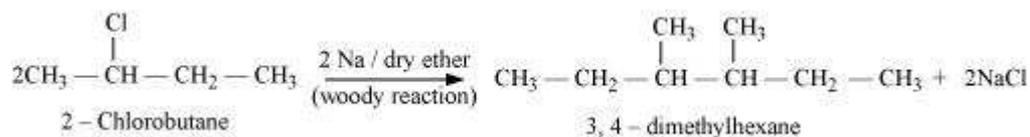
(vii)



(viii)



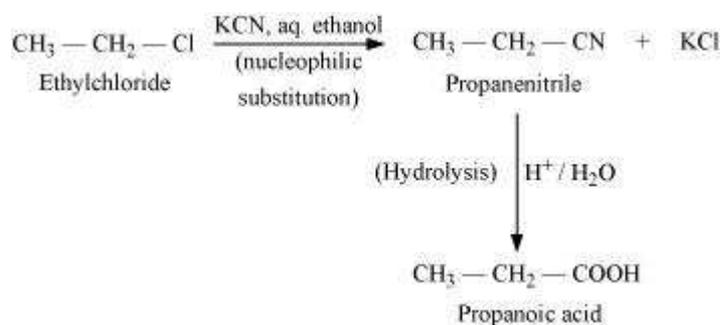
(ix)



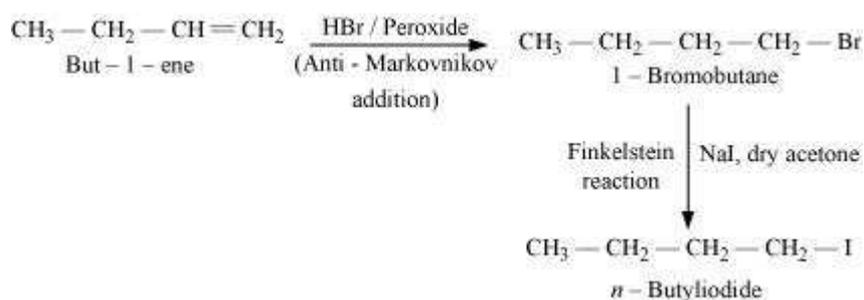
(x)



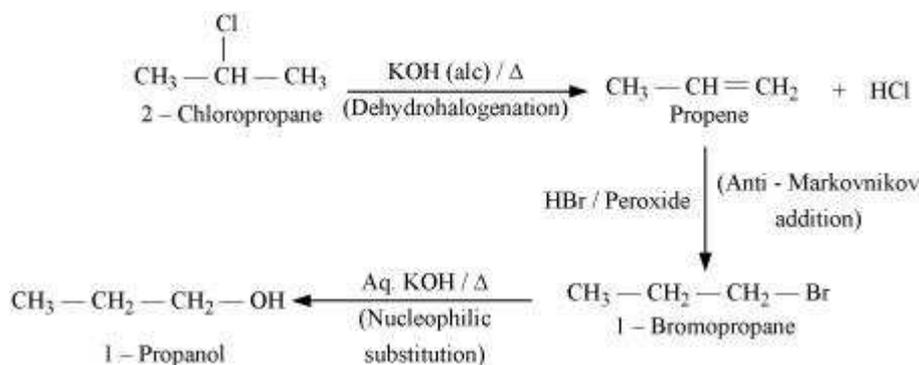
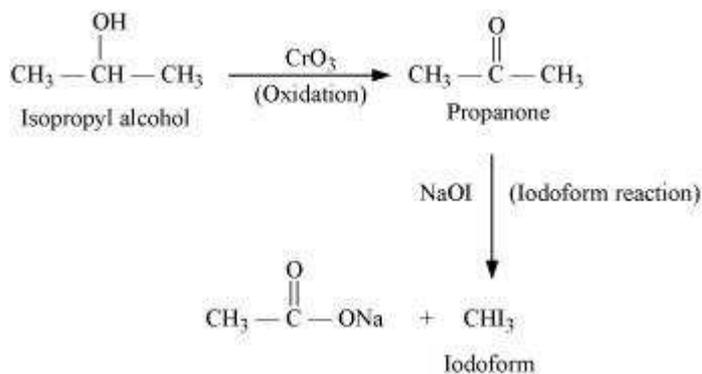
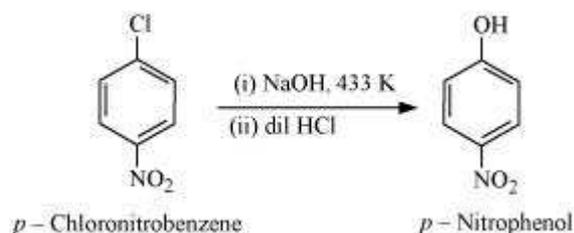
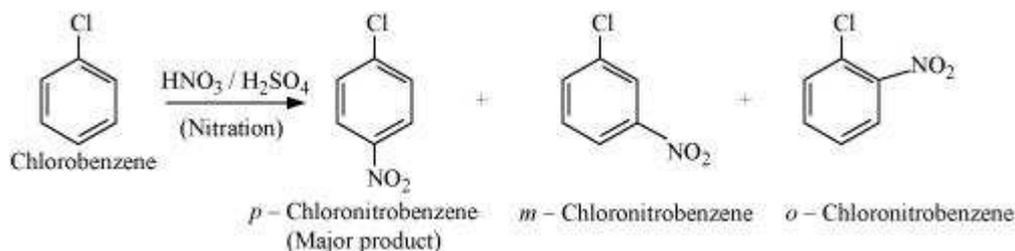
(xi)

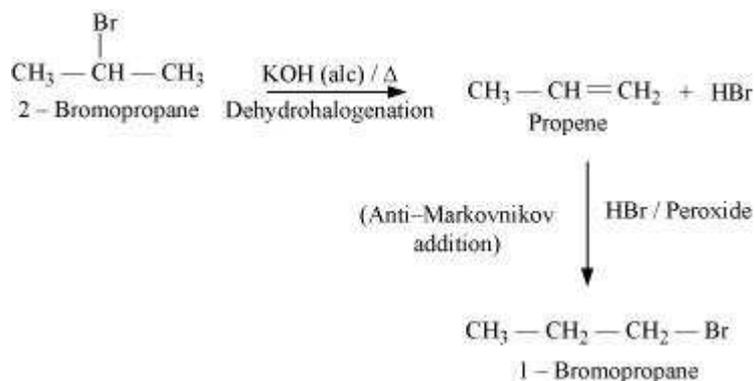
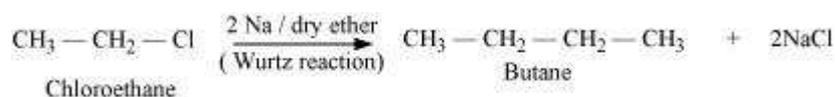
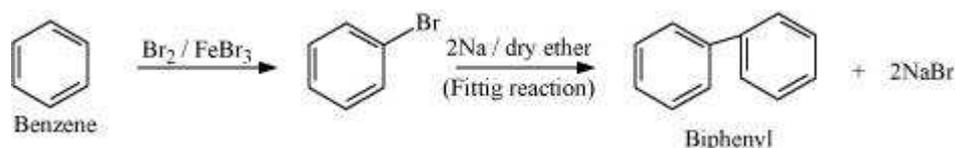
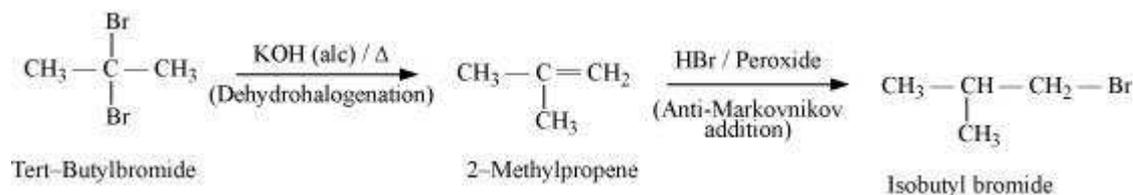
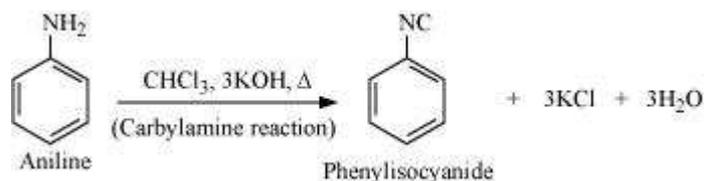


(xii)



(xiii)

**(xiv)****(xv)****(xvi)**

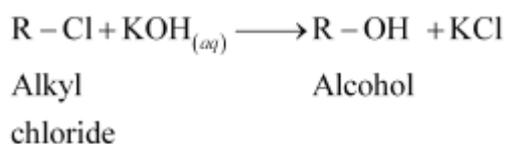
**(xvii)****(xviii)****(xix)****(xx)****Question 10.20:**

The treatment of alkyl chlorides with aqueous KOH leads to the formation of alcohols but in the presence of alcoholic KOH, alkenes are major products. Explain.

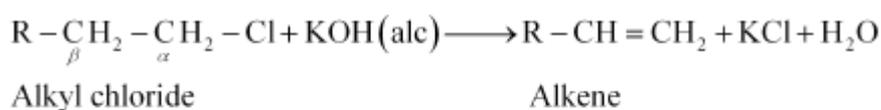
Answer



In an aqueous solution, KOH almost completely ionizes to give  $\text{OH}^-$  ions.  $\text{OH}^-$  ion is a strong nucleophile, which leads the alkyl chloride to undergo a substitution reaction to form alcohol.



On the other hand, an alcoholic solution of KOH contains alkoxide ( $\text{RO}^-$ ) ion, which is a strong base. Thus, it can abstract a hydrogen from the  $\beta$ -carbon of the alkyl chloride and form an alkene by eliminating a molecule of HCl.



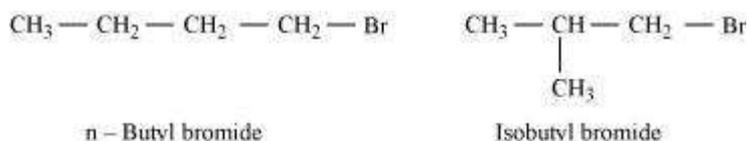
$\text{OH}^-$  ion is a much weaker base than  $\text{RO}^-$  ion. Also,  $\text{OH}^-$  ion is highly solvated in an aqueous solution and as a result, the basic character of  $\text{OH}^-$  ion decreases. Therefore, it cannot abstract a hydrogen from the  $\beta$ -carbon.

**Question 10.21:**

Primary alkyl halide  $\text{C}_4\text{H}_9\text{Br}$  (a) reacted with alcoholic KOH to give compound (b). Compound (b) is reacted with HBr to give (c) which is an isomer of (a). When (a) is reacted with sodium metal it gives compound (d),  $\text{C}_8\text{H}_{18}$  which is different from the compound formed when *n*-butyl bromide is reacted with sodium. Give the structural formula of (a) and write the equations for all the reactions.

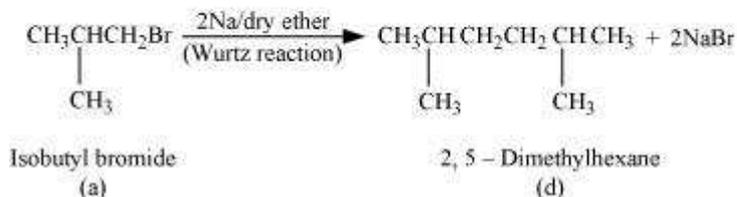
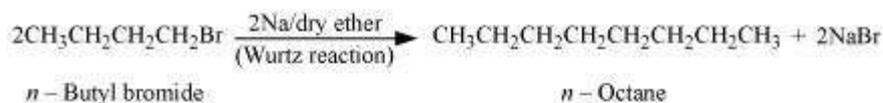
Answer

There are two primary alkyl halides having the formula,  $\text{C}_4\text{H}_9\text{Br}$ . They are *n*-butyl bromide and isobutyl bromide.



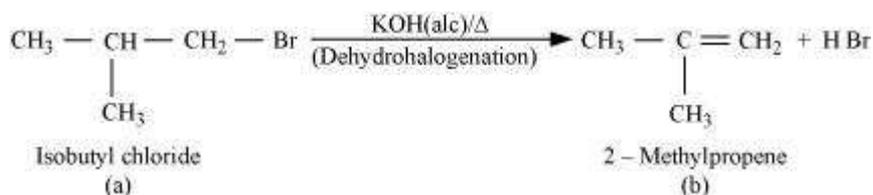
Therefore, compound (a) is either *n*-butyl bromide or isobutyl bromide.

Now, compound (a) reacts with Na metal to give compound (b) of molecular formula,  $\text{C}_8\text{H}_{18}$ , which is different from the compound formed when *n*-butyl bromide reacts with Na metal. Hence, compound (a) must be isobutyl bromide.



Thus, compound (d) is 2, 5-dimethylhexane.

It is given that compound (a) reacts with alcoholic KOH to give compound (b). Hence, compound (b) is 2-methylpropene.



Also, compound (b) reacts with HBr to give compound (c) which is an isomer of (a). Hence, compound (c) is 2-bromo-2-methylpropane.



### Question 10.22:

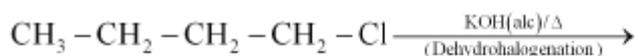
What happens when

- (i) *n*-butyl chloride is treated with alcoholic KOH,
- (ii) bromobenzene is treated with Mg in the presence of dry ether,
- (iii) chlorobenzene is subjected to hydrolysis,
- (iv) ethyl chloride is treated with aqueous KOH,
- (v) methyl bromide is treated with sodium in the presence of dry ether,
- (vi) methyl chloride is treated with KCN.

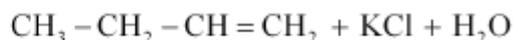
Answer



(i) When *n*-butyl chloride is treated with alcoholic KOH, the formation of but-1-ene takes place. This reaction is a dehydrohalogenation reaction.

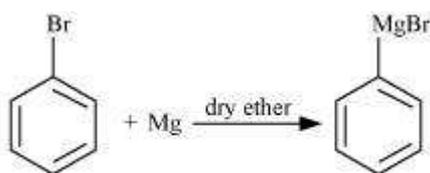


*n*-Butyl chloride



But-1-ene

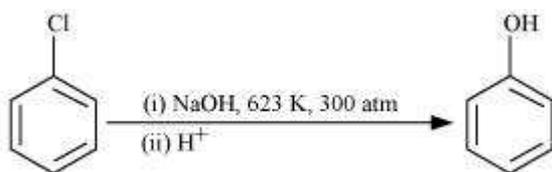
(ii) When bromobenzene is treated with Mg in the presence of dry ether, phenylmagnesium bromide is formed.



Bromobenzene

Phenylmagnesium bromide

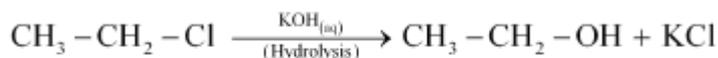
(iii) Chlorobenzene does not undergo hydrolysis under normal conditions. However, it undergoes hydrolysis when heated in an aqueous sodium hydroxide solution at a temperature of 623 K and a pressure of 300 atm to form phenol.



Chlorobenzene

Phenol

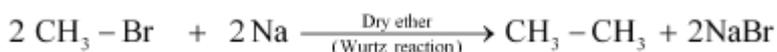
(iv) When ethyl chloride is treated with aqueous KOH, it undergoes hydrolysis to form ethanol.



Ethyl chloride

Ethanol

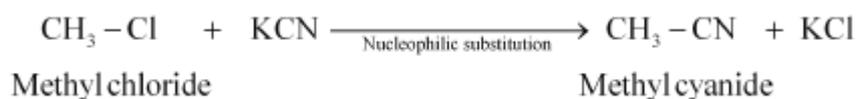
(v) When methyl bromide is treated with sodium in the presence of dry ether, ethane is formed. This reaction is known as the Wurtz reaction.



Methyl bromide

Ethane

(vi) When methyl chloride is treated with KCN, it undergoes a substitution reaction to give methyl cyanide.

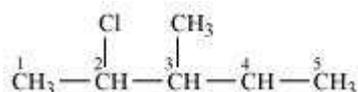
**Text solution****Question 10.1:**

Write structures of the following compounds:

- (i) 2-Chloro-3-methylpentane
- (ii) 1-Chloro-4-ethylcyclohexane
- (iii) 4-tert. Butyl-3-iodoheptane
- (iv) 1,4-Dibromobut-2-ene
- (v) 1-Bromo-4-sec. butyl-2-methylbenzene

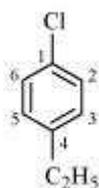
Answer

(i)



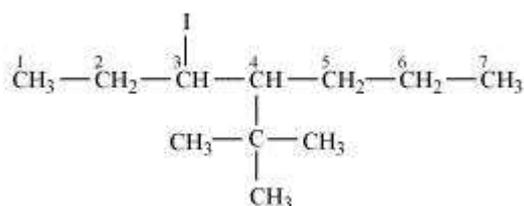
2-Chloro-3-methyl pentane

(ii)



1-Chloro-4-ethylcyclohexane

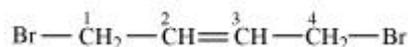
(iii)





4- tert-Butyl-3-iodoheptane

(iv)



1, 4-Dibromobut-2-ene

(v)



1-Bromo-4-sec-butyl-2-methylbenzene

### Question 10.2:

Why is sulphuric acid not used during the reaction of alcohols with KI?

Answer

In the presence of sulphuric acid (H<sub>2</sub>SO<sub>4</sub>), KI produces HI



Since H<sub>2</sub>SO<sub>4</sub> is an oxidizing agent, it oxidizes HI (produced in the reaction to I<sub>2</sub>).



As a result, the reaction between alcohol and HI to produce alkyl iodide cannot occur. Therefore, sulphuric acid is not used during the reaction of alcohols with KI. Instead, a non-oxidizing acid such as H<sub>3</sub>PO<sub>4</sub> is used.

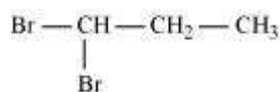
### Question 10.3:

Write structures of different dihalogen derivatives of propane.

Answer

There are four different dihalogen derivatives of propane. The structures of these derivatives are shown below.

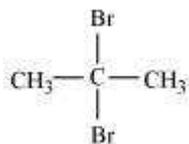
(i)





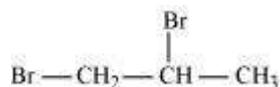
1, 1-Dibromopropane

(ii)



2, 2-Dibromopropane

(iii)



1, 2-Dibromopropane

(iv)



1, 3-Dibromopropane

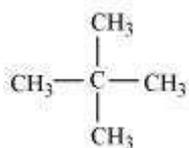
**Question 10.4:**

Among the isomeric alkanes of molecular formula  $\text{C}_5\text{H}_{12}$ , identify the one that on photochemical chlorination yields

- (i) A single monochloride.
- (ii) Three isomeric monochlorides.
- (iii) Four isomeric monochlorides.

Answer

(i) To have a single monochloride, there should be only one type of H-atom in the isomer of the alkane of the molecular formula  $\text{C}_5\text{H}_{12}$ . This is because, replacement of any H-atom leads to the formation of the same product. The isomer is neopentane.

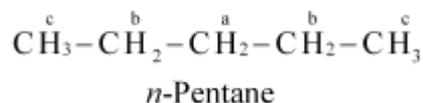


Neopentane

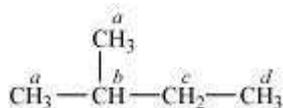
(ii) To have three isomeric monochlorides, the isomer of the alkane of the molecular formula  $\text{C}_5\text{H}_{12}$  should contain three different types of H-atoms.



Therefore, the isomer is *n*-pentane. It can be observed that there are three types of H atoms labelled as *a*, *b* and *c* in *n*-pentane.

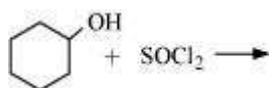


(iii) To have four isomeric monochlorides, the isomer of the alkane of the molecular formula  $\text{C}_5\text{H}_{12}$  should contain four different types of H-atoms. Therefore, the isomer is 2-methylbutane. It can be observed that there are four types of H-atoms labelled as *a*, *b*, *c*, and *d* in 2-methylbutane.

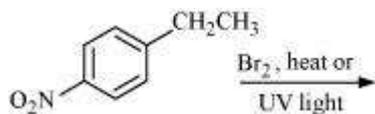
**Question 10.5:**

Draw the structures of major monohalo products in each of the following reactions:

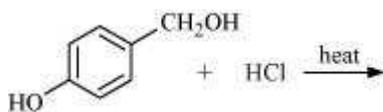
(i)



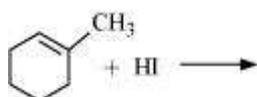
(ii)



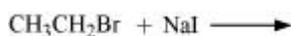
(iii)



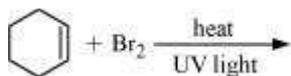
(iv)



(v)



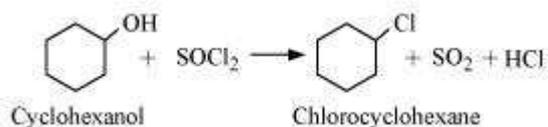
(vi)



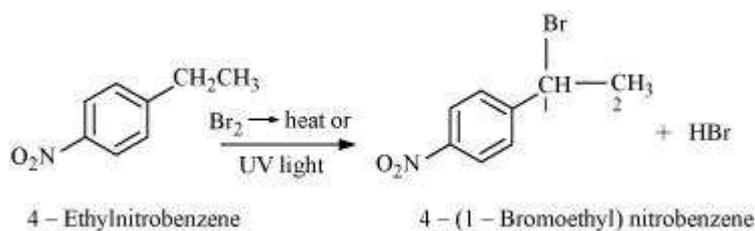


Answer

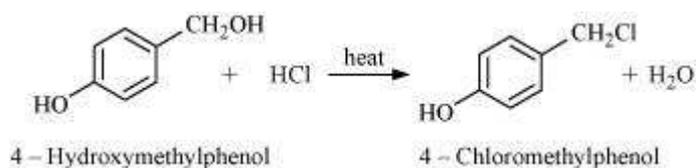
(i)



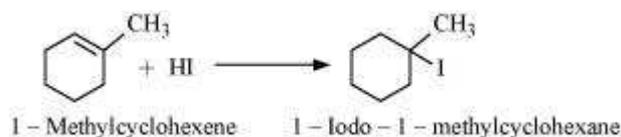
(ii)



(iii)



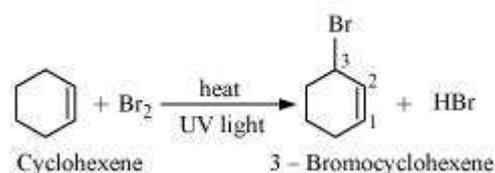
(iv)



(v)



(vi)

**Question 10.6:**

Arrange each set of compounds in order of increasing boiling points.

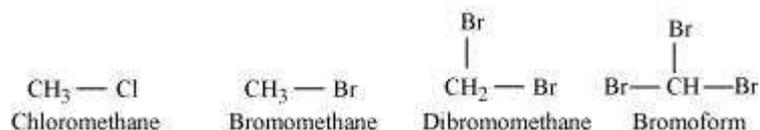
(i) Bromomethane, Bromoform, Chloromethane, Dibromomethane.

(ii) 1-Chloropropane, Isopropyl chloride, 1-Chlorobutane.



Answer

(i)



For alkyl halides containing the same alkyl group, the boiling point increases with an increase in the atomic mass of the halogen atom.

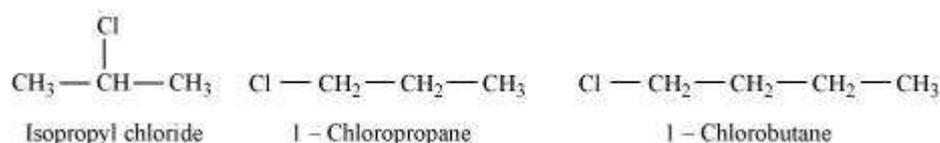
Since the atomic mass of Br is greater than that of Cl, the boiling point of bromomethane is higher than that of chloromethane.

Further, for alkyl halides containing the same alkyl group, the boiling point increases with an increase in the number of halides. Therefore, the boiling point of Dibromomethane is higher than that of chloromethane and bromomethane, but lower than that of bromoform.

Hence, the given set of compounds can be arranged in the order of their increasing boiling points as:

Chloromethane < Bromomethane < Dibromomethane < Bromoform.

(ii)



For alkyl halides containing the same halide, the boiling point increases with an increase in the size of the alkyl group. Thus, the boiling point of 1-chlorobutane is higher than that of isopropyl chloride and 1-chloropropane.

Further, the boiling point decreases with an increase in branching in the chain. Thus, the boiling point of isopropyl alcohol is lower than that of 1-chloropropane.

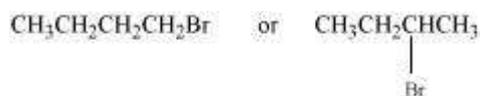
Hence, the given set of compounds can be arranged in the increasing order of their boiling points as:

Isopropyl chloride < 1-Chloropropane < 1-Chlorobutane

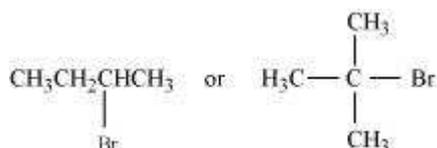
### Question 10.7:

Which alkyl halide from the following pairs would you expect to react more rapidly by an  $\text{S}_{\text{N}}2$  mechanism? Explain your answer.

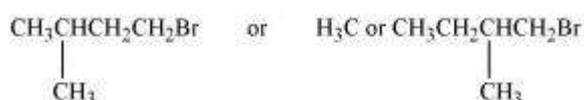
(i)



(ii)

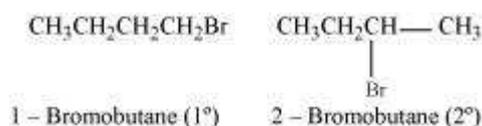


(iii)



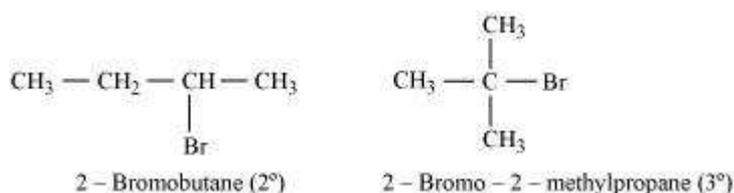
Answer

(i)



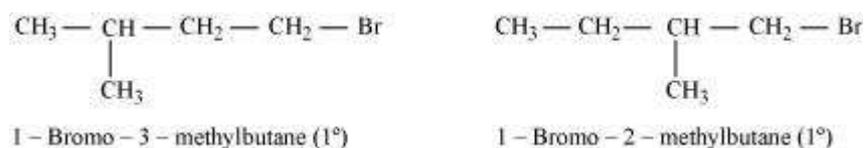
2-bromobutane is a 2° alkylhalide whereas 1-bromobutane is a 1° alkyl halide. The approaching of nucleophile is more hindered in 2-bromobutane than in 1-bromobutane. Therefore, 1-bromobutane reacts more rapidly than 2-bromobutane by an S<sub>N</sub>2 mechanism.

(ii)



2-Bromobutane is 2° alkylhalide whereas 2-bromo-2-methylpropane is 3° alkyl halide. Therefore, greater numbers of substituents are present in 3° alkyl halide than in 2° alkyl halide to hinder the approaching nucleophile. Hence, 2-bromobutane reacts more rapidly than 2-bromo-2-methylpropane by an S<sub>N</sub>2 mechanism.

(iii)

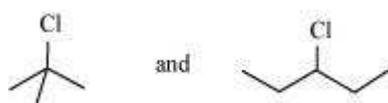
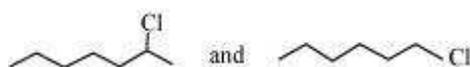




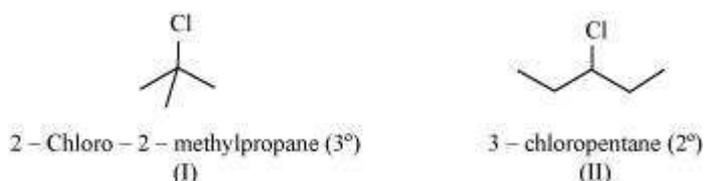
Both the alkyl halides are primary. However, the substituent  $-\text{CH}_3$  is at a greater distance to the carbon atom linked to Br in 1-bromo-3-methylbutane than in 1-bromo-2-methylbutane. Therefore, the approaching nucleophile is less hindered in case of the former than in case of the latter. Hence, the former reacts faster than the latter by  $\text{S}_{\text{N}}2$  mechanism.

**Question 10.8:**

In the following pairs of halogen compounds, which compound undergoes faster  $\text{S}_{\text{N}}1$  reaction?

**(i)****(ii)**

Answer

**(i)**

$\text{S}_{\text{N}}1$  reaction proceeds via the formation of carbocation. The alkyl halide (I) is  $3^\circ$  while (II) is  $2^\circ$ . Therefore, (I) forms  $3^\circ$  carbocation while (II) forms  $2^\circ$  carbocation. Greater the stability of the carbocation, faster is the rate of  $\text{S}_{\text{N}}1$  reaction. Since  $3^\circ$  carbocation is more stable than  $2^\circ$  carbocation, (I), i.e. 2-chloro-2-methylpropane, undergoes faster  $\text{S}_{\text{N}}1$  reaction than (II) i.e., 3-chloropentane.

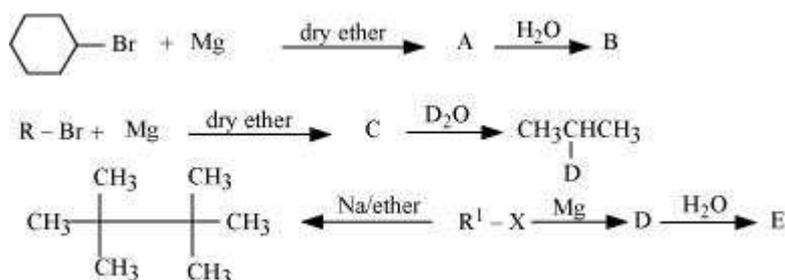
**(ii)**



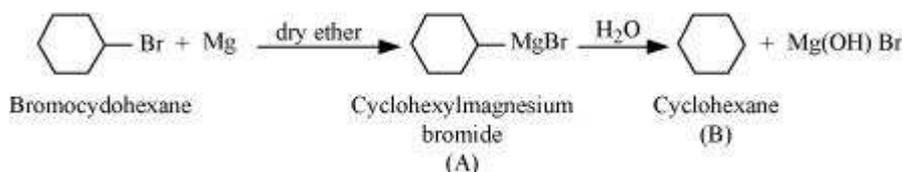
The alkyl halide (I) is 2° while (II) is 1°. 2° carbocation is more stable than 1° carbocation. Therefore, (I), 2-chloroheptane, undergoes faster S<sub>N</sub>1 reaction than (II), 1-chlorohexane.

**Question 10.9:**

Identify A, B, C, D, E, R and R<sup>1</sup> in the following:



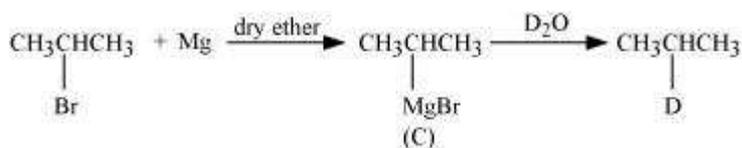
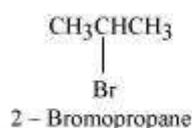
Answer



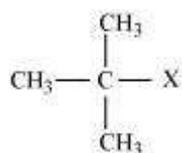
Since D of D<sub>2</sub>O gets attached to the carbon atom to which MgBr is attached, C is



Therefore, the compound R – Br is

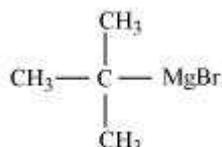


When an alkyl halide is treated with Na in the presence of ether, a hydrocarbon containing double the number of carbon atoms as present in the original halide is obtained as product. This is known as Wurtz reaction. Therefore, the halide, R<sup>1</sup>-X, is



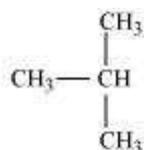
*tert* - Butylhalide

Therefore, compound D is

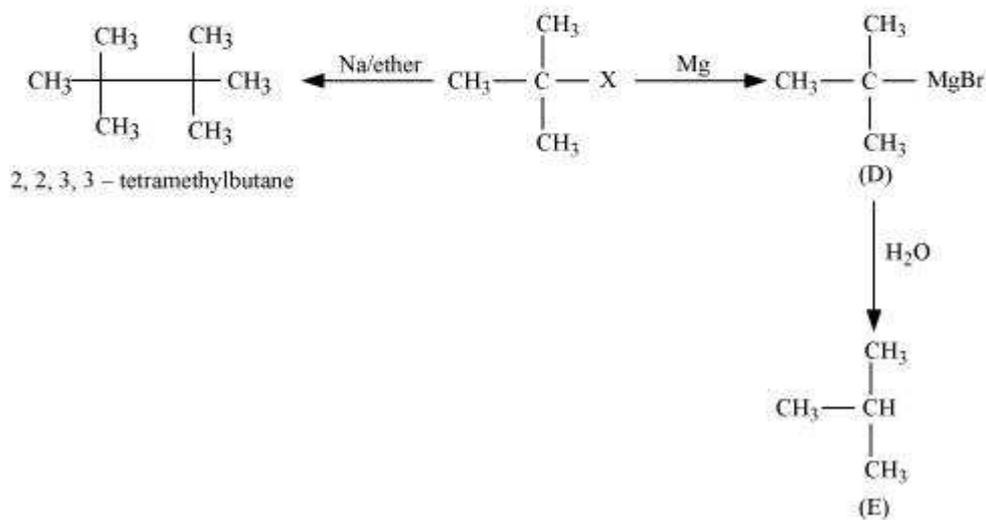


*tert* - Butylmagnesiumbromide

And, compound E is



2 - Methylpropane



Q7. What is meant by ambidentate ligands? Give two examples.

Q8. Draw the structures of optical isomers of:



Q9. Discuss the nature of bonding in metal carbonyls.

Q10. What is meant by the *chelate effect*? Give an example.

Q11. Draw the structures of:



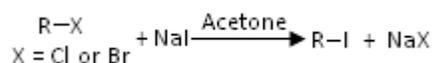
## CHAPTER-10. HALO ALKANES AND HALOARENES

### 4 Marks Chapter

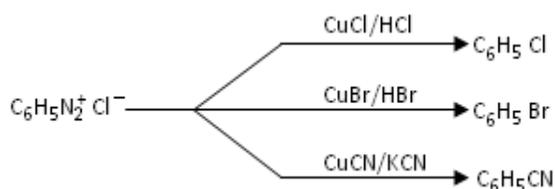
- For  $\text{C}_4\text{H}_9\text{Br}$ , four isomeric compounds are possible out of which one (sec-butyl bromide) can show enantiomerism.
- For  $\text{C}_5\text{H}_{11}\text{Br}$ , eight isomeric compounds are possible out of which three can exhibit enantiomerism.
- Alcohols can be converted into chlorides by reaction with (i)  $\text{HCl}/\text{ZnCl}_2$ , (ii)  $\text{PCl}_5$ , (iii)  $\text{PCl}_3$  or (iv)  $\text{SOCl}_2/\text{Pyridine}$ . The reaction with  $\text{SOCl}_2/\text{Pyridine}$  is preferred because in this case side products are gaseous and can be expelled readily during distillation.
- **Addition of halogen acids to alkenes** takes place via **carbocations** as intermediates.
- **Halogenation of alkenes in the presence of peroxides**, takes place through **free radicals** as intermediates and results in anti-Markownikoff's product (KHARASCH EFFECT).

- **Allylic substitution** can be carried out using  $\text{Cl}_2$  or  $\text{Br}_2$  at 800 K or sulphuryl chloride ( $\text{SO}_2\text{Cl}_2$ ) at 475 K in the presence of light and traces of peroxide. The reaction proceeds via **free radicals** as intermediates.

- **Finkelstein reaction**



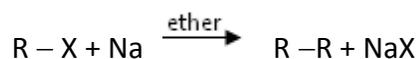
- **Halogenation of benzene** with  $\text{Cl}_2$  or  $\text{Br}_2$  in the presence of  $\text{FeCl}_3$  or  $\text{FeBr}_3$  (Halogen carrier) is an **electrophilic substitution reaction**, which proceeds through a resonance stabilised **carbocation** as intermediate.
- **Sandmeyer's Reaction:** The reaction of benzene diazonium salts with  $\text{CuCl}$  or  $\text{CuBr}$  or  $\text{CuCN}$  in the presence of  $\text{HCl}$ ,  $\text{HBr}$  or  $\text{KCN}$  respectively is known as Sandmeyer's reaction.



- For same alkyl group, boiling points of alkyl halides are in the order :  $\text{RI} > \text{RBr} > \text{RCl} > \text{RF}$ .
- For same halogen boiling point of halides increases with increase in size of alkyl group.
- Among isomeric halides boiling point decreases with increase in branching in alkyl group.
- Alkyl halides are insoluble in water due to their inability to form hydrogen bonds with water.
- Density of alkyl halides in the order  $\text{RI} > \text{RBr} > \text{RCl}$ . Alkyl chlorides are lighter than water whereas bromides and iodides are heavier than water.
- **Nucleophilic substitution reactions** are the characteristic reactions of alkyl halides.
- These reactions may proceed through  $\text{S}_\text{N}^2$  mechanism. The order of reactivity of alkyl halides through  $\text{S}_\text{N}^1$  mechanism is  $3^\circ > 2^\circ > 1^\circ$ . The order of reactivity of alkyl halides through  $\text{S}_\text{N}^2$  mechanism is  $1^\circ > 2^\circ > 3^\circ$ .

➤

- Saytzeff-Rule. During dehydrohalogenation the more substituted alkene is the preferred product.
- Wurtz Reaction. For preparing symmetrical alkanes.



Methane cannot be prepared by this method.

- Aryl halides undergo substitution less readily than alkyl halides. Reactivity towards nucleophilic substitution increases if some electron withdrawing group such as  $-\text{NO}_2$  is present at ortho or para positions with respect to halogen.
- Fittig Reaction

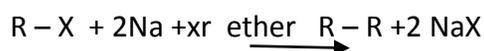


- Haloarenes are less reactive than benzene towards electrophilic substitution reactions.

- Westron: 1, 1, 2, 2–Tetrachloroethane
- Westrosol : Trichloroethene
- D.D.T: 1,1, 1–Trichloro–2, 2–bis (*p*–chlorophenyl) ethane
- CF<sub>2</sub>Cl<sub>2</sub> : (Freon – 12) is used as refrigerant
- CCl<sub>4</sub> : is used as fire extinguisher under the name **pyrene**.
- IUPAC name of B.H.C. is 1, 2, 3, 4, 5, 6. Hexachlorocyclohexane.
- Aryl and vinyl halides do not give precipitate with AgNO<sub>3</sub> solution.

### Some important name reaction

#### 1. Wurtz reaction



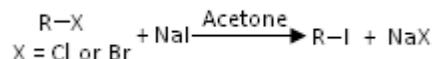
#### 2. Wurtz –Fittig reaction



#### 3. Fittig reaction



#### 4. Finkelstein Reaction



### CONCEPTUAL QUESTIONS

#### Q1. Why haloalkanes are more reactive than haloarenes.

Ans. In haloarenes, there is double bond character b/w carbon and halogen due to resonance effect which makes less reactive.

(ii) In benzene, carbon being sp<sup>2</sup> hybridised which is smaller in size than sp<sup>3</sup> present in haloalkanes. So C-Cl bond in aryl halides is shorter and stronger.

#### Q2. Why do haloalkanes undergo nucleophilic substitution whereas haloarenes undergo electrophilic substitution.

Ans. Due to more electro negative nature of halide atom in haloalkanes carbon atom becomes slightly positive and is easily attacked by nucleophilic reagents.

While in haloarenes due to resonance, carbon atom becomes slightly negative and attacked by electrophilic reagents.

**Q3. When an alkyl halide is treated with ethanolic solution of KCN, the major product is alkyl cyanide where as if alkyl halide is treated with AgCN, the major product is alkyl isocyanide.**

Ans. KCN is ionic they can attach through C or N but C-C bond is stronger than C-N bond. So alkyl cyanide is the major product but AgCN is covalent so more electronegative N can attach to C and forms isocyanides.

**Q4. Aryl halides cannot be prepared by the action of sodium halide in the presence H<sub>2</sub>SO<sub>4</sub>. Why?**

Ans. Due to resonance the carbon-oxygen bond in phenols has partial double bond and it is stronger than carbon oxygen single bond.

**Q5. Why Grignard reagent should be prepared under anhydrous conditions?**

Ans. Grignard reagent reacts with H<sub>2</sub>O to form alkanes, therefore they are prepared under anhydrous conditions.

**Q6. Why is Sulphuric acid not used during the reaction of alcohols with KI?**

Ans. It is because HI formed will get oxidized to I<sub>2</sub> by concentrated Sulphuric acid which is an oxidizing agent.

**Q7. p-dichlorobenzene has highest m.p. than those of ortho and m-isomers?**

Ans. p-dichlorobenzene is symmetrical, fits into crystal lattice more readily and has higher melting point.

**Q8. Although chlorine is an electron-withdrawing group, yet it is ortho and para directing in electrophilic aromatic substitution reactions. Why?**

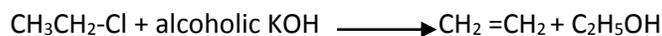
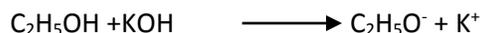
Ans. Chlorobenzene is resonance hybrid, there is -ve charge at ortho and para positions, electrophilic substitution reaction will take place at ortho and para position due to +R effect.

**Q9. The treatment of alkyl chlorides with aqueous KOH leads to the formation of alcohols but in presence of alcoholic KOH alkenes are major products. Explain?**

Ans. In aqueous KOH, OH<sup>-</sup> is nucleophile which replaces another nucleophile.



Where as in alcoholic KOH



(C<sub>2</sub>H<sub>5</sub>O<sup>-</sup>)

**Q10. Explain why vinyl chloride is unreactive in nucleophilic substitution reaction?**

Ans. Vinyl chloride is unreactive in nucleophilic substitution reaction because of double bond character between C-Cl bond which is difficult to break and moreover C is in sp<sup>2</sup> hybridisation.

**Q11. Arrange the following compounds according to reactivity towards nucleophilic substitution reaction with reagents mentioned :-**

- (i) 4-nitrochlorobenzene, 2,4-dinitrochlorobenzene, 2,4,6-trinitrochlorobenzene with  $\text{CH}_3\text{ONa}$

Ans- 2,4,6-trinitrochlorobenzene > 2,4-dinitrochlorobenzene > 4-nitrochlorobenzene

**Q12. Which compound will react faster in  $\text{S}_\text{N}2$  reaction with  $\text{OH}^-$ ?**

Ans- (a)  $\text{CH}_3\text{Br}$  and  $\text{CH}_3\text{I}$  ( $\text{S}_\text{N}2$ )

$\text{CH}_3\text{I}$  will react faster than  $\text{CH}_3\text{Br}$

(b)  $(\text{CH}_3)_3\text{C-Cl}$  or  $\text{CH}_3\text{Cl}$  ( $\text{S}_\text{N}2$ )

$\text{CH}_3\text{Cl}$  will react faster than  $3^\circ$  halide

**Q13. Arrange in order of boiling points.**

(a) Bromobenzene, Bromoform, chloromethane, Dibromo-methane

(b) 1-chloropropane, Isopropyl chloride, 1-Chlorobutane.

Ans. (a) chloromethane < Bromobenzene < Dibromo-methane < Bromoform

(b) Isopropyl chloride < 1-chloropropane < 1-Chlorobutane

(As branching increases, boiling point decreases)

**Q 14. Predict the reactivity in  $\text{S}_\text{N}1$**

(a)  $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ ,  $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$ ,  $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$ ,  $\text{C}_6\text{H}_5\text{C}(\text{CH}_3)(\text{C}_6\text{H}_5)\text{Br}$

Ans.  $3^\circ > 2^\circ > 1^\circ$  ( $\text{S}_\text{N}1$ )

$\text{C}_6\text{H}_5\text{C}(\text{CH}_3)(\text{C}_6\text{H}_5)\text{Br} > \text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br} > \text{C}_6\text{H}_5\text{CH}_2\text{Br}$

( $3^\circ$ )                      ( $2^\circ$ )                      ( $2^\circ$ )                      ( $1^\circ$ )

**VERY SHORT ANSWER TYPE QUESTION**

**[1 MARKS]**

Q.1. Write the formula & chemical name of DDT?

Q.2. An alkyl halide having molecular formula  $\text{C}_4\text{H}_9\text{Cl}$  is optically active. What is its structure?

Q.3. Why is vinyl chloride less reactive than ethyl chloride?

Q.4. Write the structural isomers of  $\text{C}_3\text{H}_6\text{Cl}_2$  which can exhibit enantiomerism?

Q.5. Write down the structure of the following compounds;

(a) 1-chloro-4-ethyl cyclohexane

(b) 1,4-dibromobut-2-ene

(c) 4-tert-butyl-3-iodoheptane

(d) 1-bromo-4-secbutyl-2-methylbenzene

Q.6. Which compound  $(\text{CH}_3)_3\text{C-Cl}$  or  $\text{CH}_3\text{Cl}$  will react faster in  $\text{S}_\text{n}^2$  reaction with  $\text{-OH}^-$ ?

Q.7. A hydrocarbon  $\text{C}_5\text{H}_{10}$  does not react with chlorine in dark but it gives a single monobromo compound in bright sunlight. Identify the compound.

Q.8. Why is sulphuric acid not used during the reaction of alcohols with KI?

Q.9. Out of  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  &  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  which is more easily hydrolysed with aq. KOH & why?

Q.10. Chloroform is stored in dark coloured & sealed bottle. Why?

### Short answer type questions

Q.1. Give the IUPAC names of the following compounds?

A)  $\text{ClCH}_2\text{C} = \text{CCH}_2\text{Br}$

b)  $(\text{CCl}_3)_3\text{CCl}$

C)  $\text{CH}_3\text{CH}(\text{Cl})\text{CH}(\text{Br})\text{CH}_3$

Q.2. Starting from methyl iodide, how will you prepare :

A) nitromethane

B) methyl nitrite

Q.3. How can iodoform be prepared from ethanol ?

Q.4. Predict the product of the following reactions;

Q.5. Write the reaction involved in :

A) the isocyanide test

B) iodoform test

Q.6. Rearrange the following in order of increasing ease of dehydrohalogenation:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ ,  $\text{CH}_3\text{CHClCH}_3$ ,  $\text{CH}_3\text{-C-Cl}(\text{CH}_3)_2$

Q.7. How will you distinguish between

(i)  $\text{CH}_3\text{NH}_2$  and  $(\text{CH}_3)_2\text{NH}$

(ii) ethanol & 1-propanol

Q.8. Give the uses of (a)  $\text{CCl}_4$  (b) iodoform

Q.9. Propose the mechanism of the following reaction :



Q.10. Which will have a higher boiling point 1-chloropentane or 2-chloro-2-methylbutane?

Q.11. How will you bring the following conversion?

(a) Propene to Propyne

(b) Toluene to Benzyl Alcohol

(c) Aniline to Phenylisocyanide

Q.12. What happens when;

(a) n-butyl chloride is treated with alc.KOH.

(b) ethyl chloride is treated with aq.KOH.

(c) methyl chloride is treated with KCN.

### LONG ANSWER TYPE QUESTIONS

**Q1) How the following conversions can be carried out?**

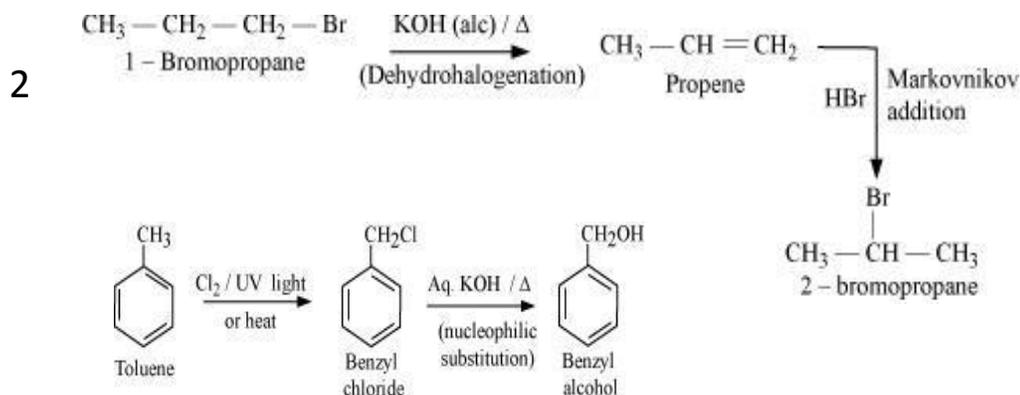
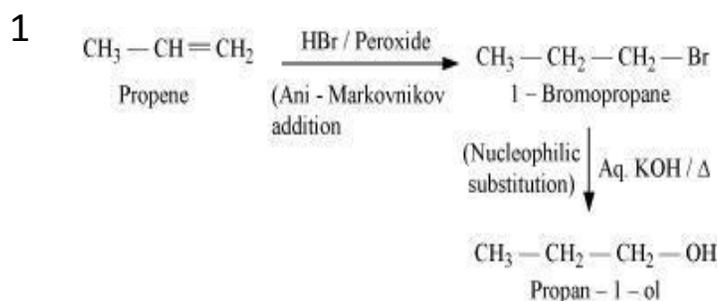
(i) Propene to propan-1-ol

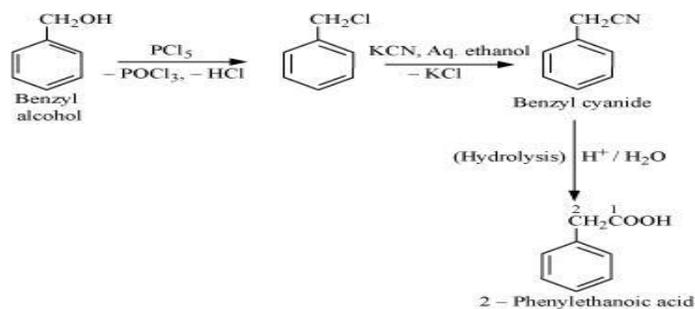
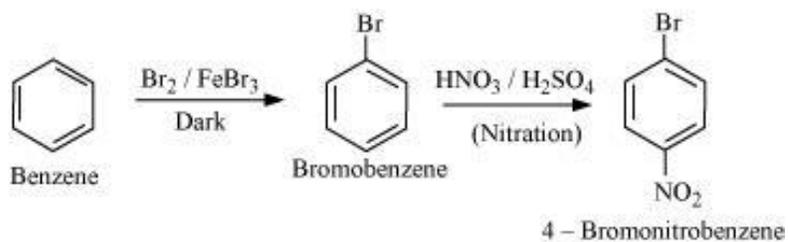
(ii) 1-Bromopropane to 2-bromopropane

(iii) Toluene to benzyl alcohol

(iv) Benzene to 4-bromonitrobenzene

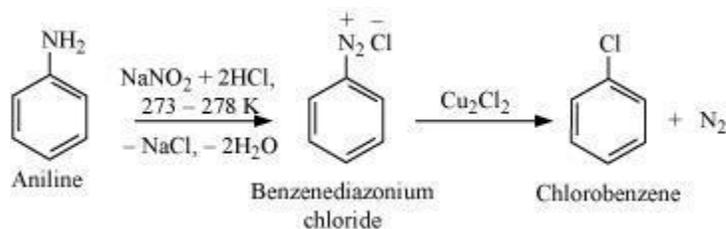
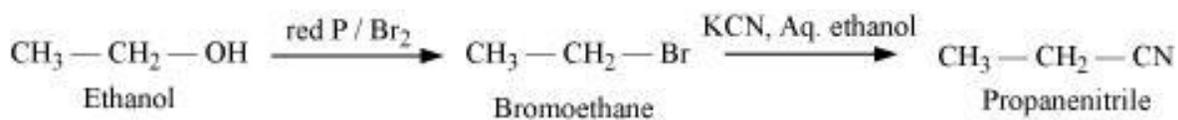
(v) Benzyl alcohol to 2-phenylethanoic acid

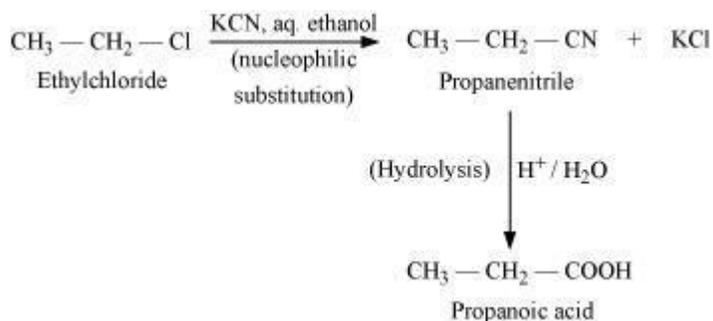




**Q2) How the following conversions can be carried out?**

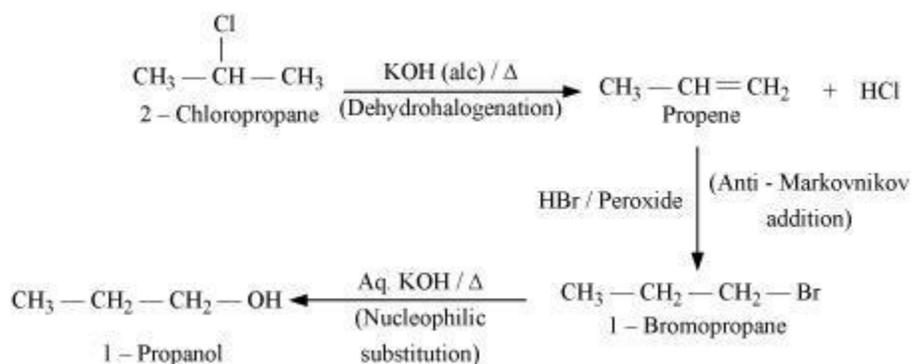
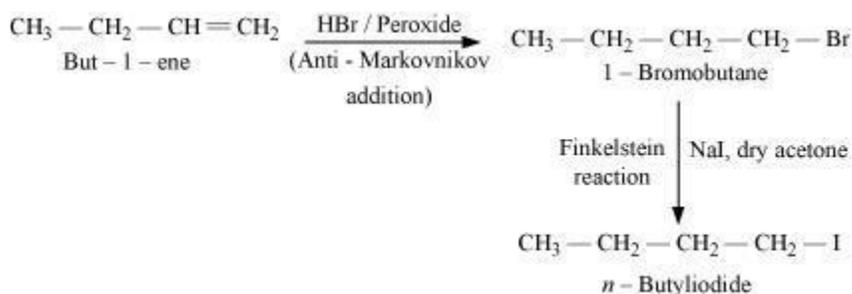
- (i) Ethanol to propanenitrile
- (ii) Aniline to chlorobenzene
- (iii) 2-Chlorobutane to 3, 4-dimethylhexane
- (iv) 2-Methyl-1-propene to 2-chloro-2-methylpropane
- (v) Ethyl chloride to propanoic acid

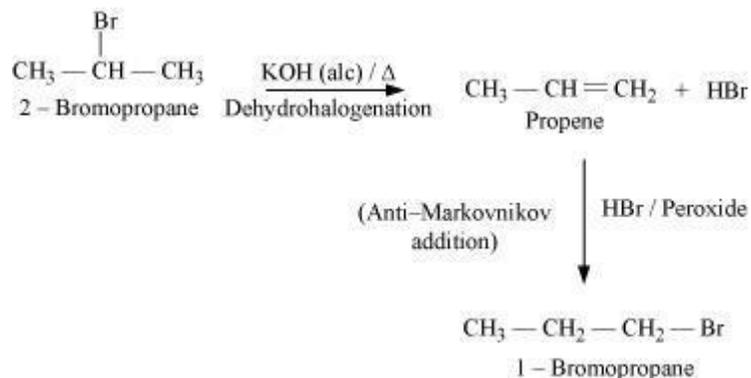
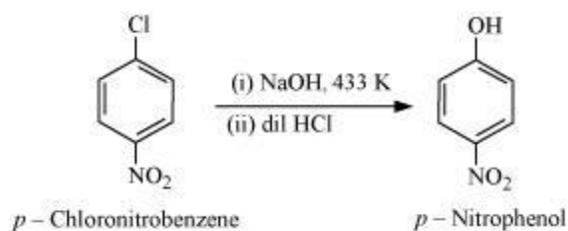
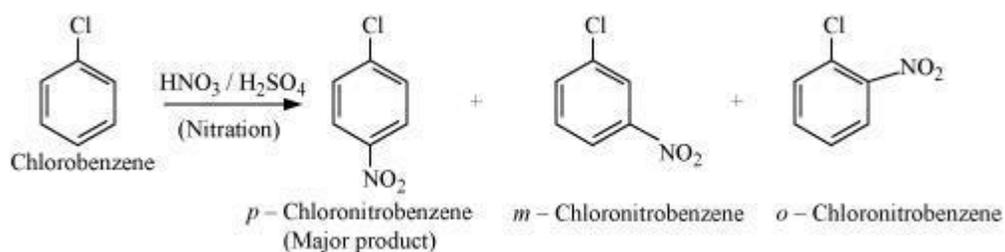
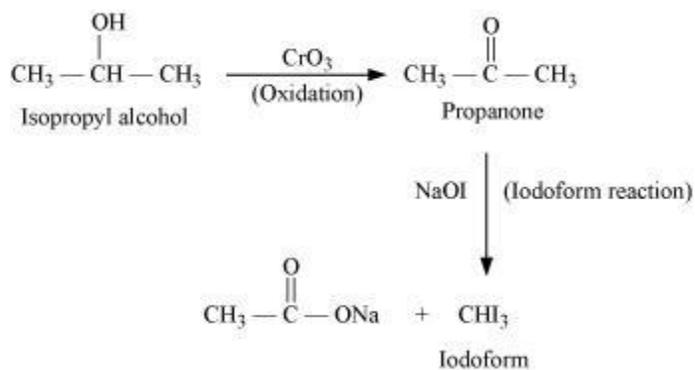




**Q3) How the following conversions can be carried out?**

- (i) But-1-ene to n-butyliodide
- (ii) 2-Chloropropane to 1-propanol
- (iii) Isopropyl alcohol to iodoform
- (iv) Chlorobenzene to p-nitrophenol
- (v) 2-Bromopropane to 1-bromopropane





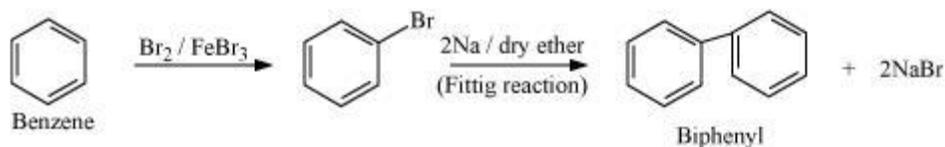
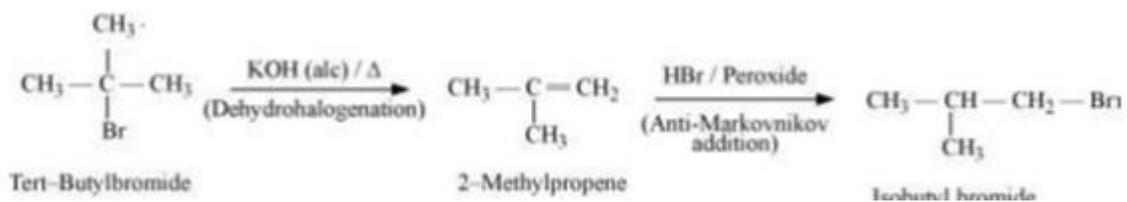
**Q4) How the following conversions can be carried out?**

(i) Chloro ethane to butane

(ii) Benzene to diphenyl

(iii) tert-Butyl bromide to isobutyl bromide

(iv) Aniline to phenylisocyanide



## CHAPTER-11 ALCOHOLS PHENOLS AND ETHER

4 Marks Chapter

### Name reaction

(1) Reimer Tiemann. Reaction – [See in haloalkanes]