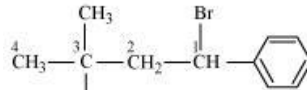
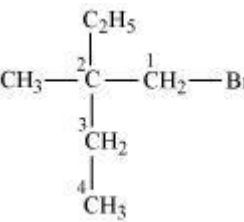
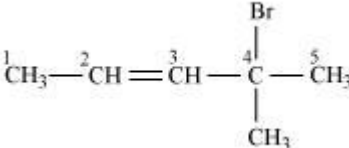


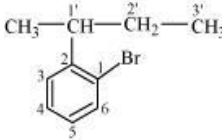
# Haloalkane Halo arenes

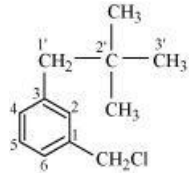
## IUPAC NAMES

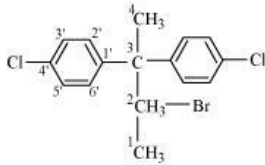
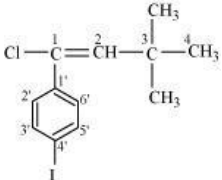
- Q1 Name the following compounds according to IUPAC system. (i)  $(\text{CH}_3)_3\text{CCH}_2\text{CH}(\text{Br})\text{C}_6\text{H}_5$  (ii)  $\text{CH}_3\text{C}(\text{C}_2\text{H}_5)_2\text{CH}_2\text{Br}$  (iii)  $\text{CH}_3\text{CH}=\text{CHC}(\text{Br})(\text{CH}_3)_2$  (iv)  $\text{o-Br-C}_6\text{H}_4\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$  (v)  $m\text{-ClCH}_2\text{C}_6\text{H}_4\text{CH}_2\text{C}(\text{CH}_3)_3$  (vi)  $\text{CH}_3\text{C}(p\text{-ClC}_6\text{H}_4)_2\text{CH}(\text{Br})\text{CH}_3$  (vii)  $(\text{CH}_3)_3\text{CCH}=\text{CClC}_6\text{H}_4\text{I-}p$

### Answer

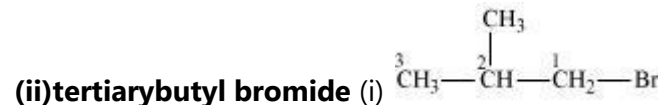
- (i)  1-Bromo-3,3-dimethyl-1-phenylbutane
- (ii)  1-Bromo-2-ethyl-2-methylbutane
- (iii)  4-Bromo-4-methylpent-2-ene

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

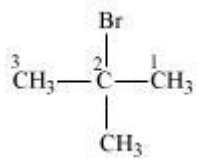
- (v)  1-Bromo-2-(1-methylpropyl)benzene

- (vi)  2-Bromo-3,3-bis(4-chlorophenyl)butane
- (vii)  1-chloro-1-(4-iodophenyl)-3,3-dimethylbut-1-ene

- Q2 Write the structures and IUPAC name of the following organic halogen compounds (i) isobutyl bromide

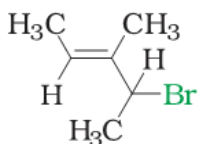
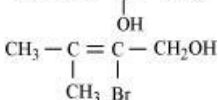
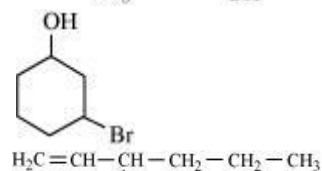
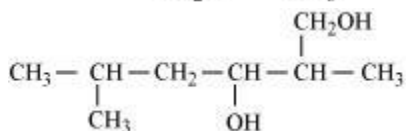
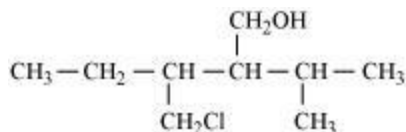


2-Bromo-2-methylpropane



(ii) 1-Bromo-2-methylpropane

**Q3 Name the following compounds according to IUPAC system.**



(vi)

**Answer** (i) 3-Chloromethyl-2-isopropylpentan-1-ol

(ii) 2, 5 Dimethylhexane-1, 3-diol

(iii) 3-Bromocyclohexanol

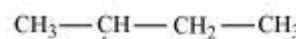
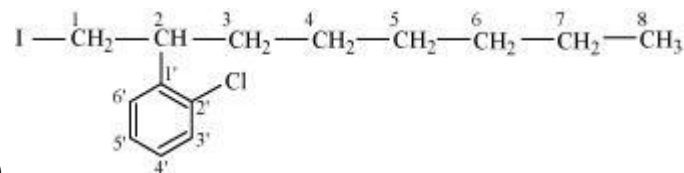
(iv) Hex-1-en-3-ol

(v) 2-Bromo-3-methylbut-2-en-1-ol

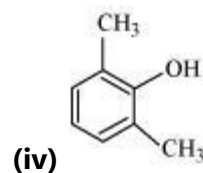
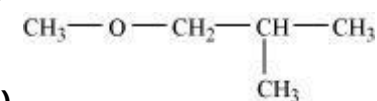
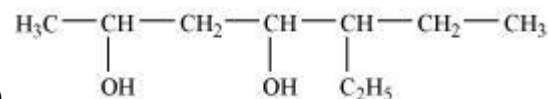
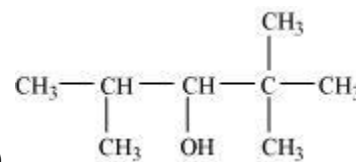
(vi) 4-Bromo-3-methylpent-2-ene

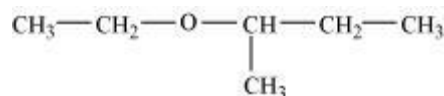
**Q4 Write the structures of the following organic halogen compounds**  
 (i) 2-(2-Chlorophenyl)-1-iodooctane  
 (ii) 1-Bromo-4-sec-butyl-2-methylbenzene

**Answer**

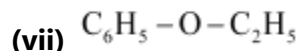
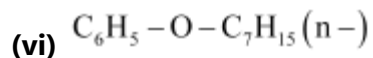


**Q5 Write IUPAC names of the following compounds:**





(v)

**Answer**

(i) 2, 2, 4-Trimethylpentan-3-ol

(ii) 5-Ethylheptane-2, 4-diol

(iii) 1-Methoxy-2-methylpropane

(iv) 2, 6-Dimethylphenol

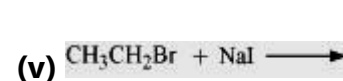
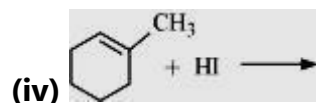
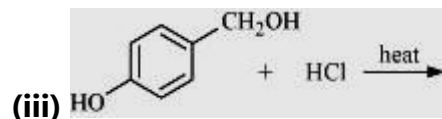
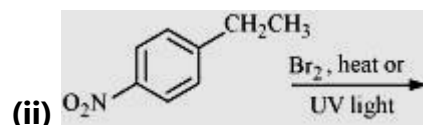
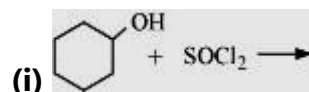
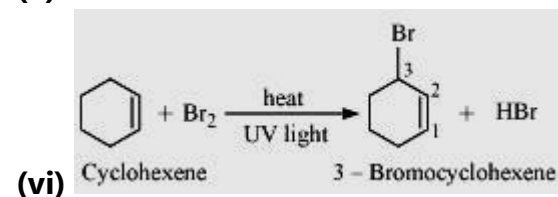
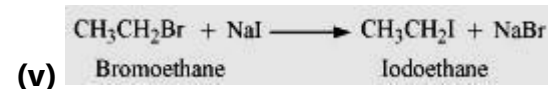
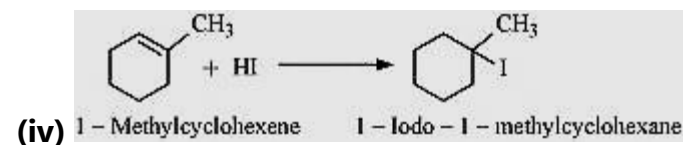
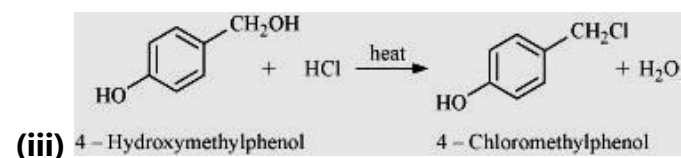
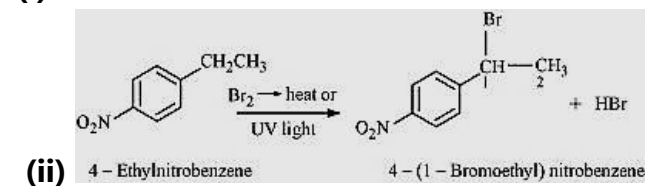
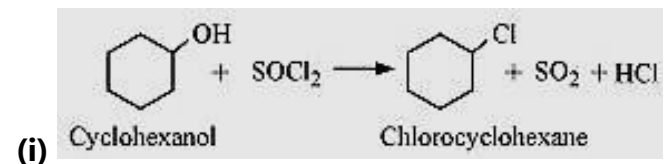
(v) 2-Ethoxybutane

(vi) 1-Phenoxyheptane

(vii) Ethoxybenzene

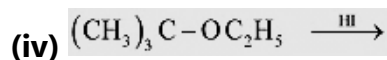
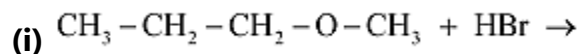
**INCOMPLETE REACTIONS**

**Q1** Draw the structures of major monohalo products in each of the following reactions:

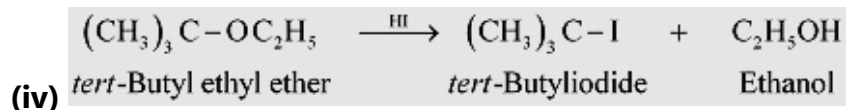
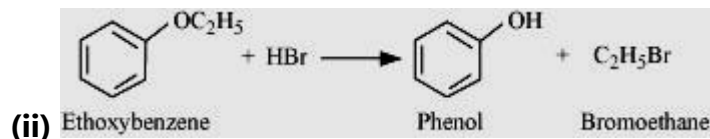
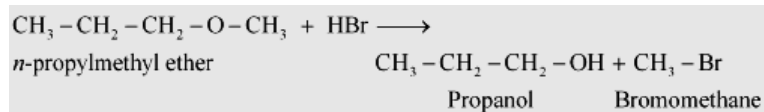
**Answer1**



**Q4 Predict the products of the following reactions:**



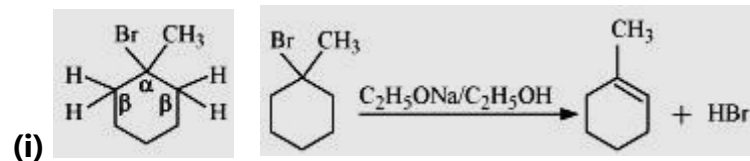
**Answer 4**



**Q5 Predict all the alkenes that would be formed by dehydrohalogenation of the following halides with sodium ethoxide in ethanol and identify the major alkene:**

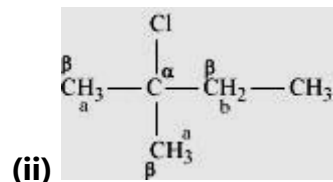
- (i) 1-Bromo-1-methylcyclohexane  
 (ii) 2-Chloro-2-methylbutane  
 (iii) 2,2,3-Trimethyl-3-bromopentane.

**Answer 5**

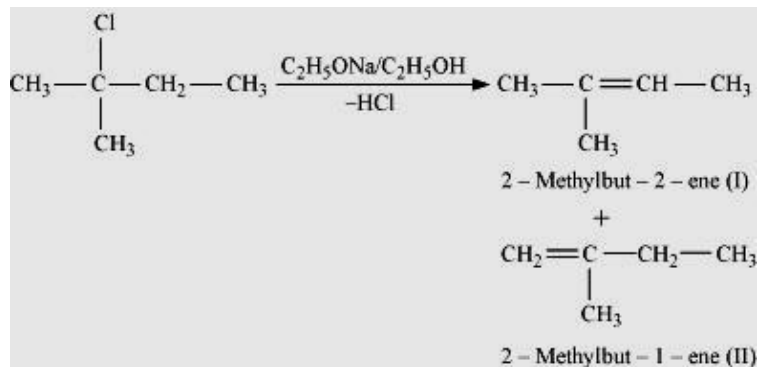


1-bromo-1-methylcyclohexane

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



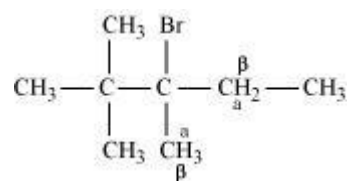
(iii) In the given compound, there are two different sets of equivalent  $\beta$ -hydrogen atoms labelled as *a* and *b*. Thus, dehydrohalogenation of the compound yields two alkenes.



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.

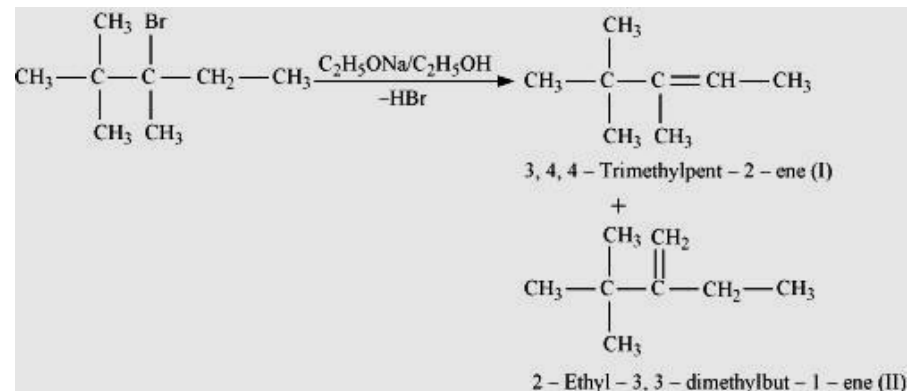
(iii)



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.

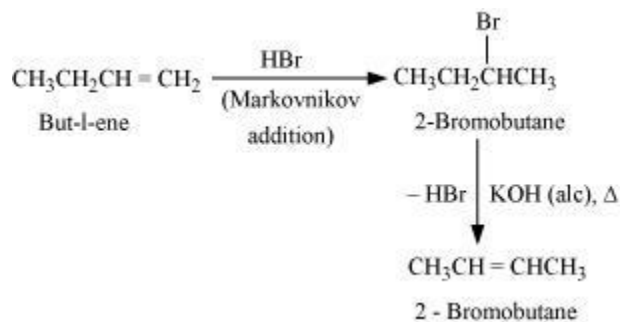
## INTER CONVERSIONS

1 How will you bring about the following conversions?

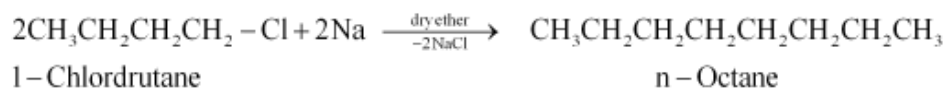
- (i) Ethanol to but-1-yne
- (ii) Ethane to bromoethene
- (iii) Propene to 1-nitropropane
- (iv) Toluene to benzyl alcohol
- (v) Propene to propyne
- (vi) Ethanol to ethyl fluoride
- (vii) Bromomethane to propanone
- (viii) But-1-ene to but-2-ene
- (ix) 1-Chlorobutane to n-octane
- (x) Benzene to biphenyl.

(i)

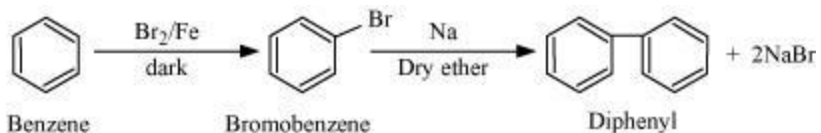




(ix)



(x)

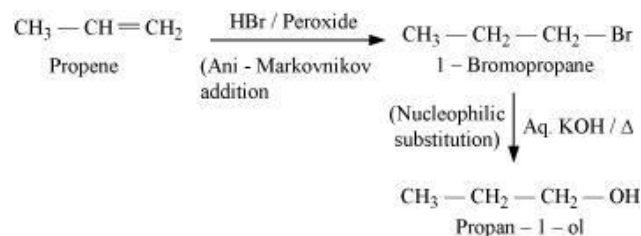


2 How the following conversions can be carried out?

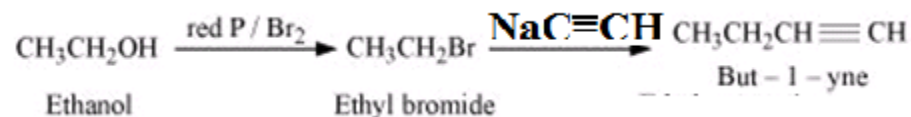
- (i) Propene to propan-1-ol
- (ii) Ethanol to but-1-yne
- (iii) 1-Bromopropane to 2-bromopropane
- (iv) Toluene to benzyl alcohol
- (v) Benzene to 4-bromonitrobenzene
- (vi) Benzyl alcohol to 2-phenylethanoic acid
- (vii) Ethanol to propanenitrile
- (viii) Aniline to chlorobenzene
- (ix) 2-Chlorobutane 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

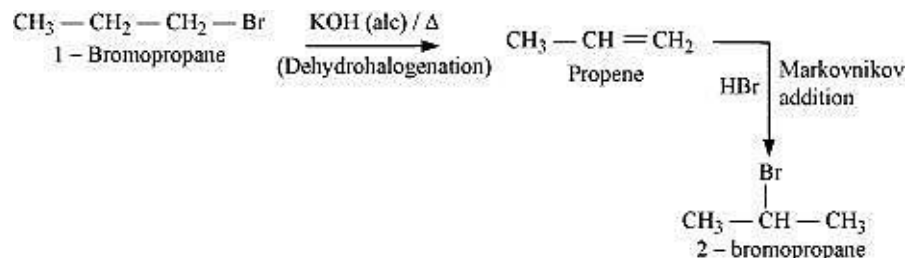
Answer (i)



(ii)

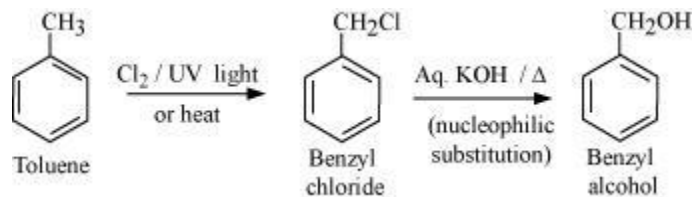


(iii)

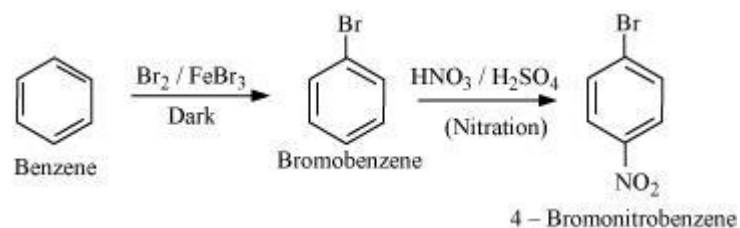


(iv)

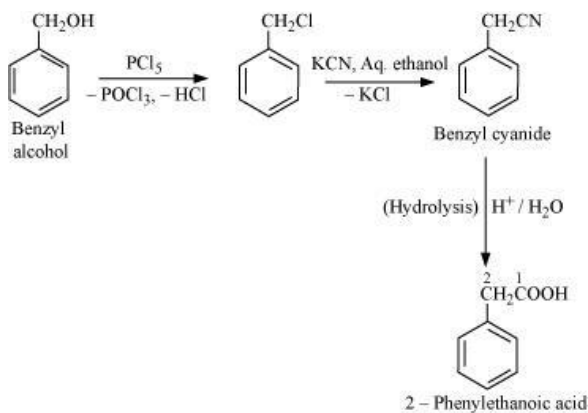




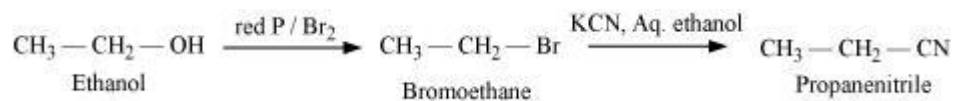
(v)



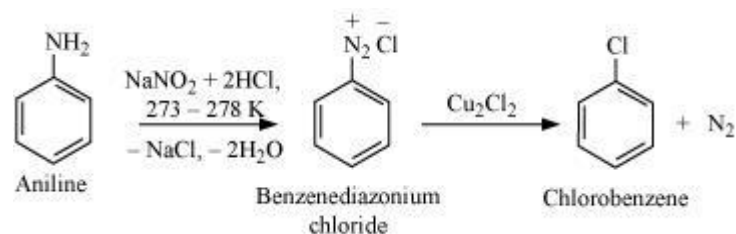
(vi)



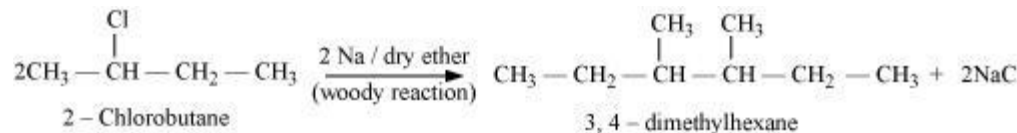
(vii)



(viii)



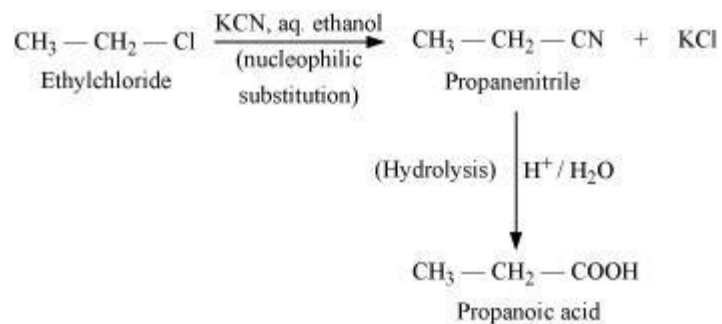
(ix)



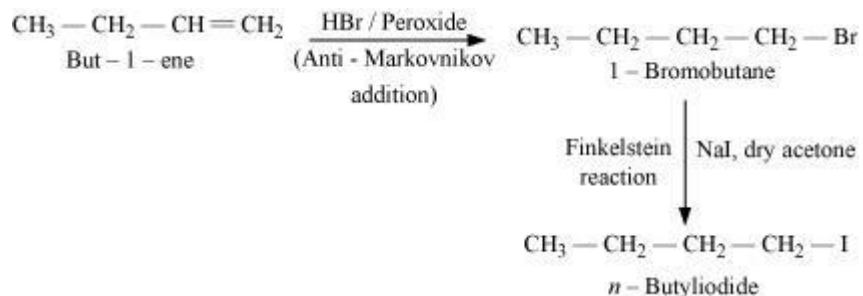
(x)



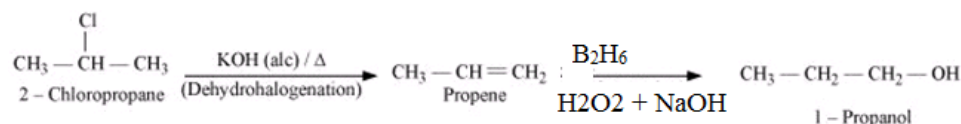
(xi)



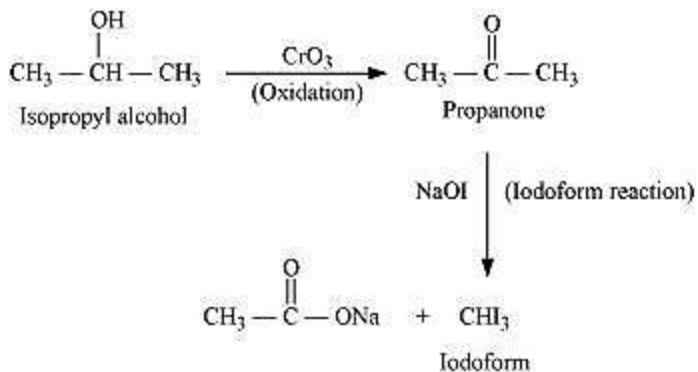
(xii)



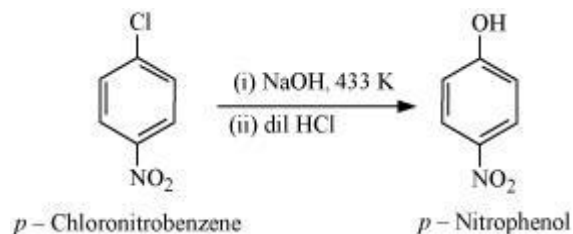
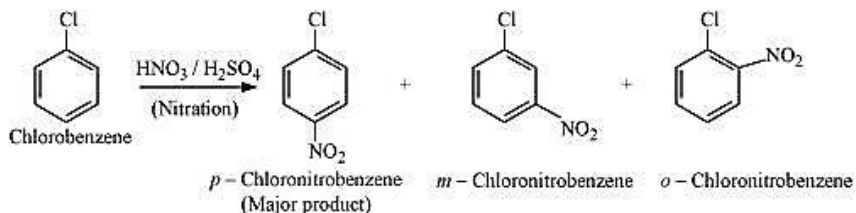
(xiii)



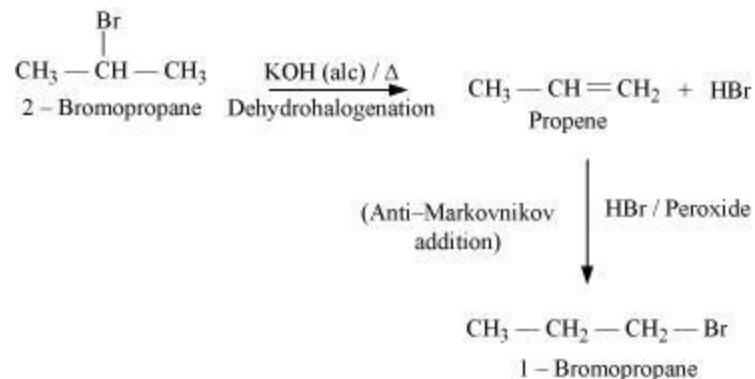
(xiv)



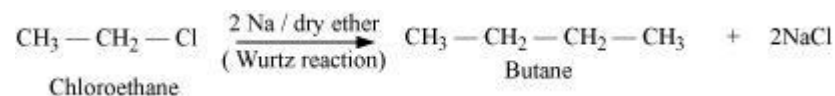
(xv)



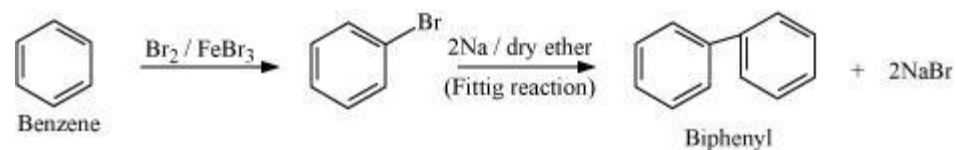
(xvi)



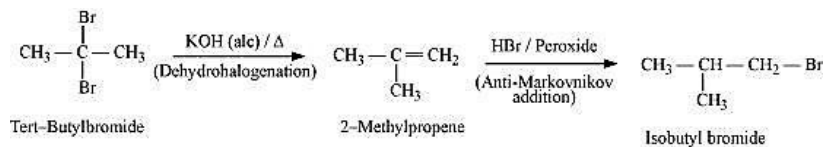
(xvii)



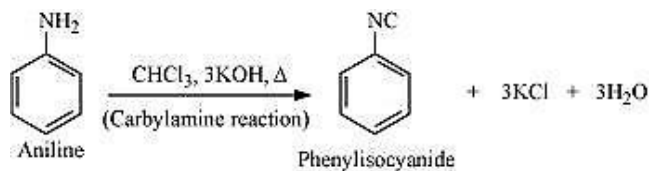
(xviii)



(xix)



(xx)



**Q3 How are the following conversions carried out?**

(i) Propene → Propan-2-ol

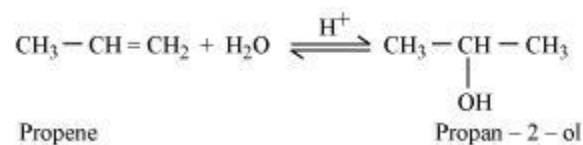
(ii) Benzyl chloride → Benzyl alcohol

(iii) Ethyl magnesium chloride → Propan-1-ol.

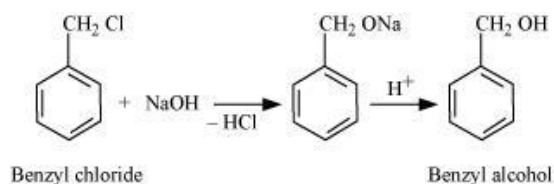
(iv) Methyl magnesium bromide → 2-Methylpropan-2-ol.

**Answer**

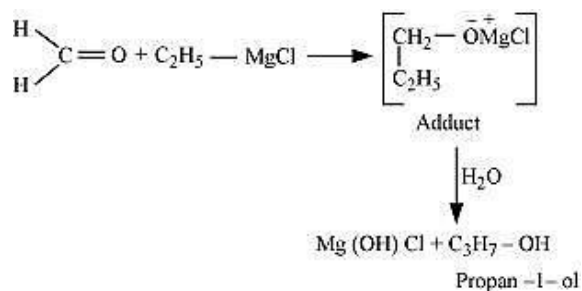
(i) If propene is allowed to react with water in the presence of an acid as a catalyst, then propan-2-ol is obtained.



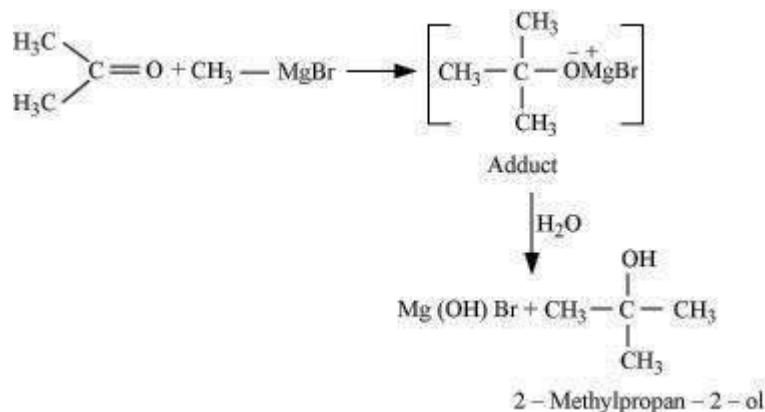
(ii) If benzyl chloride is treated with NaOH (followed by acidification) then benzyl alcohol is produced.



(iii) When ethyl magnesium chloride is treated with methanal, an adduct is the product which gives propan-1-ol on hydrolysis.



(iv) When methyl magnesium bromide is treated with propane, an adduct is the product which gives 2-methylpropan-2-ol on hydrolysis.

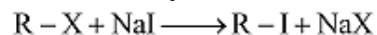


# NAMED REACTIONS

note :- always write few lines about reaction conditions and remarkable point

## 1 Finkelstein Reaction

Alkyl iodides are often prepared by the reaction of alkyl chlorides/ bromides with NaI in dry acetone. This reaction is known as



Finkelstein (X = Cl, Br)



reaction. X=Cl, Br

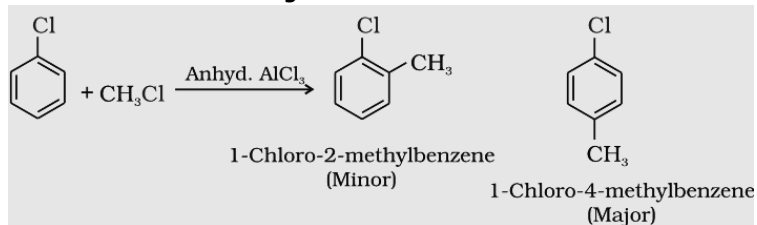
**2 Swarts Reaction** Preparation of alkyl fluoride by reaction of metallic

fluoride such as AgF, Hg<sub>2</sub>F<sub>2</sub>, CoF<sub>2</sub>, or SbF<sub>3</sub> with alkyl halides



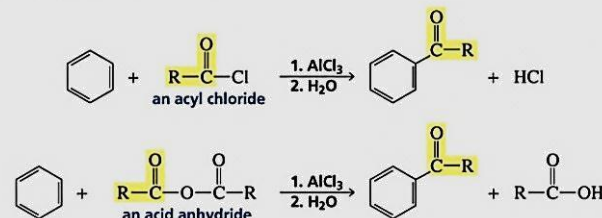
## 3 Friedel-Crafts reactions

### [1] Friedel-Crafts Alkylation



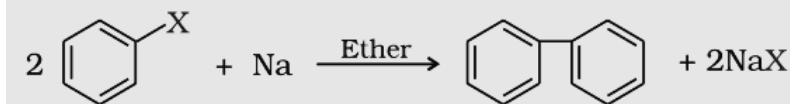
### [ii] Friedel-Crafts Acylation

#### Friedel-Crafts acylation

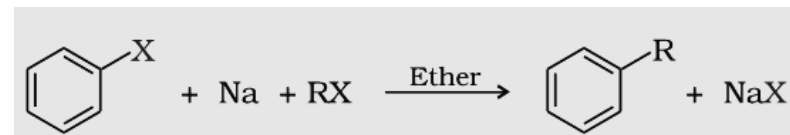


## 4 Fittig reaction :

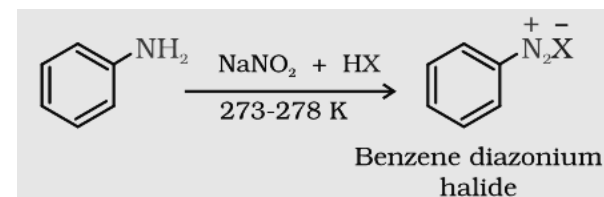
reactions of aryl halides with sodium

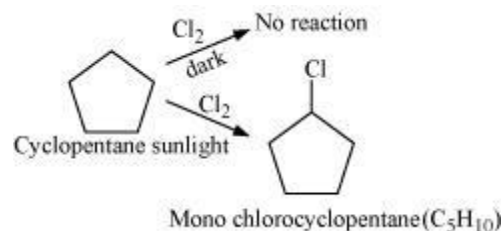
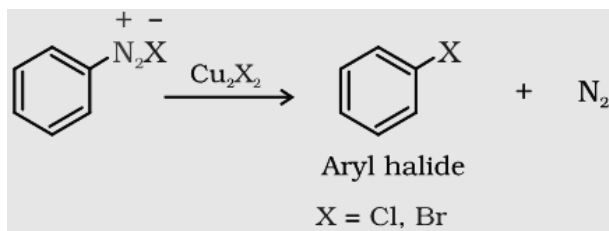


## 5 Wurtz-Fittig reaction:-



**6 Sandmeyer's reaction** Replacement of  $N_2^+$  group of benzene diazonium chloride by halide or cyanide ion is called Sandmeyer reaction





## WORD MAP

**Q1** A hydrocarbon C<sub>5</sub>H<sub>10</sub> does not react with chlorine in dark but gives a single monochloro compound C<sub>5</sub>H<sub>9</sub>Cl in bright sunlight. Identify the hydrocarbon.

**Answer** hydrocarbon with the molecular formula, C<sub>5</sub>H<sub>10</sub> belongs to the group with a general molecular formula C<sub>n</sub>H<sub>2n</sub>. 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, C<sub>5</sub>H<sub>9</sub>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.

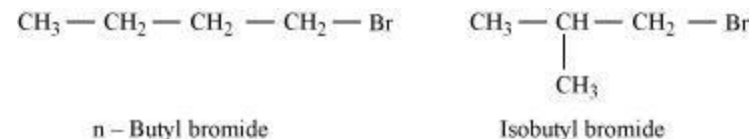


Cyclopentane (C<sub>5</sub>H<sub>10</sub>) The reactions involved in the question are:

**Q2**

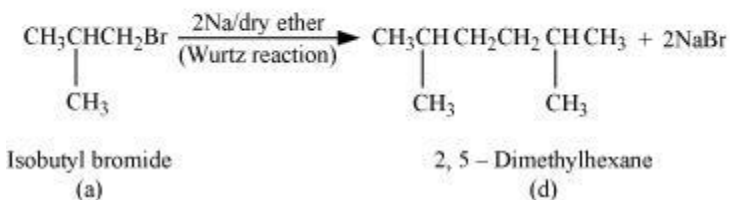
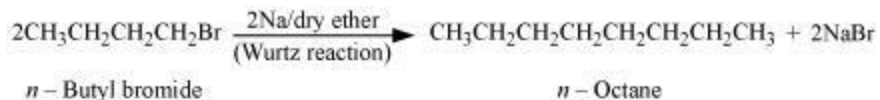
Primary alkyl halide C<sub>4</sub>H<sub>9</sub>Br (a) reacted with alcoholic KOH to give compound (b). Compound (b) is reacted with HBr to give (c) which is an isomer of (a). When (a) is reacted with sodium metal it gives compound (d), C<sub>8</sub>H<sub>18</sub> which is different from the compound 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, C<sub>4</sub>H<sub>9</sub>Br. They are n-butyl bromide and isobutyl bromide.



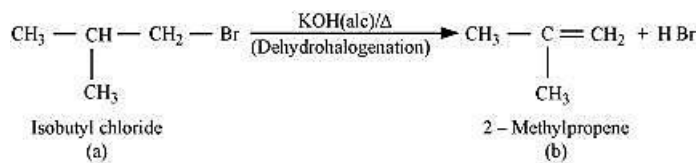
Therefore, compound (a) is either n-butyl bromide or isobutyl bromide.

Now, compound (a) reacts with Na metal to give compound (b) of molecular formula, C<sub>8</sub>H<sub>18</sub>, which is different from the compound formed when n-butyl bromide reacts with Na metal. Hence, compound (a) must be isobutyl bromide.

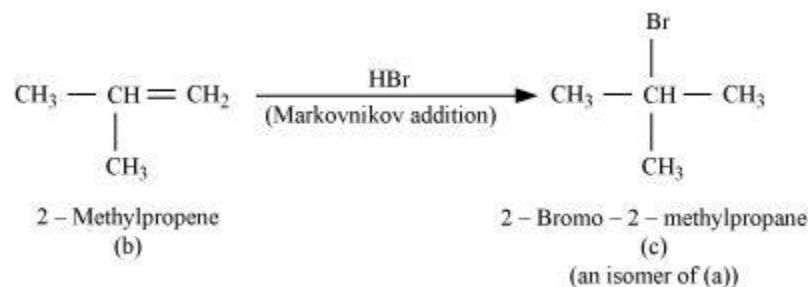


Thus, compound (d) is 2, 5-dimethylhexane.

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



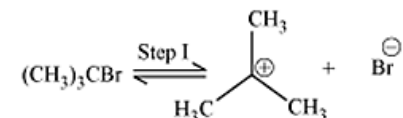
Also, compound (b) reacts with HBr to give compound (c) which is an isomer of (a). Hence, compound (c) is 2-bromo-2-methylpropane.



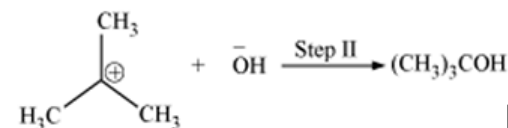
## REACTION MECHANISM

### 1 $\text{S}_{\text{N}}1$ unimolecular Nucleophilic Substitution ( $\text{S}_{\text{N}}1$ )

Step 1 – removal of leaving group and formation of carbocation



Step 2- attack of nucleophile

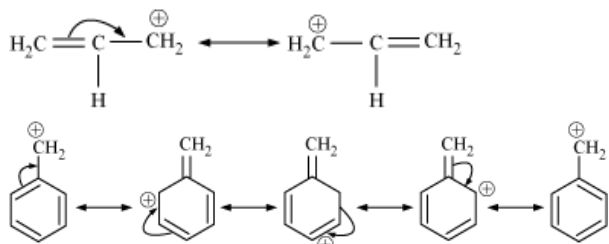


The increasing order of reactivity

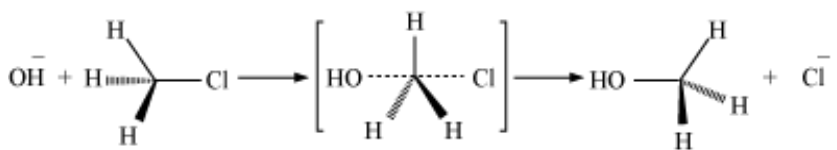
for  $\text{S}_{\text{N}}1$  is  $1^\circ \text{ halide} < 2^\circ \text{ halide} < 3^\circ \text{ halide}$

Reason – Greater the stability of carbocation, more easily the alkyl halide is formed and hence, faster is the reaction rate. The increasing order of stability of carbocation is  $1^\circ < 2^\circ < 3^\circ$ . Since  $1^\circ$  halide forms  $1^\circ$  carbocation,  $2^\circ$  halide forms  $2^\circ$  carbocation, and  $3^\circ$  halide forms  $3^\circ$  carbocation.

**Allylic and benzylic halides are very reactive towards  $\text{S}_{\text{N}}1$  reaction because of stabilisation of their carbocations through resonance.**



## 2 (S<sub>N</sub>2) bimolecular Substitution nucleophilic



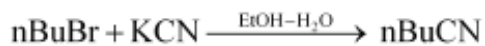
Inversion of configuration takes place.

The increasing order of reactivity FOR SN<sub>2</sub> is

**3° halide < 2° halide < 1° halide**

**For both S<sub>N</sub>1 and S<sub>N</sub>2 reaction, the order of reactivity is R-F << R-Cl < R-Br < R-I**

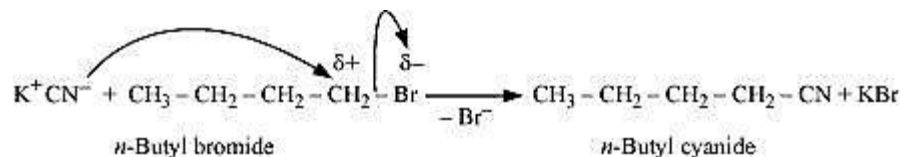
**Q.1 write the mechanism of S<sub>N</sub><sup>2</sup> with the following example**



The given reaction is:

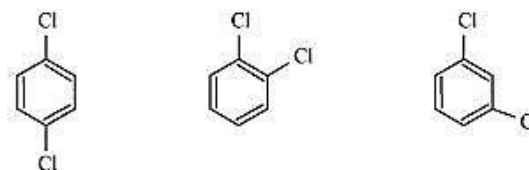


The given reaction is an S<sub>N</sub>2 reaction. In this reaction, CN<sup>-</sup> acts as the nucleophile and attacks the carbon atom to which Br is attached. CN<sup>-</sup> ion is an ambident nucleophile and can attack through both C and N. In this case, it attacks through the C-atom.



## REASONING

**Q1** *p*-Dichlorobenzene has higher m.p. and lower solubility than those of *o*- and *m*-isomers. Discuss.



*p*-Dichlorobenzene    *o*-Dichlorobenzene    *m*-Dichlorobenzene

**A** *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.

**Q2** Why C-Cl bond is more polar than C-F bond

**A2** higher bond length of C-Cl

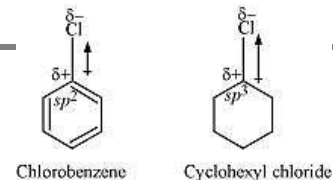
**Q3** Explain why

**(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?

**A3** (i) C-Cl bond is shorter in chlorobenzene because of partial

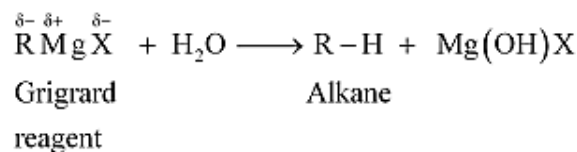


double bond character than C–Cl bond In cyclohexyl chloride

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.

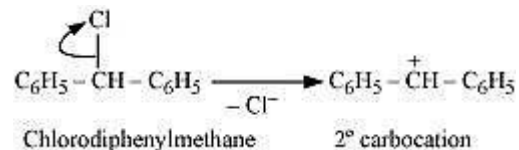
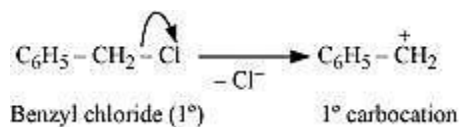
(ii) To be miscible with water, the solute-water force of attraction must be stronger than the solute-solute and water-water forces of attraction. Alkyl halides are not capable of making H-bond with the water molecules. Hence, alkyl halides (though polar) are immiscible with water.

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



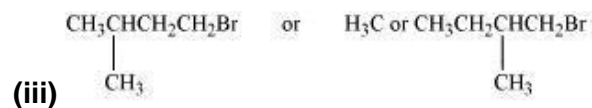
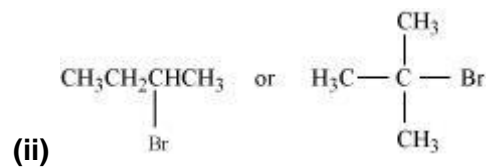
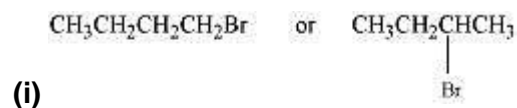
Therefore, Grignard reagents should be prepared under anhydrous conditions.

**Q4 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?**

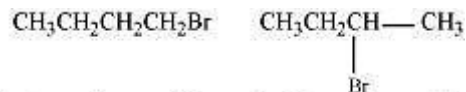


**A4** Hydrolysis by aqueous KOH proceeds through the formation of carbocation. If carbocation is stable, then the compound is easily hydrolyzed by aqueous KOH. Now,  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  forms  $1^\circ$ -carbocation, while  $\text{C}_6\text{H}_5\text{CHClC}_6\text{H}_5$  forms  $2^\circ$ -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.

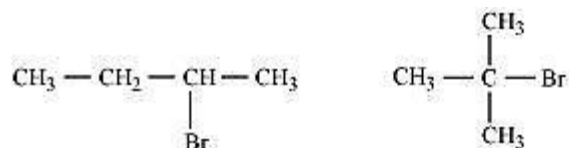
**Q5 Which alkyl halide from the following pairs would you expect to react more rapidly by an  $\text{S}_\text{N}2$  mechanism? Explain your answer.**







**A5 (i)** 1-Bromobutane ( $1^\circ$ ) 2-Bromobutane ( $2^\circ$ ) 2-bromobutane is a  $2^\circ$  alkylhalide whereas 1-bromobutane is a  $1^\circ$  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  $\text{S}_{\text{N}}2$  mechanism.

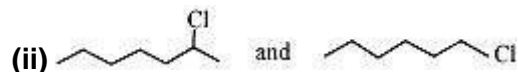


**(ii)** 2-Bromobutane ( $2^\circ$ ) 2-Bromo-2-methylpropane ( $3^\circ$ )

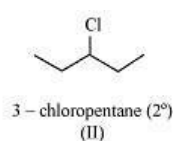
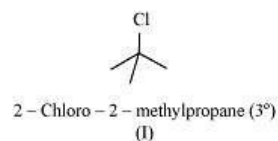


**(iii)** 1-Bromo-3-methylbutane ( $1^\circ$ ) 1-Bromo-2-methylbutane ( $1^\circ$ )

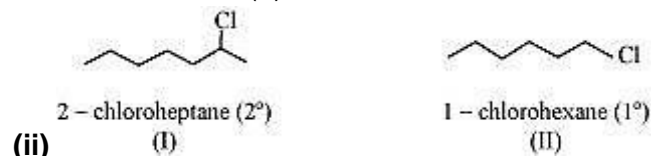
**Q6** In the following pairs of halogen compounds, which compound undergoes faster  $\text{S}_{\text{N}}1$  reaction?



**A6 (i)**



The alkyl halide (I) is  $3^\circ$  while (II) is  $2^\circ$ . Therefore, (I) forms  $3^\circ$  carbocation while (II) forms  $2^\circ$  carbocation.



The alkyl halide (I) is  $2^\circ$  while (II) is  $1^\circ$ .  $2^\circ$  carbocation is more stable than  $1^\circ$  carbocation. Therefore, (I), 2-chloroheptane, undergoes faster  $\text{S}_{\text{N}}1$  reaction than (II), 1-chlorohexane.

**Q7** Haloalkanes react with KCN to form alkyl cyanides as main product while AgCN forms isocyanides as the chief product. Explain.

**A7** KCN is predominantly ionic and provides cyanide ions in solution. Although both carbon and nitrogen atoms are in a position to donate electron pairs, the attack takes place mainly through carbon atom and

not through nitrogen atom since C—C bond is more stable than C—N bond. However, AgCN is mainly covalent in nature and nitrogen is free to donate electron pair forming isocyanide as the main product.

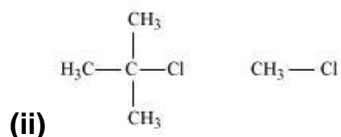
**Q8** Which compound in each of the following pairs will react faster in  $\text{S}_{\text{N}}2$  reaction with  $\text{OH}^-$ ?

**(i)**  $\text{CH}_3\text{Br}$  or  $\text{CH}_3\text{I}$  **(ii)**  $(\text{CH}_3)_3\text{CCl}$  or  $\text{CH}_3\text{Cl}$

**A8 (i)** In the  $\text{S}_{\text{N}}2$  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.



Therefore,  $\text{CH}_3\text{I}$  will react faster than  $\text{CH}_3\text{Br}$  in  $\text{S}_\text{N}2$  reactions with  $\text{OH}^-$ .

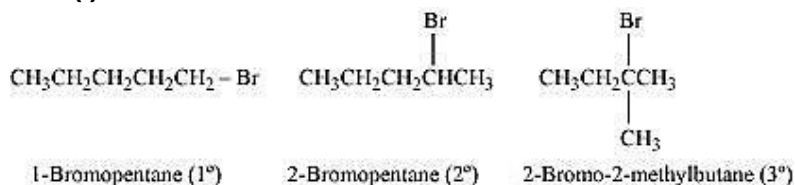


there are no bulky substituents on the carbon atom bearing the leaving group in  $\text{CH}_3\text{Cl}$ . Hence,  $\text{CH}_3\text{Cl}$  reacts faster than  $(\text{CH}_3)_3\text{CCl}$  in  $\text{S}_\text{N}2$  reaction with  $\text{OH}^-$ .

**Q9 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.

**A 9 (i)**



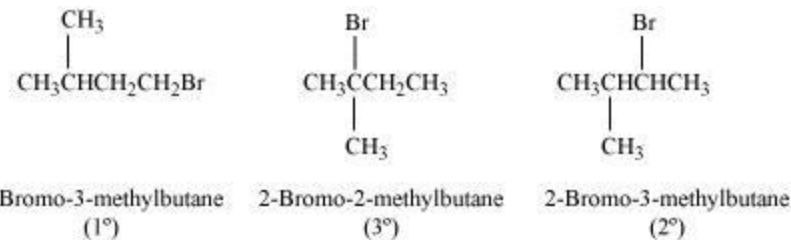
Due to the presence of substituents, hindrance to the approaching nucleophile increases in the following order.

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

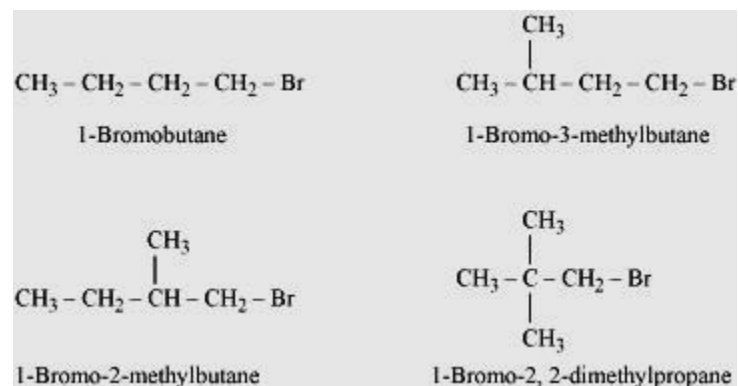
$3^\circ < 2^\circ < 1^\circ$ .

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)



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

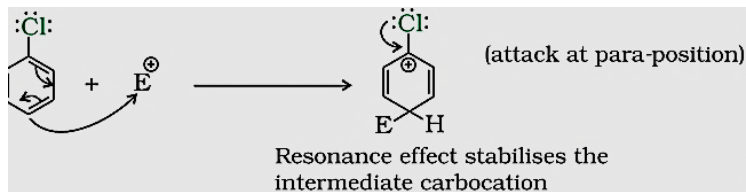
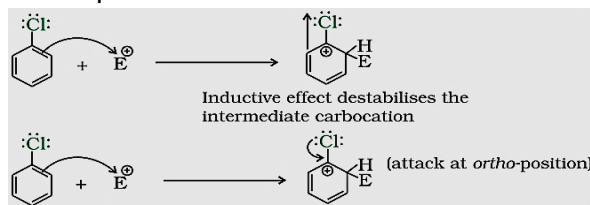
< 1-Bromo-2, 2-dimethylpropane

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

**Q10** Although chlorine is an electron withdrawing group, yet it is ortho-, para- directing in electrophilic aromatic substitution reactions. Why?

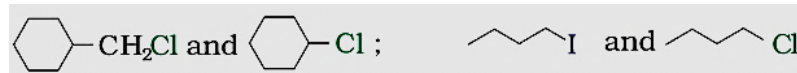
**A10** Chlorine withdraws electrons through inductive effect and releases electrons through resonance. Through inductive effect, chlorine destabilises the intermediate carbocation formed during the electrophilic substitution.



Through resonance, halogen tends to stabilise the carbocation and the effect is more pronounced at ortho- and para- positions. The inductive effect is stronger than resonance and causes net electron withdrawal and thus causes net deactivation. The resonance effect

Reactivity is thus controlled by the stronger inductive effect and orientation is controlled by resonance effect

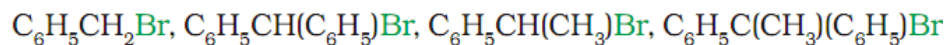
**Q11** In the following pairs of halogen compounds, which would undergo  $S_N2$  reaction faster?



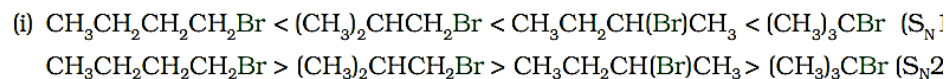
**A11** In 1<sup>st</sup> pair is primary halide and therefore undergoes  $S_N2$  reaction faster.

In 2<sup>nd</sup> As iodine is a better leaving group because of its large size, it will be released at a faster rate in the presence of incoming nucleophile.

**Q12** Predict the order of reactivity of the following compounds in  $S_N1$  and  $S_N2$  reactions:



**A12**



**Q23** 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.

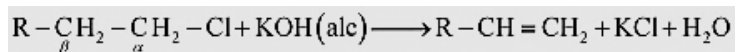
**A23** In an aqueous solution, KOH almost completely ionizes to give  $OH^-$  ions.  $OH^-$  ion is a strong nucleophile, which leads the alkyl chloride to undergo a substitution reaction to form alcohol.



Alkyl chloride                      Alcohol

○

On the other hand, an alcoholic solution encourages removal of a hydrogen from the  $\beta$ -carbon of the alkyl chloride and forms an alkene by eliminating a molecule of HCl.



Alkyl chloride                      Alkene

## CHEMICAL TESTS

Pair	Reagent used for reaction	observations
Allyl chloride and vinyl chloride	Aqueous $\text{AgNO}_3$	White ppt with Allyl chloride
Chlorobenzene and benzyl chloride	Aqueous $\text{AgNO}_3$	White ppt with benzyl chloride