

OPEN STUDENT FOUNDATION

STD:12th Chemistry

Date : 05/03/24

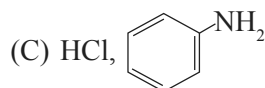
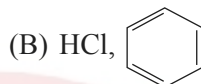
PRACTICE TEST-13

Section A

● Choose correct answer from the given options. [Each carries 1 Mark]

[10]

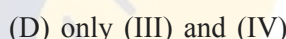
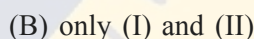
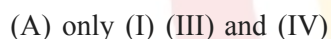
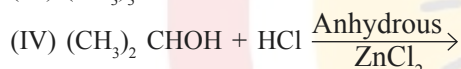
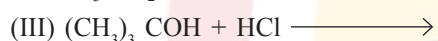
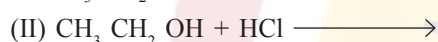
1. Which of the following is suitable to synthesize chlorobenzene ?



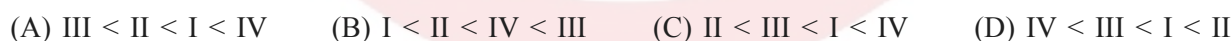
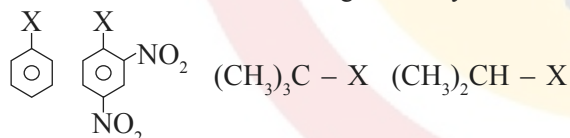
2. The Correct sequence of bond enthalpy of 'C-X' bond is.



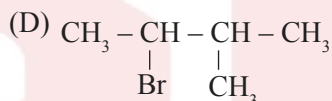
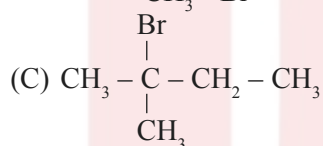
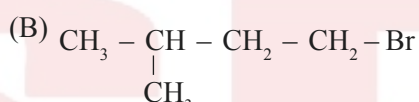
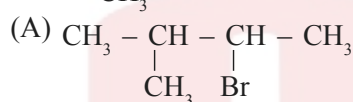
3. Which of the following reaction (s) can be used for the preparation of alkyl halides ?



4. The correct order of increasing reactivity of C-X bond towards nucleophile in the following compound is :



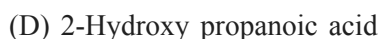
5. $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH} = \text{CH}_2 + \text{HBr} \rightarrow \text{A}$ Here A (predominantly) is.



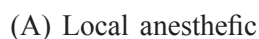
6. Which of the following is not chiral ?



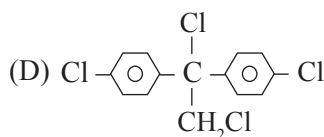
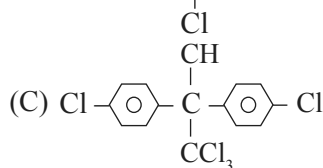
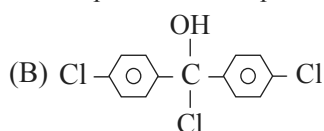
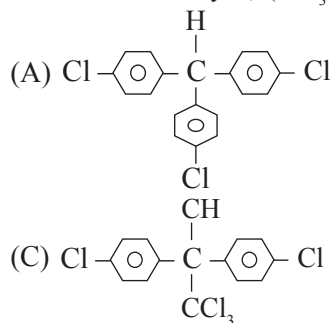
7. Which of the following is not chiral ?



8. What is the use of freon ?



9. Trichloroacetaldehyde, (CCl₃CHO) reacts with chloro benzene in presence of sulphuric acid and produces ?



10. In below reactions $C_6H_5CH_2Br \xrightarrow[(2) H_3O^+]{(1) Mg \text{ Ether}} X$, Identify the product "X".



Section B

● Write the answer of the following questions. [Each carries 2 Marks]

[8]

1. Write note on Nature of C-X Bond.
2. Explain reactivity order of S_N1 and S_N2 reaction for alkyl halide, allylic halide and benzylic halide.
3. What is organo metallic compound ? Explain grignard reagent.
4. Write note on trichloromethane (Chloroform)

Section C

● Write the answer of the following questions. [Each carries 3 Marks]

[9]

5. Give Fittig, Wurtz – Fittig and Grignard reaction of haloarene.
6. Why Haloarenes are less reactive towards Nucleophilic substitution reactions. Give reasons.
7. What is nucleophilic substitution reactions. Write down different products obtain from alkyl halides.

Section D

● Write the answer of the following questions. [Each carries 4 Marks]

[8]

8. Explain the preparation of haloalkanes from hydrocarbon.
9. Explain stereochemistry of S_N1 and S_N2 reaction.

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
Section A

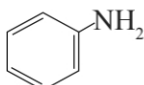
● Choose correct answer from the given options. [Each carries 1 Mark]

[10]

1. Which of the following is suitable to synthesize chlorobenzene ?

(A) Phenol, NaNO_2 , HCl , CuCl

(B) HCl , 

(C) HCl , 

(D) Benzene, Cl_2 , Anhydrous AlCl_3

⇒ Ans : (D)

2. The Correct sequence of bond enthalpy of 'C-X' bond is.

(A) $\text{CH}_3 - \text{Cl} > \text{CH}_3 - \text{F} > \text{CH}_3 - \text{Br} > \text{CH}_3 - \text{I}$ (B) $\text{CH}_3 - \text{F} < \text{CH}_3 - \text{Cl} < \text{CH}_3 - \text{Br} < \text{CH}_3 - \text{I}$

(C) $\text{CH}_3 - \text{F} > \text{CH}_3 - \text{Cl} > \text{CH}_3 - \text{Br} > \text{CH}_3 - \text{I}$ (D) $\text{CH}_3 - \text{F} < \text{CH}_3 - \text{Cl} > \text{CH}_3 - \text{Br} > \text{CH}_3 - \text{I}$

⇒ Ans : (C)

3. Which of the following reaction (s) can be used for the preparation of alkyl halides ?

(I) $\text{CH}_3\text{CH}_2\text{OH} + \text{HCl} \xrightarrow{\text{Anhydrous ZnCl}_2}$

(II) $\text{CH}_3\text{CH}_2\text{OH} + \text{HCl} \longrightarrow$

(III) $(\text{CH}_3)_3\text{COH} + \text{HCl} \longrightarrow$

(IV) $(\text{CH}_3)_2\text{CHOH} + \text{HCl} \xrightarrow[\text{ZnCl}_2]{\text{Anhydrous}}$

(A) only (I) (III) and (IV)

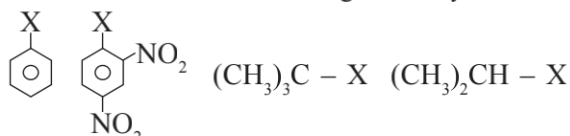
(B) only (I) and (II)

(C) only (IV)

(D) only (III) and (IV)

⇒ Ans : (A)

4. The correct order of increasing reactivity of C-X bond towards nucleophile in the following compound is :



(I) (II) (III) (IV)

(A) $\text{III} < \text{II} < \text{I} < \text{IV}$ (B) $\text{I} < \text{II} < \text{IV} < \text{III}$ (C) $\text{II} < \text{III} < \text{I} < \text{IV}$ (D) $\text{IV} < \text{III} < \text{I} < \text{II}$

Ans. (B)

⇨ Depends on stability of carbo cation.

⇨ Among the alkyl halides ($3^\circ > 2^\circ > 1^\circ > \text{H}$), more stable the carbocation more is its reactivity, tertiary carbocation bearing halides are more reactive than secondary and primary :

5. $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH} = \text{CH}_2 + \text{HBr} \rightarrow \text{A}$ Here A (predominantly) is.

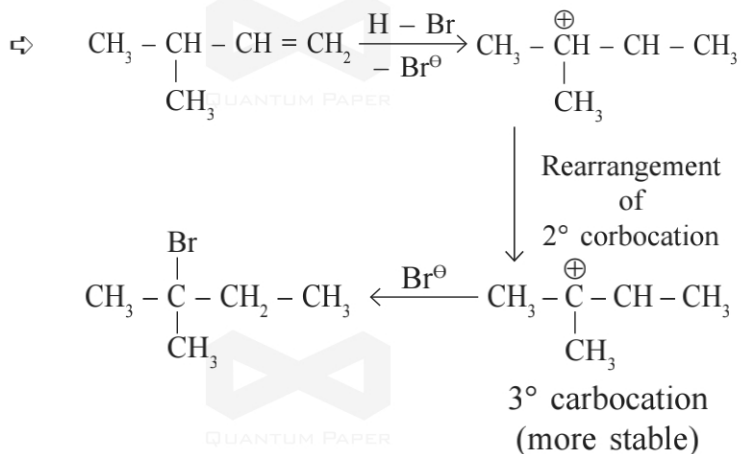
(A) $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \underset{\text{Br}}{\text{CH}} - \text{CH}_3$

(B) $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{CH}_2 - \text{Br}$

(C) $\text{CH}_3 - \underset{\text{CH}_3}{\overset{\text{Br}}{\text{C}}} - \text{CH}_2 - \text{CH}_3$

(D) $\text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$

Ans. (D)



6. Which of the following is not chiral ?

(A) 2-hydroxypropanoic acid

(B) 2-Butanol

(C) 2, 3-Di bromo pentane

(D) 3-bromo pentane

Ans : (D)

7. Which of the following is not chiral ?

(A) 2-Butanol

(B) 2, 3- Dibromo pentane

(C) 3-bromo pentane

(D) 2-Hydroxy propanoic acid

Ans. (C)

It is not chiral because it does not have asymmetric carbon.

8. What is the use of freon ?

(A) Local anesthetic

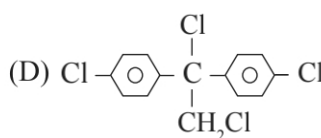
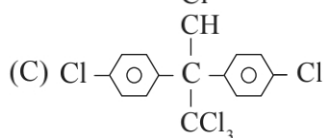
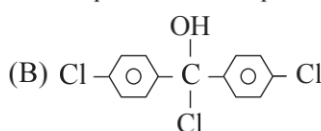
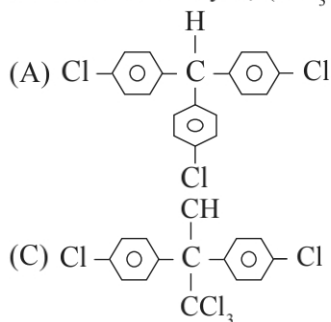
(B) Metallurgy

(C) Refrigerators

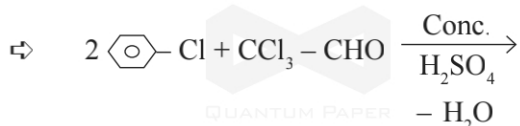
(D) Printing industry

Ans : (C)

9. Trichloroacetaldehyde, (CCl_3CHO) reacts with chloro benzene in presence of sulphuric acid and produces ?



Ans. (C)



10. In below reactions $\text{C}_6\text{H}_5\text{CH}_2\text{Br} \xrightarrow[\text{(2) H}_3\text{O}^+]{\text{(1) Mg Ether}} \text{X}$, Identify the product "X".

(A) $\text{C}_6\text{H}_5\text{CH}_2\text{OCH}_2\text{C}_6\text{H}_5$

(B) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$

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

(D) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{C}_6\text{H}_5$

Ans : (C)

Section B

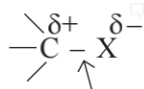
[8]

- Write the answer of the following questions. [Each carries 2 Marks]

1. Write note on Nature of C-X Bond.

⇒ Halogen atoms are more electronegative than carbon, therefore, carbon-halogen bond of alkyl halide is polarised.

⇒ The carbon atom bears a partial positive charge whereas the halogen atom bears a partial negative charge.



Polar bond

⇒ As we go down the group in the periodic table, the size of halogen atom increases. Fluorine atom is the smallest and iodine atom is the largest.

⇒ Consequently the carbon-halogen bond length also increases from C—F to C—I.

Bond Length : C - F < C - Cl < C - Br < C - I

Bond enthalpy : C - F > C - Cl > C - Br > C - I

Dipole Moment : CH₃ - Cl > CH₃ - F > CH₃ - Br > CH₃ - I

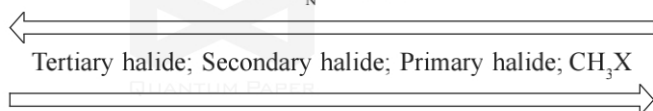
Carbon-Halogen (C - X) Bond Lengths, Bond Enthalpies and Dipole Moments

Bond	Bond length/pm	C-X Bond enthalpies / kJmol ⁻¹	Dipole moment / Debye
CH ₃ - F	139	452	1.847
CH ₃ - Cl	178	351	1.860
CH ₃ - Br	193	293	1.830
CH ₃ - I	214	234	1.636

2. Explain reactivity order of S_N1 and S_N2 reaction for alkyl halide, allylic halide and benzylic halide.

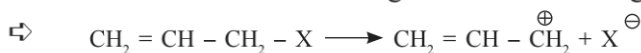
⇒ The order of reactivity of alkyl halides towards SN¹ and SN² reactions as follows :

For S_N2 reaction

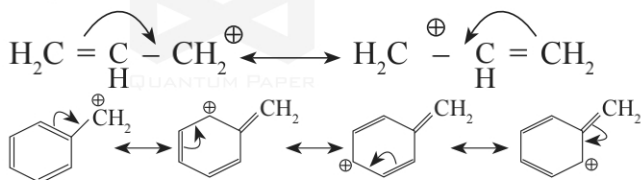


For S_N1 reaction

⇒ For the same reasons, allylic and benzylic halides show high reactivity towards the S_N1 reaction. The carbocation thus formed gets stabilised through resonance as shown below :



Allylic halide



⇒ For a given alkyl group, the reactivity of the halide, R-X, follows the same order in both the mechanisms R-I > R-Br > R-Cl >> R-F.

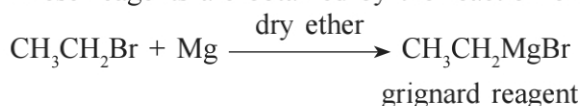
3. What is organo metallic compound ? Explain grignard reagent.

⇒ Most organic chlorides, bromides and iodides react with certain metals to give compounds containing carbon-metal bonds. Such compounds are known as organo-metallic compounds.

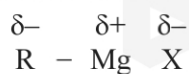
⇒ An important class of organo-metallic compounds discovered by Victor Grignard in 1900 is alkyl magnesium

halide, RMgX, referred as Grignard Reagents.

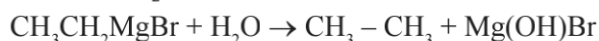
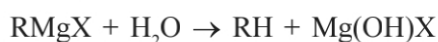
⇒ These reagents are obtained by the reaction of haloalkanes with magnesium metal in dry ether.



⇒ In the Grignard reagent, the carbon-magnesium bond is covalent but highly polar, with carbon pulling electrons from electropositive magnesium; the magnesium halogen bond is essentially ionic.



⇒ Grignard reagents are highly reactive and react with any source of proton to give hydrocarbons. Even water, alcohols, amines are sufficiently acidic to convert them to corresponding hydrocarbons.



Ethyl magnesium bromide Ethane

⇒ It is therefore necessary to avoid even traces of moisture from a Grignard reagent. That is why reaction is carried out in dry ether. On the other hand, this could be considered as one of the methods for converting halides to hydrocarbons.

4. Write note on trichloromethane (Chloroform)

⇒ Chloroform is employed as a solvent for fats, alkaloids, iodine and other substances.

⇒ The major use of chloroform today is in the production of the freon refrigerant R-22.

⇒ It was once used as a general anaesthetic in surgery but has been replaced by less toxic, safer anaesthetics, such as ether.

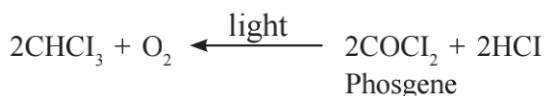
⇒ As might be expected from its use as an anaesthetic, inhaling chloroform vapours depresses the central nervous system.

⇒ Breathing about 900 parts of chloroform per million parts of air (900 parts per million) for a short time can cause dizziness, fatigue and headache.

⇒ Chronic chloroform exposure may cause damage to the liver (where chloroform is metabolised to phosgene) and to the kidneys, and some people develop sores when the skin is immersed in chloroform.

⇒ Chloroform is slowly oxidised by air in the presence of light to an extremely poisonous gas, carbonyl chloride, also known as phosgene.

⇒ It is therefore stored in closed dark coloured bottles completely filled so that air is kept out.



Section C

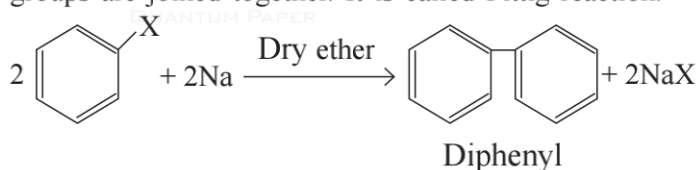
● Write the answer of the following questions. [Each carries 3 Marks]

[9]

5. Give Fittig, Wurtz – Fittig and Grignard reaction of haloarene.

⇒ (1) Fittig reaction :

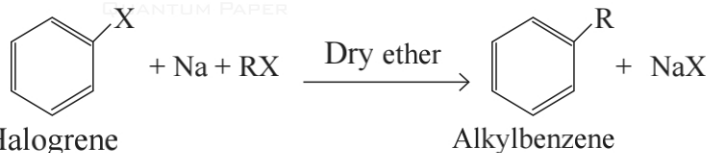
⇒ Aryl halides also give analogous compounds when treated with sodium in dry ether, in which two aryl groups are joined together. It is called Fittig reaction.



(2) Wurtz-Fittig reaction :

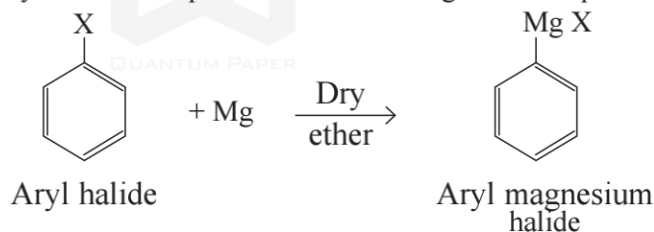
⇒ A mixture of an alkyl halide and aryl halide gives an alkylarene when treated with sodium in dry ether

and is called Wurtz-Fittig reaction.



(3) Grignard reaction :

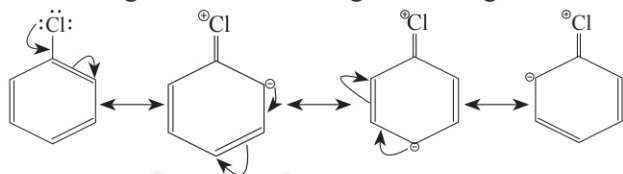
⇒ Aryl halide compounds react with Mg Metal in presence of Dry ether & gives Aryl Magnesium halide.



6. Why Haloarenes are less reactive towards Nucleophilic substitution reactions. Give reasons.

⇒ Aryl halides are extremely less reactive towards Nucleophilic substitution reactions due to the following reasons :

⇒ (i) Resonance effect : In haloarenes, the electron pairs on halogen atom are in conjugation with π -electrons of the ring and the following resonating structures are possible.

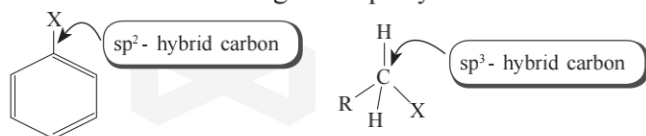


⇒ C-Cl bond acquires a partial double bond character due to resonance.

⇒ As a result, the bond cleavage in haloarene is difficult than haloalkane and therefore, they are less reactive towards Nucleophilic substitution reaction.

(ii) Difference in hybridisation of carbon atom in C-X bond :

⇒ In haloalkane, the carbon atom attached to halogen is sp^3 hybridised while in case of haloarene, the carbon atom attached to halogen is sp^2 hybridised.



⇒ The sp^2 hybridised carbon with a greater s-character is more electronegative and can hold the electron pair of C-X bond more rightly than sp^3 hybridised carbon in haloalkane with less s-character.

⇒ Thus, C-Cl bond length in haloalkane is 177 pm while in haloarene is 169 pm.

⇒ Since it is difficult to break a shorter bond than a longer bond, therefore, haloarenes are less reactive than haloalkanes towards Nucleophilic substitution reaction.

(iii) Instability of phenyl cation :

⇒ In case of haloarenes, the phenyl cation formed as a result of self-ionisation will not be stabilised by resonance and therefore, SN^1 mechanism is ruled out.

(iv) Repulsion :

⇒ Because of the possible repulsion, it is less likely for the electron rich nucleophile to approach electron rich arenes.

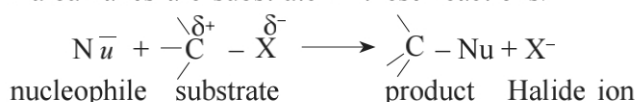
7. What is nucleophilic substitution reactions. Write down different products obtain from alkyl halides.

⇒ Nucleophiles are electron rich species. Therefore, they attack at that part of the substrate molecule which is electron deficient.

⇒ The reaction in which a nucleophile replaces already existing nucleophile in a molecule is called nucleophilic

substitution reaction.

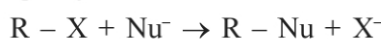
⇒ Haloalkanes are substrate in these reactions.



⇒ In this type of reaction, a nucleophile reacts with haloalkane (the substrate) having a partial positive charge on the carbon atom bonded to halogen.

⇒ A substitution reaction takes place and halogen atom, called leaving group departs as halide ion. Since the substitution reaction is initiated by a nucleophile, it is called nucleophilic substitution reaction.

⇒ It is one of the most useful classes of organic reactions of alkyl halides in which halogen is bonded to sp³ hybridised carbon.



Reagent	Nucleophile (Nu ⁻)	Substitution product R - Nu	Class of main product
NaOH (KOH)	HO ⁻	ROH	Alcohol
H ₂ O	H ₂ O	ROH	Alcohol
NaOR'	R'O ⁻	ROR'	Ether
NaI	I ⁻	R-I	Alkyl iodide
NH ₃	NH ₃	RNH ₂	Primary amine
R'NH ₂	R'NH ₂	RNHR'	Sec. amine
R'R''NH	R'R''H	RNR'R''	Tert. amine
KCN	$\bar{\text{C}}\equiv\text{N}:$	RCN	Nitrile (cyanide)
AgCN	Ag-CN	RNC (isocyanide)	Isonitrile
KNO ₂	O=N-O	R-O-N=O	Alkyl nitrite
AgNO ₂	Ag-Ö-N=O	R-NO ₂	Nitroalkane
R'COOAg	R'COO ⁻	R'COOR	Ester
LiAlH ₄	H	RH	Hydrocarbon
R'-M ⁺	R'	RR'	Alkane

Section D

● Write the answer of the following questions. [Each carries 4 Marks]

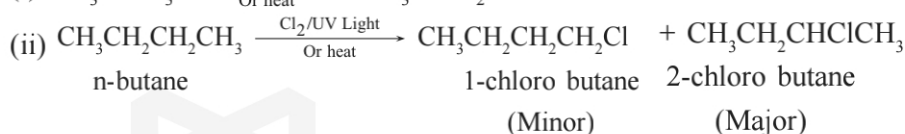
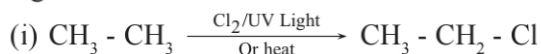
[8]

8. Explain the preparation of haloalkanes from hydrocarbon.

⇒ (I) From alkanes by free radical halogenation :

⇒ Free radical chlorination or bromination of alkanes gives a complex mixture of isomeric mono- and polyhaloalkanes, which is difficult to separate as pure compounds. Consequently, the yield of any single compound is low.

e.g.

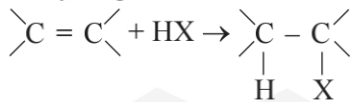


⇒ (II) From alkenes :

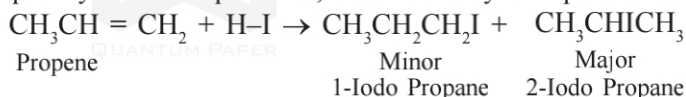
(i) Addition of hydrogen halides :

⇒ An alkene is converted to corresponding alkyl halide by reaction with hydrogen chloride, hydrogen bromide

or hydrogen iodide.



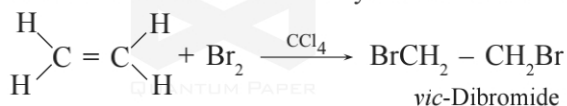
Propene yields two products, however only one predominates as per Markovnikov's rule.



(ii) Addition of halogens:

In the laboratory, addition of bromine in CCl_4 to an alkene resulting in discharge of reddish brown colour of bromine constitutes an important method for the detection of double bond in a molecule.

The addition results in the synthesis of vic-dibromides, which are colourless.



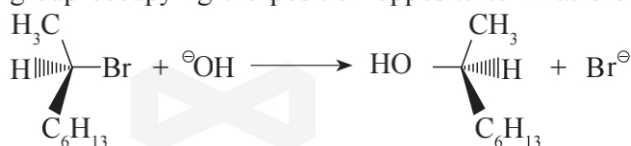
9. Explain stereochemistry of $\text{S}_\text{N}1$ and $\text{S}_\text{N}2$ reaction.

$\text{S}_\text{N}2$ reaction :

In case of optically active alkyl halides, the product formed as a result of $\text{S}_\text{N}2$ mechanism has the inverted configuration as compared to the reactant.

This is because the nucleophile attaches itself on the side opposite to the one where the halogen atom is present.

When (–)-2-bromooctane is allowed to react with sodium hydroxide, (+)-octan-2-ol is formed with the –OH group occupying the position opposite to what bromide had occupied.



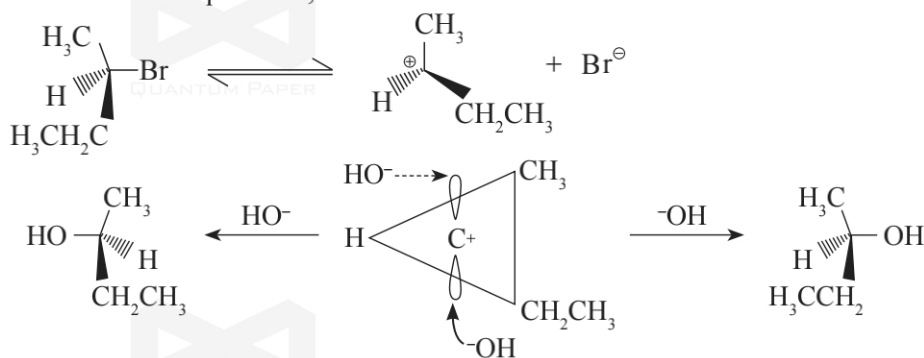
Thus $\text{S}_\text{N}2$ reactions of optically active halides are accompanied by inversion of configuration.

• $\text{S}_\text{N}1$ reaction :

In case of optically active alkyl halides, $\text{S}_\text{N}1$ reactions are accompanied by racemisation.

Actually the carbocation formed in the slow step being sp^2 hybridised is planar (achiral).

The attack of the nucleophile may be accomplished from either side of the plane of carbocation resulting in a mixture of products,



(+)-Butan-2-ol

(–)-Butan-2-ol

one having the same configuration (the –OH attaching on the same position as halide ion) and the other having opposite configuration (the –OH attaching on the side opposite to halide ion).

This may be illustrated by hydrolysis of optically active 2-bromobutane, which results in the formation of (±)-butan-2-ol.