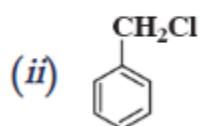
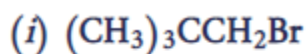


Short Answer Questions–I

Short Answer Questions–I (PYQ)

Q.1. Write the IUPAC names of the following compounds:

[CBSE (AI) 2008]



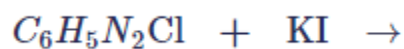
Ans. (i) 1-Bromo-2,2-dimethylpropane

(ii) Phenylchloromethane

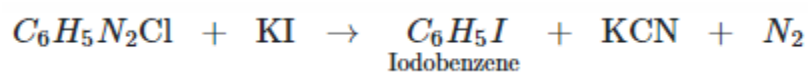
Q.2. Complete the following reaction equations:

[CBSE Delhi 2008]

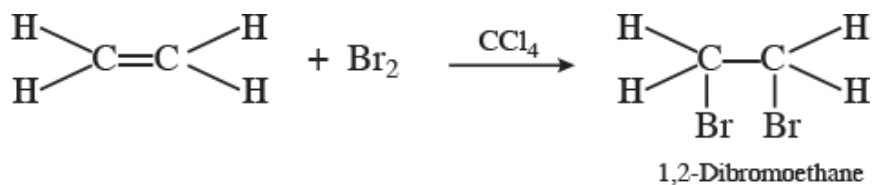
Q.



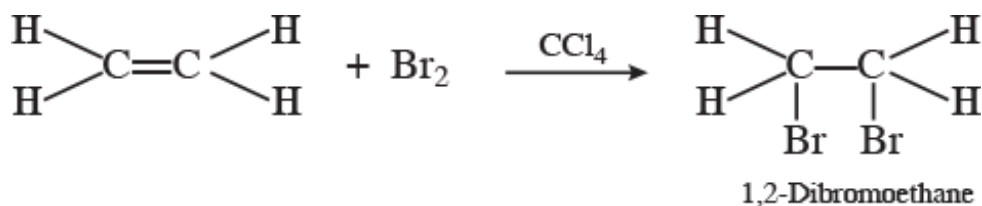
Ans.



Q.



Ans.



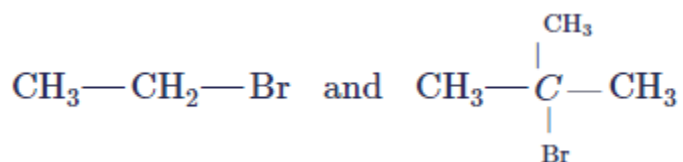
Q.3. Answer the following questions

[CBSE Patna 2015]

Q. Which is a better nucleophile, a bromide ion or an iodide ion?

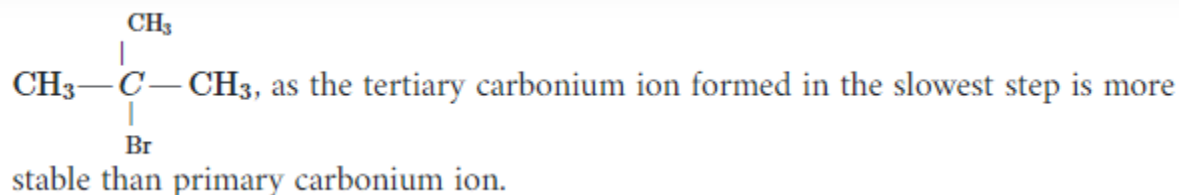
Ans. Iodide ion is a better nucleophile because of its bigger size and lower electronegativity.

Q. Which would undergo $\text{S}_{\text{N}}1$ reaction faster in the following pair?



[CBSE Patna 2015]

Ans.

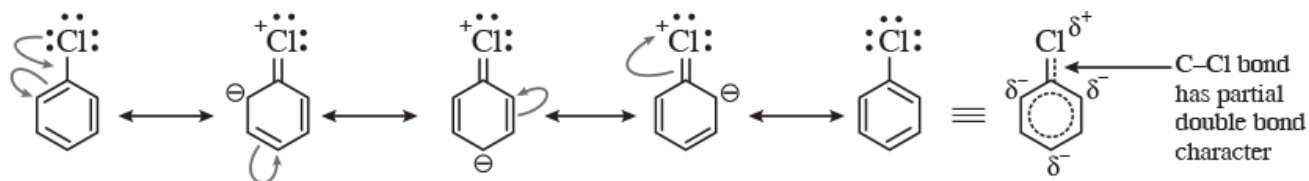


Q.4. Give reasons:

[CBSE Delhi 2016]

Q. C—Cl bond length in chlorobenzene is shorter than C—Cl bond length in $\text{CH}_3\text{—Cl}$.

Ans. In chlorobenzene, C—Cl bond acquires partial double bond character while in methyl chloride, C—Cl bond has pure single bond character. As a result C—Cl bond in chlorobenzene is shorter than methyl chloride.



Q. S_N1 reactions are accompanied by racemisation in optically active alkyl halides.

Ans. Carbocations are intermediate in S_N1 reactions. Carbocations being sp² hybridised are planar species, therefore, attack of nucleophile on it can occur from both front and rear with almost equal ease giving a racemic mixture.

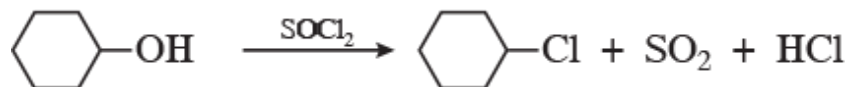
Q. Draw the structure of major monohalo product in each of the following reactions:

[CBSE Delhi 2014]

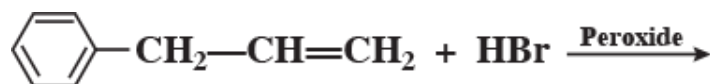
Q.



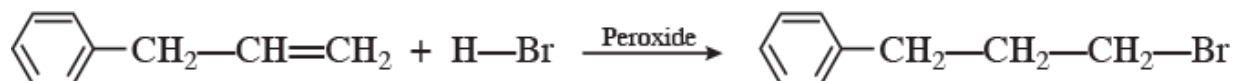
Ans.



Q.



Ans.



Q.6. Answer the following questions

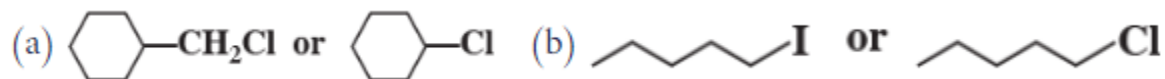
[CBSE Delhi 2009]

Q. Which will have a higher boiling point?

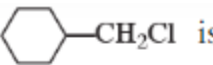
1-Chloropentane or 2-methyl-2-chlorobutane



Ans. 1-Chloropentane will have higher boiling point as branching lowers the surface area and hence the strength of van der Waal's forces.

Q. Which ones in the following pairs of substances undergoes S_N2 substitution reaction faster and why?



Ans.

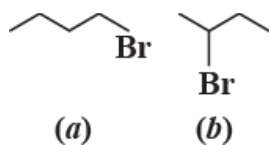
(a)  is primary halide therefore undergoes S_N2 reaction faster.

(b) 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. So,  I reacts faster than .

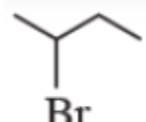
Q.7. Answer the following questions


[CBSE Delhi 2014]

Q. Which alkyl halide from the following pair is chiral and undergoes faster S_N2 reaction?



Ans.

 2-bromobutane is a chiral molecule.

, primary halides undergo faster S_N2 reactions than secondary halides due to less steric hinderance.

Q. Out of S_N1 and S_N2 , which reaction occurs with

(a) Inversion of configuration

(b) Racemisation

Ans. (a) S_N2 reaction occurs with inversion of configuration.

(b) S_N1 reaction occurs with racemisation.

Q.8. Which one of the following compounds is more easily hydrolysed by KOH and why?



[CBSE (AI) 2012]

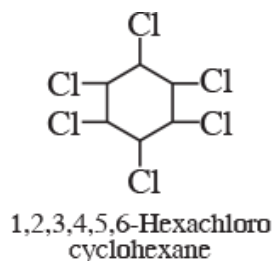
Ans. Due to +I effect of alkyl groups the 2° carbonium ion $\text{CH}_3\text{—CH—CH}_2\text{—CH}_3$ derived from sec. butyl chloride is more stable than the 1° carbonium ion $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—}^+\text{CH}_2$ derived from *n*-propyl chloride. Therefore sec. butyl chloride gets hydrolysed more easily than *n*-propyl chloride under S_N1 conditions.

Short Answer Questions–I (OIQ)

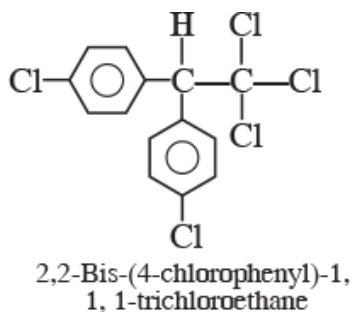
Q.1. Give the structural formula and IUPAC name of the following compounds:

(i) BHC (ii) DDT

Ans. (i) BHC



(ii) DDT



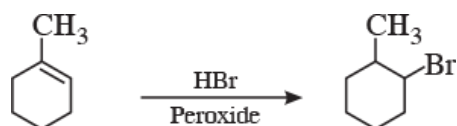
Q.2. Complete the following giving the structures:

[HOTS]

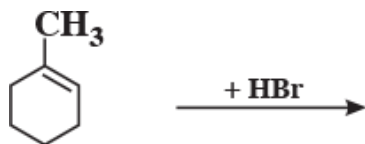
Q.



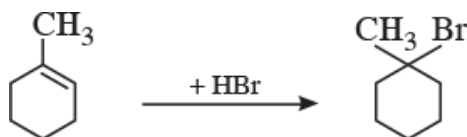
Ans.



Q.



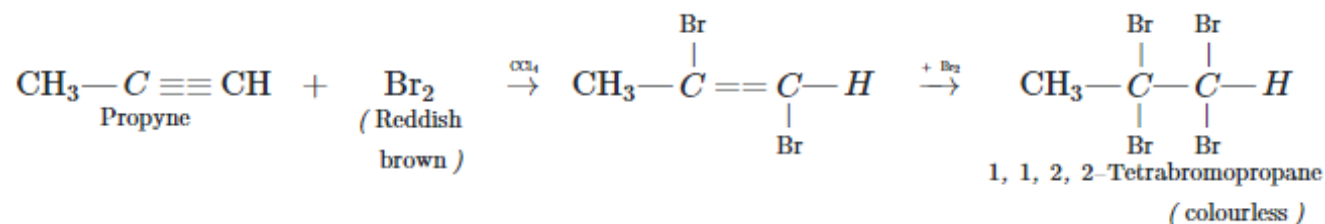
Ans.



Q.3. What happens when bromine reacts with $\text{CH}_3\text{—C}\equiv\text{CH}$? How would you justify this reaction?

Ans.

When bromine reacts with propyne, the reddish brown colour of bromine is discharged as long as propyne is present in excess.

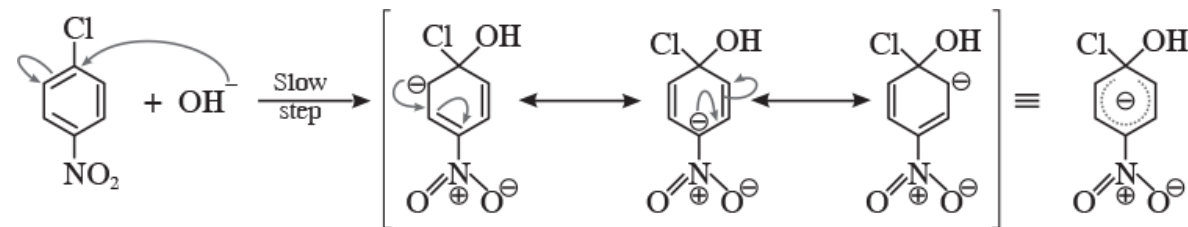


This is due to the formation of 1, 1, 2, 2-tetrabromopropane which is colourless.

Q.4. Give reasons for the following:

Q. *p*-nitrochlorobenzene undergoes nucleophilic substitution faster than chlorobenzene. Explain giving the resonating structures as well.

Ans. In *p*-nitrochlorobenzene a carbanion intermediate is formed. This is stabilised by resonance as shown below.



The $-I$ effect of nitro group further stabilises the intermediate. Hence, *p*-nitrochlorobenzene reacts faster than chlorobenzene.

Q. Iodoform is obtained by reaction of acetone with hypoiodite ion but not iodide ion.

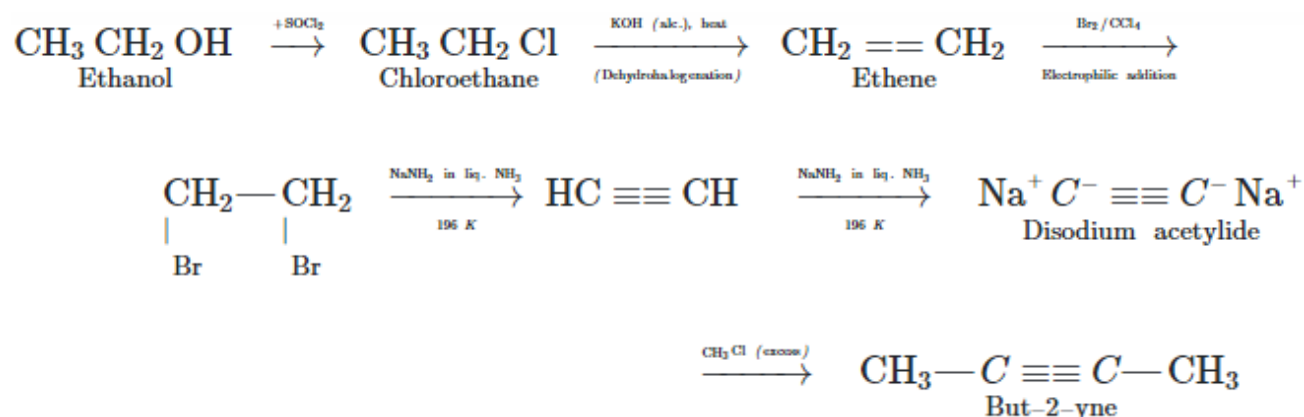
Ans. Hypoiodite ion can act as an oxidising agent while iodide ion does not.

Q.5. How the following conversions can be carried out?

Ethanol to But-2-yne

[HOTS]

Ans.



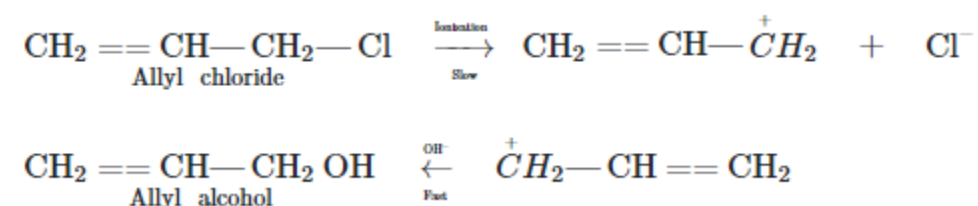
Q. Explain the following in one or two sentences:

[HOTS]

Q. Allyl chloride is hydrolysed more readily than *n*-propyl chloride.

Ans.

Allyl chloride shows high reactivity as the carbocation formed by hydrolysis is stabilised by resonance while no such stabilisation of carbocation exists in the case of *n*-propyl chloride.



On the other hand, *n*-propyl chloride does not undergo ionisation to produce *n*-propyl carbocation and hence allyl chloride is hydrolysed more readily than *n*-propyl chloride.

Q.6. Vinyl chloride is hydrolysed more slowly than ethyl chloride.

Ans. Vinyl chloride may be represented as a resonance hybrid of the following two structures:



As a result of resonance, the carbon–chlorine bond acquires some double bond character in vinyl chloride. On the other hand, in ethyl chloride, the carbon–chlorine bond is a pure single bond. Thus, vinyl chloride undergoes hydrolysis more slowly than ethyl chloride.

Q.7. Differentiate between conformation and configuration in open chain molecules by giving one example each.

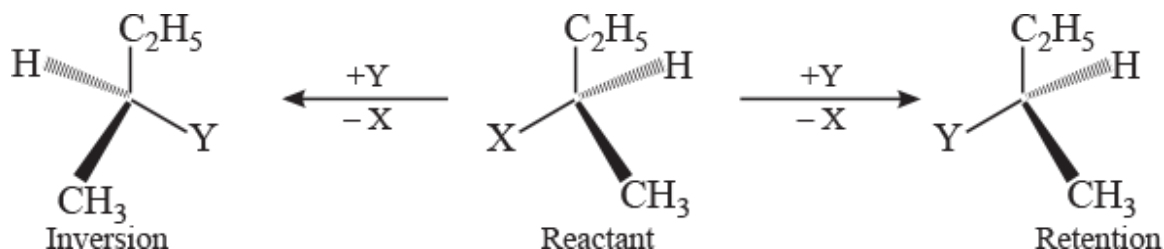
Ans. Conformational isomers: These are compounds having different spatial arrangements of atoms or groups attached to carbon atom bonded by a single bond and are obtained by the rotation of single bond. These isomers are called conformers or rotational isomers and have different energies. The conformation isomerism is exhibited by alkanes and cycloalkanes.

Configurational isomerism: It is due to certain type of rigidity within the molecule. Configurational isomers can be interconverted only by breaking and remaking of covalent bonds. These are of two types:

(a) Geometrical isomerism, (b) Optical isomerism.

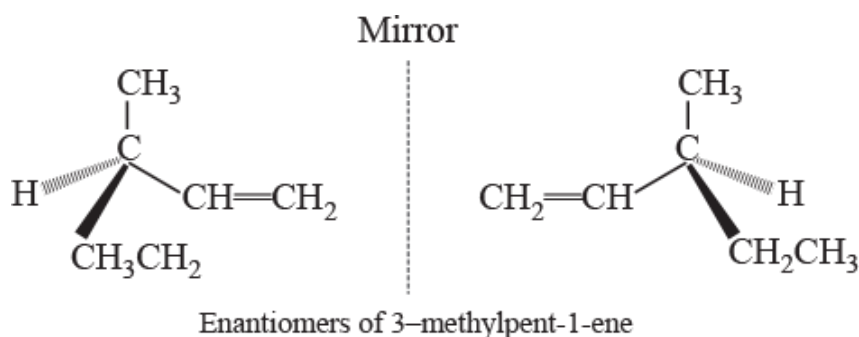
Q.8. Differentiate between retention and inversion.

Ans. If the relative configuration of the atoms/groups around a chiral centre in an optically active molecule remains the same before and after the reaction, the reaction is said to proceed with retention of configuration. On the other hand, if the relative configuration of the atoms/groups around a stereocentre in the product is opposite to that in the reactant, the reaction is said to proceed with inversion of configuration. For example,



Q.9. What are enantiomers? Draw the structures of the possible enantiomers of 3-methylpent-1-ene.

Ans. Stereoisomers which are non-superimposable mirror images of each other are called enantiomers.

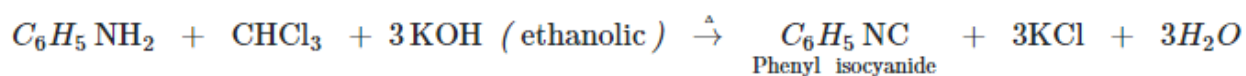


Q.10. How will you distinguish between the following pairs of compounds:

[CBSE Sample Paper 2014]

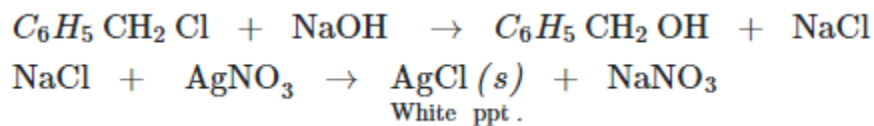
Q. Chloroform and carbon tetrachloride.

Ans. On heating chloroform and carbon tetrachloride with aniline and ethanolic potassium hydroxide separately chloroform forms pungent smelling isocyanide but carbon tetrachloride does not form this compound.



Q. Benzyl chloride and chlorobenzene.

Ans. On adding sodium hydroxide and silver nitrate to both the compounds benzyl chloride forms white precipitate but chlorobenzene does not form white precipitate.



Q.11. Predict the order of reactivity of the four isomeric bromobutanes in S_N1 and S_N2 reactions.

Ans. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br} < (\text{CH}_3)_2\text{CHCH}_2\text{Br} < \text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3 < (\text{CH}_3)_3\text{CBr}$ (S_N1)

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br} > (\text{CH}_3)_2\text{CHCH}_2\text{Br} > \text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3 > (\text{CH}_3)_3\text{CBr}$ (S_N2)

Of the two primary bromides, the carbocation intermediate derived from $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$ is more stable than that derived from $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ because of greater electron donating inductive effect of $(\text{CH}_3)_2\text{CH}$ group. So, $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$ is more reactive than $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ in S_N1 reactions. $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$ is a secondary bromide and $(\text{CH}_3)_3\text{CBr}$ is a tertiary bromide. Thus, the above order is followed in S_N1 . The reactivity in S_N2 reactions follows the reverse order as the steric hindrance around the electrophilic carbon increases in that order.

Q.12. Predict the order of reactivity of the following compounds in S_N1 and S_N2 reactions:

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

Ans. $\text{C}_6\text{H}_5\text{C}(\text{CH}_3)(\text{C}_6\text{H}_5)\text{Br} > \text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br} > \text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br} > \text{C}_6\text{H}_5\text{CH}_2\text{Br}$ (S_N1).

$\text{C}_6\text{H}_5\text{C}(\text{CH}_3)(\text{C}_6\text{H}_5)\text{Br} < \text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br} < \text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br} < \text{C}_6\text{H}_5\text{CH}_2\text{Br}$ (S_N2).

Of the two secondary bromides, the carbocation intermediate obtained from $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$ is more stable than that obtained from $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$ because it is stabilised by two phenyl groups due to resonance. Hence, the former bromide is more reactive than the latter in S_N1 reaction. Phenyl group is bulkier than a methyl group. Thus, $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$ is less reactive than $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$ in S_N2 reactions.

Q.13. Explain the following:

[HOTS]

Q. Haloalkanes react with KCN to form alkyl cyanides as main product while AgCN forms isocyanides as the major product.

Ans. KCN is predominantly ionic and provides cyanide ions in solution. The attack takes place mainly through carbon atom and not through nitrogen atom as C—C bond is more stable than C—N bond. In contrast, AgCN is mainly covalent in nature and nitrogen is free to donate electron pair forming isocyanide as the major product.

Q. Neopentyl bromide undergoes nucleophilic substitution reaction very slowly.

Ans. Neopentyl bromide undergoes nucleophilic substitution reactions very slowly because of following reasons:

- a. Due to bulky neopentyl group, difficult for a nucleophile to attack from back side at C of C—Br bond.
- b. Cleavage of C—Br bond gives primary carbocation which is less stable.

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- b. Cleavage of C—Br bond gives primary carbocation which is less stable.

Q.14. Give reasons for the following:

Q. Chloroethane is insoluble in water.

Ans. Chloroethane is unable to form hydrogen bonds with water. Hence, it is insoluble in water.

Q. Thionyl chloride method is preferred for preparing alkyl chlorides from alcohols.

Ans. The byproducts of the reaction, *i.e.*, SO₂ and HCl being gases escape into the atmosphere leaving behind alkyl chlorides in almost pure state.