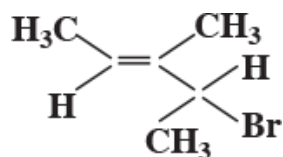


Very Short Answer Questions

Very Short Answer Questions (PYQ)

Q.1. Give the IUPAC name of the following compound:

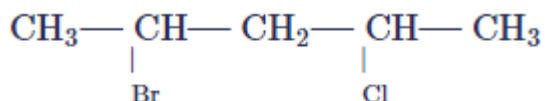
[CBSE (AI) 2010]



Ans. 4-Bromo-3-methyl-pent-2-ene

Q.2. Give the IUPAC name of the following compound:

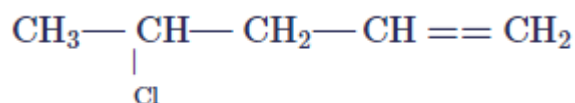
[CBSE (AI) 2013]



Ans. 2-Bromo-4-chloropentane.

Q.3. Give the IUPAC name of the following compound:

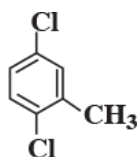
[CBSE Delhi 2013]



Ans. 4-Chloropent-1-ene.

Q.4. Write the IUPAC name of the following compound:

[CBSE (AI) 2013]



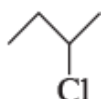
Ans. 2, 5-Dichlorotoluene/1,4-Dichloro-2-methylbenzene.

Q.5. Identify the chiral molecule in the following pair:

[CBSE (AI) 2014]

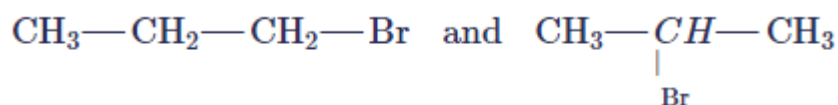


Ans.

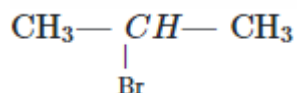


Q.6. Which would undergo S_N1 reaction faster in the following pair and why?

[CBSE Allahabad 2015]



Ans.



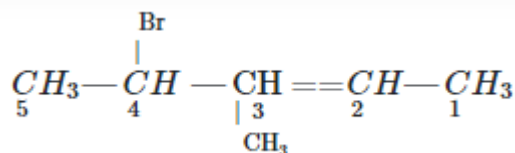
because the secondary carbocation formed in the slowest step is more stable than the primary carbocation.

Q.7. Draw the structure of the following compound:

4-Bromo-3-methylpent-2-ene

[CBSE (F) 2010]

Ans.



Q.8. What happens when bromine attacks $\text{CH}_2\text{=CH—CH}_2\text{—C}\equiv\text{CH}$?

[CBSE (AI) 2012]

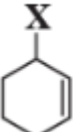
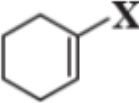
Ans. The reddish brown colour of bromine is discharged.

Q.9. What is known as a racemic mixture? Give an example.

[CBSE Delhi 2011]

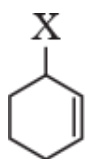
Ans. An equimolar mixture of a pair of enantiomers is called racemic mixture. A racemic mixture is optically inactive due to external compensation.

Q.10.

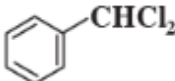
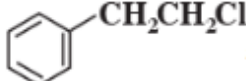
Out of  and , which is an example of allylic halide?

[CBSE (AI) 2017]

Ans.

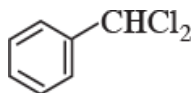


Q.11.

Out of  and , which is an example of a benzylic halide?

[CBSE (AI) 2017]

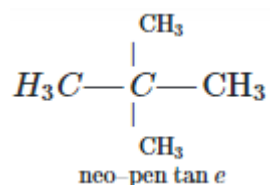
Ans.



Q.12. Among the isomers of pentane (C₅H₁₂), write the one which on photochemical chlorination yields a single monochloride.

[CBSE (F) 2017]

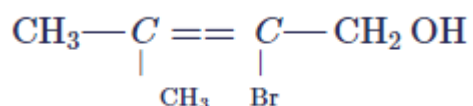
Ans.



As all the hydrogen atoms are equivalent and replacement of any hydrogen will give the same product.

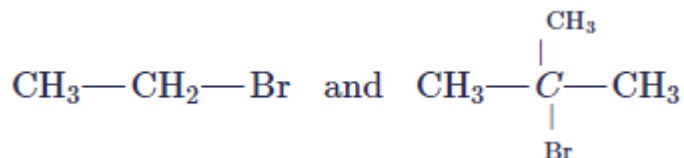
Q.13. Give the IUPAC name of the following compound:

[CBSE Delhi 2009]



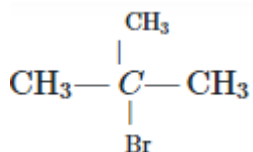
Ans. 2-Bromo-3-methyl but-2-en-1-ol.

Q.14. Which would undergo S_N1 reaction faster in the following pair and why?



[CBSE Panchkula 2015]

Ans.

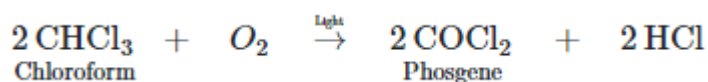


tertiary halide reacts faster than primary halide because of greater stability of 3°-carbocation.

Q.15. Given reason: Chloroform is stored in closed dark coloured bottles completely filled so that air is kept out.

[CBSE Delhi 2010]

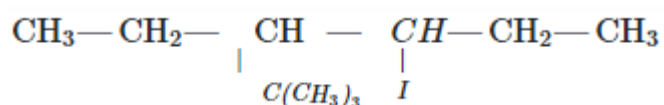
Ans. This is because chloroform is slowly oxidised by air in the presence of light to an extremely poisonous gas phosgene.



Very Short Answer Questions (OIQ)

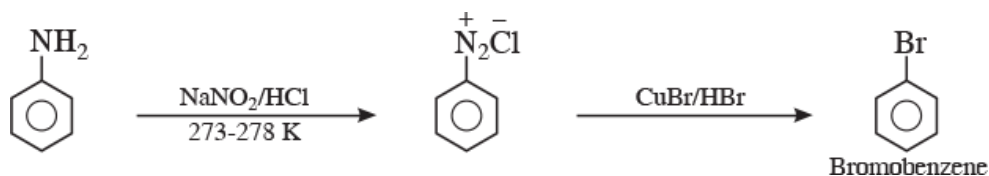
Q.1. Draw the structure of the compound, 4-tert-butyl-3-iodoheptane.

Ans.

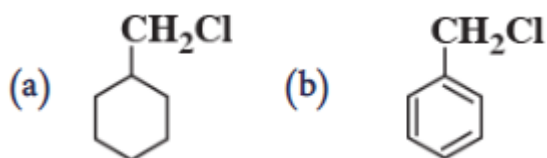


Q.2. How will you convert aniline to bromobenzene?

Ans.



Q.3. Which of the following compounds would undergo $\text{S}_{\text{N}}1$ reaction faster and why?



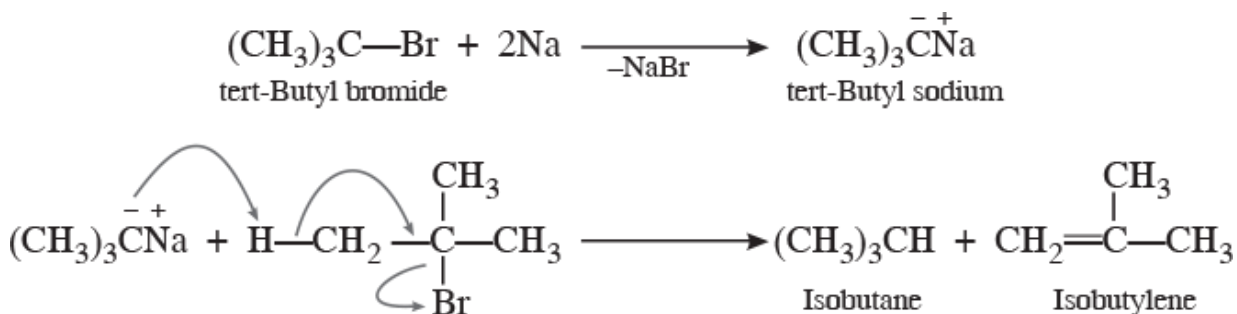
[NCERT Exemplar]

Ans. (B) undergoes $\text{S}_{\text{N}}1$ reaction faster than (A) because in case of (B), the carbocation formed after the loss of Cl^- is stabilised by resonance, whereas, no such stabilisation is possible in the carbocation obtained from (A).

Q.4. Wurtz reaction fails in case of tert-alkyl halides. Why?

[HOTS]

Ans. This is because tert-alkyl halides prefer to undergo dehydrohalogenation in the presence of sodium metal instead of undergoing Wurtz reaction.



Q.5. Benzyl chloride undergoes S_N1 reaction faster than cyclohexyl methyl chloride. Why?

Ans. Benzyl chloride undergoes S_N1 reaction faster than cyclohexyl methyl chloride because in case of benzyl chloride, the carbocation formed after the loss of Cl⁻ is stabilised by resonance, whereas, no such stabilisation is possible in the carbocation obtained from cyclohexyl methyl chloride.

Q.6. Halogen compounds used in industry as solvents are alkyl chlorides rather than bromides and iodides. Give reason for your answer.

Ans. This is because alkyl chlorides are more stable and more volatile than bromides and iodides.

Q.7. What is an asymmetric carbon?

Ans. A carbon which is attached to four different atoms/groups is called asymmetric carbon. For example, the carbon atom in BrCHClI.

Q.8. What is plane polarised light?

Ans. A beam of light which has vibration in only one plane is called plane polarised light.

Q.9. How does the ordinary light differ from the plane polarised light?

Ans. Ordinary light has oscillations in all the directions perpendicular to the path of propagation whereas plane polarised light has all oscillations in the same plane.

Q.10. What do you understand by the term optical activity of compounds?

Ans. The property of certain compounds to rotate the plane of polarised light in a characteristic way when it is passed through their solutions is called optical activity of compounds.

Q.11. Give one chemical test to distinguish between C₂H₅Br and C₆H₅Br.

Ans. Hydrolysis of C₂H₅Br with aqueous KOH followed by acidification with dil. HNO₃ and subsequent treatment with AgNO₃ gives light yellow ppt. of AgBr whereas C₆H₅Br does not give this test.

Q.12. Amongst the isomeric alkanes of molecular formula C₅H₁₂, identify the one that on photochemical chlorination yields a single monochloride.

[CBSE Sample Paper 2016] [HOTS]

Ans.

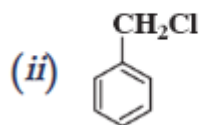
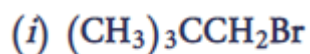
$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
 neo-pentane. Since all the H-atoms are equivalent and replacement of any hydrogen will give the same product.

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

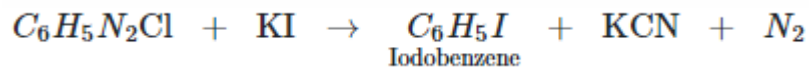
Q.2. Complete the following reaction equations:

[CBSE Delhi 2008]

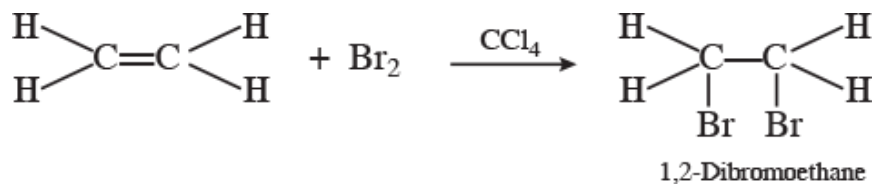
Q.



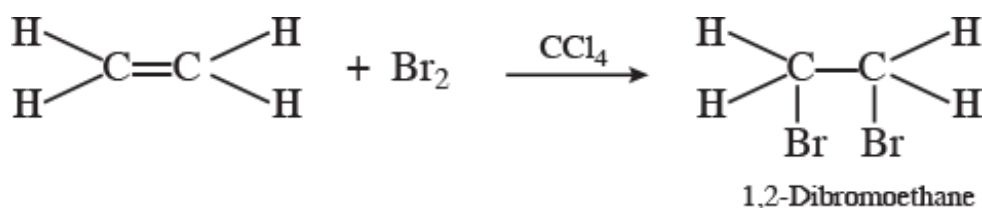
Ans.



Q.



Ans.



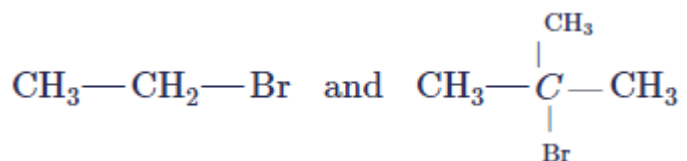
Q.3. Answer the following questions

[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 S_N1 reaction faster in the following pair?



[CBSE Patna 2015]

Ans.

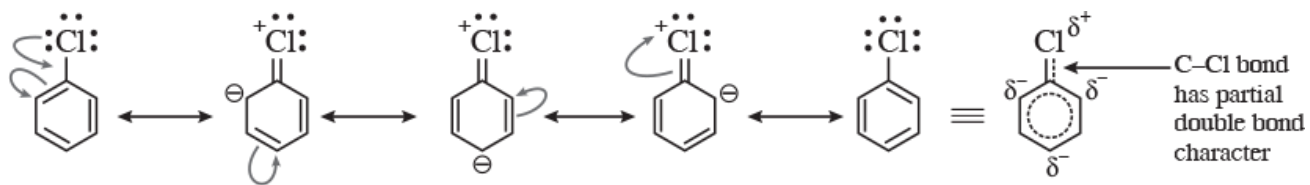
$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ | \\ \text{Br} \end{array}$$
 as the tertiary carbonium ion formed in the slowest step is more stable than primary carbonium ion.

Q.4. Give reasons:

[CBSE Delhi 2016]

Q. C—Cl bond length in chlorobenzene is shorter than C—Cl bond length in CH₃—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.

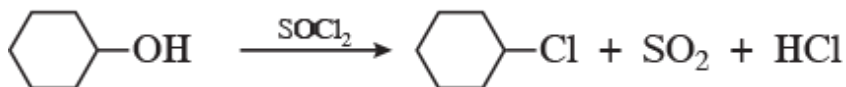
Q. Draw the structure of major monohalo product in each of the following reactions:

[CBSE Delhi 2014]

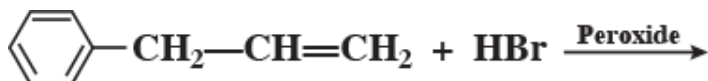
Q.



Ans.



Q.



Ans.



Q.6. Answer the following questions

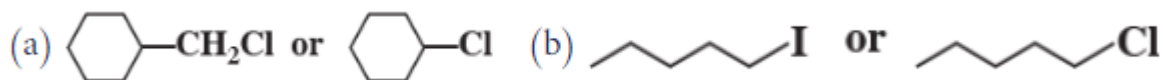
[CBSE Delhi 2009]

Q. Which will have a higher boiling point?

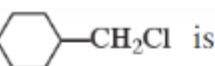
1-Chloropentane or 2-methyl-2-chlorobutane



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.

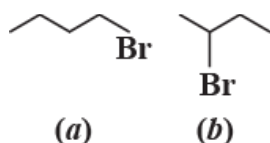
(a)  is primary halide therefore undergoes S_N2 reaction faster.

(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  Cl .

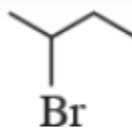
Q.7. Answer the following questions


[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.

 **Br**, 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]

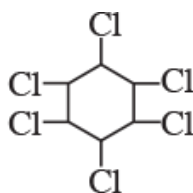
Ans. Due to +I effect of alkyl groups the 2° carbonium ion $\text{CH}_3\text{—CH—CH}_2\text{—CH}_3$ derived from sec. butyl chloride is more stable than the 1° carbonium ion $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—}^+\text{CH}_2$ derived from *n*-propyl chloride. Therefore sec. butyl chloride gets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

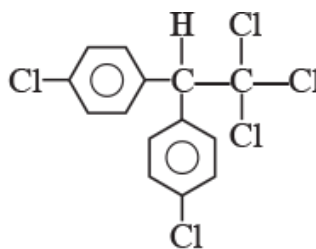
(i) BHC (ii) DDT

Ans. (i) BHC



1,2,3,4,5,6-Hexachloro
cyclohexane

(ii) DDT

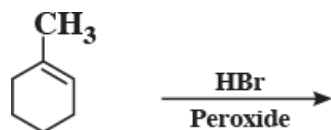


2,2-Bis-(4-chlorophenyl)-1,
1,1-trichloroethane

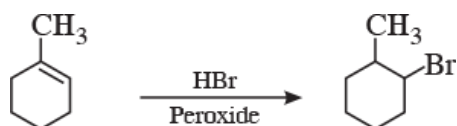
Q.2. Complete the following giving the structures:

[HOTS]

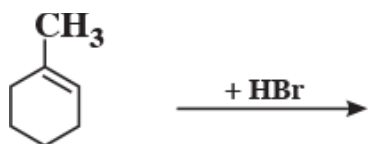
Q.



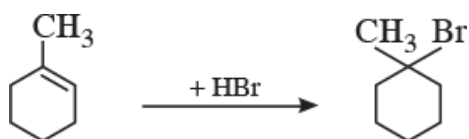
Ans.



Q.



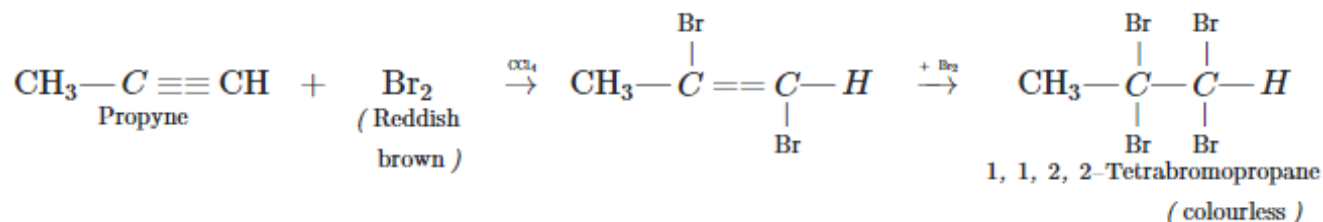
Ans.



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.

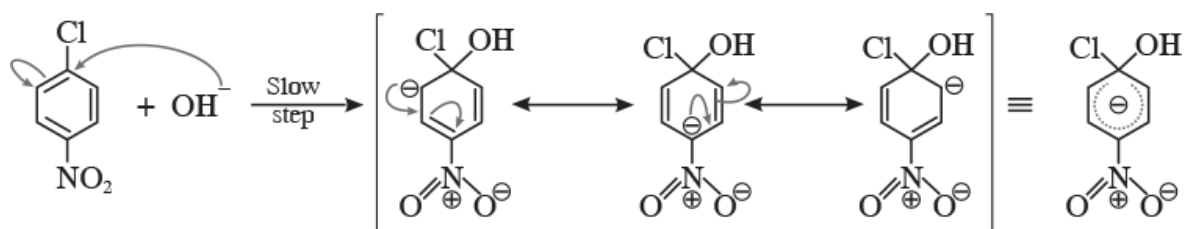


This is due to the formation of 1, 1, 2, 2-tetrabromopropane which is colourless.

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 hypiodite ion but not iodide ion.

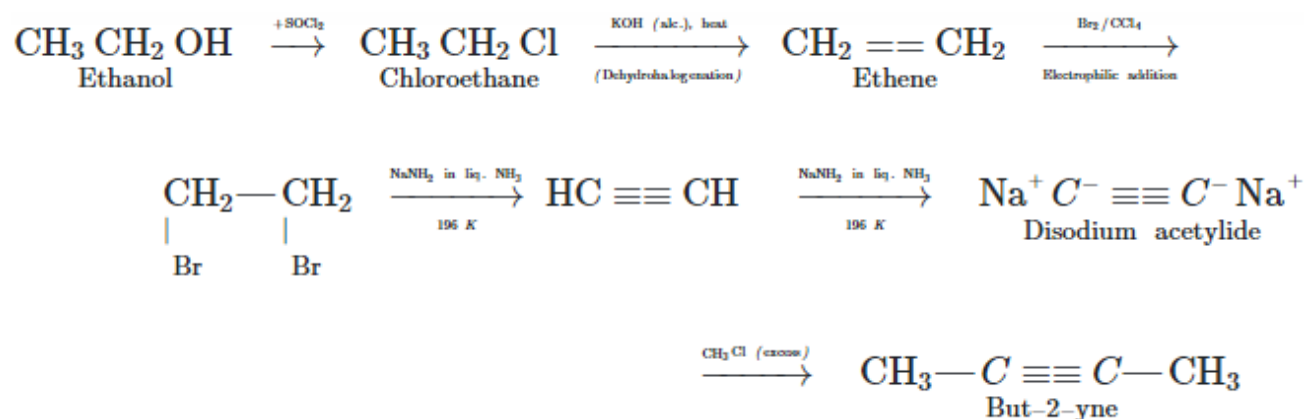
Ans. Hypiodite ion can act as an oxidising agent while iodide ion does not.

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

Ethanol to But-2-yne

[HOTS]

Ans.



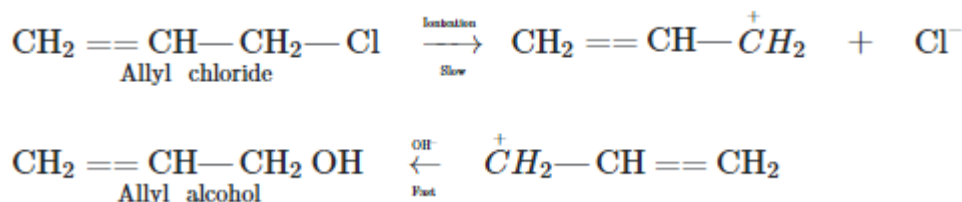
Q. Explain the following in one or two sentences:

[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.

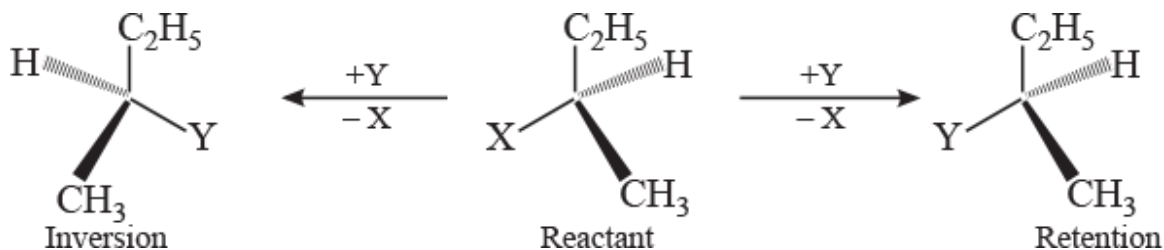
Ans. Conformational isomers: These are compounds having different spatial arrangements of atoms or groups attached to carbon atom bonded by a single bond and are obtained by the rotation of single bond. These isomers are called conformers or rotational isomers and have different energies. The conformation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

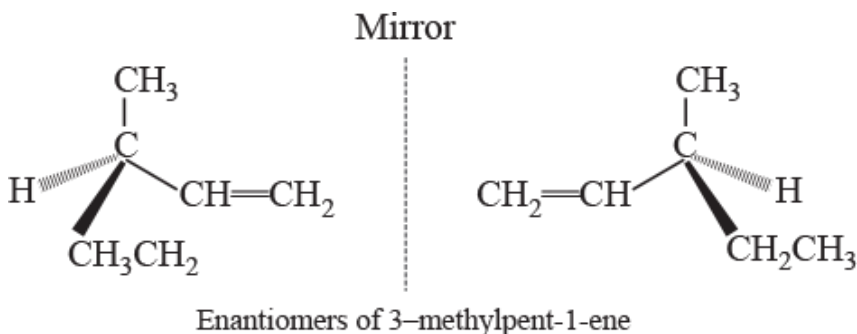
Q.8. Differentiate between retention and inversion.

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.

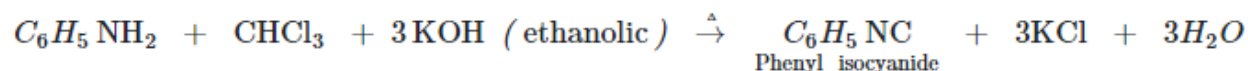


Q.10. How will you distinguish between the following pairs of compounds:

[CBSE Sample Paper 2014]

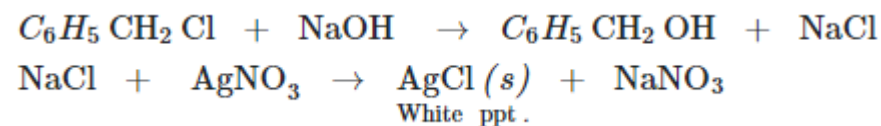
Q. Chloroform and carbon tetrachloride.

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.

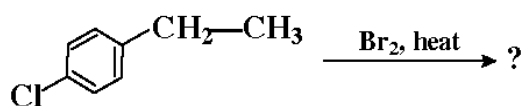
Short Answer Questions-II

Short Answer Questions-II (PYQ)

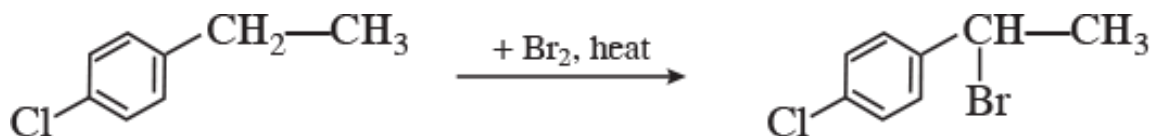
Q.1. Draw the structures of the major monohalo product for each of the following reactions:

[CBSE (F) 2017]

Q.



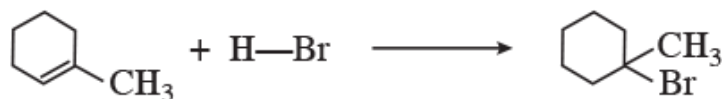
Ans.



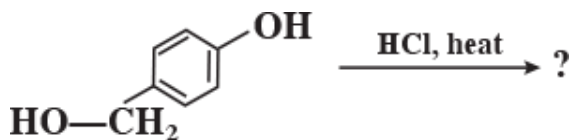
Q.



Ans.



Q.



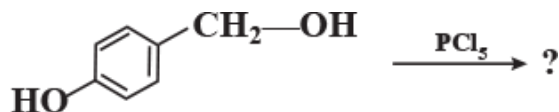
Ans.



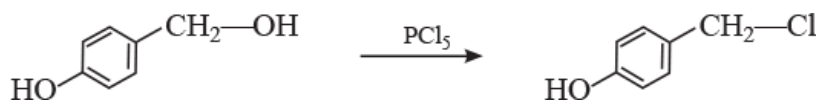
Q.2. Write the major product(s) in the following reactions:

[CBSE (F) 2016]

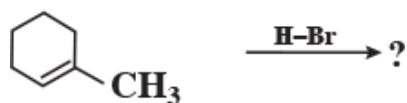
Q.



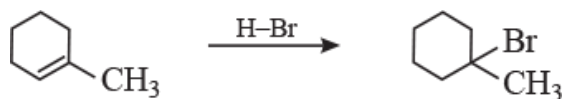
Ans.



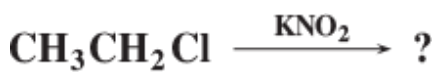
Q.



Ans.



Q.

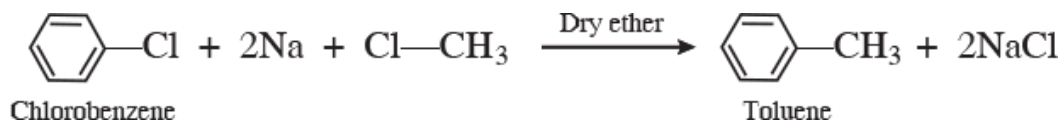


Q.3. How do you convert

[CBSE East 2016]

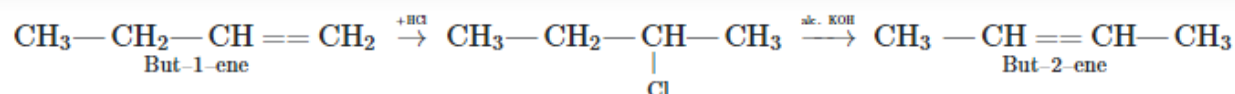
Q. chlorobenzene to toluene?

Ans.



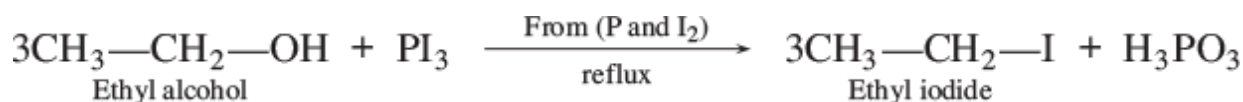
Q. but-1-ene to but-2-ene?

Ans.



Q. ethanol to ethyl iodide?

Ans.



Q.4. Following compounds are given to you:

2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane

[CBSE Delhi 2017]

Q. Write the compound which is most reactive towards S_N2 reaction.

Ans. 1-Bromopentane, it is primary halide therefore undergoes S_N2 reaction faster.

Q. Write the compound which is optically active.

Ans. 2-Bromopentane as carbon number two is symmetric carbon.

Q. Write the compound which is most reactive towards β-elimination reaction.

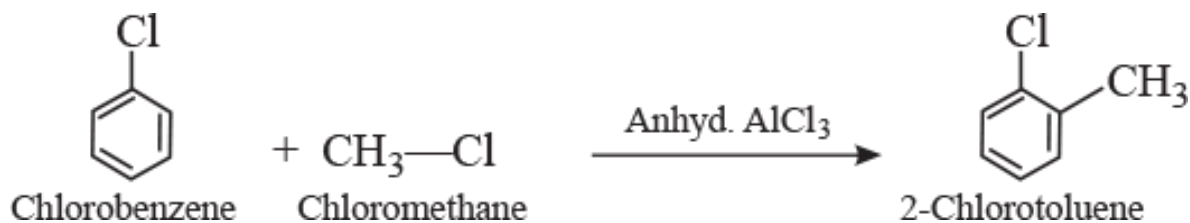
Ans. 2-Bromo-2-methyl butane, because tertiary alkyl halides on dehydrogenation form most substituted alkene which is more stable.

Q.5. Answer the following questions

[CBSE (F) 2015]

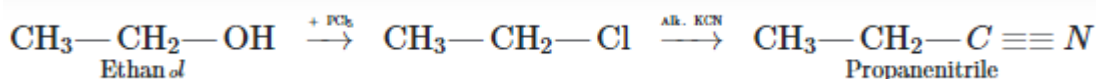
Q. Why are alkyl halides insoluble in water?

Ans. This is due to the inability of alkyl halide molecule to form intermolecular hydrogen bonds with water molecules.



Q. Ethanol to propanenitrile

Ans.

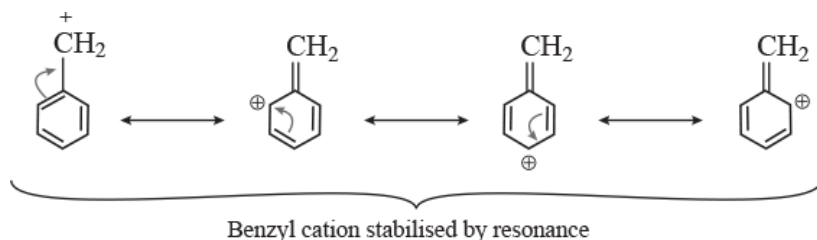


Q.8. Give reasons for the following:

[CBSE Bhubaneswar 2015] [HOTS]

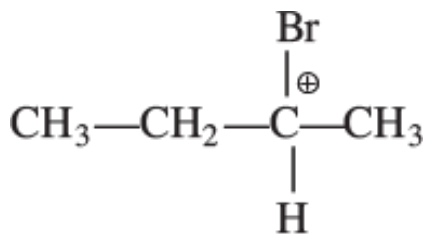
Q. Benzyl chloride is highly reactive towards the S_N1 reaction.

Ans. Benzyl chloride is highly reactive towards the S_N1 reaction because the intermediate benzyl carbocation formed in slowest step is stabilized through resonance.



Q. 2-bromobutane is optically active but 1-bromobutane is optically inactive.

Ans. 2-bromobutane is a chiral molecule as it contains an asymmetric carbon atom therefore, it is optically active whereas 1-bromobutane is an achiral molecule as it does not contain asymmetric carbon atom therefore it is optically inactive.

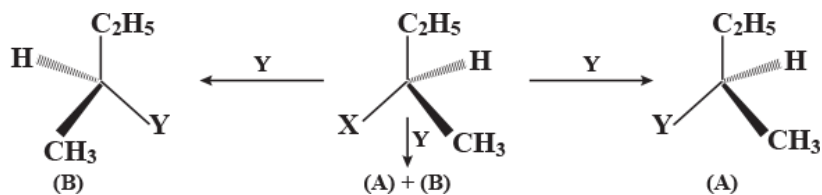


Carbocation of 2-Bromobutane

Q. Electrophilic reactions in haloarenes occur slowly.

Ans. Halogen in haloarenes withdraws electrons through $-I$ effect and release electrons through $+R$ effect. The inductive effect is stronger than resonance effect and causes net electron withdrawal. As a result, the electrophilic substitution reactions in haloarenes occur slowly.

Q.9. Consider the three types of replacement of group X by group Y as shown here.



This can result in giving compound (A) or (B) or both. What is the process called if

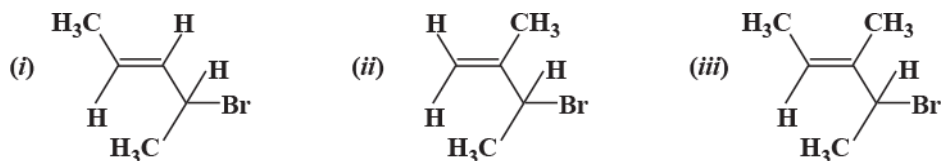
- i. (A) is the only compound obtained?
- ii. (B) is the only compound obtained?
- iii. (A) and (B) are formed in equal proportions?

[CBSE (F) 2013]

Ans.

- i. Retention
- ii. Inversion
- iii. Racemisation

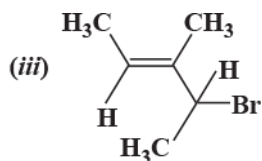
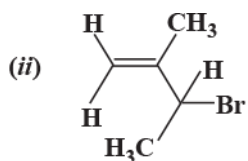
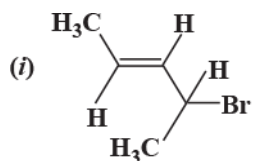
Q.10. Write IUPAC names of the following:



Ans.

- i. 4-Bromopent-2-ene
- ii. 3-Bromo-2-methylbut-1-ene
- iii. 4-Bromo-3-methylpent-2-ene

Q. 11. Write IUPAC names of the following:

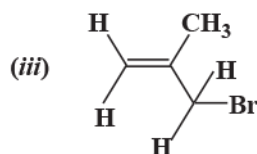
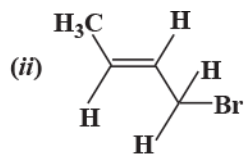
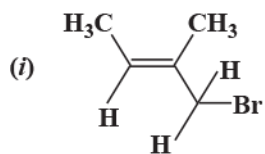


Ans.

- i. 4-Bromopent-2-ene
- ii. 3-Bromo-2-methylbut-1-ene
- iii. 4-Bromo-3-methylpent-2-ene

Q.12. Write IUPAC names of the following:

[CBSE (AI) 2011]



Ans.

- i. 1-Bromo-2-methylbut-2-ene
- ii. 1-Bromobut-2-ene
- iii. 1,1,2,3-Tetrabromo-2-methylpropene

Q. Give reasons for the following:

SE (AI) 2013]

Q. Ethyl iodide undergoes S_N2 reaction faster than ethyl bromide.

Ans.

Since I^- ion is a better leaving group than Br^- ion, hence, CH_3I reacts faster than CH_3Br in S_N2 reaction with OH^- ion.

Q. (\pm) 2-Butanol is optically inactive.

Ans. (\pm) 2-Butanol is a racemic mixture, *i.e.*, there are two enantiomers in equal proportions. The rotation by one enantiomer will be cancelled by the rotation due to the other isomer, making the mixture optically inactive.

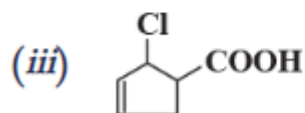
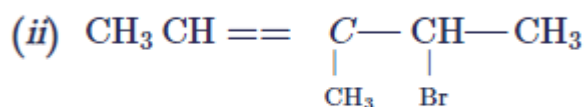
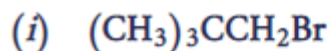
Q. C-X bond length in halobenzene is smaller than C-X bond length in CH_3-X .

Ans.

In $\text{CH}_3\text{-X}$ the carbon atom is sp^3 hybridised while in halobenzene the carbon atom is sp^2 hybridised. The sp^2 hybridised carbon is more electronegative due to greater s-character and holds the electron pair of C-X bond more tightly than sp^3 hybridised carbon with less s-character. Thus, C-X bond length in $\text{CH}_3\text{-X}$ is bigger than C-X in halobenzene.

Short Answer Questions-II (OIQ)

Q.1. Give the IUPAC name of the following organic compounds:



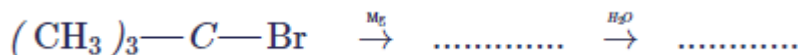
Ans.

- 1-Bromo-2, 2-dimethyl propane.
- 4-Bromo-3-methyl pent-2-ene.
- 2-Chloro-cyclopent-3-ene carboxylic acid.

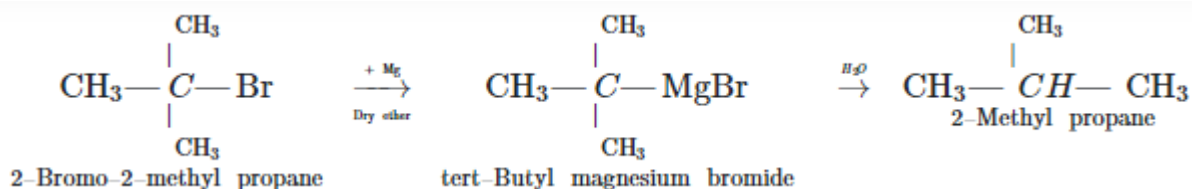
Q.2. Complete the following giving the structures of major organic products.

[HOTS]

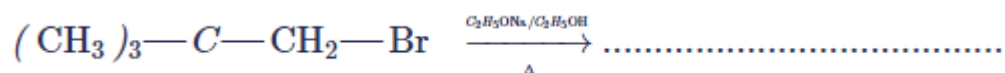
Q.



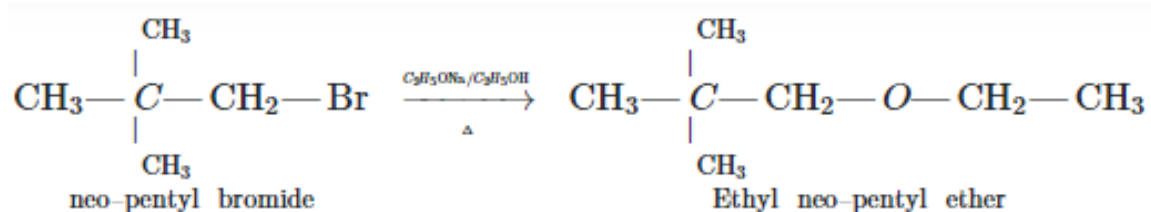
Ans.



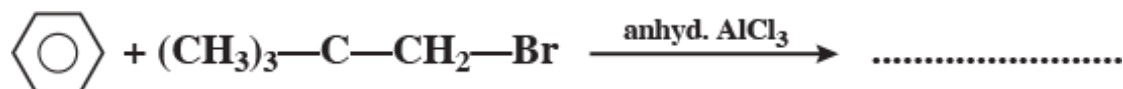
Q.



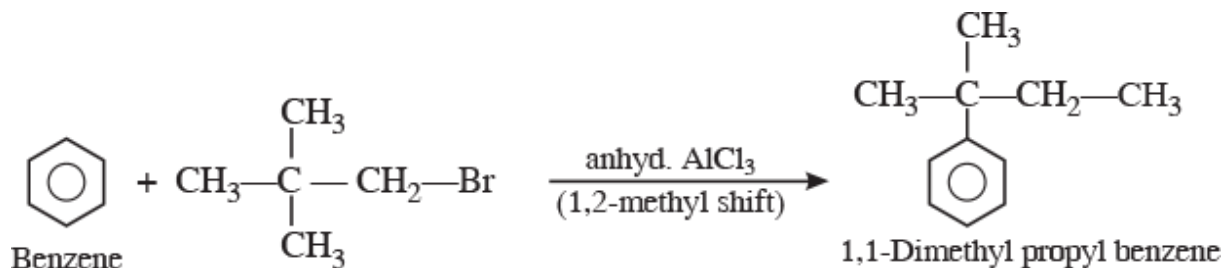
Ans.



Q.



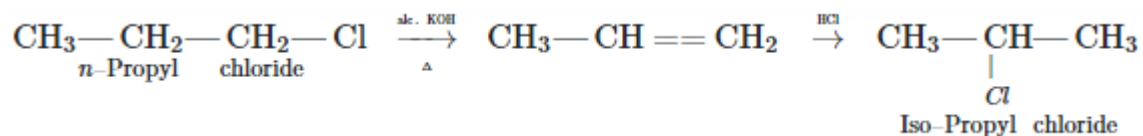
Ans.



Q.3. How will you bring about the following conversions?

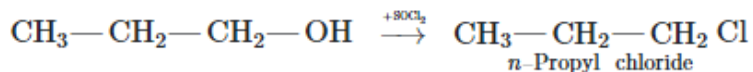
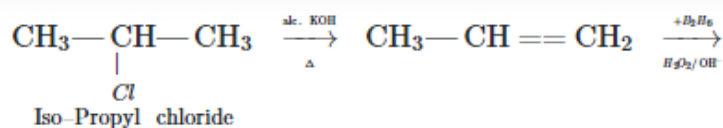
Q. *n*-Propyl chloride to iso-propyl chloride

Ans.



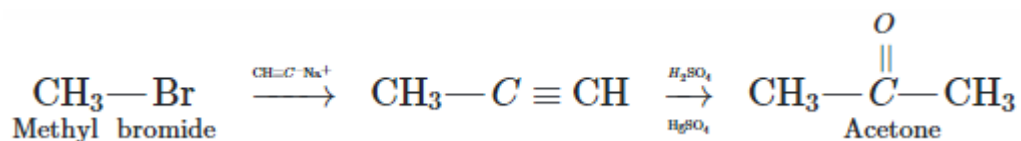
Q. Iso-propyl chloride to *n*-propyl chloride

Ans.



Q. Methyl bromide to acetone

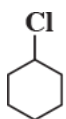
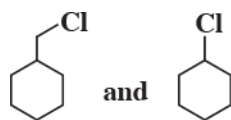
Ans.



Q.4. Answer the following questions

[CBSE Sample Paper 2015]

Q. In the following pairs of halogen compounds, which would undergo S_N1 reaction faster? Explain.



Ans.  because of greater stability of secondary carbocation than primary.

Q. Amongst the isomeric dihalobenzenes which isomer has the highest melting point and why?

Ans. Amongst the isomeric dihalobenzenes para-isomer has the highest melting point. This is due to greater symmetry of para-isomer that fits in crystal lattice better as compared to ortho and meta isomers.

Q. Arrange the following haloalkanes in the increasing order of density. Justify your answer.

CCl₄, CH₂Cl₂ and CHCl₃

Ans. Density increases with increase in molecular mass, so the order is $\text{CH}_2\text{Cl}_2 < \text{CHCl}_3 < \text{CCl}_4$.

Q.5. Answer the following questions

[CBSE Sample Paper 2016]

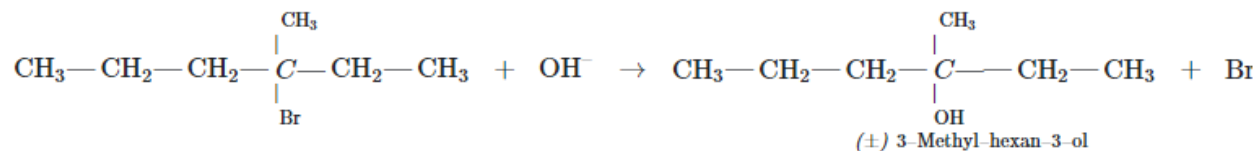
Q. Explain why the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

Ans. Gatterman's Reaction: The reaction of diazonium salts with 'Cu' powder in the presence of corresponding halogen acids is known as Gatterman's reaction.

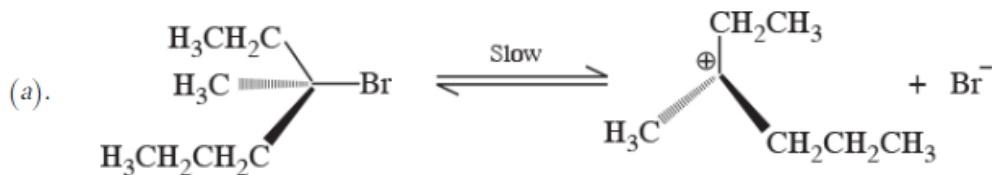


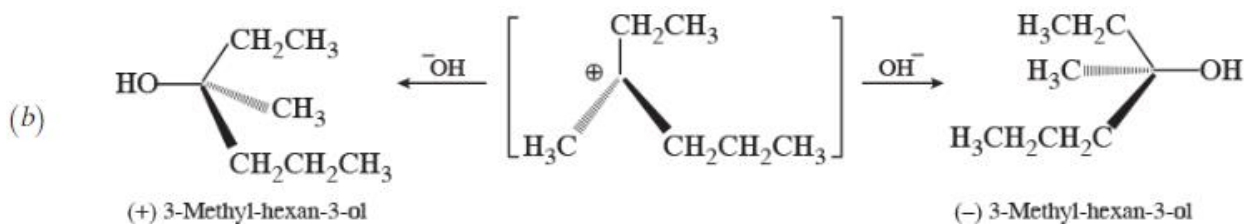
Q. An optically active compound having molecular formula $\text{C}_7\text{H}_{15}\text{Br}$ reacts with aqueous KOH to give a racemic mixture of products. Write the mechanism involved in this reaction.

Ans. Since the optically active compound, $\text{C}_7\text{H}_{15}\text{Br}$ reacts with KOH forms a racemic mixture, therefore it must be tertiary alkyl halide and the reaction will follow $\text{S}_{\text{N}}1$ mechanism.



Mechanism:





Q.6. Give reasons for the following observations:

[CBSE Sample Paper 2017]

Q. *p*-dichlorobenzene has higher melting point than those of *o*- and *m*- isomers.

Ans. It is due to the greater symmetry of para-isomer that fits in the crystal better as compared to ortho and meta-isomers.

Q. Haloarenes are less reactive than haloalkanes towards nucleophilic substitution reaction.

Ans. As C–X bond in aryl halide acquires a partial double bond character due to resonance while the C–X bond in alkyl halide is a pure single bond.

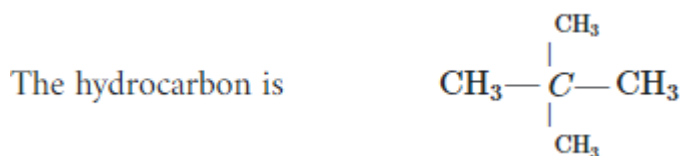
Q. The treatment of alkyl chloride with aqueous KOH leads to the formation of alcohol but in the presence of alcoholic KOH, alkene is the major product.

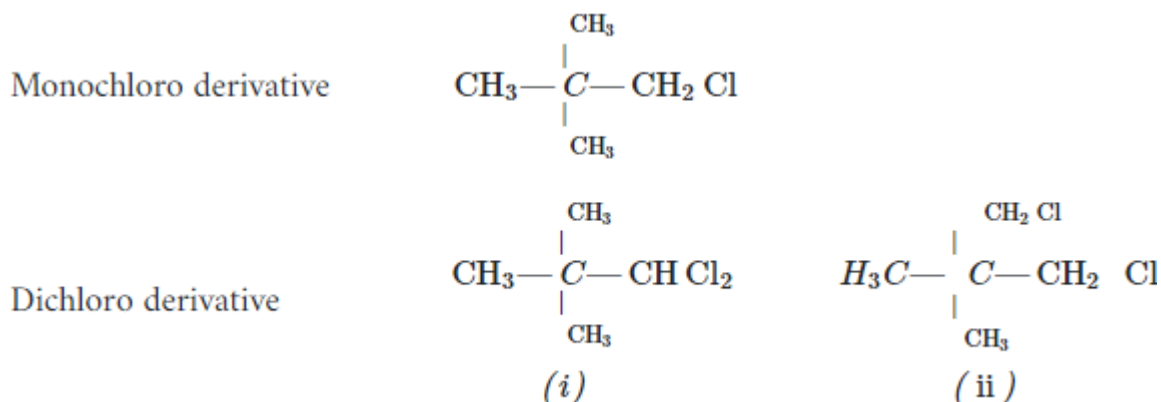
Ans. Alkoxide ion present in alcoholic KOH, is not only a strong nucleophile but also a strong base so preferentially eliminate a molecule of HCl from alkyl halide to form alkenes.

Q.7. A hydrocarbon of molecular mass 72 g mol^{-1} gives a single monochloro derivative and two dichloro derivatives on photochlorination. Give the structure of the hydrocarbon. [NCERT Exemplar]

[HOTS]

Ans. C_5H_{12} , pentane has molecular mass 72 g mol^{-1} , i.e., the isomer of pentane which yield single monochloro derivative should have all the 12 hydrogens equivalent.

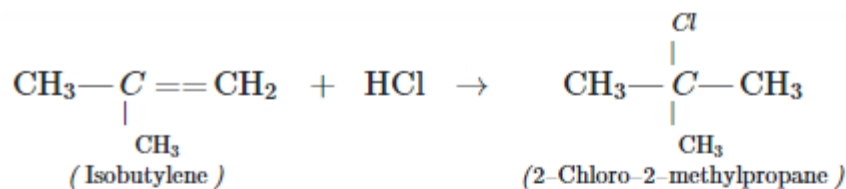




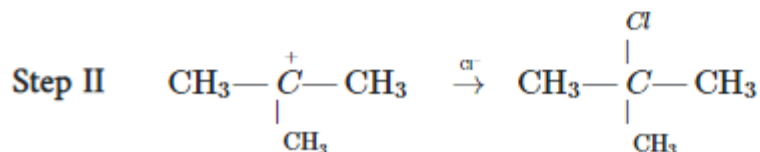
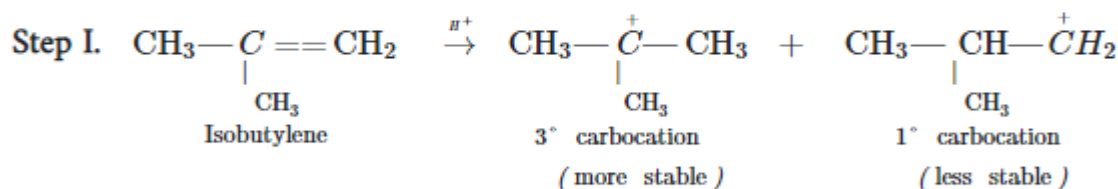
Q.8. Predict the major product formed when HCl is added to isobutylene. Explain the mechanism involved. [NCERT Exemplar]

[HOTS]

Ans.



The mechanism involved in this reaction is:



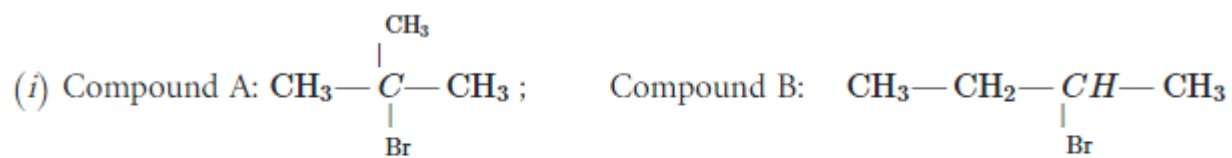
Q.9. Compound 'A' with molecular formula C₄H₉Br is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq. KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.

i. Write down the structural formula of both compounds 'A' and 'B'.

- ii. Out of these two compounds, which one will be converted to the product with inverted configuration?

[NCERT Exemplar] [HOTS]

Ans.



(ii) Compound 'B'.