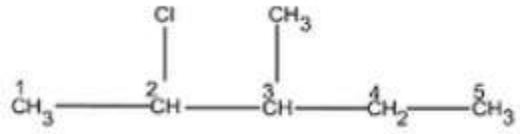
NCERT Solutions for Class 12 Chemistry Chapter 10 Haloalkanes and Haloarenes

Question 1 Write structures of the following compounds:

(i)2-Chloro-3-methylpentane

Answer :

The structure of 2-Chloro-3-methylpentane is given below :-



Question 10.1 Write structures of the following compound:

(ii)1-Chloro-4-ethylcyclohexane

Answer :

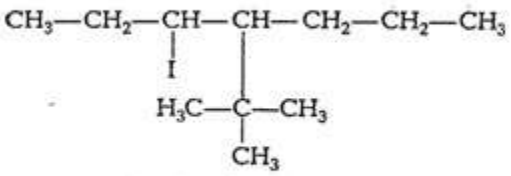
The structure of 1-Chloro-4-ethylcycloexane is given below :-

Question 10.1 Write structures of the following compounds:

(iii)4-tert. Butyl-3-iodoheptane

Answer :

The structure of 4-tert. Butyl-3-iodoheptane is given below :-



Question 10.1 Write structures of the following compounds:

(iv) 1,4-Dibromobut-2-ene

Answer :

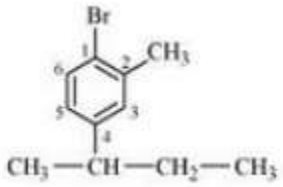
The structure of 1,4-Dibromobut-2-ene is given below :-

Question 10.1 Write structures of the following compounds:

(v) 1-Bromo-4-sec. butyl-2-methylbenzene

Answer :

The structure of 1-Bromo-4-sec. butyl-2-methylbenzene is shown below :-



Question 10.2 Why is sulphuric acid not used during the reaction of alcohols with KI?

Answer :

We don't use sulphuric acid because it acts as an oxidising agent and the required alkyl iodide is not produced. The reactions are given below :-

$2KI + H_2SO_4 \rightarrow 2KHSO_4 + 2HI$

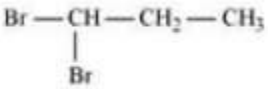
$2HI + H_2SO_4 \rightarrow I_2 + SO_2 + H_2O$

Question 10.3 Write structures of different dihaloge derivatives of propane.

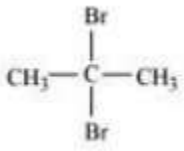
Answer :

We obtain four dihalogen derivatives of propane :-

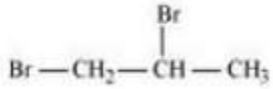
(i) 1,1 Dibromopropane



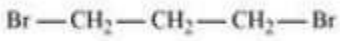
(ii) 2, 2 Dibromopropane



(iii) 1, 2 Dibromopropane



(iv) 1, 3 Dibromopropane



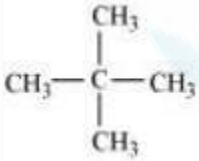
Question 10.4 Among the isomeric alkanes of molecular formula C 5 H12 , identify the one that on photochemical chlorination yields

(i) A single monochloride

Answer :

In this we have to find an isomer in which replacemet of any hydrogen atom gives the singel compound for all replacements.

So the isomer is Neopentane.



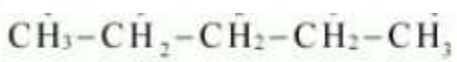
Question 10.4 Among the isomeric alkanes of molecular formula C 5 H12 , identify the one that on photochemical chlorination yields

(ii) Three isomeric monochlorides.

Answer :

For the given condition we must have three different hydrogens so that we can get three different monochlorides on the replacement.

Thus the isomer is n-pentane.



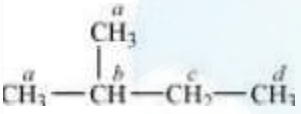
Question 10.4 Among the isomeric alkanes of molecular formula C 5 H12 , identify th one that on photochemical chlorination yields

(iii) Four isomeric monochlorides .

Answer :

For four monochlorides we need four different hydrogens which can be replaced by chlorine.

Hence the required isomer is :-

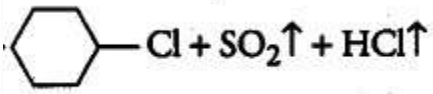


Question 10.5 Draw the structures of major monohalo products in each of the following reactions:

(i)

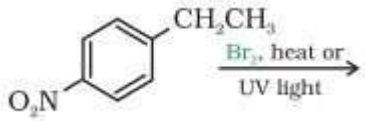
Answer:

The final products are:-

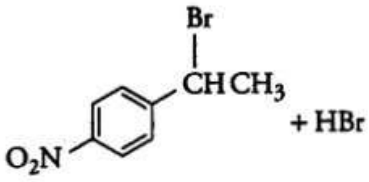


Question 10.5 Draw the structures of major monohalo products in each of the following reactions:

(ii)

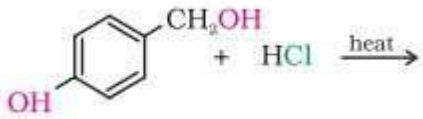


Answer :

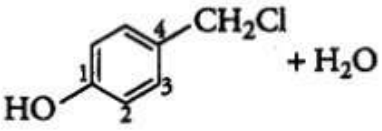


Question 10.5 Draw the structure of major monohalo products in each of the following reactions:

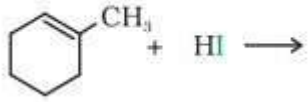
(iii)



Answer :

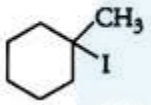


Question 10.5 Draw the structures of major monohalo products in each of the following reactions:

(iv) 

Answer :

The obtained product is:-



Question 10.5 (V) Draw the structures of major monohalo products in each of the following reactions:

$CH_3CH_2Br + NaI \rightarrow$

Answer :

$CH_3CH_2I + NaBr$

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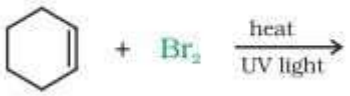
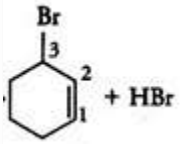
Question 10.5 Draw the structures of major monohalo products in each of the following reactions:



(vi)

Answer :

The obtained product is :-



Question 10.6 Arrange each set of compounds in order of increasing boiling points.

(i) Bromomethane, Bromoform, Chloromethane, Dibromomethane.

Answer :

It is known that boiling point increases with increase in molecular mass when the alkyl group is the same.

So the order of increasing boiling point is Chloromethane < Bromomethane < Dibromomethane < Bromoform

Question 10.6 Arrange each set of compounds in order of increasing boiling points.

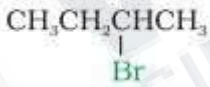
(ii) 1-Chloropropane, Isopropyl chloride, 1-Chlorobutane.

Answer :

In the given compounds the halide groups are same. In these cases, the boiling point depends on the bulkiness of the alkyl group. The boiling point increases with an increase in the chain length. Also, the boiling point decreases with an increase in branching.

So the order is :- 1- Chlorobutane > 1- Chloropropane > Isopropyl Chloride

Question 10.7 Which alkyl halide from the following pairs would you expect to react more rapidly by an S_N2 mechanism? Explain your answer.

(i) $CH_3CH_2CH_2CH_2Br$ or 

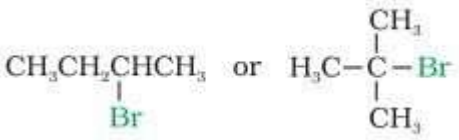
Answer :

In this case, the rate of S_N2 reaction will depend on the hindrance of the substrate.

Since 1- Bromobutane is a 1° alkyl halide and 2- Bromobutane is a 2° alkyl halide hence 2- Bromobutane gives more hindrance to the nucleophile.

Hence 1- Bromobutane reacts faster.

Question 10.7 Which alkyl halide from the following pairs would you expect to react more rapidly by an S_N2 mechanism? Explain your answer.

(ii) 

Answer :

The rate of S_N2 reaction decreases with increase in hindrance to the attack of the nucleophile.

So 2-bromobutane will react faster than 2-bromo-2-methylpropane in the ncleophilic attack.

Question 10.7 Which alkyl halide from the following pairs would you expect to react more rapidly by an S_N2 mechanism? Explain your aswer.

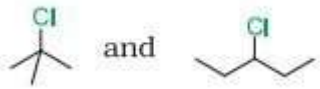
(iii) 

Answer :

In these kinds of cases, we see where is the substituent is attached i.e., how far from the halide group. It can be clearly seen that the methyl group attached in 1-bromo-2-methylbutane is near than that attached in 1-bromo-3-methyl butane.

Hence the rate of S_N2 reaction will be faster in case of 1-bromo-3-methylbutane.

Question 10.8 In the following pairs of halogen compounds, which compound undergoes faster S_N1 reaction?

(i) 

Answer :

In S_N1 reactions, we see the formation of carbocation and this is the rate determining step for this kind of reactions. So the compound having more stable carbocation will react faster. In the given case 2- Chloro, 2- Methylpropane we have 3^o carbon whereas in 3-Chloropentane we have 2^o carbon.

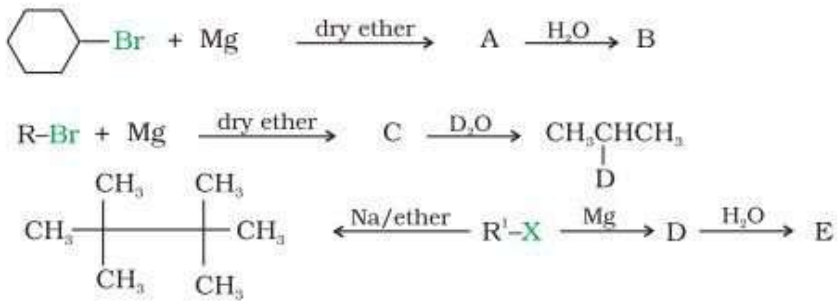
Question 10.8 In the following pairs of halogen compounds, which compound undergoes faster S_N1 reaction?

(ii) 

Answer :

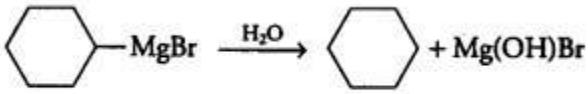
In S_N1 reactions, we see the formation of carbocation and this is the rate determining step for these kinds of reactions.So the compound having more stable carbocation will react faster. Hence 2-Chloroheptane will react faster than 1- Chlorohexane.

Question 10.9 Identify A, B, C, D, E, R and R1 in the following:

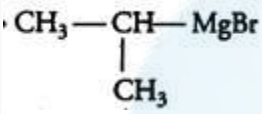


Answer :

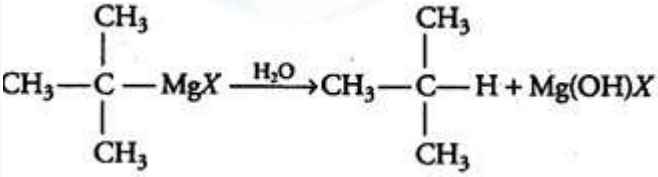
1st reaction :-



2nd reaction :-



3rd reaction :-



NCERT Solutions for Class 12 Chemistry Chapter 10 Haloalkanes and Haloarenes- Exercise Questions

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(i) $(CH_3)_2 CHCH(Cl)CH_3$

Answer :

(i) 2-Chloro-3-methylbutane. And it is a secondary alkyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(ii) $CH_3CH_2CH(CH_3)CH(C_2H_5)Cl$

Answer :

3-Chloro-4-methylhexane. And it is primary alkyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(iii) $CH_3CH_2C(CH_3)_2CH_2I$

Answer :

(iii) 1-Iodo-2, 2-dimethylbutane. And it is primary alkyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(iv) $(CH_3)_3CCH_2CH(Br)C_6H_5$

Answer :

(iv) 1-Bromo-3, 3-dimethyl-1-phenylbutane. And it is secondary benzyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(v) $CH_3CH(CH_3)CH(Br)CH_3$

Answer :

(v) 2-Bromo-3-methylbutane. And it is secondary alkyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(vi) $CH_3C(C_2H_5)_2CH_2Br$

Answer :

(vi) 1-Bromo-2-ethyl-2-methylbutane. And it is a primary alkyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(vii) $CH_3C(Cl)(C_2H_5)CH_2CH_3$

Answer :

(vii) 3-Chloro-3-methylpentane. And it is tertiary alkyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(viii) $CH_3CH = C(Cl)CH_2CH(CH_3)_2$

Answer :

(viii) 3-Chloro-5-methylhex-2-ene. And it is vinyl halide

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(ix) $CH_3CH = CHC(Br)(CH_3)_2$

Answer :

(ix) 4-Bromo-4-methylpent-2-ene. And it is allyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(x) $p-ClC_6H_4CH_2CH(CH_3)_2$

Answer :

(x) 1-Chloro-4-(2-methylpropyl) benzene. And it is aryl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(xi) $m-ClC_6H_4CH_2CH(CH_3)_2$

Answer :

(xi) 1-Chloromethyl-3-(2, 2-dimethylpropyl) benzene. And it is primary benzyl halide.

Question 10.1 Name the following halides according to IUPAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiary), vinyl or aryl halides:

(xii) $o-BrC_6H_4CH(CH_3)CH_2CH_3$

Answer :

(xii) 1-Bromo-2-(1-methylpropyl) benzene. And it is aryl halide.

Question 10.2 Give the IUPAC names of the following compounds:

(i) $CH_3CH(Cl)CH(Br)CH_3$

Answer :

(i) 2-Bromo-3-chlorobutane

Question 10.2 Give the IUPAC names of the following compounds:

(ii) $CHF_2CBrCIF$

Answer :

1-Bromo-1-chloro-1, 2, 2-trifluroethane

Question 10.2 Give the IUPAC names of the followig compounds:

(iii) $ClCH_2C \equiv CCH_2Br$

Answer :

1-Bromo-4-chlorobut-2-yne

Question 10.2 Give the IUPAC names of the following compounds:

(iv) $(CCl_3)_3CCl$

Answer :

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

Question 10.2 Give the IUPAC names of the following compounds:

(v) $CH_3(p-ClC_6H_4)_2CH(Br)CH_3$

Answer :

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

Question 10.2 Give the IUPAC names of the following compounds:

(vi) $(CH_3)_3CCH=CClC_6H_4I-p$

Answer :

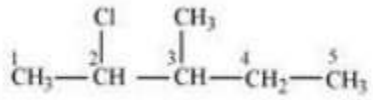
1-Chloro-1-(4-iodophenyl)-3, 3-dimetylbut-1-ene

Question 10.3 Write the structures of the following organic halogen compounds.

(i) 2-Chloro-3-methylpentane

Answer :

(i)



Question 10.3 Write the structures of the following organic halogen compounds.

(ii) p-Bromochlorobenzene

Answer :

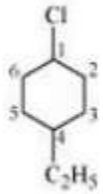
(ii)

Question 10.3 Write the structures of the following organic halogen compounds.

(iii) 1-Chloro-4-ethylcyclohexane

Answer :

(iii)

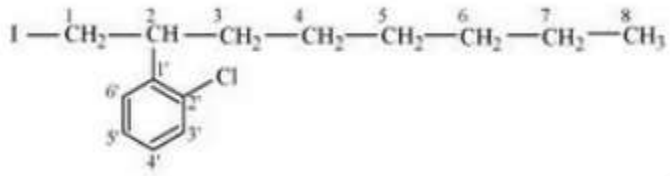


Question 10.3 Write the structures of the following organic halogen compounds.

(iv) 2-(2-Chlorophenyl)-1-iodooctane

Answer :

(iv)

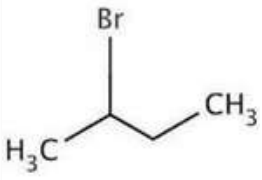


Question 10.3 Write the structures of the following organic halogen compounds.

(v) 2-Bromobutane

Answer :

(v)

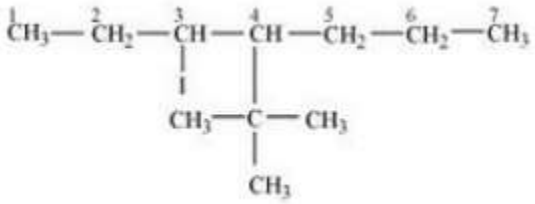


Question 10.3 Write the structures of the following organic halogen compounds.

(vi) 4-tert-Butyl-3-iodoheptane

Answer :

(vi)

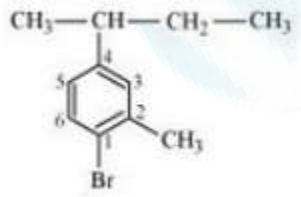


Question 10.3 Write the structures of the following organic halogen compounds.

(vii) 1-Bromo-4-sec-butyl-2-methylbenzene

Answer :

(vii)

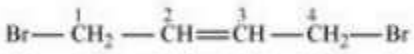


Question 10.3 Write the structures of the following organic halogen compounds.

(viii) 1,4-Dibromobut-2-ene

Answer :

(viii)



Question 10.4 Which one of the following has the highest dipole moment?

(i) CH_2Cl_2 (ii) $CHCl_3$ (iii) CCl_4

Answer :

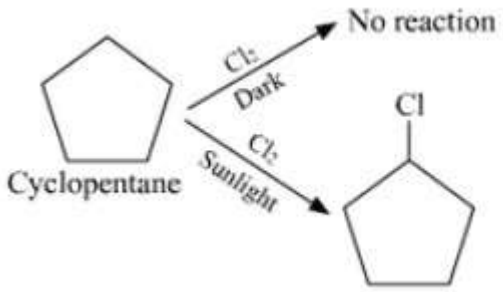
The order of dipole moment will be :- $CH_2Cl_2 > CHCl_3 > CCl_4$.

The reason for the above order is given as- CCl_4 is a symmetrical compound so its dipole moment will be zero. In case of $CHCl_3$, one of the Cl cancels dipole moment of the opposite Cl atom, so net dipole moment is just due to one Cl. In the case of CH_2Cl_2 , both Cl groups contribute to the dipole moment so it has the highest dipole moment among all.

Question 10.5 A hydrocrbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound C_5H_9Cl in bright sunlight. Identify the hydrocarbon.

Answer :

We are given the formula C_5H_{10} which can be either of an alkene or of cycloalkane. Since the hydrocarbon doesn't react with chlorine in dark thus it cannot be alkene. So the only option left out is cyclopentane.

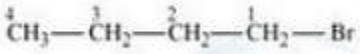


Question 10.6 Write the isomers of the compound having formula C_4H_9Br .

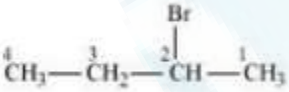
Answer :

The isomers of the compound C_4H_9Br are :-

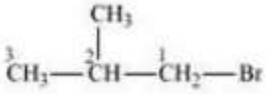
(i) 1-Bromobutane



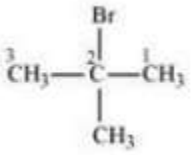
(ii) 2-Bromobutane



(iii) 1-Bromo-2-methylpropane



(iv) 2-Bromo-2-methylpropane

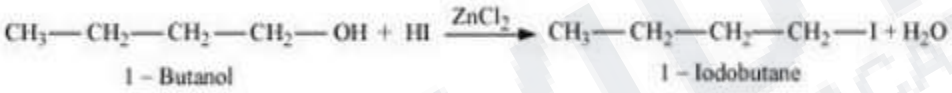


Question 10.7 Write the equations for the preparation of 1-iodobutane from:

(i) 1-butanol

Answer :

(i) The procedure given below can be used :-

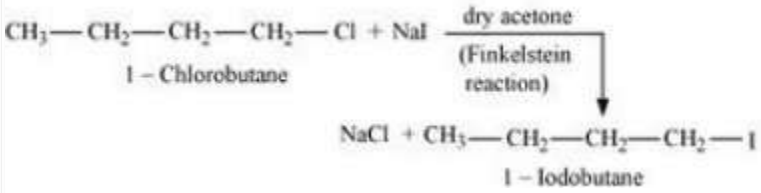


Question 10.7 Write the equations for te preparation of 1-iodobutane from

(ii) 1-chlorobutane

Answer :

(ii) The required product can be obtained as shown below :-

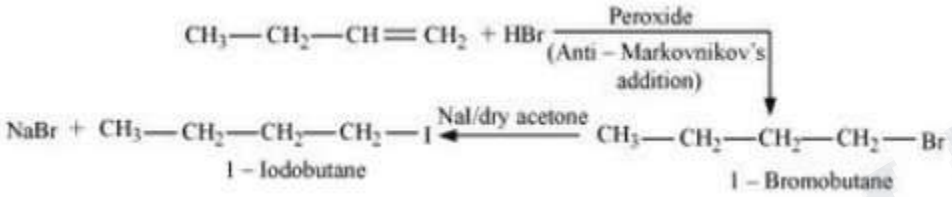


Question 10.7 Write the equations for the preparation of 1-iodobutane from

(iii) but-1-ene

Answer :

(iii) The required product is obtained by following procedure :-



Question 10.8 What are ambident nucleophiles? Explain with an example.

Answer :

The ambident nucleophiles are those nucleophiles which have two nucleophilic sites through which they can attack. For e.g Nitrile ion can attack through both nitrogen atom (forms nitroalkanes) and an oxygen atom (forms alkyl nitrites), thus it is an ambident nucleophile.

Question 10.9 Which compound in each of the following pairs will react faster in S N 2 reaction with –OH?

(i) CH 3 Br or CH 3

Answer :

In this case, we have the same alkyl group but different halide ions. For this rate of S N 2 reaction increases with increase in atomic mass. So, CH 3 I will react faster than CH 3 Br.

Question 10.9 Which compound in each of the following pairs will react faster in S N 2 reaction with –OH?

(ii) $(CH_3)_3CCl$ or CH_3Cl

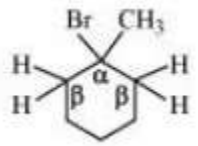
Answer :

In this case, the hindrance will be deciding factor for the rate of S N 2 reaction because hindrance will directly affect the attack of the nucleophile. So CH_3Cl will react faster as compared to $(CH_3)_3CCl$.

Question 10.10 Predict all the alkenes that would be formed by dehydrohalogenation of the following halides with sodium ethoxide in ethanol and identify the major alkene:

(i) 1-Bromo-1-methylcyclohexane

Answer :



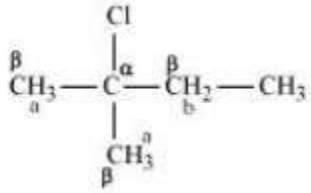
In this compound, it is clear that we have identical β hydrogen, therefore, dehalogenation of the given compound gives the same alkene.

Question 10.10 Predict all the alkenes that would be formed by dehydrohalogenation of the following halides with sodium ethoxide in ethanol and identify the major alkene:

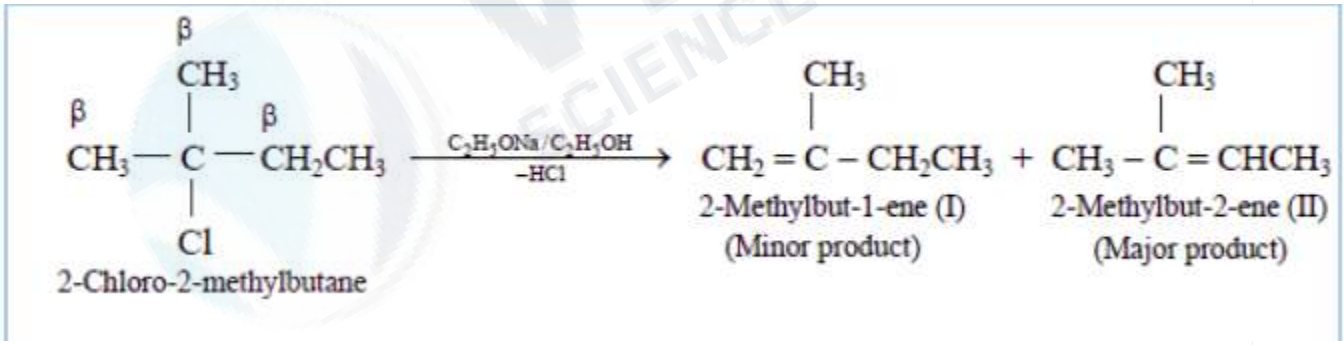
(ii) 2-Chloro-2-methylbutane

Answer :

(ii)



In this compound we have two kind of β hydrogen. So dehalogenation will give two kind of alkenes, namely 2-Methylbut-2-ene and 2-Methylbut-1-ene.



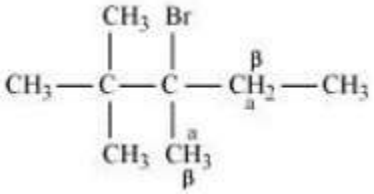
The major product of this reaction will be 2-Methylbut-2-ene as the number of α - hydrogens attached to double bonded carbon are more in case of this compound.

Question 10.10 Predict all the alkenes that would be formed by dehydrohalogenation of the following halides with sodium ethoxide in ethanol and identify the major alkene:

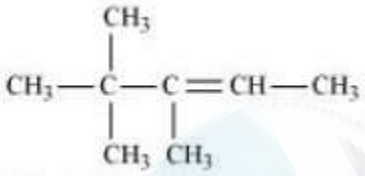
(iii) 2,2,3-Trimethyl-3-bromopentane

Answer :

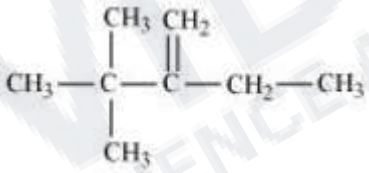
(iii)



In this compound we have two type of β-hydrogen thus dehalogenation we get two types of products namely 3, 4, 4-Trimethylpent-2-ene and 2-Ethyl-3,3-dimethylbut-2-ene.



and



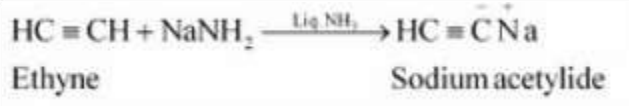
Here 3, 4, 4-Trimethylpent-2-ene will be major product, since the α - hydrogen attached to the double bond are greater.

Question 10.11 How will you bring about the following conversions?

(i) Ethanol to but-1-yne

Answer :

(i) The conversion will take place by following procedure :-



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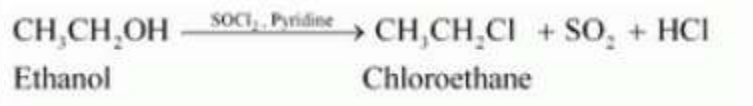
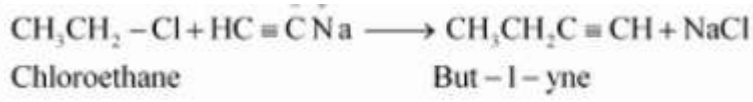


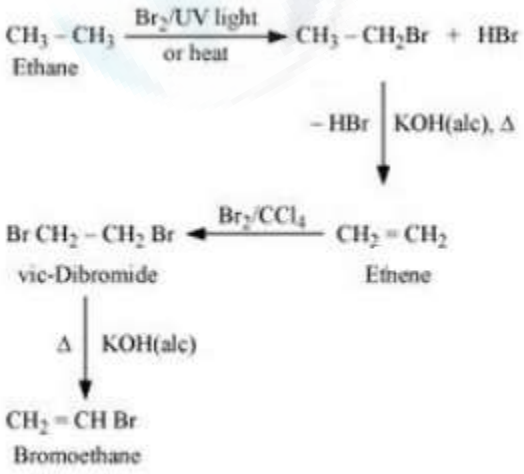


Question 10.11 How will you bring about the following conversions?

(ii) Ethane to bromoethene

Answer :

(ii)

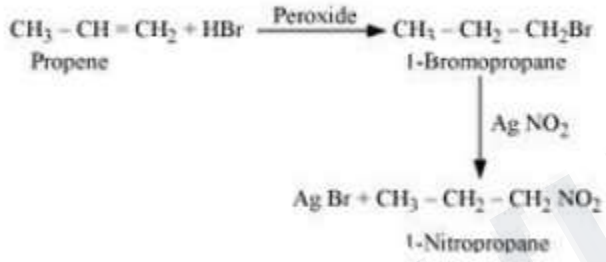


Question 10.11 How will you bring about the following conversions?

(iii) Propene to 1-nitropropane

Answer :

(iii)

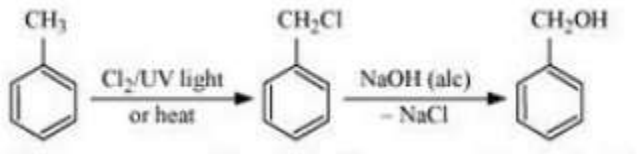


Question 10.11 How will you bring about the following conversions?

(iv) Toluene to benzyl alcohol

Answer :

(iv)

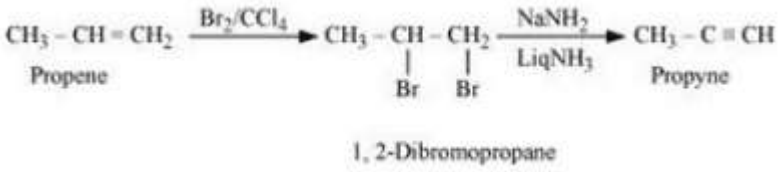


Question 10.11 How will you bring about the following conversions?

(v) Propene to propyne

Answer :

(v)

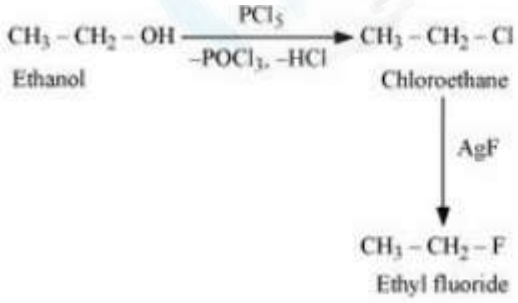


Question 10.11 How will you bring about the following conversions?

(vi) Ethanol to ethyl fluoride

Answer :

(vi)

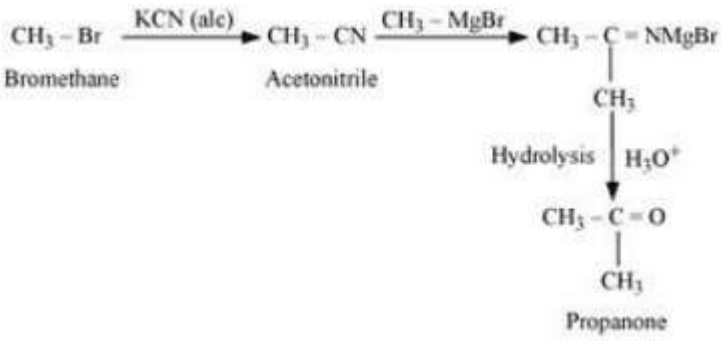


Question 10.11 How will you bring about the following conversions?

(vii) Bromomethane to propanone

Answer :

(vii)

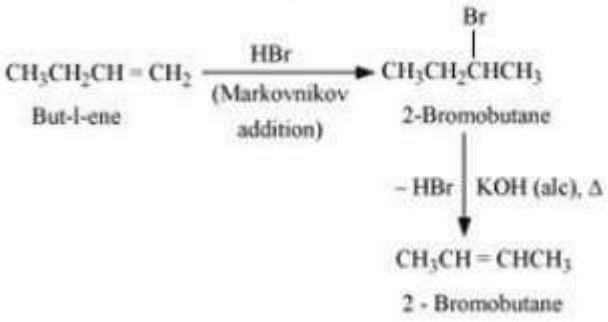


Question 10.11 How will you bring about the followig conversions?

(viii) But-1-ene to but-2-ene

Answer :

(viii)



Question 10.11 How will you bring about the following conversions?

(ix) 1-Chlorobutane to n-octane

Answer :

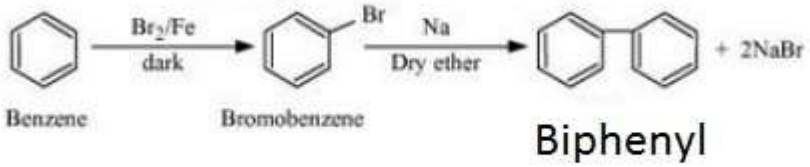
(ix)

Question 10.11 How will you bring about the following conversions?

(x) Benzene to biphenyl.

Answer :

(x)



Question 10.12 Explain why

(i) the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride?

Answer :

We know that the Cl-atom in chlorobenzene is attached to a sp 2 hybridized carbon atom whereas, in cyclohexyl chloride, the Cl-atom is attached to a sp 3 hybridized carbon atom. It is known that sp 2hybridized carbon has more s-character than sp 3 hybridized carbon atom. Thus, chlorobenzene is more electronegative than cyclohexyl chloride.

Apart from this, the - R effect of the benzene ring of chlorobenzene results in decreasing the electron density of the C - Cl bond near the Cl-atom. And the C - Cl bond in chlorobenzene becomes less polar. Due to these reasons, the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

Question 10.12 Explain why

(ii) alkyl halides, though polar, are immiscible with water?

Answer :

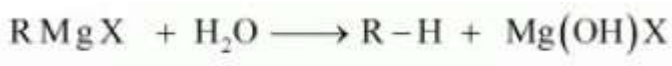
For being soluble in the wter we have a condition that the solute-water force of attraction must be stronger than the solute-solute and water-water forces of attraction. Alkyl halides are held together by dipole-dipole interactions and there are polar molecules. Similarly, the intermolecular force of attraction present between the water molecules is hydrogen bonding. The new force of attraction after we dissolve solute in water i.e., between the alkyl halides and water molecules is weaker than the alkyl halide-alkyl halide and water-water forces of attraction. That is why alkyl halides (though polar) are immiscible with water.

Question 10.12 Explain why

(iii) Grignard reagents should be prepared under anhydrous conditions?

Answer :

This is done because in presence of moisture, they react to give alkane.



Question 10.13 Give the uses of freon 12, DDT, carbon tetrachloride and iodoform.

Answer :

(i) Freon-12 or dichlorodifluoromethane is generally known as CFC. It is used in refrigerators and air conditioners as a refrigerant. It is also used in body sprays, hair sprays, etc. But it has environmental impacts as it damages the ozone layer.

(ii) DDT or p, p-dichlorodiphenyltrichloroethane is one of the best-known insecticides which was used very widely all over the world. It is very effective against mosquitoes, insects and lice. But it has harmful effects.

(iii) **CCl 4** :- It is mostly used for manufacturing refrigerants for refrigerators and air conditioners. It is also used as a solvent in the manufacture of pharmaceutical products. In the early years, carbon tetrachloride was widely used as a cleaning fluid and a fire extinguisher.

(iv) Iodoform was used earlier as an antiseptic. And this antiseptic property of iodoform is due to the liberation of free iodine when it comes in contact with the skin.

Question 10.14 Write the structure of the major organic product in each of the following reactions:

(i) $CH_3CH_2CH_2Cl + NaI \xrightarrow[heat]{acetone}$

Answer :

(i) The obtained product is :-

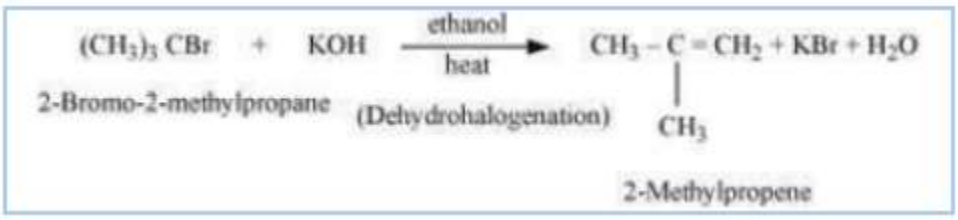
$$CH_3CH_2CH_2Cl + NaI \xrightarrow[heat]{acetone} CH_3CH_2CH_2I + NaCl$$

Question 10.14 Write the structure of the major organic product in each of the following reactions:

(ii) $(CH_3)_3CBr + KOH \xrightarrow[heat]{ethanol}$

Answer :

(ii) The obtained product is 2-Methylpropene



Question 10.14 Write the structure of the major organic product in each of the following reactions:

(iii) $CH_3CH(Br)CH_2CH_3 + NaOH \overset{water}{\rightarrow}$

Answer :

(iii) The obtained product is Butan-2-ol.

Question 10.14 Write the structure of the major organic product in each of the following reactions:

(iv) $CH_3CH_2Br + KCN \overset{aq.ethanol}{\rightarrow}$

Answer :

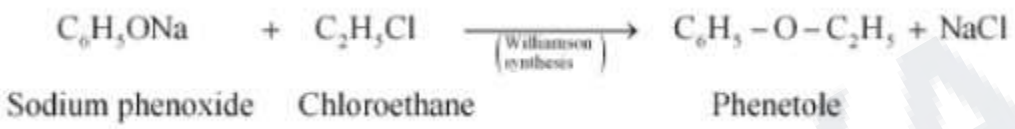
(iv) The obtained product is Cyanoethane.

Question 10.14 Write the structure of the major organic product in each of the following reactions:

(v) $C_6H_5ONa + C_2H_5Cl \rightarrow$

Answer :

(v) The obtained product is Phenetole.



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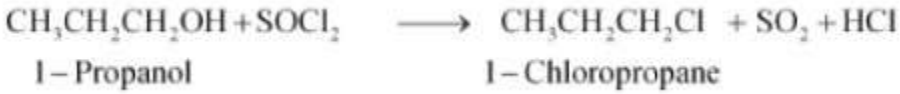
Question 10.14 Write the structure of the major organic product in each of the following reactions:

(vi) $CH_3CH_2CH_2OH + SOCl_2 \rightarrow$

Answer :

(vi) The obtained product is 1-Chloropropane.

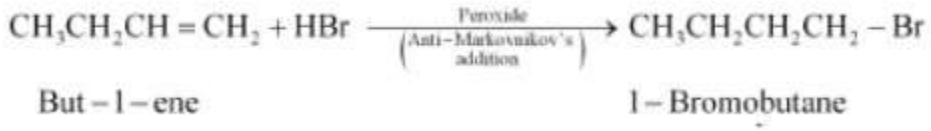


Question 10.14 Write the structure of the major organic product in each of the following reactions:

(vii) $CH_3CH_2CH = CH_2 + HBr \overset{peroxide}{\rightarrow}$

Answer :

(vii) The obtained product is 1-Bromobutane.

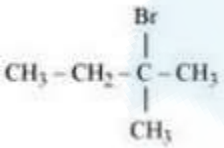


Question 10.14 Write the structure of the major organic product in each of the following reactions:

(viii) $CH_3CH = C(CH_3)_2 + HBr \rightarrow$

Answer :

The obtained product is 2-Bromo-2-methylbutane.

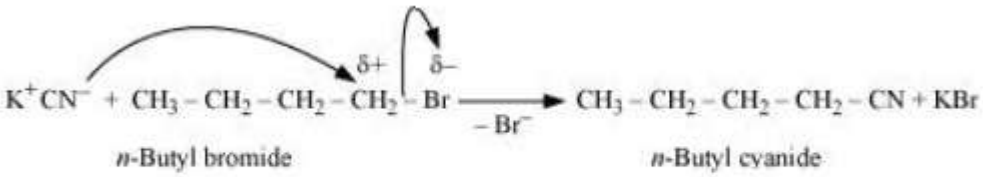


Question 10.15 Write the mechanism of the following reaction:

$nBuBr + KCN \overset{EtOH-H_2O}{\rightarrow} nB_4CN$

Answer :

The reaction will proceed through S N 2 mechanism. The mechanism for the given reaction is shown below :-

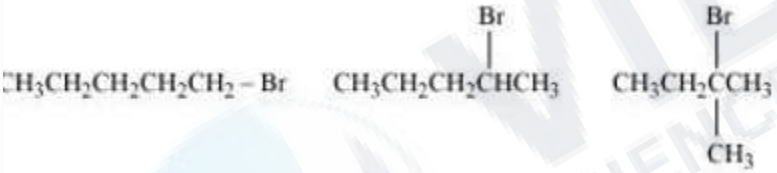


Question 10.16 Arrange the compounds of each set in order of reactivity towards S N 2 displacement:

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

Answer :

(i) Here the deciding factor the rate of reaction will be a steric hindrance.



It is clear from the above that the order of hindrance is:-

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

So the order of rate of rection will be:-

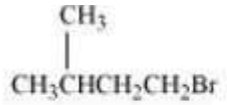
2-Bromo-2-methylbutane < 2-Bromopentane < 1-Bromopentane

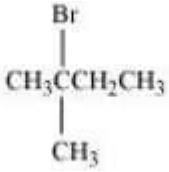
Question 10.16 Arrange the compounds of each set in order of reactivity towards S N 2 displacement:

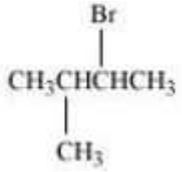
(ii) 1-Bromo-3-methylbutane, 2-Bromo-2-methylbutane, 2-Bromo-3-methylbutane

Answer :

(ii) In this case, also, the order of the rate of reaction will be decided from the steric hindrance factor.







It is clear from the above that the steric hindrance in 2-Bromo-2-methylbutane highest (note that hindrance of the carbon attached to halide ion is seen). So the order of the rate of reaction is:-

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

Question 10.16 Arrange the compounds of each set in order of reactivity towards S N 2 displacement:

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

Answer :

(iii) The steric hindrance is the deciding factor here.

The order of steric hindrance is :-

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

Thus the order of the rate of reaction will be : -

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

Question 10.17 Out of $C_6H_5CH_2Cl$ and $C_6H_5CHClC_6H_5$, which is more easily hydrolysed by aqueous KOH.

Answer :

Hydrolysis by KOH will take place by the formation of a carbocation in its rate-determining step. So the compound having stable carbocation will hydrolyse faster.

The carbocations of both the compounds are given below:-

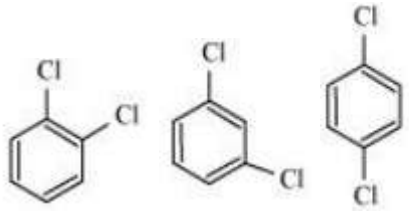
It is clear that carbocation of $C_6H_5CHClC_6H_5$ is more stable.

Hence $C_6H_5CHClC_6H_5$ will hydrolyse faster than $C_6H_5CH_2Cl$.

Question 10.18 p-Dichlorobenzene has higher m.p. than those of o- and m-isomers. Discuss.

Answer :

The structures of o-Dichlorobenzene, m-Dichlorobenzene and p-Dichlorobenzene are given below.



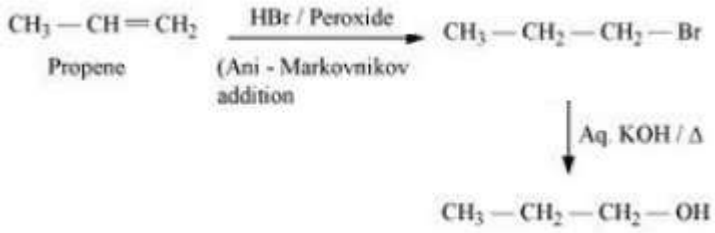
We can see that p-Dichlorobenzene is a very symmetric structure thus packing of it will be maximum. As a result more and more energy will be required to break bonds (during boiling). Thus boiling point is high for p-Dichlorobenzene.

Question 10.19 How the following conversions can be carried out?

(i) Propene to propan-1-ol

Answer :

The mechanism is given below :-

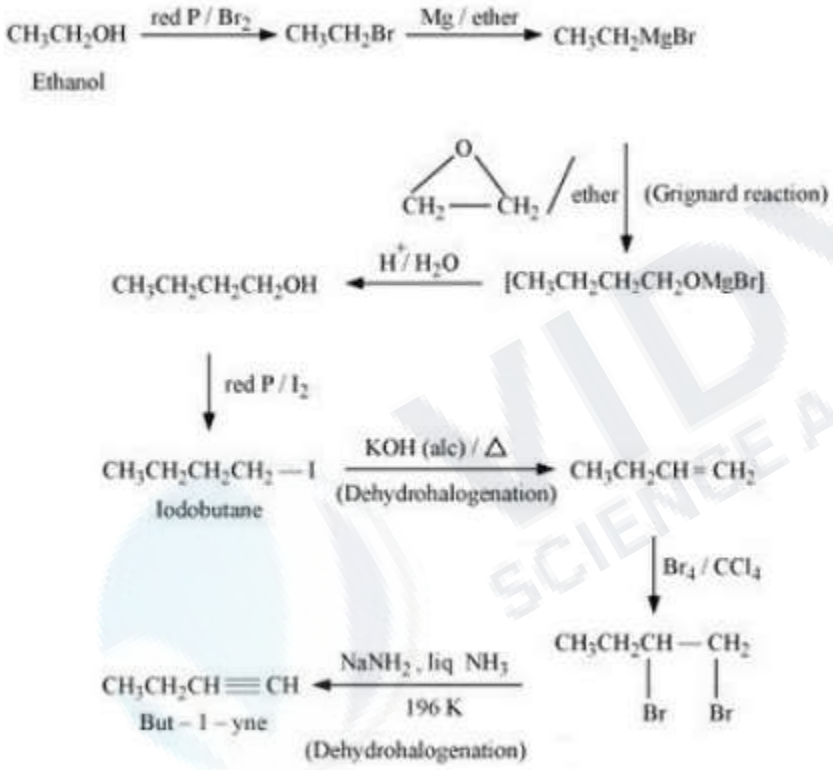


Question 10.19 How the following conversions can be carried out?

(ii) Ethanol to but-1-yne

Answer :

The reaction mechanism is given below :-

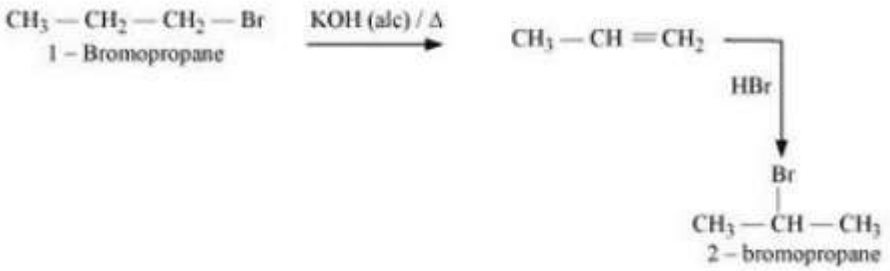


Question 10.19 How the following conversions can be carried out?

(iii) 1-Bromopropane to 2-bromopropane

Answer :

(iii) The mechanism is given below :-

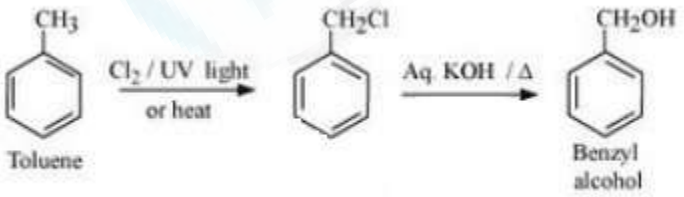


Question 10.19 How the following conversions can be carried out?

(iv) Toluene to benzyl alcohol

Answer :

(iv) The mechanism is given below :-

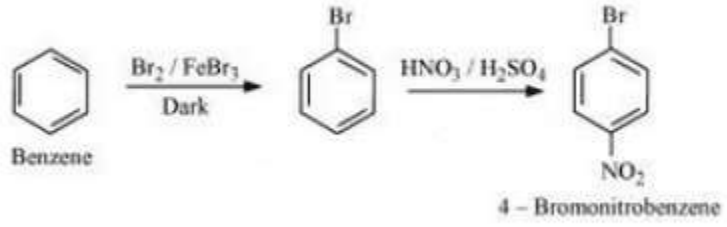


Question 10.19 How the following conversions can be carried out?

(v) Benzene to 4-bromonitrobenzene

Answer :

The mechanism for the given reaction is as follows :-

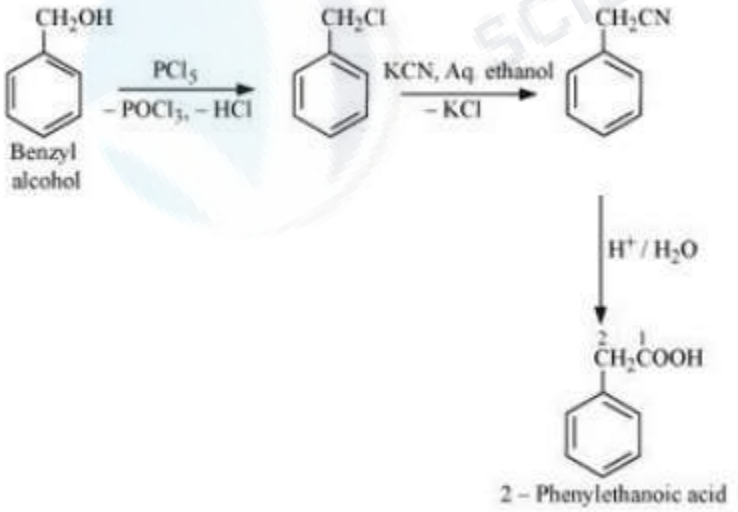


Question 10.19 How the following conversions can be carried out?

(vi) Benzyl alcohol to 2-phenylethanoic acid

Answer :

(vi) The mechanism for the reaction is given below :-

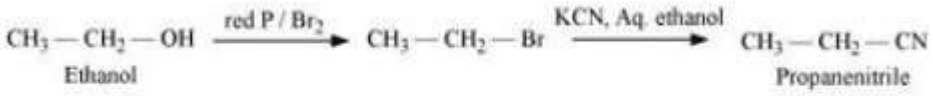


Question 10.19 How the following conversions can be carried out?

(vii) Ethanol to propanenitrile

Answer :

(vii) The mechanism of the given reaction reaction is :-

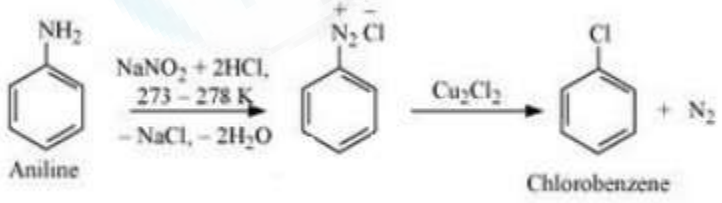


Question 10.19 How the following conversions can be carried out?

(viii) Aniline to chlorobenzene

Answer :

The mechanism of the reaction is given below :-

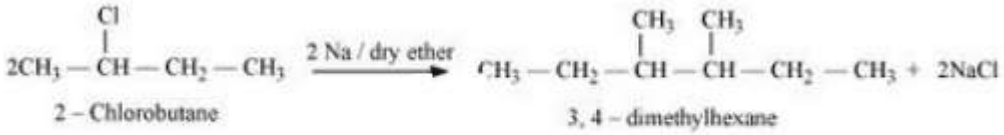


Question 10.19 How the following conversions can be carried out ?

(ix) 2-Chlorobutane to 3, 4-dimethylhexane

Answer :

(ix) The required mechanism is as follows :-



Question 10.19 How the following conversions can be carried out?

(x) 2-Methyl-1-propene to 2-chloro-2-methylpropane

Answer :

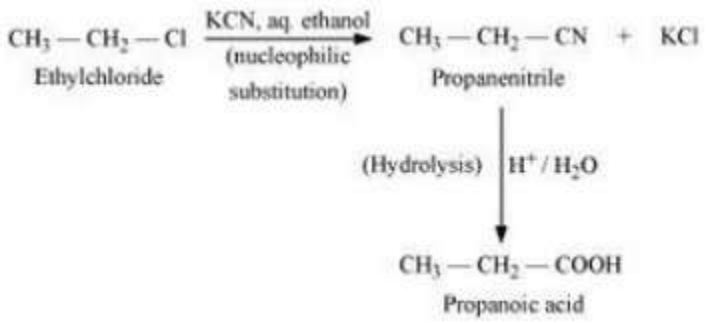
(x) The required mechanism is given below :-

Question 10.19 How the following conversions can be carried out ?

(xi) Ethyl chloride to propanoic acid

Answer :

The mechanism of the given reaction is :-

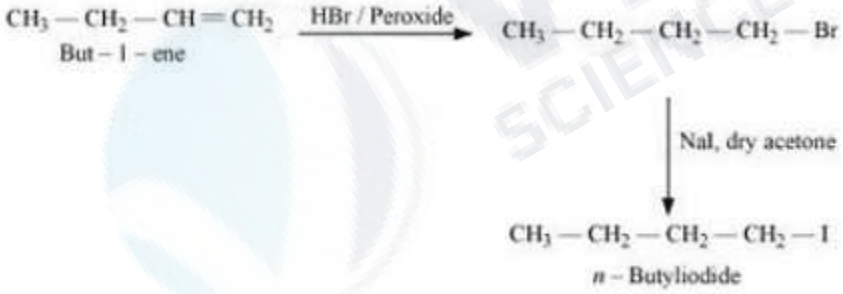


Question 10.19 How the following conversions can be carried out?

(xii) But-1-ene to n-butyliodide

Answer :

The mechanism is given below :-

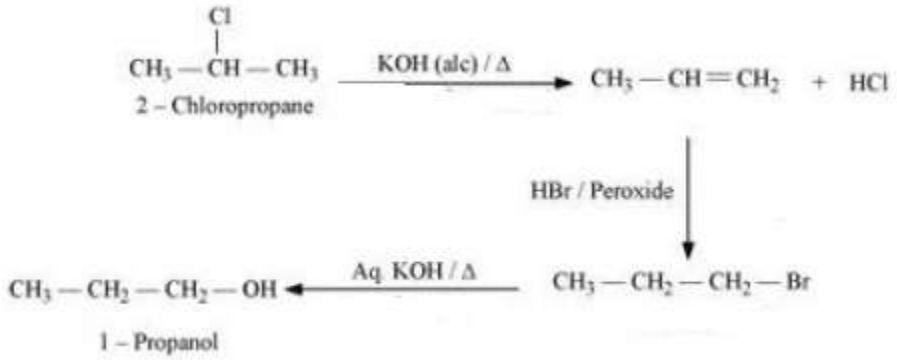


Question 10.19 How the following conversions can be carried out?

(xiii) 2-Chloropropane to 1-propanol

Answer :

The mechanism is :-

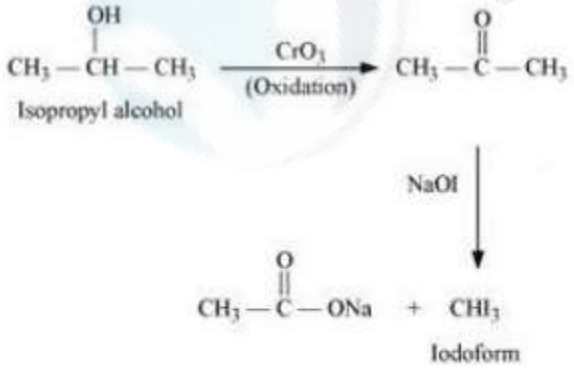


Question 10.19 How the following conversions can be carried out?

(xiv) Isopropyl alcohol to iodoform

Answer :

(xiv) The proposed mechanism is :-

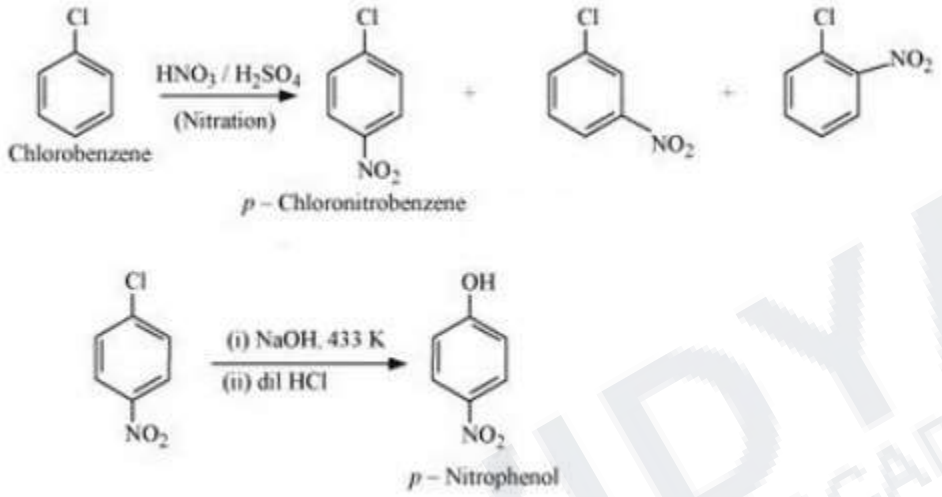


Question 10.19 How the following conversions can be carried out?

(xv) Chlorobenzene to p-nitrophenol

Answer :

(xv) The required mechanism is given below :-

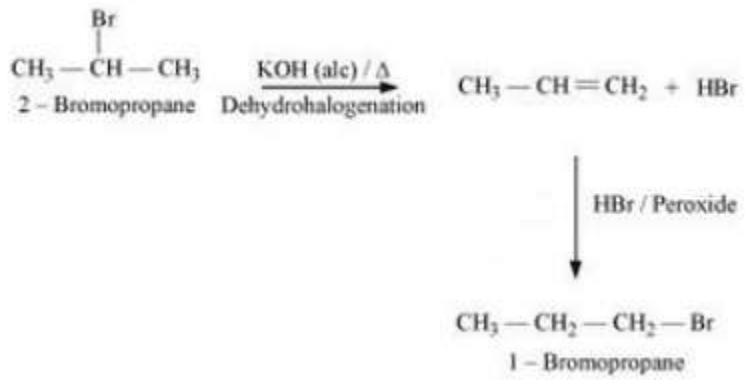


Question 10.19 How the following conversions can be carried out?

(xvi) 2-Bromopropane to 1-bromopropane

Answer :

The mechanism of the reaction is given below :-

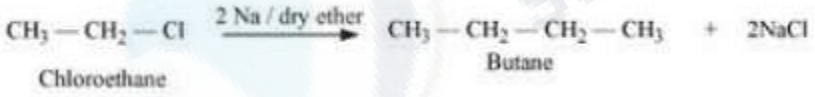


Question 10.19 How the following conversions can be carried out?

(xvii) Chloroethane to butane

Answer :

(xvii) The mechanism of the reaction is :-

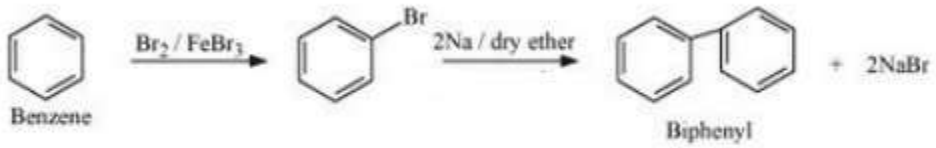


Question 10.19 How the following conversions can be carried out?

(xviii) Benzene to diphenyl

Answer :

The mechanism for the given reaction is :-

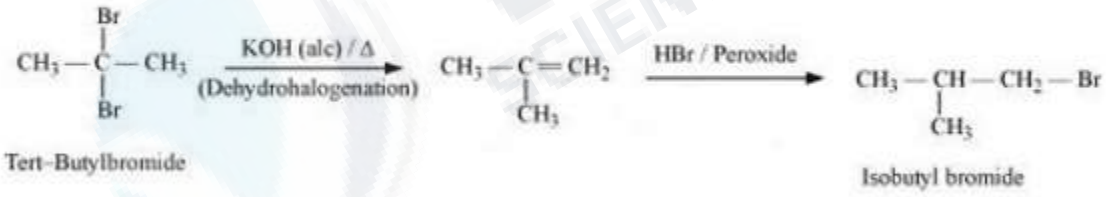


Question 10.19 How the following conversions can be carried out?

(xix) tert-Butyl bromide to isobutyl bromide

Answer :

The mechanism of the given reaction is :-

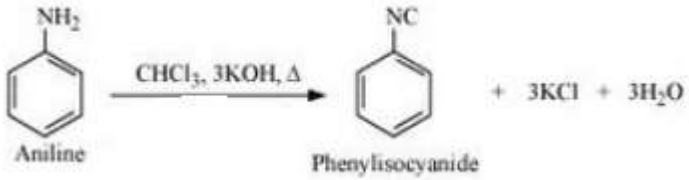


Question 10.19 How the following conversions can be carried out?

(xx) niline to phenylisocyanide

Answer :

The mechanism for the given reaction is as follows :-



Question 10.20 The treatment of alkyl chlorides with aqueous KOH leads to the formation of alcohols but in the presence of alcoholic KOH, alkenes are major products. Explain.

Answer :

In an aqueous solution, KOH almost completely dissociates into OH - ions. We know that OH - ions are strong nucleophile, which leads the alkyl chloride to undergo a reaction to form alcohol. But an alcoholic solution of KOH contains alkoxide (RO -) ion, which is a strong base. Thus, it can remove hydroge from the β-carbon of the alkyl chloride and form an alkene. The OH - ion is a weaker base than RO - ion. The basic character of OH - ion decreases in aqueous solution. Therefore, it cannot remove hydrogen from the β-carbon.

$$R-Cl+KOH_{(aq)} \longrightarrow R-OH + KCl$$

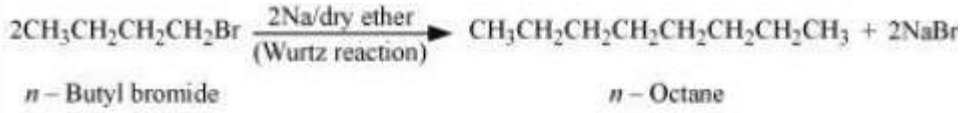
$$R-\underset{\beta}{C}H_2-\underset{\alpha}{C}H_2-Cl+KOH(alc) \longrightarrow R-CH=CH_2+KCl+H_2O$$

Question 10.21 Primary alkyl halide C_4H_9Br (a) reacted with alcoholic KOH to give compound (b). Compound (b) is reacted with HBr to give (c) which is an isomer of (a). When (a) is reacted with sodium metal it gives compound (d), C_8H_{18} which is different from the compound formed when n-butyl bromide is reacted with sodium. Give the structural formula of (a) and write the equations for all the reactions.

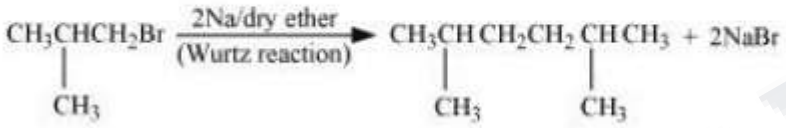
Answer :

With the given formula we have two alkyl halides They are *n* - butyl bromide and isobutyl bromide.

For the first set of reaction we get two possibilities:-



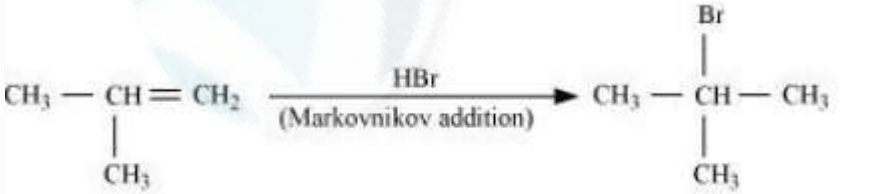
n – Butyl bromide *n* – Octane



Isobutyl bromide 2, 5 – Dimethylhexane

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

Isobutyl chloride 2 – Methylpropene



2 – Methylpropene
(b)

2 – Bromo – 2 – methylpropane
(c)

Question 10.22 What happens when

(i) n-butyl chloride is treated with alcoholic KOH,

Answer :

When n-butyl chloride is treated with alcoholic KOH the following reaction occurs:-

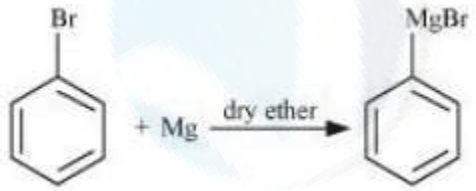
$$\underset{n-\text{Butyl chloride}}{CH_3-CH_2-CH_2-CH_2-Cl} \xrightarrow[\text{(Dehydrohalogenation)}]{KOH(alc)/\Delta} \underset{\text{But-1-ene}}{CH_3-CH_2-CH=CH_2} + KCl + H_2O$$

Question 10.22 What happens when

(ii) bromobenzene is treated with Mg in the presence of dry ether

Answer :

When bromobenzene is treated with Mg in the presence of dry ether the following reaction occurs :-

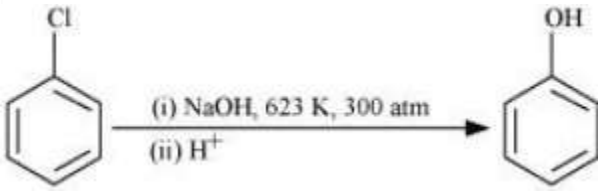


Question 10.22 What happens when

(iii) chlorobenzene is subjected to hydrolysis

Answer :

The reaction is given below :-



Question 10.22 What happens when

(iv) ethyl chloride is treated with aqueous KOH

Answer :

When ethyl chloride is treated with aqueous KOH the following reaction occurs :-

$$CH_3-CH_2-Cl \xrightarrow[\text{(Hydrolysis)}]{KOH_{(aq)}} CH_3-CH_2-OH + KCl$$