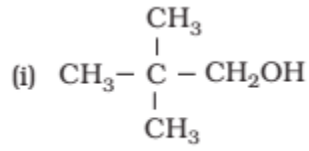
NCERT Solutions for Class 12 Chemistry Chapter 11 Alcohols, Phenols and Ethers

Question 11. 1 (1) Classify the following as primary, secondary and tertiary alcohols:

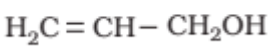
(i) 

Answer :

To classify we look at the OH bonded carbon.

Here, only 1 carbon is attached to it, hence it is **primary alcohol** .

Question 11.1 (2) Classify the following as primary, secondary and tertiary alcohols:

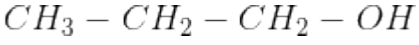
(ii) 

Answer :

To classify we look at the OH bonded carbon.

Here, only 1 carbon is attached to it, hence it is **primary alcohol.**

Question 11.1 (3) Classify the following as primary, secondary and tertiary alcohols:

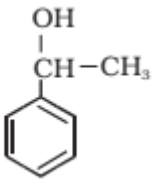


Answer :

To classify we look at the OH bonded carbon.

Here, only 1 carbon is attached to it, hence it is **primary alcohol.**

Question 11.1 (4) Classify the following as primary, secondary and tertiary alcohols:

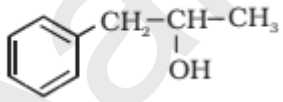
(iv) 

Answer :

To classify we look at the OH bonded carbon.

Here, 2 carbons are attached to it, hence it is **secondary alcohol.**

Question 11.1 (5) Classify the following as primary, secondary and tertiary alcohols:

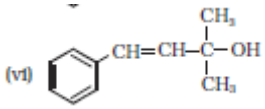
(v) 

Answer :

To classify we look at the OH bonded carbon.

Here, 2 carbons are attached to it, hence it is **secondary alcohol.**

Question **11.1 (6)** Classify the following as primary, secondary and tertiary alcohols :

(vi) 

Answer:

To classify we look at the OH bonded carbon.

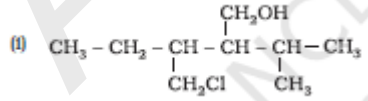
Here, 3 carbons are attached to it, hence it is **tertiary alcohol.**

Question 11.2 Identify allylic alcohols in the above examples.

Answer :

The alcohols (ii) and (vi) are allylic alcohols. Because **-C=C-C-OH** is the skeleton of allylic alcohol.

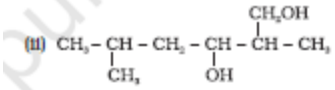
Question 11.3 (1) Name the following compounds according to IUPAC system.

(i) 

Answer :

3-Chloromethyl-2-isopropylpentan-1-ol

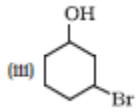
Question 11.3 (2) Name the following compounds according to IUPAC system.



Answer :

2, 5-Dimethylhexane-1, 3-diol

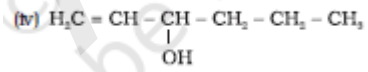
Question 11.3 (3) Name the following compounds according to IUPAC system.



Answer :

3-Bromocyclohexanol

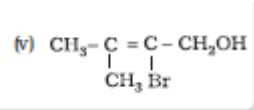
Question 11.3 (4) Name the following compounds according to IUPAC system.



Answer :

Hex-1-en-3-ol

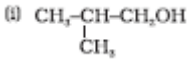
Question 11.3 (5) Name the following compounds according to IUPAC system.



Answer :

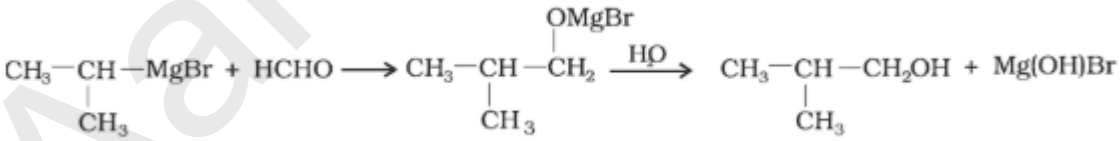
2-Bromo-3-methylbut-2-en-1-ol

Question 11.4 (1) Show how are the following alcohols prepared by the reaction of a suitable Grignard reagent on methanal ?



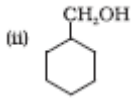
Answer :

The reaction of a suitable Grignard reagent on the methanal is mentioned below:

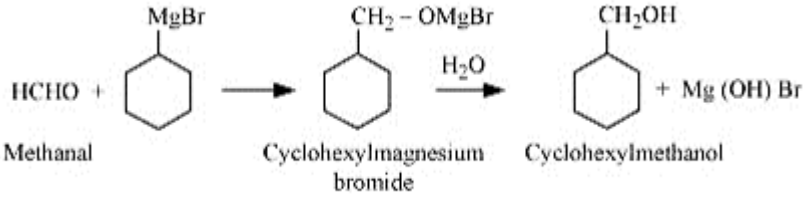


Question 11.4 (2) Show how are the following alcohols prepared by the reaction of a suitable

Grignard reagent on methanal ?

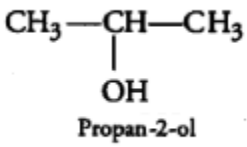
(iii) 

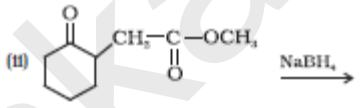
Answer :



Question 11.5 (1) Write structures of the products of the following reactions: (i) $CH_3 - CH = CH_2 \xrightarrow{H_2O/H^+}$

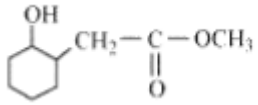
Answer :



Question 11.5 (2) Write structures of the products of the following reactions: (ii) 

Answer :

Product of the given reaction is-



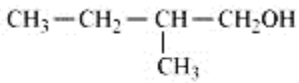
Methyl (2 – hydroxycyclohexyl) ethanoate

Question 11.5 (3) Write structures of the products of the following reactions:

(iii) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CHO \xrightarrow{NaBH_4}$

Answer :

Product of the given reaction is



2 – Methylbutan – 1 – ol

Question 11.6 (1) Give structures of the products you would expect when each of the following alcohol reacts with

(a) $HCL - ZnCl_2$ with Butan-1-ol

Answer :

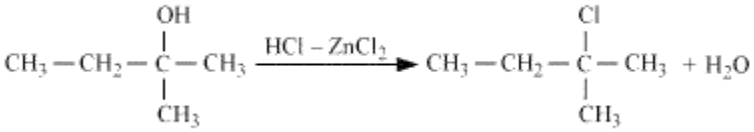
Primary alcohols do no react with Lucas' reagent.

Hence no reaction.

Question 11.6 (2) Give structures of the products you would expect when each of the following alcohol reacts with $HCl - ZnCl_2$ with 2-Methylbutan-2-ol

Answer :

Reaction of $HCl - ZnCl_2$ with 2-Methylbutan-2-ol



Question 11.6 (3) Give structures of the products you would expect when each of the following alcohol reacts with HBr with Butan-1-ol

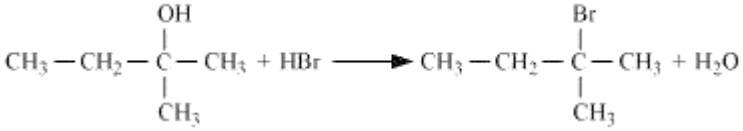
Answer :

Reaction of HBr with Butan-1-ol

Question 11.6 (4) Give structures of the products you would expect when each of the following alcohol reacts with HBr with 2-Methylbutan-2-ol

Answer :

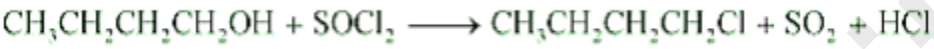
Reaction of HBr with 2-Methylbutan-2-ol



Question 11.6 (5) Give structures of the products you would expect when each of the following alcohol reacts with $SOCl_2$ with Butan-1-ol

Answer :

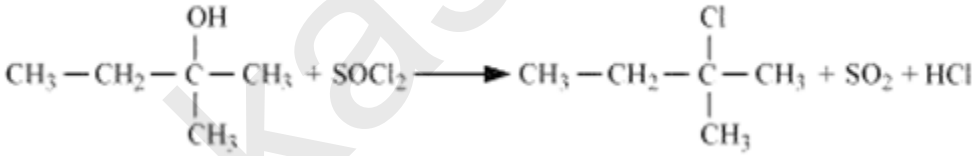
Reaction of $SOCl_2$ with Butan-1-ol



Question 11.6 (6) Give structures of the products you would expect when each of the following alcohol reacts with $SoCl_2$ with 2-Methylbutan-2-ol

Answer :

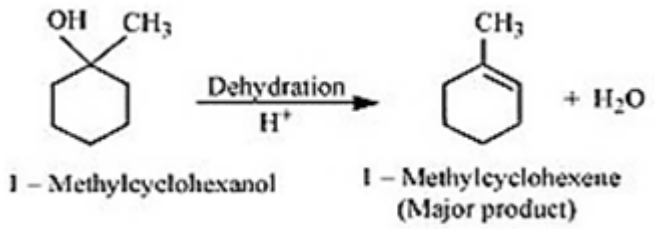
Reaction of $SoCl_2$ with 2-Methylbutan-2-ol



Question 11.7(1) Predict the major product of acid catalysed dehydration of 1-methylcyclohexanol

Answer :

Dehydration of 1-methylcyclohexanol

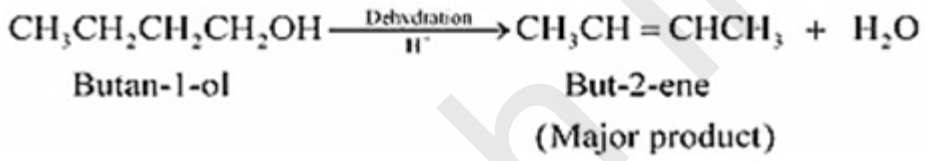


1-Methylcyclohexene is the major product.

Question 11.7 (2) Predict the major product of acid catalysed dehydration of butan-1-ol

Answer :

Dehydration of butan-1-ol

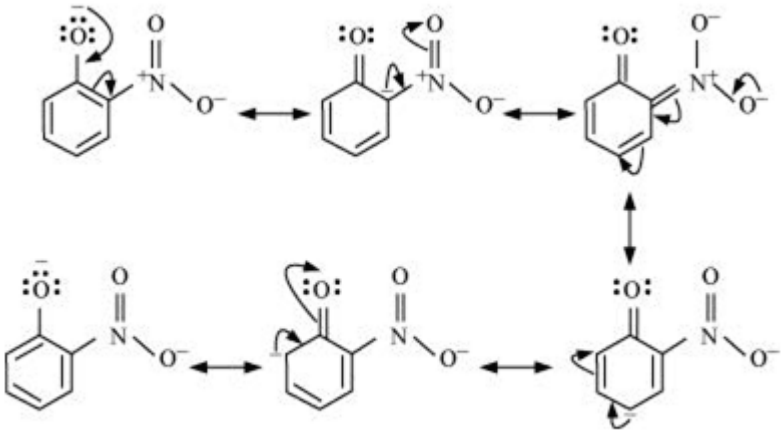


But-2-ene is the major product.

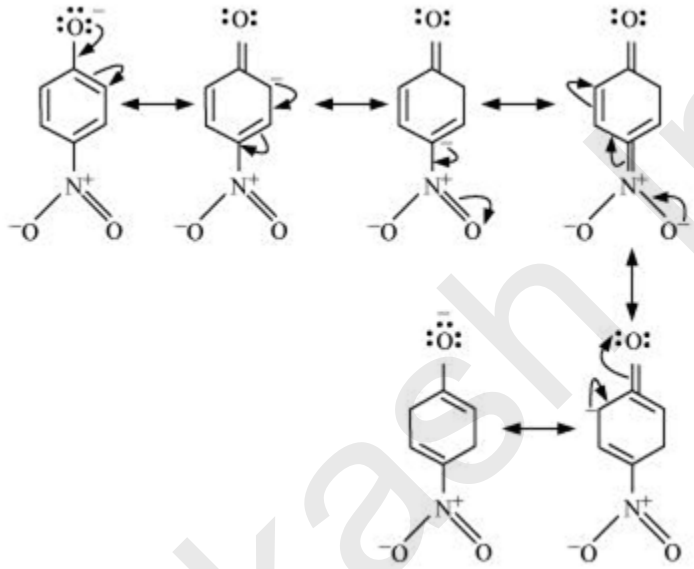
Question 11.8 Ortho and para nitrophenols are more acidic than phenol. Draw the resonance structures of the corresponding phenoxide ions.

Answer :

Resonance structure of ortho-nitrophenol



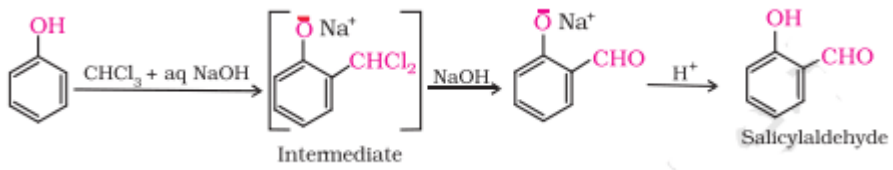
Resonance structure of para-nitrophenol



Question 11.9 (1) Write the equations involved in the following reactions: Reimer - Tiemann reaction

Answer :

Reimer - Tiemann reaction



Question 11.9 (2) Write the equations involved in the following reactions: Kolbe's reaction

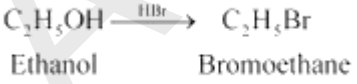
Answer :

Kolbe's reaction

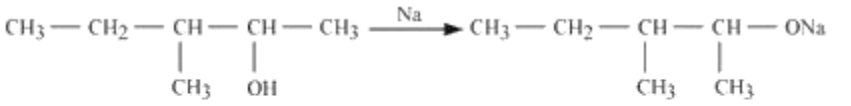
Question 11.10 Write the reactions of Williamson synthesis of 2-ethoxy-3-methylpentane starting from ethanol and 3-methylpentan-2-ol.

Answer :

1.Reaction of ethanol with hydrogen bromide.

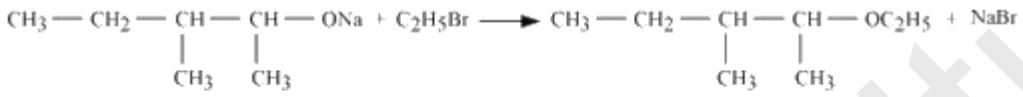


2. Reaction of 3-methylpentan-2-ol with sodium



3 – Methylpentan – 2 – ol Sodium 3 – Methylpentan – 2 – oxide

3. Reaction of product formed in 1st and reaction with the product formed in the 2nd reaction.



Sodium 3 – Methylpentan – 2 – oxide 2 – Ethoxy – 3 – methylpentane

Question 11.11 Which of the following is an appropriate set of reactants for the preparation of 1-methoxy-4-nitrobenzene and why?

Answer :

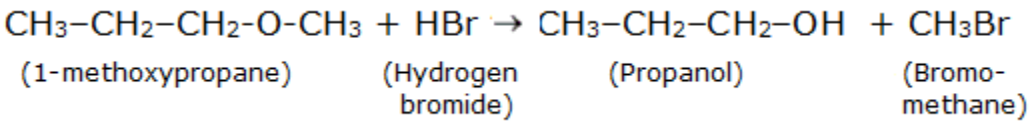
(ii) is appropriate because CH_3Br is nucleophile whereas CH_3ONa is also a strong base. So elimination will be dominating in (i).

Question 11.12 (1) Predict the products of the following reactions:

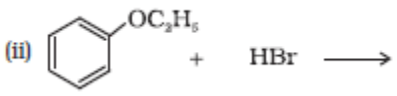
$$CH_3 - CH_2 - CH_2 - O - CH_3 + HBr$$

Answer :

Reaction is

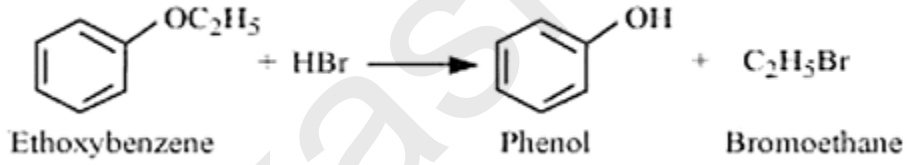


Question 11.12 (2) Predict the products of the following reactions:

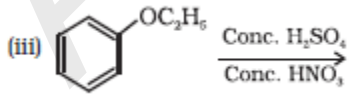


Answer :

The reaction between ethoxybenzene and HBr is

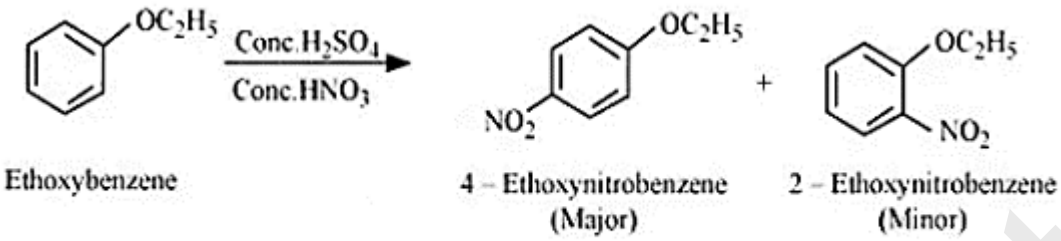


Question 11.12 (3) Predict the products of the following reactions:



Answer :

Reaction between ethoxybenzene and $Conc.\ H_2SO_4\ +\ conc.HNO_3$



Question 11.12 (4) Predict the products of the following reactions:

$(CH_3)_3C-OC_2H_5 \xrightarrow{HI}$

Answer :

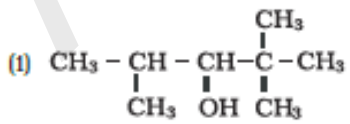
Reaction between **ter - butyl ethyl ether** and **HI**

$(CH_3)_3C-OC_2H_5 \xrightarrow{HI} (CH_3)_3C-I + C_2H_5OH$

tert-Butyl ethyl ether — *tert*-Butyliodide — Ethanol

NCERT Solutions for Class 12 Chemistry Chapter 11 Alcohols, Phenols and Ethers - Exercise Questions

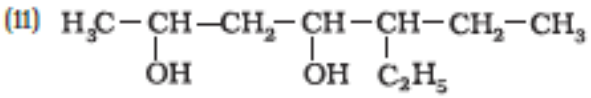
Question 11.1 (1) Write IUPAC names of the following compounds:



Answer :

IUPAC name of the given compound is 2,2,4-Trimethylpentan-3-ol

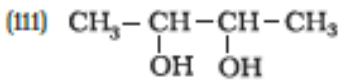
Question 11.1 (2) Write IUPAC names of the following compounds:

(ii) 

Answer :

IUPAC name of the given compound is **5-Ethylheptane-2,4-diol**

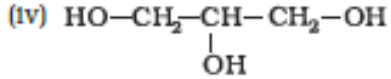
Question 11.1 (3) Write IUPAC names of the following compounds:

(iii) 

Answer :

IUPAC name of the given compound is **Butane-2,3-diol**

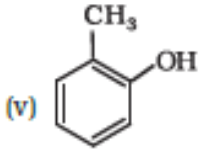
Question 11.1 (4) Write IUPAC names of the following compounds:

(iv) 

Answer :

IUPAC name of the given compound is **Propane-1,2,3-triol**

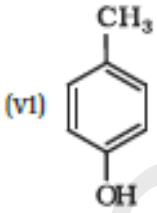
Question 11.1 (5) Write IUPAC names of the following compounds:



Answer :

IUPAC name of the given compound is **2-Methylphenol**

Question 11.1 (6) Write IUPAC names of the following compounds:

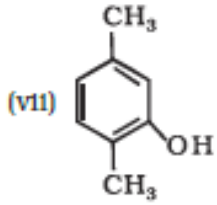


Answer :

IUPAC name of the given compound is **4-Methylphenol**

Note : Also called p-cresol

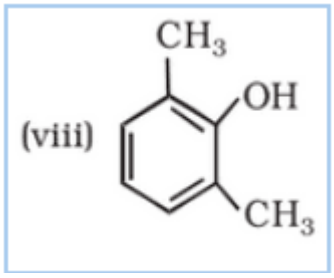
Question 11.1 (7) Write IUPAC names of the following compounds:

(vii) 

Answer :

IUPAC name of the given compound is **2,5-Dimethylphenol**

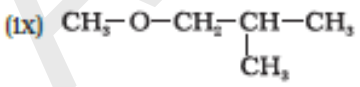
Question 11.1 (8) Write IUPAC names of the following compounds:

(viii) 

Answer :

IUPAC name of the given compound is **2,6-Dimethylphenol**

Question 11.1 (9) Write IUPAC names of the following compounds:

(ix) 

Answer :

IUPAC name of the given compound is **1-Methoxy-2-methylpropane**

Question 11.1 (10) Write IUPAC names of the following compounds:

(x) $C_6H_5–O–C_2H_5$

Answer :

IUPAC name of the given compound is **Ethoxybenzene**

Question 11.1 (11) Write IUPAC names of the following compounds:

(xi) $C_6H_5–O–C_7H_{15}$(n–)

Answer :

IUPAC name of the given compound is **1-Phenoxyheptane**

Question 11.1 (12) Write IUPAC names of the following compounds:

(xii) $CH_3–CH_2–O–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$

Answer :

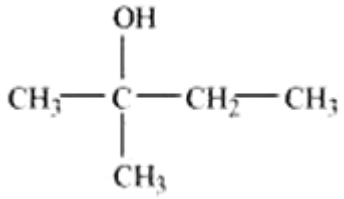
IUPAC name of the given compound is **2-Ethoxybutane**

Question 11.2 Write structures of the compounds whose IUPAC names are as follows:

(i) 2-Methylbutan-2-ol

Answer :

Structure of 2-Methylbutan-2-ol

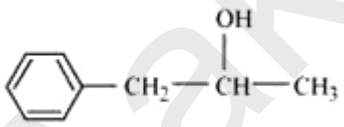


Question 11.2 Write structures of the compounds whose IUPAC names are as follows:

(ii) 1-Phenylpropan-2-ol

Answer :

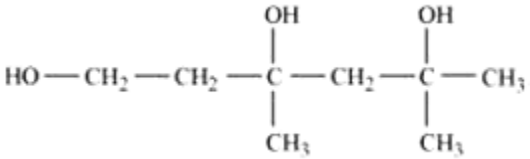
Structure of 1-Phenylpropan-2-ol



Question 11.2(iii) Write structures of the compounds whose IUPAC names are as follows: (iii) 3,5-Dimethylhexane –1, 3, 5-triol

Answer :

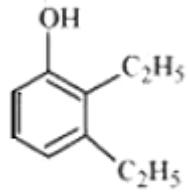
structure of 3,5-Dimethylhexane –1, 3, 5-triol



Question 11.2(iv) Write structures of the compounds whose IUPAC names are as follows: (iv) 2,3 – Diethylphenol

Answer :

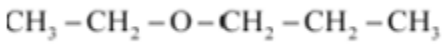
structure of 2,3 – Diethylphenol



Question 11.2(v) Write structures of the compounds whose IUPAC names are as follows:
(v) 1 – Ethoxypropane

Answer :

structure of 1 – Ethoxypropane

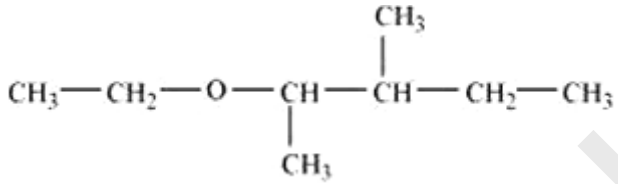


Question 11.2(vi) Write structures of the compounds whose IUPAC names are as follows:

(vi) 2-Ethoxy-3-methylpentane

Answer :

structure of 2-Ethoxy-3-methylpentane

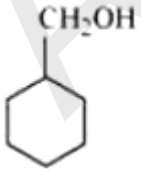


Question 11.2(vii) Write structures of the compounds whose IUPAC names are as follows:

(vii) Cyclohexylmethanol

Answer :

Structure of Cyclohexylmethanol

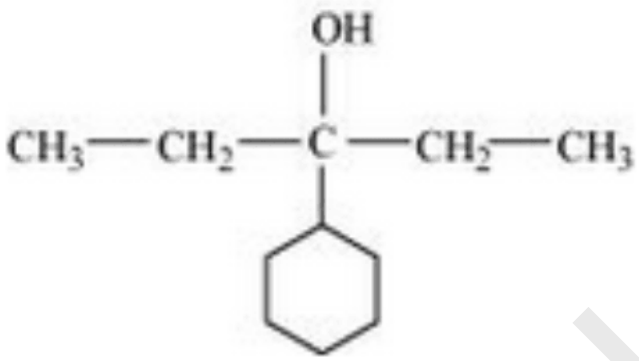


Question 11.2(viii) Write structures of the compounds whose IUPAC names are as follows:

(viii) 3-Cyclohexylpentan-3-ol

Answer :

The structure of 3-Cyclohexylpentan-3-ol is as follows:

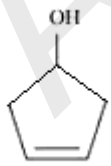


Question 11.2(ix) Write structures of the compounds whose IUPAC names are as follows:

(ix) Cyclopent-3-en-1-ol

Answer :

structure of Cyclopent-3-en-1-ol

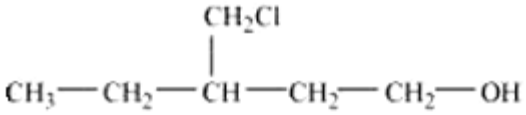


Question 11.2(x) Write structures of the compounds whose IUPAC names are as follows:

(x) 4-Chloro-3-ethylbutan-1-ol.

Answer :

structure of 4-Chloro-3-ethylbutan-1-ol

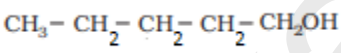
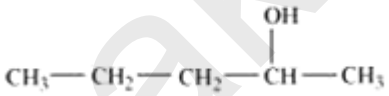
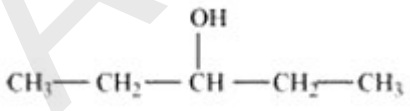


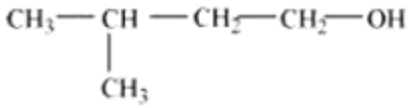
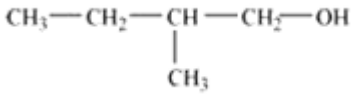
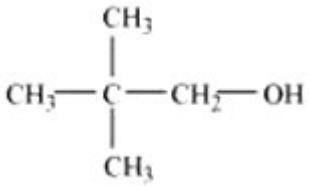
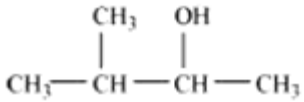
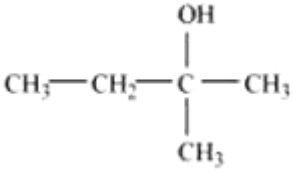
Question 11. 3 (i) Draw the structures of all isomeric alcohols of molecular formula $C_5H_{12}O$

and give their IUPAC names.

Answer :

The structures of all isomeric alcohols of $C_5H_{12}O$ are given below:

	Pentan-1-ol
	Pentan-2-ol
	Pentan-3-ol

	3-Methylbutan-1-ol
	3-Methylbutan-1-ol
	2,2-Dimethylpropan-1-ol
	3-Methylbutan-2-ol
	2-Methylbutan-2-ol

Question 11. 3 (ii) Classify the isomers of alcohols in question 11.3 (i) as primary, secondary and tertiary alcohols.

Answer :

Primary Alcohol: Pentan-1-ol; 2-Methylbutan-1-ol; 3-Methylbutan-1-ol; 2,2-Dimethylpropan-1-ol

Secondary Alcohol: Pentan-2-ol; 3-Methylbutan-2-ol; Pentan-3-ol

Tertiary Alcohol: 2-Methylbutan-2-ol

Question 11.4 Explain why propanol has higher boiling point than that of the hydrocarbon, butane?

Answer :

Propanol forms intermolecular H-bonds because of the presence of -OH group while butane cannot. To break these bonds, extra energy will be required. This causes a higher boiling point for propanol as compared to butane.

Question 11.5 Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.

Answer :

Alcohols form hydrogen bonds with water due to the presence of –OH group whereas hydrocarbons cannot. Due to this inter molecular hydrogen bonding, alcohols are more soluble in water.

Question 11.6 What is meant by hydroboration-oxidation reaction? Illustrate it with an example.

Answer :

Hydroboration-oxidation reaction also called HBO reaction is the addition of borane followed by oxidation to produce alcohol.

Eg: Hydroboration-oxidation reaction of propene. In this reaction, propene reacts with diborane $(BH_3)_2$ to form trialkyl borane. This addition product is oxidized by hydrogen peroxide in the presence of aqueous sodium hydroxide to form propan-1-ol.

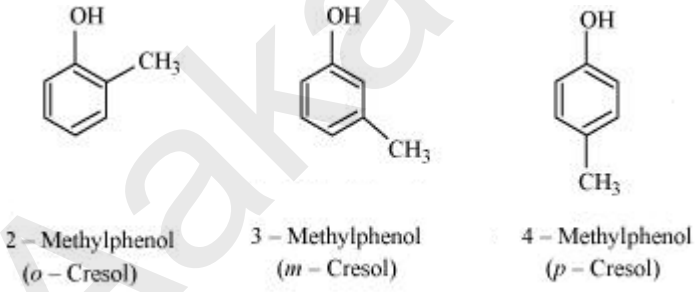
Question 11.7 Give the structures and IUPAC names of monohydric phenols of molecular formula, C_7H_8O .

Answer :

The structures and IUPAC names of monohydric phenols of molecular formula, C_7H_8O .

Phenol: C_6H_5OH

$C_7H_8O \rightarrow (C_6H_5OH)(CH_2)$



2 – Methylphenol (*o* – Cresol)

3 – Methylphenol (*m* – Cresol)

4 – Methylphenol (*p* – Cresol)

Question 11.8 While separating a mixture of ortho and para nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.

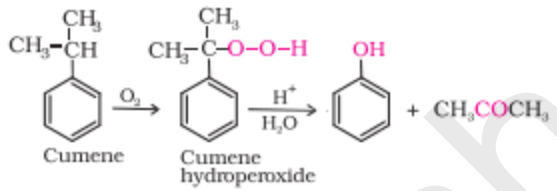
Answer :

Due to inter-molecular H bonding in para-nitrophenol, it gets tightly bonded with water. But ortho nitrophenol has intra-molecular H bonding and hence is steam volatile.

Question 11.9 Give the equations of reactions for the preparation of phenol from cumene.

Answer :

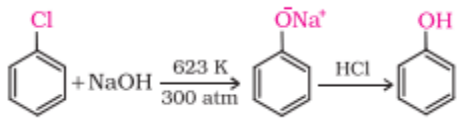
Cumene (isopropylbenzene) is oxidised in the presence of air to form cumene hydroperoxide. On treating with dilute acid it is converted to phenol and acetone.



Question 11.10 Write chemical reaction for the preparation of phenol from chlorobenzene.

Answer :

Chlorobenzene, when fused with NaOH, produces sodium phenoxide which on acidification produces Phenol.



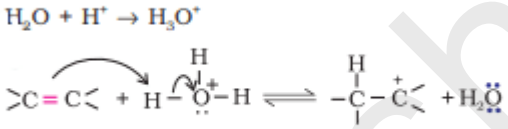
Question 11.11 Write the mechanism of hydration of ethene to yield ethanol.

Answer :

Ethanol is yielded from ethene by acid catalysed hydration.

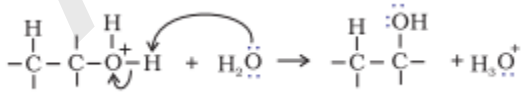
The mechanism:

Step 1. Protonation of alkene to form carbocation by electrophilic attack of hydronium ion.



Step 2. Nucleophilic attack of water on carbocation .

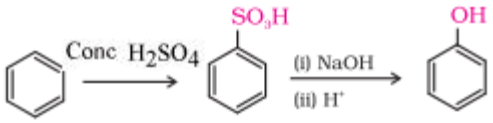
Step 3. Deprotonation to form an alcohol.



Question 11.12 You are given benzene, $conc. H_2SO_4$ and NaOH. Write the equations for the preparation of phenol using these reagents .

Answer :

When benzene reacts with $conc. H_2SO_4$ and heat it gives benzene sulphonic acid ,and after sulphonic this acid with NaOH then it gives phenol

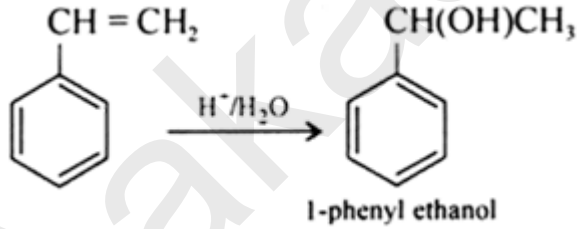


Question 11.13 Show how will you synthesise:

(i) 1-phenylethanol from a suitable alkene.

Answer :

Styrene on acid catalysed hydration gives 1-phenylethanol.

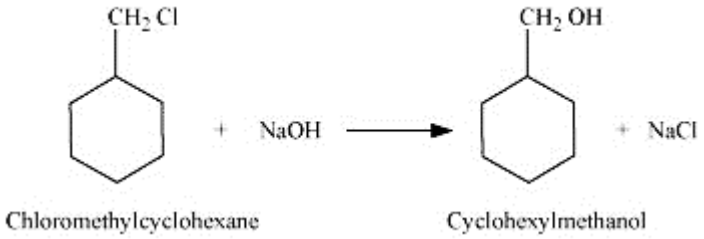


Question 11.13 (2) Show how will you synthesise:

(ii) cyclohexylmethanol using an alkyl halide by an SN2 reaction.

Answer :

On adding NaOH to chloromethylcyclohexane, cyclohexy methanol is formed.



Question 11.13 Show how will you synthesise:

(iii) pentan-1-ol using a suitable alkyl halide?

Answer :

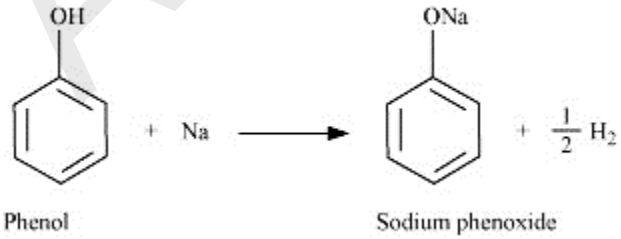
when 1-chloropentane reacts with NaOH it gives pantan-1-ol

$$\underset{\text{1-Chloropentane}}{CH_3CH_2CH_2CH_2CH_2Cl} + NaOH \longrightarrow \underset{\text{Pantan-1-ol}}{CH_3CH_2CH_2CH_2CH_2OH} + NaCl$$

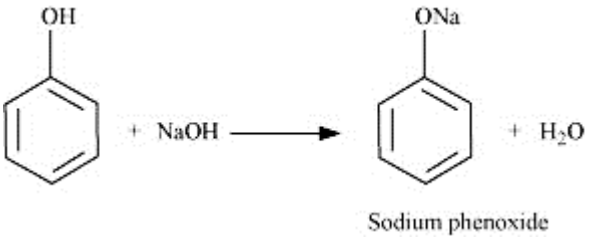
Question 11.14 Give two reactions that show the acidic nature of phenol. Compare acidity of phenol with that of ethanol.

Answer :

1. Phenol reacts with sodium to give sodium phenoxide, liberating hydrogen gas.



2. Phenol reacts with sodium hydroxide to give sodium phenoxide and water.



Sodium phenoxide

Phenol is more acidic than ethanol. This is because phenol after losing a proton becomes phenoxide ion which is highly stable due to resonance whereas ethoxide ion does not.

Question 11.15 Explain why is ortho nitrophenol more acidic than ortho methoxyphenol ?

Answer :

Ortho-nitrophenol is more acidic than ortho- methoxyphenol . The presence of the nitro group, which is an electron withdrawing group, at the ortho position decreases the electron density in the O-H bond. Also, the o- nitrophenoxide ion formed after the loss of protons is stabile due to resonance. Hence, ortho nitrophenol is a stronger acid. Whereas the methoxy group is an electron-releasing group. Thus, it increases the electron density in the O-H bond.

Question 11.16 Explain how does the –OH group attached to a carbon of benzene ring activate it towards electrophilic substitution?

Answer :

The -OH group is an electron-donating group (EDG). Thus, it increases the electron density in the benzene ring in the resonance structure of phenol. As a result, the benzene ring is activated towards electrophilic substitution.

Question 11.17(i) Give equations of the following reactions:

(i) Oxidation of propan-1-ol with alkaline $KMnO_4$ solution.

Answer :

Oxidation of propane-1-ol with alkaline $KMnO_4$ solution gives propanoic acid.

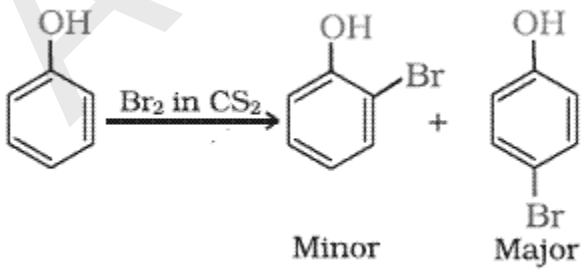
$$\underset{propane-1-ol}{CH_3CH_2CH_2OH} \rightarrow \underset{propanoic\,acid}{CH_3CH_2COOH}$$

Question 11.17(ii) Give equations of the following reactions:

(ii) Bromine in CS_2 with phenol.

Answer :

Bromine in CS_2 with phenol produces a mixture of o-bromo phenol and p-bromo phenol is formed.

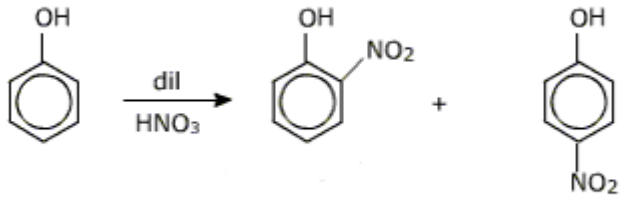


Question 11.17(iii) Give equations of the following reactions:

(iii) Dilute HNO3 with phenol.

Answer :

When dilute HNO3 reacts with phenol it gives o-bromo phenol and p-bromo phenol



Question 11.17(iv) Give equations of the following reactions:

(iv) Treating phenol with chloroform in presence of aqueous NaOH.

Answer :

Treating phenol with chloroform in presence of aqueous NaOH.

This reaction is known as the Reimer-Tiemann reaction.

Question 11.18(i) Explain the following with an example.

(i) Kolbe's reaction.

Answer :

Kolbe's reaction: Phenol with carbon dioxide under pressure followed by treating the product with sulphuric acid produces Ortho-hydroxybenzoic acid (salicylic acid). Phenoxide ion generated is more reactive than phenol towards electrophilic aromatic substitution. Hence, it undergoes electrophilic substitution with carbon dioxide, a weak electrophile.

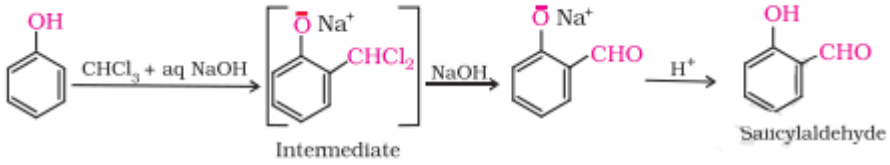
2-Hydroxybenzoic acid
(Salicylic acid)

Question 11.18(ii) Explain the following with an example.

(ii) Reimer-Tiemann reaction.

Answer :

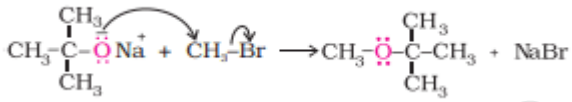
On treating phenol with chloroform in the presence of sodium hydroxide, a –CHO group is introduced at the ortho position of the benzene ring. This reaction is known as Reimer - Tiemann reaction



Question 11.18(iii) Explain the following with an example. (iii) Williamson ether synthesis.

Answer :

Williamson ether synthesis is a reaction forming ether from a primary alkyl halide via S_N2 reaction.



Question 11.18(iv) Explain the following with an example.(iv) Unsymmetrical ether.

Answer :

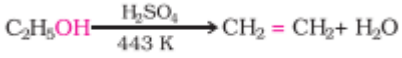
If the alkyl or aryl groups attached to the oxygen atom are different, then it is mixed or unsymmetrical ether.

Eg: $C_2H_5 - O - CH_3$ *and* $C_2H_5 - O - C_6H_5$

Question 11.19 . Write the mechanism of acid dehydration of ethanol to yield ethene.

Answer :

Alcohols undergo dehydration (removal of a molecule of water) to form alkenes on treating with a protic acid. Ethanol undergoes dehydration by heating it with concentrated sulphuric acid at 443 K.

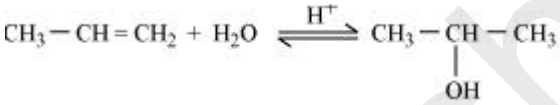


Question 11.20(i) How are the following conversions carried out?

(i) Propene → Propan-2-ol.

Answer :

Acid catalysed hydration of propene produces propan-2-ol.

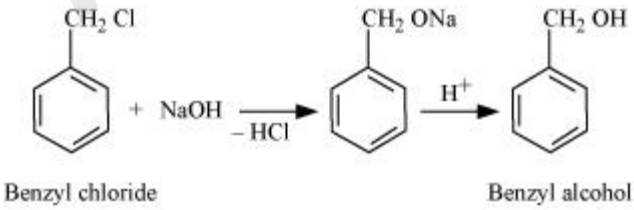


Question 11.20(ii) How are the following conversions carried out?

(ii) Benzyl chloride → Benzyl alcohol.

Answer :

Benzyl chloride treated with NaOH followed by acidification produces benzyl alcohol.

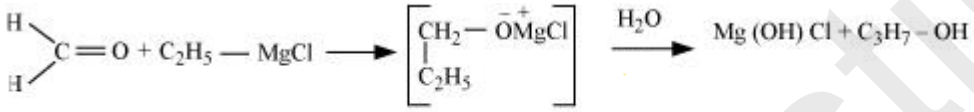


Question 11.20(iii) How are the following conversions carried out?

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

Answer :

Ethyl magnesium chloride treated with formaldehyde followed by hydrolysis produces propan-1-ol.

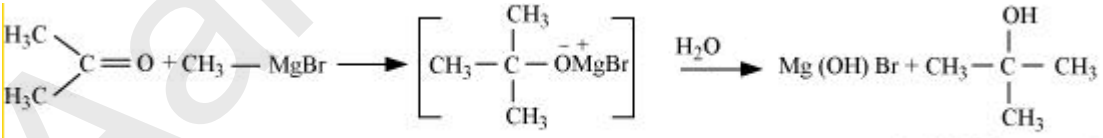


Question 11.20(iv) How are the following conversions carried out?

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

Answer :

Methyl magnesium bromide treated with propane, gives 2-methylpropane-2-ol on hydrolysis.



Question 11.21(i) Name the reagents used in the following reactions:

(i) Oxidation of a primary alcohol to carboxylic acid.

Answer :

Acidic/neutral/alkaline potassium permanganate $(KMnO_4)$ or acidified $K_2Cr_2O_7$

Question 11.21(ii) Name the reagents used in the following reactions:

(ii) Oxidation of a primary alcohol to aldehyde.

Answer :

The reagent used for oxidation of primary alcohol to aldehyde is **Pyridinium chlorochromate (PCC)** .

Question 11.21(iii) Name the reagents used in the following reactions:

(iii) Bromination of phenol to 2,4,6-tribromophenol.

Answer :

Reagents used in the bromination of phenol to 2,4,6-tribromophenol is **Bromine water**

Question 11.21(iv) Name the reagents used in the following reactions:

(iv) Benzyl alcohol to benzoic acid.

Answer :

Reagent used in the benzyl alcohol to benzoic acid isAcidified $KMnO_4$ (potassium permanganate)

Question 11.21(v) Name the reagents used in the following reactions:

(v) Dehydration of propan-2-ol to propene.

Answer :

Reagents used in the dehydration of propan-2-ol to propene is **Concentrated Phosphoric acid.**

Question 11.21(vi) Name the reagents used in the following reactions:

(vi) Butan-2-one to butan-2-ol.

Answer :

Reagent used in the butan-2-one to butan-2-ol is $LiAlH_4$ or $NaBH_4$

Question 11.22 Give reason for the higher boiling point of ethanol in comparison to methoxymethane.

Answer :

Ethanol undergoes intermolecular hydrogen bonding due to the presence of -OH group. Therefore, extra energy is required to break those hydrogen bonds. Whereas

methoxymethane does not make H-bonds and hence ethanol has a higher boiling point than methoxymethane.

Question 11.23(i) Give IUPAC names of the following ethers:

(i) $C_2H_5OCH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-CH_3$

Answer :

IUPAC names of the given ether is 1-Ethoxy-2-methylpropane

Question 11.23(ii) Give IUPAC names of the following ethers:

(ii) $CH_3OCH_2CH_2Cl$

Answer :

IUPAC names of the given ether is 2-Chloro-1-methoxyethane

Question 11.23(iii) Give IUPAC names of the following ethers:

(iii) $O_2N-C_6H_4-OCH_3(p)$

Answer :

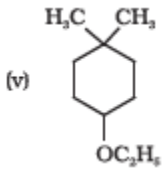
IUPAC names of the given ether is 4-Nitroanisole

Question 11.23(iv) Give IUPAC names of the following ethers:

Answer :

IUPAC names of the given ether is 1-Methoxypropane

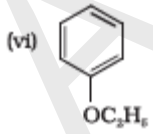
Question 11.23(v) Give IUPAC names of the following ethers:



Answer :

IUPAC names of the given ether is 4-Ethoxy-1, 1-dimethylcyclohexane

Question 11.23(vi) Give IUPAC names of the following ethers:



Answer :

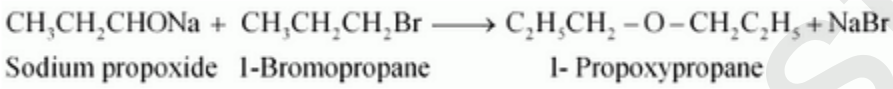
IUPAC names of the given ether is Ethoxybenzene

Question 11.24(i) Write the names of reagents and equations for the preparation of the following ethers by Williamson's synthesis:

(i) 1-Propoxypropane

Answer :

Names of reagents and equations for the preparation of the 1-Propoxypropane ether by Williamson's synthesis:-

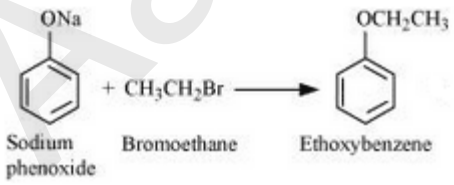


Question 11.24(ii) Write the names of reagents and equations for the preparation of the following ethers by Williamson's synthesis:

(ii) Ethoxybenzene

Answer :

Names of reagents and equations for the preparation of the Ethoxybenzene ether by Williamson's synthesis:-

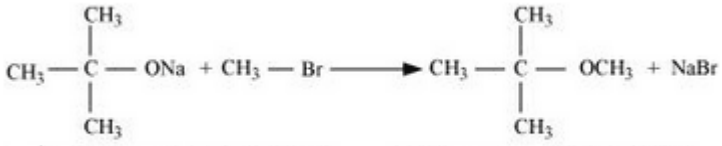


with NaBr as side product.

Question 11.24(iii) Write the names of reagents and equations for the preparation of the following ethers by Williamson's synthesis:
(iii) 2-Methoxy-2-methylpropane

Answer :

Names of reagents and equations for the preparation of the2-Methoxy-2-methylpropane ether by Williamson's synthesis:-

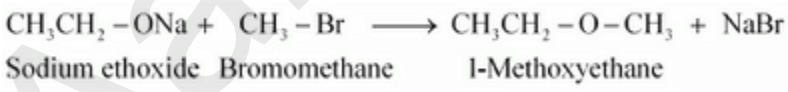


Bromomethane

Question 11.24(iv) Write the names of reagents and equations for the preparation of the following ethers by Williamson's synthesis: (iv) 1-Methoxyethane

Answer :

Names of reagents and equations for the preparation of the1-Methoxyethane ether by Williamson's synthesis:-

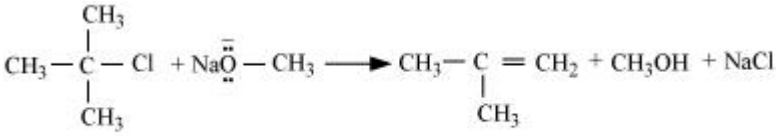


Sodium ethoxide Bromomethane 1-Methoxyethane

Question 11.25 Illustrate with examples the limitations of Williamson synthesis for the preparation of certain types of ethers.

Answer :

Williamson synthesis involves S_N2 attack by alkoxide ion on a primary alkyl halide. But if secondary or tertiary alkyl halides are taken then alkenes would be produced because elimination would take place. This is because alkoxides are nucleophiles as well as strong bases.



Tertiary alkyl halide Alkene

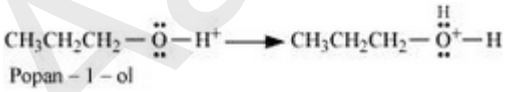
Question 11.26 How is 1-propoxypropane synthesised from propan-1-ol? Write mechanism of this reaction.

Answer :

Propan-1-ol on dehydration using protic acids such as sulphuric acid gives 1-propoxypropane.

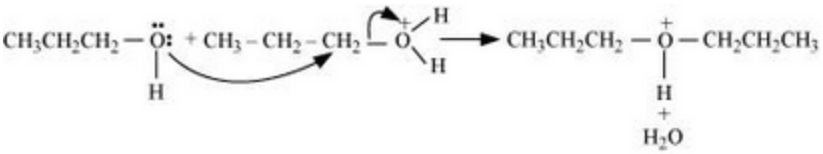
Mechanism of this reaction:

Formation of protonated alcohol.

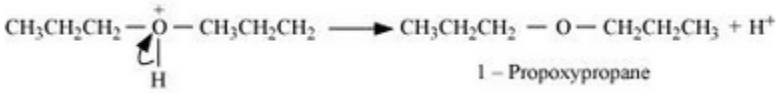


Popan – 1 – ol

Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.



Formation of ethene by the elimination of a proton.



Question 11.27 Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method. Give reason.

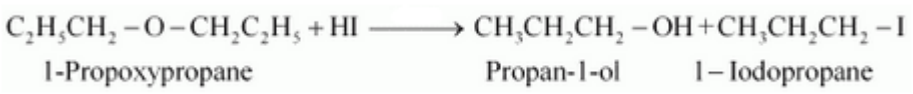
Answer :

The formation of ethers by dehydration of a primary alcohol is an S_N2 reaction. In case of secondary or tertiary alcohols, the alkyl group is hindered and hence elimination dominates substitution. Therefore alkenes are formed in place of ethers.

Question 11.28(i) Write the equation of the reaction of hydrogen iodide with:
(i) 1-propoxypropane

Answer :

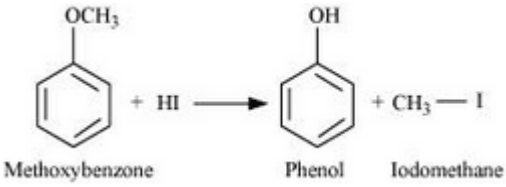
1-propoxypropane reacts with HI to give propan-1-ol and 1-iodopropane as the products.



Question 11.28(ii) Write the equation of the reaction of hydrogen iodide with: (ii) methoxybenzene

Answer :

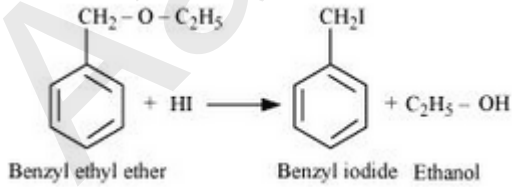
Methoxybenzene reacts with HI to give phenol and iodomethane.



Question 11.28(iii) Write the equation of the reaction of hydrogen iodide with: (iii) benzyl ethyl ether.

Answer :

Benzyl ethyl ether reacts with HI to give benzyl iodide and ethanol.



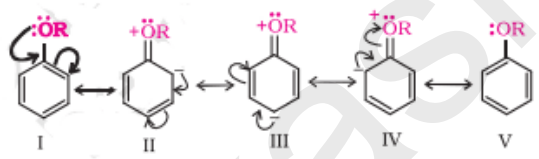
Question 11.29(i) Explain the fact that in aryl alkyl ethers (i) the alkoxy group activates the benzene ring towards electrophilic substitution

Answer :

Due to the +R effect of the alkoxy group, it increases the electron density of the benzene ring pushing electrons into the ring making the benzene ring activated towards electrophilic substitution reactions.

Question 11.29(ii) Explain the fact that in aryl alkyl ethers (ii) it directs the incoming substituents to ortho and para positions in benzene ring.

Answer :



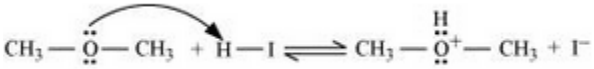
The above resonating structures shows that the electron density increases more at the ortho and para positions as compared to the meta positions. Hence, the alkoxy group directs the incoming substituents to ortho and para positions in the benzene ring.

Question 11.30. Write the mechanism of the reaction of HI with methoxymethane.

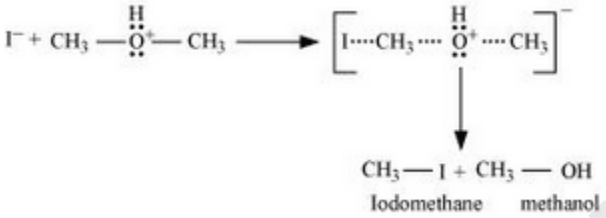
Answer :

Following is the mechanism:

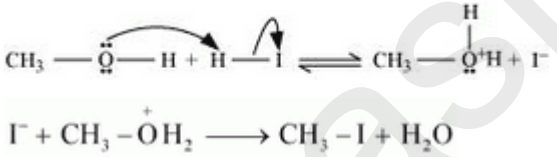
1. Protonation of methoxymethane



2. Nucleophilic attack of I^-



3. If HI is in excess, then methanol formed in step 2 reacts with another HI molecule and gets converted to methyl iodide at a high temperature.

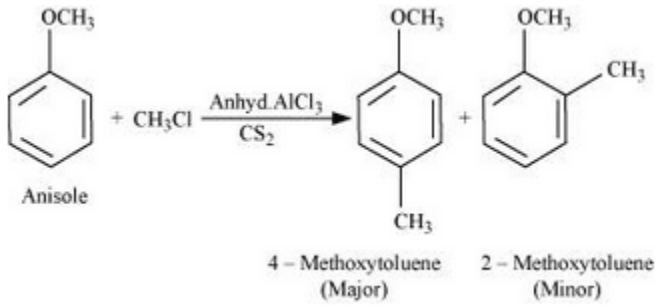


Question 11.31(i) Write equations of the following reactions:

(i) Friedel-Crafts reaction – alkylation of anisole.

Answer :

Fridel Craft reaction(Alkylation):



Question 11.31(ii) Write equations of the following reactions: (ii) Nitration of anisole.

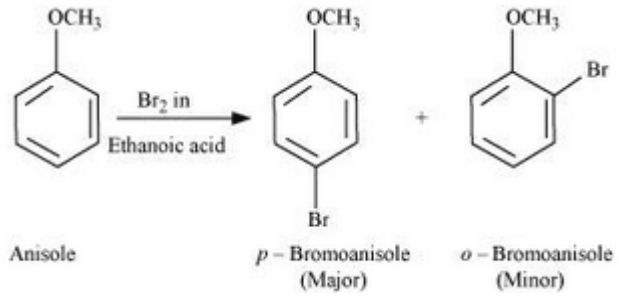
Answer :

Nitration of anisole:

Question 11.31(iii) Write equations of the following reactions: (iii) Bromination of anisole in ethanoic acid medium.

Answer :

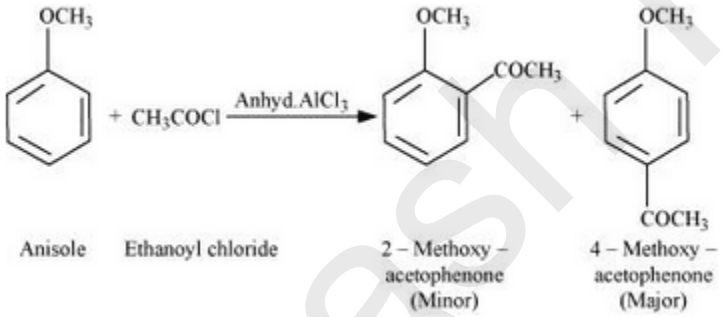
Bromination of anisole in ethanoic acid medium:



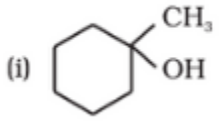
Question 11.31(iv) Write equations of the following reactions: (iv) Friedel-Craft's acetylation of anisole.

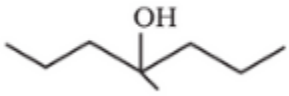
Answer :

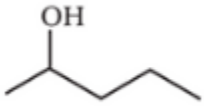
Friedel-Craft's acetylation of anisole:

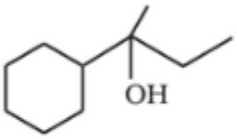


Question 11.32 Show how would you synthesise the following alcohols from appropriate alkenes?

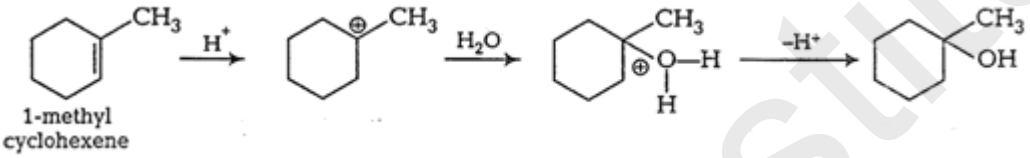
(i) 

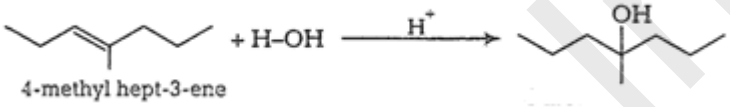
(ii) 

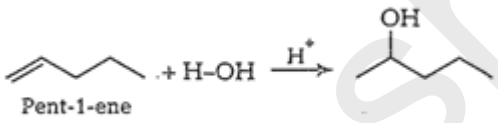
(iii) 

(iv) 

Answer :

(i) 

(ii) 

(iii) 

(iv)