
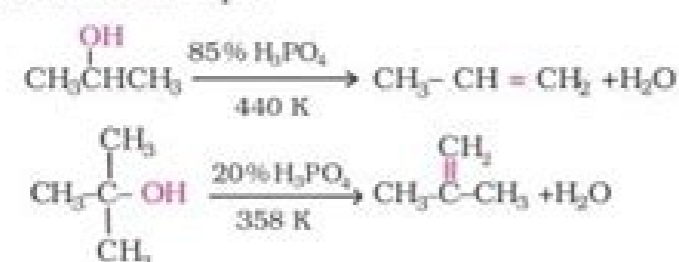


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Secondary and tertiary alcohols are dehydrated under milder conditions. For example



Thus, the relative ease of dehydration of alcohols follows the following order:

Tertiary > Secondary > Primary

The mechanism of dehydration of ethanol involves the following steps:

Mechanism

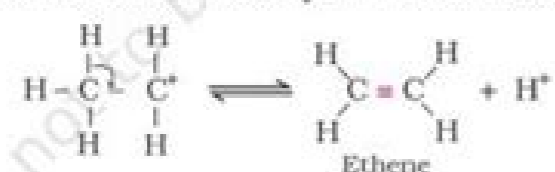
Step 1: Formation of protonated alcohol.



Step 2: Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.



Step 3: Formation of ethene by elimination of a proton.



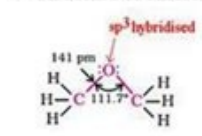
The acid used in step 1 is released in step 3. To drive the equilibrium to the right, ethene is removed as it is formed.

4. **Oxidation:** Oxidation of alcohols involves the formation of a carbon-oxygen double bond with cleavage of an O-H and C-H bonds.



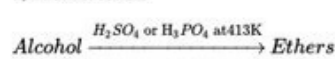
Such a cleavage and formation of bonds occur in oxidation reactions. These are also known as **dehydrogenation** reactions as these involve loss of dihydrogen from an alcohol molecule. Depending on the oxidising agent used, a primary alcohol is oxidised to an aldehyde which in turn is oxidised to a carboxylic acid.

Structure of ethers:



Preparation of ethers:

a) From alcohols



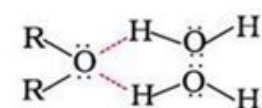
b) From alkyl halide and sodium alkoxide



Here, the alkyl halide should be primary and alkoxide should be tertiary. In case of aromatic ether, the aromatic part should be with phenoxide ion.

Physical properties of ethers:

a) **Miscibility:** Miscibility of ethers with water resembles those of alcohols of the same molecular mass. This is due to the fact that just like alcohols, oxygen of ether can also form hydrogen bonds with water molecule.

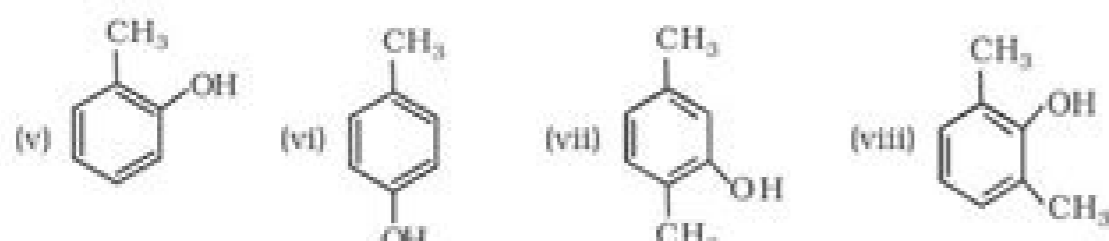
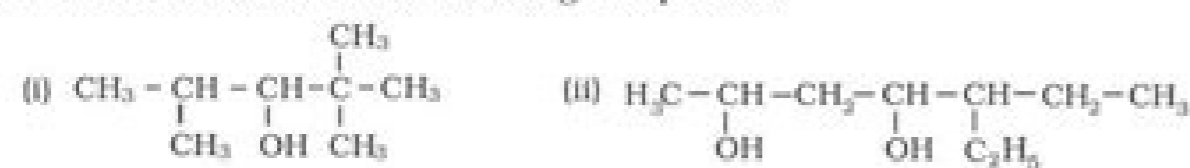


b) Boiling points:

Ethers have much lower boiling points than alcohols. This is due to the presence of hydrogen bonding in alcohols. Hydrogen bonding is absent in ethers.

Exercises

11.1 Write IUPAC names of the following compounds:



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

- (i) 2-Methylbutan-2-ol (ii) 1-Phenylpropan-2-ol
 (iii) 3,5-Dimethylhexane -1, 3, 5-triol (iv) 2,3 - Diethylphenol
 (v) 1 - Ethoxypropane (vi) 2-Ethoxy-3-methylpentane
 (vii) Cyclohexylmethanol (viii) 3-Cyclohexylpentan-3-ol
 (ix) Cyclopent-3-en-1-ol (x) 4-Chloro-3-ethylbutan-1-ol.

11.3 (i) Draw the structures of all isomeric alcohols of molecular formula $\text{C}_5\text{H}_{12}\text{O}$ and give their IUPAC names.

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

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

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

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

11.7 Give the structures and IUPAC names of monohydric phenols of molecular formula, $\text{C}_7\text{H}_8\text{O}$.

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

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

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

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

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

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