5) Reactivity: Ether are inert at moderate temperature.

3) Discuss explicitly two methods of preparing ethers and show equations of reaction.

Simple ethers are manufactured from alcohols by catalytic dehydration. The alcohol in excess and conc H_2SO_4 is heated at a carefully maintained temperature of 140°C. This process is known as continuous etherification. If excess alcohol is not used, the temperature is as high as 170-180°C, further dehydration to yield alkene occurs.

$$2ROH \xrightarrow{\text{conc. } H_2SO_4 / 140°C} R\text{-}O\text{-}R + H_2O.$$

CHEMICAL REACTIONS.

Ethers are relatively inert with regards to chemical reaction and in this regard, they resemble the corresponding alkanes which carry no functional groups. However, the oxygen atom is sufficiently basic to undergo protonation in an acidic medium by the donation of a lone pair of electron, that is, it functions as a Lewis base.

Heat decomposes ethers especially in the presence of alumina catalysts to form olefins and water as principal products

$$CH_3CH_2-O-CH_3 \xrightarrow{Al_2O_3/\text{heat}} CH_3CH=CH_2 + H_2O.$$

Ethers undergo carbon-oxygen fission on heating with strong acids

such as hydriodic, hydrobromic and nitric acids.

$CH_3CH_2OCH_2CH_3$ HI / reflux $CH_3CH_2I + CH_3CH_2OH$

↓

~~CH_3CH_2~~ $CH_3CH_2OCH_2CH_2CH_3$ 2HI / reflux CH_3CH_2I + $CH_3CH_2CH_2I + H_2O$.

↓

$CH_3CH_2OCH_2CH_2CH_3 + O_2$ hv $CH_3CH_2-O-CH(OOH)CH_2CH_3$.

4) 3 uses of ethylene oxide.

1) It is used as an intermediate in the hydrolytic manufacture of ethylene glycol.

2) It is used as a gaseous sterilizing agent.

3) It is used in the preparation of nonionic emulsifying agents, plastics, plasticizers and several synthetic textiles.

1). CH_3OCH_3 = Methoxymethane.

$CH_3CH_2OCH_2CH_3$ = Ethoxyethane

$(CH_3CH_2CH_2CH_2)_2O$ = Butoxymethane

$CH_3CH_2OCH_3$ = Methoxyethane

$CH_3CH_2CH_2OCH_2CH_3$ = Ethoxy propane.

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2. Properties of ethers.

Ans:
1) At room temperature, ethers are colourless, neutral liquids with pleasant odours.
2) Solubility:
Ethers are less soluble in water than are the corresponding alcohols. Lower molecular weight ethers such as methoxy-methane and methoxy ethane are fairly soluble in water since the molecule are able to form hydrogen bonds with the water molecules but as the hydrocarbon content of the molecules increases, there is a rapid decline in solubility. They are miscible with most organic solvent.

3) Density: Most simple ethers are less dense than water, and some of the aromatic ethers are denser than water.

4) Boiling point: low molecular mass ethers have a lower boiling point than the corresponding alcohols but those ethers containing alkyl radicals larger than four carbon atoms, the reverse is true.