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**COURSE CODE: CHM 102**

**MATRIC NO: 19/MHS09/012**

**1. Naming of Ethers**

i. CH3OCH3 - Methoxymethane

ii. CH3CH20CH2CH3- Ethoxyethane

iii. (CH3CH2CH2CH2)2O- Butoxybutane

iv. CH3CH2OCH3- Methoxyethane

v. CH3CH2CH2OCH2CH3-Ethoxypropane

**2. PROPERTIES OF ETHERS**

**General Properties**

**Physical states**At room temperature, ethers are colourless, neutral liquids with pleasant odours. The lower aliphatic rthers are highly flammable gases or volatile liquids.

**Solubility**  
Ethers are less soluble in water than are the corresponding alcohols. Lower molecular weight ethers such as methoxymethane and methoxyethane 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 solvents.

**Density**  
Most of the simple ethers are less dense than water, although the density increases with increasing relative molecular mass and some of the aromatic ethers are in fact denser than water.

**Boiling point**  
Low molecular mss 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. The boiling point of ethers tend to approximate those of hydrocarbons of same relative molecular mass from which it can be concluded that the molecules are not associated in the liquid phase as there are no suitably available hydrogen for association through hydrogen bonds.

**Reactivity**  
Ethers are inert at moderate temperature. Their inertness at moderate temperatures leads to their wide use as reaction media.  
Simple ethers are not found commonly in nature but the ether linkage is present in such natural products as sugars, starches and cellulose.

**Chemical Properties**

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. The protonated species is then susceptible to subsequent attack by a nucleophile. It is as a result of this phenomenon that ethers unlike alkanes do form salts with hydrogen chloride gas or concentrated tetraoxosulphate(vi) acid.

Below are some of the reactions they undergo;  
**Cleavage**  
i. Heat decomposes ethers especially in the presence of alumina catalysts to form olefins and water as principal products  
CH3CH2-O-CH3 <**------**Al2O3/heat**----->**CH3CH=CH2 + H2O  
ii. Ethers undergo carbon –oxygen fission on heating with strong acids such as hydriodic, hydrobromic and nitric acids.  
This cleaves one or both of the carbon-oxygen linkages to form alkyl derivatives and in cases in which only one bond is cleaved, an alcohol is one of the products

CH3CH2OCH2CH3<**------**HI/reflux**------**>CH3CH2I + CH3CH2OH

CH3CH2OCH2CH3CH3<**------**HI/reflux**------**>CH3CH2I + CH3CH2CH2I + H2O

**Autoxidation**  
In the presence of oxygen, ethers undergo self-oxidation to unstable peroxides and this reaction may create the danger of explosion in stored ether. For this reason, ethers should be stored in dark bottles and should contain an antioxidant  
CH3CH2OCH2CH2CH3 + O2 <**------**hv**------**> CH3CH2-O-CH(OOH)CH2CH3

**3. TWO METHODS OF PREPARING ETHERS**

**i. Partial dehydration of alcohols**  
Simple ethers are manufactured from alcohols by catalytic dehydration. The alcohol in excess and concentrated tetraoxosulphate(vi) acid is heated at a carefully maintained temperature of 140oC. this process is known as continuous etherification. If excess alcohol is not used, the temperature is as high as 170-1800C, further dehydration to yield alkene occurs  
 2ROH <**------**conc. H2SO4/1400C**------**> R-O-R + H2O  
Examples;  
2CH3CH2OH <**------**conc. H2SO4/1400C**------**> CH3CH2-O-CH2CH3 + H2O

**ii. From Haloalkanes and dry silver (I) oxide**  
2RX + Ag2O <**------**warm**------**> R-O-R + 2AgX  
2CH3CH2CH2Cl + Ag2O <**------**warm**------**>CH3CH2CH2O CH2CH2CH3 + 2AgCl

Propoxypropane

**4. THREE USES OF ETHYLENE OXIDE**

i. Ethylene oxide is used as an intermediate in the hydrolytic manufacture of ethylene glycol.  
ii. Ethylene oxide is used in the preparation of nonionic emulsifying agents, plastics, plasticizers and several synthetic textiles.  
iii. Ethylene oxide is used as a gaseous sterilizing agent