Idale-Fadure Oluwatunmise Benita
Medicine and Surgery
19/MHS01/H37
CHM 102

1) Give the IUPAC names of the following organic compounds
CH_3OCH_3.
$CH_3CH_2OCH_2CH_3$
$(CH_3CH_2CH_2CH_2)_2O$
$CH_3CH_2CH_2OCH_2CH_3$
$CH_3CH_2OCH_3$

2) Discuss the properties of ethers
3) Discuss explicitly two methods of preparing ethers and show equations of reaction
4) State three uses of ethylene oxide

Answers

4) i) CH_3OCH_3 : Methoxymethane
ii) $CH_3CH_2OCH_2CH_3$: Ethoxyethane
iii) $(CH_3CH_2CH_2CH_2)_2O$: Pentanamide
iv) $CH_3CH_2CH_2OCH_2CH_3$: Ethoxypropane
v) $CH_3CH_2OCH_3$: Methoxyethane.

B Physical properties
1) An ether molecule has a net dipole moment. We can attribute this to the polarity of C-O bonds
2) The boiling point of ethers is comparable of molecular mass

3) 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 ded-

ase in Solubility : they are miscible with most organic solvents

4) 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.

5) Boiling point : Low molecular mass ethers have a lower boiling point than the corresponding alcohols but those ethers containing alkyl radicals longer than four carbon atoms. The reverse is true. The boiling point of ethers tend to approximate those of hydrocarbons of the 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.

b) Reactivity : Ethers are inert at moderate temperature. Their inertness at moderate temperatures leads to their wide use as reaction media

* Chemical Properties

1) It doesn't react with bases, active metals, oxidising agents and reducing agents

2) Strong acids and dilute bases at elevated temperatures

3) Cleavage of C-O Bond : Ethers are generally very unreactive in nature. When we add an excess of hydrogen halide to the ether, cleavage of C-O bond takes place. It leads to the formation of alkyl halides.

$$HI > HBr > HCl$$

$$R-O-R + HX \rightarrow RX + R-OH$$

* Electrophilic Substitution : The alkoxy group in ether activates the aromatic ring at ortho and para positions for electrophilic substitutions. Common electrophilic substitution reactions are halogenation, Friedel Craft's reaction etc

3 Preparation of Ethers

1) 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 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. There are two major roles of the alcohol that we find in this reaction. One is that the alcohol molecule is that it acts as a nucleophile. It can either follow S_N1 or S_N2 mechanism.

$$2ROH \xleftarrow{Conc\ H_2SO_4\ /140^\circ C} R-O-R + H_2O$$

$$2CH_3CH_2OH \xleftarrow{conc\ H_2SO_4\ /140^\circ C} CH_3CH_2-O-CH_2CH_3 + H_2O$$

2) Controlled Catalytic hydration of Olefins

$$2CH_3CH=CH_2 + H_2O \longrightarrow (CH_3)_2CH-O-CH(CH_3)_2$$

2 - Isopropoxypropane

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a) Ethylene Oxide is used for Synthesis of ethylene glycols, including diethylene glycol and triethylene glycol.
b) It is used as a fumigant for foods and textiles
c) It is used for agricultural fungicide and insecticide
d) It is used as a sterilant for medical equipment.