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CHM 102

1. Give the IUPAC names of the following compounds

Methoxymethane

Ethoxyethane

Ethoxypropane

Methoxyethane

Ethoxy ethane

2. Properties of Ester

Most of the esters are liquids with much lower boiling point than those of the acids or alcohols of nearly equal weight, this is due to the absence of the polar hydroxyl group which found in alcohols and acids and leads to the association of the alcohol and carboxylic acid molecules with hydrogen bonds, Esters have a neutral effect on litmus.

The boiling point of the ester is less than the boiling point of the acid and alcohol forming it due to the absence of polar hydroxyl group (presents in alcohols and acids) which has the ability to form hydrogen bonds between molecules and water.

The solubility degree of ester in water is less than that of the corresponding acid due to the absence of polar hydroxyl group (presents in alcohols and acids) which has the ability to form hydrogen bonds between molecules and water.

3. Two methods of preparing ethers and show equations of reaction

Preparation of Ethers by Dehydration of Alcohols

In the presence of protic acids (sulphuric acid), alcohols undergo dehydration to produce alkenes and ethers under different conditions. For example: in the presence of sulphuric acid, dehydration of ethanol at 443 K yields ethene whereas it yields ethoxyethane at 413 K. This is an ideal method of preparation through primary alcohols.

The preparation of ethers by dehydration of alcohol is a nucleophilic substitution reaction. The alcohol involved in reaction plays two roles: one alcohol molecule acts as a substrate while the other acts as a nucleophile. It can follow either an S_N1 or S_N2 mechanism. The choice of the mechanism depends on whether the protonated alcohol loses water before or simultaneously upon the attack of a second alcohol molecule. Generally, the secondary and tertiary alcohols follow the S_N1 mechanism while the primary alcohols follow the S_N2 mechanism.

Preparations of Ethers by Williamson Synthesis

Williamson synthesis is an important method for the preparation of symmetrical and asymmetrical ethers in laboratories. In this method, an alkyl halide is reacted with sodium alkoxide which leads to the formation of ether. The reaction generally follows the S_N2 mechanism for primary alcohol.

As we know alkoxides are strong bases and they can react with alkyl halides leading to elimination reactions. Williamson synthesis exhibits higher productivity in the case of primary alkyl halides. In the case of secondary alkyl halides, elimination competes with substitution whereas, we observe the formation of elimination products only in the case of tertiary alkyl halides.

4. State three uses of ethylene oxide

Ethylene oxide is used as an accelerator of maturation of tobacco leaves and fungicide.

Ethylene oxide is also used as a main component of thermobaric weapons (fuel-air explosives), used in hospitals and the medical equipment industry to replace steam in the sterilization of heat-sensitive tools and equipment, such as disposable plastic syringes