NAME: TAHIR FAISAL MUSA

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DEPT: MBBS

Assignment on ethers

1.CH3OCH3 - Methoxymethane

CH3CH2OCH2CH3 – 2-butanol

[CH3CH2CH2CH2]2O – 2-methanidyl propane

CH3CH2OCH3 - Propyl alcohol [propanol]

CH3CH2CH2OCH2CH3 – 1-Pentanol [Amyl alcohol]

2. Ethers exhibit a wide range of physical and chemical properties.

Some of the physical and chemical properties of ethers are discussed below:

Physical Properties of Ethers

1. An ether molecule has a net dipole moment due to the polarity of C-O bonds.
2. The boiling point of ethers is comparable to the alkanes but much lower than that of alcohols of comparable molecular mass despite the polarity of the C-O bond. The miscibility of ethers with water resembles those of alcohols.
3. Ether molecules are miscible in water. This is attributed to the fact that like alcohol, the oxygen atom of ether can also form hydrogen bonds with a water molecule.

Chemical Properties of Ethers

Ethers generally undergo chemical reactions in two ways:

1. Cleavage of C-O bond

Ethers are generally very unreactive in nature. When an excess of hydrogen halide is added to the ether, cleavage of C-O bond takes place leading to the formation of alkyl halides. The order of reactivity is given as HI>HBr>HCl

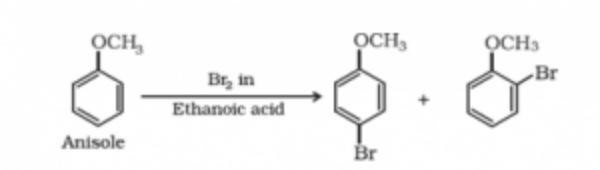
R-O-R + HX → RX + R-OH

2. Electrophilic Substitution

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

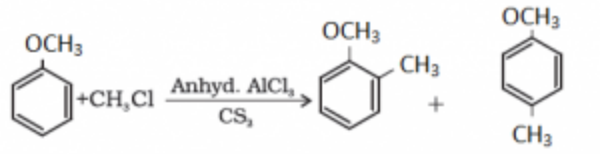
3. Halogenation of Ethers

Aromatic ethers undergo halogenation, for example, bromination, upon the addition halogen in the presence or absence of a catalyst.



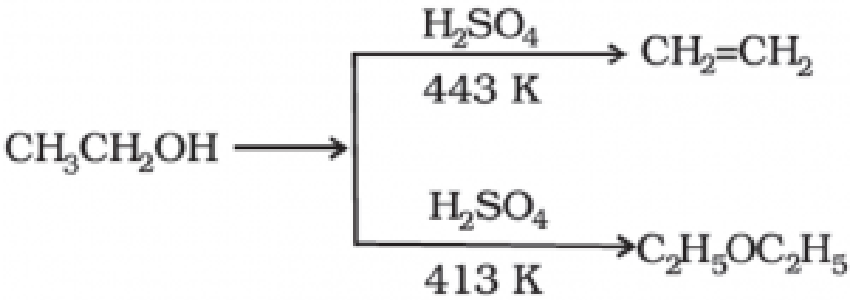
4. Friedel Craft's Reaction of Ethers

Aromatic ethers undergo Friedel Craft's reaction for example addition of alkyl or acyl group upon the reaction with alkyl or acyl halide in the presence of a Lewis acid as catalyst.



3. 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. 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. <u>USES OF ETHYLENE OXIDE</u>;

It is used to manufacture antifreeze, detergents, adhesives e.t.c

It is used as a sterilization agent for medical equipment.

It is used as a fumigant in certain agricultural products.