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**Question**

1. Give the IUPAC names for the following;
2. CH3OCH2
3. CH3CH2OCH2CH3
4. =(CH3CH2CH2CH2)O
5. CH3CH2OCH3
6. CH3CH2CH2OCH2CH3
7. Discuss the properties of ethers.
8. Discuss explicitly two methods of preparing ethers and show equations of reaction.
9. State three uses of ethylene oxide.

**Answers**

**(1)**

1. CH3OCH2 – Methoxymethane (Dimethylether)
2. CH3CH2OCH2CH3 – Ethoxy Ethane (Diethyl ether)
3. (CH3CH2CH2CH2)O – Dibutylether (Buthoxybuthane)
4. CH3CH2OCH3 – Methoxyethane
5. CH3CH2CH2OCH2CH3 - Ethoxypropane

**(2)**

**Physical Properties Of Ethers**

1. An ether molecules has a net dipole moment. We can attribute this to the polarity of C—O bonds.
2. The boiling point of ethers is comparable to the alkanes. However, it is much lower compared to that of alcohols of comparable molecular mass. This is despite the fact of the polarity of C—O bonds.
3. The miscibility of ethers with water resembles those of alcohols.
4. Ether molecules are miscible in water. We can attribute this to the fact that like alcohols, the oxygen atom of ether can also form hydrogen bonds with a water molecule.

**Chemical Properties Of Ethers**

* **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. The order of reactivity is as follows:

HI $>$ HBr $>$ HCI

R—O—R + HX $\rightarrow $ RX + R—OH

* **Electrophilic Substitution:** The alkoxy group in ether activates the artomatic ring at ortho and para positions for electrophilic substitution. Common electrophilic substation reactions are halogenation, Friedel Craft’s reaction, e.t.c.
* **Halogenation Reaction Of Ethers:** Aromatic ethers undergo halogenation, for example, bromination, when we add a halogen in the presence or absence of a catalyst.
* **Friedel Craft’s reaction Of Ethers**: Aromatic ethers undergo Friedel Craft’s redaction for example, addition of alkyl or acyl halide in the presence of a Lewis acid as catalyst.

**(3)**

1. **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. On the other hand, it yields ethoxyethane at 413 K. This is an ideal method of preparation for primary alcohols.

The preparation of ethers by dehydration of an alcohol is a nucleophilic substitution reaction. There are two major roles of the alcohol that we find in this reaction. One is that the alcohol molecule can act as the substrate while the other is that it acts as a nucleophile. It can follow either SN1 or SN2 mechanism.

The preparation of ethers by dehydration of an alcohol is a nucleophilic substitution reaction. There are two major roles of the alcohol that we find in this reaction. One is that the alcohol molecule can act as the substrate while the other is that it acts as a nucleophile. It can follow either SN1 or SN2 mechanism.

The choice of mechanism is dependent on whether the protonated alcohol loses water before or simultaneously upon the attack of a second alcohol molecule. Generally, we will find that the secondary and tertiary alcohols follow SN1 mechanism. While on the other hand, the primary alcohols follow SN2mechanism.

### **2) 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, we carry out a reaction of an alkyl halide with sodium alkoxide which leads to the formation of ether. The reaction generally follows SN2 mechanism for primary alcohol.

As we know alkoxides are strong bases and they can react with alkyl halides. Thus, they take part in elimination reactions. Williamson synthesis exhibits higher productivity in case of primary alkyl halides.

**(3)**

* Ethylene oxide is used as a [fumigant](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/fumigants) for spices, seasonings, and foodstuffs and as an agricultural fungicide. When used directly in the gaseous form or in nonexplosive [gaseous mixtures](https://www.sciencedirect.com/topics/engineering/gaseous-mixture) with nitrogen or carbon dioxide, ethylene oxide can act as a disinfectant, fumigant, sterilizing agent, and insecticide.
* It is a man-made chemical used as an intermediate in organic synthesis for ethylene glycol, polyglycols, glycol ethers, esters, ethanolamines, [acrylonitrile](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/acrylonitrile), plastics, and surface-active agents.
* It is also used as a fumigant for textiles and for sterilization, especially for surgical instruments. It is used in drug synthesis and as a pesticide intermediate.