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1) Give the IUPAC names of the following Organic compounds

a) $CH_3OCH_3$ → Methoxymethane
b) $CH_3CH_2OCH_2CH_3$ → Ethoxyethane
c) $(CH_3CH_2CH_2CH_2)_2O$ → Butoxymethane
d) $CH_3CH_2OCH_3$ → Methoxyethane
e) $CH_3CH_2CH_2OCH_2CH_3$ → Ethoxypropane

2) Discuss the Properties of ethers:

a) Physical Properties of ethers

1) An ether molecule has a net dipole moment. We can attribute this to the polarity of C- 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 despite the polarity of the C-O bond.
3) 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.
4) The miscibility of ethers with water resembles those of alcohols.

b) Chemical Properties of ethers.

1) Halogenation of Ethers: Aromatic ethers Undergo halogenation, for example, bromination, upon the addition of halogen in the presence or absence of

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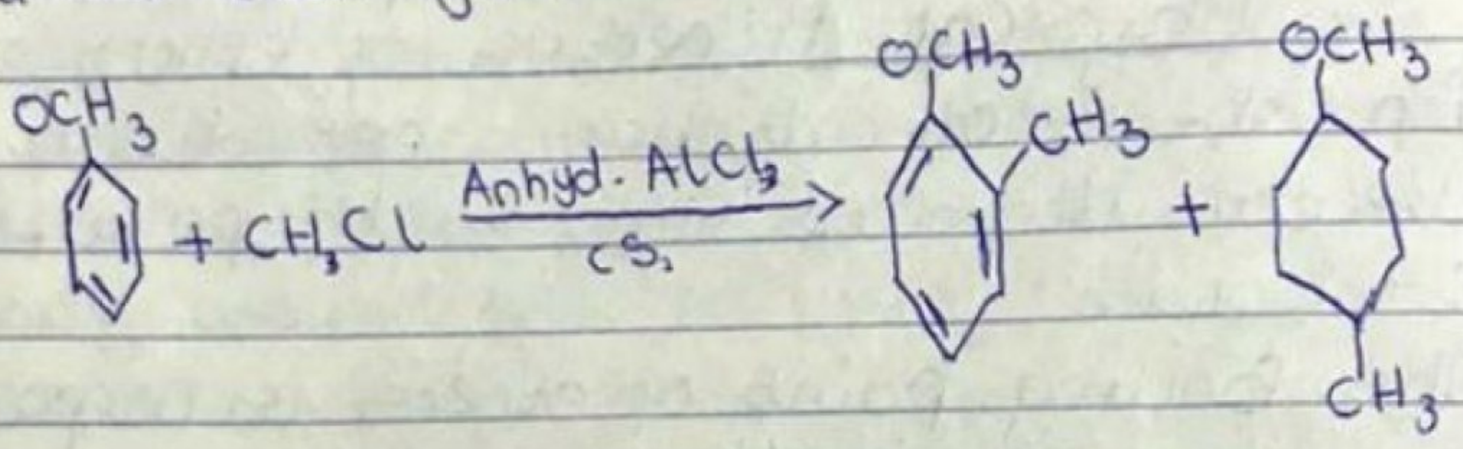
Catalyst

2) Electrophilic Substitution: The alkoxy group in ether activates the aromatic ring at Ortho and para position for electrophilic Substitution. Common electrophilic Substitution reactions are halogenation, Friedel Craft's reaction e.t.c

3) 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




4) Cleavage of C-O bonds → 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 halide.

Order of reactivity: HI → HBr → HCl

3 Discuss explicitly two methods of preparing ethers and show equations of reaction.

i) Partial 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 this, simple ethers

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are manufactured from alcohols by catalytic dehydration. The alcohol in excess and concentrated $H_2SO_4$ is heated at a carefully maintained temperature of 140°C - this known as continious etherification

$$CH_3CH_2OH \xrightarrow[443K]{H_2SO_4} CH_2=CH_2$$

$$CH_3CH_2OH \xrightarrow[410K]{H_2SO_4} C_2H_5OC_2H_5$$

At temperature 110° to 130°

$$2CH_3CH_2-OH + H_2SO_4 \xrightarrow{130^\circ C} CH_3CH_2-O-CH_2CH_3 + H_2O$$

$$CH_3CH_2-OH + H_2SO_4 \xrightarrow{150^\circ C} CH_2=CH_2 + H_2O$$

ii) By Williamson Synthesis:

This important method for producing ethers in the laboratory. In this method, we carry out a reaction of an alkyl halide with sodium alkoxide which leads to the formation of ether - Alkoxides are strong bases and they can react with alkyl halides. Thus, they take part in elimination reaction. Basically, a halide ion is displaced from an alkyl halide by an alkoxide ion.

Example

$$R-X + R-\ddot{O}\,Na^+ \longrightarrow R-\ddot{O}-R' + NaX$$

$$[Na]^+[C_2H_6O]^- + C_2H_5Cl \longrightarrow C_2H_5OC_2H_5 + [Na]^+[Cl]$$

4) State three uses of ethylene oxide

1) Ethylene oxide is used as an intermediate in the hydrolytic manufacture of ethylene glycol

2) Ethylene oxide is used in the preparation of nonionic emulsifying agents, plastics, plasticizers and several Synthetic textiles

3) Ethylene Oxide is used as a gaseous sterilizing agent for medical equipment e.t.c