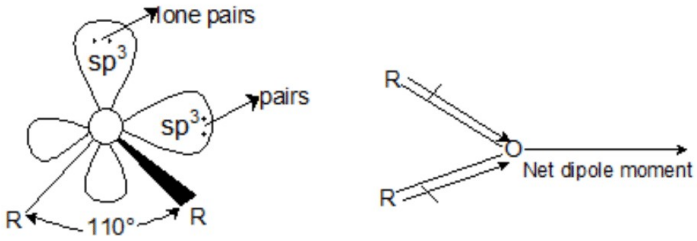
- **Physical state, colour and odour**: Dimethyl ether and ethyl methyl ether is gas at ordinary temperature while the other lower homologues of ethers are colourless liquid with characteristic 'ether smell'.

- **Dipole nature**: Ethers have a tetrahedral geometry i.e., oxygen is sp^3 hybridized. The C— O—C angle in ethers is 110°. Because of the greater electronegativity of oxygen than carbon, the C—O bonds are slightly polar and are inclined to each other at an angle of 110°, resulting in a net dipole moment.



  Bond angle of ether is greater than that of tetrahedral bond angle of 109°28'.

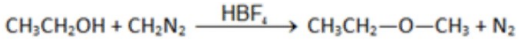
- **Solubility and boiling point:** Due to the formation of less degree of hydrogen bonding, ethers have lower boiling point than their corresponding isomeric alcohols and are slightly soluble in water.

Preparation of Ethers:

a) From alcohols:

$$CH_3CH_2OH \xrightarrow[140^0C]{H_2SO_4} \underset{\text{Ether}}{CH_3CH_2-O-CH_2CH_3}$$

Order of dehydration of alcohol leading to formation of ethers:
1° > 2° > 3°

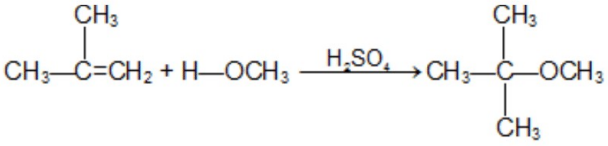


b) **Williamson's synthesis:**

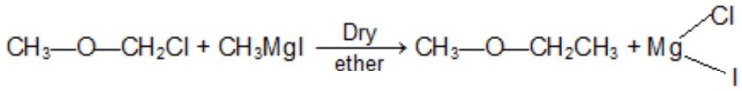
$R\text{-}X + Na^{+}\ {}^{-}O\text{-}R' \rightarrow R\text{-}O\text{-}R' + Na^{+}\ X^{-}$

In case of tertiary substrate elimination occurs giving alkenes.

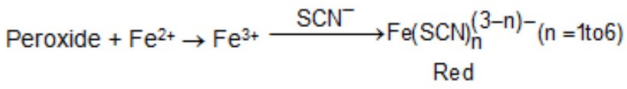
From alkenes:.



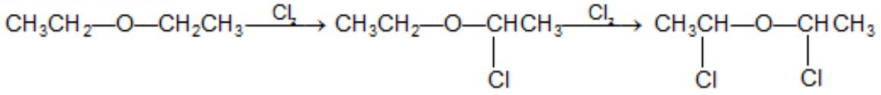
From Grignard reagent: Treating a - halo ethers with suitable Grignard reagents.



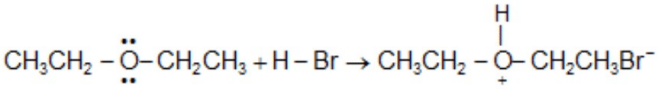
On standing in contact with air, most aliphatic ethers are converted slowly into unstable peroxides. The presence of peroxides is indicated by formation of a red colour when the ether is shaken with an aqueous solution of ferrous ammonium sulfate and potassium thiocyanate ?



f) Halogenation of ethers:



g) Ethers as base:

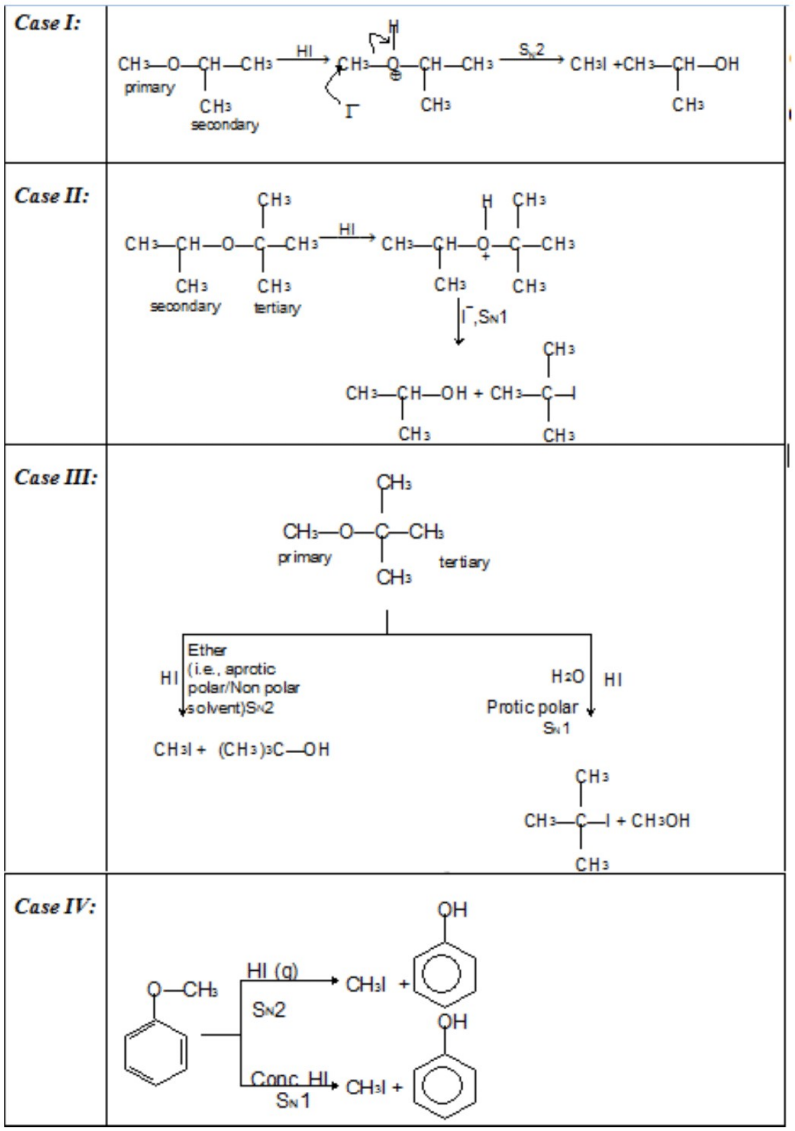


h) Reaction With Cold conc. HI/HBr:

$$R—O—R' + \text{Cold HI} \longrightarrow R\text{-OH} + R'I \ (R' < R)$$

i) Hot conc. HI/HBr:

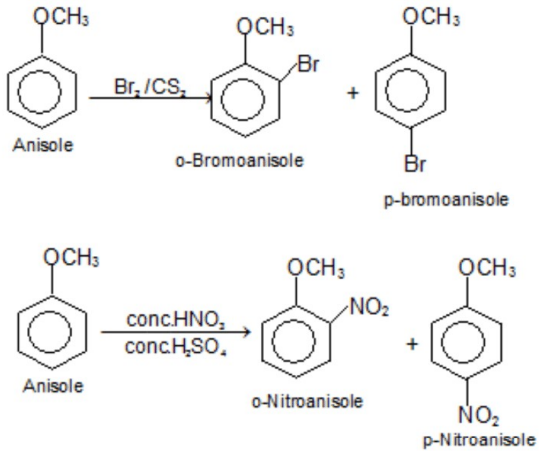
$$R—O—R' + \text{Hot HI} \longrightarrow RI + R'I + H_2O$$



i) Reaction with acid chlorides and anhydrides:

$$C_2H_5 - O - C_2H_5 \ + \ CH_3COCl \xrightarrow[Anhy\ ZnCl_2]{\Delta} C_2H_5Cl \ + \ CH_3COOC_2H_5$$

j) Electrophilic substitution reactions



Epoxides or Oxiranes:

Preparation

a) Oxidation of ethylene :