

unit: ether

→ General formula:  $C_n H_{2n+2} O$

→ Representative formula:  $R-OR$ ,  $R-O-R'$   
Symmetric ether

The organic compound in which two hydrocarbon groups are directly attached to oxygen is called ether.

Ether and alcohol are functional isomer of each other.

Eg  $C_2H_6O$

$CH_3-O-CH_3$   
ether

$CH_3-(CH_2-OH)$   
alcohol

\* Classification of ether:

On the basis of hydrocarbon group present in ether, they are of following types


(i) ~~TH~~ Symmetric ether :-

They are ether containing same hydrocarbon group.

Eg:  $CH_3-O-CH_3$ ,  $CH_3-CH_2-O-CH_2-CH_3$  etc.

(ii) Unsymmetric ether :-

They are ether containing different hydrocarbon group.

Eg:  $CH_3-CH_2-O-CH_3$ , -O-CH<sub>3</sub> etc

# # Nomenclature of ether

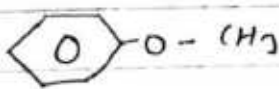
## \* Common system:

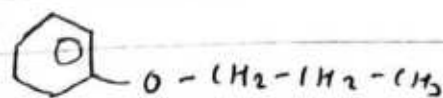
In this system symmetric ethers are named as dialkyl ether. Unsymmetric ethers are named by writing the name of alkyl group in alphabetical order before the word ether.

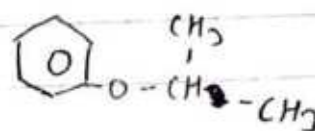
## \* IUPAC system:-

prefix + wordroot + pr. suffix : alkoxyalkane

Eg.	formula	Common Name	IUPAC NAME
①	$\text{CH}_3 - \text{O} - \text{CH}_3$	dimethyl ether	Methoxymethane
②	$\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$	diethyl ether	Ethoxyethane
③	$\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_3$	ethyl methyl ether	Methoxyethane
④	$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{O} - \text{CH}_3$	methyl-n-propyl	1-Methoxypropane
⑤	$\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{CH} - \text{O} - \text{CH}_3 \end{array}$	iso-propyl methyl ether	2-methoxypropane

⑥	 $\text{O} - \text{CH}_3$	Methylphenyl ether (Anisole)	Methoxybenzene (Anisole)
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 $\text{O} - (\text{CH}_2 - \text{CH}_2 - \text{CH}_3)$	n-propyl phenyl ether	propoxybenzene
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 $\text{O} - \begin{array}{c} \text{CH}_3 \\   \\ \text{CH} - \text{CH}_3 \end{array}$	iso-propyl phenyl ether	2-propoxybenzene
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B-2F

## General Method of preparation of ether

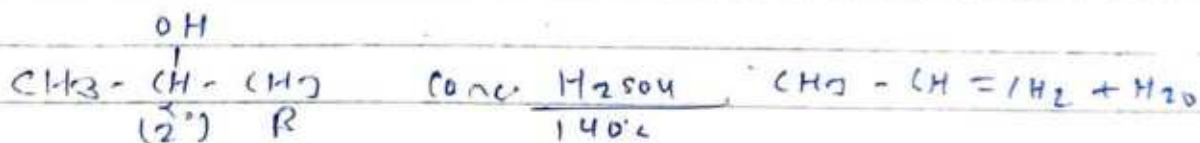
### (A) From Alcohol :

When primary alcohol is heated with conc.  $H_2SO_4$  at  $140^\circ C$  temp., it under goes intermolecular dehydration producing ether



Secondary & tertiary

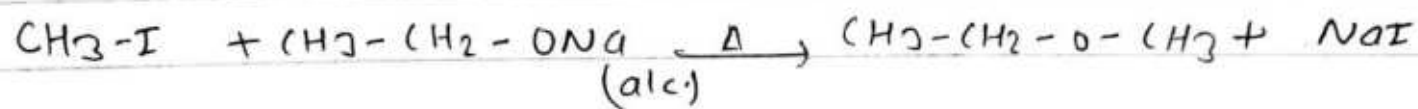
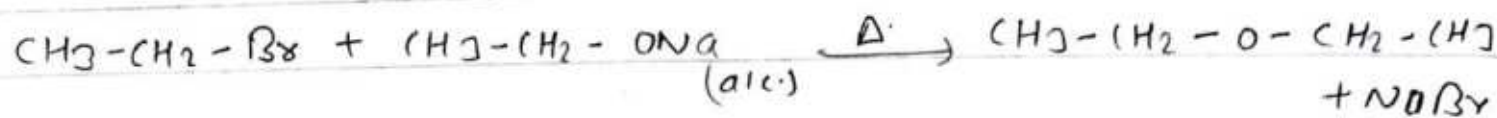
But, when  $\uparrow$  alcohol is heated with conc.  $H_2SO_4$  at  $140^\circ C$  temp., they undergo intermolecular dehydration producing alkene.



### (2) From Halalkane (By William son's synthesis)

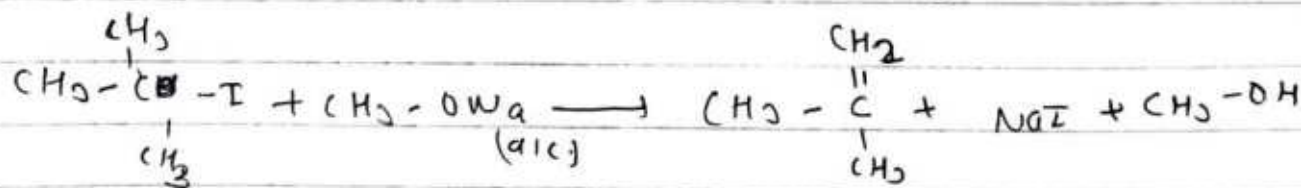
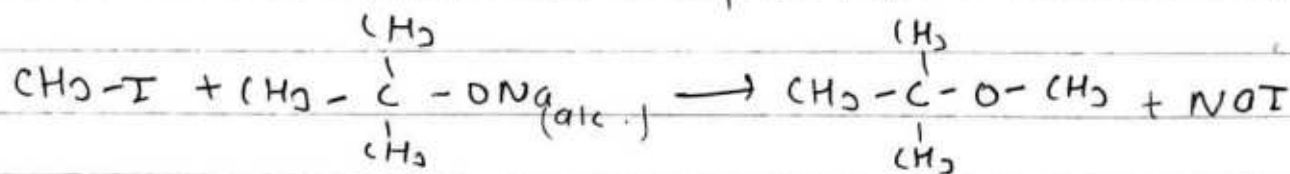
$\rightarrow$  When halalkane is heated with alcoholic sodium alkoxide ether is formed. This method of preparation of ether is called williamson's synthesis. By this method both symmetric and unsymmetric ether can be prepared.



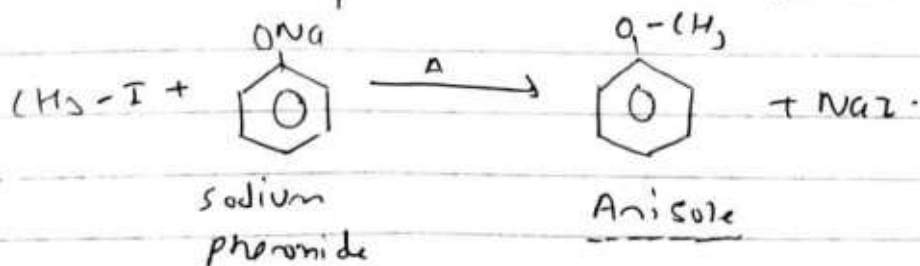


(Sodium ethoxide)

By this method ether containing branched chain alkyl group (sec, tert. alkyl group) can be also prepared but during this sodium alkoxide with branched alkyl group should be used otherwise elimination occurs producing alkene and alcohol.



By this method aromatic ether can also be prepared by treating sodium phenoxide with haloalkane.



## \* Physical properties of ether

### ① Physical state:-

All commonly known ethers are colourless volatile liquid with characteristics sweet smell but, dimethyl ether and ethylmethyl ether are gas.

### ② Boiling point:-

Due to very low polarity of etheral oxygen, the boiling point of ether is similar to that of alkane.

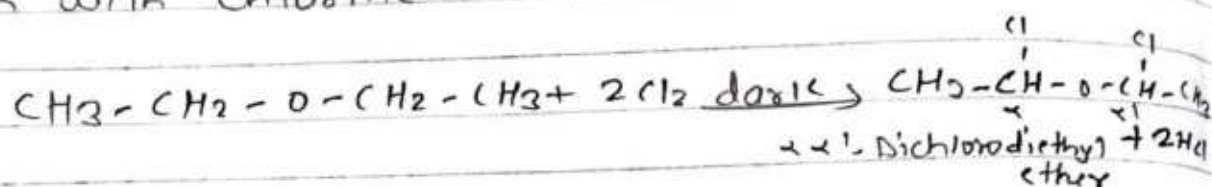
But, boiling point of ether is very less compare to its functional isomer alcohol because alcohol can form intermolecular hydrogen bond but ether can't form intermolecular hydrogen.

### ③ Solubility:-

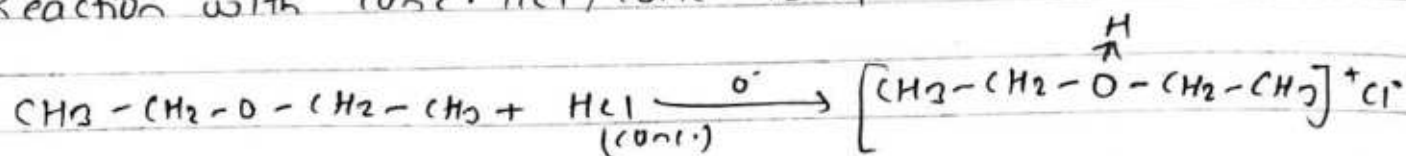
Low member of ether of up to four carbon atoms are miscible in water due to formation of intermolecular hydrogen bond with water but higher members are insoluble in water because they cannot form effective intermolecular hydrogen bond.

## \* Chemical properties of ether

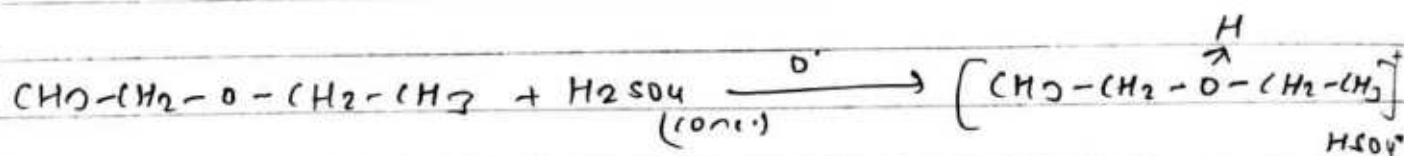
### ① Reaction with chlorine:



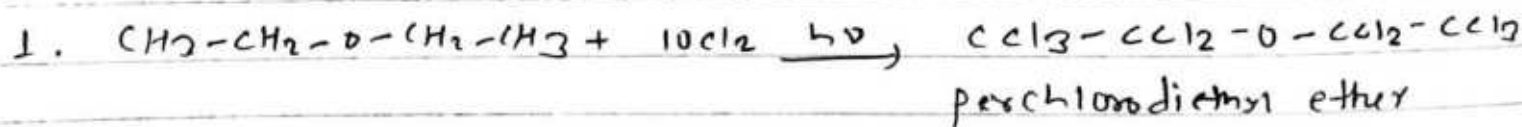
### ② Reaction with conc. HCl, conc. H<sub>2</sub>SO<sub>4</sub> (Formation of oxonium salt)



Diethyloxonium chloride



Diethyloxonium hydrogen sulphate

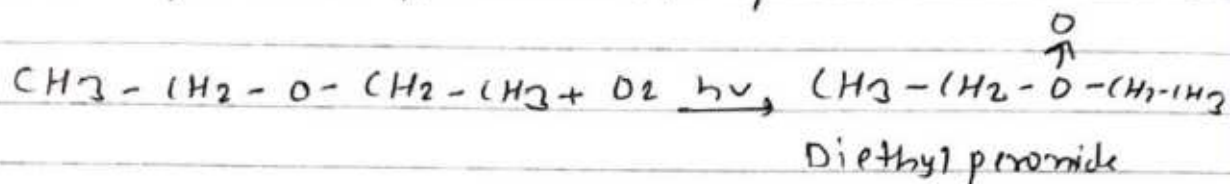


### 3. Reaction with air (formation of peroxide)

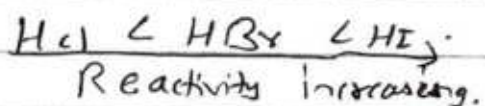
→ When ether is exposed to atmospheric air in presence of sunlight, it oxidizes to peroxide which is thermally unstable and explodes on heating so, very old sample of ether is not used for distillation purpose.



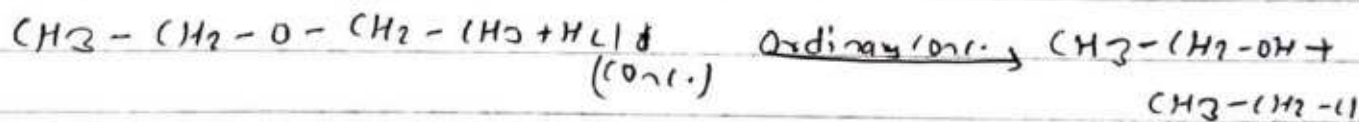
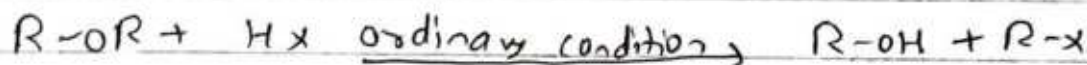
Iron wire is placed in the vessel containing ether to prevent formation of peroxide.



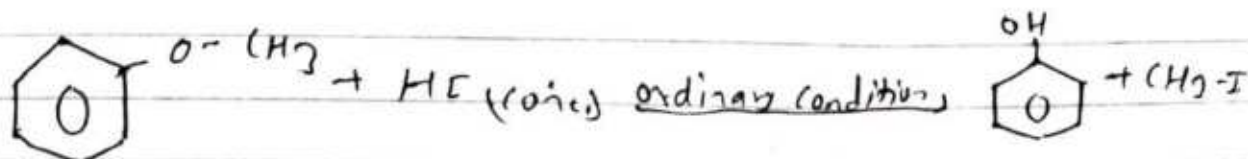
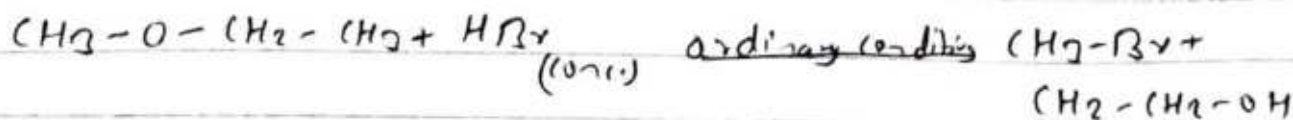
④ Reaction with hydrogen halide ( $\text{HX} = \text{HCl}, \text{HBr}, \text{HI}$ )



When ether is treated with hydrogen halide at ordinary condition alcohol and haloalkane are formed



✳ In case of unsymmetric ether, haloalkane with less number of carbon atom is formed.



But if tertiary alkyl group is present then tertiary haloalkane is formed.

