Alcohols, Phenols & Ethers

Introduction:

$$R-H \xrightarrow[+OH]{-H} R-OH$$

Alkane → Alcohol

Classification:

Monohydric → Containing one -OH group

CH_3-OH Methanol → 1° Alcohol

CH_3-CH_2-OH Ethanol → 1° Alcohol

$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$ Propan-2-ol (iso-propyl alcohol) → 2° Alcohol

$CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$ Butan-2-ol (Sec-butyl alcohol) → 2° Alcohol

$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-OH$ 2-methyl propan-2-ol (tert-butyl alcohol) → 3° Alcohol

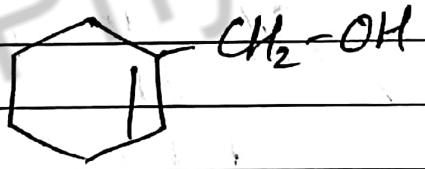
Polyhydric Alcohol ⇒ Containg more than one -OH group

CH_2-OH
|
CH_2-OH
ethan-1,2-diol
(Ethylene glycol)
(unstable)
(looses H_2O)

CH_2-OH
|
$CH-OH$
|
CH_2-OH
propan-1,2,3-trial
Glycerol
(unstable)
(looses H_2O)

Allylic Alcohol

$CH_2=CH-CH_2-OH$



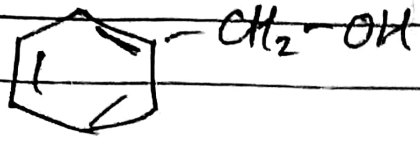
Vinylic Alcohol

→ ethenol

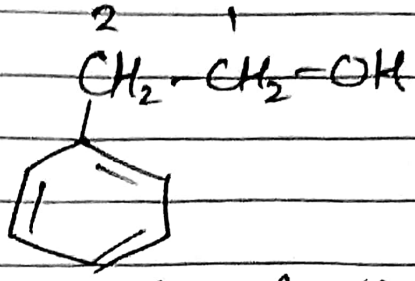
$CH_2=CH-OH$ (unstable)
changes to keto form
keto-enol tautomerism

$CH_2=CH$ (OH) $\rightleftharpoons$ $CH_3-C(=O)-H$
enol form — 1,3 H migration — keto form

Benzylic Alcohols

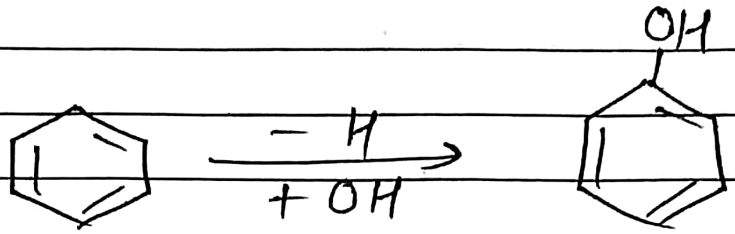


Phenyl methanol
(Benzyl Alcohol)



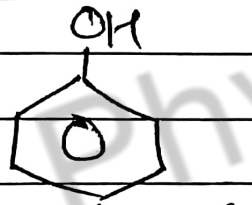
2-phenyl ethanol

Phenols

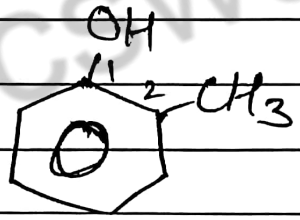


Benzene → phenol

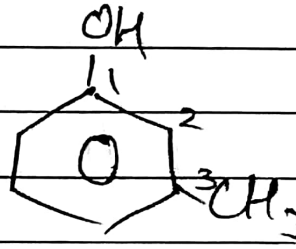
Monohydric Phenols



phenol

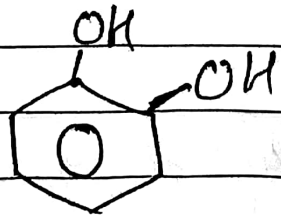


2-Methyl Phenol
(O-Cresol)

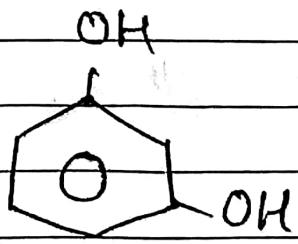


3-Methyl Phenol
(m-Cresol)

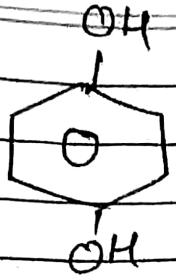
Polyhydric Phenols



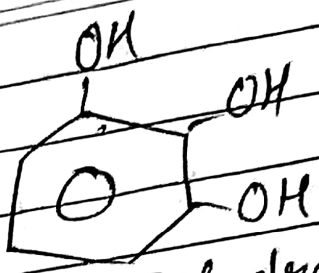
1,2-Dihydroxybenzene
(catechol)
Benzene-1,2-diol



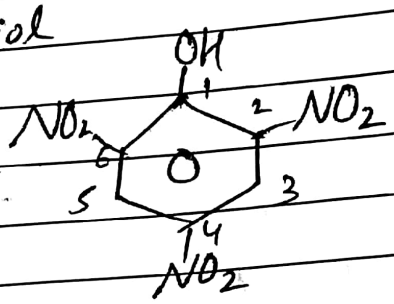
1,3-Dihydroxybenzene
(Resorcinol)
Benzene-1,3-diol



1,-4- Dihydroxy benzene
(Quinol)
— Benzene,-1,4-diol



1,2,3-Trihydroxy benzene
(pyro gallol)
Benzene-1,2,3-triol



2,4,6-trinitrophenol
(picric acid)

Ethers

R-O-R

Symmetric ethers

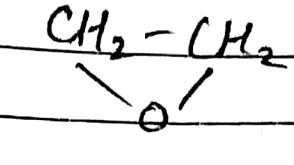
CH_3-O-CH_3
methoxy methane
dimethyl ether

$C_2H_5-O-C_2H_5$
ethoxy ethane
diethyl ether

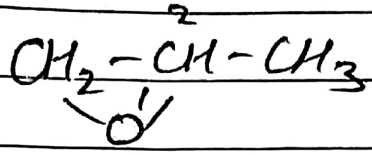
Unsymmetric ethers: $CH_3-O-C_2H_5$
methoxy ethane
ethyl methyl ether

$C_6H_5-O-CH_3$
methoxy benzene (Anisole)
Methyl phenyl ether

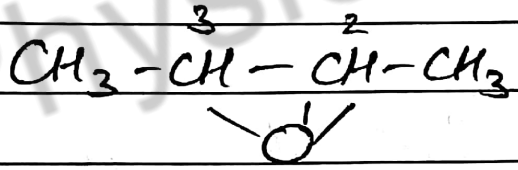
Cyclic ethers



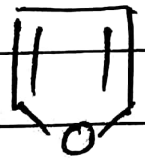
oxirane
(Epoxyethane)



2-Methyloxirane
(1,2-Epoxypropane)



2,3-Dimethyloxirane
(2,3-Epoxybutane)



Furan

Alcohols:

Preparation of Alcohols

① From Alkyl Halides: Reaction with aq. Alkalie or Moist AgOH

$$RX \xrightarrow[\text{OR}]{\text{aq. KOH}} R\text{-}OH$$
$$\xrightarrow[\text{OR}]{\text{aq. NaOH}}$$
$$\xrightarrow[]{\text{Moist AgOH}}$$

Nucleophilic substitution $\Longrightarrow$ ∵ Base is Strong
$\Rightarrow SN②$
$\Rightarrow$ Attack from Rear
$\Rightarrow$ Inversion of Configuratio

$$CH_3I + KOH_{(aq)} \longrightarrow CH_3OH + KI$$

$$CH_3\text{-}CH_2\text{-}Br + KOH_{(aq)} \longrightarrow CH_3\text{-}CH_2\text{-}OH + KBr$$

$$C_2H_5I + AgOH_{(Moist)} \longrightarrow C_2H_5OH + AgI$$

limitation: elimination also takes place side by side & hence alkene is also produced.
(Mainly for 3° Alkyl Halide)