Alcohol Phenol Ether

Page No.
Date

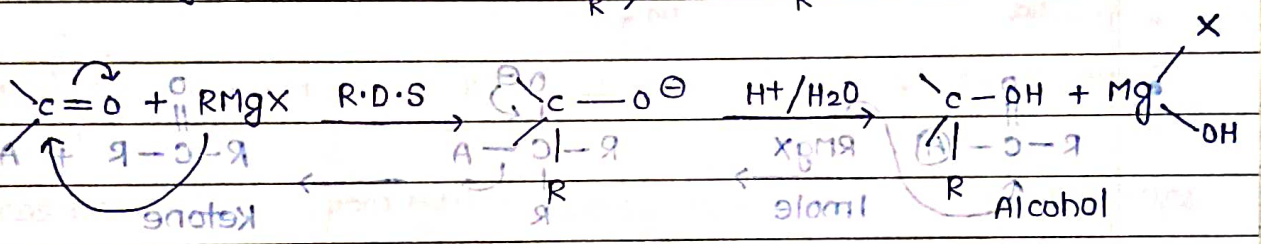
- Method of preparation:

① Grignard Reagent: $R-X + Mg \xrightarrow{\text{Dry ether}} RMgX$

Acid
H–O
H–S
H–C≡C
Base (dominating nature)

$R-MgX$ → Nucleophile

- From aldehyde and ketone



① Rate ∝ 've' charge on C-atom of aldehyde and ketone. ——— Variable

① – I effect group.

② Resonance ho.

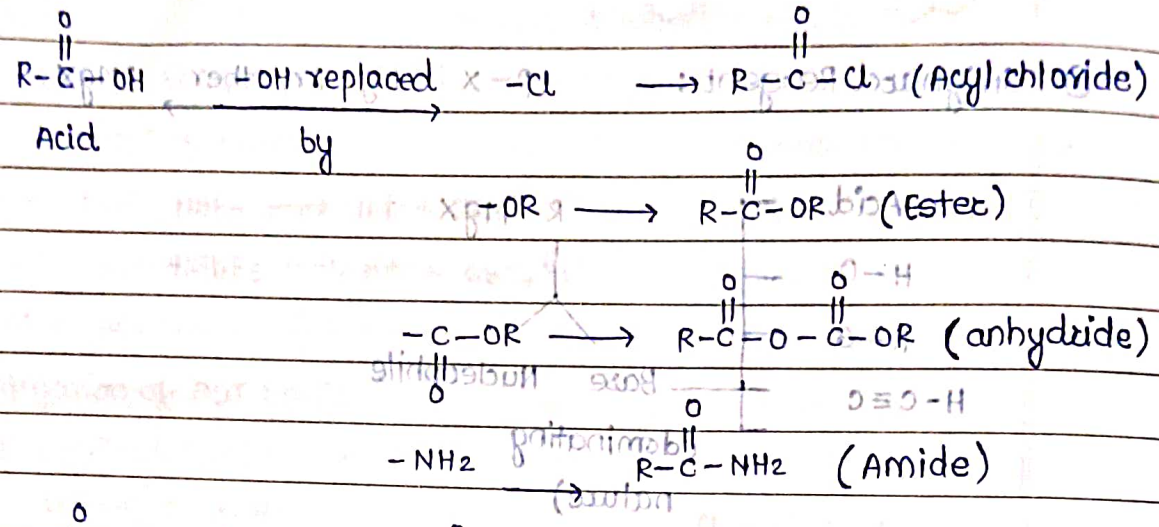
② Rate ∝ $\frac{1}{\text{steric hindrance}}$ (only alkyl group attach).

1° alcohol: $HCHO \xrightarrow{①\ RMgX} \xrightarrow{②\ H^+/H_2O} RCH_2OH$

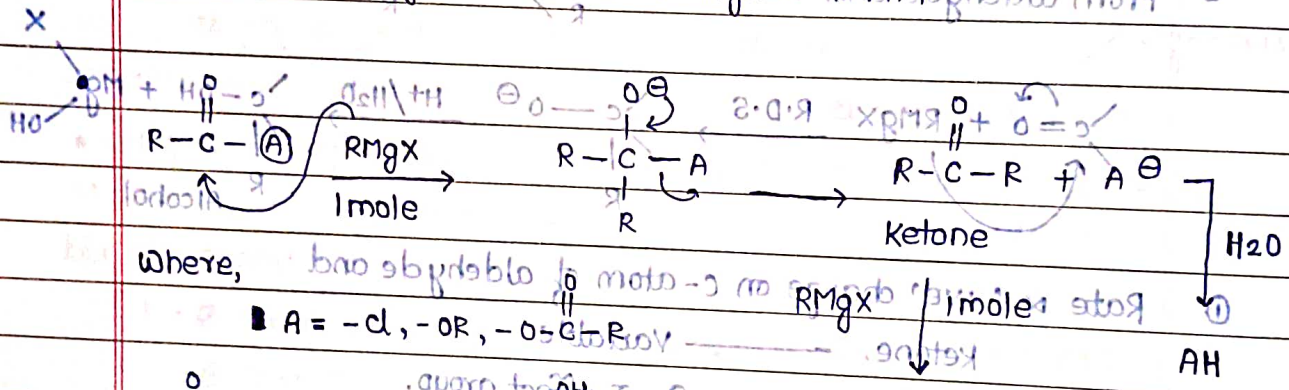
2° alcohol: $R-CHO \xrightarrow{①\ RMgX} \xrightarrow{②\ H^+/H_2O} R-CH(OH)-R$

3° alcohol: $R-CO-R \xrightarrow{①\ RMgX} \xrightarrow{②\ H^+/H_2O} R-C(OH)-R$

- From Acid and Acid Derivative :



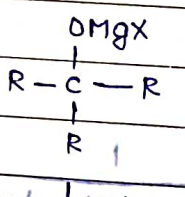
- $R-C(=O)-OH + RMgX \longrightarrow R-C(=O)-O^{\ominus}MgX^{+} + RH\uparrow$



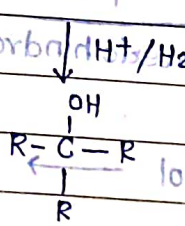
Where,

- A = -Cl, -OR, $-O-C(=O)-R$

- $R-C(=O)-Cl + R'MgX \xrightarrow{2\text{mole}} R-C(OH)(R')-R' + ROH$



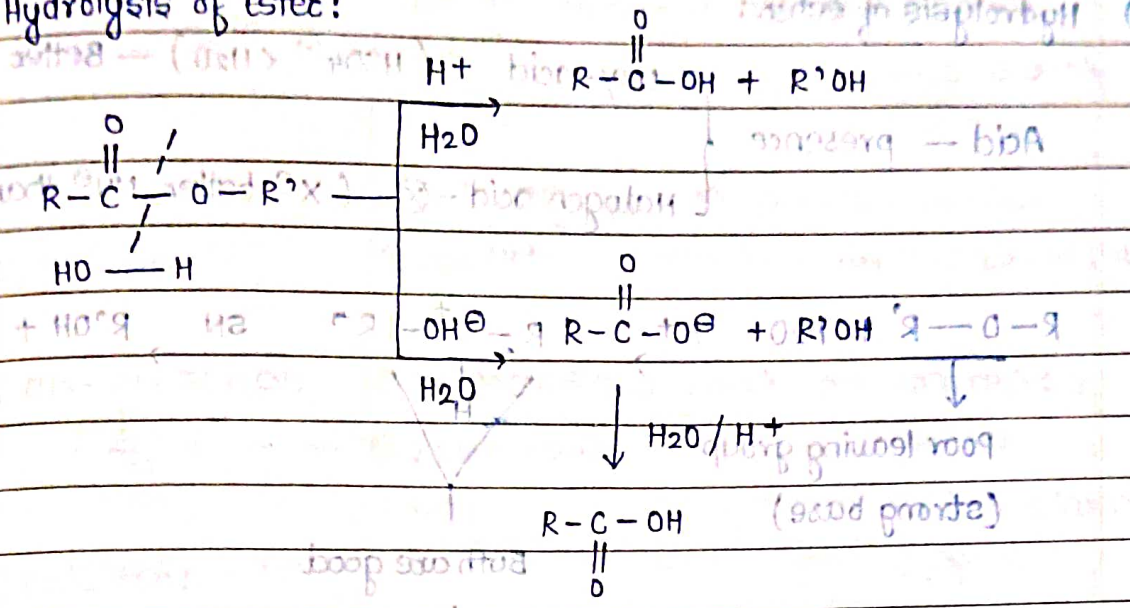
- $R-C(=O)-OR + R'MgX \xrightarrow{2\text{mole}} R-C(OH)(R')-R' + ROH$



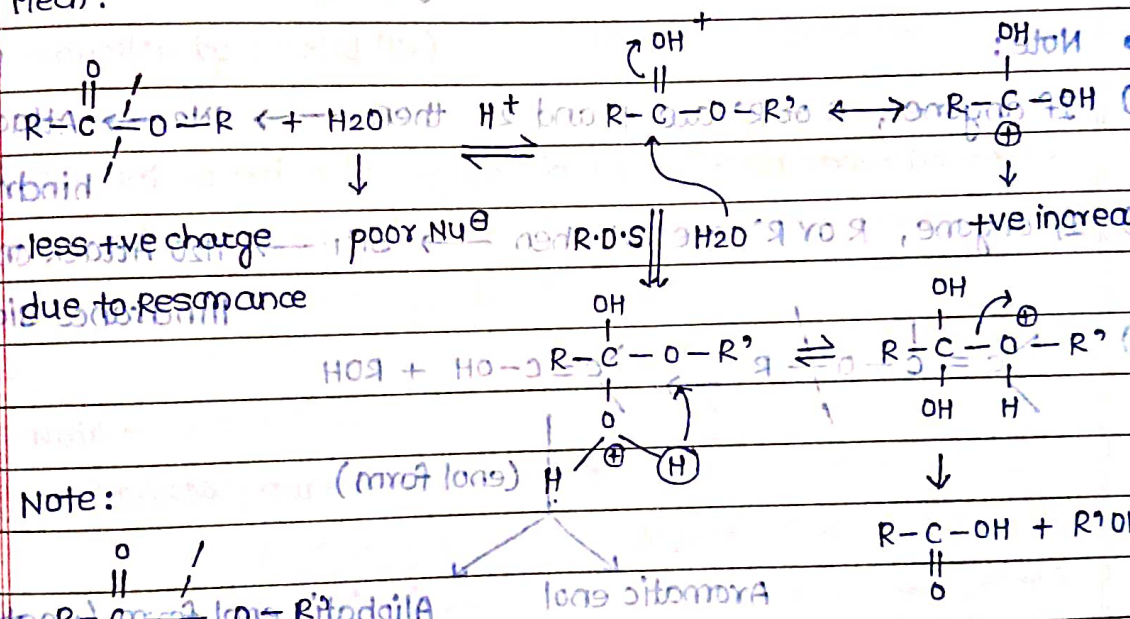
- $R-C(=O)-O-C(=O)-R \xrightarrow[H_2O/H^+]{2R'MgX} R-C(OH)(R')-R' + R-COOH$

(2) Hydrolysis of Ester and Ether :

(a) Hydrolysis of Ester:



- Mech:



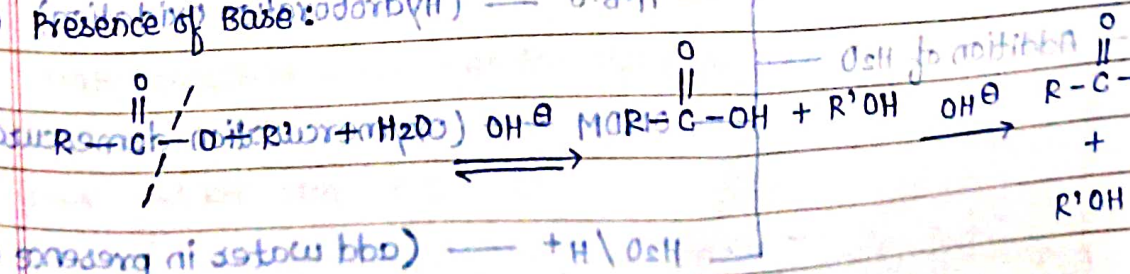
- Note:

① Acid to Alcohol

② Rate ∝ 1 / hindrance.

③ Rate ∝ +ve charge of C-atom.

(b) Presence of Base:



(c) Hydrolysis of ester :

Acid — presence { oxy-acid ($HSO_4^{\ominus}$ < H_2O) — Better H_2O Nucleophile
Halogen acid — ⊗ ($X^{\ominus}$ better $Nu^{\ominus}$ than H_2O)

$R-O-R' + H_2O \xrightarrow{H^+} R-O^+(H)-R' \xrightarrow{SN} R'OH + ROH$

Poor leaving group (strong base)

Both are good leaving group.

- Note :

① If anyone, R or R' are 1° and 2° then → S_N2 → H_2O Attack on less hindrance side

② If anyone, R or R' are 3° then → S_N1 → H_2O Attack on more Hindrance side.

③ $R-C(H)(OH)-C(=O)-R \rightarrow R-O-C(=CH_2)-OH + ROH$ (enol form)

Aromatic enol — Stable

Aliphatic enol form (unstable) — convert in keto form → $CH_3-C(=O)-$

(3) By alkene.

Addition of H_2O —
- $H\cdot B\cdot O$ — (Hydroboration oxidation)
- OMDM (oxymercuration-demercuration)
- H_2O/H^+ — (add water in presence of oxy acid.)

Page No.
Date

Q.

$CH_3 - C(OH)(CH_3) - CH_2 - CH_3$ — 3° alcohol.

$CH_3 - CH = CH_2$ (CH3) ① B_2H_6 / THF (A·M·R) ② H_2O / H^+ → $CH_3 - CH(CH_3) - CH_2 - OH$ — 1° alcohol

$CH_3 - CH(CH_3) - CH = CH_2$ ① $Hg(OOCCH_3)/H_2O$ (M·R) ② $NaBH_4$ / $OH^\ominus$ → $CH_3 - CH(CH_3) - CH(OH) - CH_3$ — 2° alcohol.

- Reduction:

① Reduction by (Metal / H_2)

" Metal ka hai sabhi pyaare, Pr Pd hai kuch khaas humare, ye Ru-C but Cu-Ba-Cr oxide hi krte hain acid (-COOH) ko alcohol mein convert pyaare. "

- Note:

① Pd / $BaSO_4$, qunoline solvent : $-C(=O)-Cl \longrightarrow -C(=O)-H$

Acyl chloride → Aldehyde.

(Rosenmund's Reduction)

② Pd / $BaSO_4$, quinoline : Alkyne → cis → Alkene.

or

Pd / $CaCO_3$, quinoline (Lindlar's catalyst)

② $NaBH_4$ / C_2H_5OH — Sodium Boro hydrates

→ Al ka ka A C

Aldehyde Ketone Acyl chloride ko reduce krta hai only.

Page No. | Date

$RCHO \longrightarrow R-CH_2OH$ $\qquad R-\overset{O}{\overset{||}{C}}-Cl \longrightarrow R-CH_2OH$

$R_2C=O \longrightarrow R_2CHOH$

③ B_2H_6 / THF —— Diborane

Diborane ka A.C. nahi hai → ON

- .lodo Acyl chloride $\left(-\overset{O}{\overset{||}{C}}-Cl\right)$
- Nitro group (NO_2)
- Oxime group ($>C=N-OH$)

Does not Reduce.

④ $LiAlH_4$ / Ether or L.A.H → all Functional group are reduced by L.A.H

• Clemmensen Reduction

$>C=O \xrightarrow{Zn-Hg\,/\,HCl} >CH_2$ —— (Best acidic condition)

• Wolf-kisner Reduction

$>C=O \xrightarrow[OH^{\ominus}]{NH_2-NH_2} >CH_2$ —— (Best Basic condition)

• Reduction clue :

① C-atom ko atleast one oxygen atom attached then it is converted to alcohol.

$R-CHO \longrightarrow RCH_2OH$ $\qquad RCOOH \longrightarrow RCH_2OH$

$R_2C=O \longrightarrow R_2CH-OH$ $\qquad R-\overset{O}{\overset{||}{C}}-O-\overset{O}{\overset{||}{C}}-R \longrightarrow 2\,RCH_2OH$

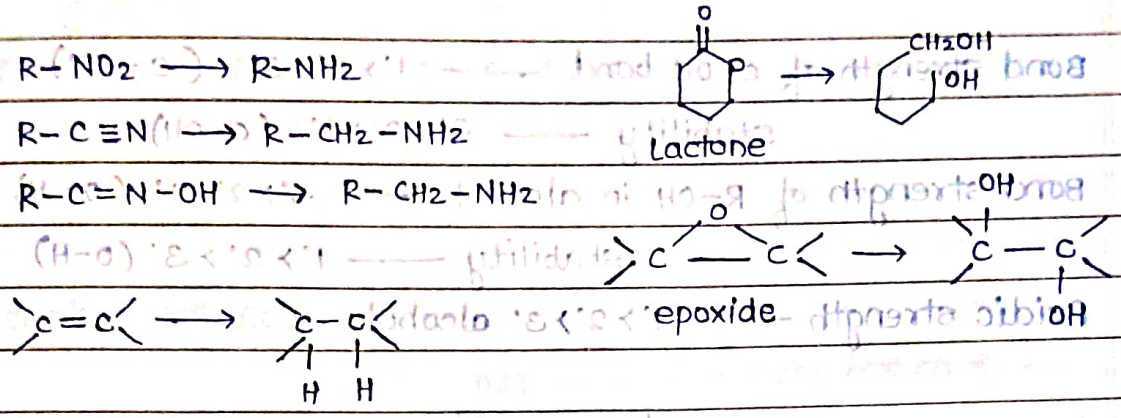
$R-\overset{O}{\overset{||}{C}}-Cl \longrightarrow RCH_2OH$ $\qquad R-\overset{O}{\overset{||}{C}}-NH_2 \longrightarrow R-CH_2-NH_2$

② If any nitrogen is present then directly convert it into NH_2.

$R-NO_2 \longrightarrow R-NH_2$

$R-C\equiv N \longrightarrow R-CH_2-NH_2$

$R-C=N-OH \longrightarrow R-CH_2-NH_2$



$-C\equiv C- \longrightarrow CH_3-CH_3$

$R-X \longrightarrow R-H$

- M·O·P By Nitrous acid:

HNO_2 — Nitrous acid → unstable.

↓

using $(NaNO_2 + HCl) \longrightarrow HNO_2 + NaCl$

$-NH_2 + HNO_2 \xrightarrow{0-05^\circ C} -\overset{\oplus}{N_2}\overset{\ominus}{-Cl}$ Diazonium Salt

($NaNO_2$ + HCl)

$R-\overset{\oplus}{N_2}\overset{\ominus}{Cl} \longrightarrow R^{\oplus}$

Aliphatic diazonium salt (unstable)

Aromatic Diazonium (stable – 0'-5'C)

- $R-NH_2 \xrightarrow[0-5^\circ C]{NaNO_2+HCl} R-N_2Cl \longrightarrow R^{\oplus} \xrightarrow{H_2O} R-OH$ Alcohol.

↓ Rearrangement

Krta hain.

- Physical properties:

① 1'- 4 number alcohol — highly soluble in water — Due to hydrogen bonding.

② Boiling point ∝ No. of -OH group.

③ Boiling point ∝ $\frac{1}{\text{Branch}}$ (M.wt → constant

No. of OH group → same)

- **chemical properties :**

① Bond strength of C–OH bond —— 1° > 2° > 3° (C–OH)
stability —— 3° > 2° > 1° (C–OH)

② Bond strength of R–OH in alcohol. —— 3° > 2° > 1° (O–H)
stability —— 1° > 2° > 3° (O–H)

③ Acidic strength —— 1° > 2° > 3° alcohol.

- **Concept:** R —[O — H]→ ① Active Hydrogen —— Basic condn mein acid-Base Rxn krta hain

② Poor L.G.

③ Nucleophile nature.

H+ or lewis acid get convected to good L.G and then occurs in SN and E reaction.

① $R-\ddot{O}H + H^+ \longrightarrow R-\overset{+}{O}(H)-H \longrightarrow R^+ + H_2O$ — Neutral stable molecule.

① Reaction of 'H' of alcohol.

R – O – H with:

- Na → $R-O^-Na^+ + H_2\uparrow$
- NaOH → $R-ONa + H_2O$
- NaH → $RONa + H_2\uparrow$
- CH_3MgBr → $ROMgBr + CH_4$
- $CH_3C\equiv C^-Na^+$ → $CH_3C\equiv CH + RO^-Na^+$
- $NaNH_2$ → $NH_3 + RONa$.

② Nucleophilic nature of alcohol (R-OH)

$R-\overset{O}{\overset{\|}{C}}-H + R'-OH \longrightarrow R-\overset{OH}{\overset{|}{C}}-H$ (with OR' on C)

$R-\overset{O}{\overset{\|}{C}}-R + R'-OH \longrightarrow R-\overset{OH}{\overset{|}{C}}-R$ (with OR' on C).

$R-\overset{O}{\overset{\|}{C}}-Cl + R'-OH \longrightarrow R-\overset{O}{\overset{\|}{C}}-OR'$ (ester)

$R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R \longrightarrow R-\overset{O}{\overset{\|}{C}}-OR'$

$R-\overset{O}{\overset{\|}{C}}-OR \longrightarrow R-\overset{O}{\overset{\|}{C}}-OR'$

③ Reaction with Acid

Alcohol →

- $\overset{+}{H_2O}$ oxy-acid → dehydration of Alcohol → alkene
  - $H_2SO_4 \longrightarrow H^+ + HSO_4^{\ominus}$
  - $H_3PO_4 \longrightarrow H^+ + H_2PO_4^{\ominus}$
  - $HSO_4^{\ominus}$ → Behaves as a Bulky Base.
- $\overset{+}{H_2O}$ Halogen acid → substitution Reaction → alkyl halide
  - $HX \longrightarrow H^+ + X^{\ominus}$
  - (HI > HBr > HCl > HF)
  - Reason → $X^{\ominus} > H_2O$ → $Nu^{\ominus}$ Better $Nu^{\ominus}$ in compare to H_2O.

• $CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-OH + H^+ \longrightarrow CH_3-\underset{CH_3}{\underset{|}{CH}}-\overset{\oplus}{CH_2} \longrightarrow CH_3-\underset{CH_3}{\underset{|}{\overset{\oplus}{C}}}-CH_3$

$X^{\ominus}$ (Nu^-) → Subs. RXN → $CH_3-\underset{CH_3}{\underset{|}{\overset{|}{C}}}-CH_3$

$HSO_4^{\ominus}$ (Base) → Elimination → $CH_3-\underset{CH_2}{\underset{\|}{C}}-CH_3$

• Reactivity ∝ stability of carbocation

Rate of dehydration
Reactivity order with HBr } ∝ stability of carbocation.

• Note : $-\overset{|}{C}=\overset{|}{C}-OH \longrightarrow$ Never do dehydration or substitution rxn. Due to partial double bond character.

• Reaction with PCl_3 or Red P/Cl_2, PCl_5 or $SOCl_2$ → Alkyl halide ke MOP me bataya hain.

$R-O-H + PCl_5 \xrightarrow[Cl]{SN_2} R-Cl + POCl_3$

- Oxidation of alcohol.

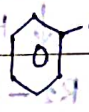
	$R-CH_2OH \rightarrow$	$R-CH_2OH \rightarrow$	$R-CH(OH)-R \rightarrow$
	$RCOOH$	$RCHO$	$R-C(=O)-R$
① Acidic $KMnO_4$ (strong O.A)	(✓)	(X)	(✓)
$MnO_4^{\ominus} \rightarrow Mn^{+2}$			
Purple colourless			
② Acidic $K_2Cr_2O_7$ (strong O.A.)	(✓)	(X)	(✓)
$Cr_2O_7^{-2} \rightarrow Cr^{+3}$			Note: t-alcohol convert in alkene.
Orange green			
③ Jone's Reagent - Acidic chromic acid soln	(✓)	(X)	(✓)
$CrO_3 + H_2O \rightarrow H_2CrO_4$ or $CrO_3/H_2O/H^+$			
④ PCC : Pyridinium chloro chromate in CH_2Cl_2 solvent (selective Reagent)	(X)	(✓)	(✓)
⑤ PDC : Pyridinium dichromate $\left(\text{C}_5\text{H}_5\text{NH}^+\right)_2 Cr_2O_7$ Sarett's Reagent	(X)	(✓)	(✓)
Sarett's Reagent in CH_2Cl_2 solvent is known as collins Reagent			
⑥ Cu-powder / 300°C (Test of 1°, 2° and 3° Alcohol)	(X)	(✓)	(✓)
			Note: t-alcohol convert into Alkene.

$R-CH_2-OH \xrightarrow[300^\circ C]{Cu} RCHO \xrightarrow[300^\circ C]{Cu} R_2CHOH \xrightarrow[300^\circ C]{Cu} R_2C=O$

$R_3C-OH \xrightarrow[300^\circ C]{Cu} R_2C=CH_2$

Note: MnO_2 — oxidising agent

— selective oxidising agent for Allylic and Benzylic position.

$CH=CH-CH(OH)-$ (Allylic) $\quad$  CH_2- (Benzylic)

1° alcohol — $-CHO$

2° alcohol — $>C=O$

- Test of Alcohol:

① Lucas Reagent

$ZnCl_2$ / conc. HCl solution — L.R.

$R-OH + ZnCl_2 \longrightarrow R^{\oplus} \xrightarrow{Cl^{\ominus}} R-Cl$

(L.B) (L.A) carbocation Alkyl halide

(White cloud form hota hain)

1°-Alcohol $\xrightarrow[HCl]{ZnCl_2}$ No rxn at room temperature

(Does not form white cloud)

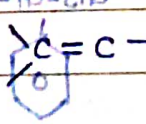
in high temp $\longrightarrow$ white cloud form.

2°-Alcohol $\xrightarrow[HCl]{ZnCl_2}$ White cloud form after 3-5 minutes.

3°-Alcohol $\xrightarrow{ZnCl_2}$ White cloud form within 1-2 minutes.

$\xrightarrow{HCl}$

- Reactivity of L.R with alcohol $\propto$ stability of carbocation.

(Note:  — L.R — No rxn)

- Victor-Mayer test: R — B — C

1° 2° 3°

$R-CH_2-OH$	$R-CH(R')-OH$	$R-C(R)(R)-OH$
$\downarrow P/I_2$	$\downarrow P/I_2$	$\downarrow P/I_2$
$R-CH_2-I$	$R-CH(R)-I$	$R-C(R)(R)-I$
$\downarrow AgNO_2$	$\downarrow AgNO_2$	$\downarrow AgNO_2$
$R-CH_2-NO_2$	$R_2-CH-NO_2$	R_3C-NO_2
$\downarrow HNO_2$	$\downarrow HNO_2$	$\downarrow HNO_2$
$R-C(H)=N-OH$	$R_2-C(NO)-NO_2$	No rxn.
(Nitrolic Acid)		
$\downarrow NaOH$	$\downarrow NaOH$	Colourless.
Red colour	Blue colour	

Phenol

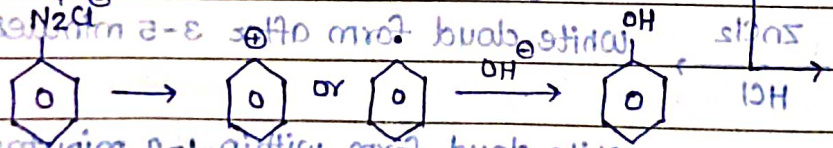
- Method of preparation:

(① Diazonium salt)

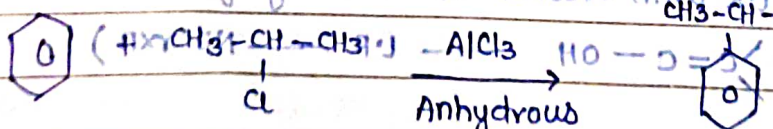
$R-N_2^{+}Cl^{-}$ – Unstable.

$-NH_2 \xrightarrow[(NaNO_2+HCl)]{HNO_2,\ 0-5^{\circ}C} -N_2^{+}Cl^{-}$

$Ar-N_2^{+}Cl^{-}$ — stable at $0^{\circ}C-5^{\circ}C$



② Air oxidation of cumene further catalysed by Acid.



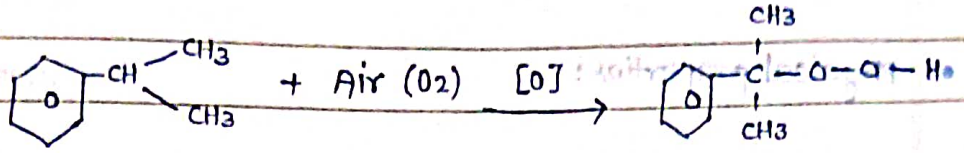
Isopropyl Benzene (cumene)

$CH_3-\overset{\oplus}{C}H-CH_3 + AlCl_4^{\ominus}$

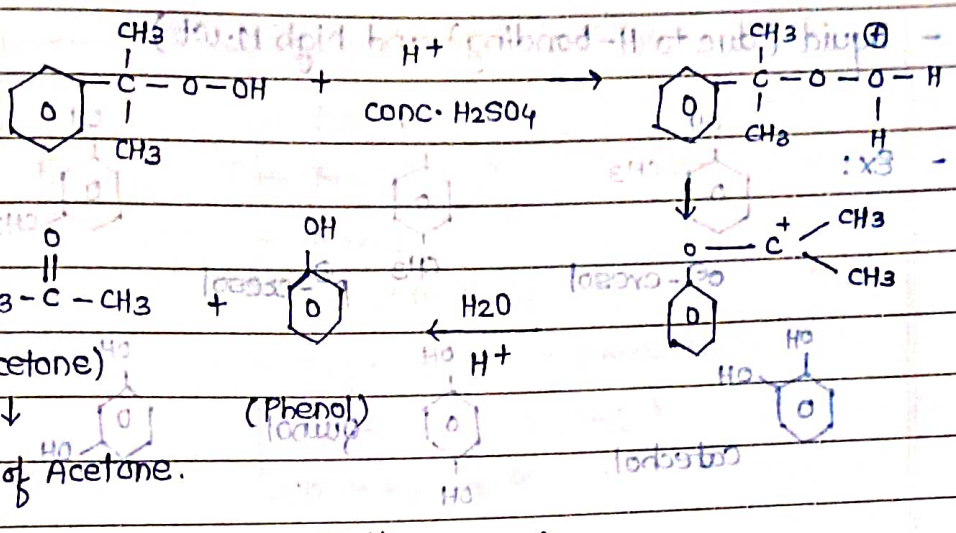
(E^{+})

Page No.
Date

- **Step I:**

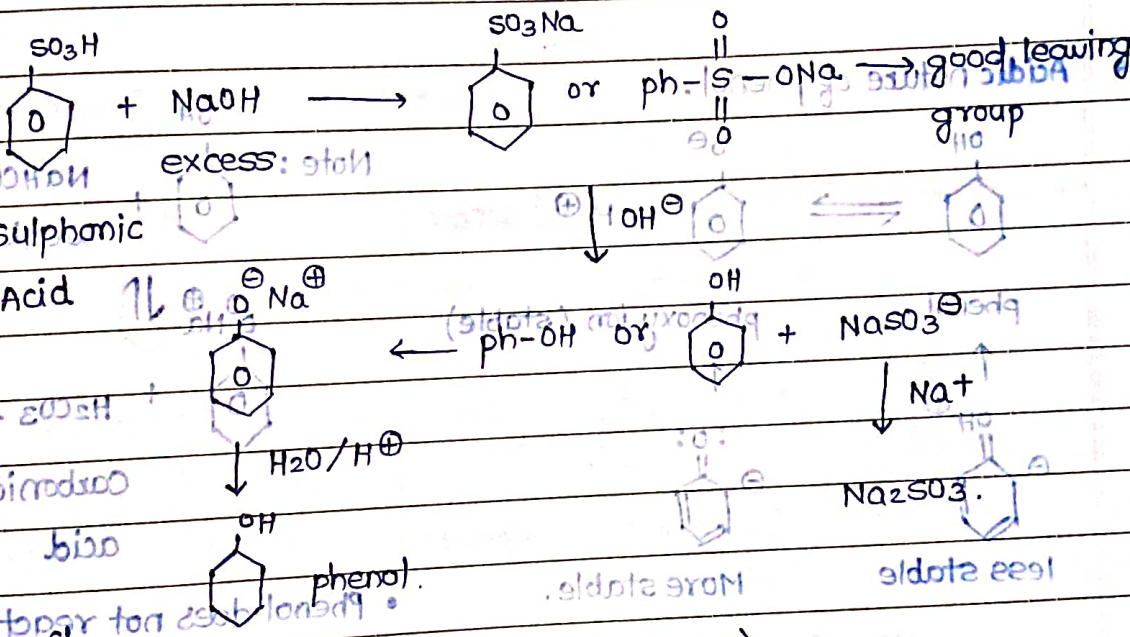


- **Step II:**

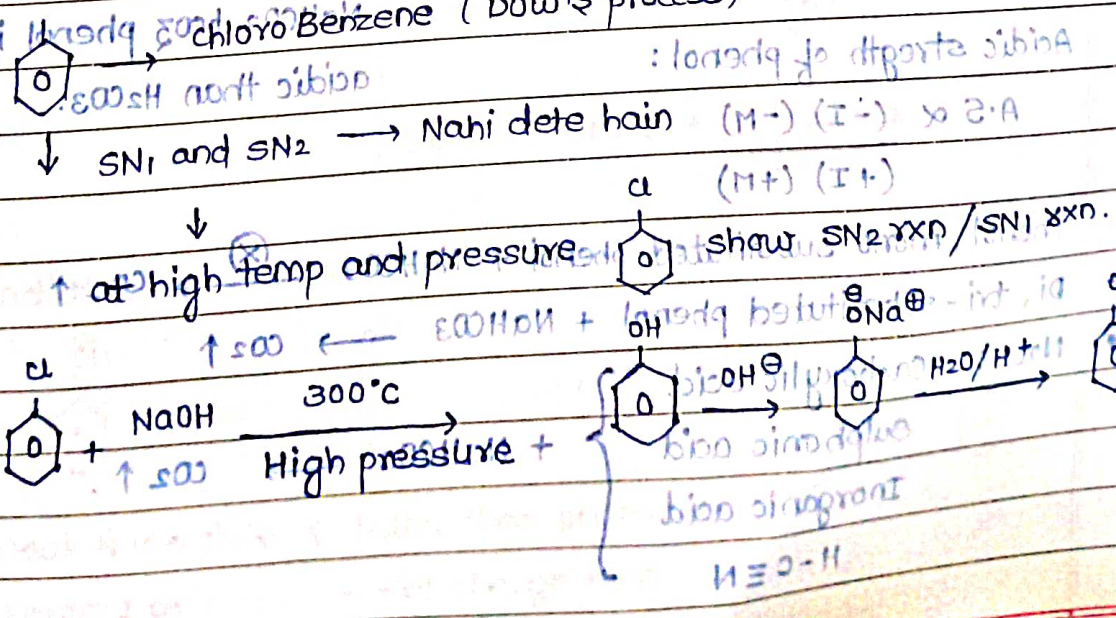


M.O.P of Acetone.

③



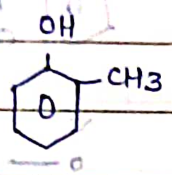
④



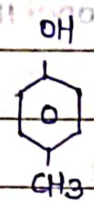
- **Physical properties:**

- liquid (due to H-bonding) and high M.wt)

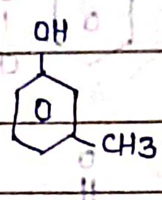
- Ex:



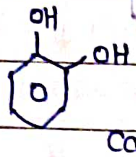
o-cresol



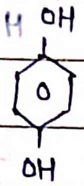
p-cresol



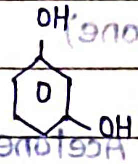
m-cresol



catechol

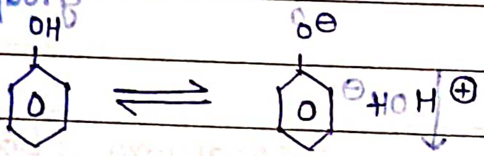


quinol

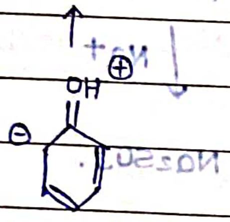


Resol crenol.

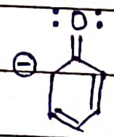
- **Acidic nature of phenol:**



phenol ⇌ phenoxy ion (stable) + $H^{\oplus}$



less stable



More stable.

Note:

+ $NaHCO_3$ (weak Base)

Acid ⇅

+ H_2CO_3 (Carbonic acid) → H_2O + $CO_2\uparrow$

- Phenol does not react with $NaHCO_3$ bcoz phenol is less acidic than H_2CO_3.

- **Acidic stregth of phenol:**

$$A.S \propto \frac{(-I)\ (-M)}{(+I)\ (+M)}$$

- Phenol, mono substituted phenol + $NaHCO_3$ ⊗→ $CO_2\uparrow$
- Di, tri-substituted phenol + $NaHCO_3$ ⟶ $CO_2\uparrow$
- Note: Carboxylic acid, Sulphonic acid, Inorganic acid, H−C≡N } + $NaHCO_3$ ⟶ $CO_2\uparrow$.

Page No.
Date

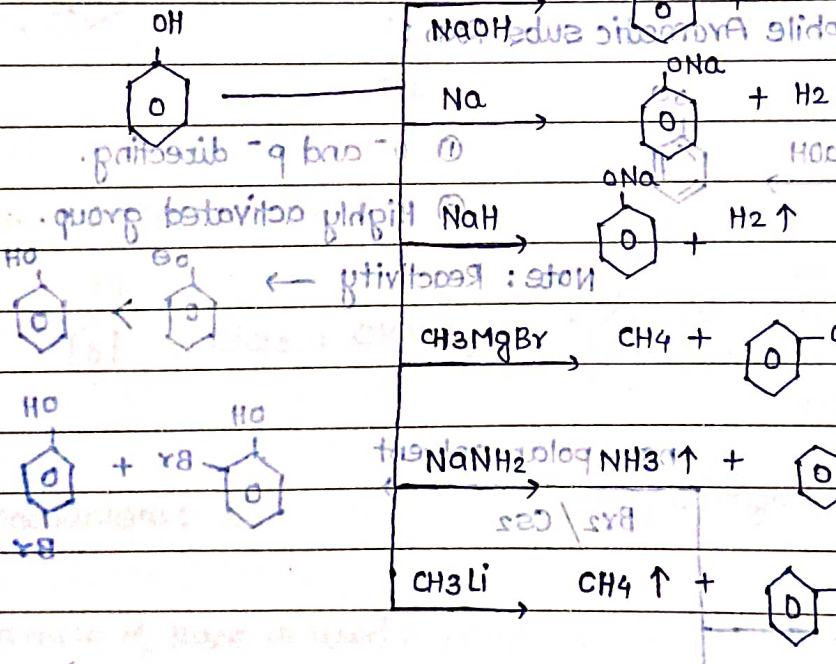
- Chemical properties:

lone pair (Nu⁻) — O — H → Weak Acidic Hydrogen.

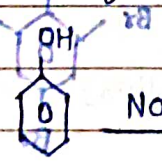
Aromatic Substitution Reaction

- Basic condition
- Base
- Metal
- Metal Hydride
- Organometallic compound — (RMgX) (RLi) (R_2Cu)
- $R-C\equiv C^{\ominus}\ Na^{\oplus}$ Acetylide.

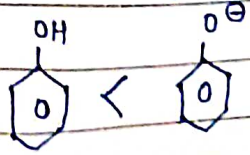
① Reaction of H-atom of phenol.



② Reaction of Nucleophilic nature of phenol



$Nu^{\ominus}$ strength:

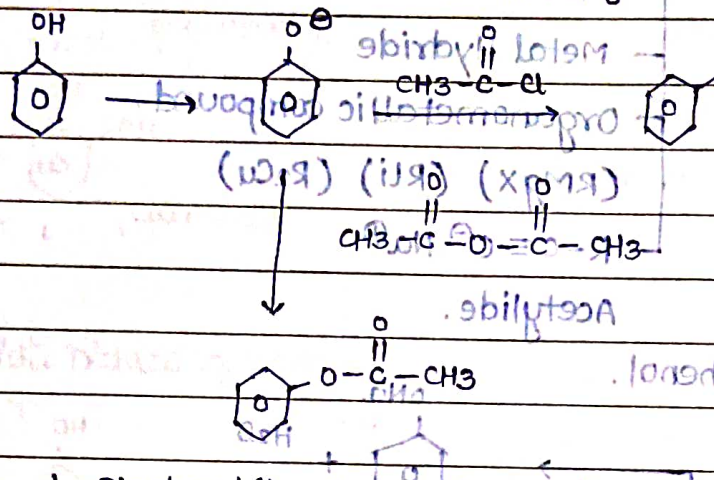


Weak Nucleophile < Better than phenol

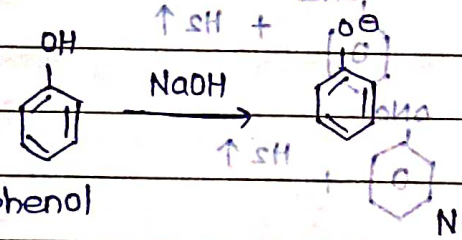
- (Resonance)
- -ve charge hain.
- Bulky

- **Acylation of phenol:**
  - Addition of $CH_3-\overset{\overset{O}{\|}}{C}-$ group (Acyl group)
  - Two Reagents are used:

① $R-\overset{\overset{O}{\|}}{C}-Cl$ ② $R-\overset{\overset{O}{\|}}{C}-O-\overset{\overset{O}{\|}}{C}-R$



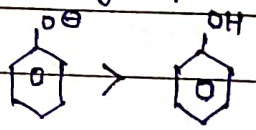
- **Rxn of Electrophile Aromatic subs Rxn:**



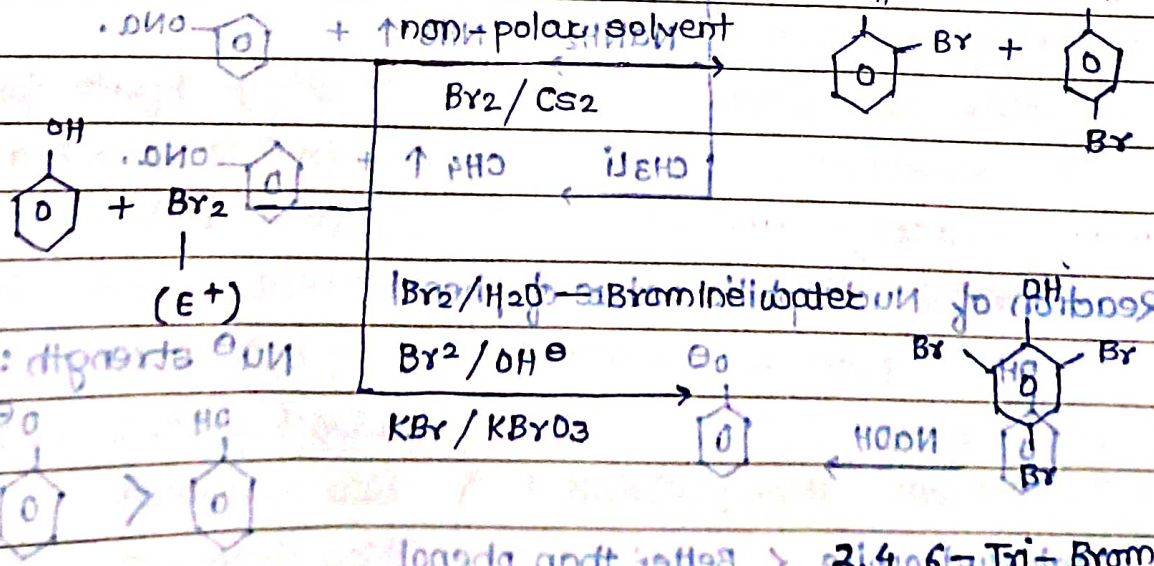
① O^- and p^- directing.

② Highly activated group.

Note: Reactivity →

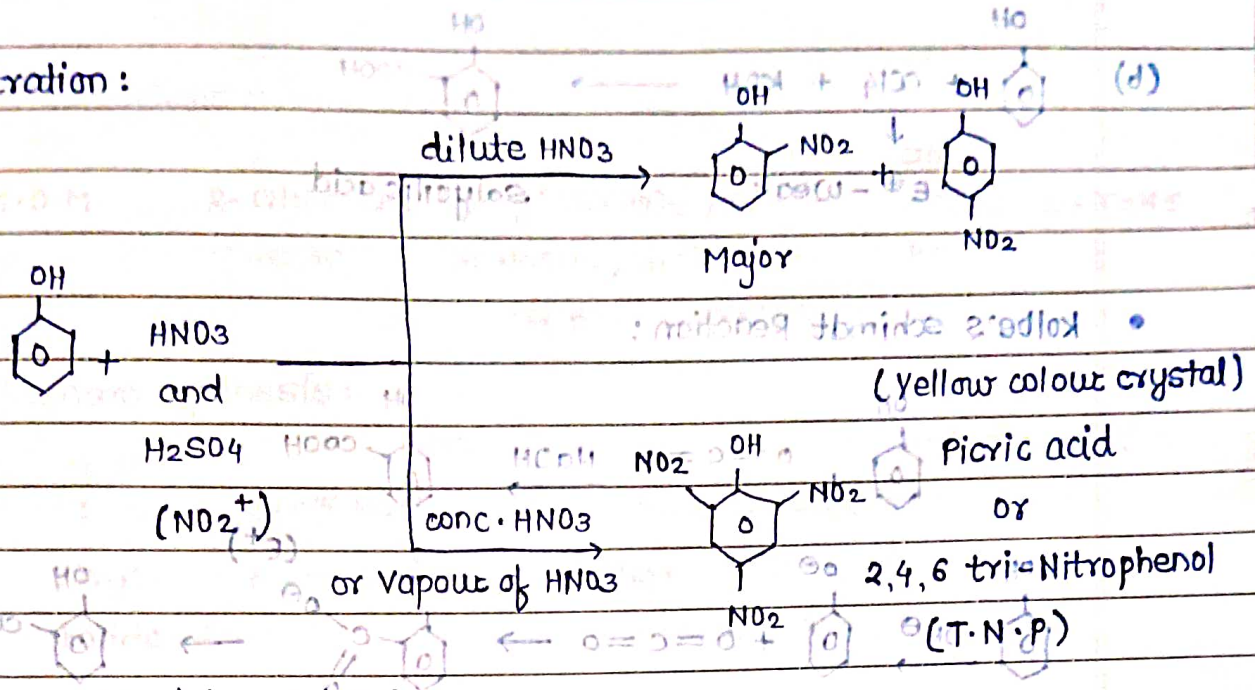


- **Halogenation:**

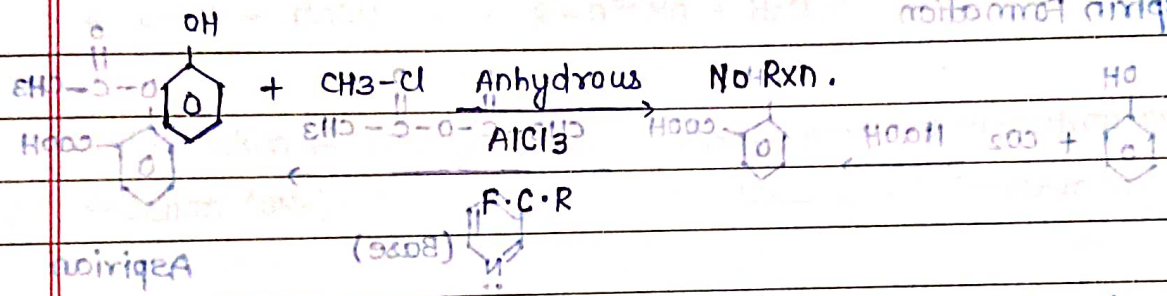


2,4,6-Tri-Bromo-phenol (White ppt ↓)

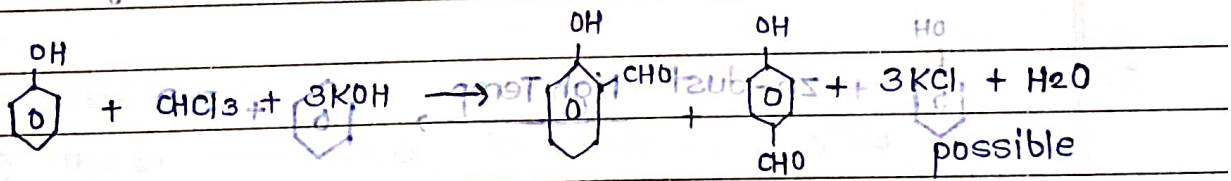
- **Nitration :**



- **Note:** phenol does not F.C.R

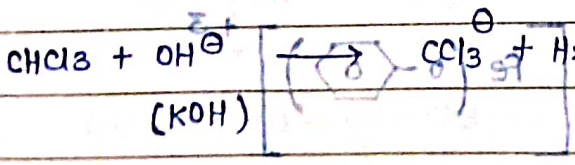


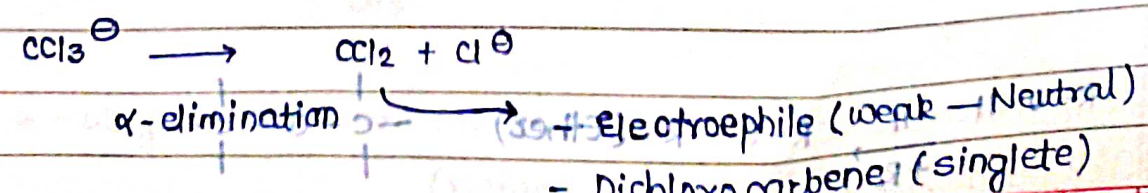
- **Riemer - Teimann Reaction :**

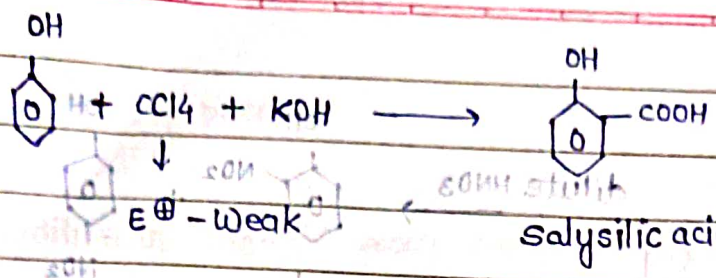


- **Mechanism :**

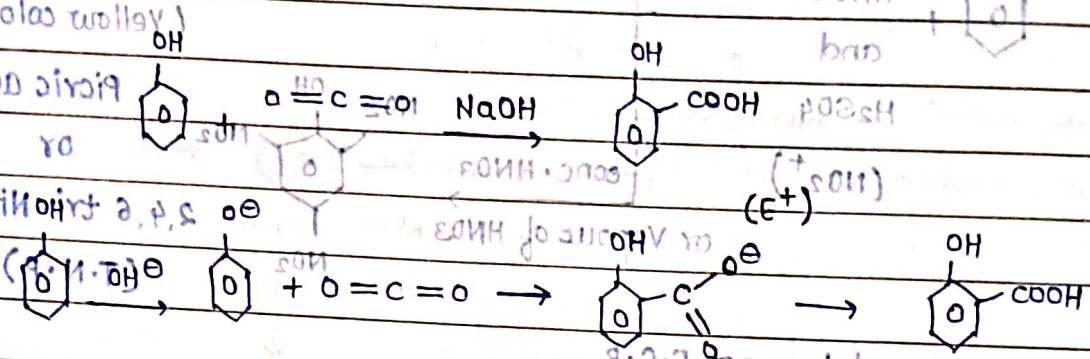
① 3 mole of Base is used



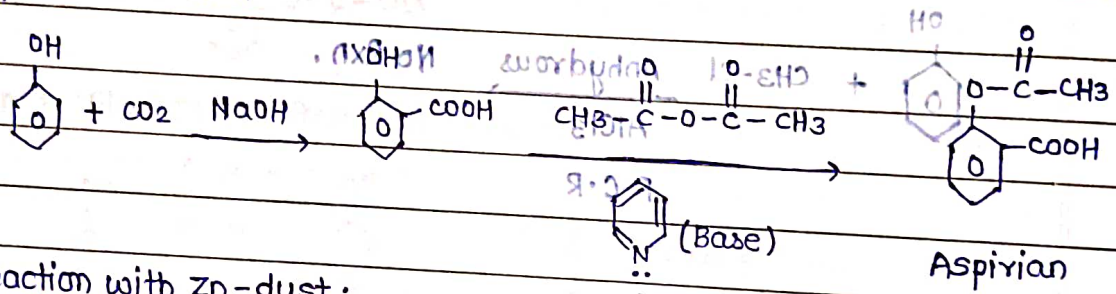


(b) 

- Kolbe's schimdt Reaction:

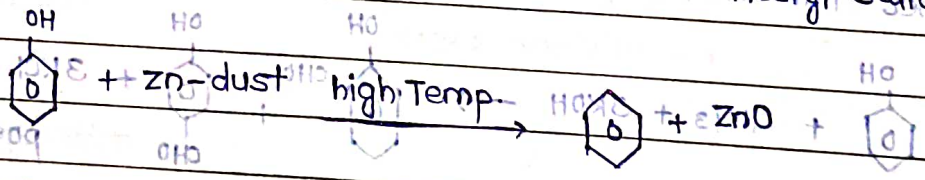


- Aspirin Formation

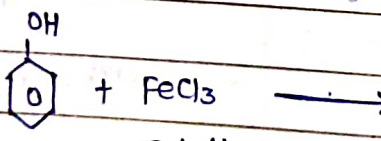


- Reaction with Zn-dust:

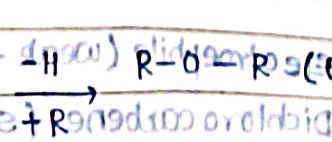
Acetyl Salicylic acid



- Test of phenol:

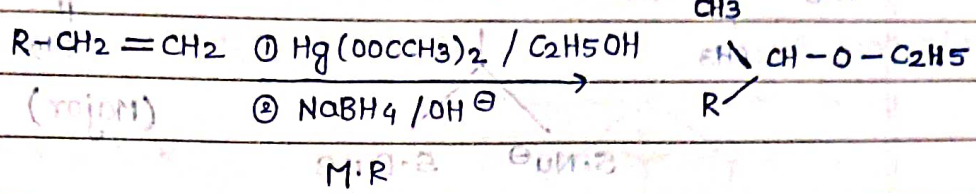


- Ether:

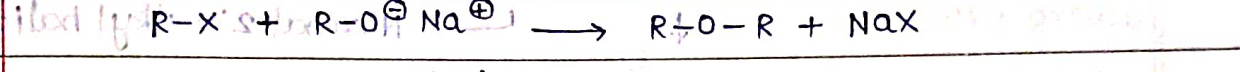


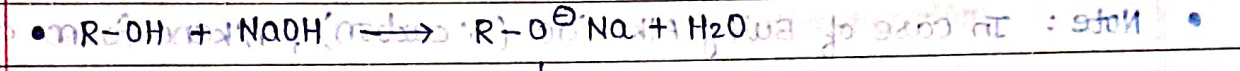
- M·O·P :

① O·M·D·M



② Williamson synthesis :





Substitution ← Strong Nu⊖ Reaction (SN_2)

Strong Base – Elimination RXN (E_2) → steric hindrance

(a) Ether Formation :

Note : Alkyl halide

① CH_3-Br —— always form ether —— $R-O^{\ominus}Na + CH_3Br$

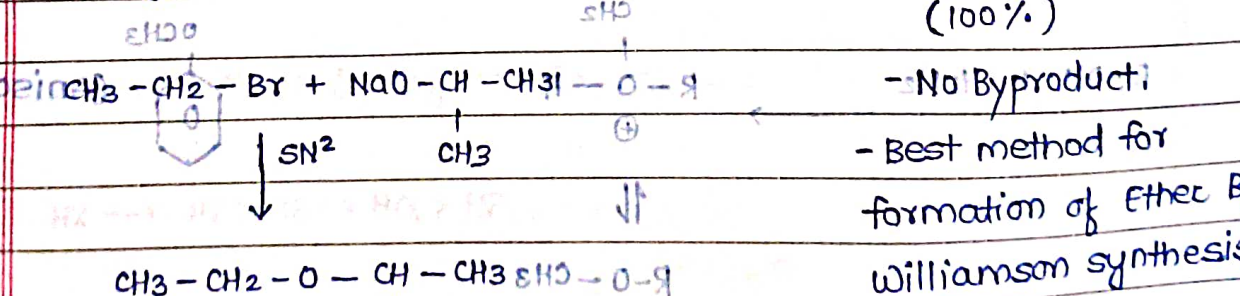
↓

$R-O-CH_3 + NaBr$ ③

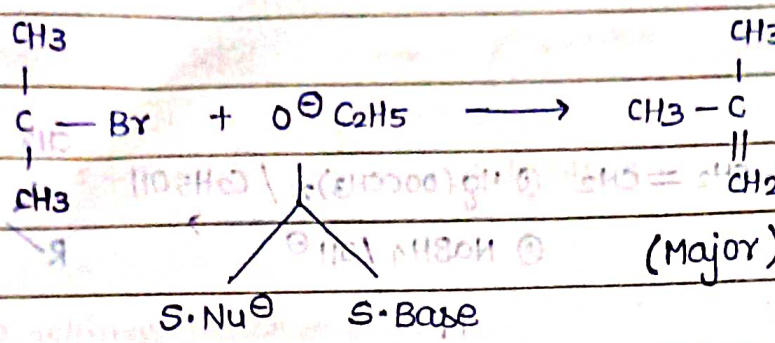
(100%)

- No Byproduct
- Best method for formation of Ether By Williamson synthesis

② 1° alkyl halide → ether (Major)



③ 3°-alkyl halide → Alkene (Major)



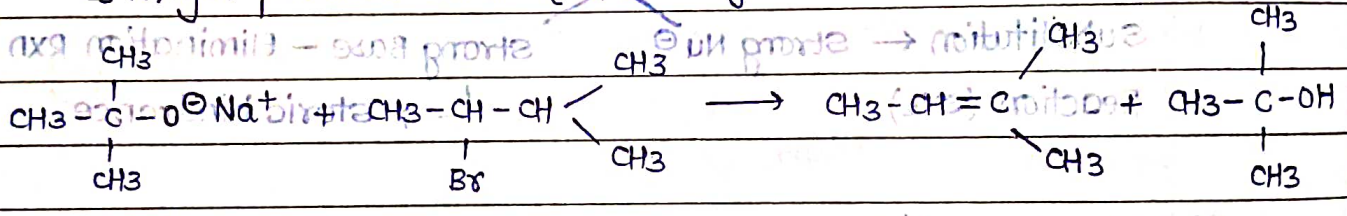
④ 2° alkyl halide ⟶ Alkene / ether

↳ Normal 2° alkyl halide

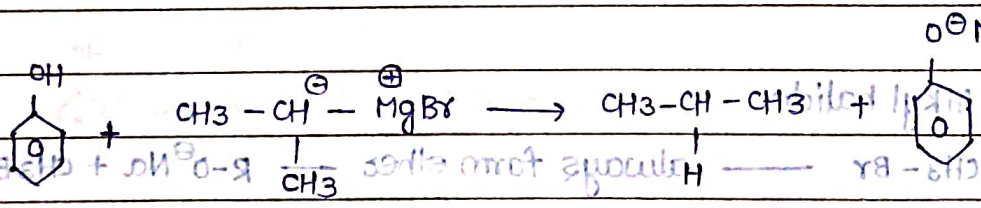
Bulky hone pr alkene major hoga

pr ether major product hoga.

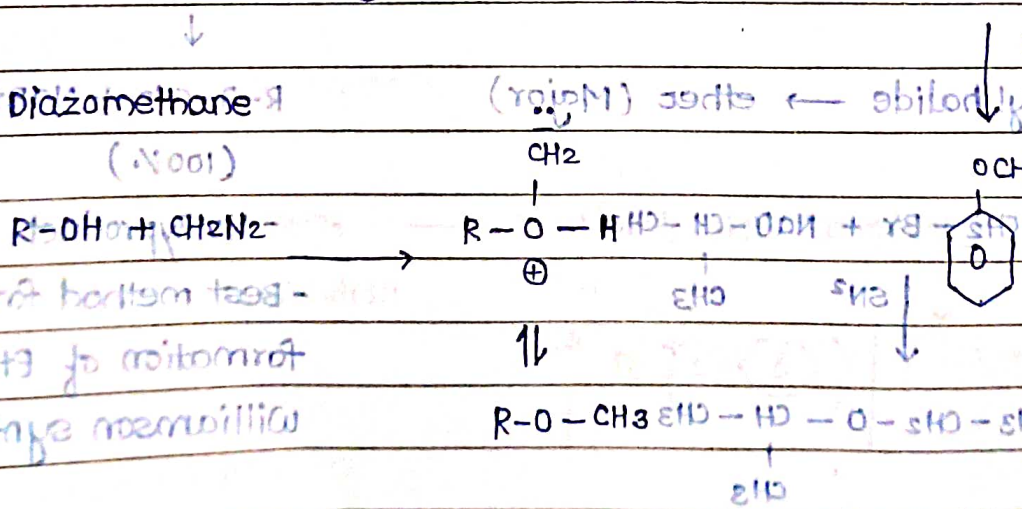
- Note: In case of Bulky Alkoxide (3° carbon), Alkene form as a major product with (2°,3°-alkyl halide)



Q.



③ Diazomethane



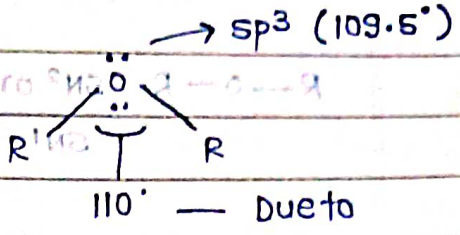
$CH_2N_2 \xrightarrow{\Delta} :CH_2 + N_2$ ⟶ Best L·G

Diazomethane. Carbene

- Physical properties :

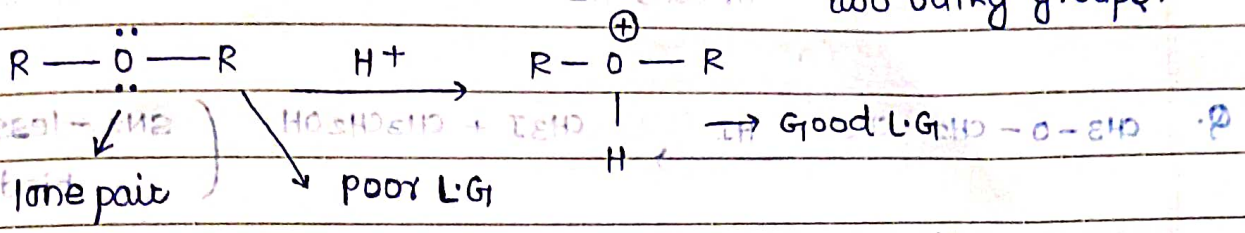
R–O–R ⟶ absence of H-bonding

B.p = R-OH > R-O-R



electronic Repulsion b/w two bulky groups.

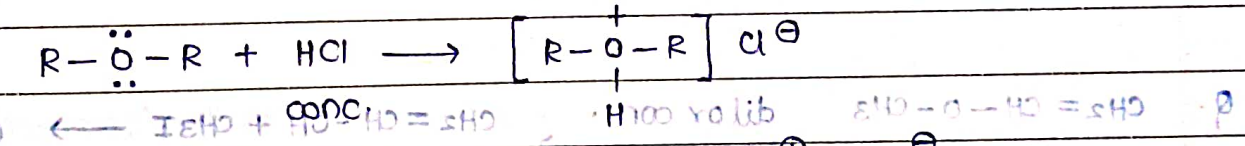
- Chemical properties :

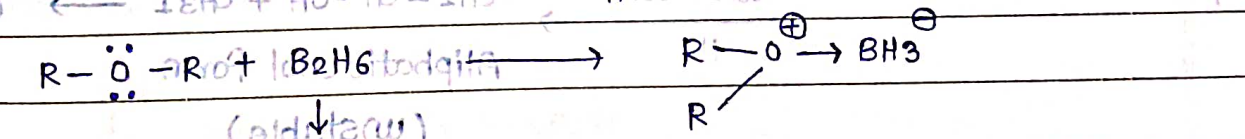


* Substitution Reaction possible (SN – Rxn)

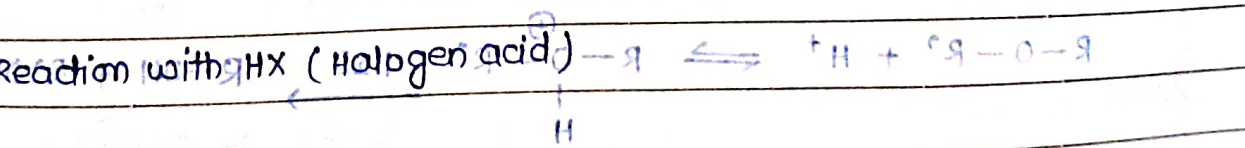
Acid – Base Reaction

- Acid-Base Reaction :

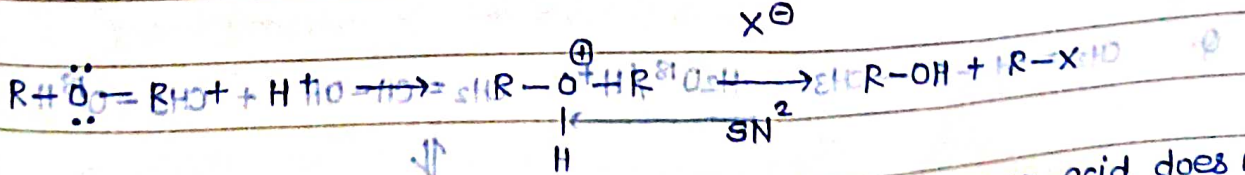




- Reaction with HX (Halogen acid)



HX ⟶ HI > HBr > HCl > HF



Nu⊖ ⟶ I⊖ > Br⊖ > Cl⊖ > F⊖

A.S ⟶ HI > HBr > HCl > HF

Note: oxo-acid does not give this type of rxn.

Page No.
Date

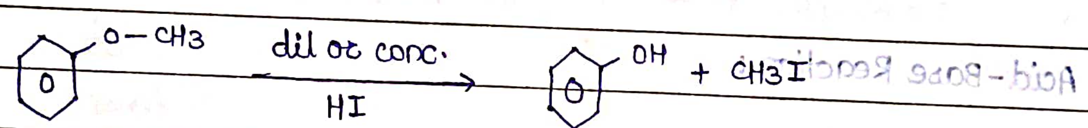
$$R-O-R \xrightarrow[\text{or dilute HI}]{\text{Cold HI}} R-O-H + R-I$$

S_N2 or S_N1

$$\xrightarrow[\text{or conc. HI}]{\text{Hot HI}} R-OH + RI \xrightarrow{HI} R-I + R-I$$

Q. $CH_3-O-CH_2-CH_3 \xrightarrow{HI} CH_3I + CH_3CH_2OH$ (S_N2 – less hindrance)

Q. $(CH_3)_3C-O-CH_3 \xrightarrow{HI} (CH_3)_3C-I + CH_3OH$ (S_N1 – Bulky hindrance)

Q. 

Q. $CH_2=CH-O-CH_3 \xrightarrow[HI]{\text{dil or conc.}} CH_2=CH-OH + CH_3I \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-H + CH_3I$

Aliphatic enol form (unstable) — (Keto form)

- Reaction with H_2O/H^+ :

$$R-O-R' + H^+ \rightleftharpoons R-\overset{\oplus}{\underset{H}{O}}-R' \xrightarrow{(H_2O)} R-OH + R'OH$$

Note: All concept are same (HI rxn)

Q. $CH_2=CH-O-CH_3 \xrightarrow{H_2O^{18}/H^+} CH_2=CH-OH + CH_3-O^{18}H$

⇅

$CH_3-\overset{\|}{C}-H$

- **Halogenation:**

(a) In Dark (absence of sunlight or hν energy)

$$CH_3-CH_2-O-CH_2-CH_3 + Cl_2 \xrightarrow{dark} CH_3-\underset{Cl}{CH}-O-\underset{Cl}{CH}-CH_3$$

Mono-halogenation.

(b) In presence of sunlight:

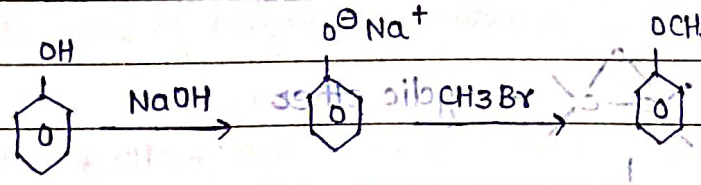
$$CH_3-CH_2-O-CH_2-CH_3 + Cl_2 \xrightarrow{h\nu} C_2Cl_5-O-C_2Cl_5$$

- **Oxidation:** Ether oxidise by air in very slow rate and form peroxide ether.

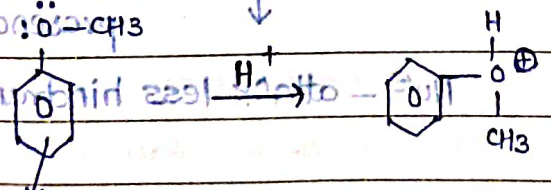
$$R-CH_2-\ddot{O}-R + Air\ (O_2) \longrightarrow R-\underset{O-O-H}{CH}-O-R$$

Ether → peroxide ether.

- **Aromatic ether:**



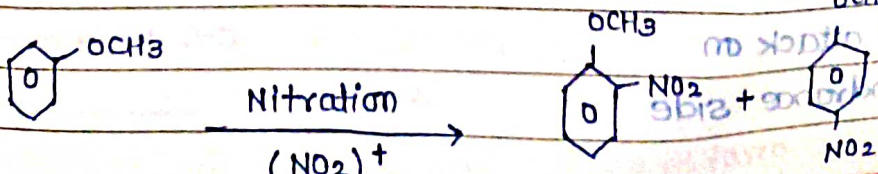
lone pair — Lewis Base / $Nu^{\ominus}$

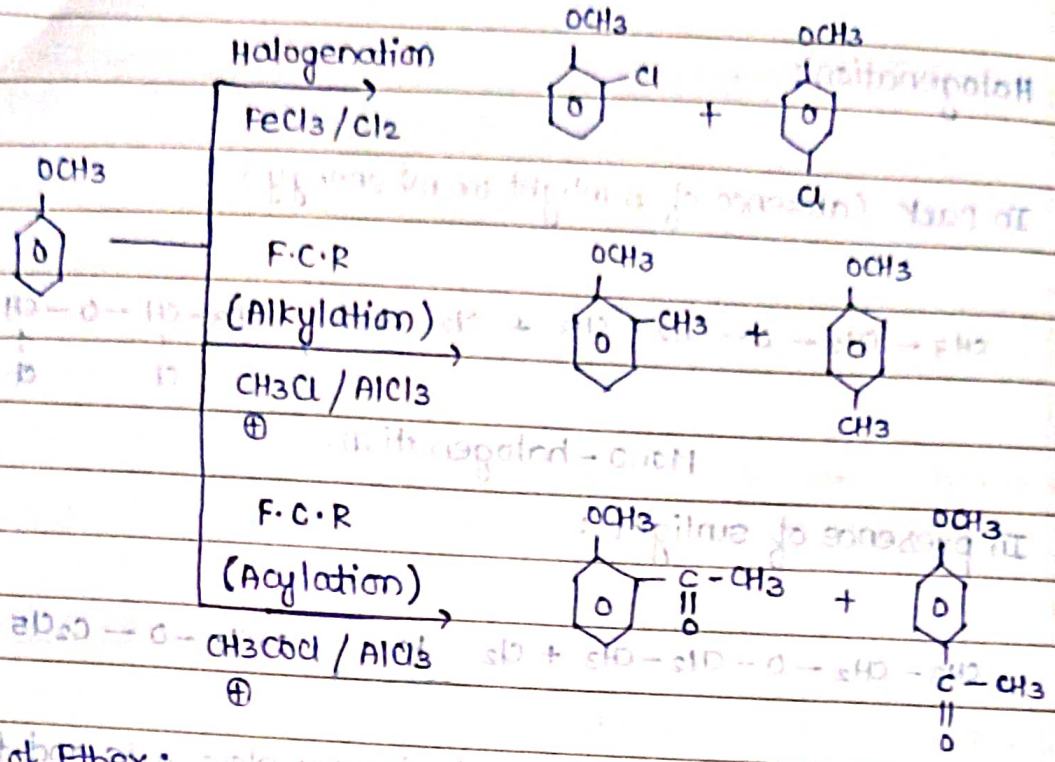


→ SN Rxn possible.

Good L.G

E.A.S Reaction — $o^{\ominus}$ and $p^{\ominus}$ directing





- Test of Ether :

Ether + Ether peroxide + KI ⟶ I_2 + Ether + Alcohol (Purple/pink)

(O·A)

Redn

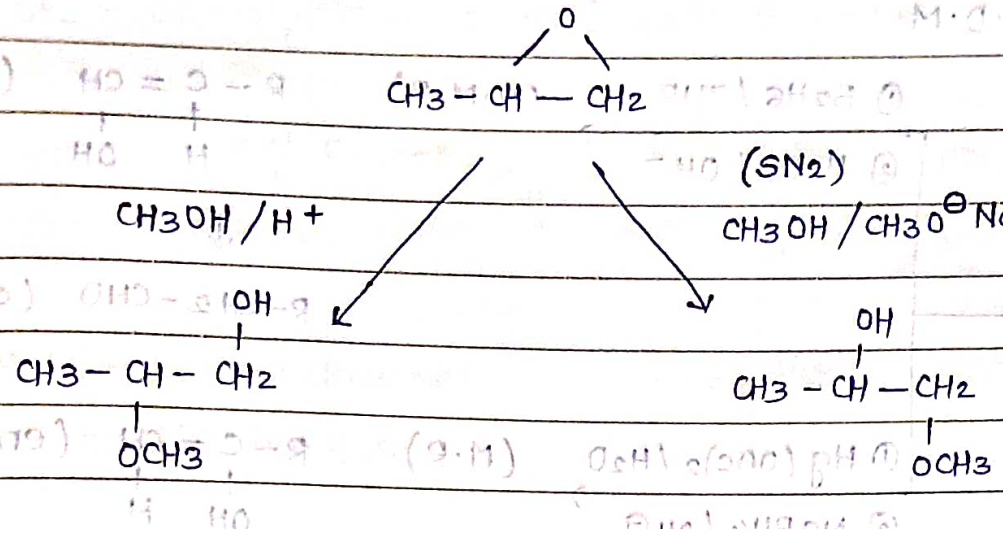
- Epoxide Ring : cyclic ether

Acid - (H+)

S_N2 (absence of acid & presence of Base)

$Nu^{\ominus}$ - attack less hindrance side

- Carbocation Form and $Nu^{\ominus}$ attack on more hindrance side


O
CH3 – CH – CH2
CH3OH / H+
(SN2)
CH3OH / CH3O⊖Na+
OH
CH3 – CH – CH2
OCH3
OH
CH3 – CH – CH2
OCH3