C–O

Carboxylic acid — $-\overset{O}{\overset{\|}{C}}-OH$

esters — $-\overset{O}{\overset{\|}{C}}-OR$

Alcohols — $-OH$

Ethers (epoxides) — $R-O-R$

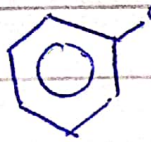
Carbonyls (Aldehyde, ketone)

$RMgX \xrightarrow{CO_2} R-\overset{O}{\overset{\|}{C}}-OH$

$R-\overset{O}{\overset{\|}{C}}-H \xrightarrow{[O]} R-\overset{O}{\overset{\|}{C}}-OH$

$R-OH \xrightarrow{[O]} R-\overset{O}{\overset{\|}{C}}-H \xrightarrow{[O]} R-\overset{O}{\overset{\|}{C}}-OH$

$R-CN \xrightarrow{\text{hydrolysis}} R\,COOH$ (hydrolysis)



$/\ Ar-R \xrightarrow[[O]]{KMnO_4} Ar\,COOH$

~~For Esters~~

for esters strong acidic cond. given.

or $-\overset{O}{\overset{\|}{C}}-OH$ become activate.

C–O bond formation:-

Fries Reerrangment (ester Intermediate)

Epoxide formed → ring opening

Wolf Rerrangment (amides, alcohols, esters, carboxylic acid)

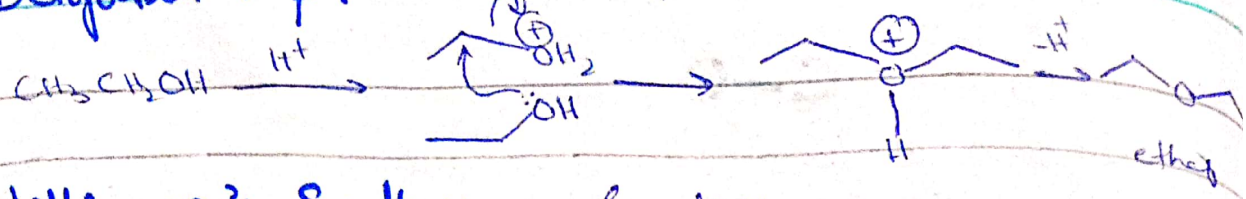
Baeyer villiger oxidation → lactons.

Williamson's Synthesis → ester.

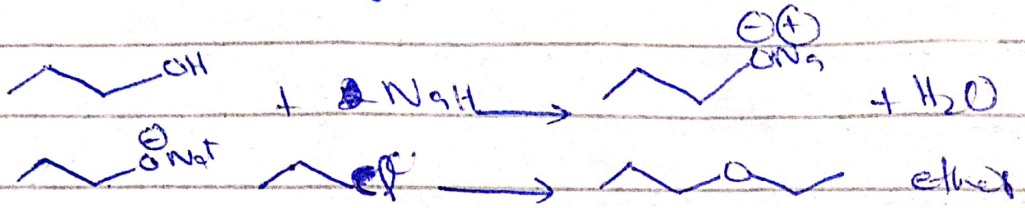
hydrolysis of nitrile → $-\overset{O}{\overset{\|}{C}}-$, $-OH$ (acid forms)

Oxymercuration, demercuration → alcohol, ester, amine

i) Dehydration of two Alcohol:- for ether



ii) Williamson's Synthesis:- for ether



iii) Oxymercuration-demercuration:-

substrate → alkene Nu different

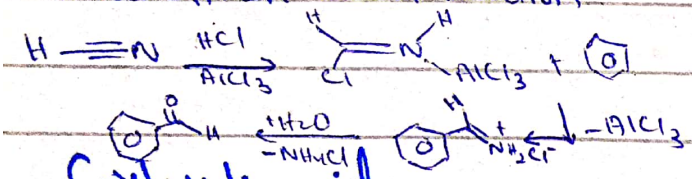
H_2O → Alcohol

R-OH → ether

$R-NH_2$ → Amines

Aldehyde

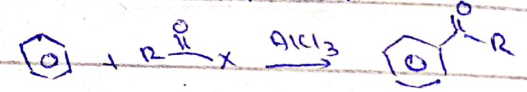
Gatterman Koch Reaction



Ketones

Friedel Craft Acylation

C-O bond Retain



Carboxylic acid:-

Oxidation by all of these form

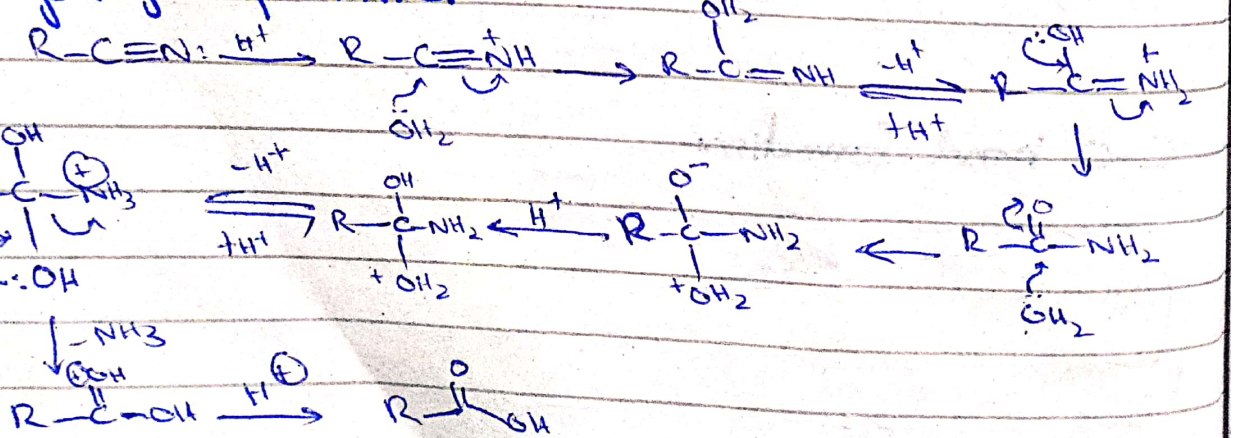
- 1° Alcohol
- Aldehyde
- methyl ketones

alkylebenzene

unsaturated hydrocarbon

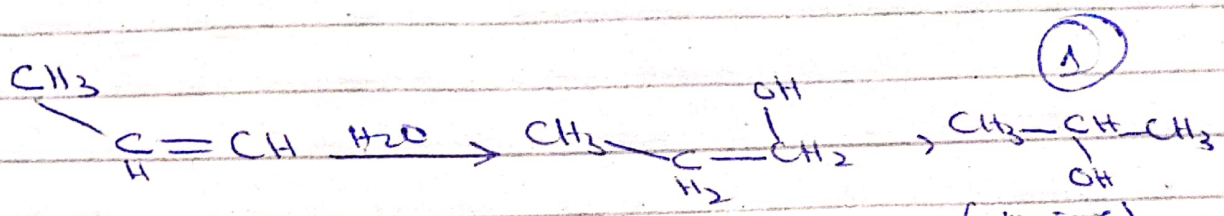
(-OH, >C=, ≡C-, bond formed)

Hydrolysis of Nitrile:-

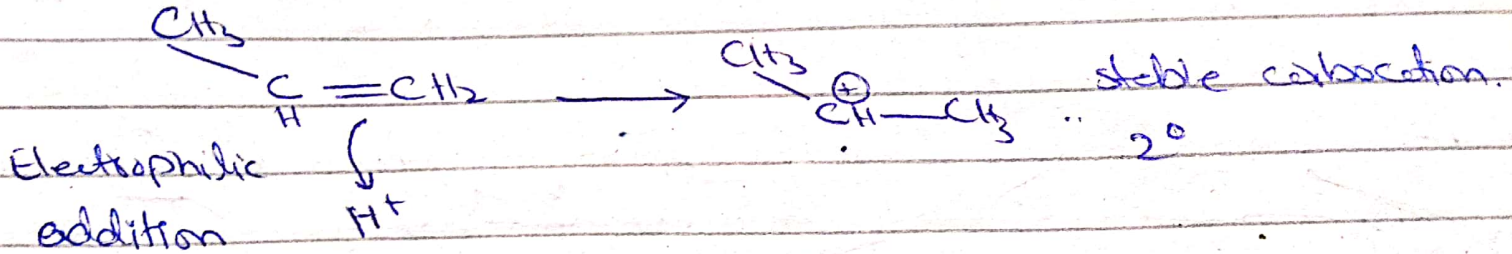


Alcohols:-

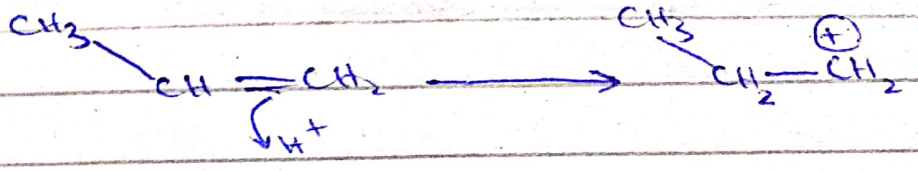
hydration of alkenes.



1) condition H_2SO_4/H_2O



Electrophilic addition



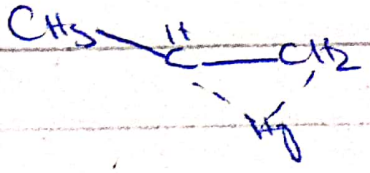
due to stability of carbocation Markonikof's give (1) major product.

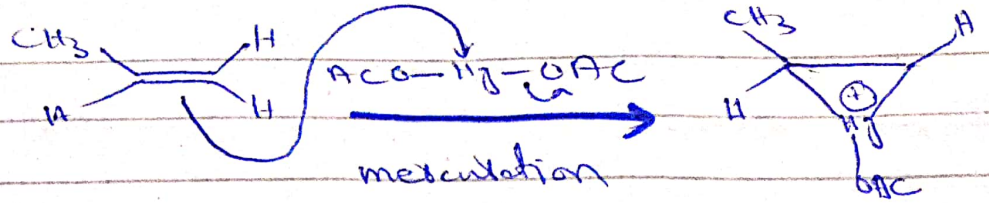
2 Mercuration, oxymercuration

(a) $Hg(OAC)_2$

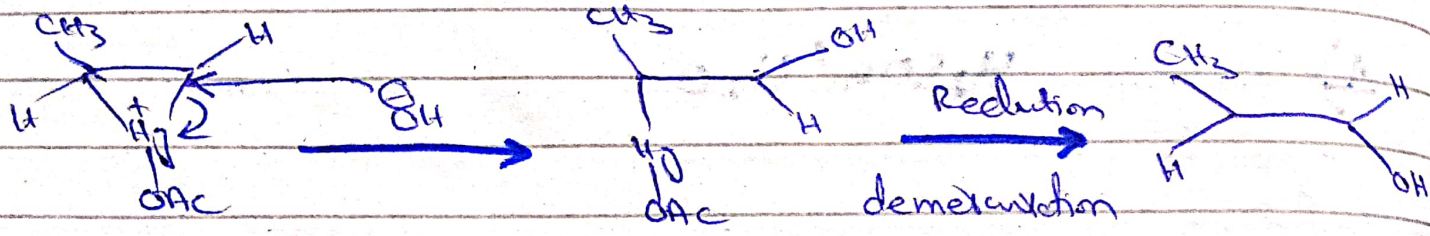
(b) Reduction

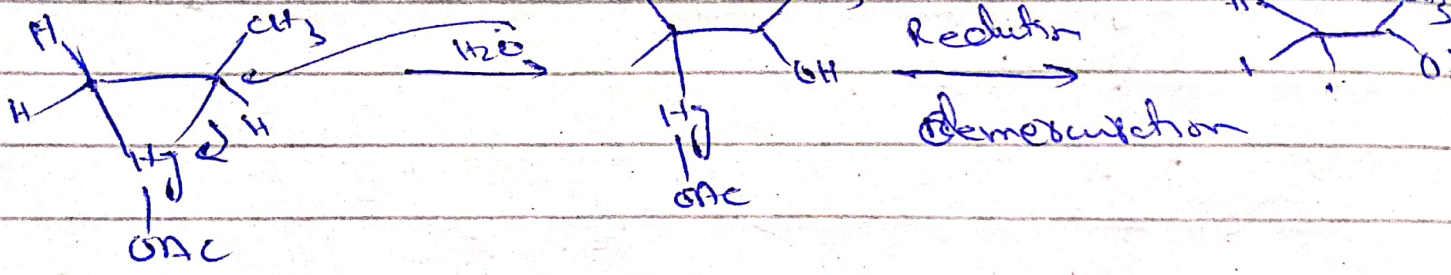
Markonikoffs product.





⊖H from H_2O attack on less hindered side





3 hydroboration:-

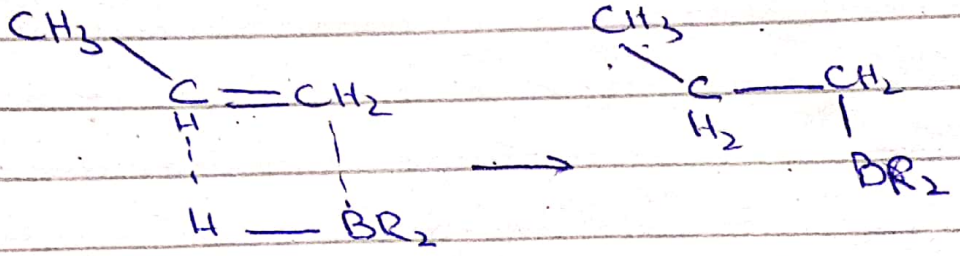
$NaOH / H_2O_2$

Borans, BH_3 having empty P orbital it have e^- defficient so singly it is not available. it is presend in form of B_2H_6. simple Borons not

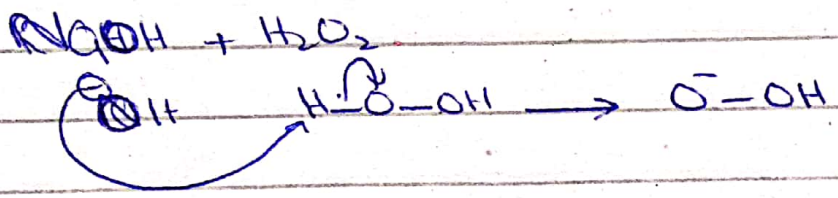
(a) HBR_2 use we normally use a & b

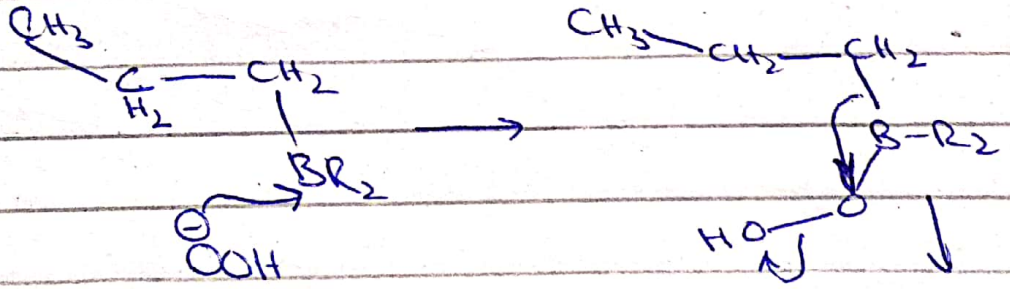
(b) 9BBN

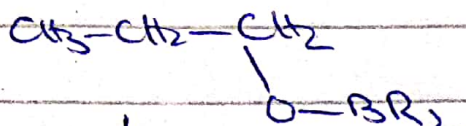
Boran



Mechanism

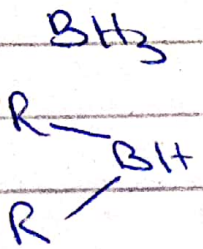






$CH_3-CH_2-CH_2-OH$ ← hydrolysis

anti markonikov's rule



Ethers R–O–R

1) **Williamson Synthesis**

$ROH \xrightarrow{NaH} RO^- \xrightarrow{R-X} R-O-R$

strong base — alkoxide ion

2) **Ulman Synthesis**

$ArOH \xrightarrow{Na\,(metal)} ArO^-Na^+ \xrightarrow{R-X} ArO-R$

easily remove

Williamson synthesis (for Aliphatic)

Ulman (for Aromatic.

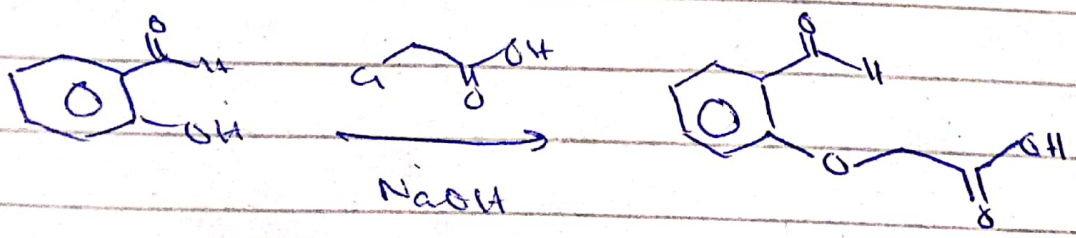
$ArOH \xrightarrow[C_4]{ArX} Ar-O-Ar$

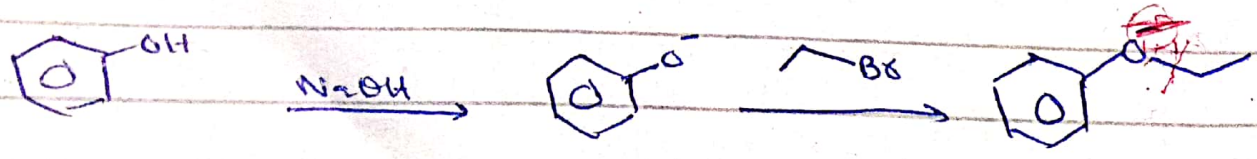
3) **dehydration of two Alcohol**

4) All 3 methods used for ether formation.

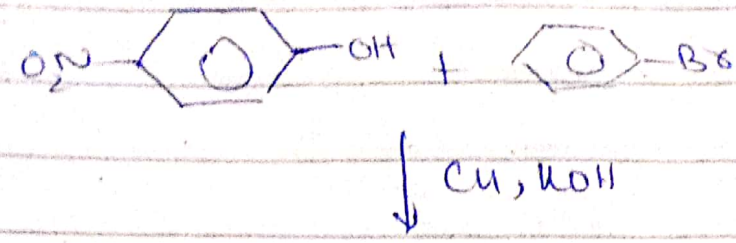
Williamson ether synthesis is an organic reaction, forming an ether from organohalide and a deprotonated alcohol (Alkoxide).

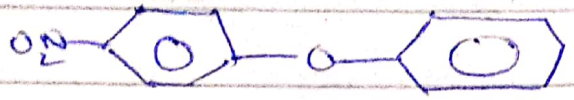
Typically it involves reaction of an alkoxide ion with primary alkyl halide thrоу SN^2 reaction.

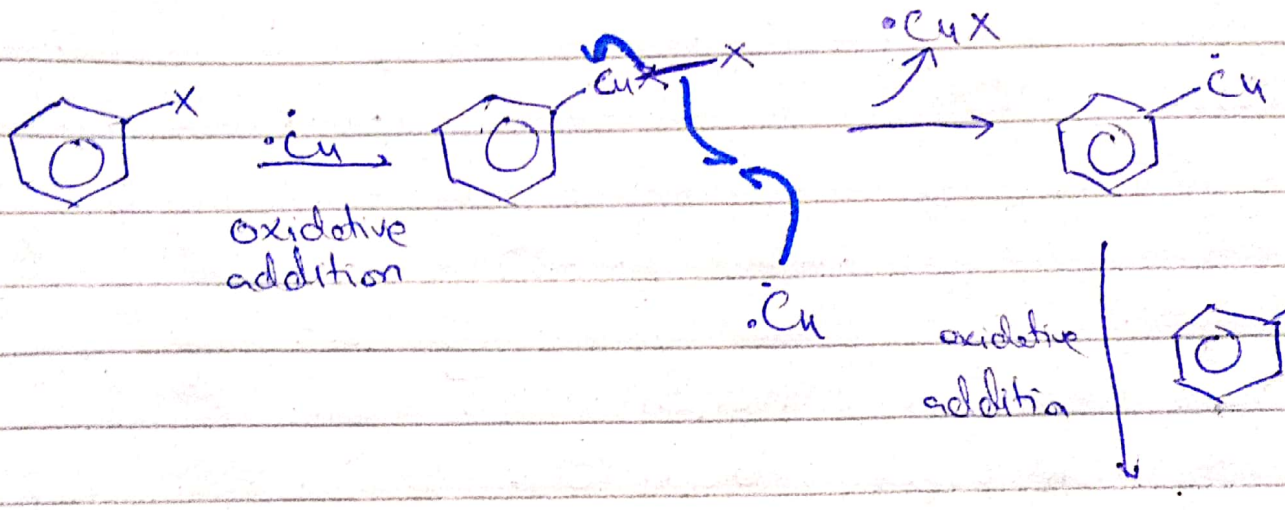


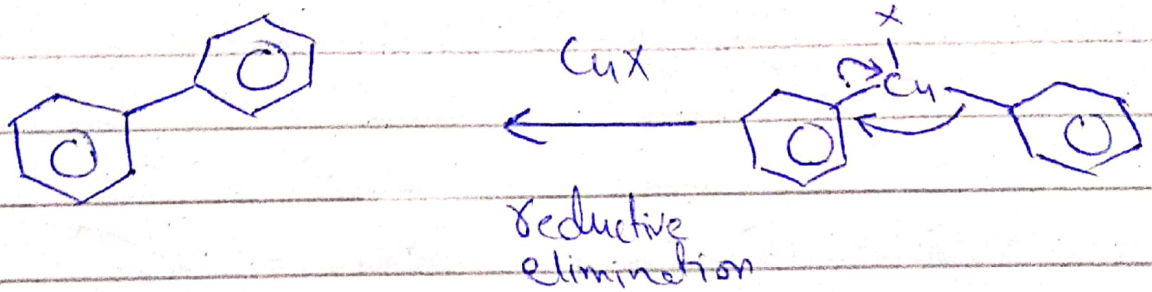


Ulman Synthesis

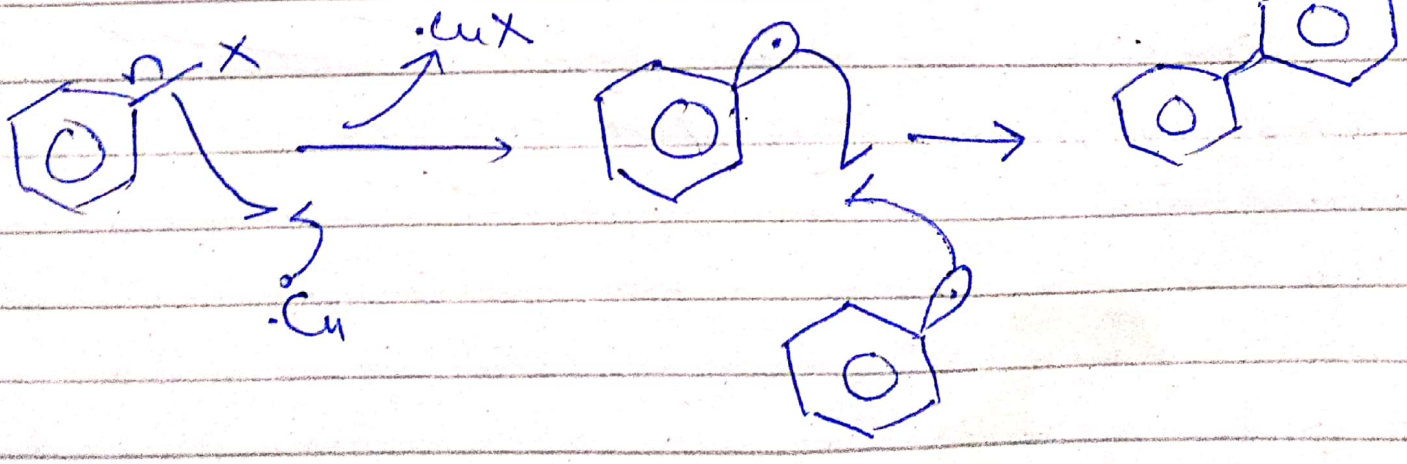




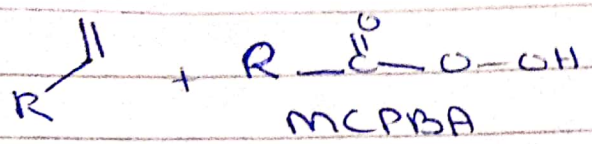


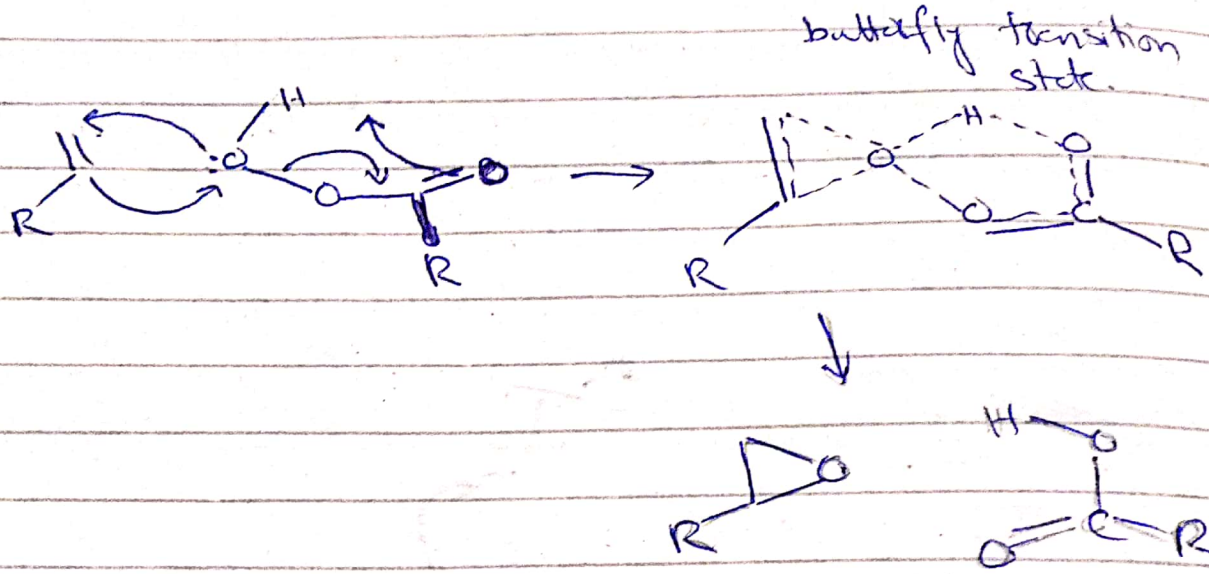


or



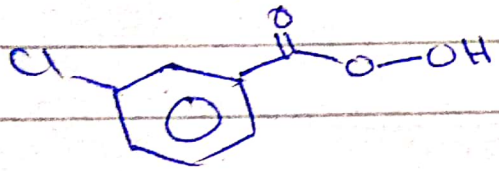
Epoxide





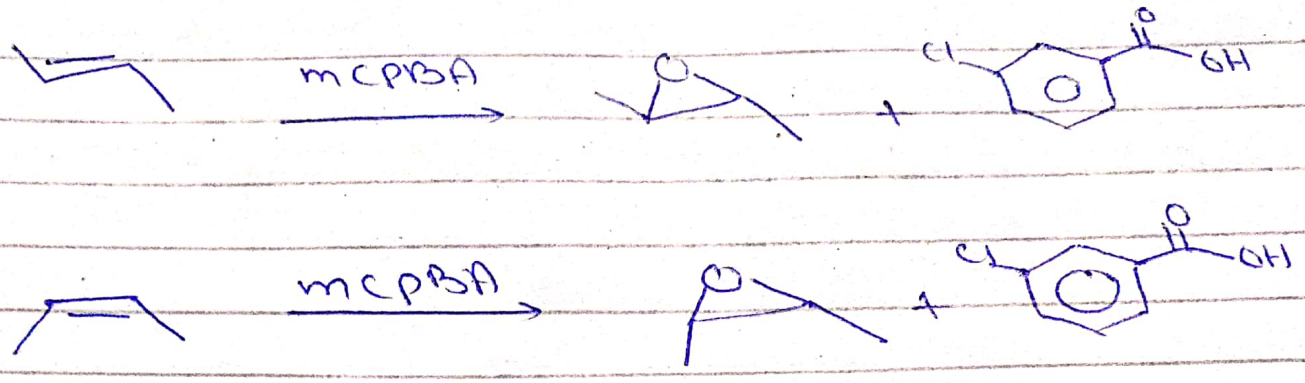
mCPBA or mCPBA

metachloroperbenzoic acid



mCPBA form epoxide when added to alkenes. One of the key feature of this reaction is that stereochemistry always retain.

That is, cis alkene give cis epoxide and trans alkene give trans epoxide.



Nitrile