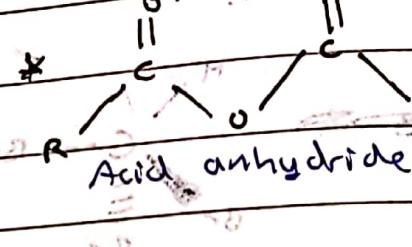
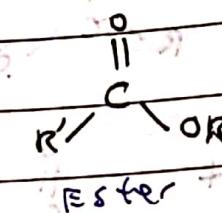
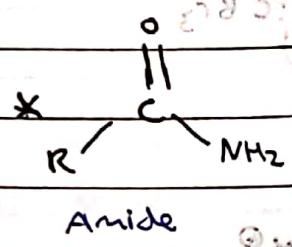
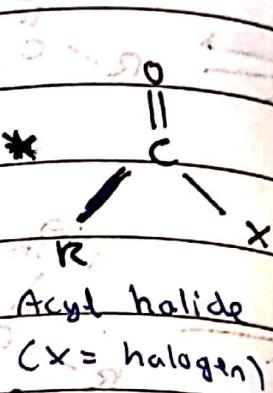
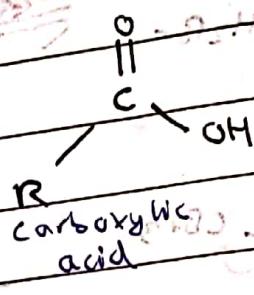
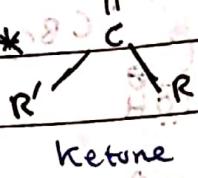
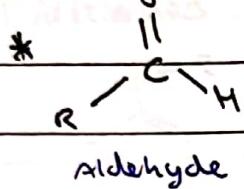


ALDEHYDES & KETONES

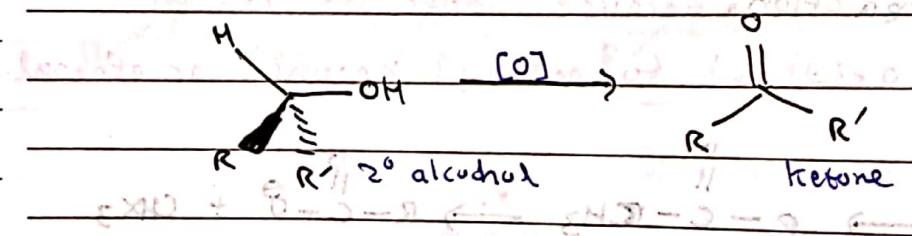
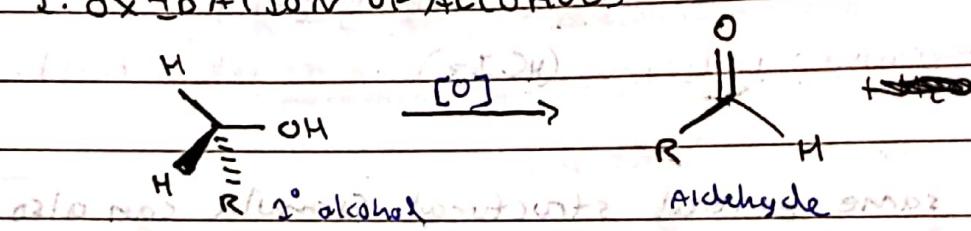
& CARBOXYLIC ACIDS

CARBONYL group ($\text{C}=\text{O}$) compounds

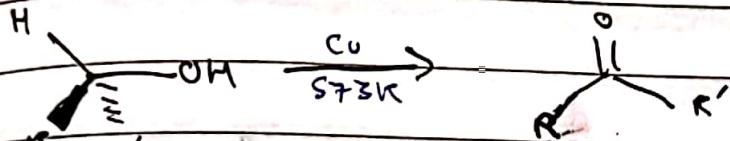
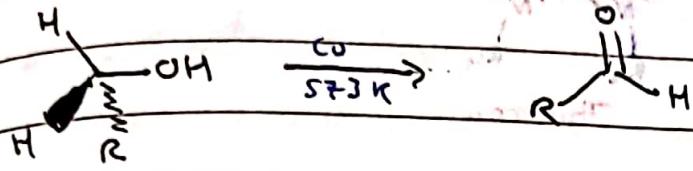


METHODS OF PREPARATION OF ALDEHYDES & KETONES..

1. OXIDATION OF ALCOHOLS



DEHYDROGENATION OF ALCOHOLS

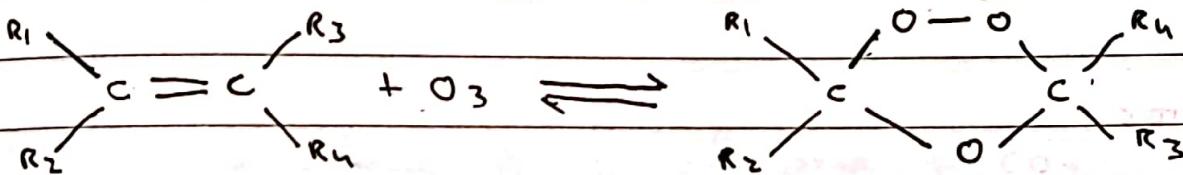


3. FROM HYDROCARBONS

(i) OZONOLYSIS OF ALKENES

REDOX WORKUP

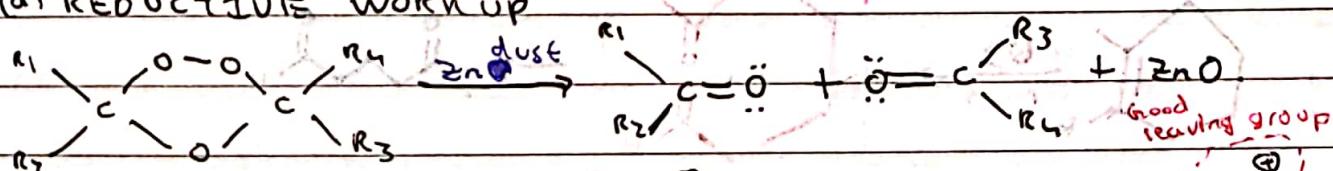
* FORMATION OF OZONE



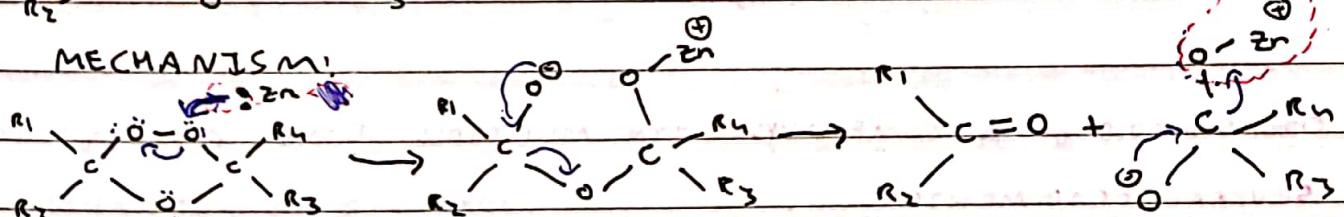
OZONE

* MECHANISM in JEE part of alkyl halides.

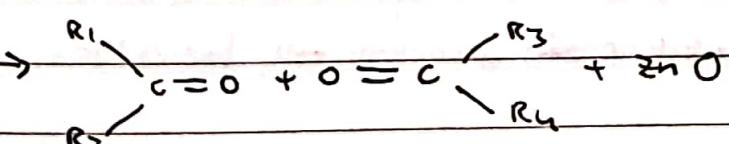
(a) REDUCTIVE WORKUP



MECHANISM:



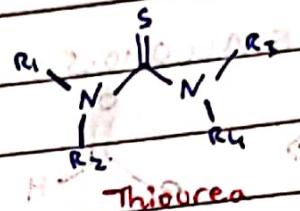
* NOTE: Depending on what



R is, the reductive workup can be used to produce aldehydes & ketones

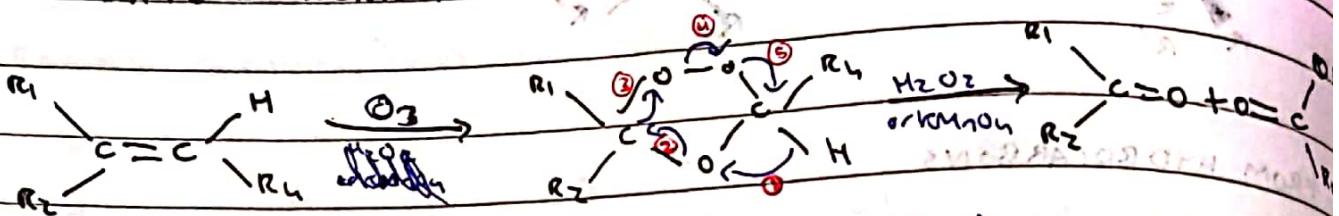
Other mild reducing agents

PPh₃, Me₂S
triphenyl phosphine, dimethyl sulfide



Thiourea

(b) OXIDATIVE WORKUP



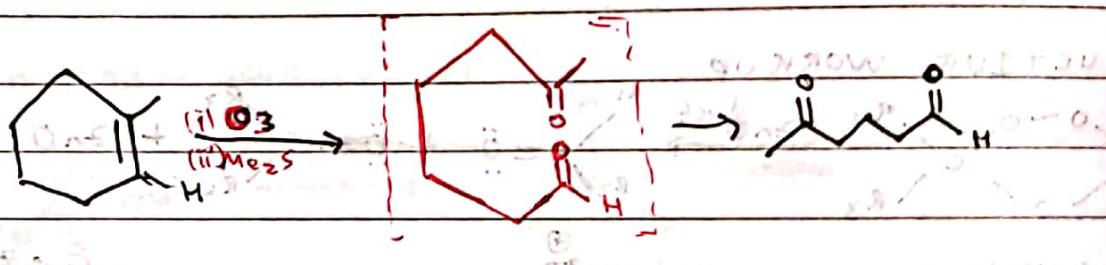
*NOTE: oxidative workup can be used to produce an aldehyde/ketone & a carboxylic acid.

JEE NOTES:

OZONOLYSIS OF CYCLIC COMPOUNDS.

This results in the formation of a chain with two carbonyls

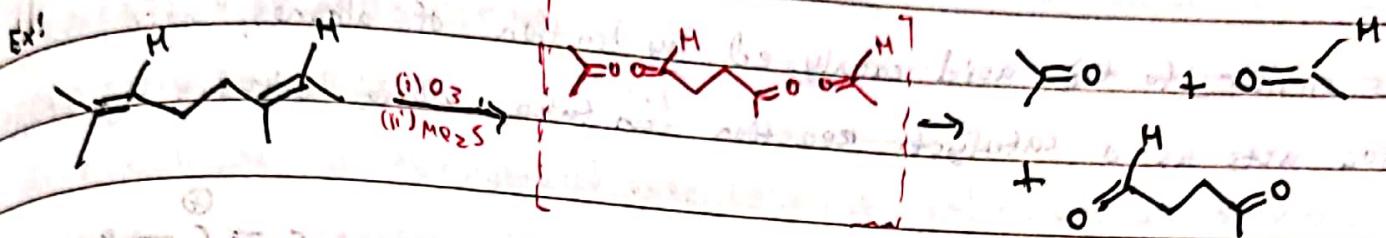
Ex:



OZONOLYSIS OF A COMPOUND WITH MULTIPLE BONDS RESULTS IN SEVERAL FRAGMENTS

The ozonides can be formed at multiple locations & hence the reductive/oxidative workup will occur at all locations.

if one of these goes to a ketone
another is an ester

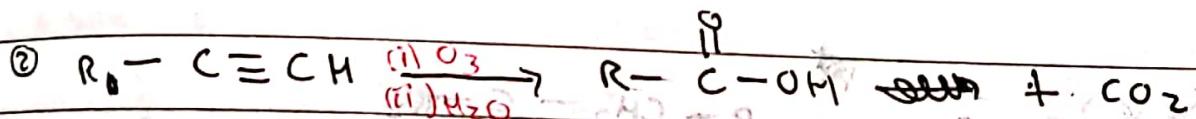
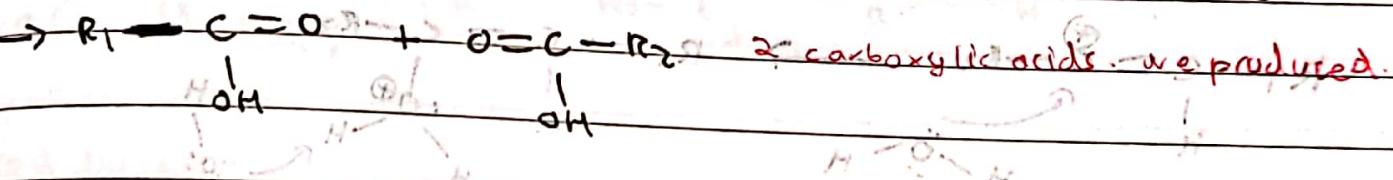
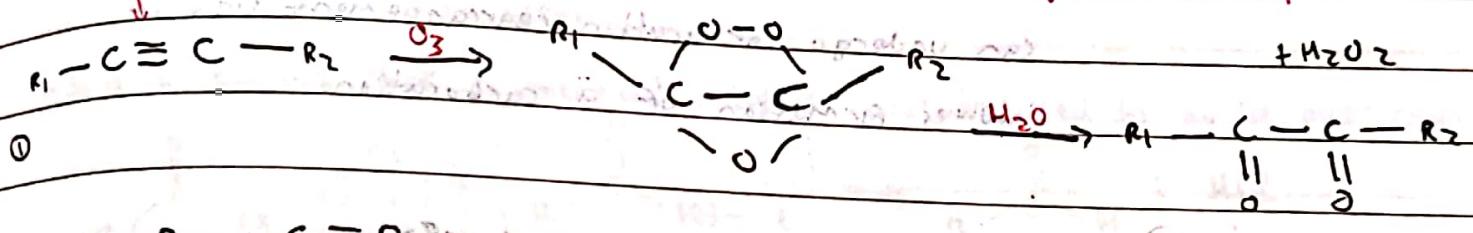


(iii) HYDRATION OF ALKYNES

OZONOLYSIS OF ALKYNES

Internal triple bond

aqueous workup



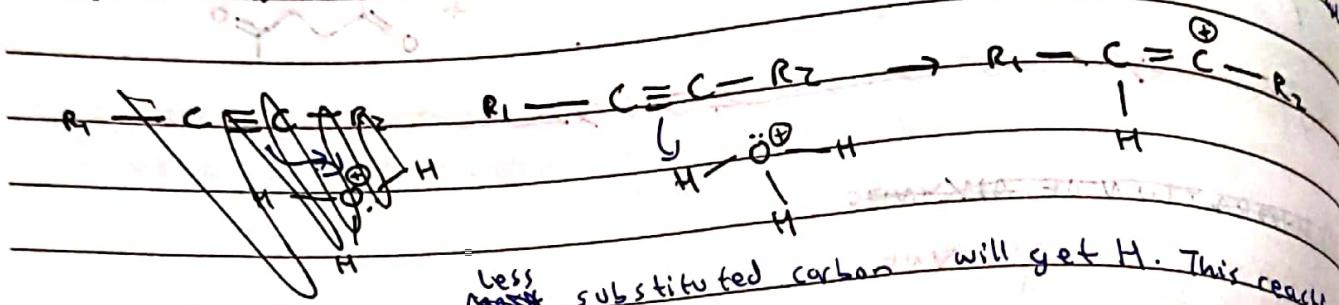
The same products can be achieved by both aqueous or oxidative workup using KMnO₄.

* OZONOLYSIS OF ALKYNES PRODUCES CARBOXYLIC ACIDS AND/OR CARBON DIOXIDE

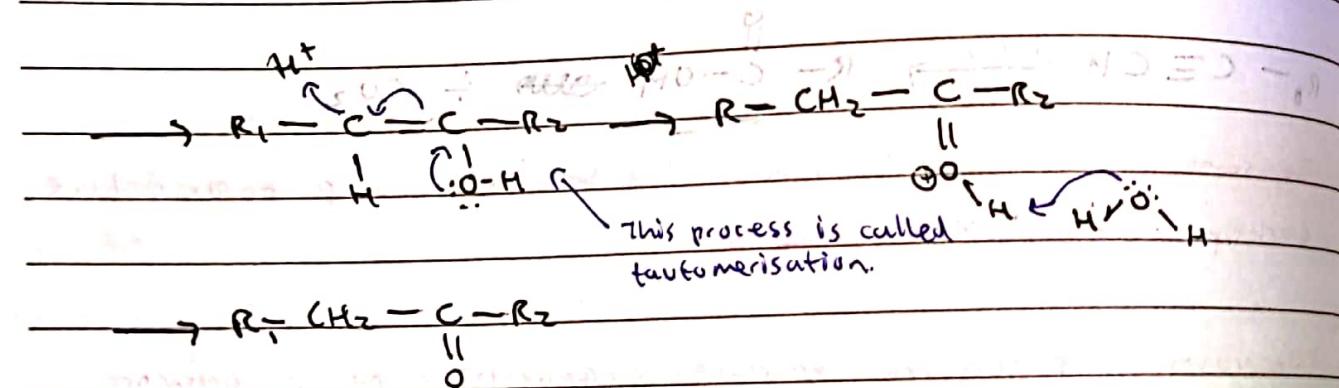
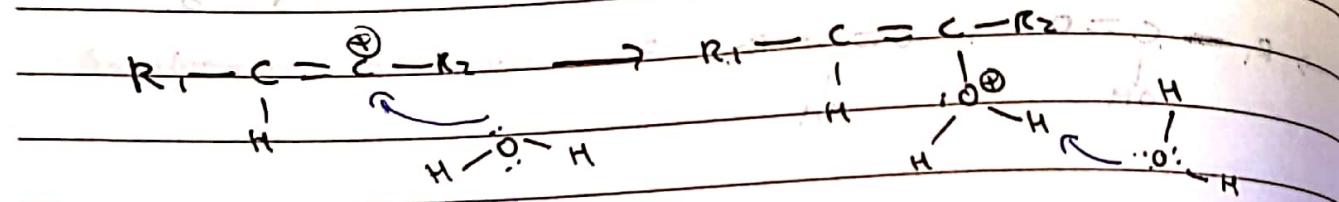
(ii) HYDRATION OF ALKYNES

Addition of water to ethyne in the presence of MgSO_4 & MgSO_4 gives acetaldehyde (ethanal). All other alkynes give ketones

It is similar to the acid catalysed hydration of alkenes, here HgSO_4 acts as a catalyst. reaction can take place without H_2O .



Less substituted carbon will get H. This reaction can undergo carbocation rearrangement since it involves formation of a carbocation.



When done with HgSO_4 , Hg forms a cyclic structure with the alkyne, providing a faster reaction. (Same as oxymmercuration reaction of alkenes)

PREPARATION OF ALDEHYDES

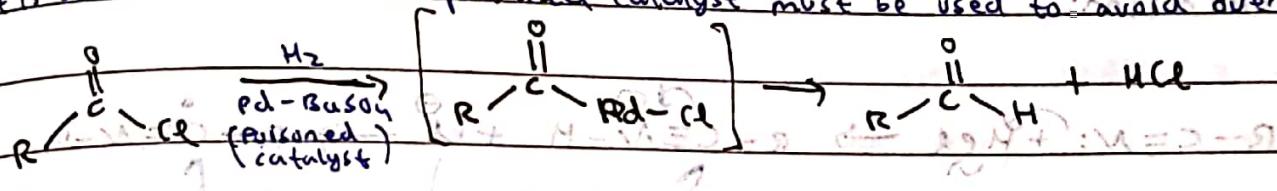
1. FROM ACYL CHLORIDE: ($R-C(=O)Cl$)

Acylic chloride is hydrogenated over catalyst, palladium on barium sulphate. This reaction is called Rosenmund reaction.

* Acid chlorides are significantly more reactive towards catalytic hydrogenation than other carbonyl compounds.

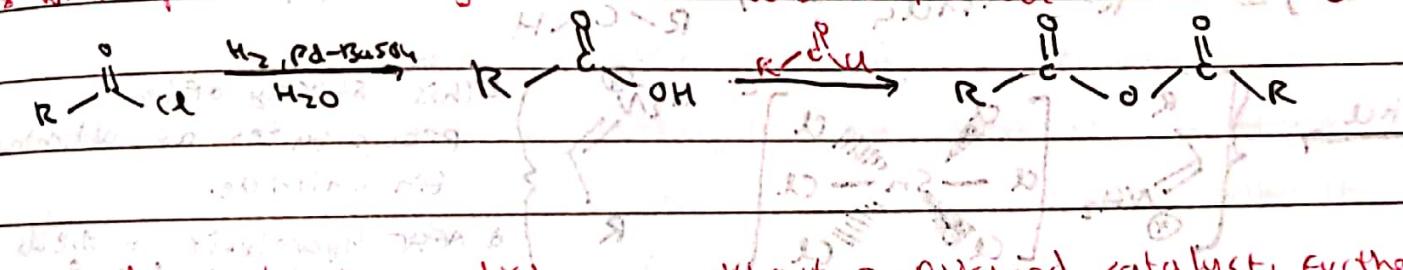
$\text{C}(=\text{O})\text{Cl}$ (The carbonyl carbon is **HIGHLY** electrophilic & the $C=O$ bond is very weak)

* It is so reactive that a poisoned catalyst must be used to avoid over reduction.

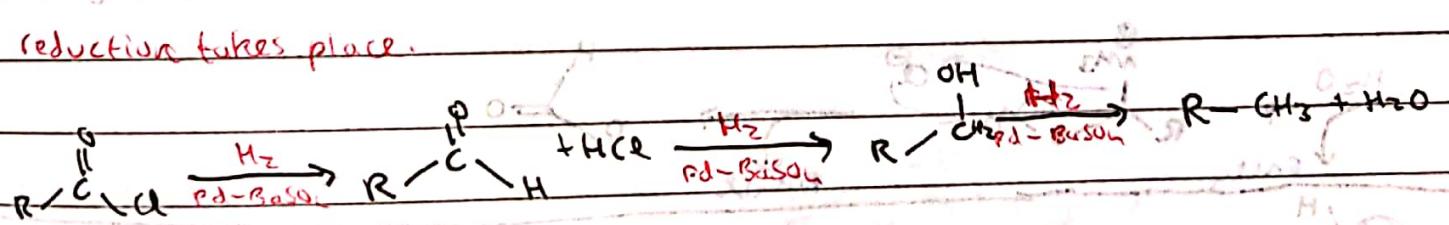


JEE NOTES

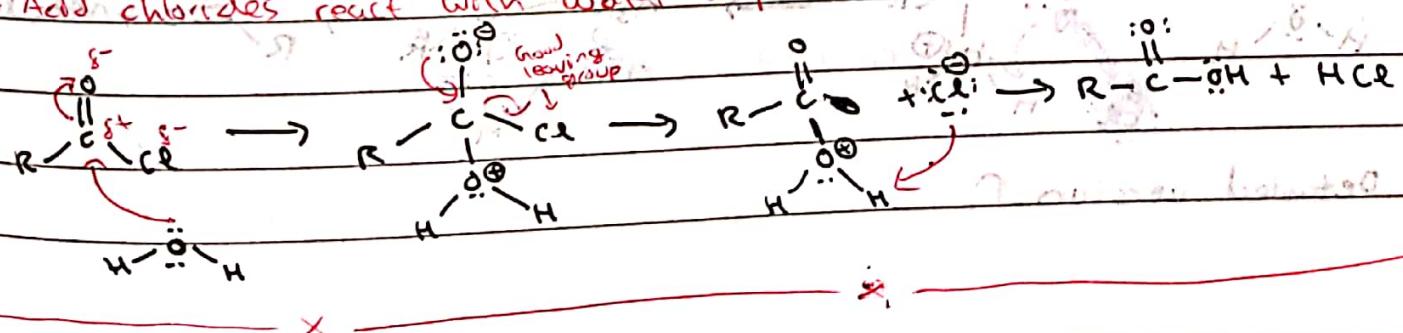
* When performed in hydrous medium a side product is acid anhydride.



(* When done in harsher conditions or without a poisoned catalyst, further reduction takes place.)



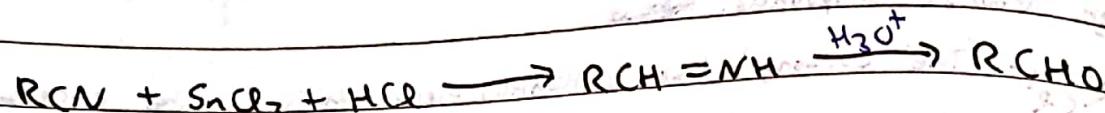
* Acid chlorides react with water to produce ~~acid~~ carboxylic acids.



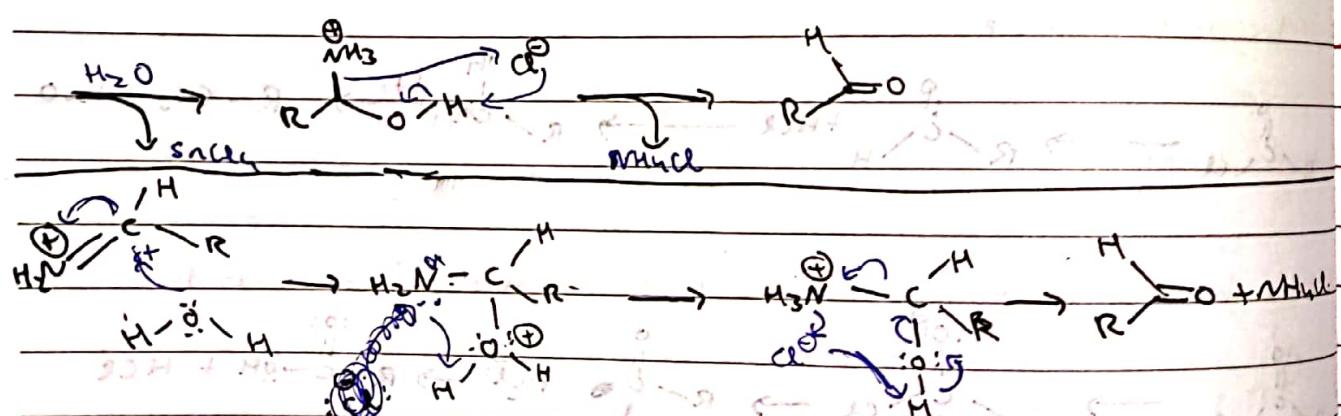
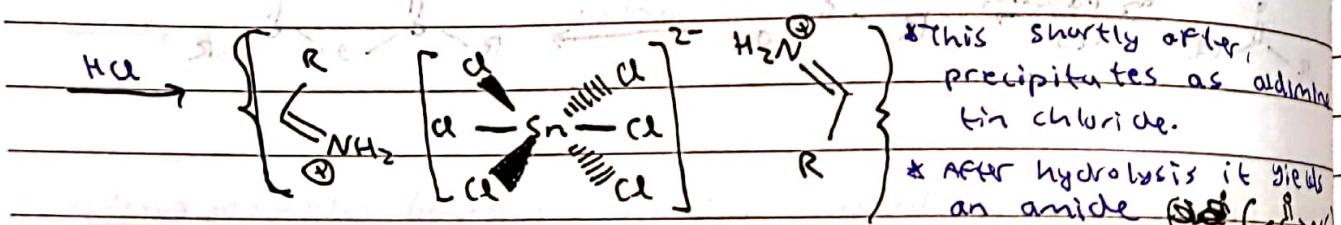
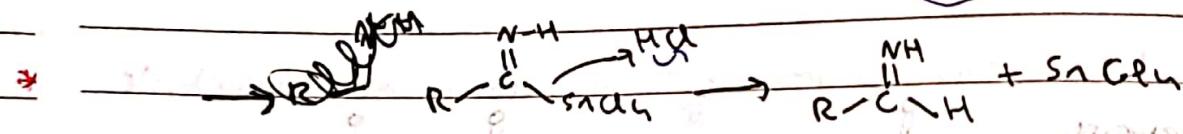
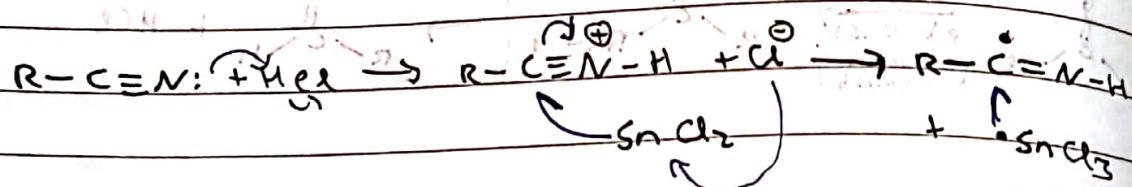
2. FROM NITRILES ($R-C\equiv N$) AND ESTERS ($R-C(=O)-OR'$)

Nitriles are reduced to corresponding imine ($R-C=N$) with stannous chloride ($SnCl_2$) in the presence of hydrochloric acid, which on hydrolysis gives corresponding aldehyde.

* This reaction is called Stephen's reaction.



MECHANISM:



Detailed version ↑

REDUCTION VIA DIBAL-H.

JEE NOTES

* DIBALH VS LiAlH₄

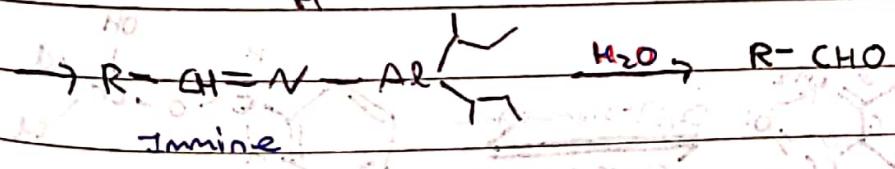
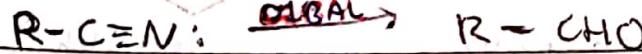
DIBALH = di-isobutylaluminum-hydride

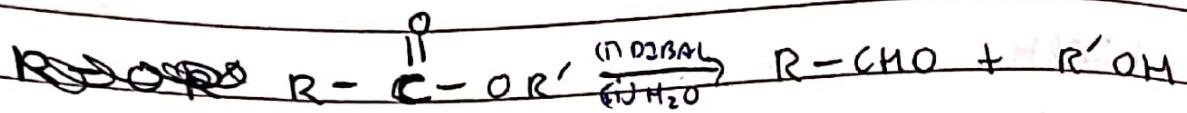


- LiAlH₄ is a nucleophilic reducing agent whereas ~~DIBAL~~, DIBAL is an electrophilic reducing agent, i.e. when using LiAlH₄, the $\delta^- H^-$ attacks an electrophilic location whereas when using DIBAL, a nucleophile attacks the empty orbital on Al first.

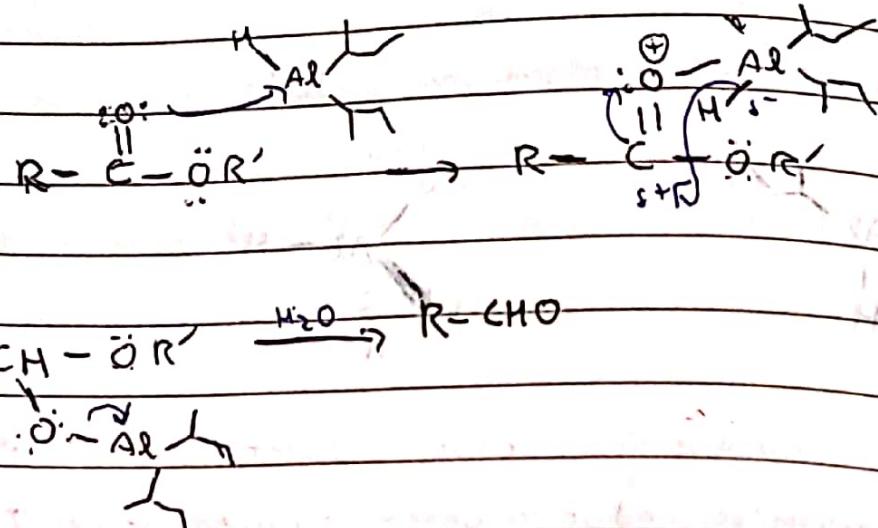
- DIBAL is very big & chunky & hence less reactive & not as powerful as LiAlH₄ in terms of reducing power.

- It can reduce esters to aldehydes ~~provided~~ at low temps (& stop the reaction there) whereas LiAlH₄ would take it all the way to alcohols or further.





MECHANISM:

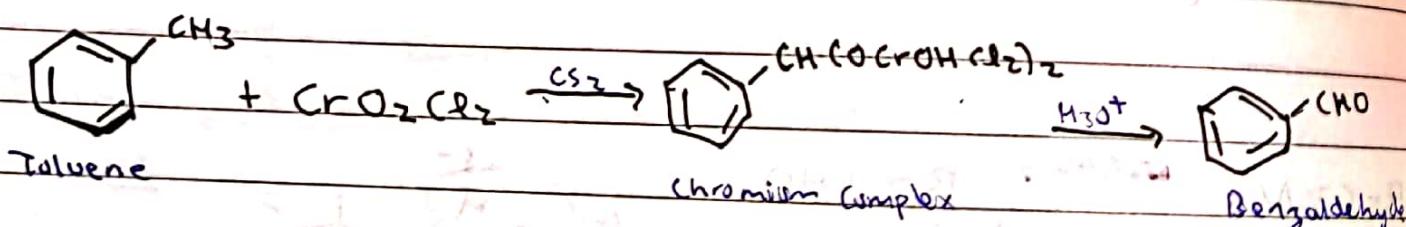


* Note: DIBAL cannot reduce carboxylic acids.

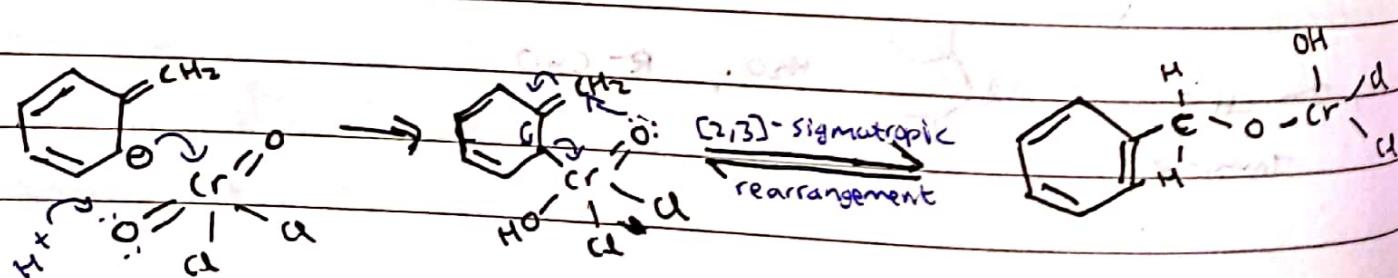
3. FROM HYDROCARBONS

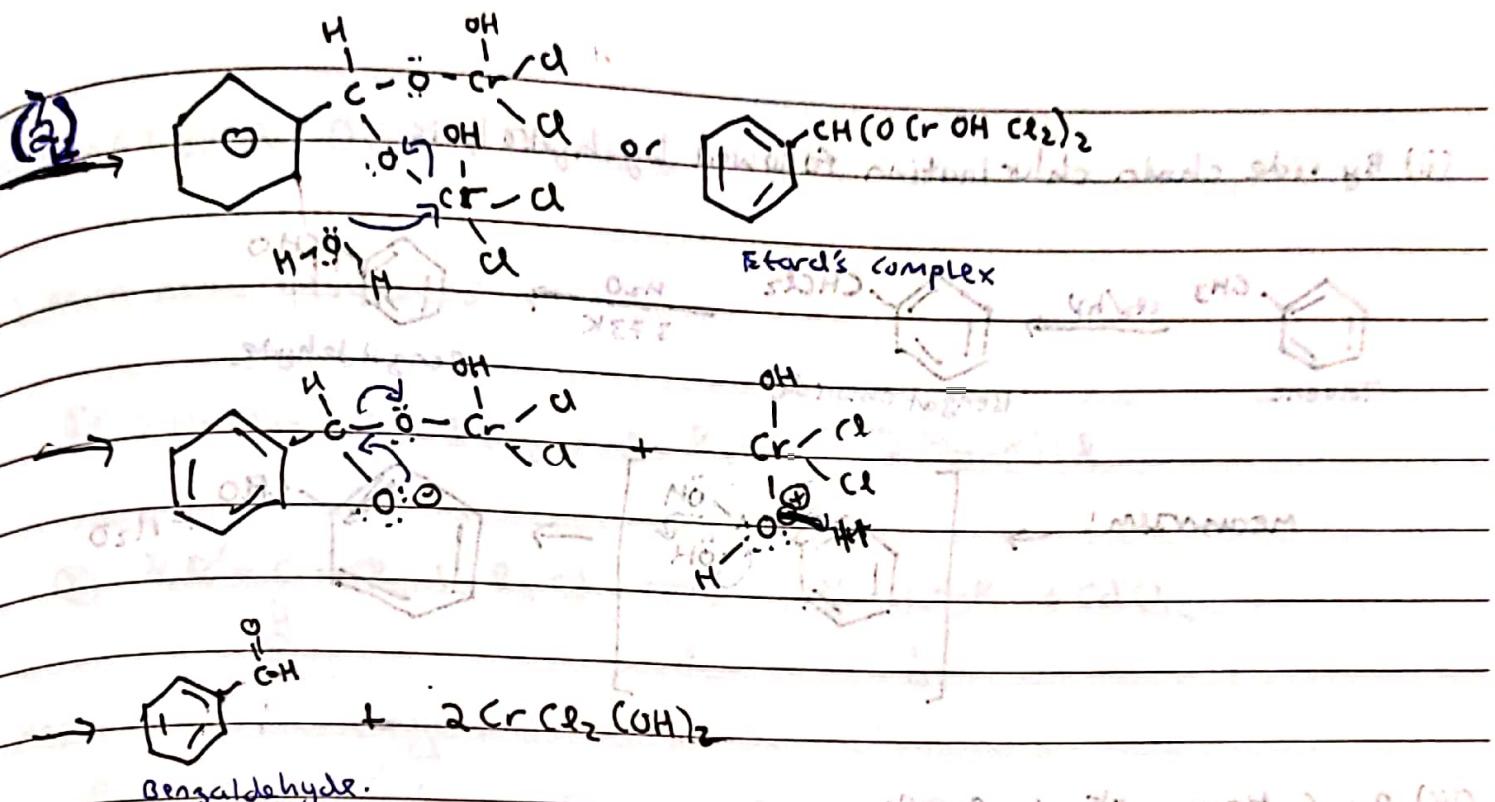
(i) OXIDATION OF METHYL BENZENE

(a) ETARD'S REACTION (use of chromyl chloride - CrO_2Cl_2)

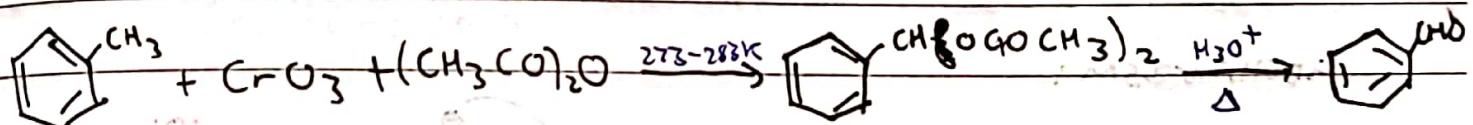


MECHANISM:





(b) Use of chromic oxide (CrO_3)



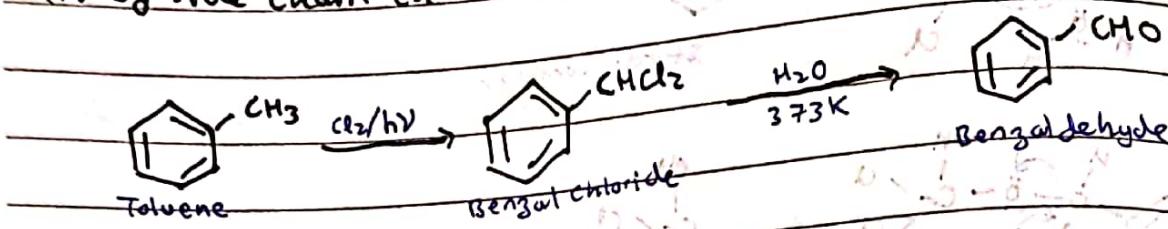
Note: Both reactions take place in a similar manner; it begins with an alkene's allylic hydrogen ($=^{\text{H}}$) reacting with chromyl chloride or precipitate with chromic oxide & acetic anhydride to ~~form~~ a complex. This complex is then hydrolyzed / decomposed in a reducing environment to prevent further oxidation to carboxylic acids. Solvent examples: CCl_4 , CS_2 , CHCl_3 , ~~or~~ Na_2SO_3 (reducing env).

* Produced high yield of aldehyde.

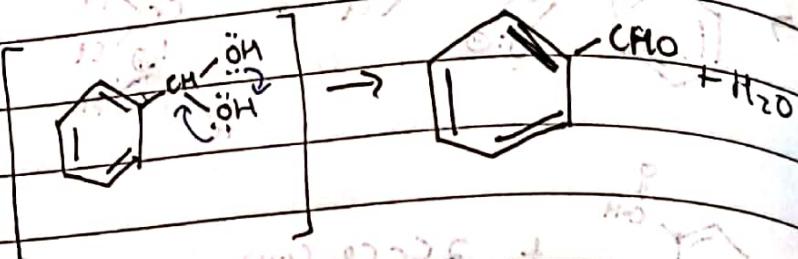
* Time frame: Several days to few weeks

* Formation of complex precipitate is necessary as it prevents further oxidation to carboxylic acids.

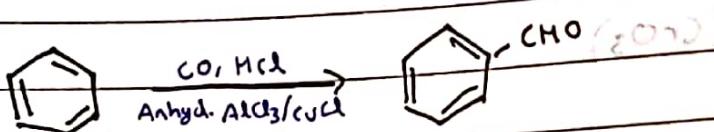
(ii) By side chain chlorination followed by hydrolysis



MECHANISM:

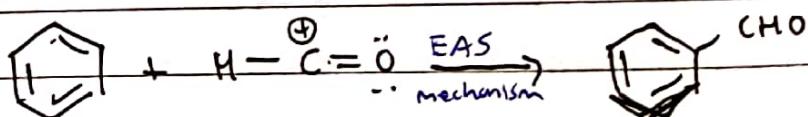
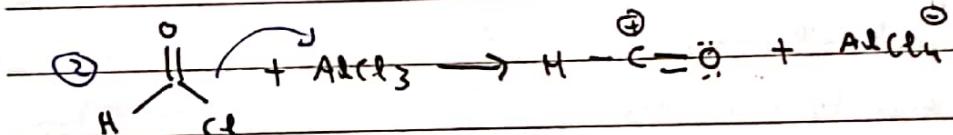
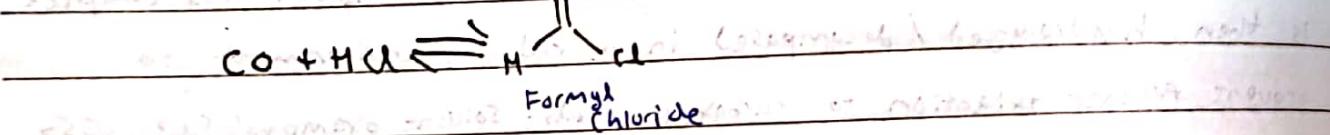
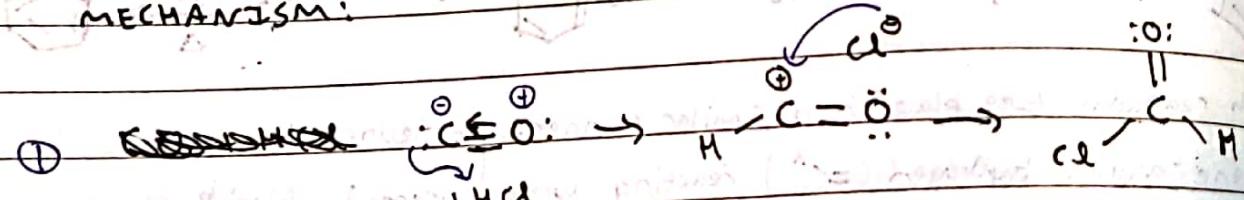


(iii) By Gatterman-Koch Reaction:



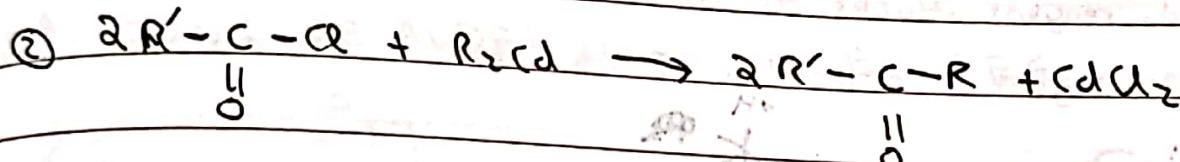
*NOTE: This reaction can take place with just benzene or substituted benzene. The core reaction is simply ELECTROPHILIC AROMATIC SUBSTITUTION.

MECHANISM:

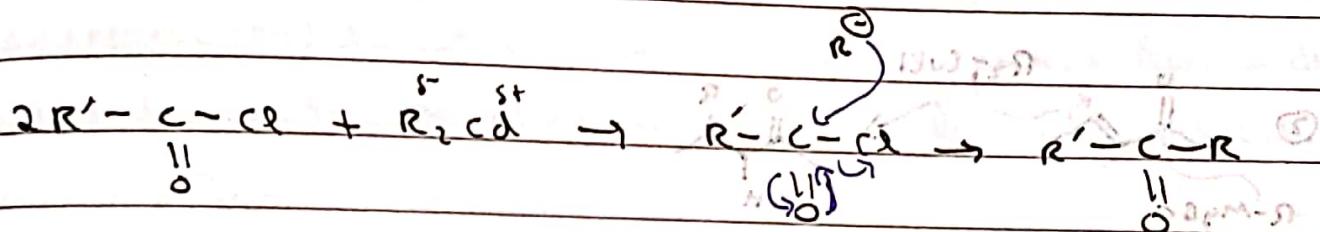
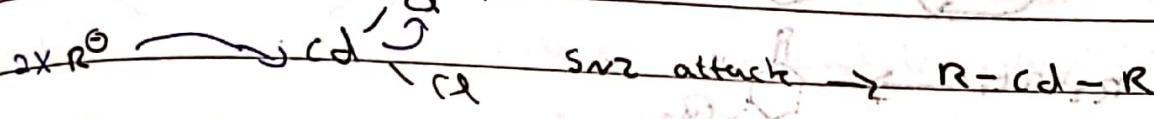


FORMATION OF KETONES

1. FROM ACYL CHLORIDES

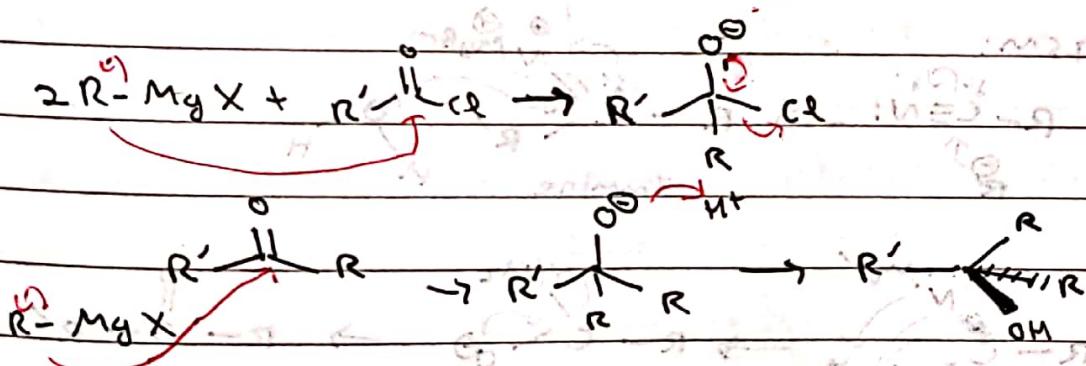


MECHANISM: (self proposed)



*NOTE: It was necessary to form dialkyl cadmium using Grignard's reagent because if done directly with Grignard's reagent they have a tendency to react twice, followed by protonation of O^0 to produce an alcohol.

We can reduce the power of an organometal by using a Gilman reagent (R_2CuLi) or dialkyl cadmium (R_2Cd)



* Gilman reagents do not react with esters whereas Grignard's reagent will reduce it all the way to alcohols.

~~FROM CARBONATES~~

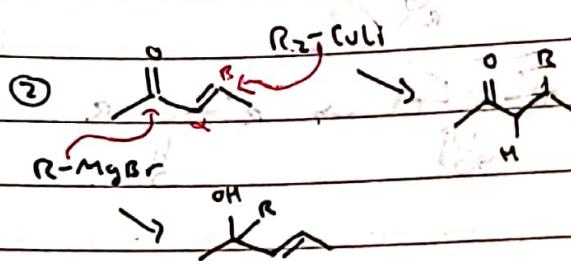
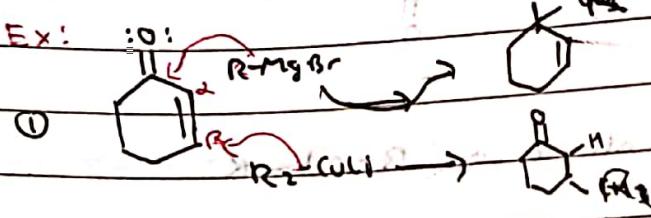
JEF NOTES

* Gilman reagent vs Grignard reagent



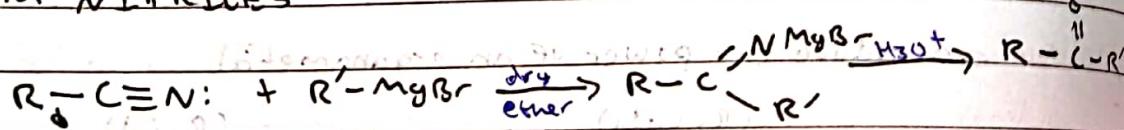
- Grignards reagent attacks the carbonyl carbon whereas Gilman's reagent attacks the β carbon.

Ex:

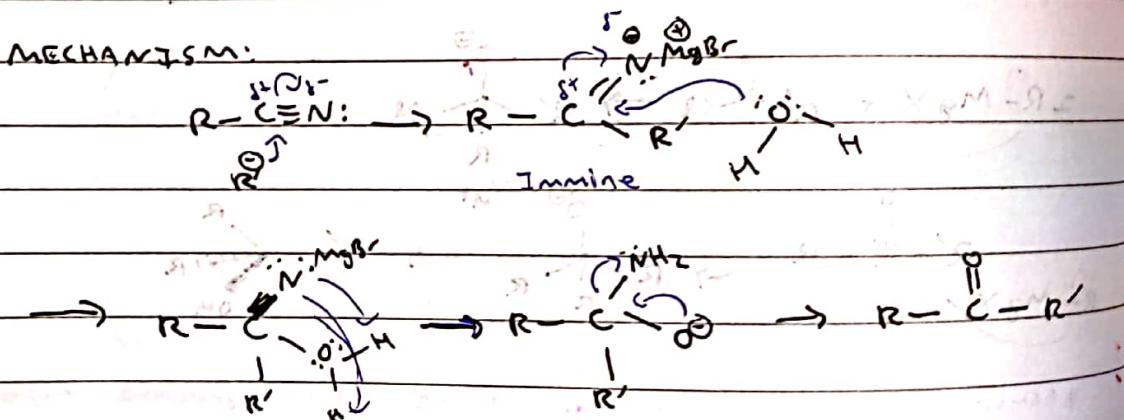


- Also the difference noted previously regarding α -cyt chlides

2. FROM NITRILES

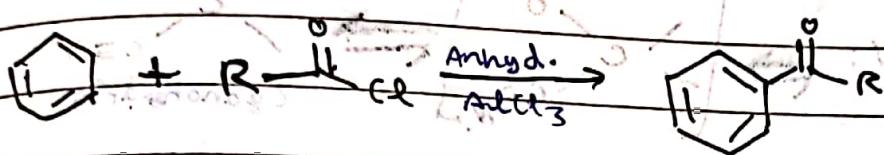


MECHANISM:

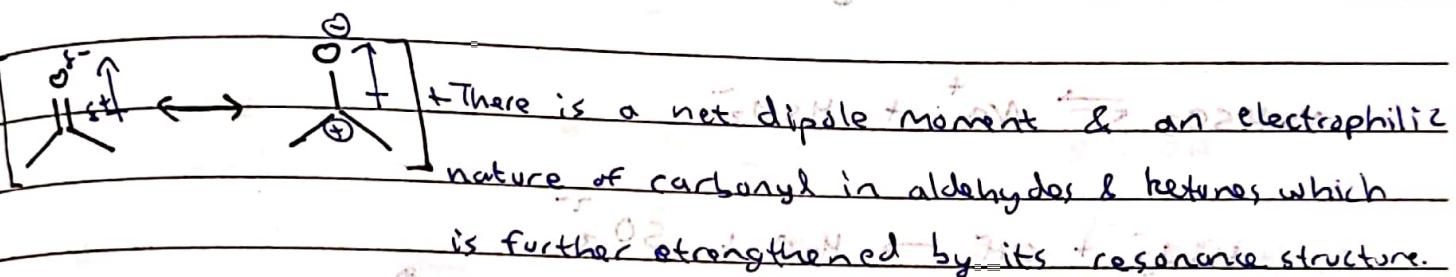


3. FROM BENZENE OR SUBSTITUTED BENZENE

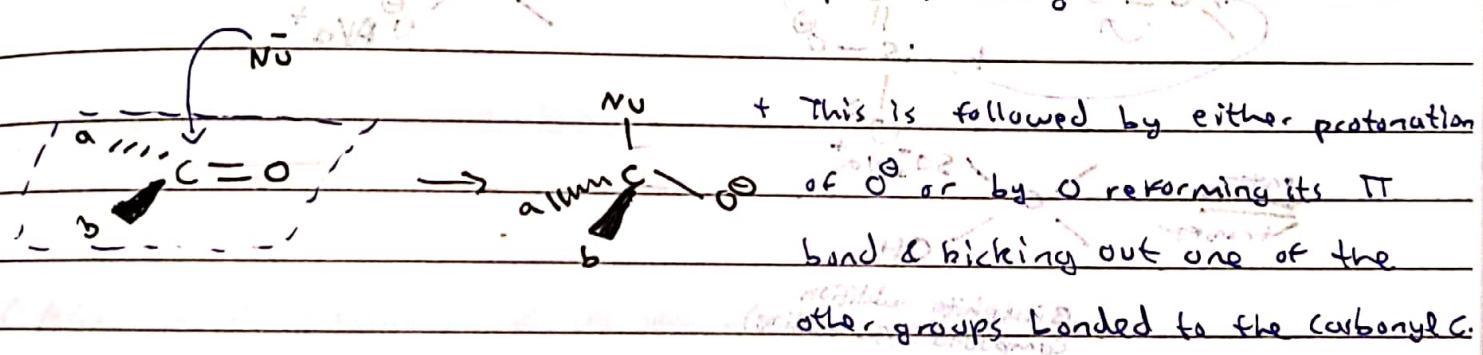
This reaction is the same as Friedel-Crafts acylation reaction & hence takes place via EAS mechanism.



REACTIONS OF ALDEHYDES & KETONES



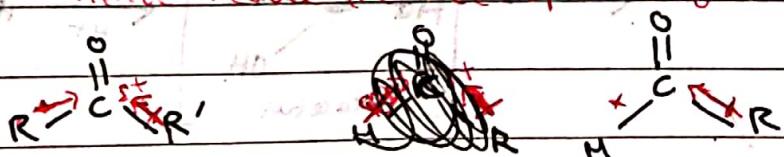
+ nucleophiles tend to attack the electrophilic carbon from a direction perpendicular to the plane of the sp^2 hybridized orbitals.



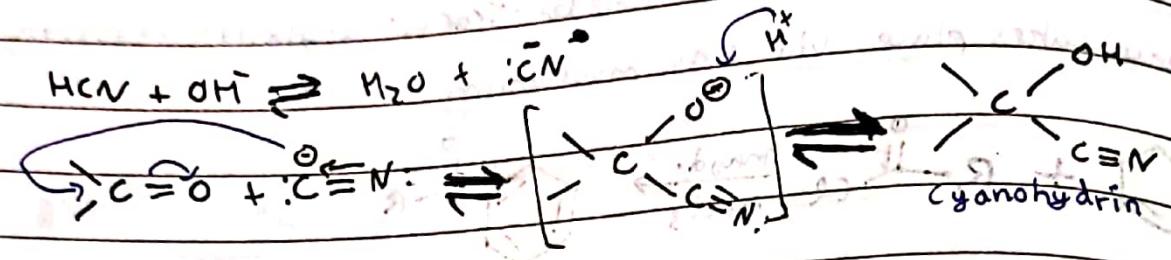
+ Aldehydes are generally more reactive than ketones towards ~~nucleop~~ this attack. 2 reasons

- Steric hindrance: $\text{R}-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{R}'$ provides more steric hindrance than $\text{H}-\overset{\text{O}}{\underset{\text{C}}{\text{C}}}-\text{R}$.

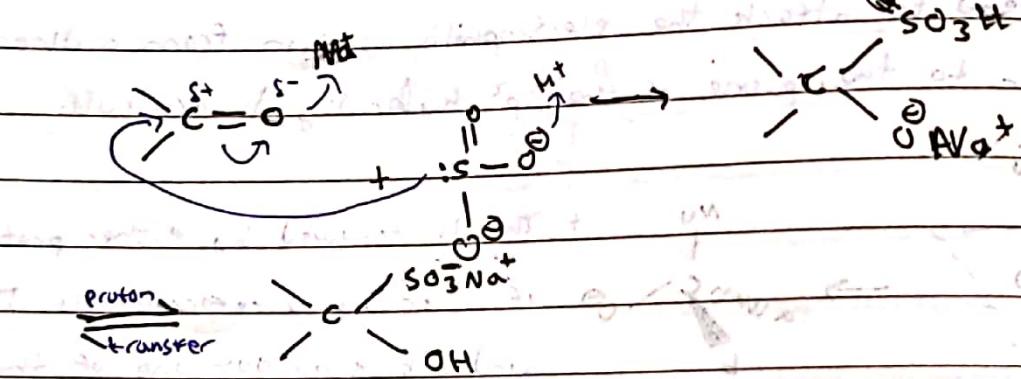
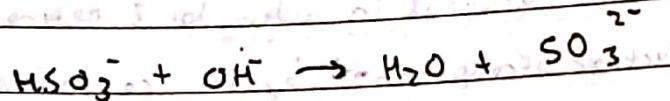
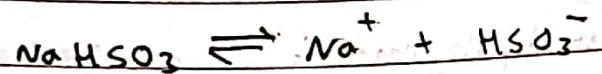
- Electronic effect: Two R groups provide more $+I$ effect and hence reduce the electrophilicity of the carbon.



(a) Addition of HCN



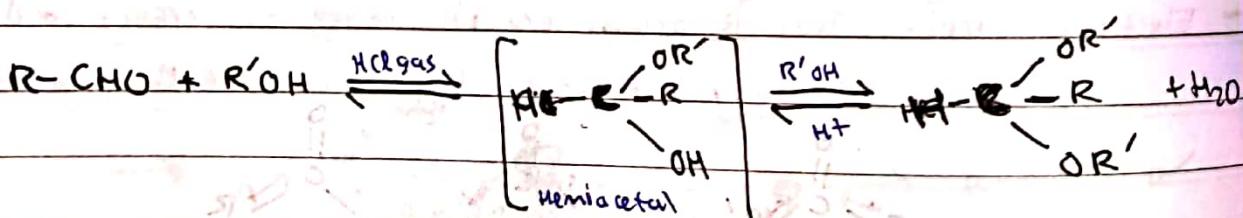
(b) Addition of sodium hydrogen sulphite (NaHSO_3)



(c) Addition of Grignard reagents

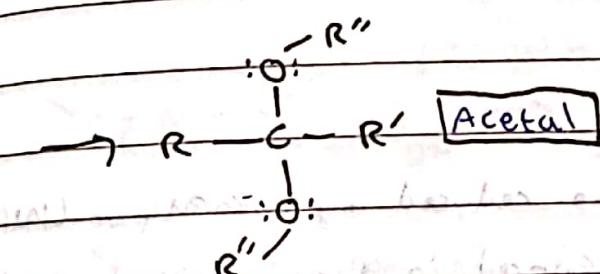
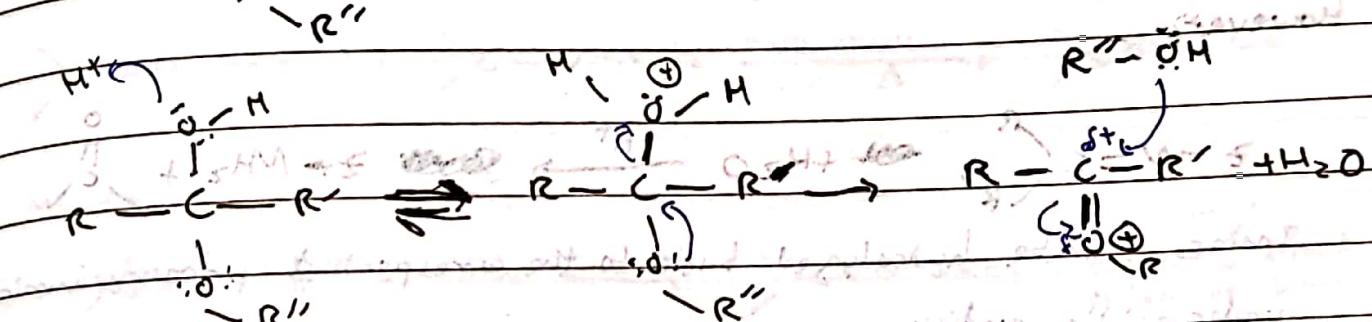
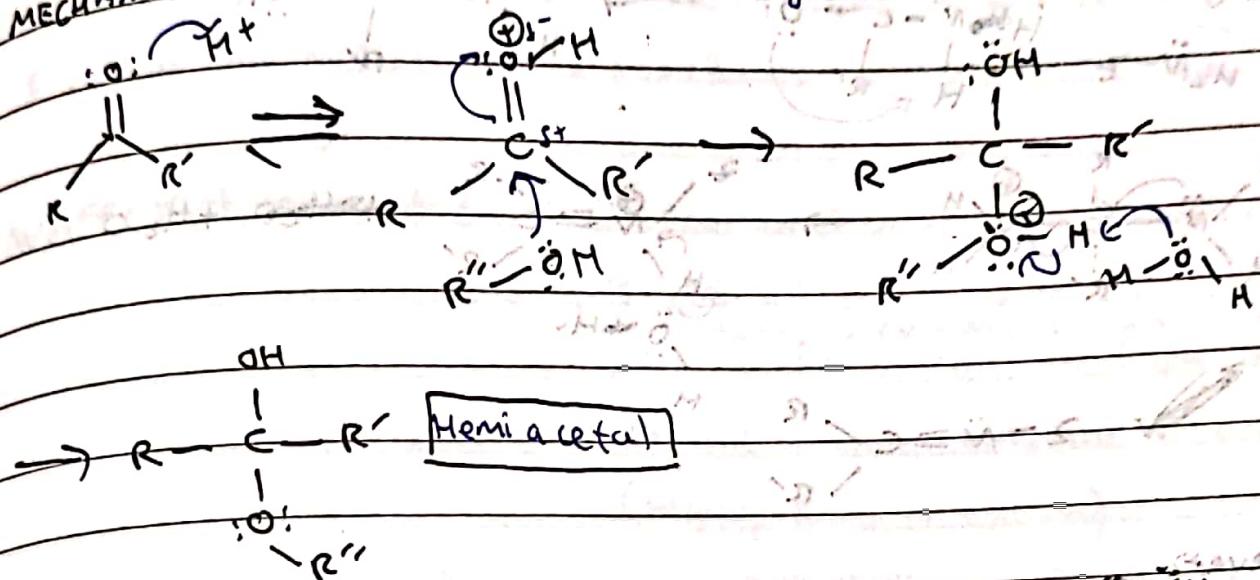
covered before

(d) Addition of Alcohols

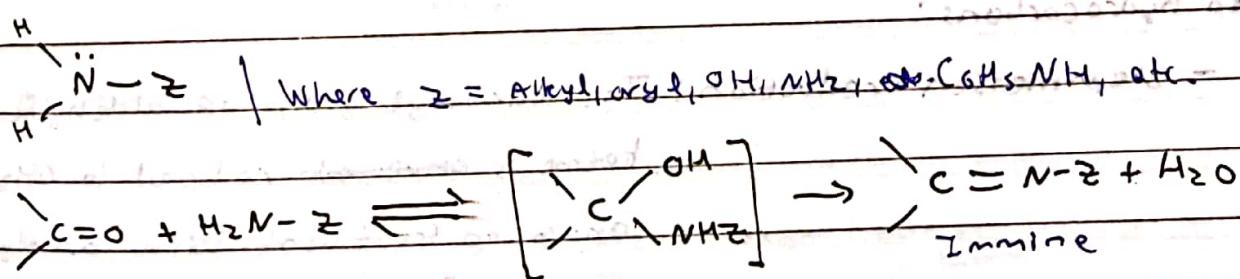


MECHANISM:

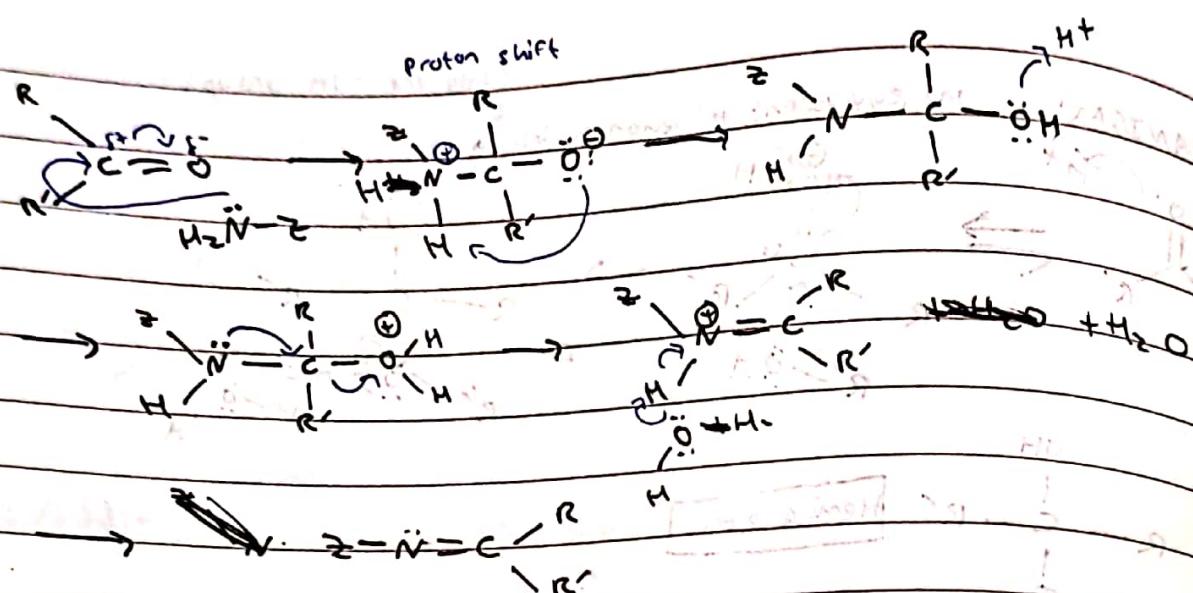
one equivalent of monohydric alcohol



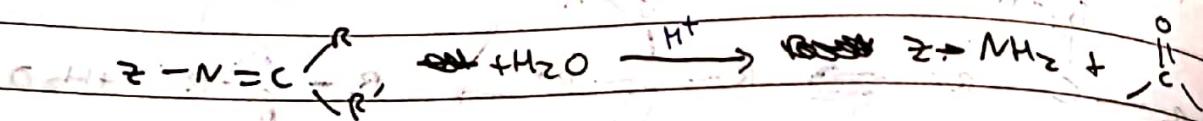
(c) Addition of Ammonia & its derivatives ($\text{H}_2\text{N-Z}$)



* However this reaction is sensitive to hydrolysis & can be reversed via hydrolysis in an acidic medium.



However,



+ Imines can be hydrolyzed back to the corresponding primary amine under acidic conditions.

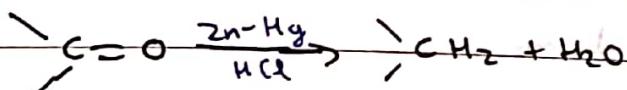
2. Reduction

(i) To alcohols: Aldehydes & ketones can be reduced by NaBH_4 or LiAlD_4 to corresponding alcohols (covered in alcohols, phenols, esters) & also by catalytic hydrogenation.

(ii) To hydrocarbons:

- Clemmensen reduction: The carbonyl group of aldehydes/ketone is converted reduced to CH_2 group on treatment with amalgam $[(\text{Zn})(\text{Hg})]$ & conc. HCl .

(Highly acidic medium)



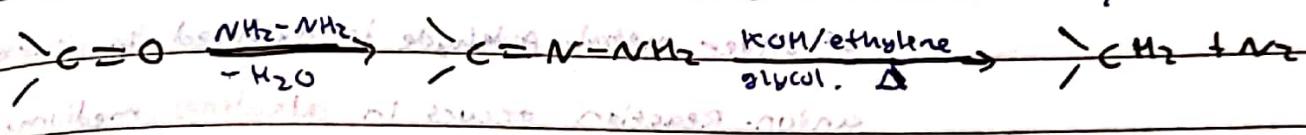
* No mechanism is known. Zn surface is thought to break C=O bonds
 & radical intermediates are a possibility.

- Wolff-Kishner reduction: The carbonyl group of aldehydes/ketones

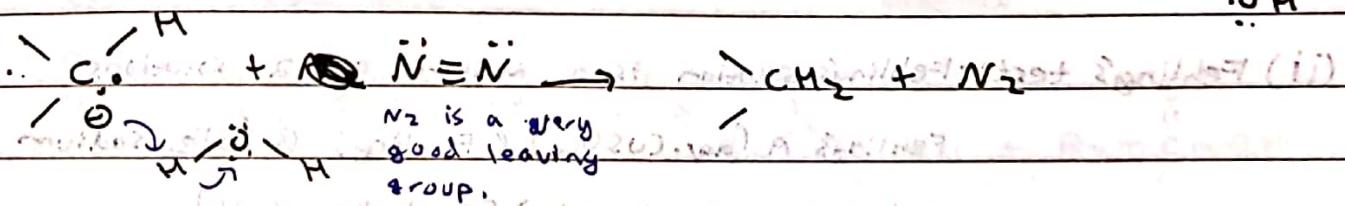
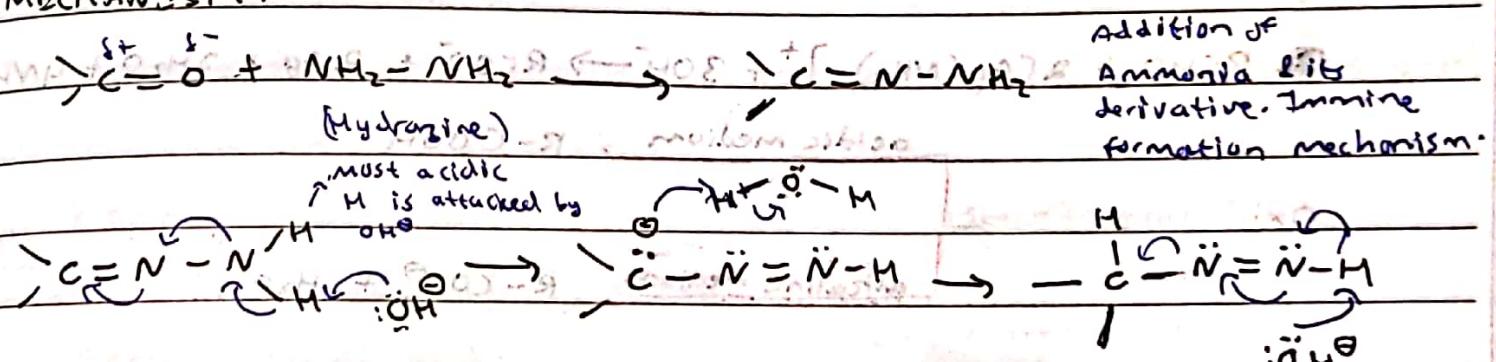
is reduced to CH₂ group by treating it with Hydrazine (NH₂-NH₂) followed by heating with NaOH or KOH in high boiling

solvent such as ethylene glycol.

(Highly Basic medium)



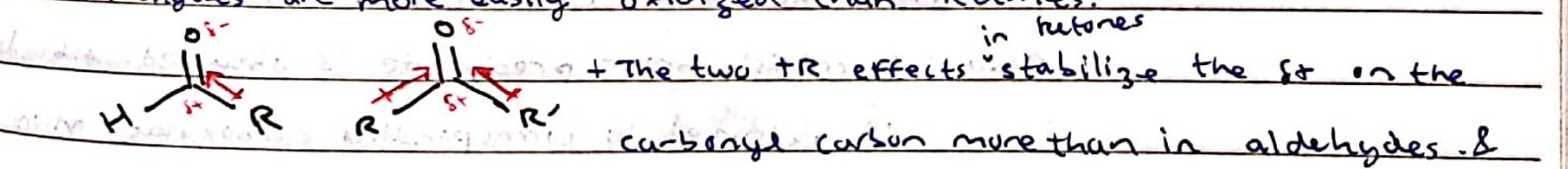
MECHANISM:

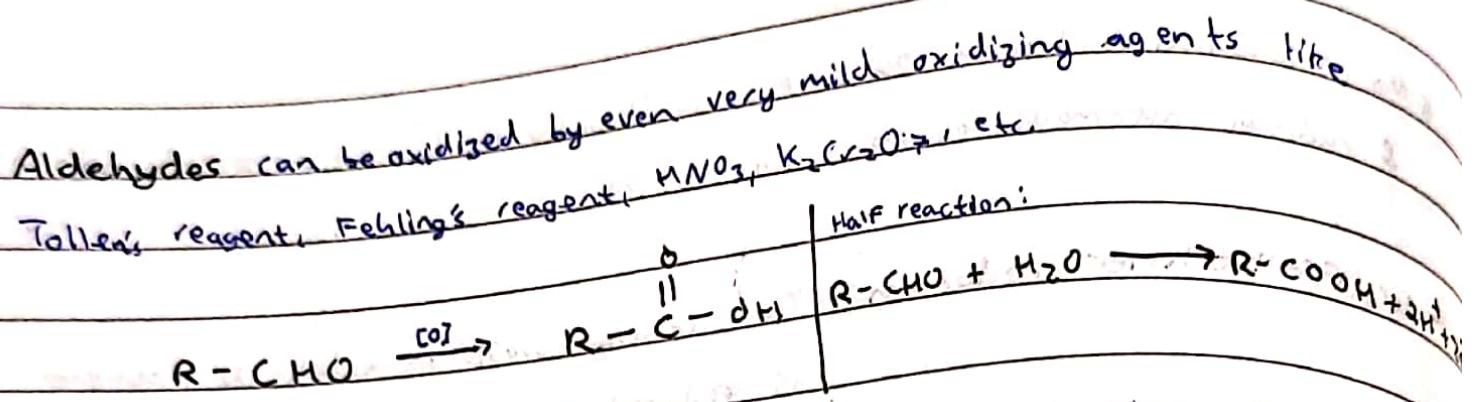


3. OXIDATION

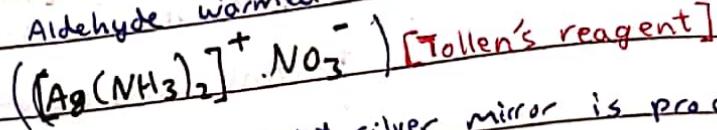
- Aldehydes vs Ketones

Aldehydes are more easily oxidized than ketones.

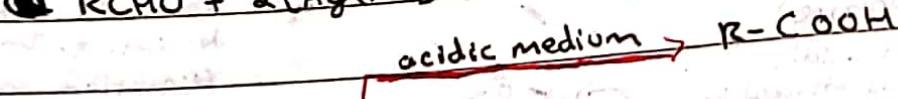
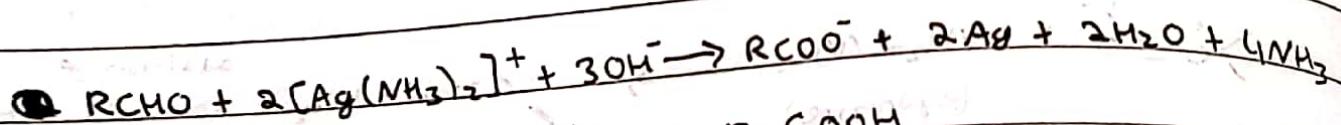




(i) Tollen's test: Aldehyde warmed with ammonical silver nitrate solution

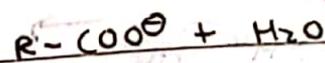


Result: Bright ~~red~~ silver mirror is produced due to formation of silver metal. Aldehyde is oxidized to carboxylate anion. Reaction occurs in alkaline medium.



Oxidation in

alkaline medium



OH^- attacks the carbonyl hydrogen & forms the carboxylate anion.

(ii) Fehling's test: Fehling's solution is a mixture of 2 solutions,

Fehling's A (aq. CuSO_4) & Fehling's B (alt. sodium

potassium tartarate) [Rochelle salt]

- These two solutions are mixed in equal amount before the test.

- Aldehyde is heated with Fehling's reagent.

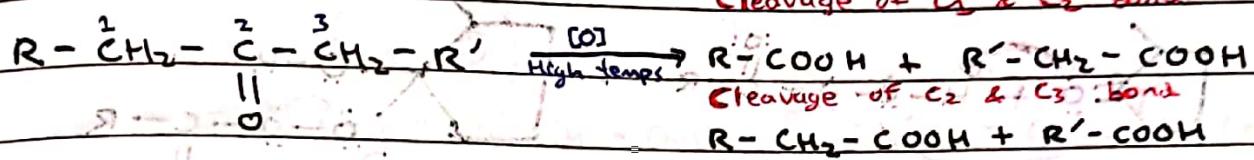
Result: A reddish brown precipitate is obtained. Aldehyde is oxidized to corresponding carboxylate anion.

Alkaline medium. Aromatic aldehydes do not respond to this test.



Red brown
ppt.

Ketones are generally oxidized under vigorous conditions like, strong oxidizing agents & high temperatures. There is C-C bond cleavage.



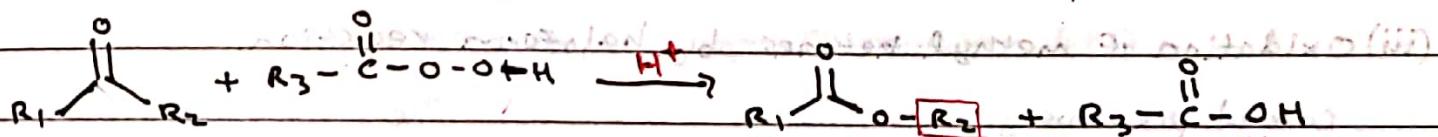
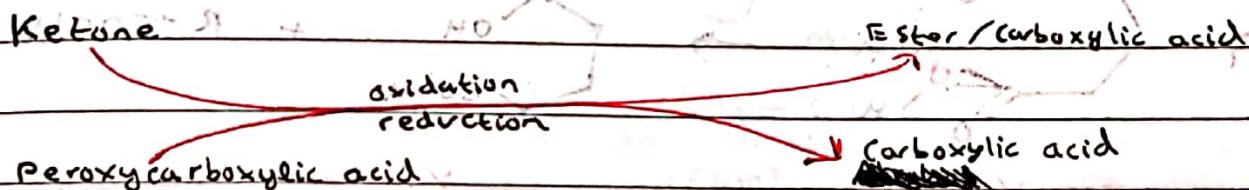
* High temperatures so it doesn't matter which stability doesn't matter for C-C bond cleavage.

JEE NOTES

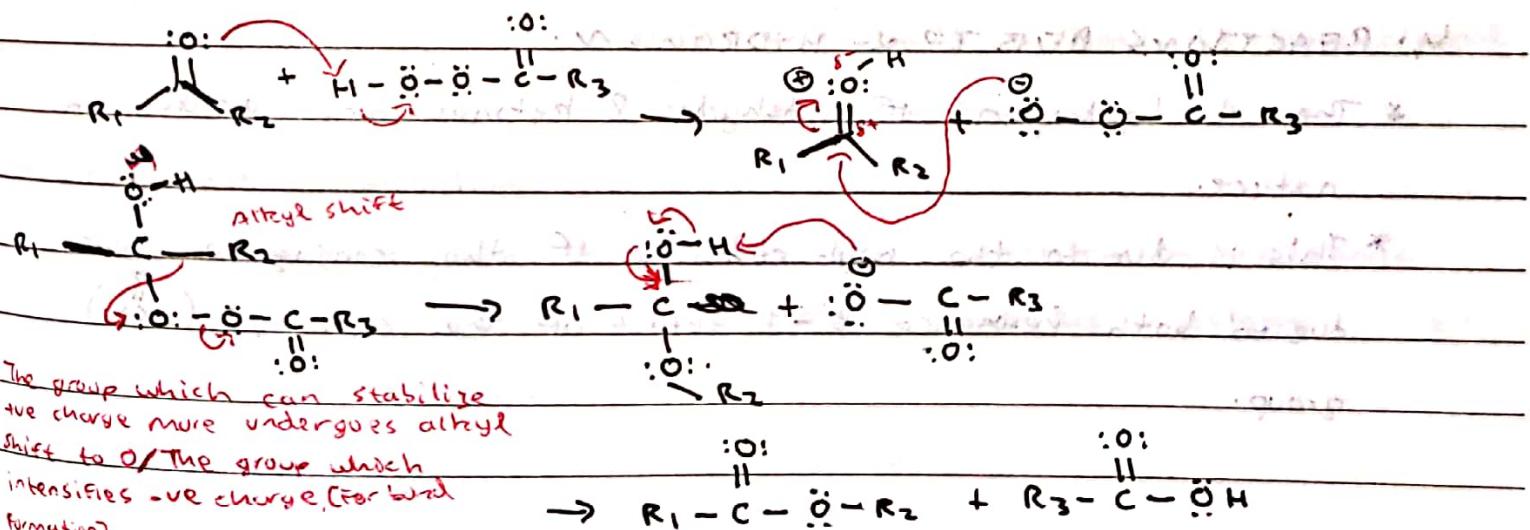
(b) Baeyer - Villiger oxidation.

* The ~~initial~~ of oxidizing agent is peroxy-carboxylic acid ($\text{R}-\overset{\text{O}}{\text{C}}\text{O}-\text{O}-\text{H}$)

* The reaction is catalysed by acid.



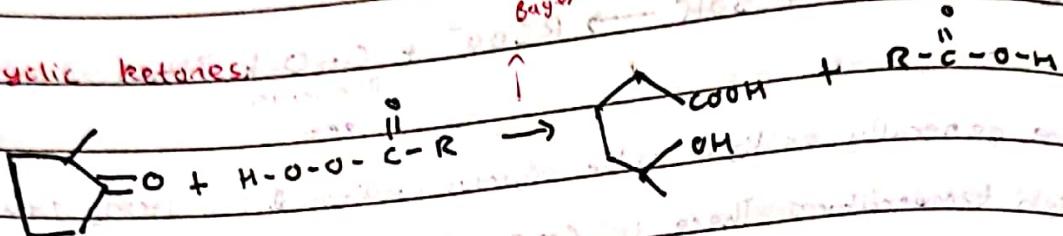
MECHANISM:



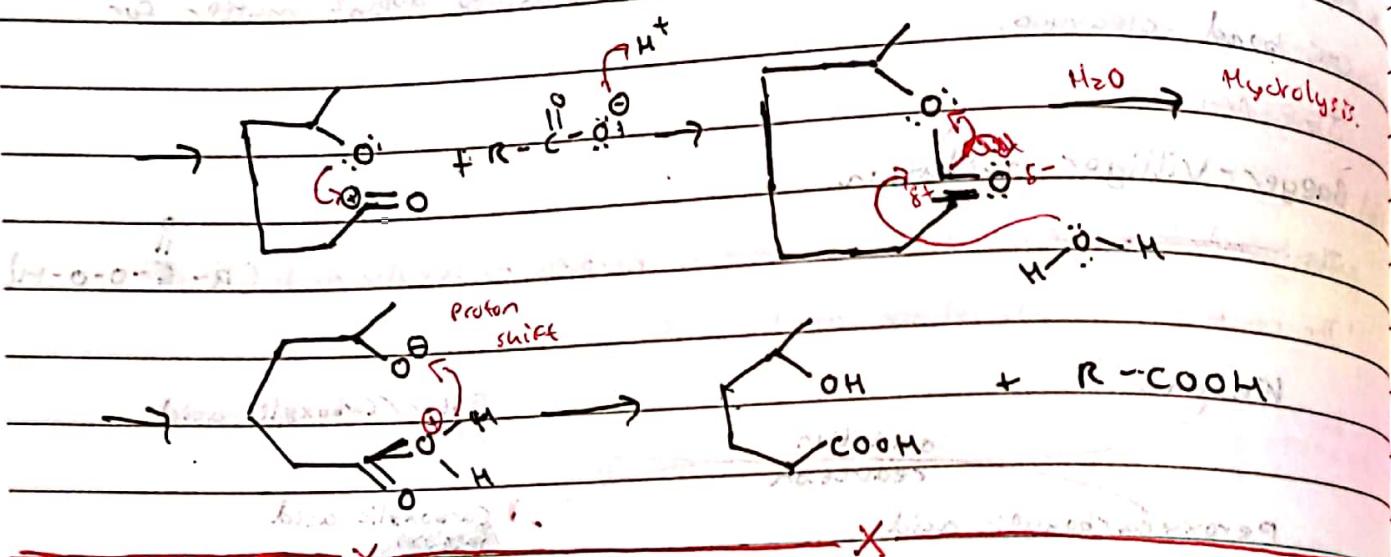
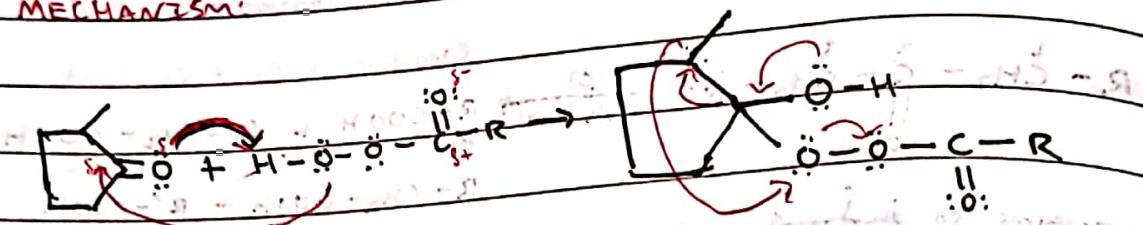
Bayer-villiger oxidation followed by hydrolysis

For cyclic ketones:

Ex:



MECHANISM



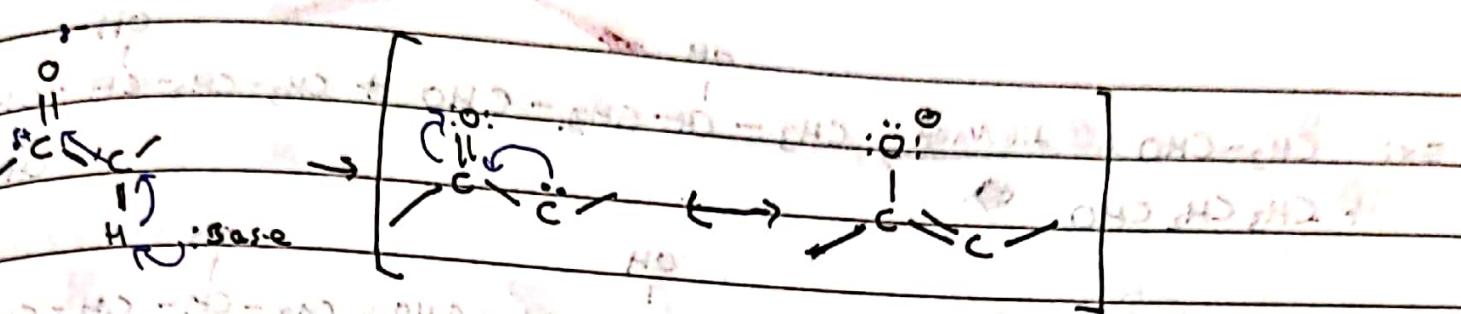
(iii) Oxidation of methyl ketones by haloform reaction.

covered previously.

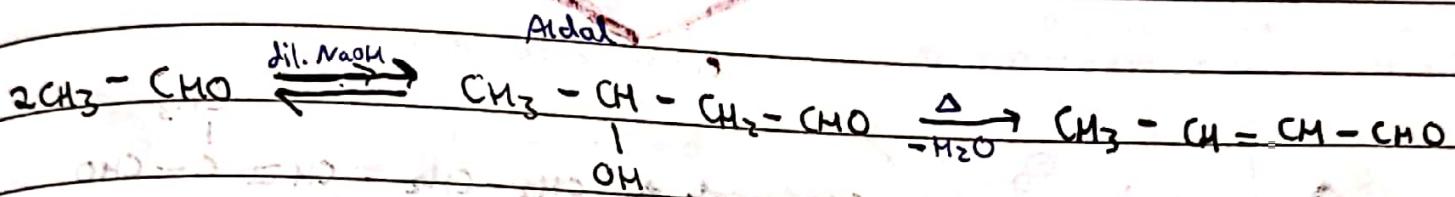
4. REACTIONS LEADING TO α -HYDROGENS.

* The α -hydrogens of aldehydes & ketones are acidic in nature.

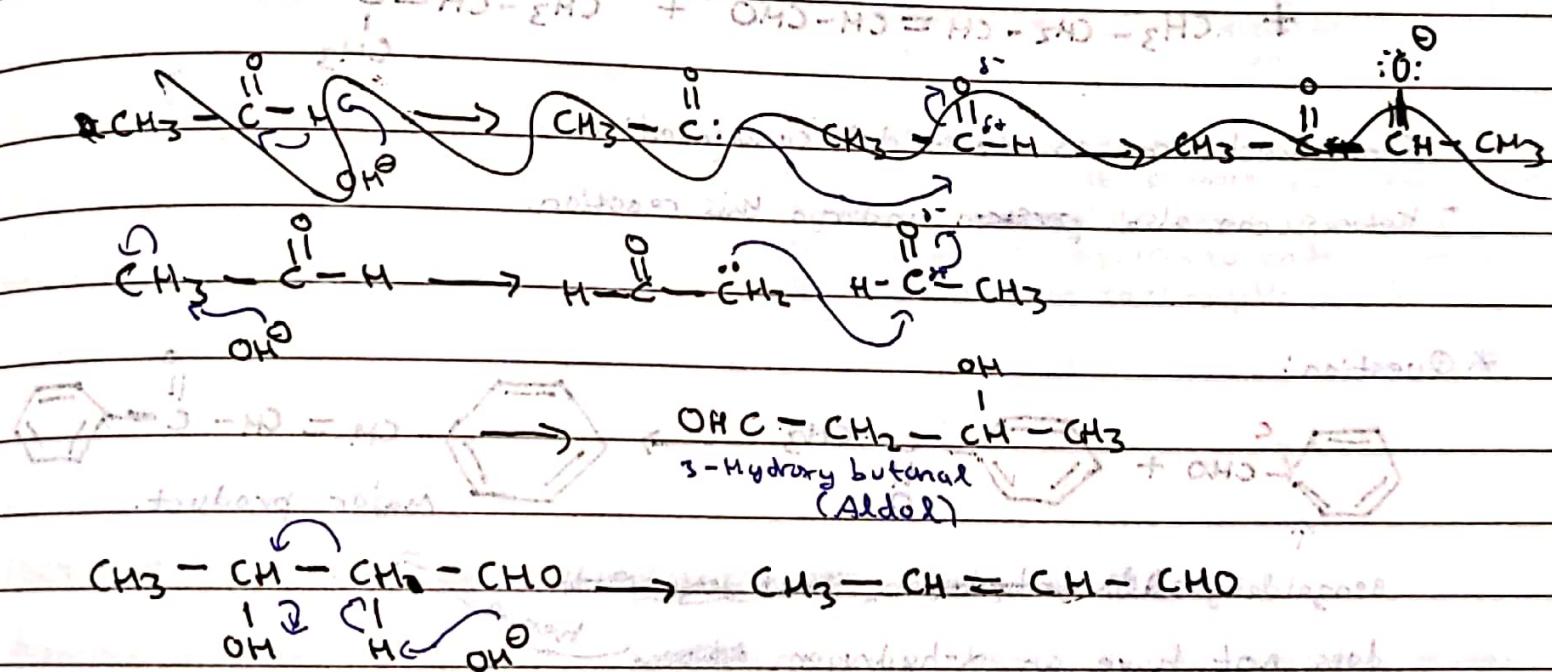
* This is due to the high stability of the conjugate base due to both resonance & π -I effect of the carbonyl ($C=O$) group.



(i) Aldol condensation.



MECHANISM:



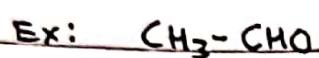
~~Aldol because alcohol + aldehyde group. If we have a ketone group instead of aldehyde, it is called a ketol (ketone + alcohol)~~

(ii) Cross-aldol condensation.

Instead of performing the aldol condensation reaction on the same aldehyde/ketone, if we use two different aldehydes or ketones, it is called 'cross-aldol condensation'.

Result: A mixture of 4 products are formed. all the possible

Self aldol products



① dil. NaOH



OH

1

CH₃

1

CH₃

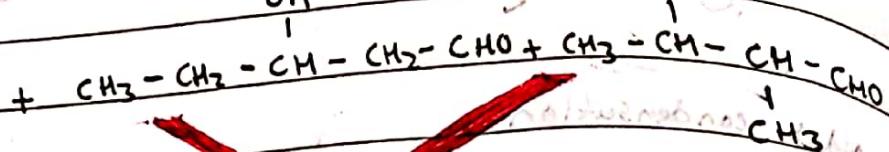
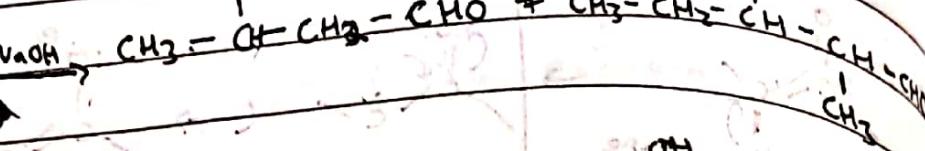
OH

1

CH₃

1

CH₃



OH

1

CH₃

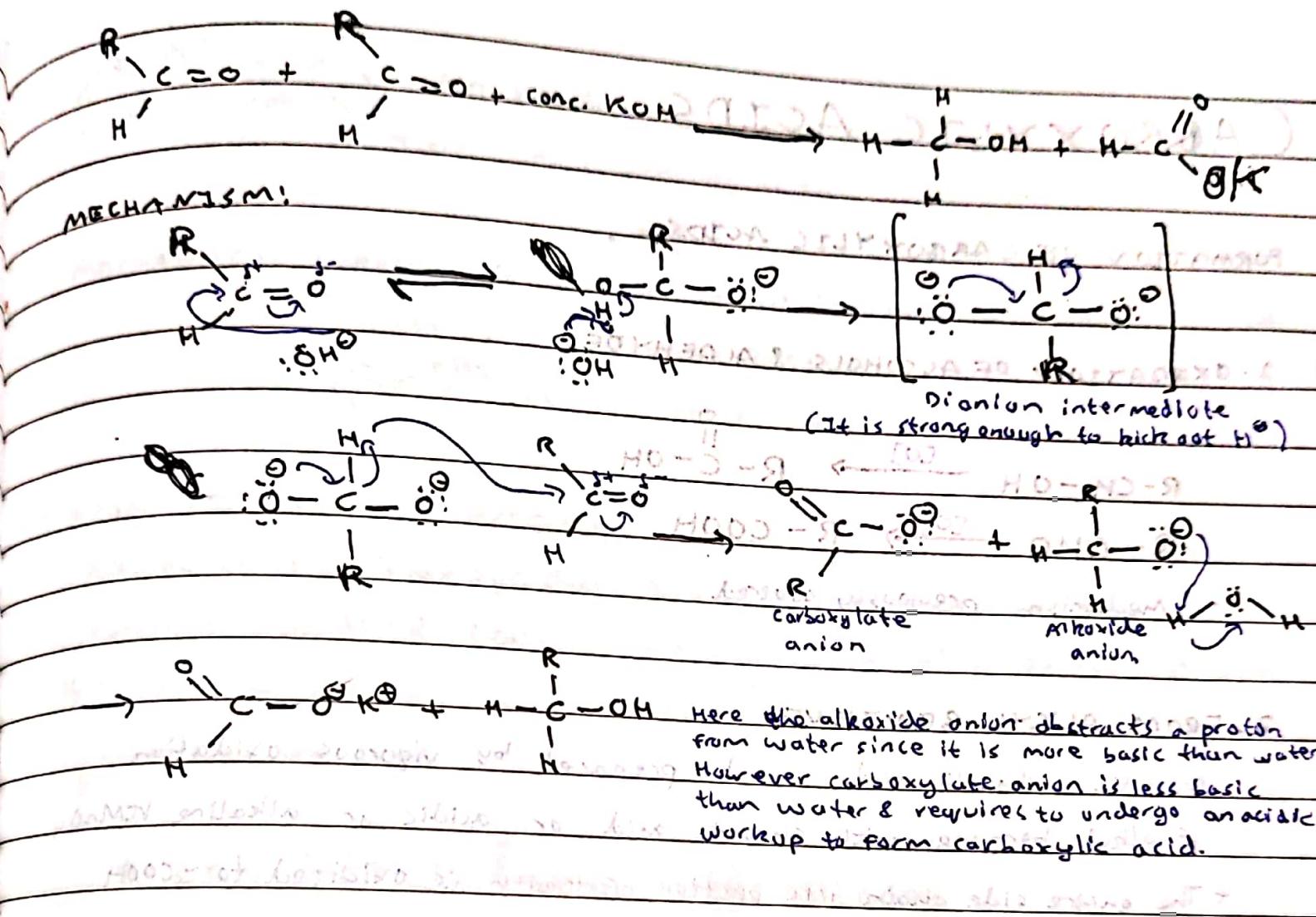
1

CH₃

OH

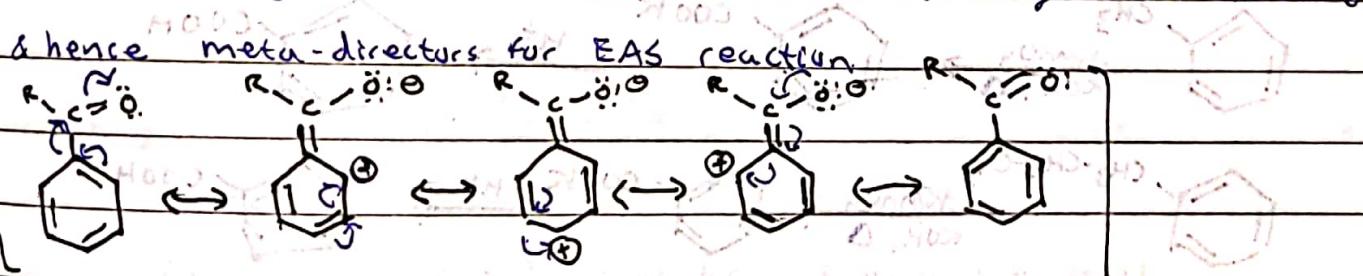
1

CH₃



6. ELECTROPHILIC AROMATIC SUBSTITUTION.

- Aromatic aldehydes & ketones are electron withdrawing or deactivating groups



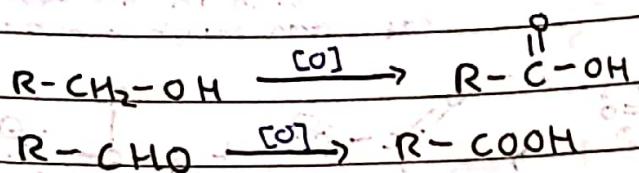
Resonance structures: the charge in ortho & para positions reduces reactivity of benzene ring towards EAS reaction.

Further, the carbonyl carbon produces $-I$ effect which destabilizes the charge at this position & is hence further meta directing.

CARBOXYLIC ACIDS

FORMATION OF CARBOXYLIC ACIDS

1. OXIDATION OF ALCOHOLS & ALDEHYDES



Mechanism previously covered.

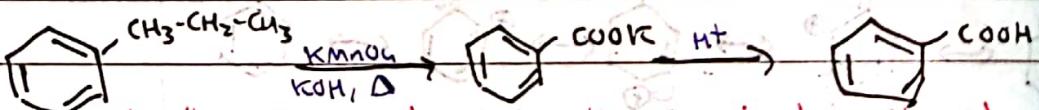
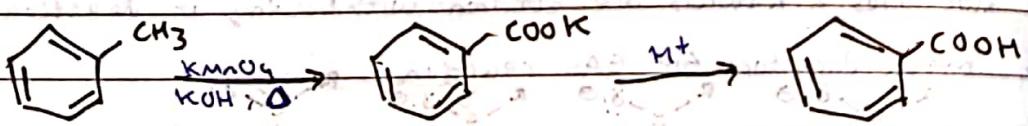
2. FROM ALKYL BENZENES

Aromatic carboxylic acids can be prepared by vigorous oxidation of alkyl benzenes with chromic acid or acidic or alkaline KMnO₄.

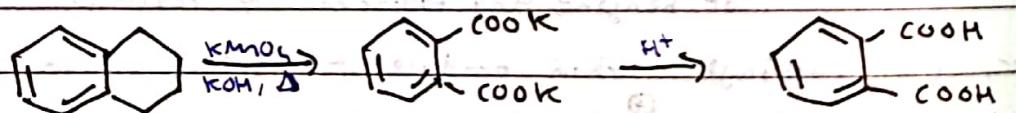
+ The entire side chain irrespective of length is oxidized to -COOH group

+ The benzyl carbon must have H attached to it, i.e., only primary & secondary groups can undergo this reaction.

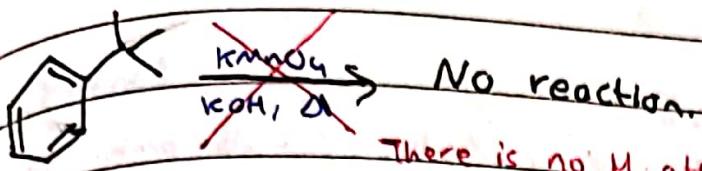
Ex:



Length of R group does not matter, C-C bond is cleaved.



Cyclic chain is broken & 2 benzoic acids are formed.



There is no H attached to the benzyllic carbon.

MECHANISM: Unknown. Thought to proceed through homolytic cleavage of C-H bond to produce resonance stabilized free radical.

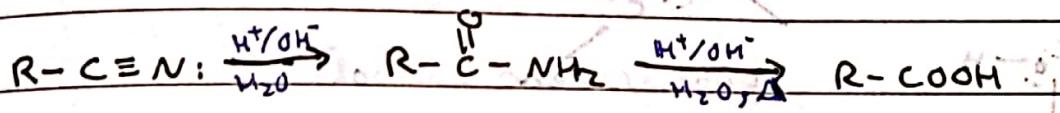


Further process unknown.

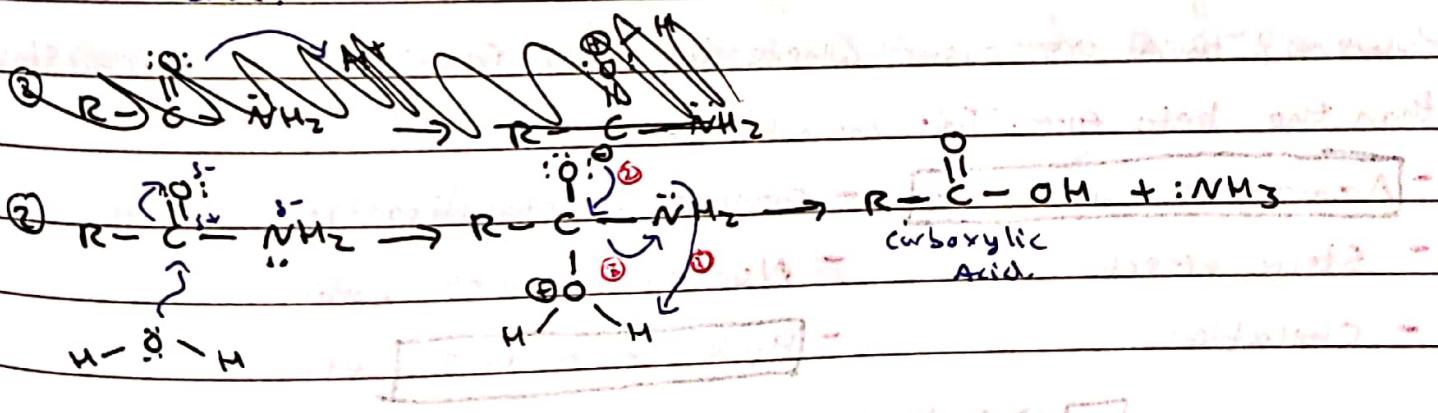
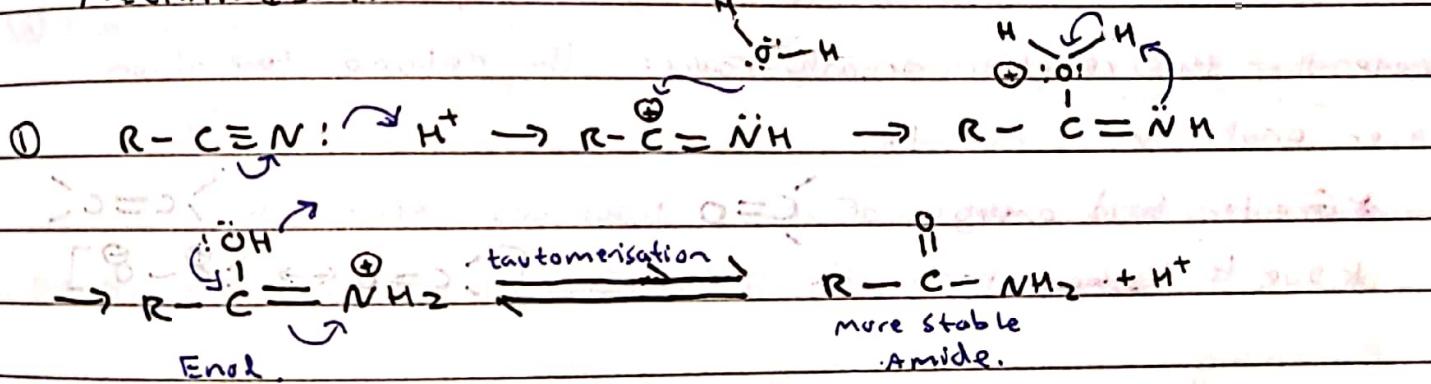
3. FROM NITRILES & AMIDES

Nitriles ($\text{R}-\text{C}\equiv\text{N}$) are hydrolysed to amides ~~then~~ & then to carboxylic acids ($\text{R}-\text{COOH}$) in the presence of H^+ or OH^- as catalyst.

* To stop the reaction at amide ($\text{R}-\text{C}(=\text{O})-\text{NH}_2$) stage, mild reaction conditions are used.



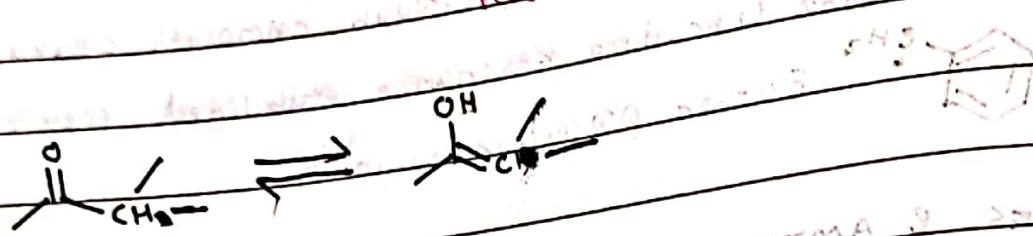
MECHANISM:



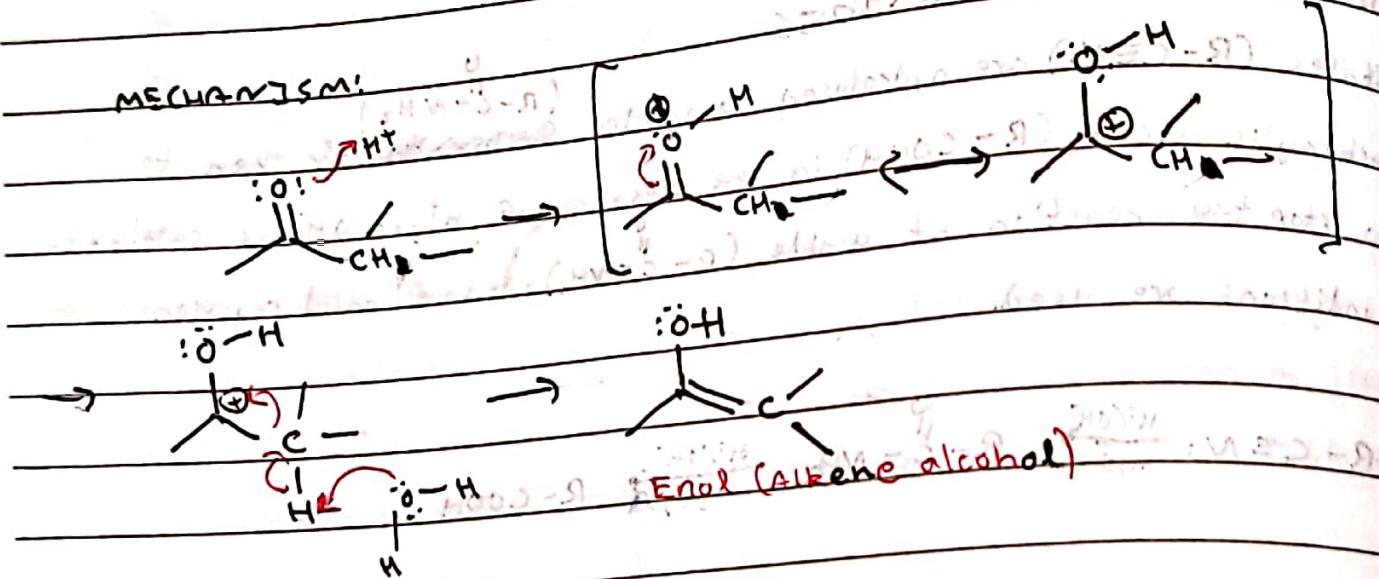
JEE NOTES

* TAUTOMERISATION: It is a reaction which involves simple proton transfer in an intermolecular fashion.

- keto-enol tautomerisation is acid or base catalysed



MECHANISM:



This reaction is reversible & hence always in equilibrium.

- Generally, this reaction greatly favors the ketone formation over enol. This is due to

* Greater bond energy of $\text{C}=\text{O}$ bond over that of $\text{C}=\text{C}$
 * Due to ~~high~~ resonance stabilization $[\text{C}=\text{O} \leftrightarrow \text{O}=\text{O}]$

However, there are cases where the enol form may be more stable than the keto form. This may be due to:

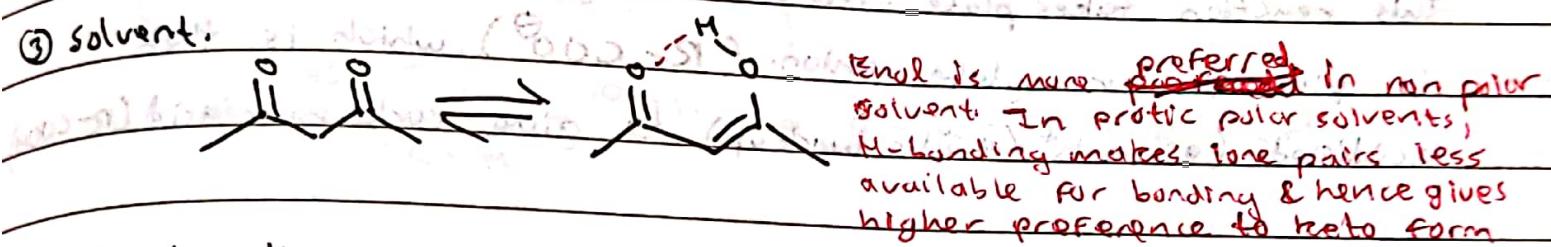
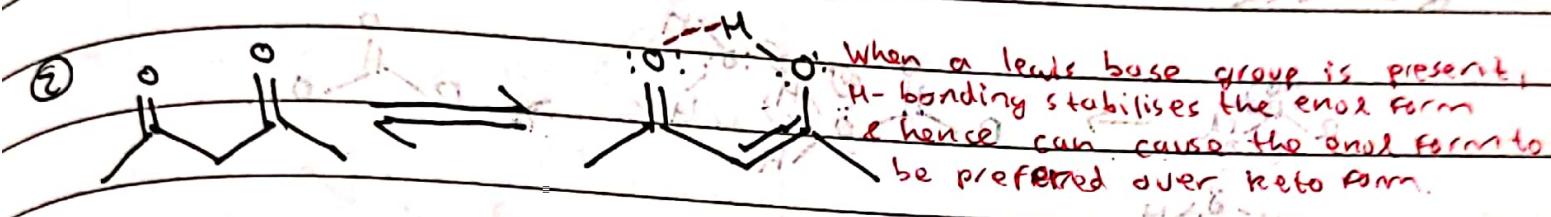
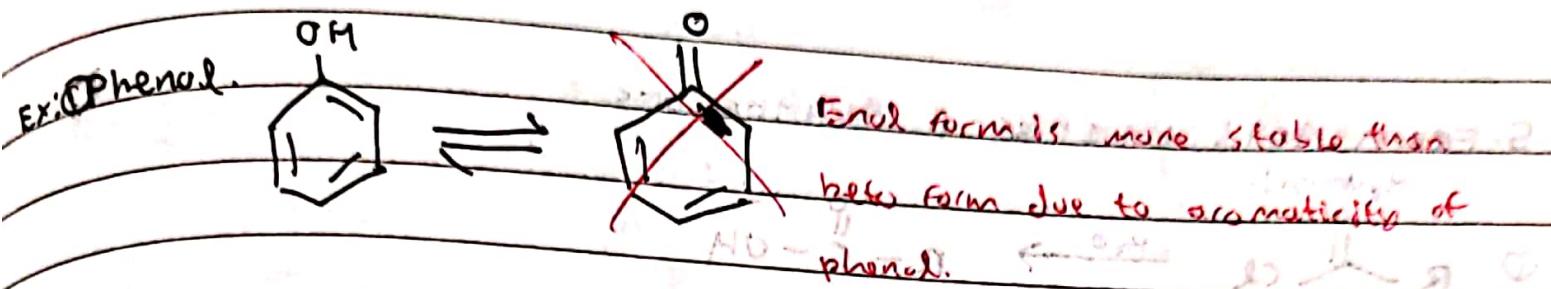
Aromatic Stabilization

- Steric effect
- Chelation

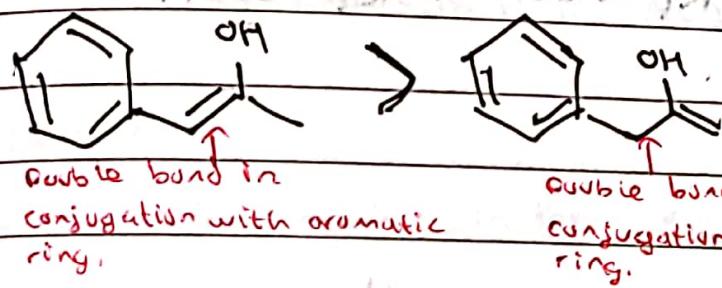
Conjugation Stabilization

- Non-polar solvents
- Hydrogen bonding, etc.

→ Main reason

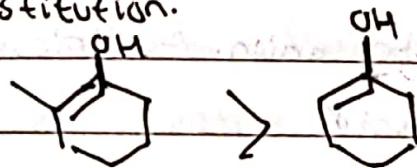


④ Configuration



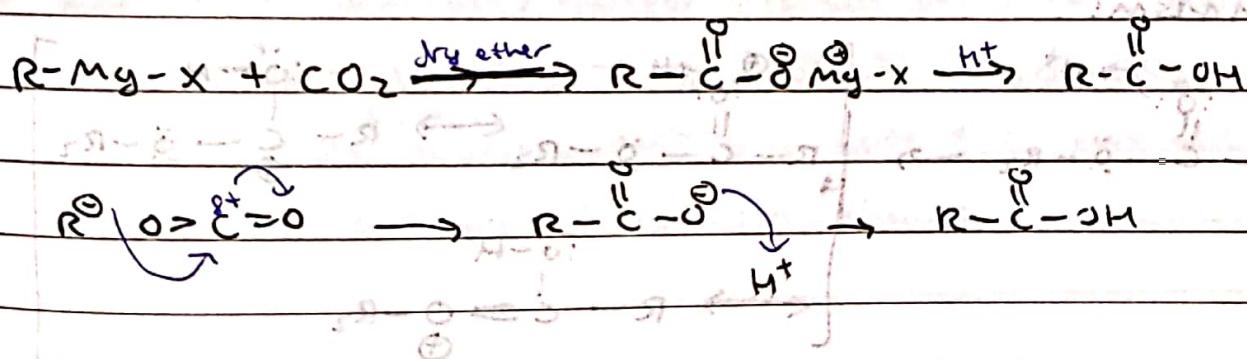
The more preferred tautomer will be the one where the double bonds are in conjugation.

⑤ Substitution.



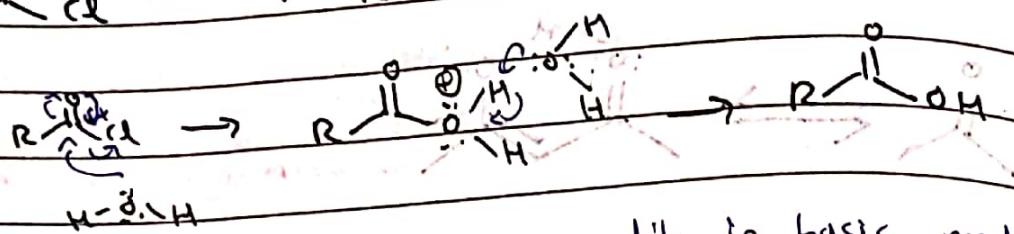
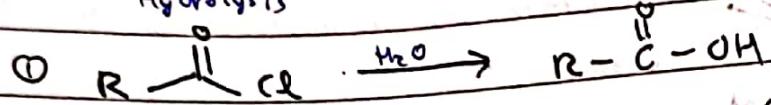
More substituted alkene (more hyperconjugative structures) is the more preferred enol.

6. FROM GRIGNARD REAGENT.



S. FROM ACYL HALIDES & ANHYDRIDES

Hydrolysis



This reaction takes place more readily in basic medium to give the carboxylate anion ($\text{R}-\text{COO}^-$) which is then acidified (given H^+ / acidic workup) to give carboxylic acid ($\text{R}-\text{COOH}$).

\textcircled{2}

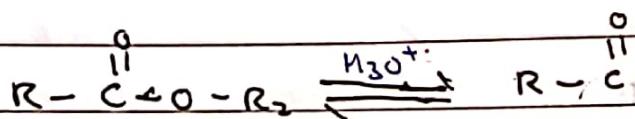


same mechanism

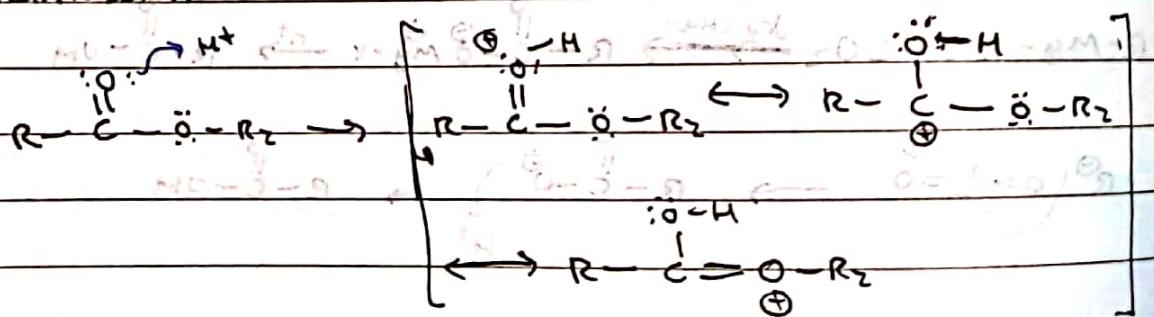
G. FROM ESTERS.

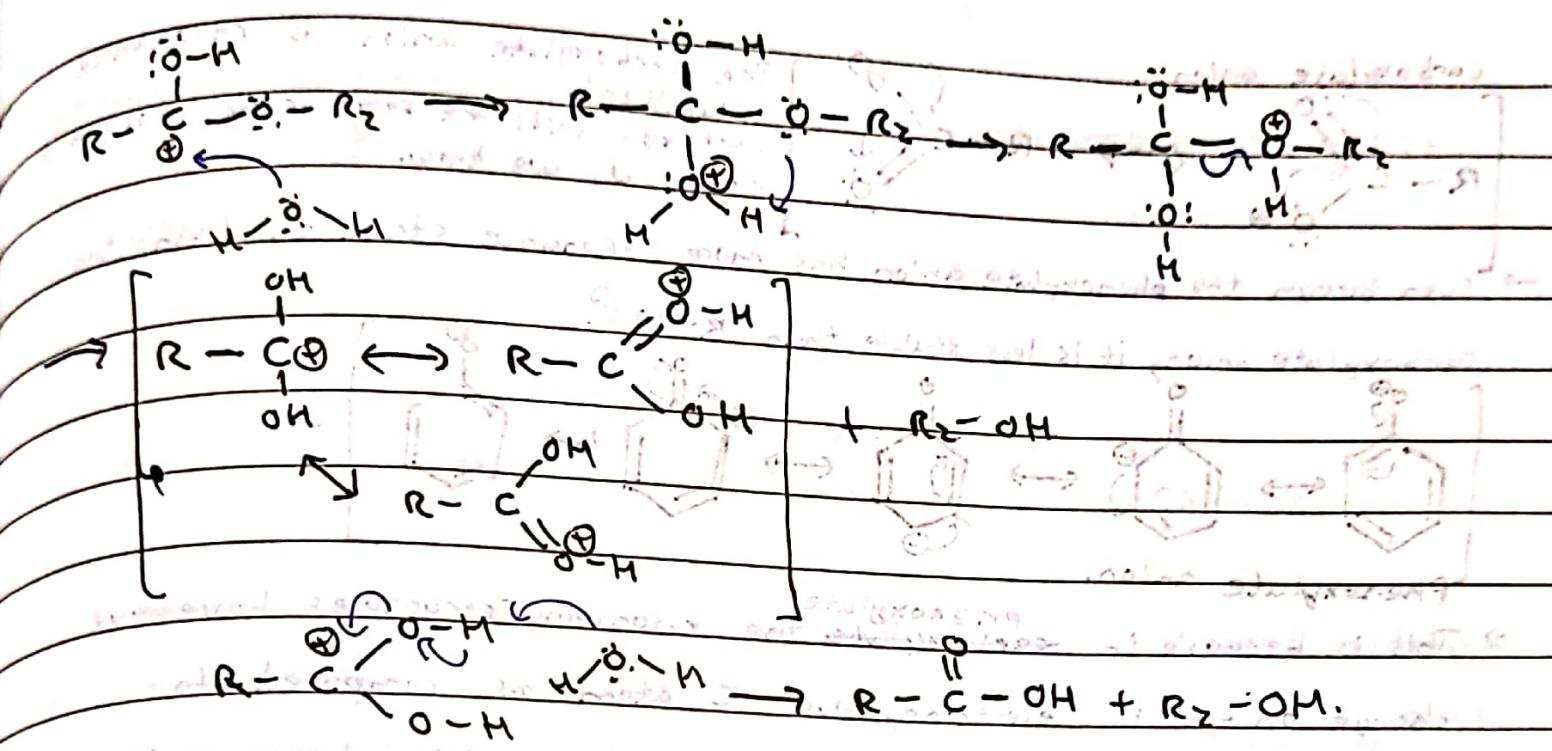
Acidic hydrolysis of esters gives carboxylic acids

Basic hydrolysis of esters gives carboxylate anion. Acidification of the carboxylate anion gives carboxylic acid



MECHANISM:



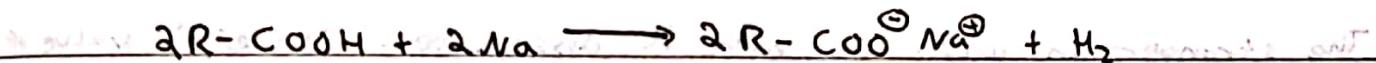


REACTIONS OF CARBOXYLIC ACIDS.

1. ACIDITY

They are similar to alcohols in their acidic nature & hence perform the following reactions:

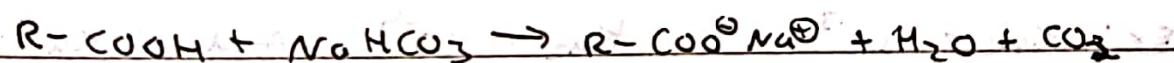
(a) Acid + metal \rightarrow liberates H_2 gas



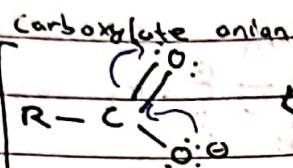
(b) Acid + base gives salt & water



(c) Acid + carbonate / hydrogen carbonate gives salt + water + CO_2

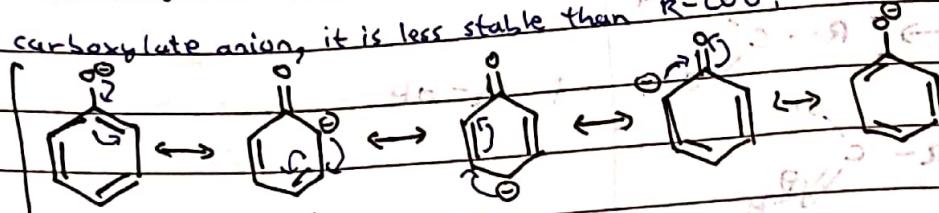


Unlike alcohols & phenols, carboxylic acids also react with weaker bases like carbonates & hydrogen carbonates.



The carboxylate anion is resonance stabilized. Carboxylic acids are some of the most common compounds we know.

Even though the phenoxylate anion has more resonance structures than the carboxylate anion, it is less stable than $\text{R}-\text{COO}^-$.



Phenoxylate anion.

This is because in phenoxylate the resonating structures have -ve charge on the less electronegative C atom as compared to carboxylate who's resonating structures have -ve charge on the more electronegative O atom.

Hence, resonating structures of carboxylate are more stable

& hence it is more acidic than phenol.

Acidity of acids is usually measured by pK_a .

$$\text{pK}_a = -\log(K_a)$$

$$K_a = \frac{[\text{H}^+][\text{RCOO}^-]}{[\text{RCOOH}]}$$

$$\log K_a = \text{pK}_a$$

The stronger an acid, the more it dissociates. Hence \Rightarrow value of K_a . Since $\text{pK}_a = -\log(K_a)$

\rightarrow Stronger acids will have lower pK_a .

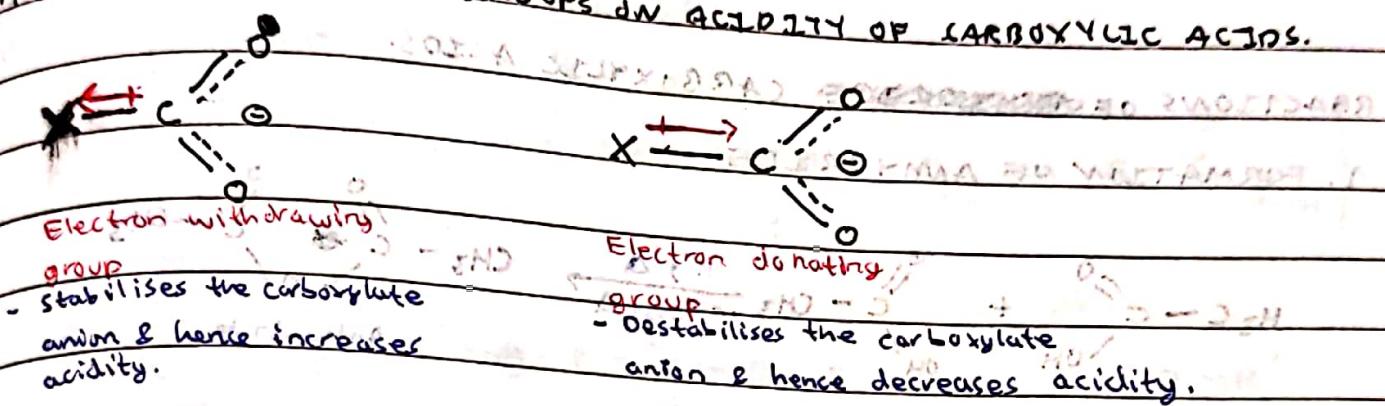
\rightarrow Weaker acids will have higher pK_a .

Ex: $K_{a1} = 10^{-3}$, $K_{a2} = 10^{-4}$. Acidity: $K_{a1} > K_{a2}$

$$\begin{aligned} \text{pK}_{a1} &= -(-3) \\ &= 3 \\ \text{pK}_{a2} &= -(-4) \\ &= 4 \end{aligned}$$

$\text{pK}_{a1} < \text{pK}_{a2}$

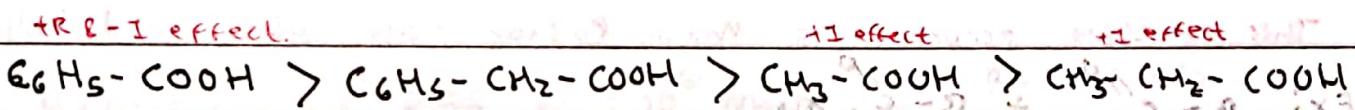
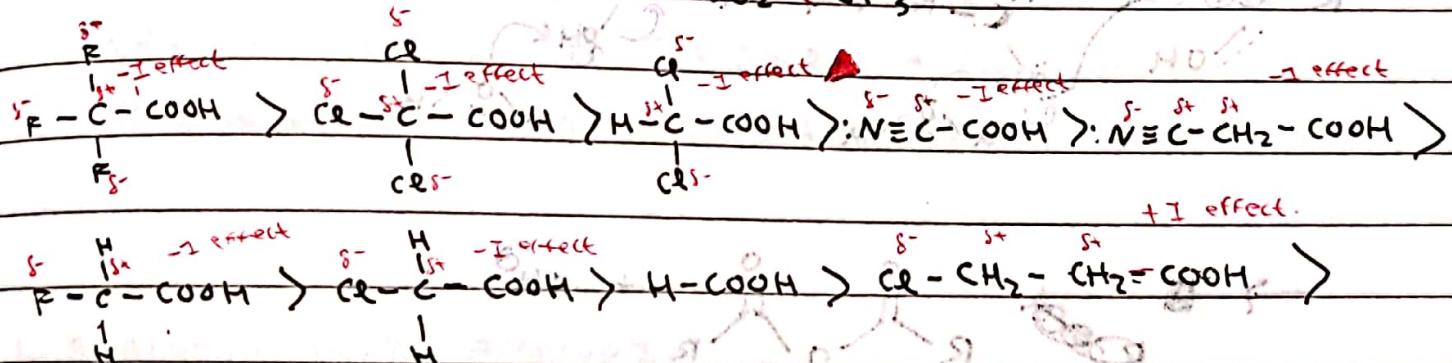
EFFECT OF SUBSTITUENT GROUPS ON ACIDITY OF CARBOXYLIC ACIDS.



However, although phenyl (C_6H_5-) group's $+I$ effect destabilises the anion, the increased number of resonating structures $\delta-\pi$ effect or the corresponding acid to which it is attached gives $+I$ effect.

The same applies for vinyl groups ($\text{CH}_2=\text{CH}-\text{C}(=\text{O})-\text{OH}$)

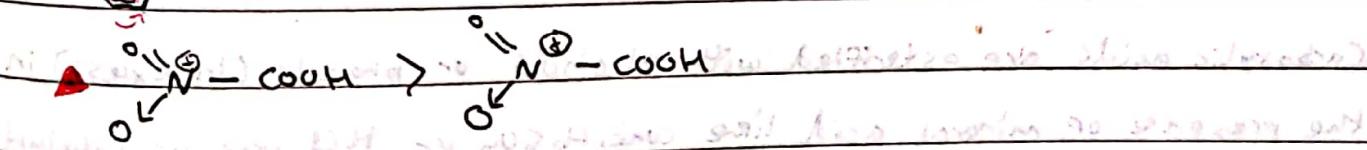
Increasing order of acidity due to effect of functional groups.



- I effect of phenyl group is due to electron flow through the ring & sp^2 hybridisation

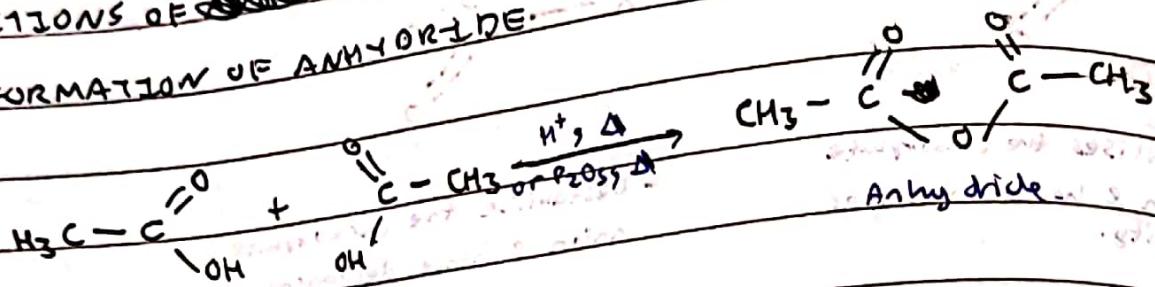


MUTUAL effect of carbon atoms.

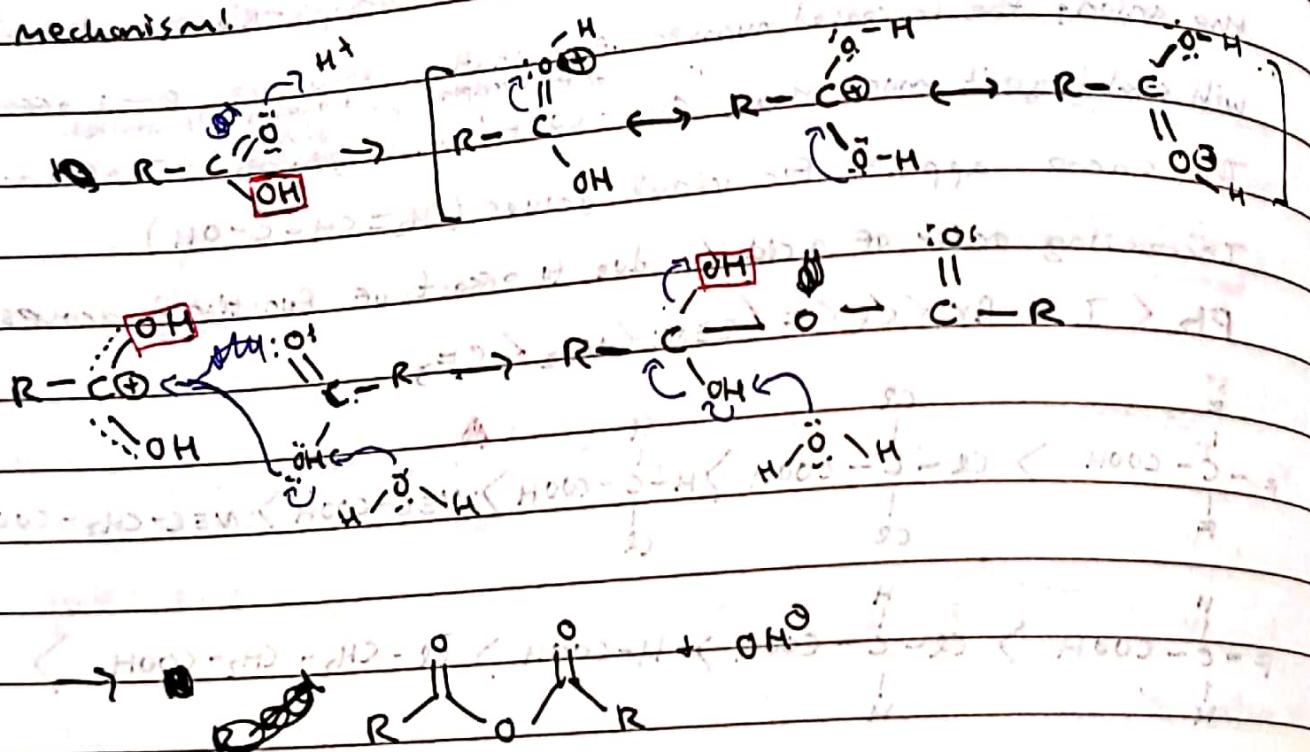


REACTIONS OF CARBOXYLIC ACIDS.

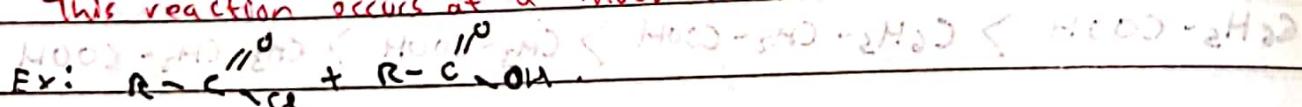
1. FORMATION OF ANHYDRIDE.



Mechanism:



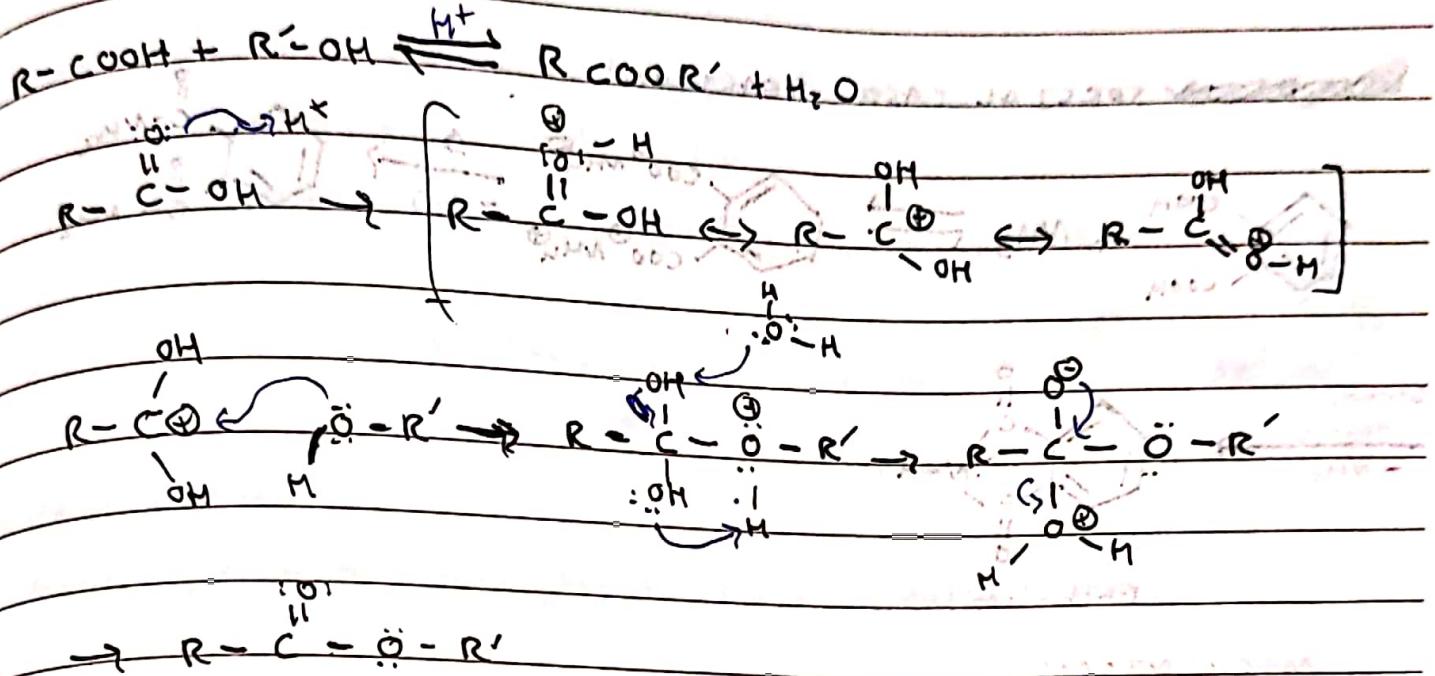
This reaction occurs at a much faster rate with acid halides



If OH is replaced by Cl it will form a much better leaving group & proceed to completion faster.

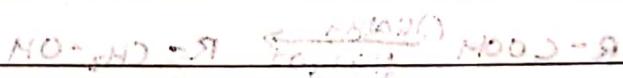
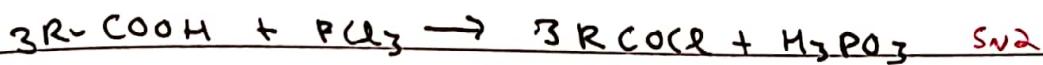
2. ESTERIFICATION

Carboxylic acids are esterified with alcohols or phenols (in excess) in the presence of mineral acid like conc. H_2SO_4 or HCl gas as catalyst.

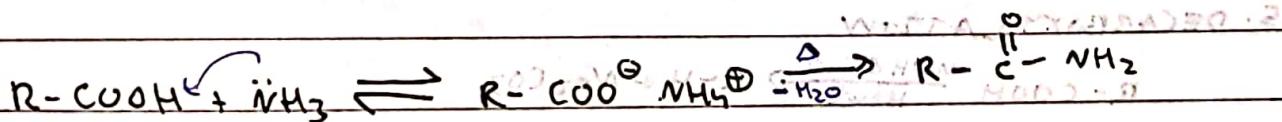


3. REACTIONS WITH PCl_5 , PCl_3 , & SOCl_2

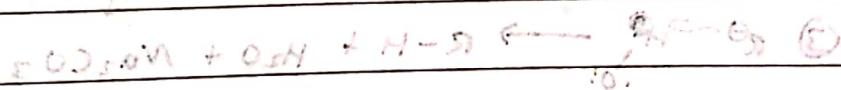
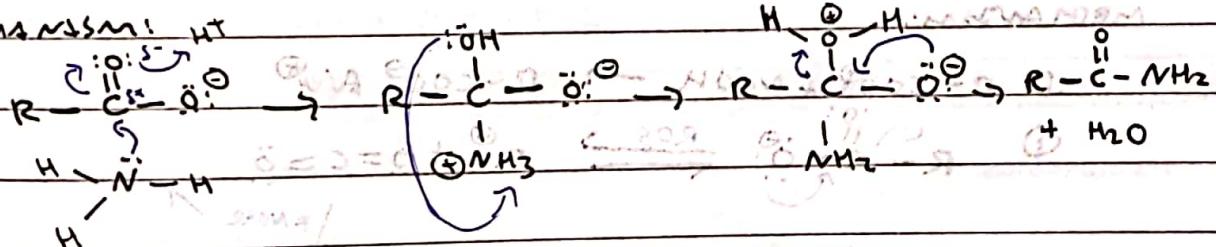
These are similar to the reactions of alcohol with the same compounds.



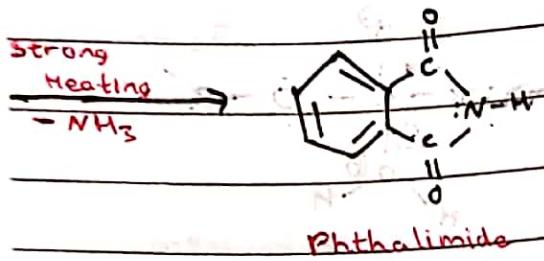
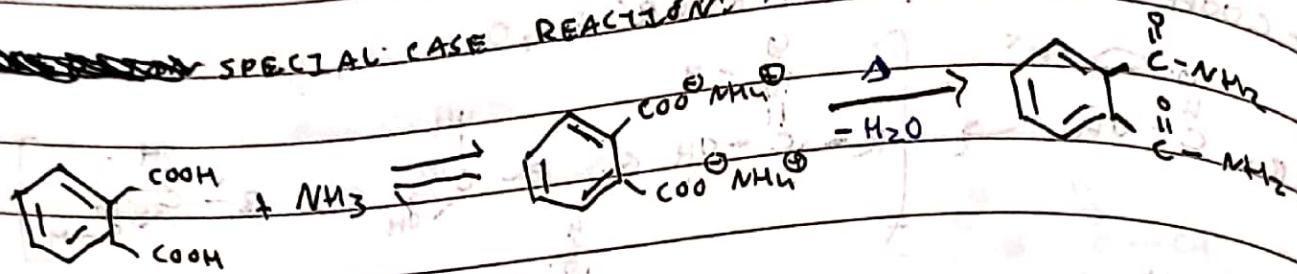
4. REACTION WITH AMMONIA.



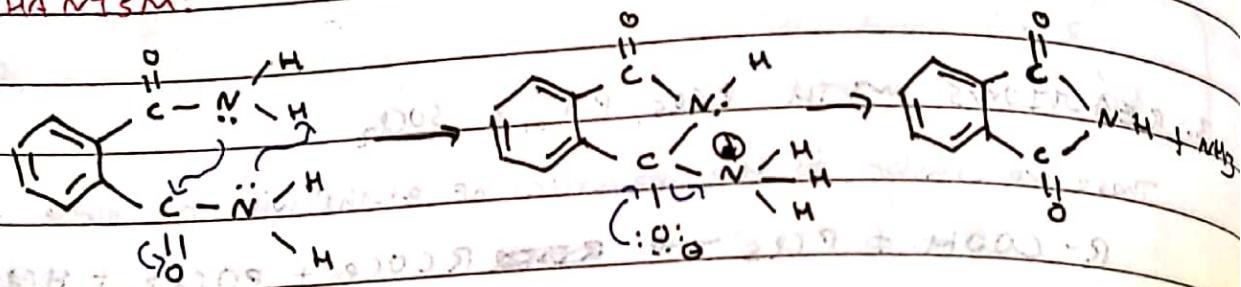
MECHANISM: H^+



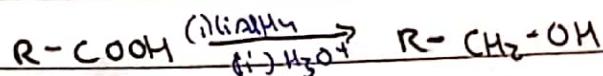
~~SPECIAL CASE REACTIONS~~



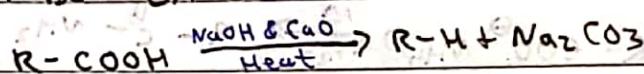
MECHANISM:



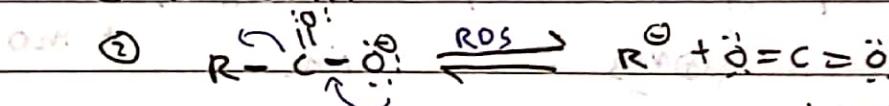
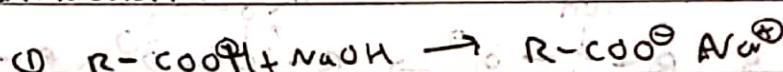
4. REDUCTION REACTION:



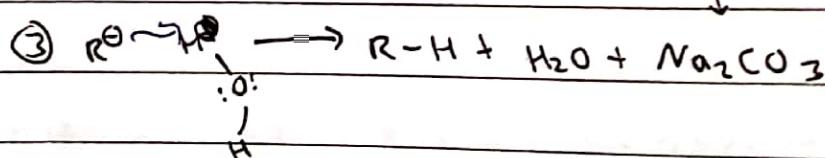
5. DECARBOXYLATION



MECHANISM:



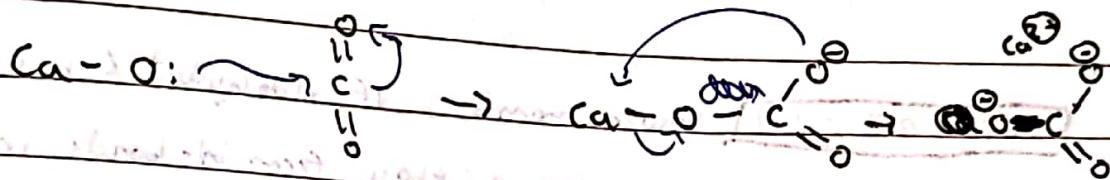
*Note ↑



* NOTE: CO_2 is taken out of reaction by CaO

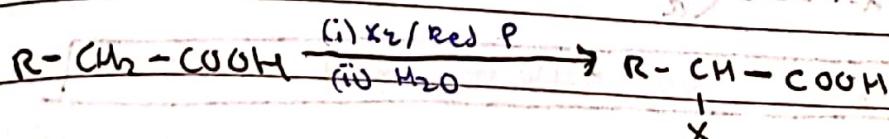
$$\text{CO}_2 + \text{CaO} \rightarrow \text{CaCO}_3$$

This facilitates forward reaction by Le Chatelier's principle.



6. HALOGENATION

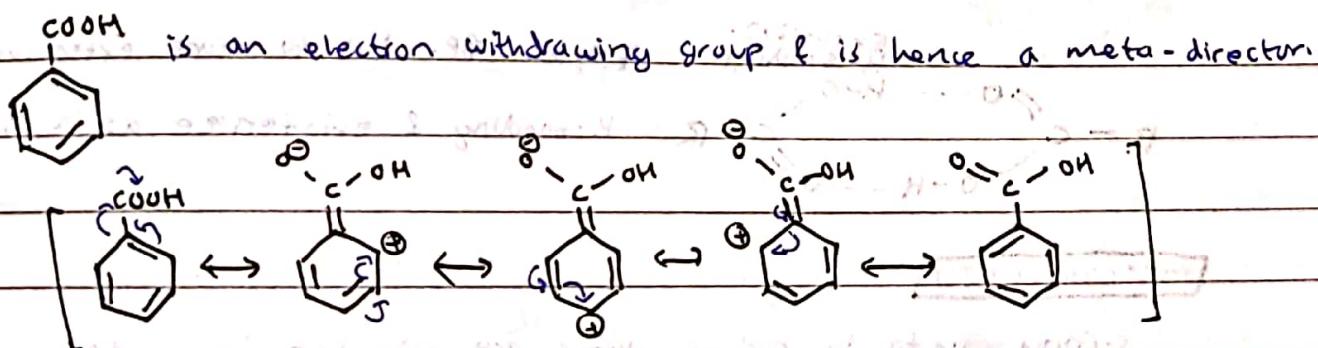
Alpha hydrogen of carboxylic acids are acidic in nature.



Mechanism: Similar to that of hydroboration oxidation.

This reaction is known as Hell-Volhard-Zelinsky reaction.

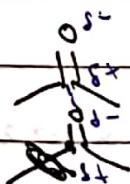
7. ELECTROPHILIC AROMATIC SUBSTITUTION.



PHYSICAL PROPERTIES

BOILING PTM.

ALDEHYDE/KETONE VS HYDROCARBONS & ETHER.



dipole-dipole interaction

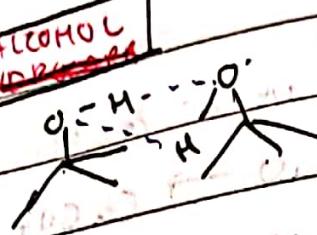
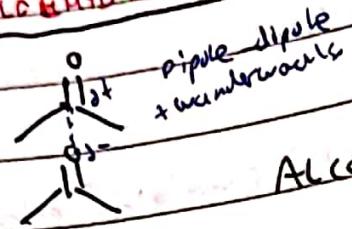
& van der waals.



van der waals.

ALDEHYDES & KETONES \rightarrow HYDROCARBONS & ETHERS.

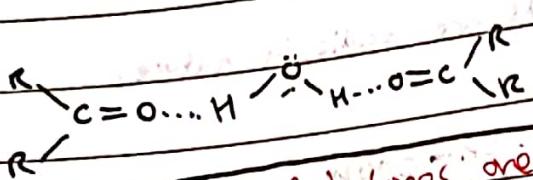
ALDEHYDE / KETONE VS HYDROCARBON



μ -Bonding
+ wonder walls.

MISCELLANEOUS

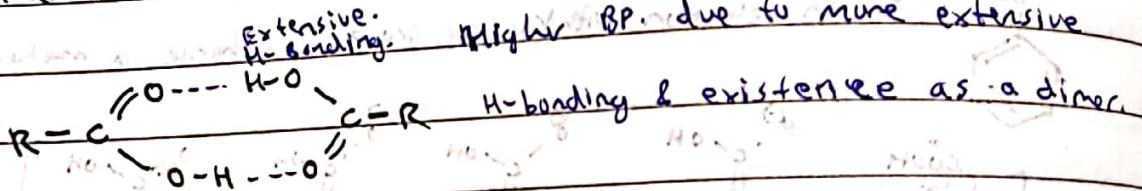
Lower members of aldehydes & ketones are miscible in water as they form H-bonds in water & hydrophobic part's influence is overpowering.



All aldehydes & ketones are soluble in organic solvents

CARBOXYLIC ACIDS VS EVERYTHING ELSE

They have higher B.P. than all other types of organic compounds of comparable molecular masses. Even in vapour phase they often exist as a dimer.



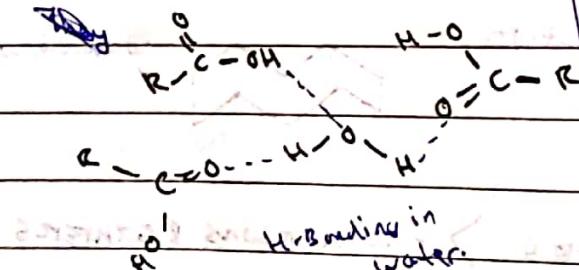
MESCHBOLD

p-COH up to 4 carbon atoms are miscible in water.

solubility decreases with increase in length of hydrocarbon chain.

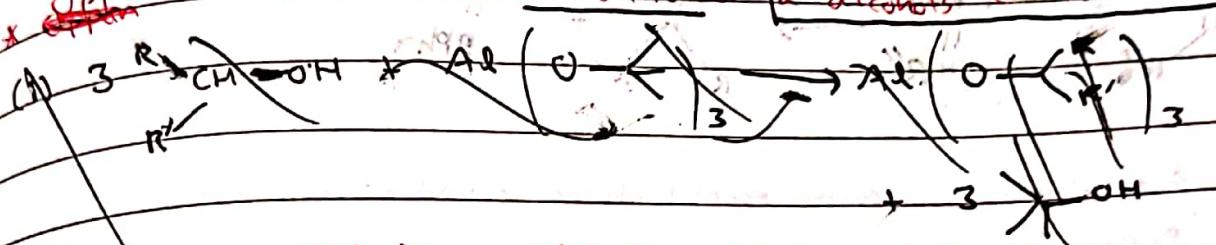
(Hydrophobic part increases)

Aromatic carboxylic acids are insoluble in water.

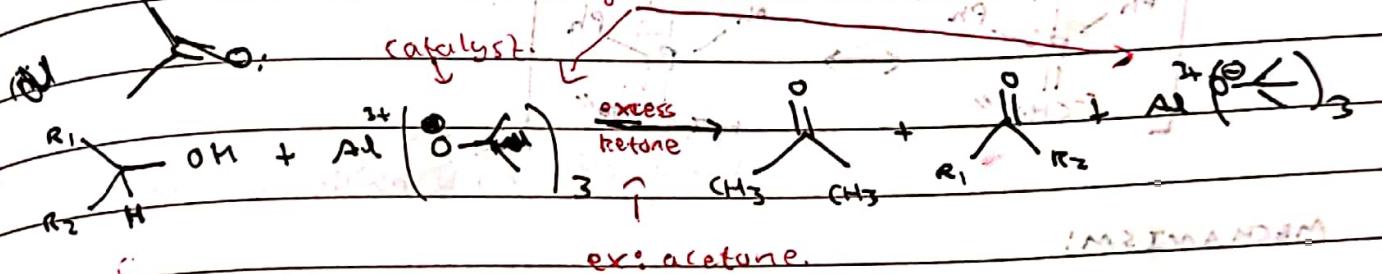


Carboxylic acids are soluble in organic non-polar solvents

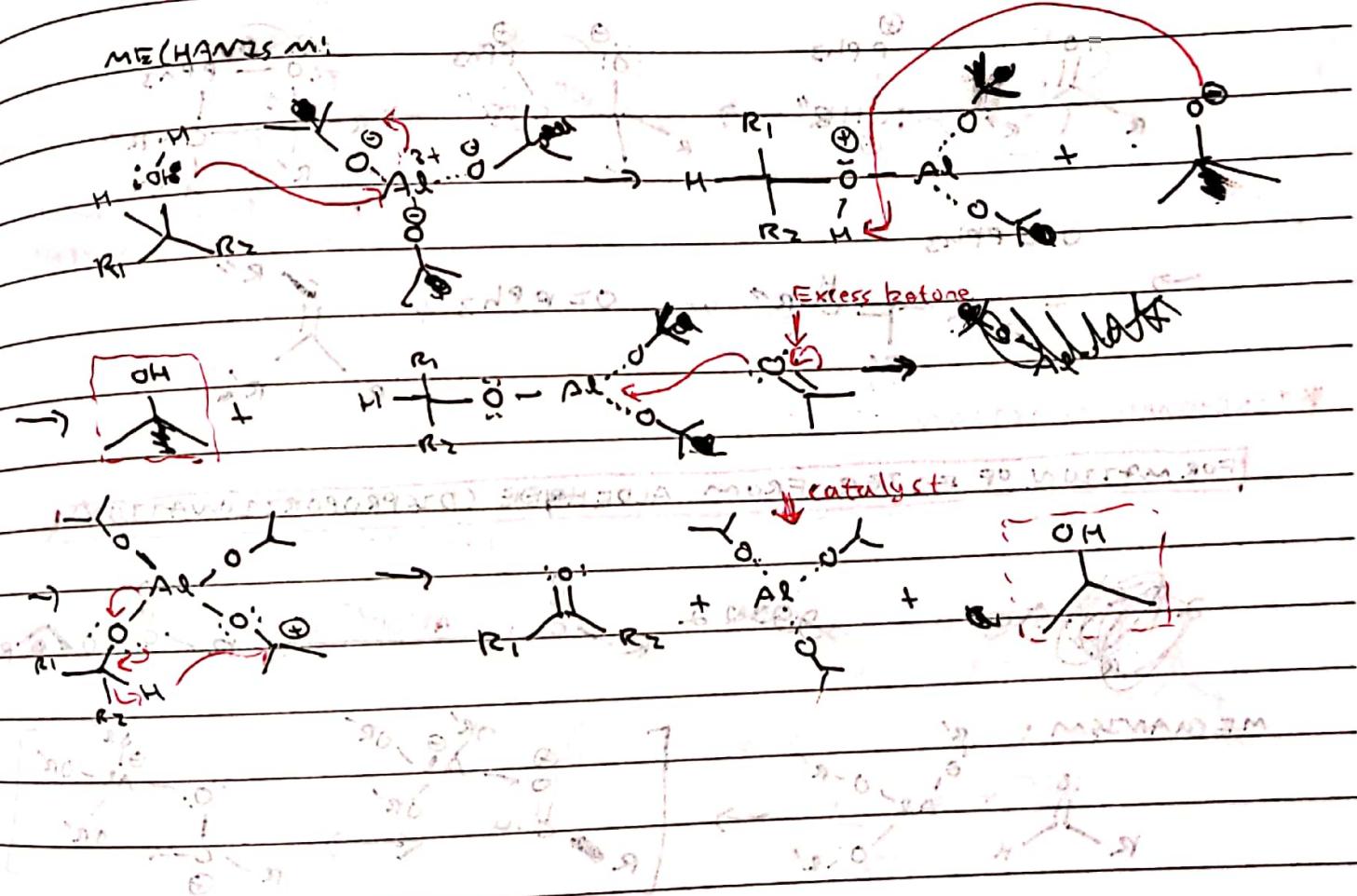
JEE NOTES: Oppenauer oxidation: Oxidation of 2° alcohols to ketones.



It is a catalytic oxidation cycle.

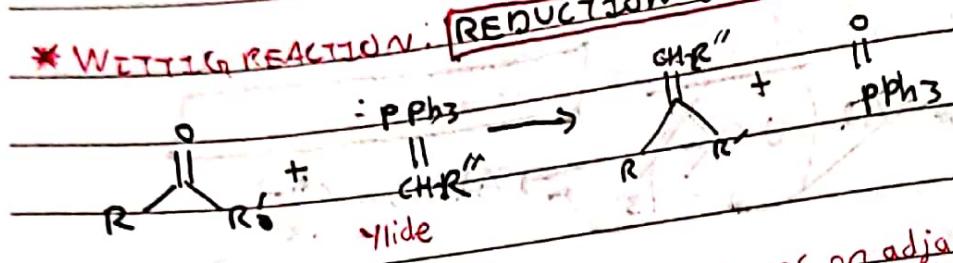


Mechanism:



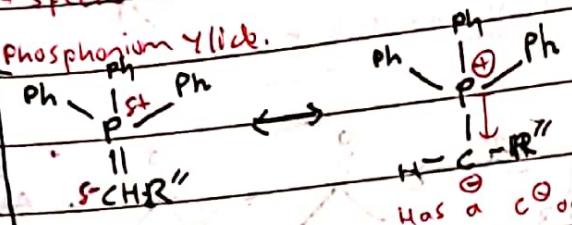
REDUCTION OF ALDEHYDES & KETONES TO ALcohols

* WITTIG REACTION:



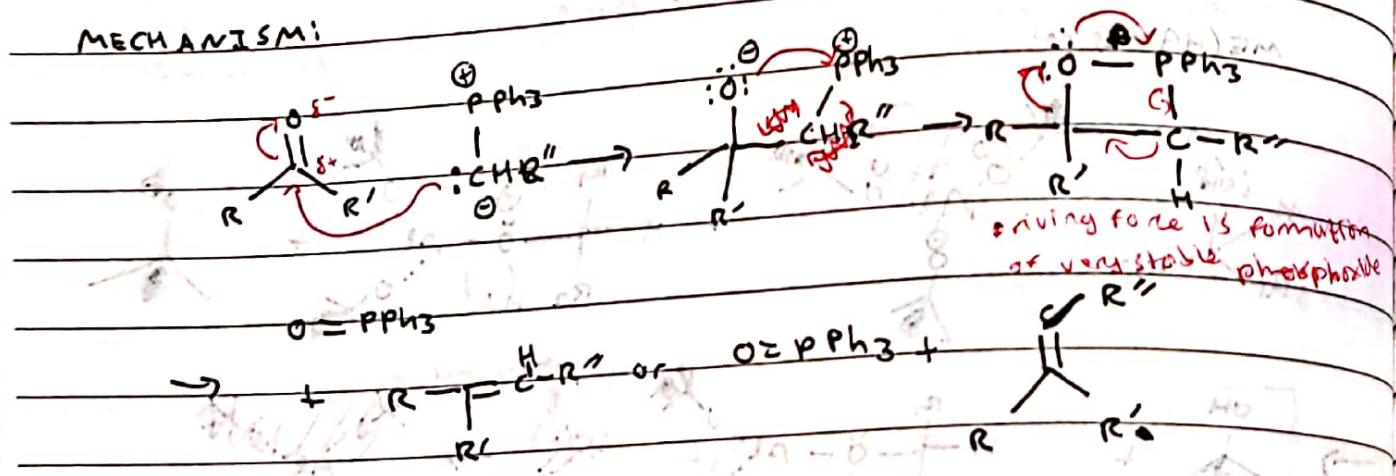
Ylide: A species with opposite formal charges on adjacent atoms.

Phosphonium Ylide.



Has a C^0 or nucleophilic carbon.

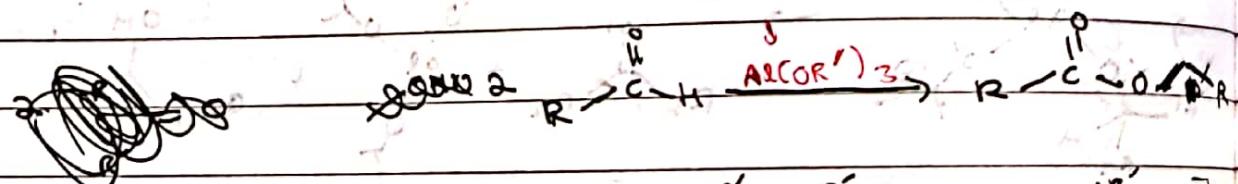
MECHANISM:



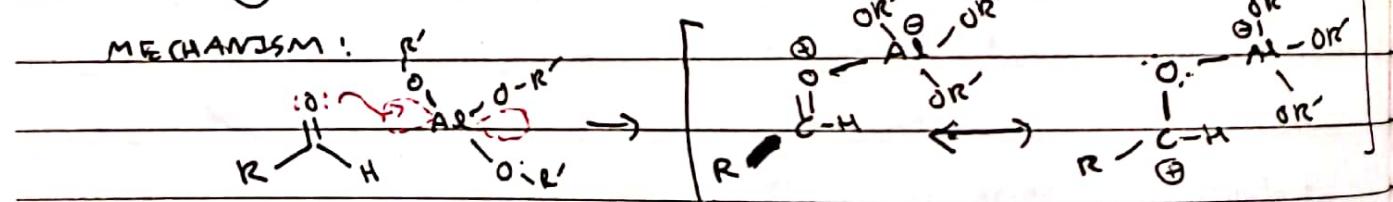
* TISCHENKO REACTION

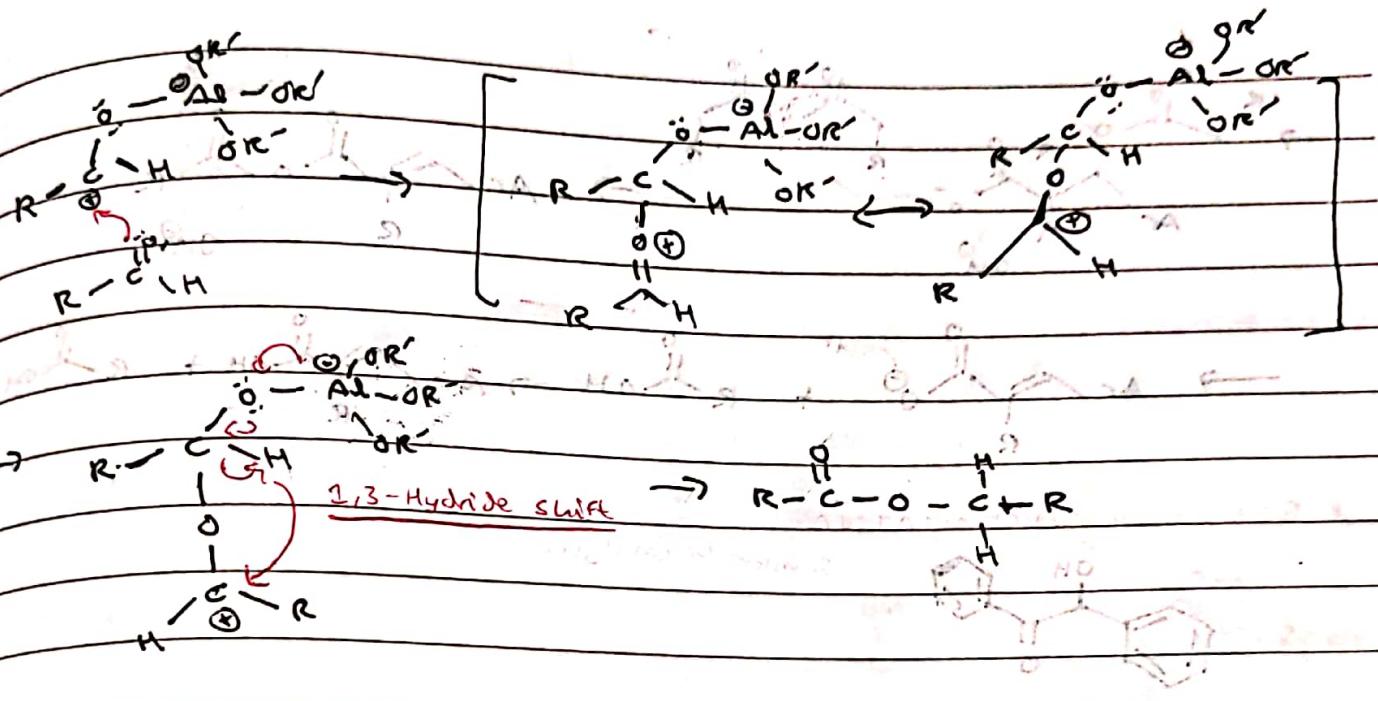
FORMATION OF ESTER FROM ALDEHYDE (DISPROPORTIONATION)

metal alkoxide catalyst



MECHANISM:

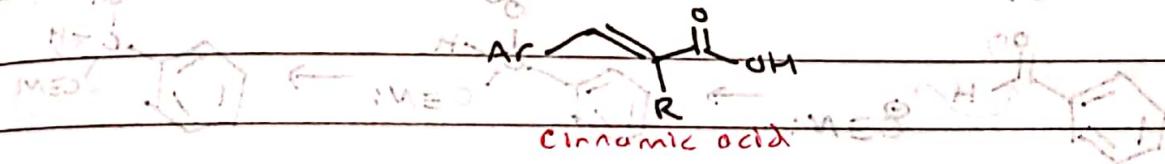




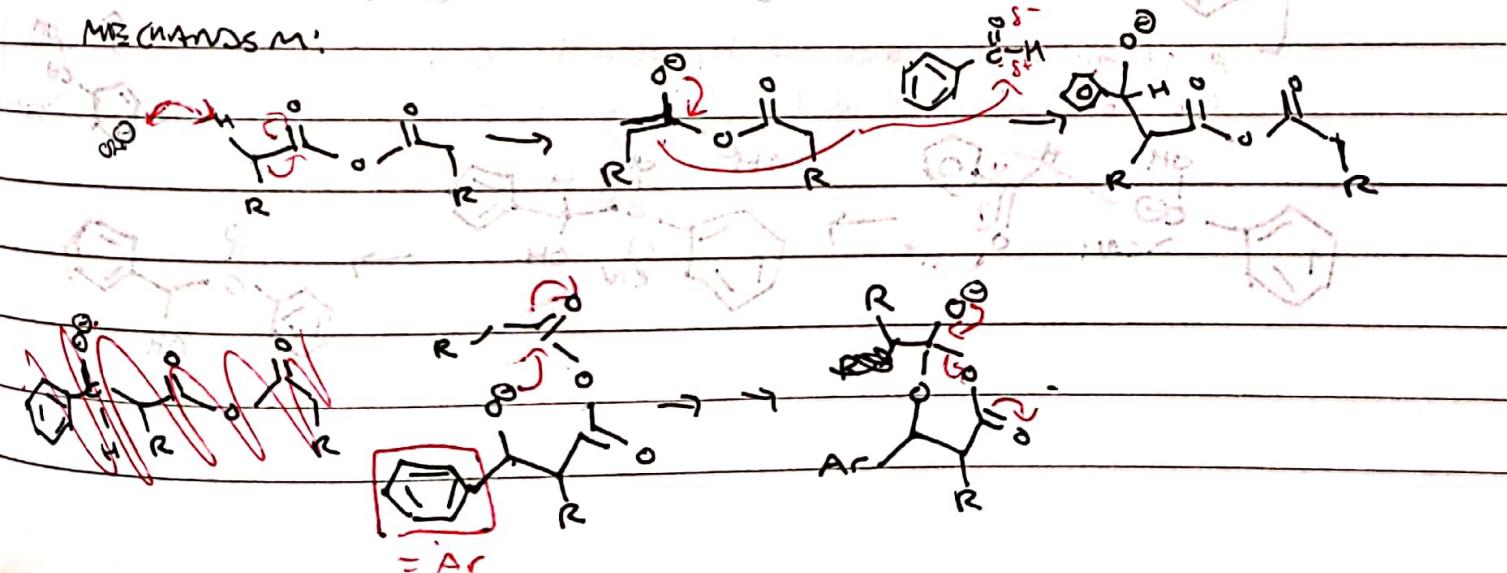
PERRINS REACTION (BENZALDEHYDE TO CINNAMIC ACID)

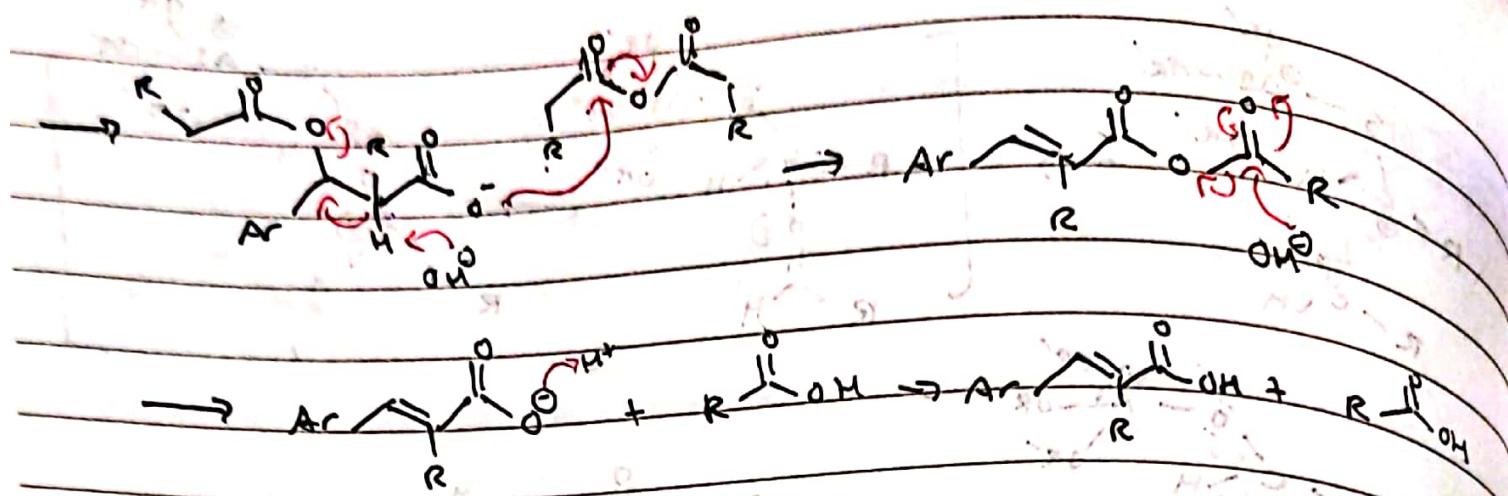
or any other aromatic aldehyde ($\text{Ar}-\text{CHO}$)

CINNAMIC ACID: A = CH_3 , B = unsaturated aromatic acid

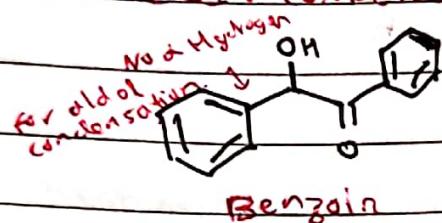


Mechanism:

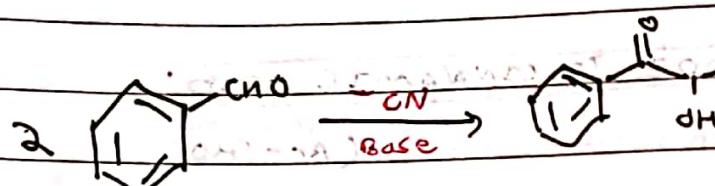




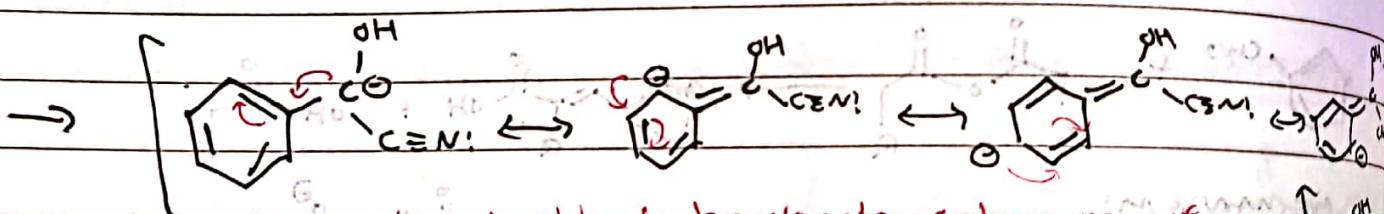
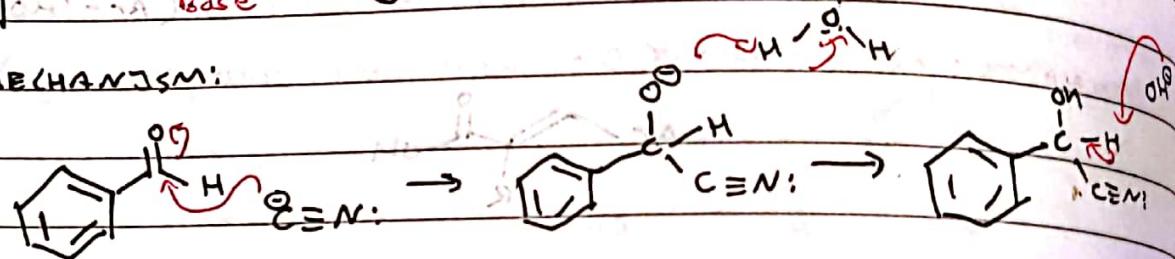
* BENZOIN CONDENSATION



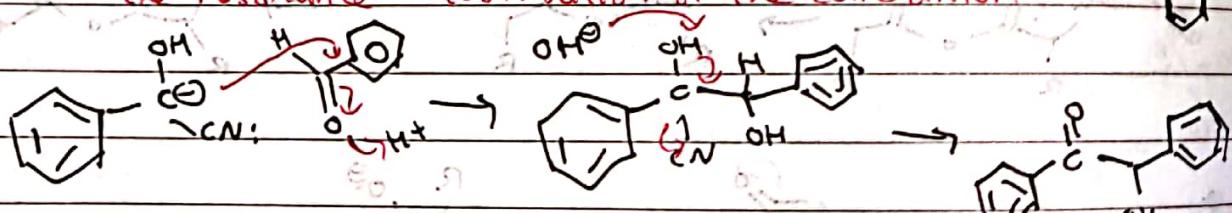
Similar to condens.



MECHANISM:



A strong base is able to deprotonate C because of the resonance stabilisation of the carbanion



* Intramolecular Cannizzaro reaction



2. FAMA

Mechanism:

