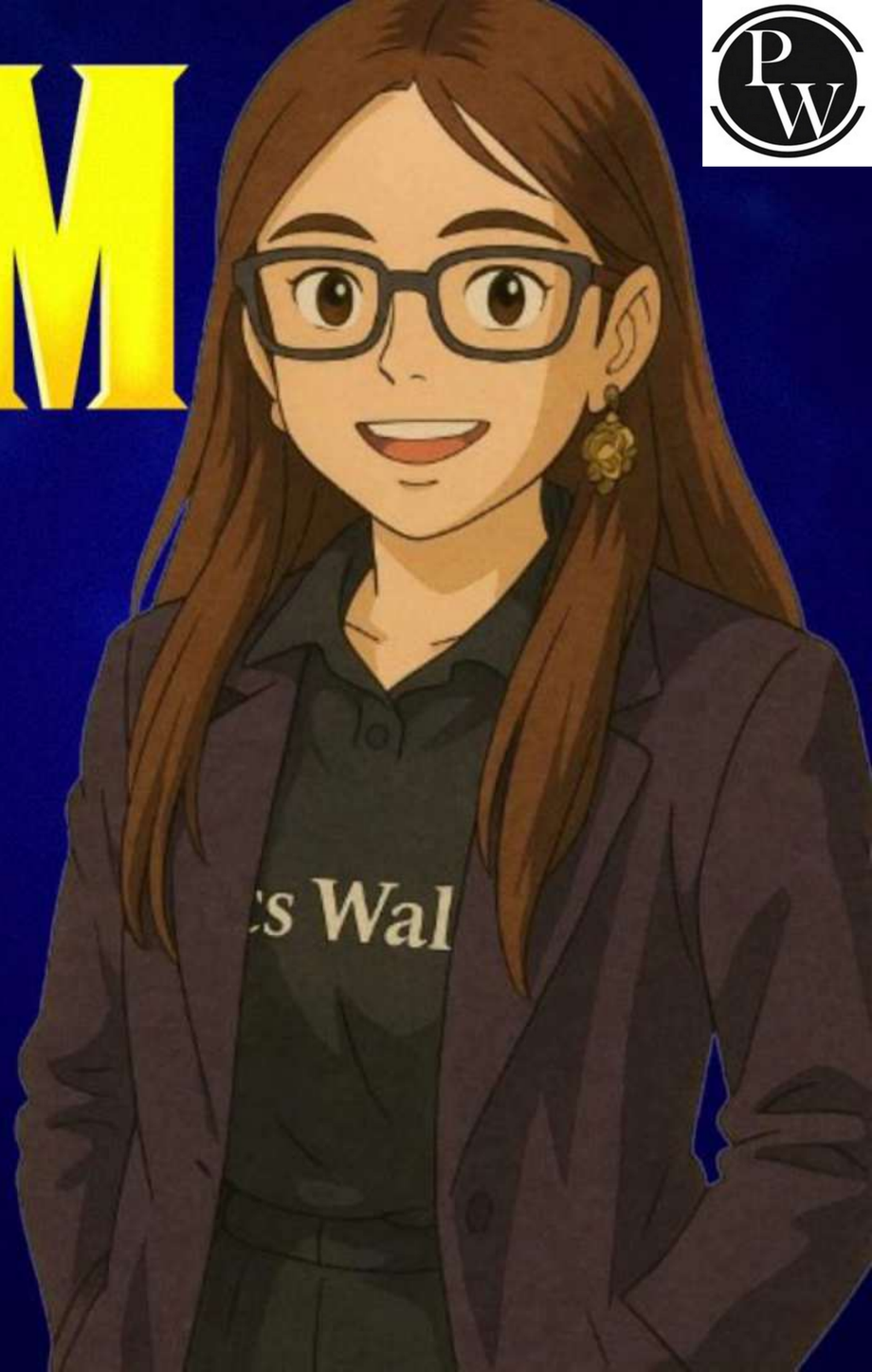
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-1

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. INTRODUCTION TO ALDEHYDE , KETONES & CARBOXYLIC ACID
2. NOMENCLATURE

MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

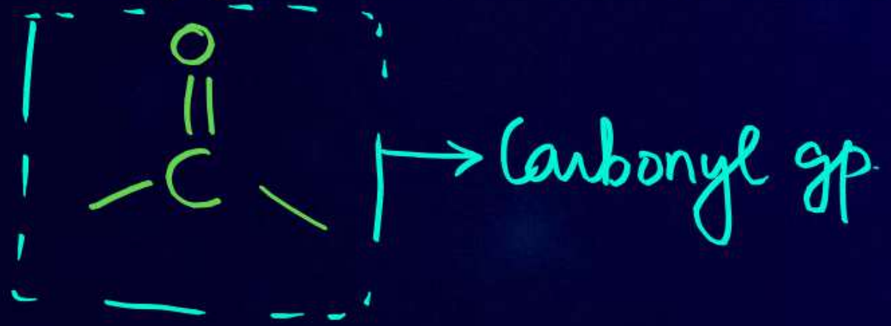
INTRODUCTION

INTRODUCTION

Hydroxyl → -OH gp

What is carbonyl group ?

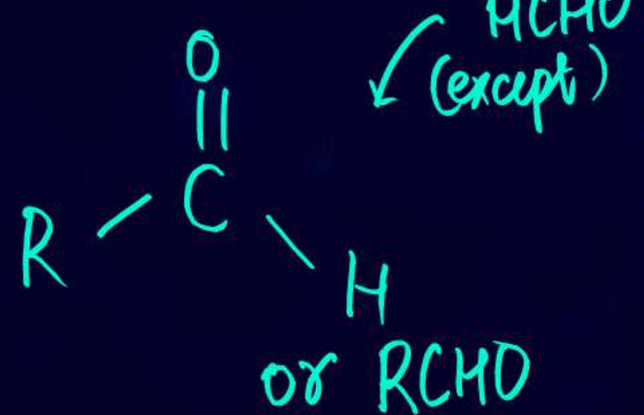
Carbon-oxygen double bond (>C=O) called carbonyl group.



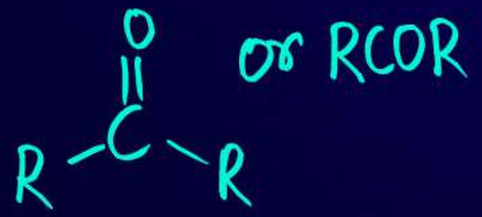
INTRODUCTION

Aldehyde , Ketones & Carboxylic acid

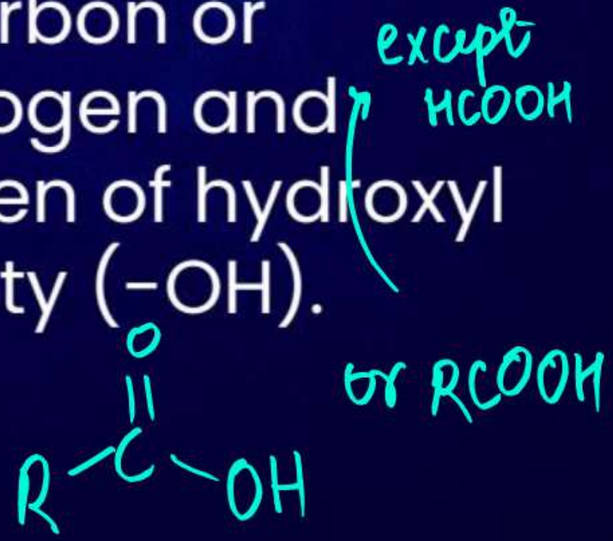
In aldehydes, the carbonyl group is bonded to a carbon and hydrogen.



In the ketones, carbonyl group is bonded to two carbon atoms .



In Carboxylic acid , the carbonyl group is bonded to a carbon or hydrogen and oxygen of hydroxyl moiety (-OH).

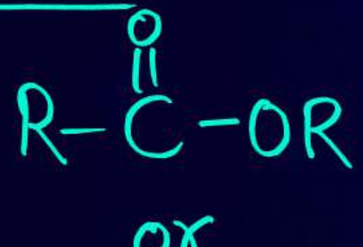


INTRODUCTION

RCOOH or 

Carboxylic acid & its derivatives

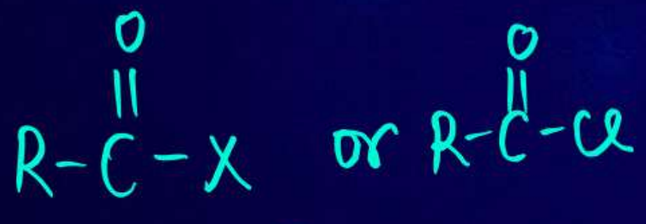
Ester



or

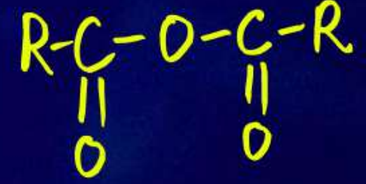
RCOOR

Acid chloride/Acylchloride



or RCOCl

Acid anhydride



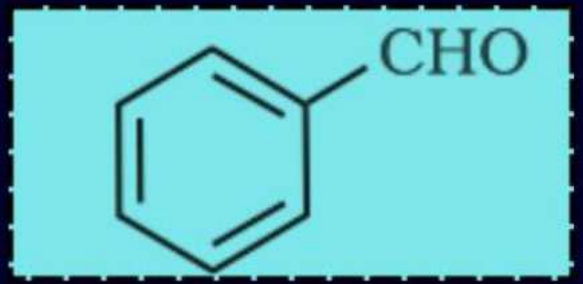
NOMENCLATURE

NOMENCLATURE

ALDEHYDE & KETONES- COMMON NAME

CH_3CHO

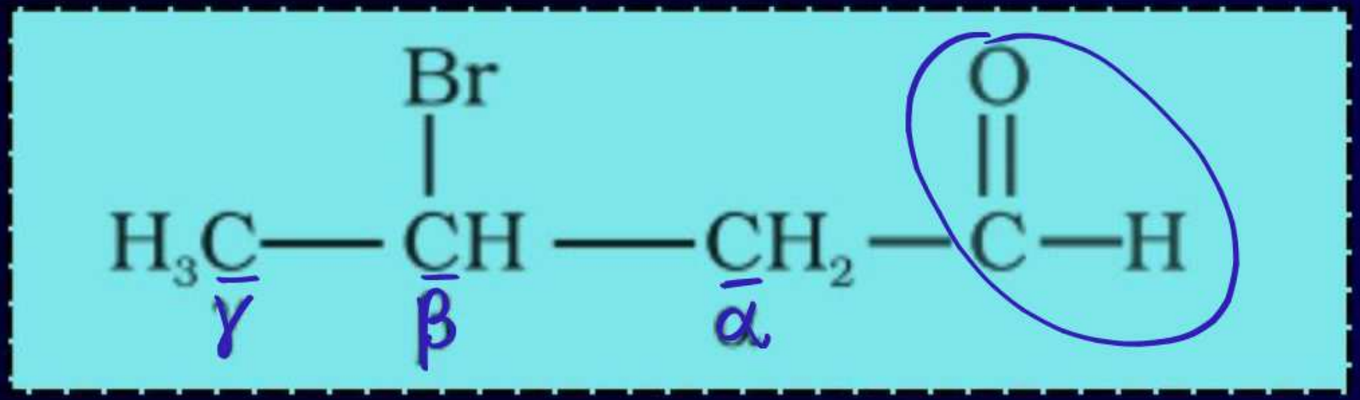
Acetaldehyde



Benzaldehyde

NOMENCLATURE

ALDEHYDE & KETONES- COMMON NAME

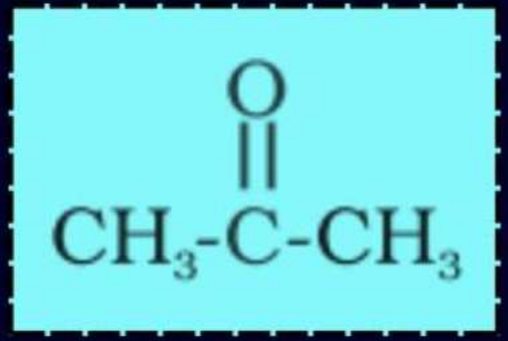


HCHO → formaldehyde

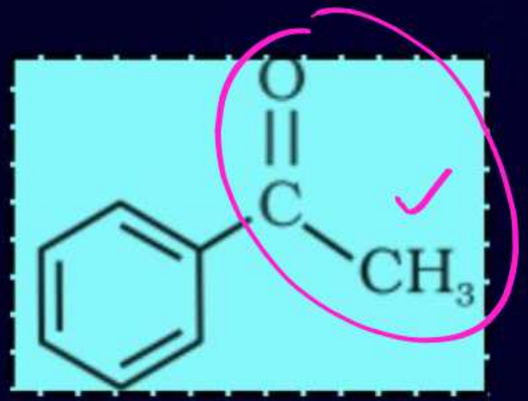
β- bromobutyraldehyde

NOMENCLATURE

ALDEHYDE & KETONES- COMMON NAME



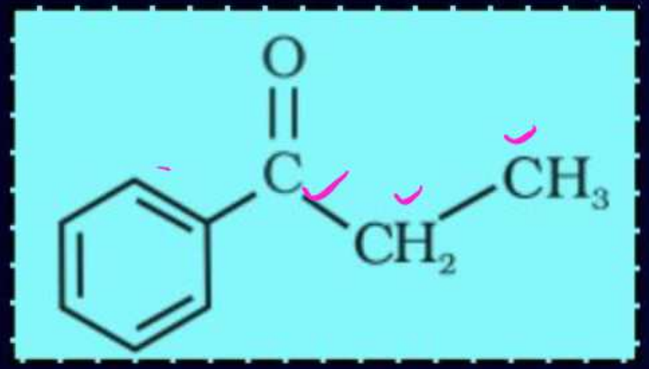
acetone



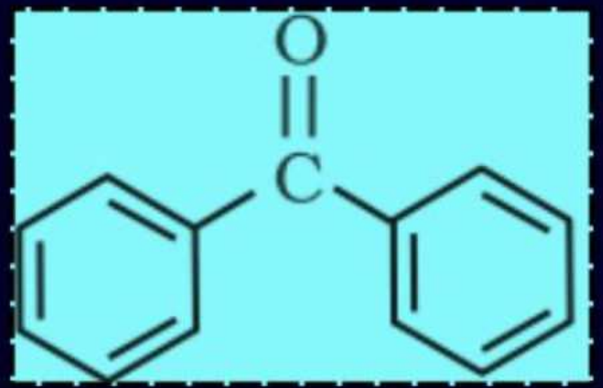
acetophenone ✡

NOMENCLATURE

ALDEHYDE & KETONES- COMMON NAME



Propiophenone



benzophenone

IUPAC NOMENCLATURE

NOMENCLATURE

2° prefix + 1° prefix + Word Root + 1° suffix + 2° suffix

1° suffix ← bonding
- C-C → ane
- C=C → ene
- C≡C → yne

2° prefix → extra gp (Cl, Br, F, I) or side chain (-alkyl) or Juniormost Fun. gp
- aldehyde – formyl or oxo
- ketone → keto or oxo

1° prefix → cyclic compound (only) → cyclo

Word Root → Total no of C atom present in Main (parent) chain

C_1 = meth	C_8 = oct
C_2 = eth	C_9 = non
C_3 = prop	C_{10} = dec
C_4 = but	C_{11} = undec
C_5 = pent	C_{12} = dodec
C_6 = hex	
C_7 = hept	

2° suffix → Seniormost Functional gp

aldehyde (-CHO) or $-\overset{O}{\overset{\|}{C}}-H$ → al

Ketone $(-\overset{O}{\overset{\|}{C}}-)$ → one

-CO-

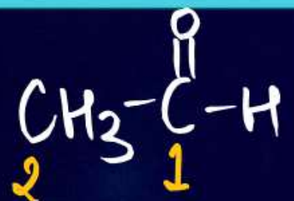
NOMENCLATURE

a, e, i, o, u

HCHO

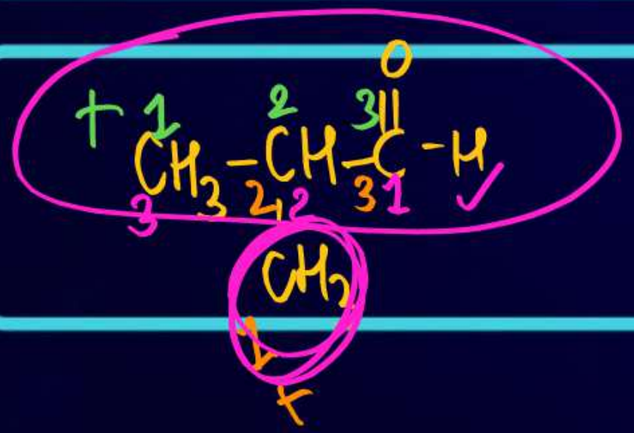
methane + al or methanal

CH3CHO



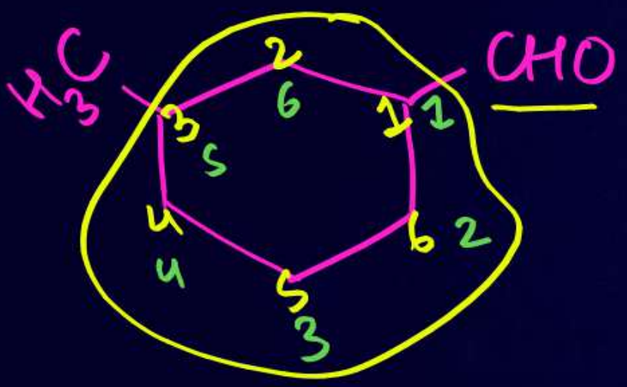
ethane-1-al ethan-1-al or ethanal

(CH3)2CHCHO



2-methylpropane-1-al or 2-methylpropanal

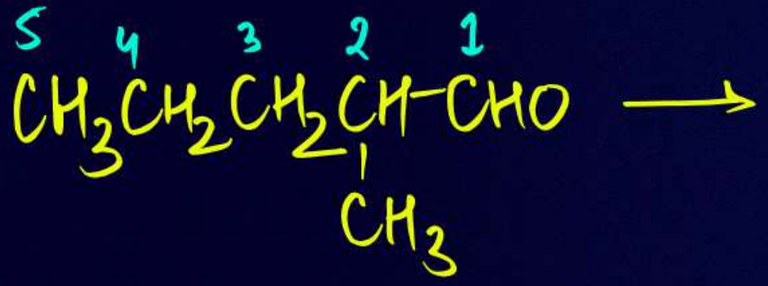
NOMENCLATURE



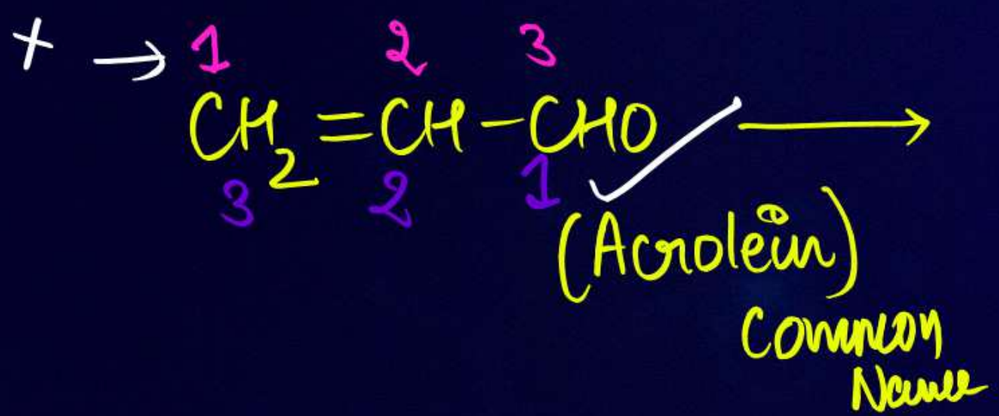
2° suffix → carbaldehyde } when CHO gp is not included in Main chain (More C) hai

} Benzene ✗
6C wali cyclic Ring

3-methyl cyclo hexane carbaldehyde

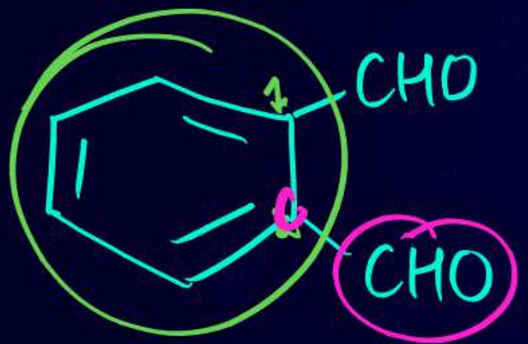


2-methylpentanal-1-al



prop-2-enal-1-al
or
prop-2-enal.

NOMENCLATURE

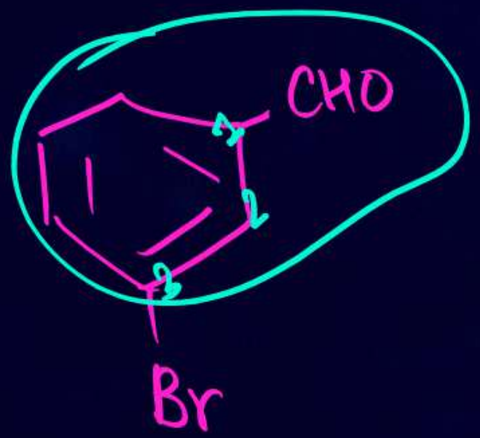


IUPAC

benzene-1,2-dicarbaldehyde

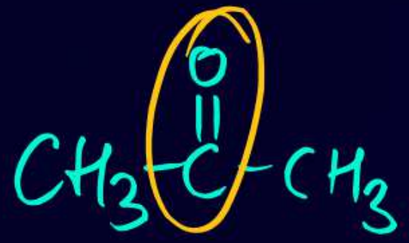
C/N

phthaldehyde



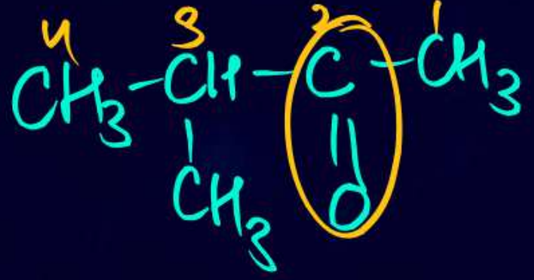
3-bromobenzaldehyde

NOMENCLATURE

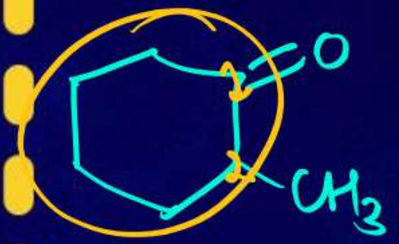


propan-2-one
or
propanone

butan-2-one
butan-2-one



3-methylbutan-2-one



2-methylcyclohexan-1-one

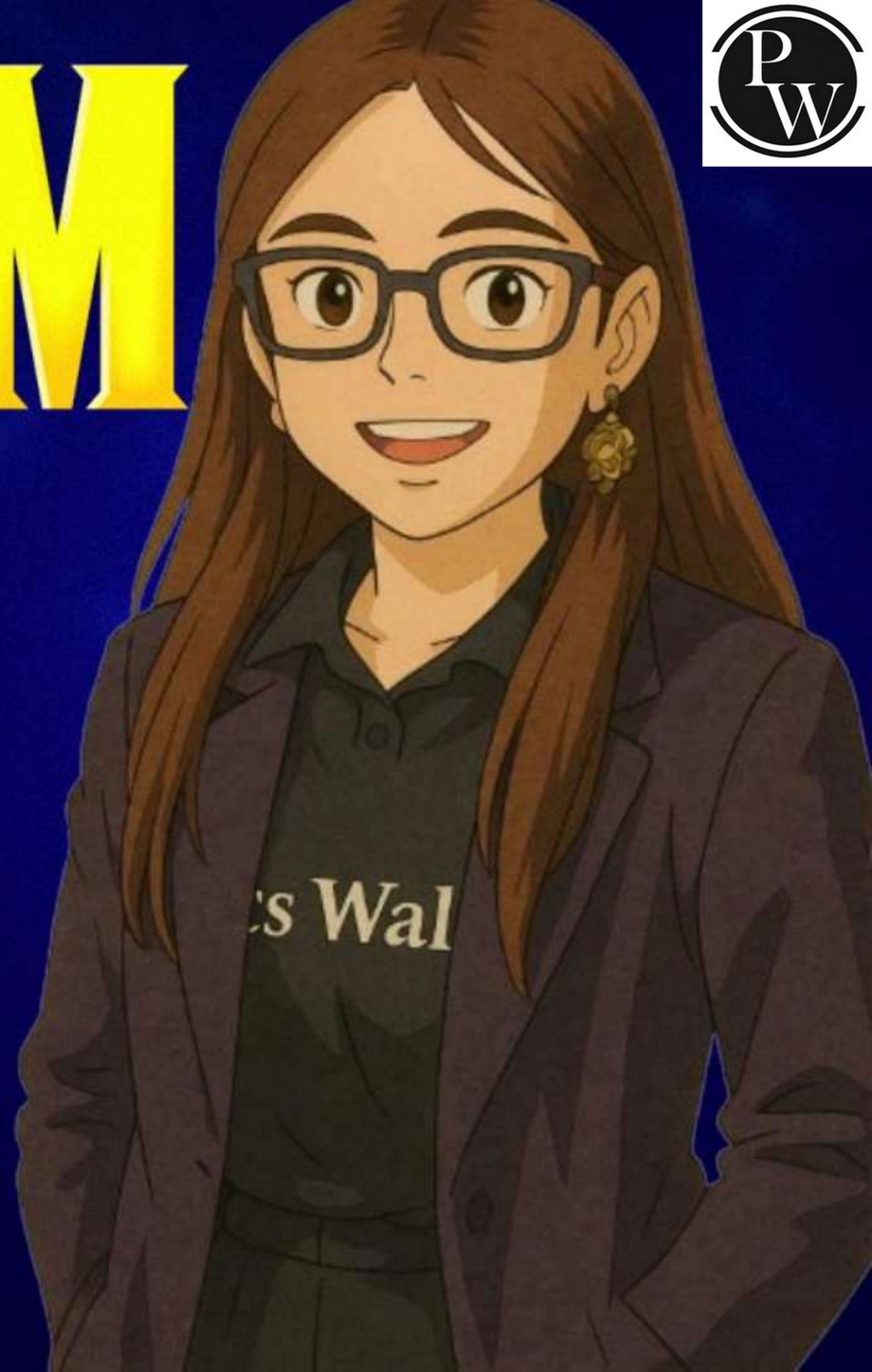
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-2

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. STRUCTURE OF CARBONYL GROUP
2. METHOD OF PREPARATION OF BOTH ALDEHYDE & KETONE
3. METHOD OF PREPARATION OF ONLY ALDEHYDE

MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

STRUCTURE OF CARBONYL GROUP

STRUCTURE OF CARBONYL GROUP

C here forms three sigma bond & 1 π bond with oxygen atom, hence carbon of carbonyl group is sp^2 hybridised.

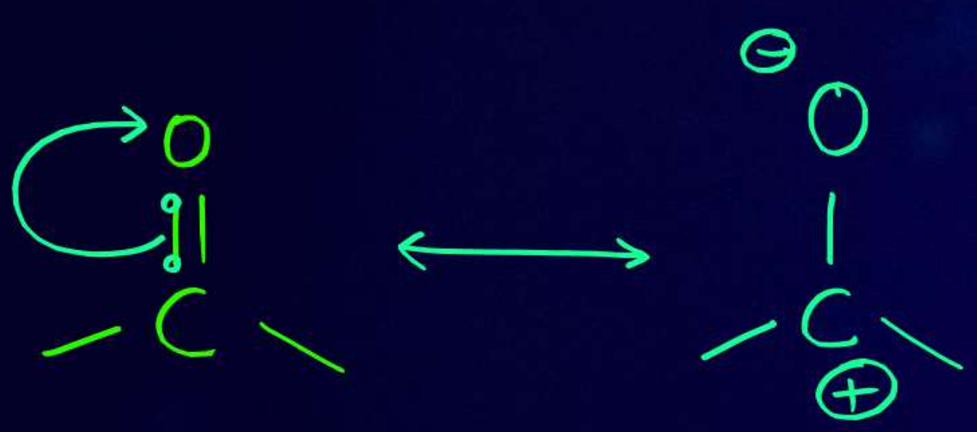
Bond angle → 120°

π bond will lie and above & below plane.

C forms π bond with p orbital of oxygen atom.

O is more EN than C. Due to this difference in EN, O of carbonyl gp carries a (negative) – ve charge & C of carbon gp carries a positive charge.

STRUCTURE OF CARBONYL GROUP



Resonating structures

* Carbon of Carbonyl group :- Electrophile (Lewis Acid)
  - e⁻ loving
  - +ve charge carrier
  - accept e⁻ pair
* Oxygen of Carbonyl group :- Nucleophile (Lewis Base)
  - nucleus loving
  - donates e⁻ pair
  - +
  - -ve charge carrier.

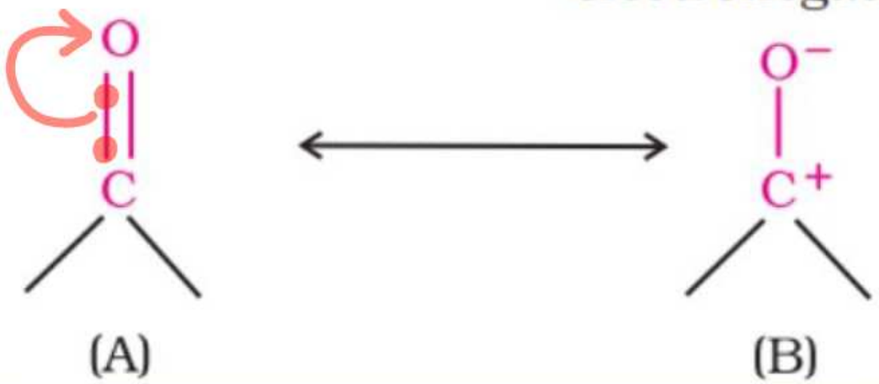
NCERT HIGHLIGHT

STRUCTURE OF CARBONYL GROUP

+, −

poles generation

The carbon-oxygen double bond is polarised due to higher electronegativity of oxygen relative to carbon. Hence, the carbonyl carbon is an electrophilic (Lewis acid), and carbonyl oxygen, a nucleophilic (Lewis base) centre. Carbonyl compounds have substantial dipole moments and are polar than ethers. The high polarity of the carbonyl group is explained on the basis of resonance involving a neutral (A) and a dipolar (B) structures as shown.



(A) (B)

MOP OF BOTH ALDEHYDE & KETONE

1. BY OXIDATION OF ALCOHOLS

1° alcohol $\xrightarrow[\text{or } CrO_3 \text{ (poor yield)}]{\text{PCC (pyridinium chlorochromate (good yield)}}$ Aldehyde

Mild Agents

$$\# \quad \underset{R}{RCH_2OH} \xrightarrow[\text{or } CrO_3 \text{ (poor yield)}]{\text{PCC}} RCHO$$

ex. $\underset{R}{CH_3CH_2}\underset{CH_2OH}{CH_2OH} \xrightarrow{CrO_3} RCHO$

CH_3CH_2CHO

propanal.

ex. $\underset{R}{CH_3CH_2OH} \xrightarrow{PCC} RCHO$

CH_3CHO

ethanal

or $K_2Cr_2O_7$ or Jones Reagent ($CrO_3 + aq.\ H_2SO_4$)

ex. $CH_3CH_2CH_2\underline{CH_2}OH \xrightarrow[\text{(Strong Agent}]{KMnO_4} RCHO \longrightarrow RCOOH$

R

$CH_3CH_2CH_2CHO$

$CH_3CH_2CH_2COOH$

butanoic acid

2° alcohol $\xrightarrow[\text{Mild}]{\text{Strong}}$ ketone

$$R-\underset{R}{\underset{|}{CH}}-OH \xrightarrow{CrO_3} R-\underset{R}{\underset{|}{C}}=O \text{ (Ketone)}$$

ex. $CH_3-\underset{CH_3}{\underset{|}{CH}}-OH \xrightarrow{CrO_3} CH_3-\underset{CH_3}{\underset{|}{C}}=O$ acetone

1° (primary) alcohol and 2° (secondary alcohol) on reaction with Mild agent such as PCC (pyridiniumchlorochromate) & CrO_3 produces aldehydes & ketones respectively

3° alcohol do not produce aldehydes or ketones.

MOP OF BOTH ALDEHYDE & KETONE

2. DEHYDROGENATION OF ALCOHOLS

1° alcohol $\xrightarrow[573\,K \text{ or } 300^\circ C]{Cu \text{ or } Ag}$ Aldehyde

RCH_2OH → $RCHO$

2° alcohol $\xrightarrow[573\,K \text{ or } 300^\circ C]{Cu \text{ or } Ag}$ Ketone (RCOR)

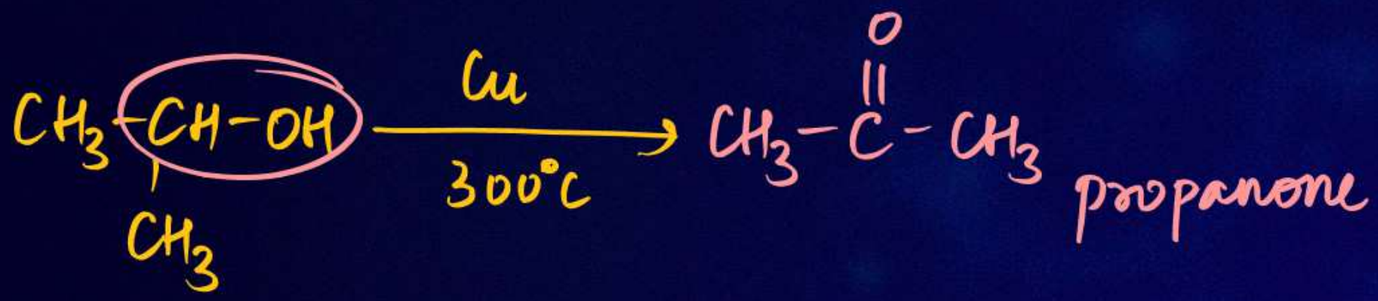
$R-\underset{\underset{R}{|}}{CH}-OH$

3° alcohol $\xrightarrow[300^\circ C]{Cu}$ Alkene

$R-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{C}}-OH$

It is suitable for volatile alcohols.

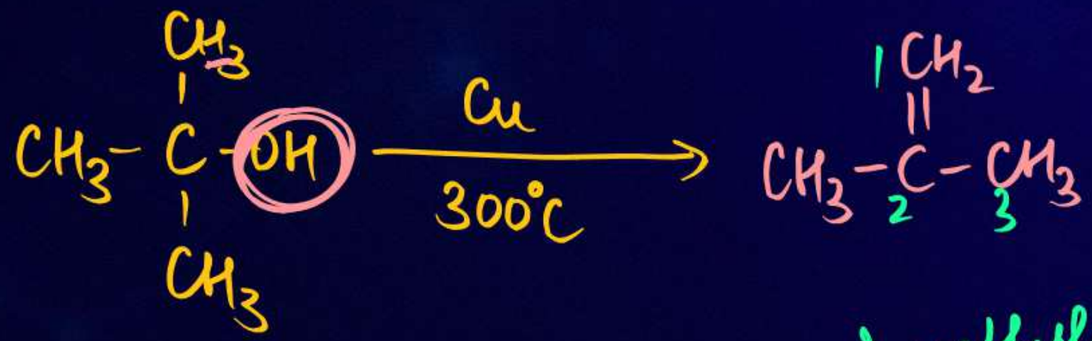
Alcohol vapours are passed over metal catalyst (Cu or Ag) at 300°C, produces aldehydes, ketones & alkenes respectively.

ex. 

propanone

ex. 

ethanal

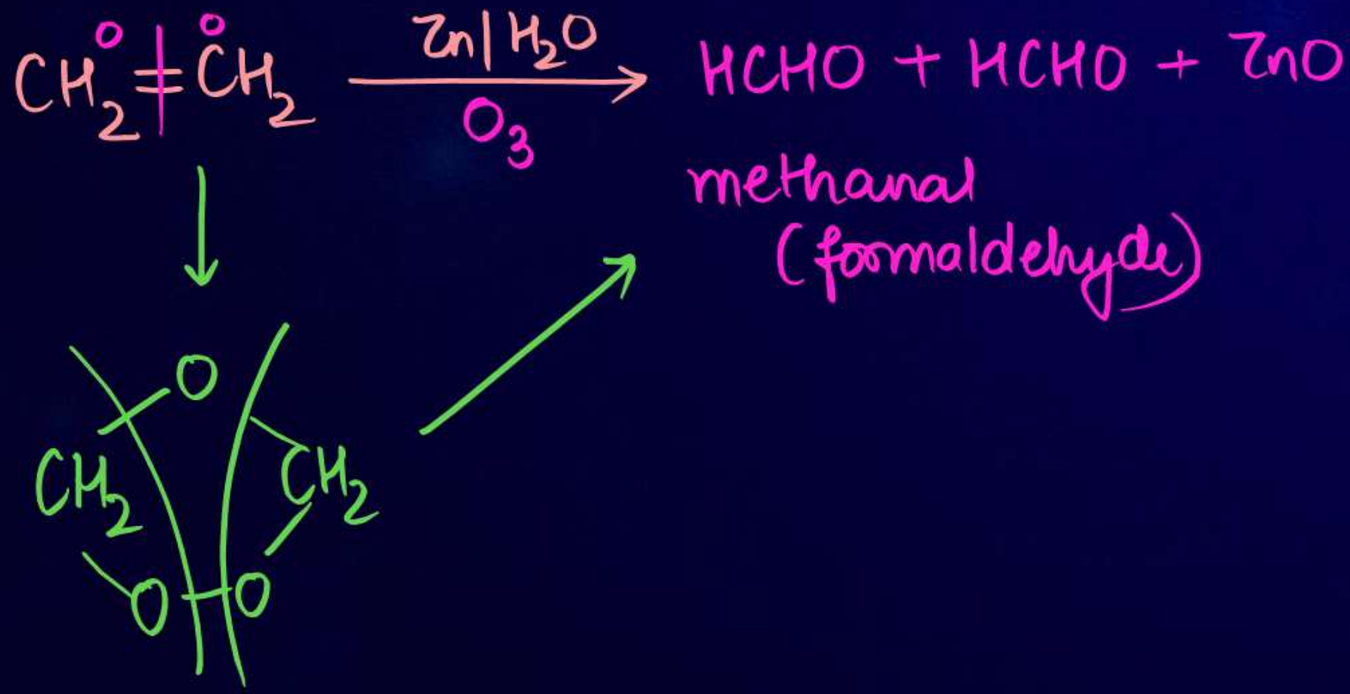
ex. 

2-methylpropene

MOP OF BOTH ALDEHYDE & KETONE

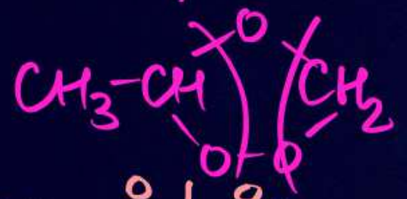
3. FROM HYDROCARBON

(i) By ozonolysis of Alkenes



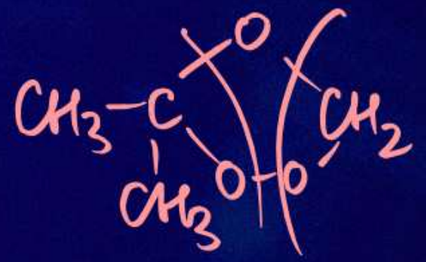
$RCH{=}CH_2 \xrightarrow[O_3]{Zn/H_2O} RCHO + HCHO + ZnO$

$CH_3CH{=}CH_2 \xrightarrow[O_3]{Zn/H_2O} CH_3CHO + HCHO + ZnO$

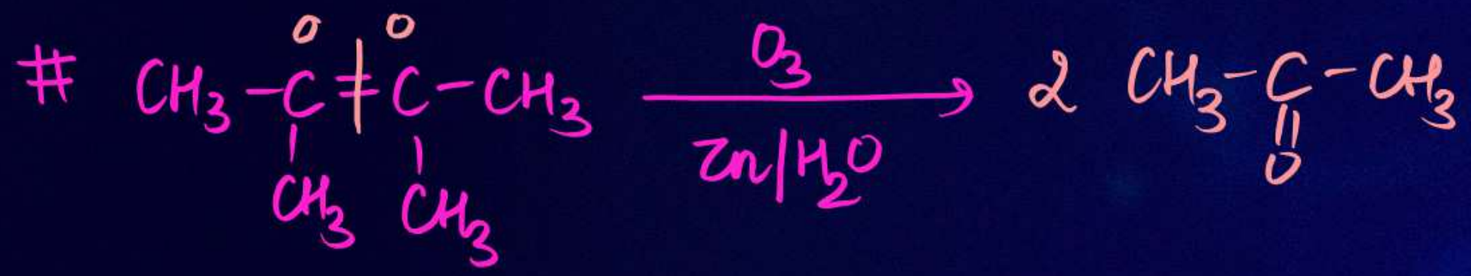


$CH_3-C(CH_3){=}CH_2 \xrightarrow[Zn/H_2O]{O_3} CH_3COCH_3 + HCHO + ZnO$

or $CH_3-C(=O)-CH_3$



$CH_3-C(CH_3){=}CH-CH_3 \xrightarrow[Zn/H_2O]{O_3} CH_3-C(=O)-CH_3 + CH_3CHO + ZnO$



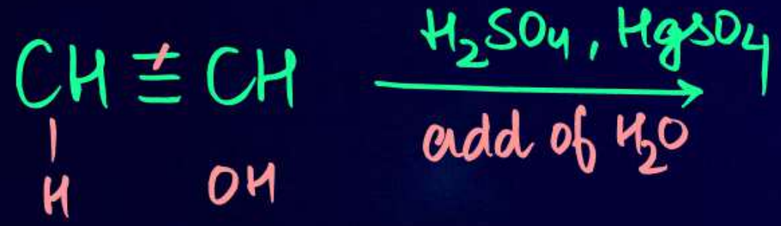
⟶ It is reductive ozonlysis

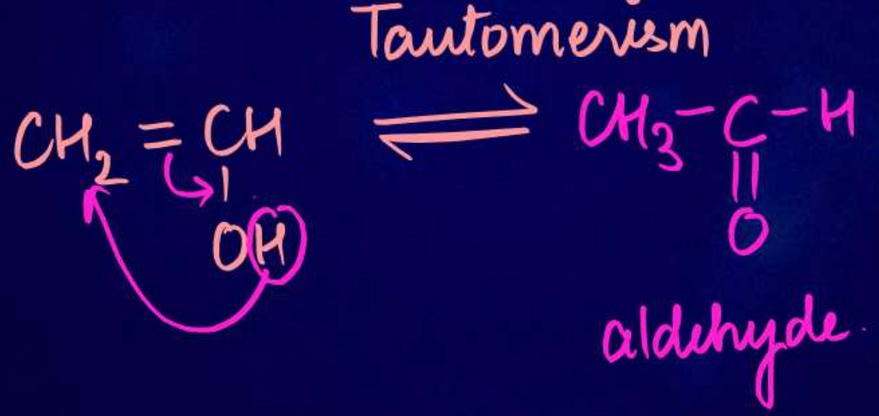
⟶ It occurs in presence of zinc dust.

MOP OF BOTH ALDEHYDE & KETONE

3. FROM HYDROCARBON

(ii) By hyration of Alkynes





MOP OF BOTH ALDEHYDE & KETONE

4.THERMAL DECOMPOSITION OF MONOCARBOXYLIC ACID

heat

1 COOH

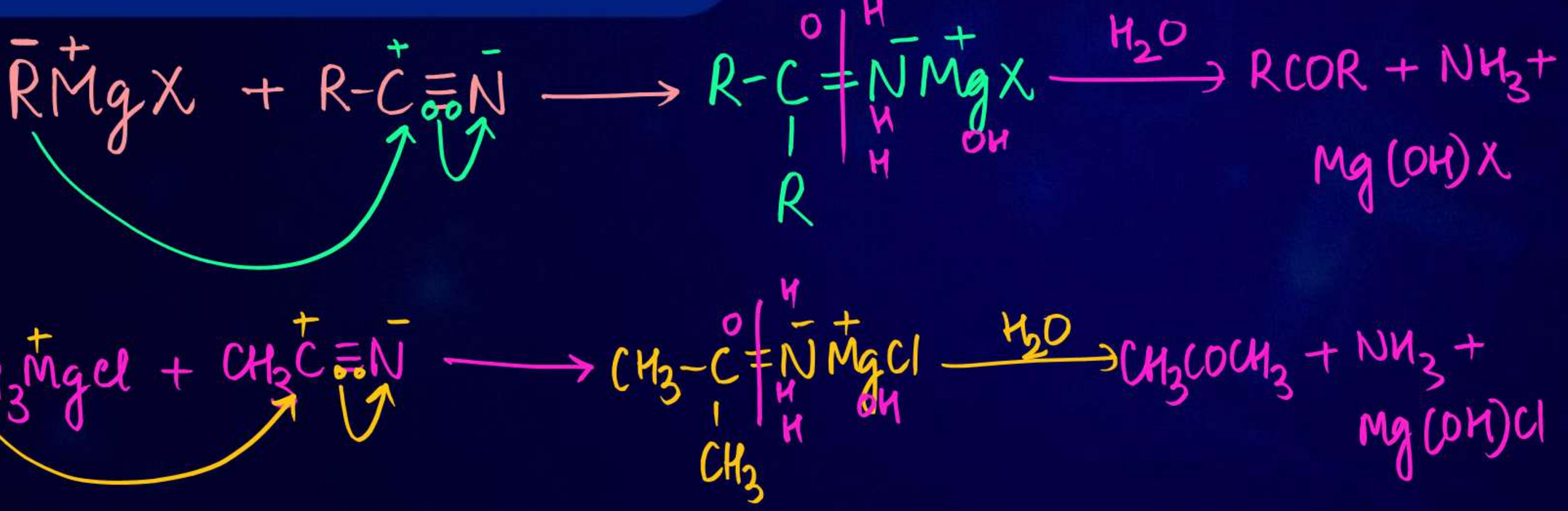
$\# \; 2\,HCOOH \xrightarrow{\Delta} H_2O + CO_2 + HCHO$

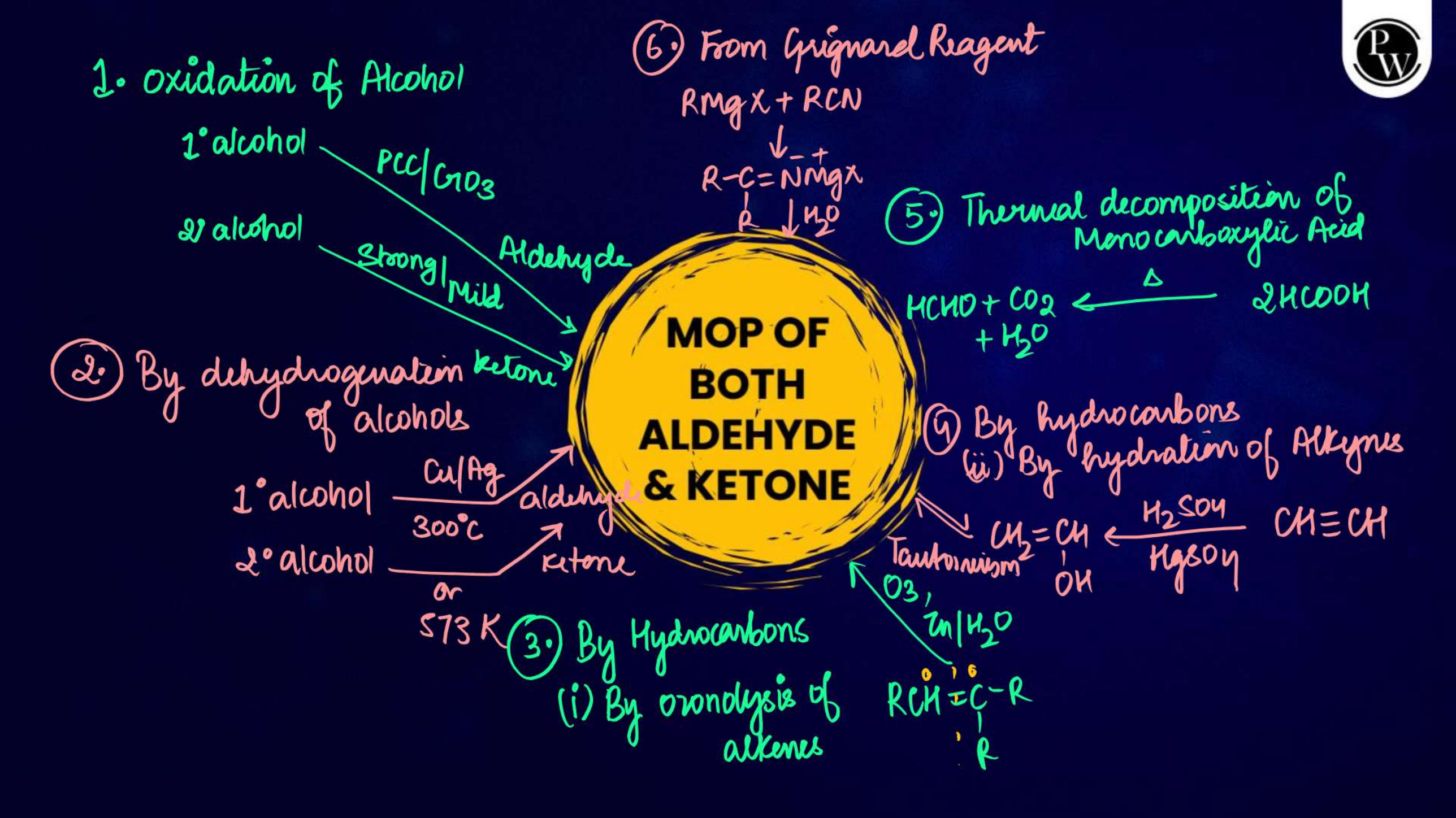
HCOOH HCOOH

$\# \; HCOOH + RCOOH \xrightarrow{\Delta} H_2O + CO_2 + RCHO$

MOP OF BOTH ALDEHYDE & KETONE

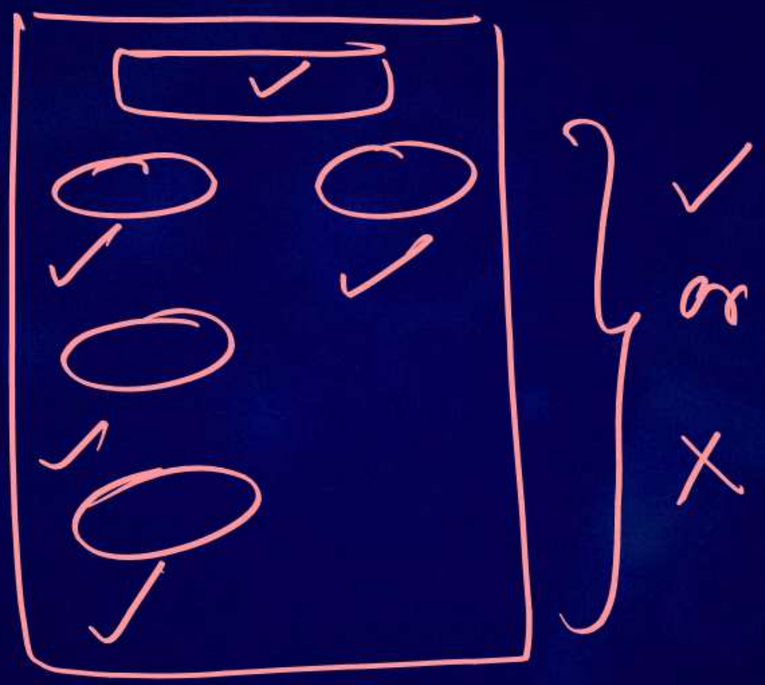
5. FROM GRIGNARD REAGENT




MOP OF BOTH ALDEHYDE & KETONE
1. oxidation of Alcohol
1° alcohol
PCC/CrO3
Aldehyde
2° alcohol
Strong/Mild
Ketone
2. By dehydrogenation of alcohols
1° alcohol
Cu/Ag
300°C
aldehyde
2° alcohol
Ketone
or
573 K
3. By Hydrocarbons
(i) By ozonolysis of alkenes
O3, Zn/H2O
RCH=C(R)-R
Tautomerism
CH2=CH(OH)
H2SO4
HgSO4
CH≡CH
4. By Hydrocarbons
(ii) By hydration of Alkynes
5. Thermal decomposition of Monocarboxylic Acid
2HCOOH
Δ
HCHO + CO2 + H2O
6. From Grignard Reagent
RMgX + RCN
R-C=NMgX
H2O

LETS ANALYSE OURSELVES

HOMEWORK



HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 1

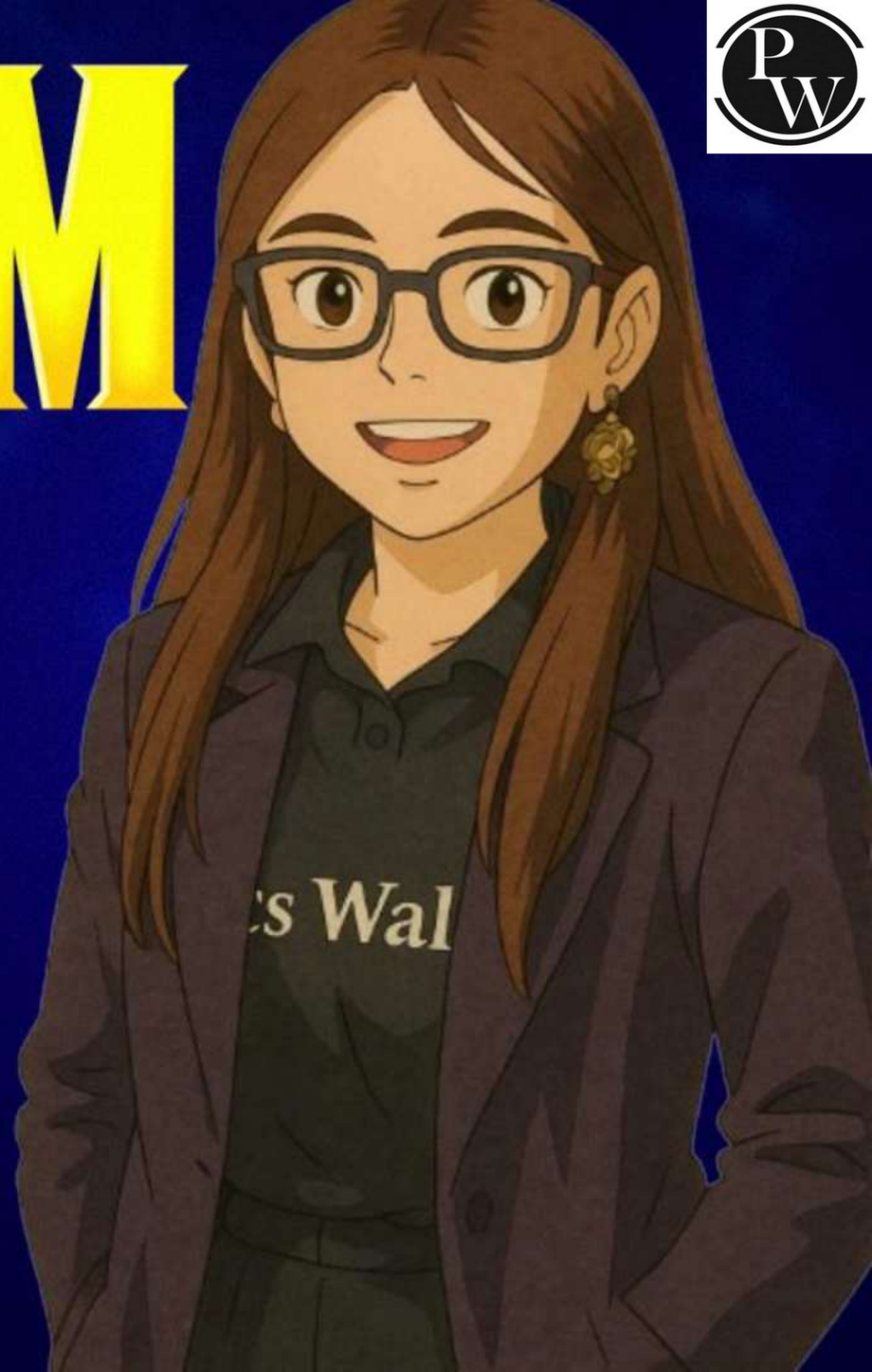
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-3

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. METHODS OF PREPARATION OF ONLY ALDEHYDE
2. METHOD OF PREPARATION OF ONLY KETONE
3. PHYSICAL PROPERTIES OF ALDEHYDE & KETONES
4. QUESTIONS

MY SHIMMERING STARS

#SHOURYA'SGALAXY

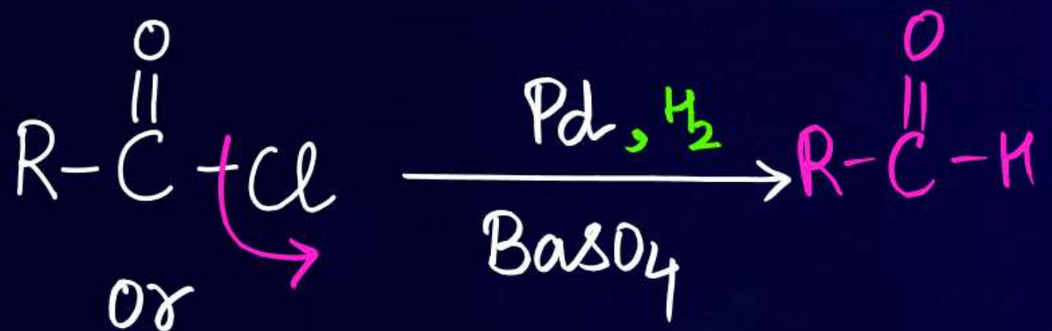

START

MOP OF ONLY ALDEHYDE

MOP OF ONLY ALDEHYDE

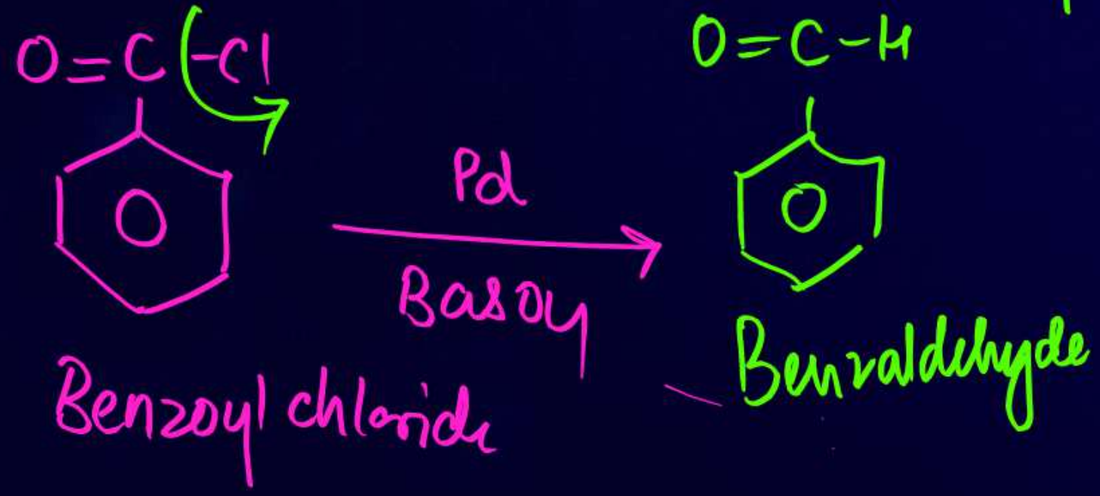
(Expected Que)

1. FROM ACYL CHLORIDE (ACID CHLORIDE)



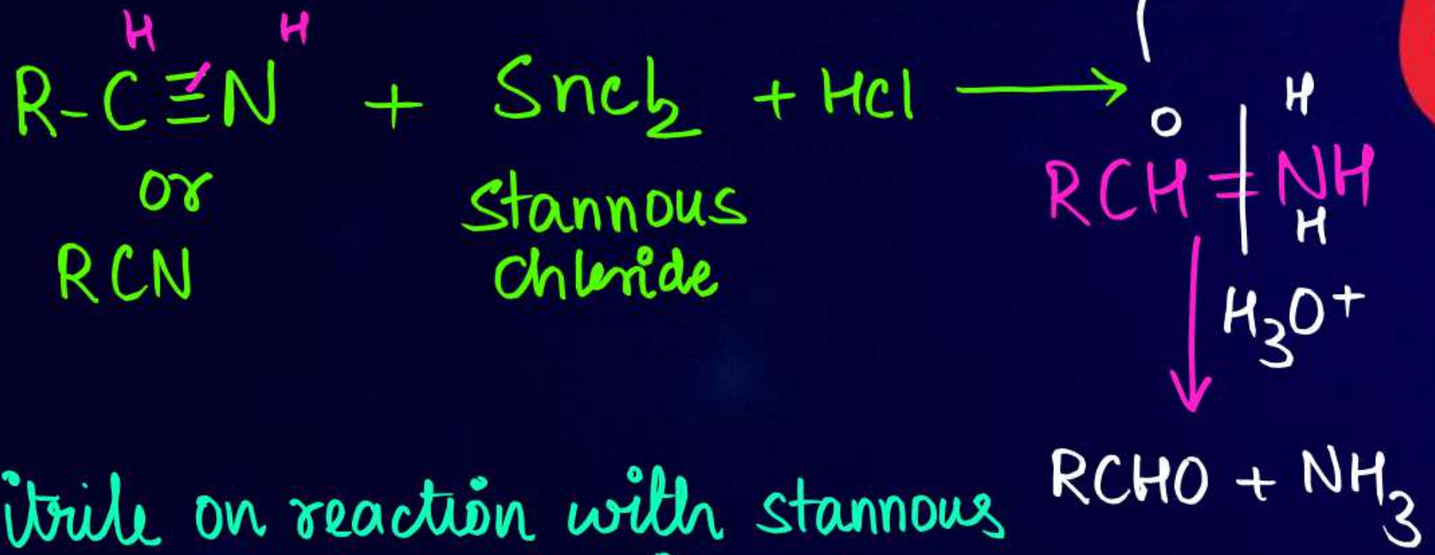
Acyl chloride is hydrogenated in the presence of palladium as a catalyst on Barium sulphate producing aldehyde.

ROSENMUND REDUCTION



MOP OF ONLY ALDEHYDE

2. FROM NITRILE /ESTER



STEPHEN REACTION

Nitrile on reaction with stannous chloride & hydrochloric acid produces imine ($RCH=NH$), which on further hydrolysis yield Aldehyde.
This Rx is Stephen Rx.

Q1.

$$CH_3CN + SnCl_2 + HCl \longrightarrow$$

$$CH_3-\overset{H}{C}\equiv\overset{H}{N} + SnCl_2 + HCl \longrightarrow CH_3CH=NH \xrightarrow{H_3O^+} CH_3CHO + NH_3$$

imine

ethanal (acetaldehyde)

\# $RCN \xrightarrow[(2)\ H_3O^+]{(1)\ AlH(\text{iso-butyl})_2 \text{ or } AlH(\text{i-but})_2} RCH=NH \xrightarrow{H_3O^+} RCHO + NH_3$

Q2. $CH_3-CH=CH-CH_2-CH_2-C\equiv N$ $\xrightarrow[(2)\ H_2O]{(1)\ AlH(i\text{-}but)_2}$ $CH_3-CH=CH-CH_2-CH_2-CH=NH$ $\xrightarrow{H_3O^+}$ $CH_3-CH=CH-CH_2-CH_2-CHO$

Q3. CH_3CH_2COCl $\xrightarrow[BaSO_4]{Pd,\ H_2}$ CH_3CH_2CHO propanal (Rosenmund Rx).

Q4. $CH_3CH_2CH_2C\equiv N$ $\xrightarrow[(2)\ H_2O/H_3O^+]{(1)\ SnCl_2,\ HCl}$ $CH_3CH_2CH_2CH=NH$ $\xrightarrow{H_3O^+}$ $CH_3CH_2CH_2CHO + NH_3$ butanal

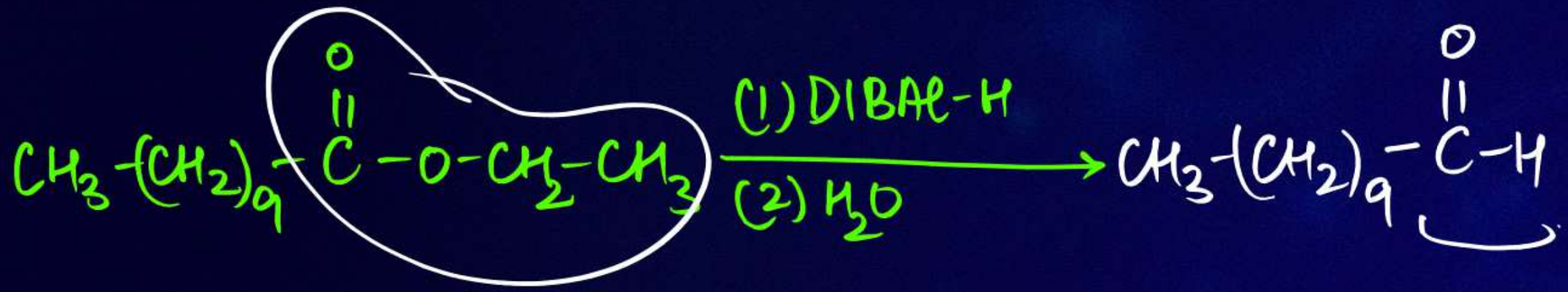
Q5. $CH_3COOH + HCOOH \xrightarrow{\Delta} H_2O + CO_2 + CH_3CHO$

Q6. $CH_3CN \xrightarrow[(2)\ H_2O]{(1)\ AlH(i\text{-}but)_2} CH_3CH{=}NH \xrightarrow{H_3O^+} CH_3CHO + NH_3$

Q7. $CH_3CN + CH_3MgBr \longrightarrow CH_3-C(CH_3){=}NMgBr(OH) \xrightarrow{H_2O} CH_3COCH_3 + NH_3 + Mg(OH)Br$

Q8. $CH_3-CH{=}CH-CH_3 \xrightarrow[O_3]{Zn,\ H_2O} 2\,CH_3CHO + ZnO$

Esters are also reduced to Aldehydes with DIBAL-H



DIBAL-H

↳ diisobutylaluminiumhydride

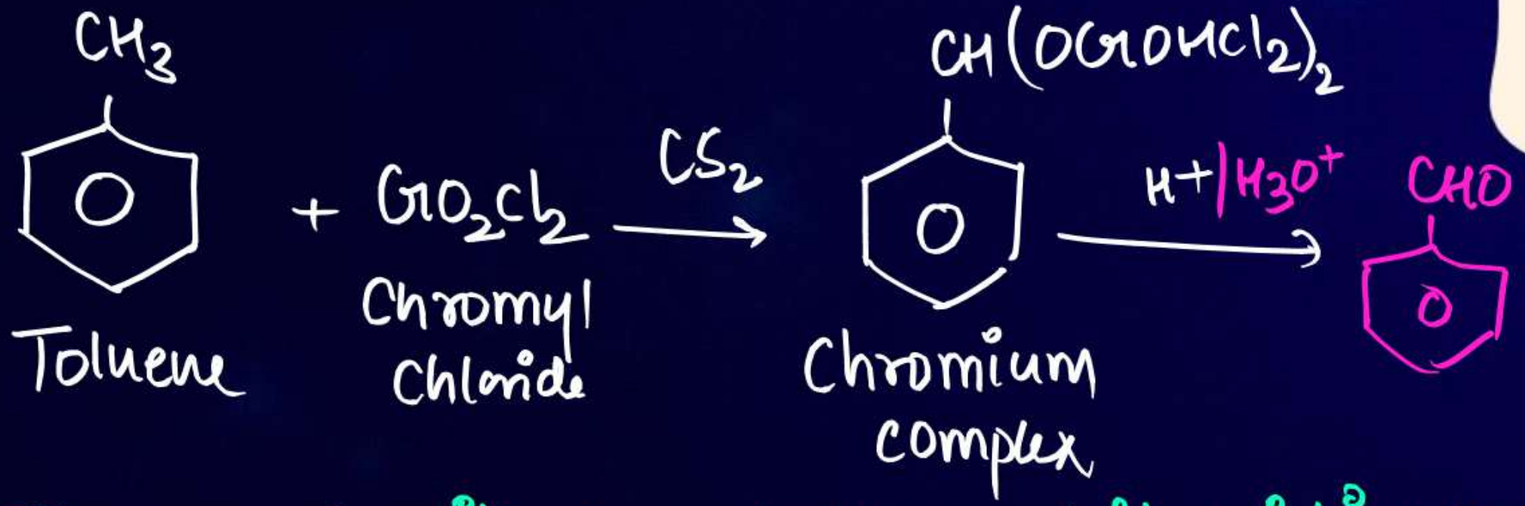
MOP OF ONLY ALDEHYDE

3.FROM HYDROCARBON

OOO, CrO3, hcl atl twice atl twice
(Expected Que)

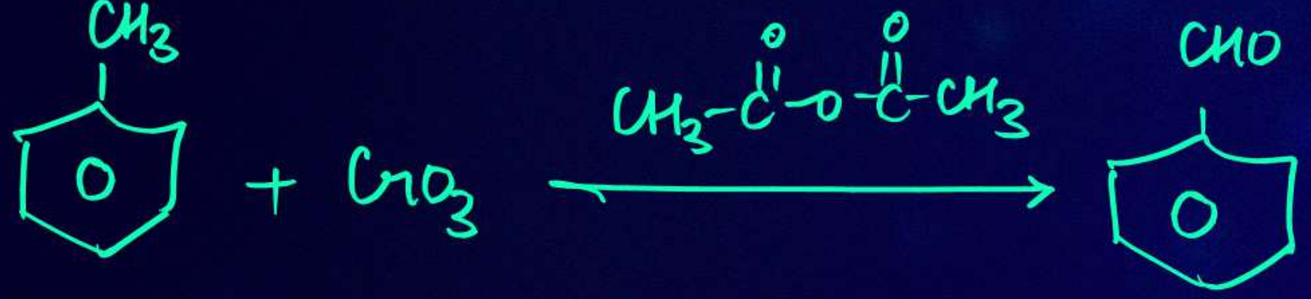
ETARD REACTION

(i) Oxidation of Methyl benzene

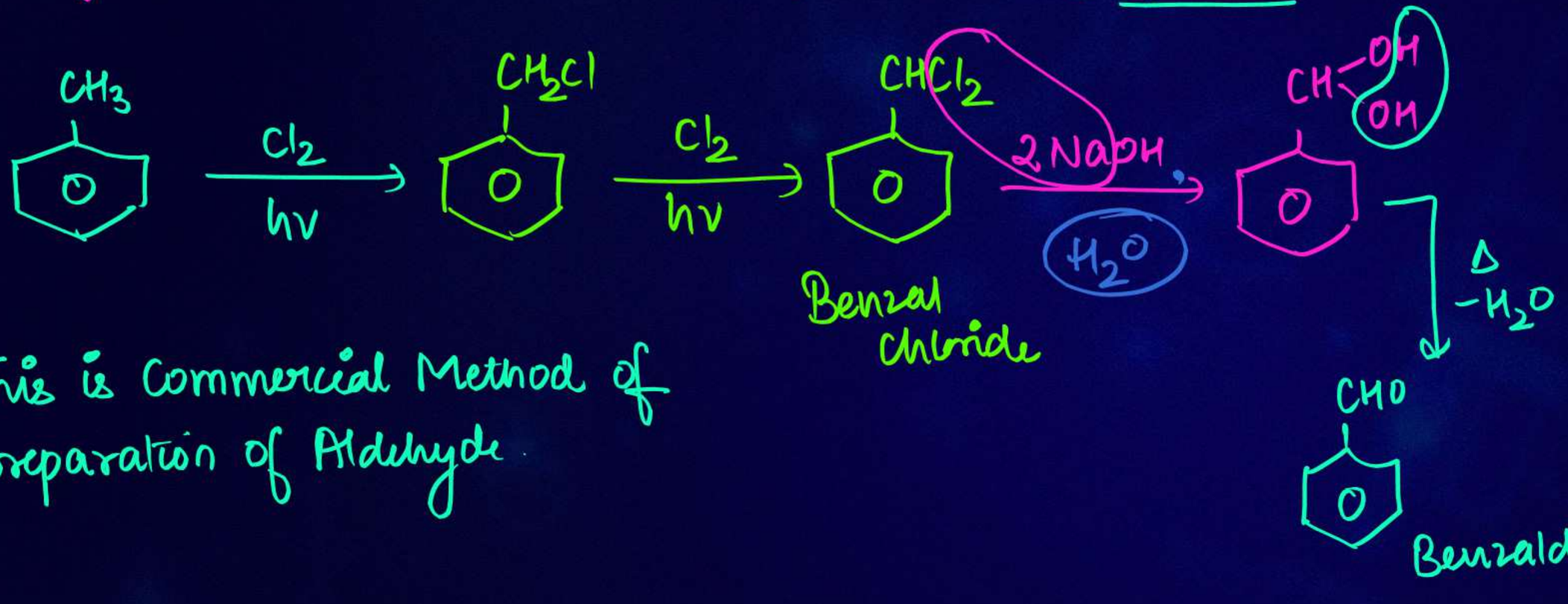


Toluene reacts with chromyl chloride which oxidises the methyl gp ($-CH_3$) to chromium complex producing aldehyde on further hydrolysis. This Rx is called Etard Rx.

(ii) By using chromic oxide (CrO_3)



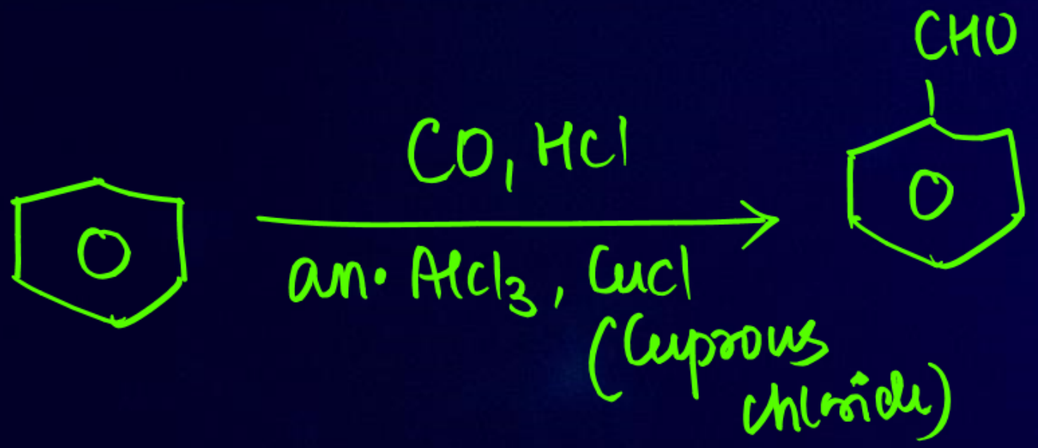
(iii) By side chlorination followed by hydrolysis ★ (Expected Que)

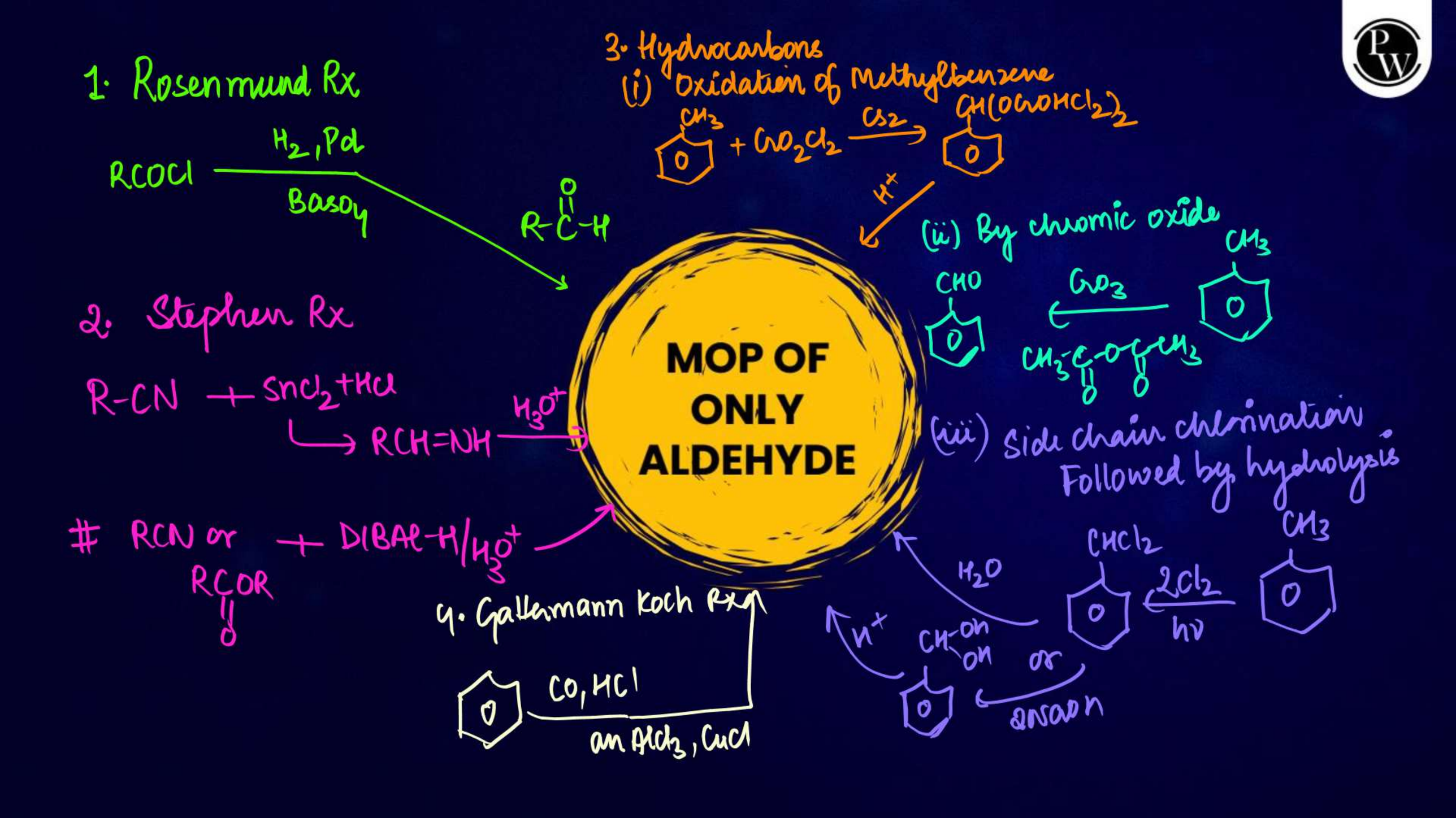


This is Commercial Method of preparation of Aldehyde.

MOP OF ONLY ALDEHYDE

4.GATTERMANN KOCH REACTION



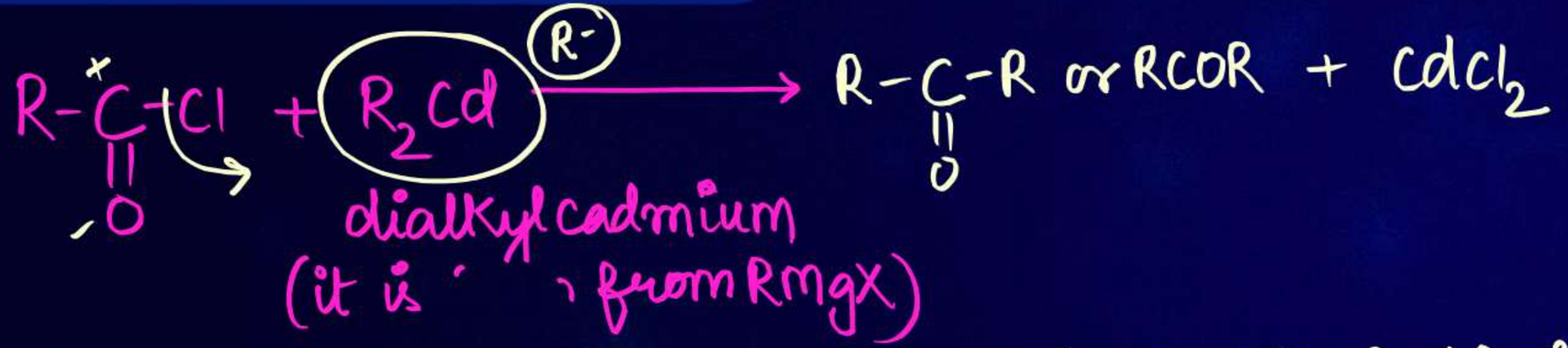

1. Rosenmund Rx
RCOCl
H2, Pd
BaSO4
R-C(=O)-H
2. Stephen Rx
R-CN + SnCl2 + HCl
RCH=NH
H3O+
RCN or RCOR
DIBAL-H/H3O+
4. Gattermann Koch Rx
CO, HCl
anAlCl3, CuCl
3. Hydrocarbons
(i) Oxidation of Methylbenzene
CrO2Cl2
CS2
CH(OCrOHCl2)2
H+
(ii) By chromic oxide
CrO3
CHO
(iii) Side chain chlorination Followed by hydrolysis
Cl2
hv
CHCl2
H2O
H+
CH-OH
OH
or
gem diol
MOP OF ONLY ALDEHYDE

MOP OF ONLY KETONE

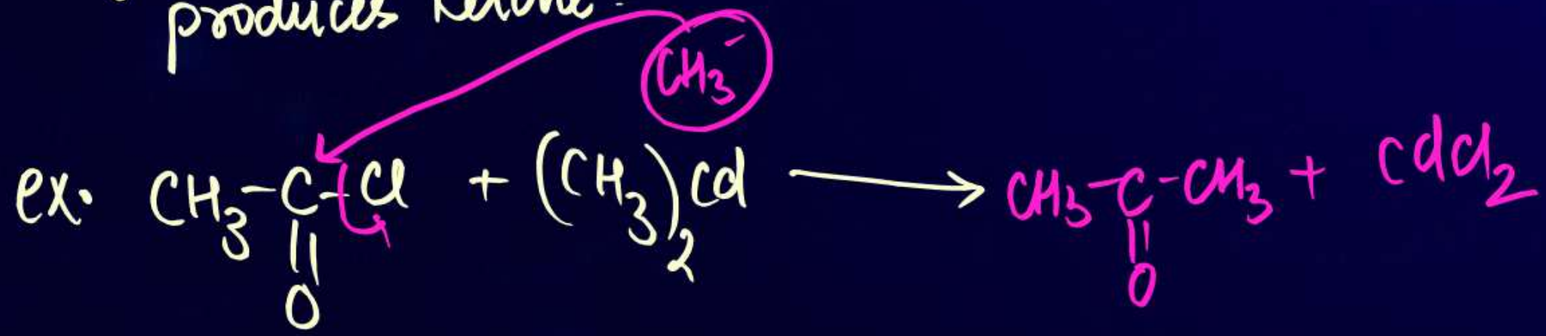
MOP OF ONLY KETONE

* $RMgX + CdCl_2 \longrightarrow R_2Cd$ (dialkyl cadmium) $+ Mg(X)Cl$

1.FROM ACYL CHLORIDE

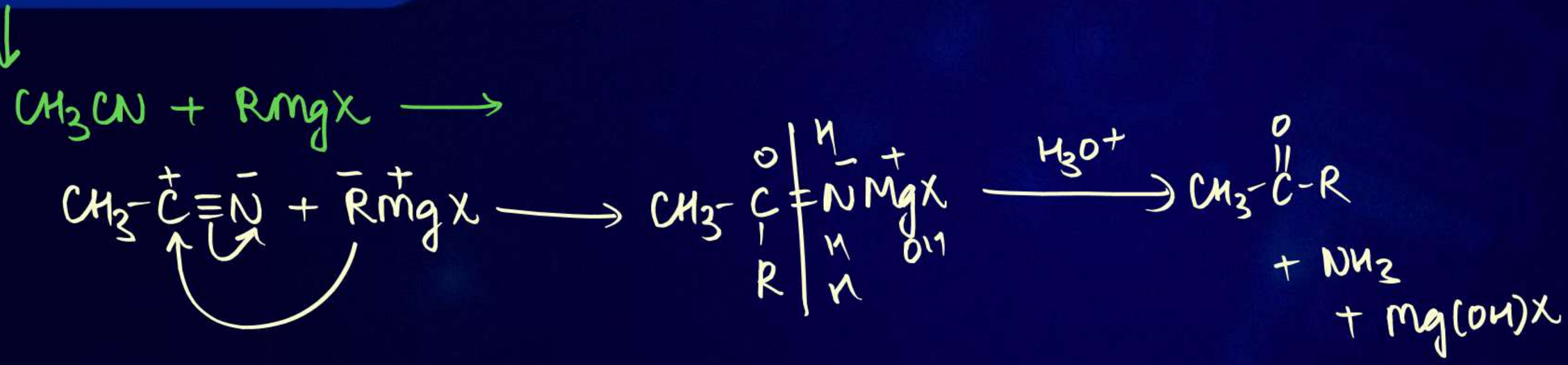


Acyl chloride or Rx with dialkyl cadmium (which is obtained from RMgX) produces Ketone.



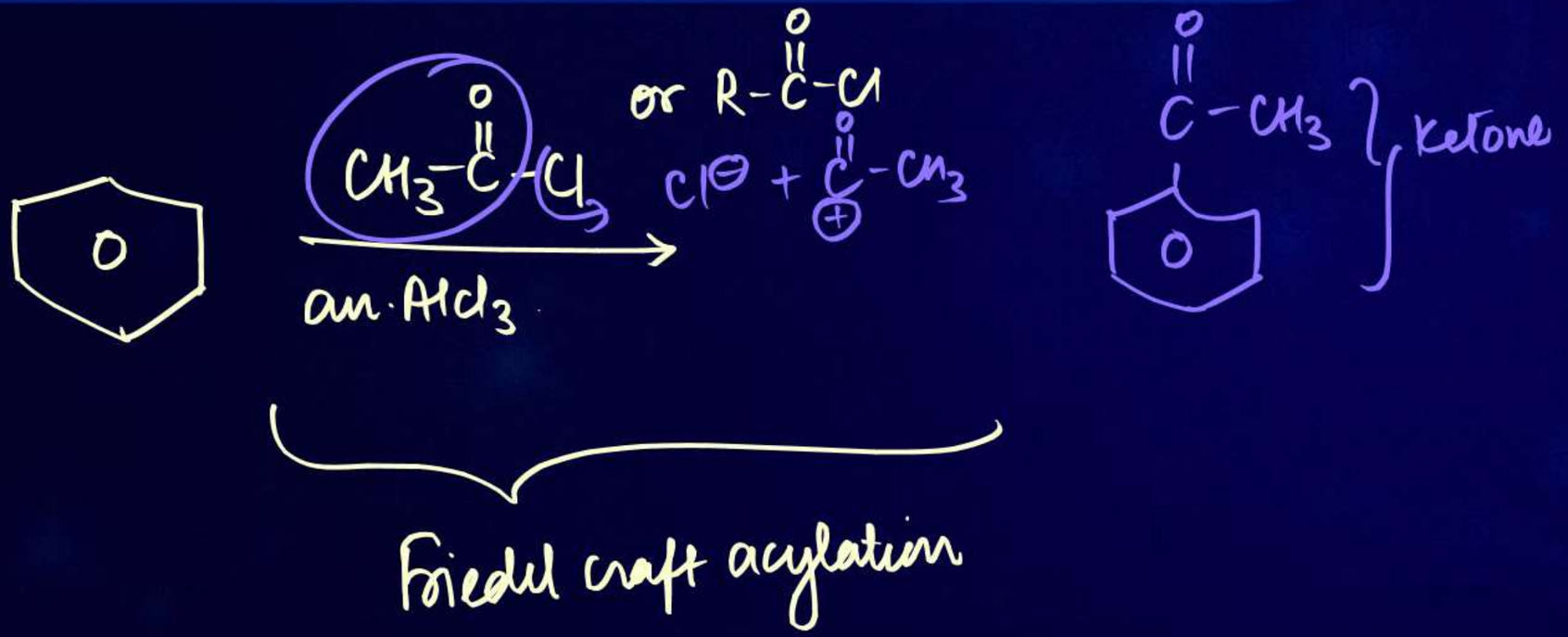
MOP OF ONLY KETONE

2. FROM NITRILES



MOP OF ONLY KETONE

3. FROM BENZENE OR SUBSTITUTED BENZENE




1. By acyl chloride
RCOCl + R2Cd
2. From nitriles
RCN + RMgX
MOP OF ONLY KETONE
3. Benzene
CH3-C(=O)-Cl
anhAlCl3
Friedel craft acylation Rx.

Example 8.1 Give names of the reagents to bring about the following transformations:

(i) Hexan-1-ol to hexanal

(ii) Cyclohexanol to cyclohexanone

(iii) *p*-Fluorotoluene to *p*-fluorobenzaldehyde

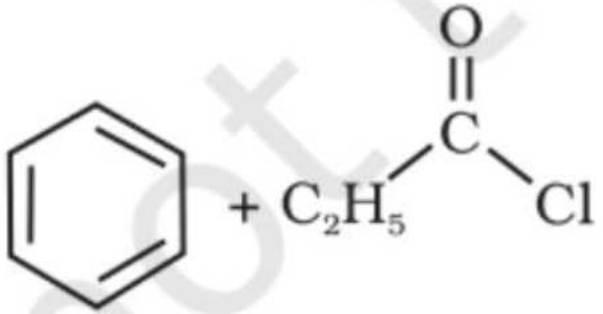
(iv) Ethanenitrile to ethanal

(v) Allyl alcohol to propenal

(vi) But-2-ene to ethanal

Intext Question

8.2 Write the structures of products of the following reactions;

(i)  $\xrightarrow[CS_2]{\text{Anhyd. } AlCl_3}$

(ii) $(C_6H_5CH_2)_2Cd + 2\ CH_3COCl \rightarrow$

NCERT INTEXT QUESTION

(iii) $H_3C-C\equiv C-H \xrightarrow{Hg^{2+},\ H_2SO_4}$

(iv)  $\xrightarrow[2.H_3O^+]{1.CrO_2Cl_2}$

Total - 10 Ques of GT ✓

↳ on your own.

HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 2 (DPP)

5.q.Test 03

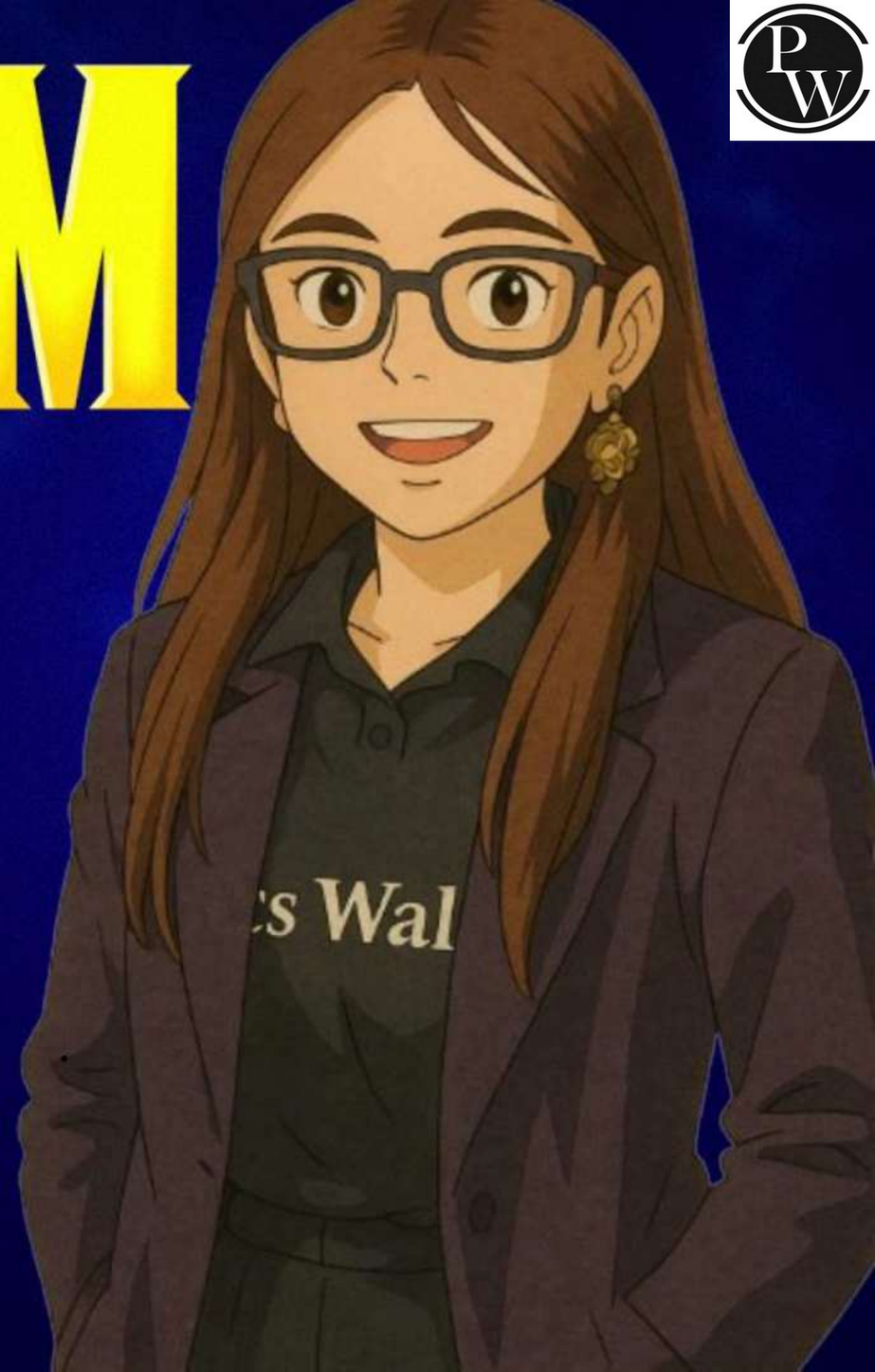
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-4

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. PHYSICAL PROPERTIES OF ALDEHYDE , KETONES
2. CHEMICAL PROPERTIES OF ALDEHYDE , KETONE
3. NCERT READING
4. QUESTIONS

MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

NCERT EXAMPLES

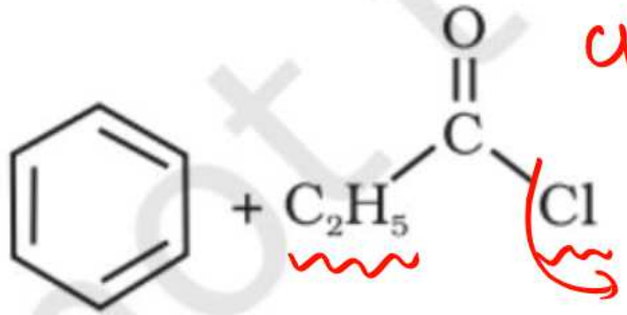
Example 8.1 Give names of the reagents to bring about the following transformations:

(i) Hexan-1-ol to hexanal
(ii) Cyclohexanol to cyclohexanone
(iii) *p*-Fluorotoluene to *p*-fluorobenzaldehyde
(iv) Ethanenitrile to ethanal
(v) Allyl alcohol to propenal
(vi) But-2-ene to ethanal

NCERT INTEXT QUESTION

Intext Question

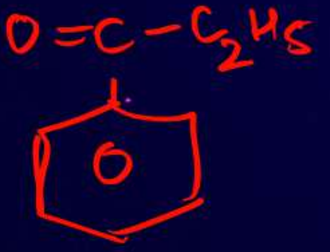
8.2 Write the structures of products of the following reactions;

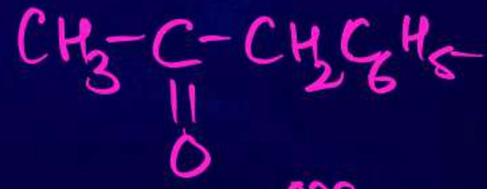
(i)  $\xrightarrow[CS_2]{\text{Anhyd. } AlCl_3}$

(ii) $(C_6H_5CH_2)_2Cd + 2\ CH_3COCl \rightarrow$

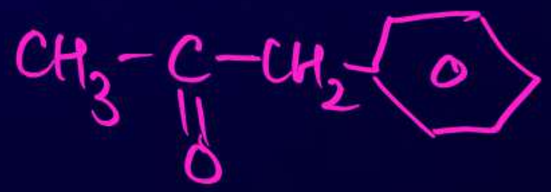
$Cl^{\ominus} + C_2H_5-C^{\oplus}=O$

Friedel craft acylation Rx.





or



NCERT INTEXT QUESTION

Hydration of Ethyne (Alkynes)

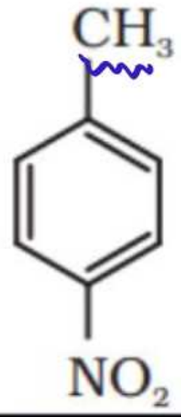
(iii) $H_3C-C\equiv C-H \xrightarrow{Hg^{2+},\ H_2SO_4}$

propyne, H^+, OH^-

$CH_3-C(OH)=CH_2$

$\sqrt{\Gamma}$ Tautomerism

$CH_3-C(=O)-CH_3$

(iv) 

Chromyl chloride

Etard Rx

$\xrightarrow[2.\ H_3O^+]{1.\ CrO_2Cl_2}$

PHYSICAL PROPERTIES

PHYSICAL PROPERTIES

1. PHYSICAL STATE

- Methanal is gaseous in nature. ($HCHO$) / Formaldehyde
- Ethanal is volatile liquid.
- Higher Members are either liquid or solid in Nature.

PHYSICAL PROPERTIES

2. BOILING POINT

Boiling point is directly dependent on Molecular Mass.

$$\text{Boiling point} \propto \text{Molecular Mass}$$

Boiling point is inversely proportional of branching.

$$\text{Bpt} \propto \frac{1}{\text{Branching}}$$

Aldehyde & Ketones exhibit dipole-dipole interaction. They dont form H bond. Hence they have Less Boiling point than alcohol & more than ether & hydrocarbon.

Q. What is the order of Boiling point of the following ?

(a) $CH_3CH_2CH_2CHO$ > (b) CH_3-CH_2-CHO > (c) CH_3CHO > (d) $HCHO$

Q. (a) $CH_3CH_2CH_2CH_2COOH$ > (b) $CH_3CH_2CH_2CH_2OH$ > (c) $CH_3CH_2CH_2CHO$ > (d) $CH_3-CH_2-O-CH_2CH_3$

H bond (dimer)

H bond

✓ (e) $CH_3CH_2CH_2CH_3$

NCERT EXAMPLES

Example 8.2

Arrange the following compounds in the increasing order of their boiling points:

$CH_3CH_2CH_2CHO$, $CH_3CH_2CH_2CH_2OH$, H_5C_2-O-C_2H_5, $CH_3CH_2CH_2CH_3$

a b c d

$d < c < a < b$

Boiling point
↳ Expected Que.

NCERT INTEXT QUESTION

Intext Question

8.3 Arrange the following compounds in increasing order of their boiling points.

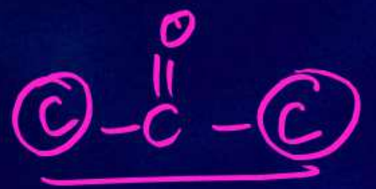
CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$

a b c d

$d < c < a < b$

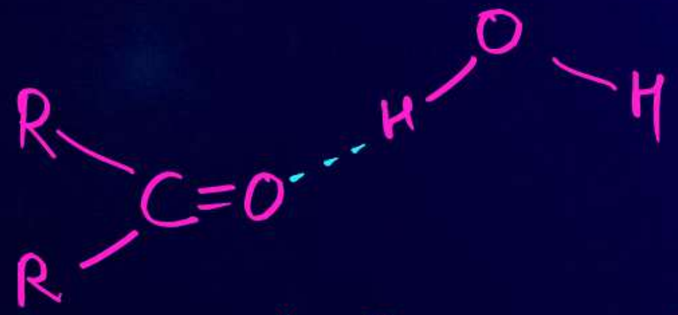
PHYSICAL PROPERTIES

3. SOLUBILITY



↓

Lower Members (Methanal, ethanal, propanone) are soluble in water but Solubility decreases on increasing C atoms, because hydrophobic part increases.



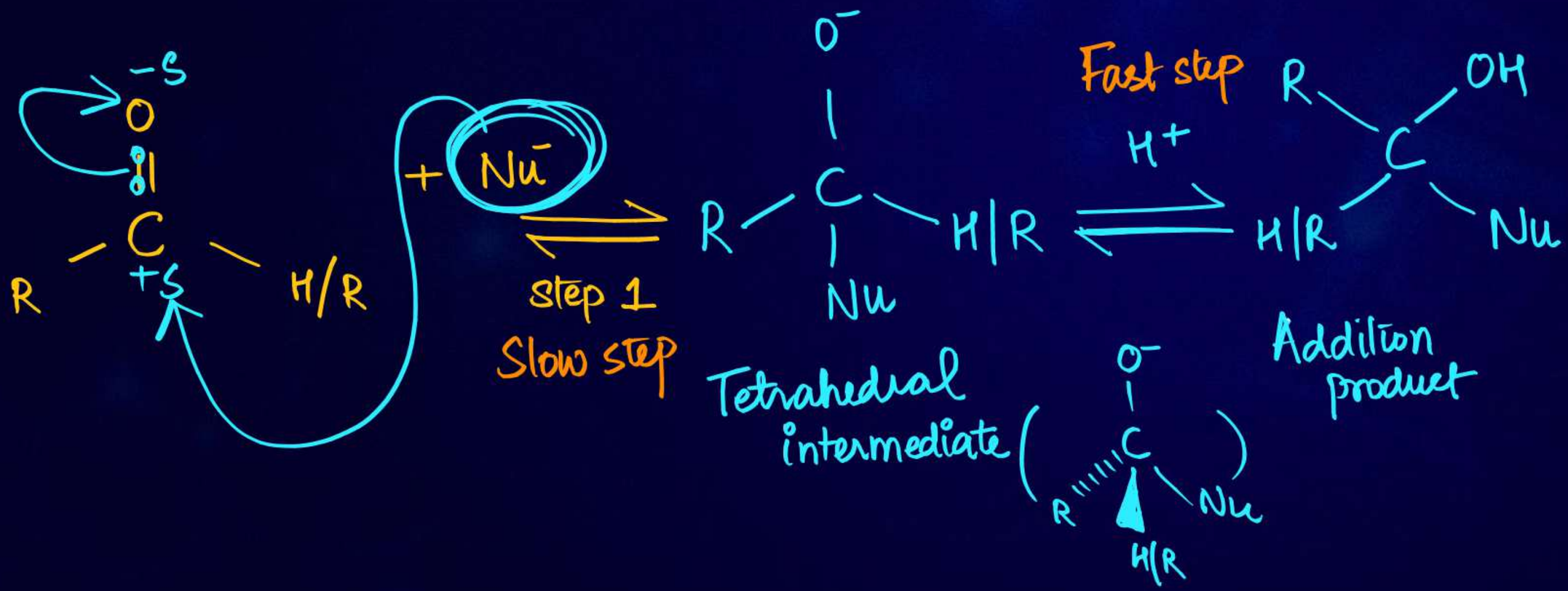
They are fairly soluble in Benzene, ether, Methanol & Chloroform.

Lower Members have sharp pungent odour.
(aldehyde)
On increasing no of carbon atoms, less pungent & more fragrent.

CHEMICAL PROPERTIES

CHEMICAL PROPERTIES

1. NUCLEOPHILIC ADDITION REACTION



In case of Aldehyde/Ketones, they exhibit Nucleophilic addition Rx.
The hybridisation of Carbon atom shifts from sp^2 to sp^3
Before Forming the final addition product, it forms an intermediate.
The intermediate is tetrahedral alkoxide.

CHEMICAL PROPERTIES

(2) Reactivity

bulky group → steric hinderance
It is difficult for Nucleophile to come to carbonyl Carbon.
Hence Reactivity ↓

Aldehydes are more Reactive than Ketones, because in Ketones steric hinderance occurs leading to decrease in Reactivity.

CHEMICAL PROPERTIES

(3) Addition of Hydrogen cyanide

(HCN)

H^+ ($\bar{C}N$)

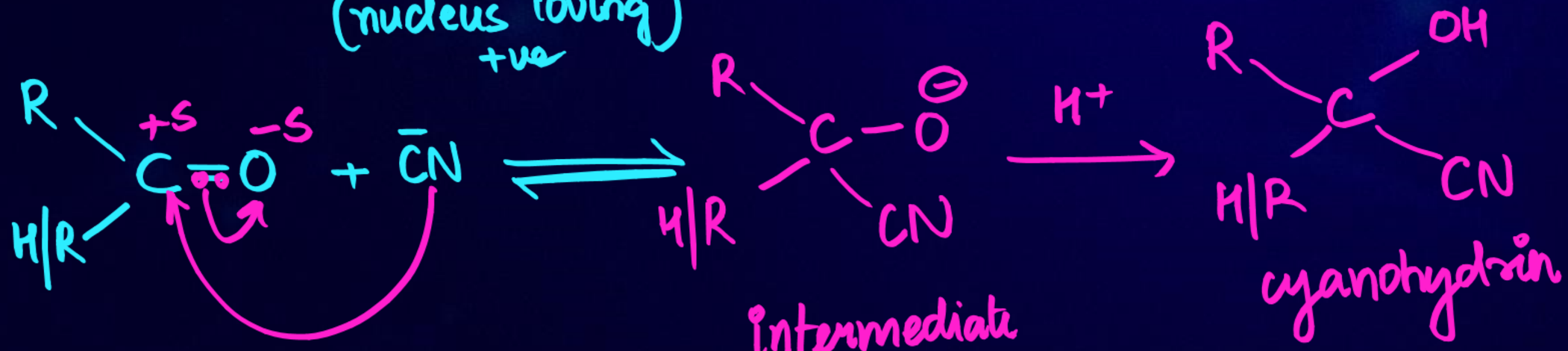
↓

Nucleophile

(nucleus loving)

+ve

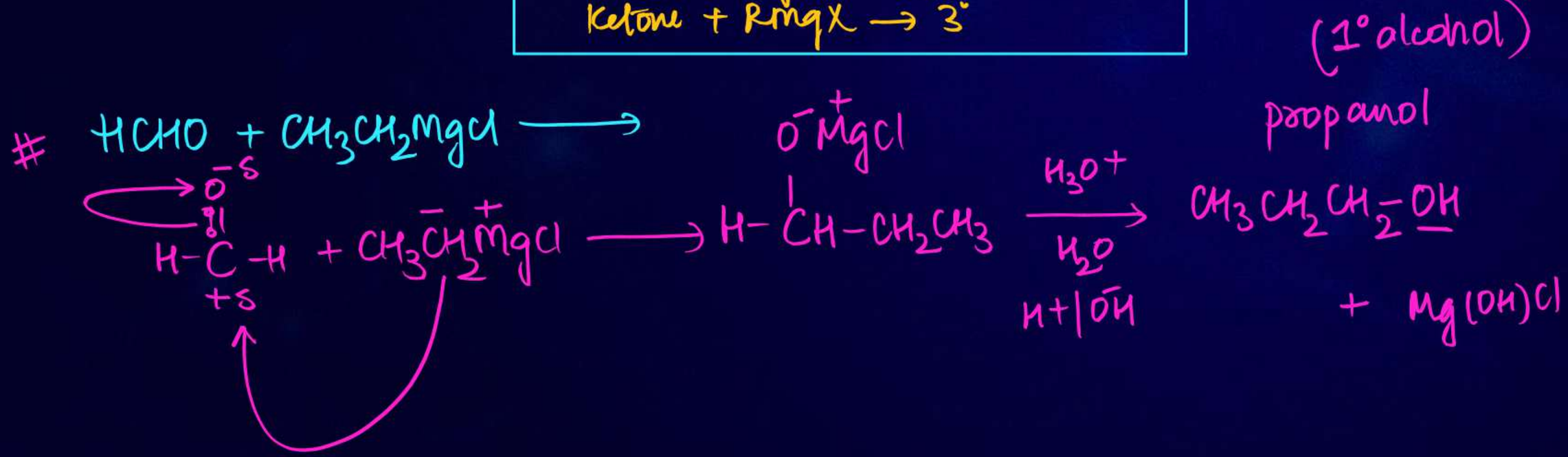
Addition of hydrogen cyanide produces an tetrahedral intermediate leading to production of cyanohydrin. The Nucleophile used over here is cyanide ion ($C\bar{N}$).



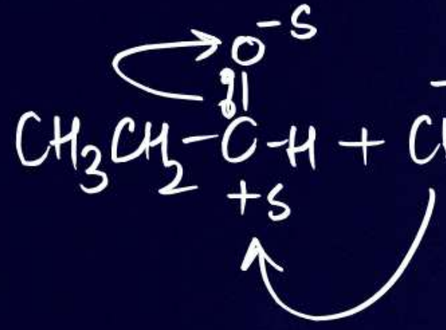
CHEMICAL PROPERTIES

(4) Addition of Grignard Reagent

Formaldehyde + RMgX → 1° alcohol
HCHO(except, aldehyde + RMgX → 2°
Ketone + RMgX → 3°



$CH_3CH_2CHO + CH_3MgBr \longrightarrow$

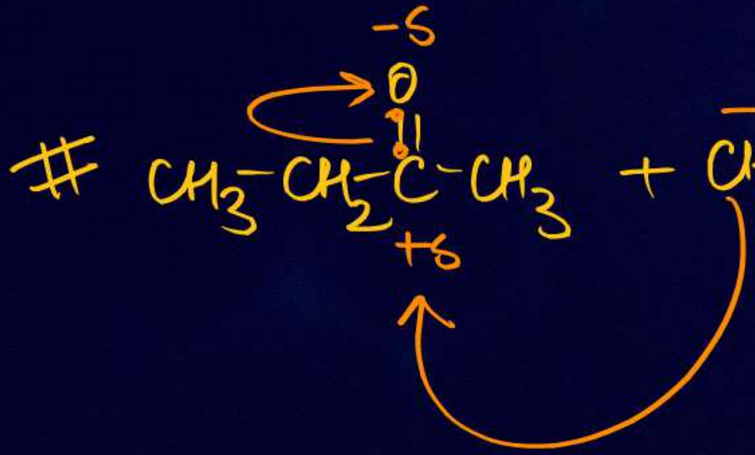


$CH_3CH_2-\underset{\underset{+\delta}{}}{C}(=O^{-\delta})-H + CH_3^{-}\,{}^{+}MgBr \longrightarrow CH_3CH_2-CH(O^{-}MgBr^{+})-CH_3$

$\xrightarrow[H^+/OH^-]{H_2O} CH_3CH_2CH(OH)CH_3$ (2° alcohol)

butan-2-ol.

+ $Mg(OH)Br$.



$CH_3-CH_2-\underset{\underset{+\delta}{}}{C}(=O^{-\delta})-CH_3 + CH_3^{-}\,{}^{+}MgCl \longrightarrow CH_3CH_2-C(O^{-}MgCl^{+})(CH_3)-CH_3$

$\xrightarrow[H^+/OH^-]{H_2O} CH_3CH_2-C(OH)(CH_3)-CH_3$ +

2-methylbutan-2-ol

$Mg(OH)Cl$

CHEMICAL PROPERTIES

(5) Addition of Sodium hydrogensulphite

($NaHSO_3$) HSO_3^-

$Na^+ + HSO_3^-$

Bisulphite addition product (water soluble).

HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 3

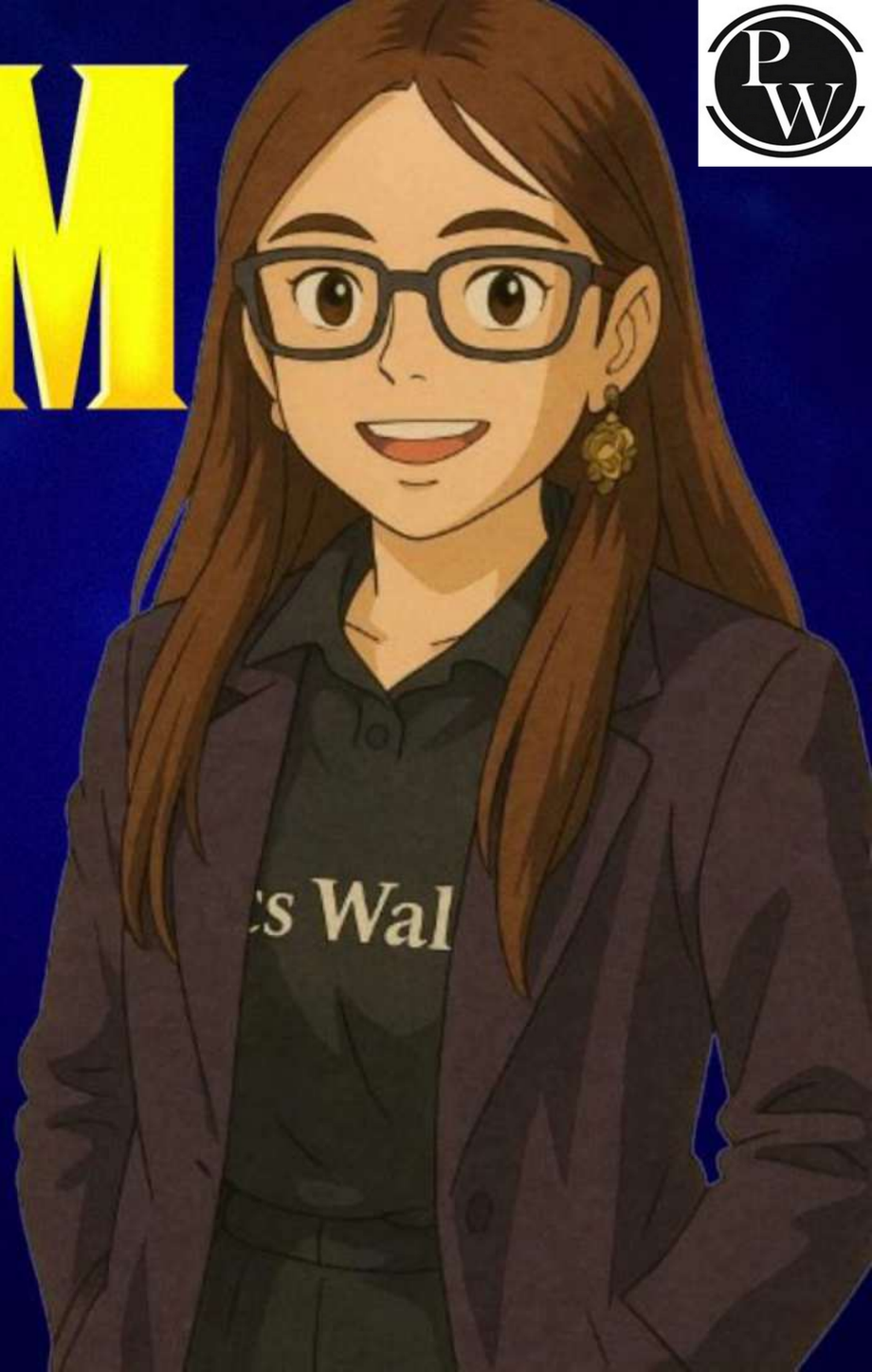
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-5

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. CHEMICAL PROPERTIES PART 2

   Chemical Properties of Aldehydes and Ketones - II

2. FLOWCHART

3. NCERT READING

4. QUESTIONS

MY SHIMMERING STARS

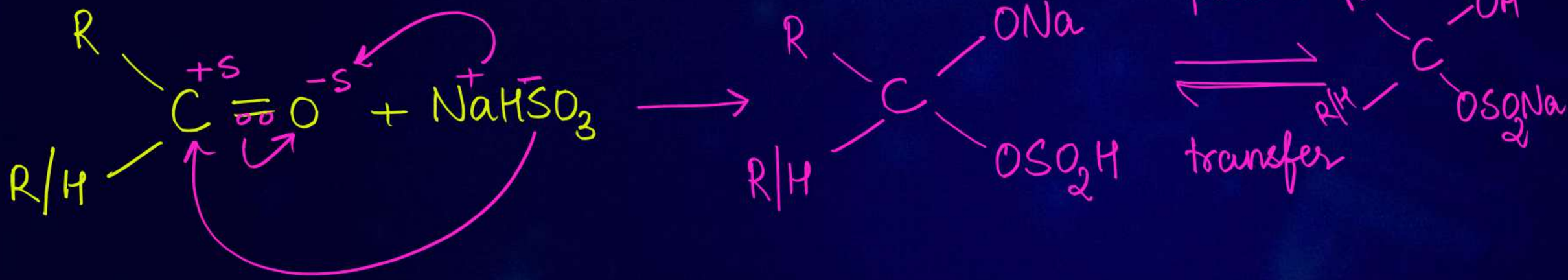
#SHOURYA'SGALAXY


START

CHEMICAL PROPERTIES

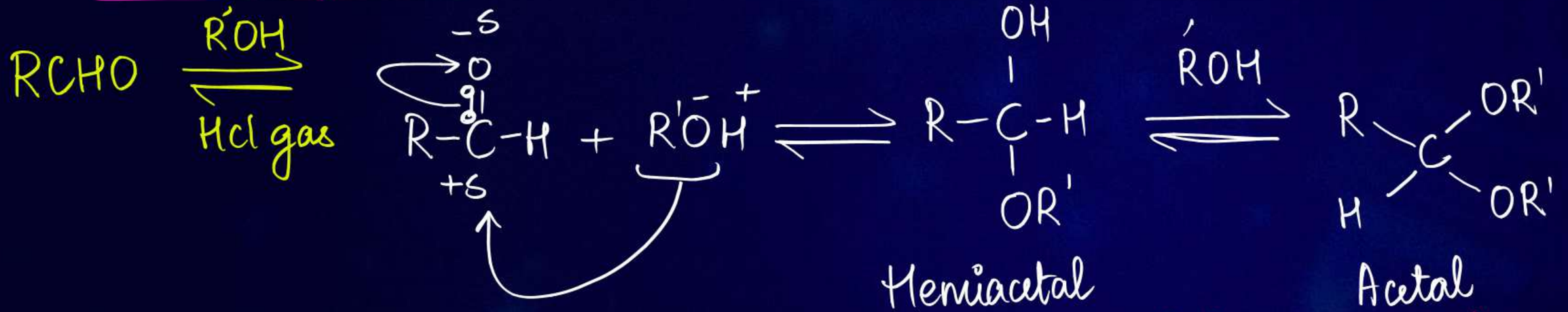
CHEMICAL PROPERTIES

Addition of $NaHSO_3$ $Na^+ \bar{H}SO_3$



CHEMICAL PROPERTIES

Addition of Alcohol

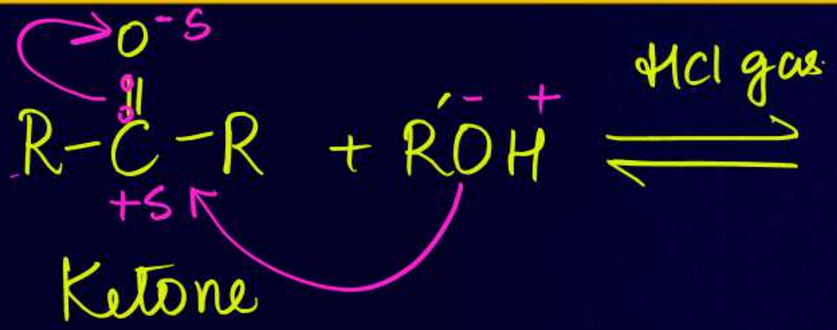


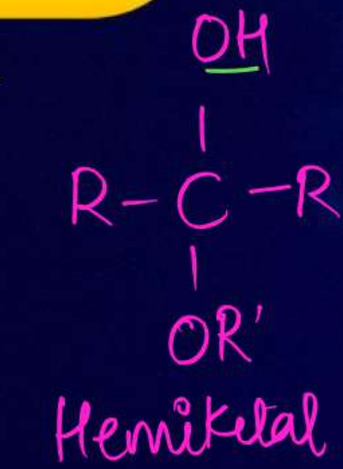
Hemiacetal

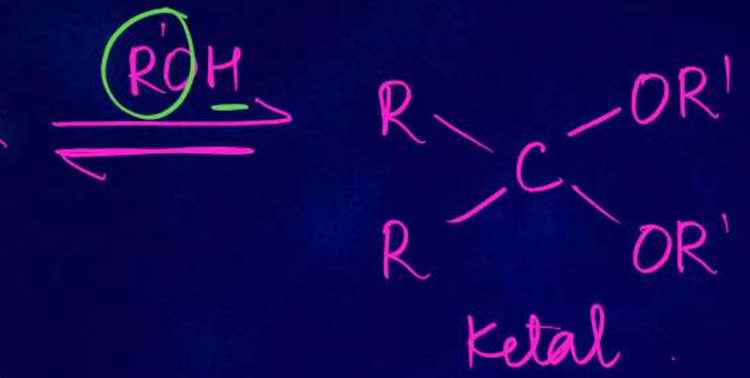
Acetal

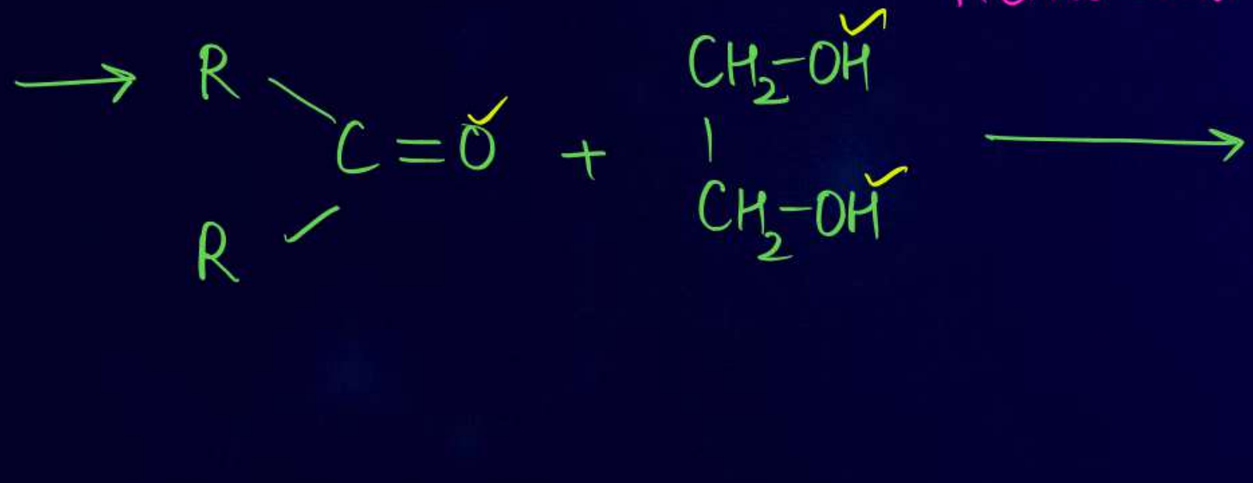
Aldehyde on Reaction with Alcohol (Monohydric) produces hemiacetal (alkoxyalcohol) which on further Rx with another alcohol produces Acetal product (gem-dialkoxy product)

CHEMICAL PROPERTIES



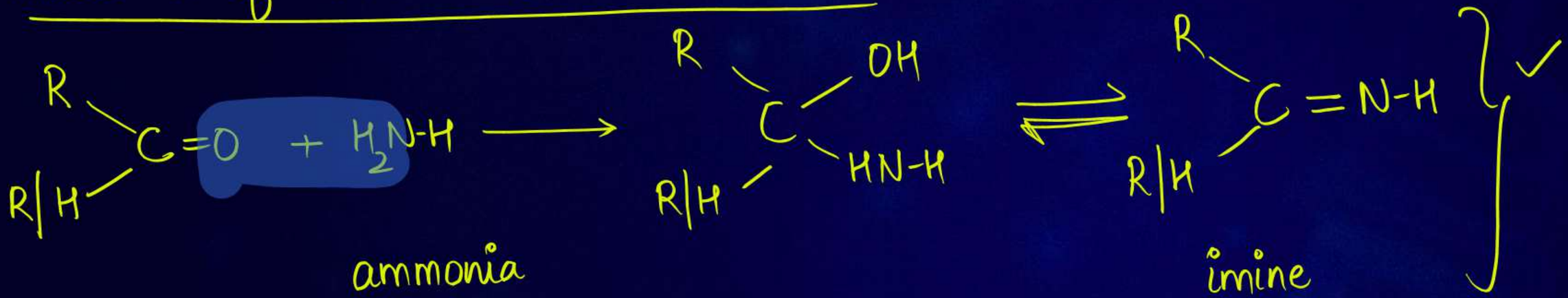


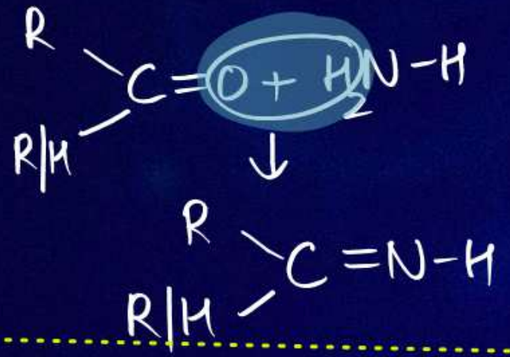
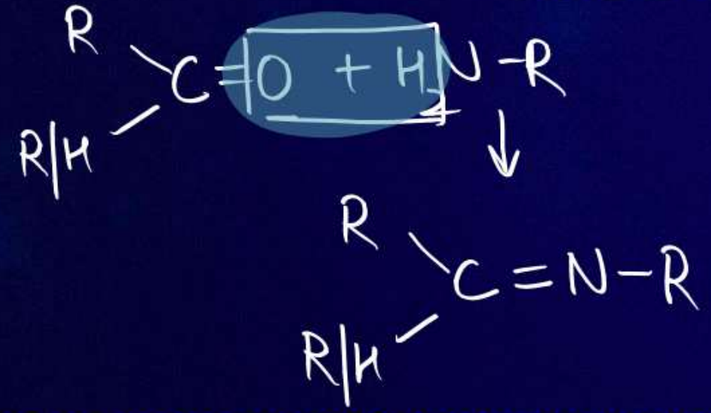
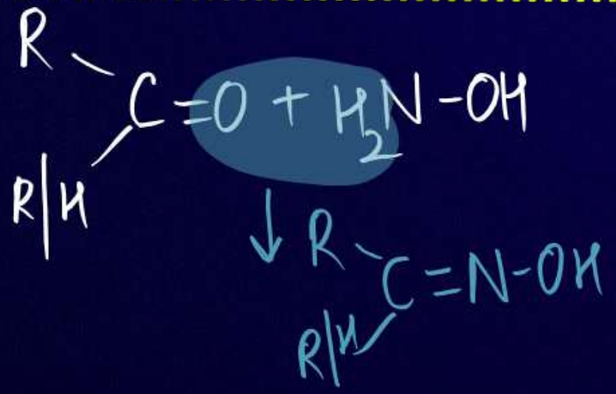


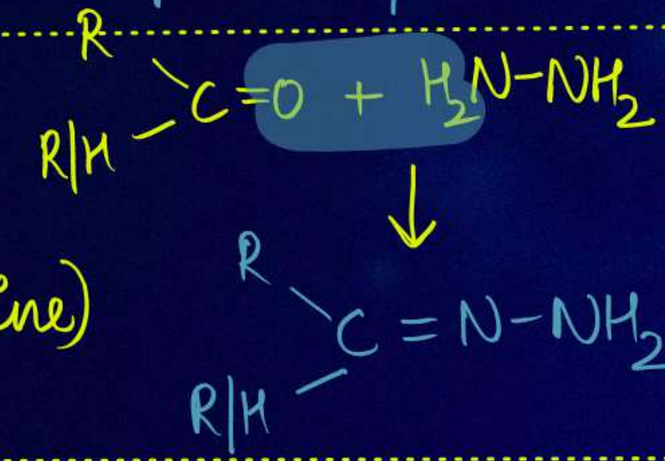
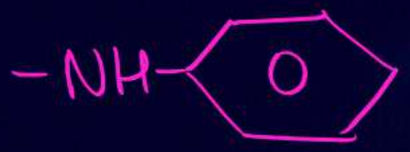
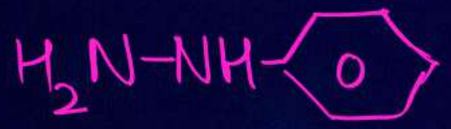
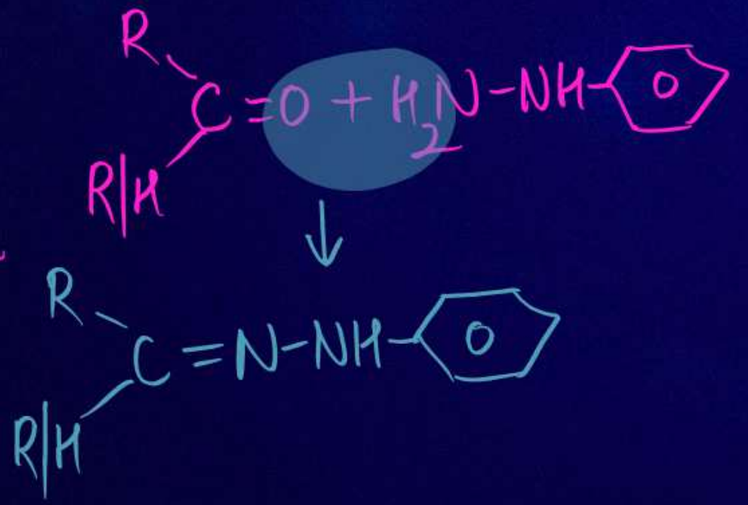


CHEMICAL PROPERTIES

Addition of ammonia & its derivatives



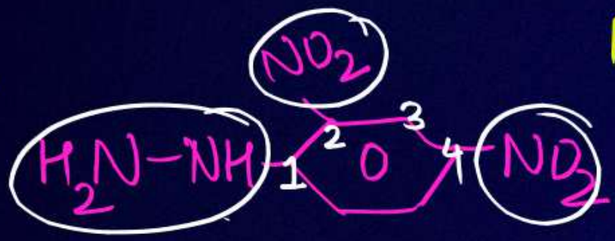
Z	Reagent Name H_2N-Z	Product Structure	Product Name
→ H	H_2N-H (ammonia)		imine
→ R	H_2N-R (amine)		substituted imine (schiff's base)
→ OH	H_2N-OH hydroxylamine		oxime

Z	Reagent Name	product formed	product Name
$-NH_2$	H_2N-Z		hydrazone.
	H_2N-NH_2 (hydrazine) ✡		
	 Phenyl hydrazine		phenylhydrazone

Z

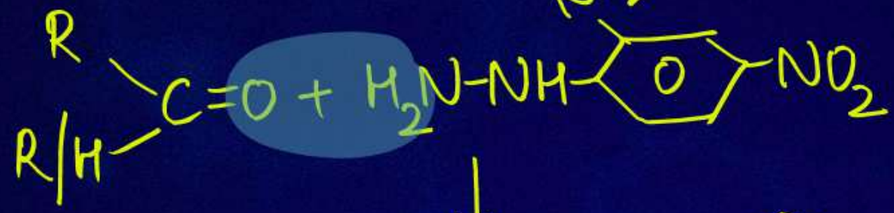
Reagent Name

H_2N-Z

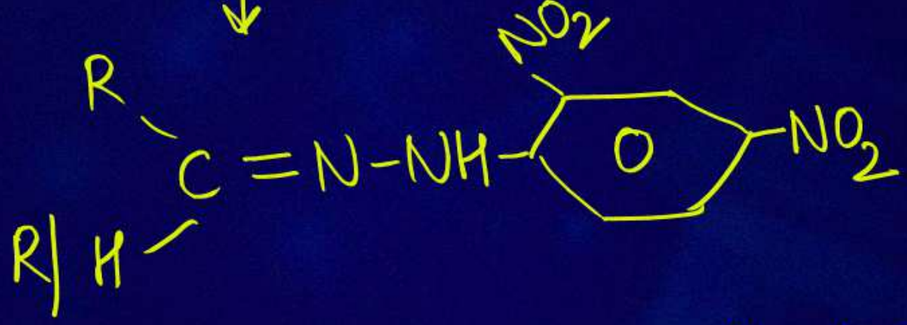


2,4-dinitrophenylhydrazine

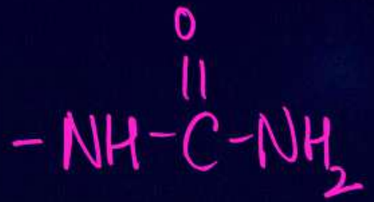
product Formed



product name



2,4-dinitrophenylhydrazone



HW ✓

Semicarbazide

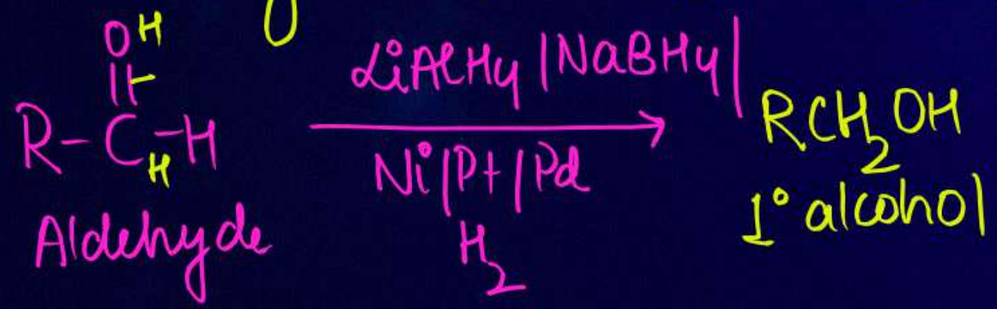
HW ✓

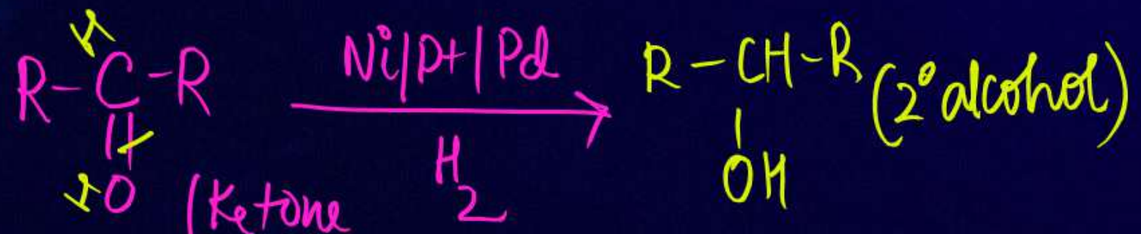
Semicarbazone

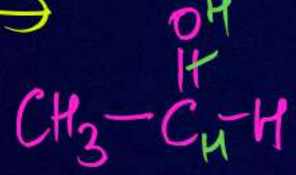
REDUCTION

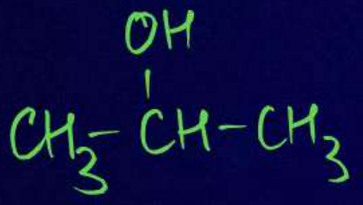
(a) Reduction to Alcohol

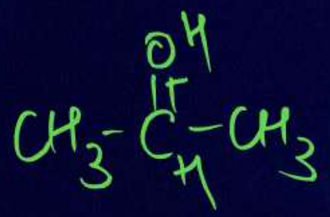
Aldehydes and Ketones can be converted to primary (1°) & secondary (2°) alcohols respectively by reacting it with Sodium borohydride ($NaBH_4$) or Lithium aluminium hydride ($LiAlH_4$) or by catalytic hydrogenation (Ni/Pt/Pd).





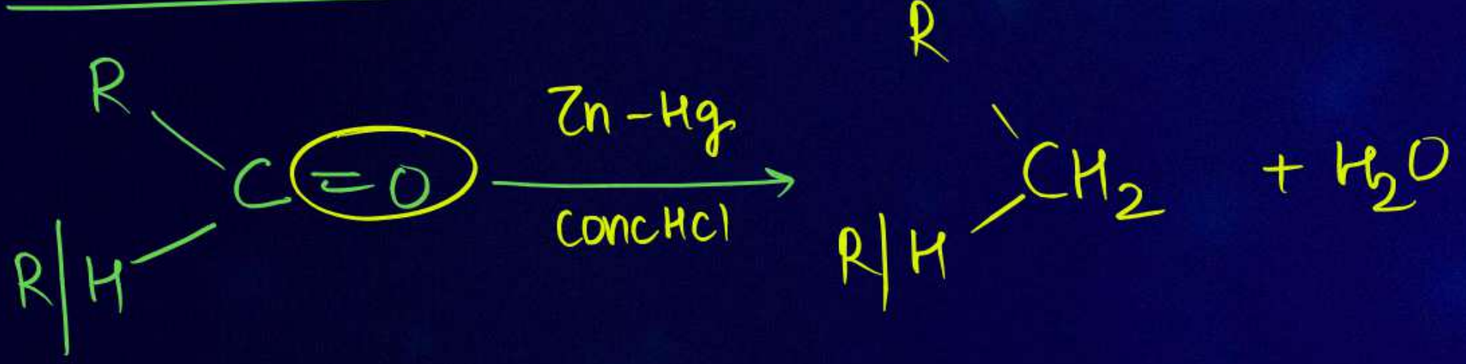
$CH_3CHO \xrightarrow{LiAlH_4}$  CH_3CH_2OH ethanol.

$CH_3COCH_3 \xrightarrow[H_2]{Ni^{\circ}}$  propan-2-ol



(b) Reduction to Hydrocarbon

→ Clemmenson Reduction



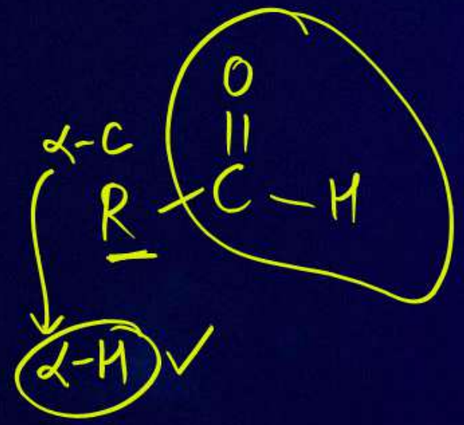
In this Rx aldehyde/ Ketone reacts with zinc amalgam with conc HCl producing hydrocarbon

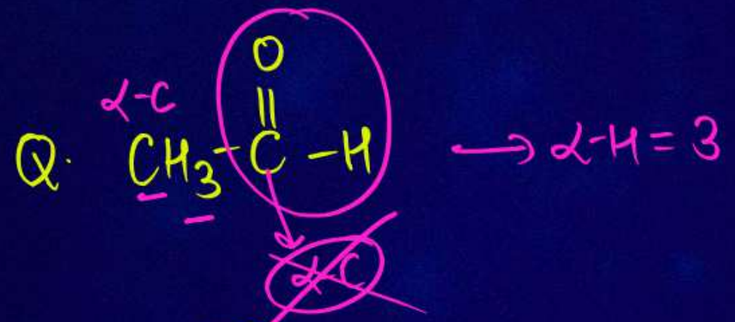
→ Wolff-Kishner Reduction

Aldol Condensation

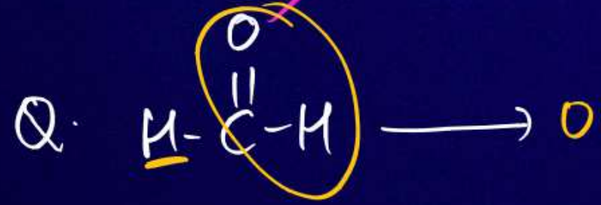
- This Reaction occurs in the presence of Base.
- α-Hydrogen is Required. ✓

α-Hydrogen →



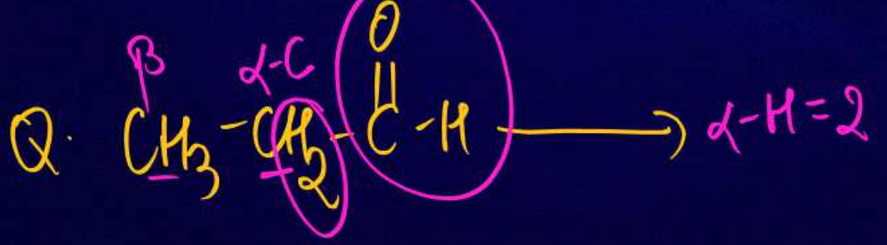
Q. 

→ α-H = 3

Q. 

→ 0

no α-C

Q. 

→ α-H = 2

Aldol Condensation is of two types :-

(1) Self Aldol condensation (same 2 Molecule)

(2) Cross Aldol condensation (two diff Molecule)

(1) Self Aldol Condensation

→ It occurs in two steps :

a) Formation of Carbanion

b) Attack of carbanion on another Molecule

HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 3

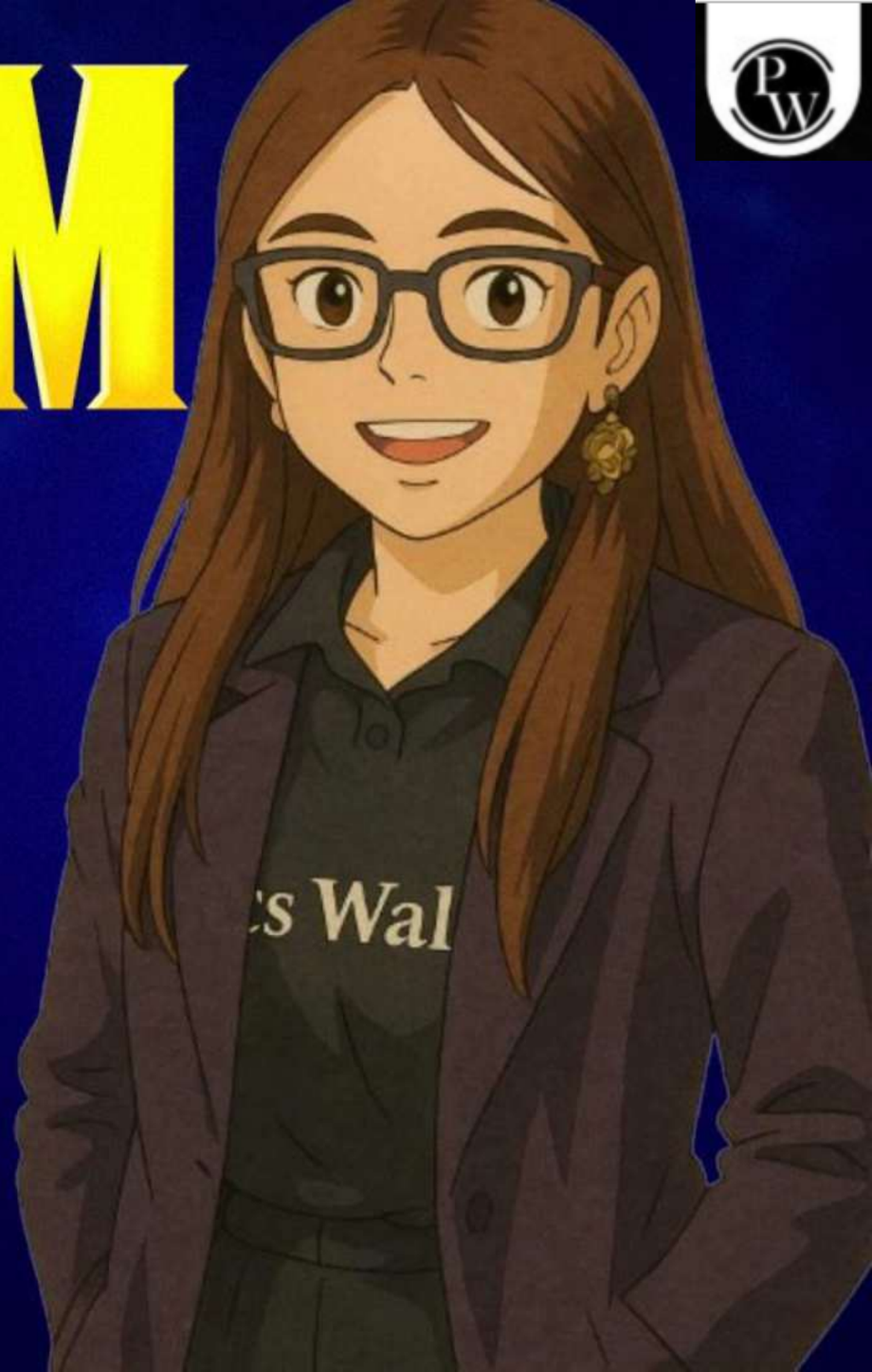
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-6

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. CHEMICAL PROPERTIES PART 3
   Chemical Properties of Aldehydes and Ketones - III
2. FLOWCHART
3. NCERT READING
4. QUESTIONS (PYQ)

MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

CHEMICAL PROPERTIES

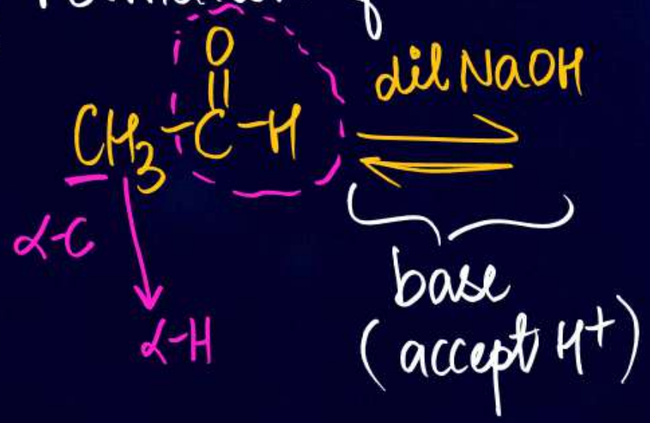
REACTION DUE TO ALPHA HYDROGEN

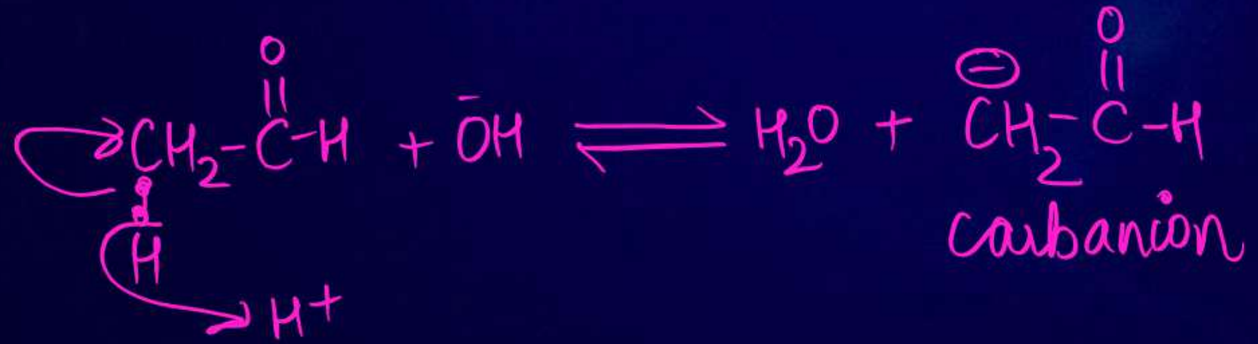
Aldol condensation

$$2\,CH_3CHO \underset{\text{dil NaOH}}{\rightleftharpoons}$$

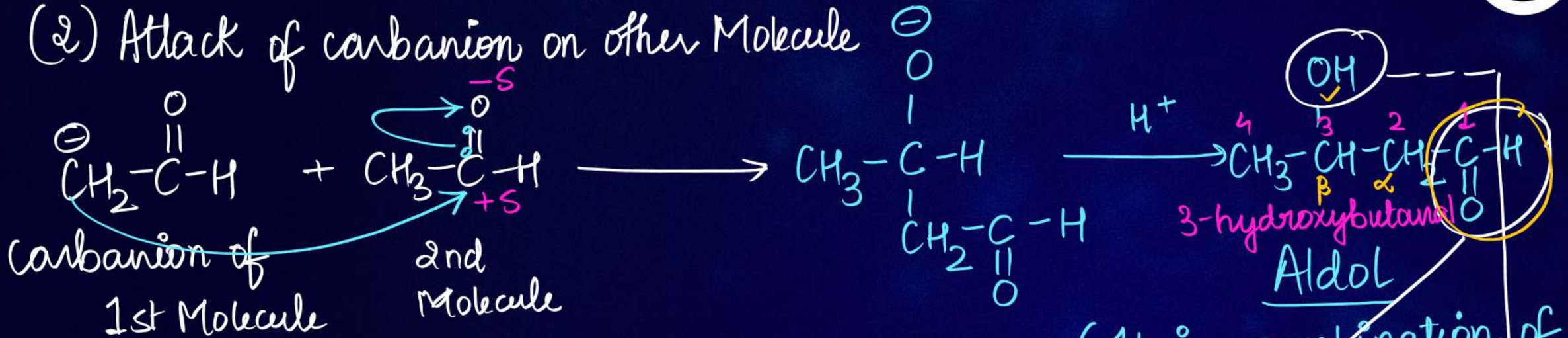
Self Aldol condensation

(1) Formation of Carbanion





(2) Attack of carbanion on other Molecule



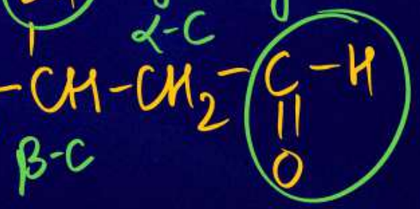
Aldol formation occurs in two steps

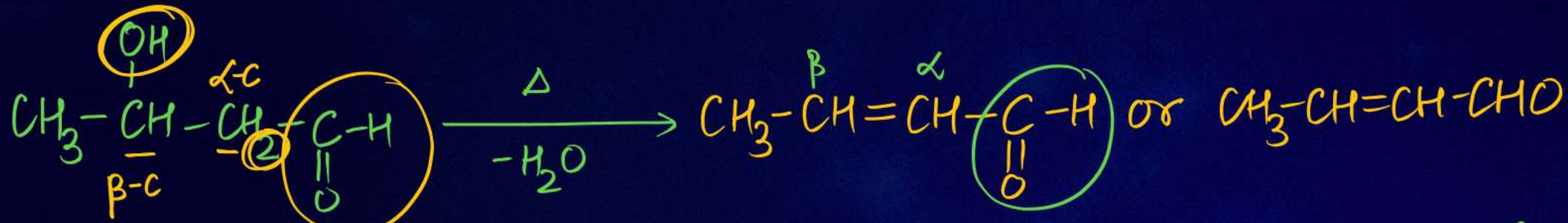
→ Formation of Carbanion

→ Attack of Carbanion on other Molecule.

In case of aldehyde aldol is β-hydroxyaldehyde

In case of Ketone Ketol is β-hydroxyketone

ex. → 



α-β unsaturated aldehyde or enal
(=)
ene + al
(double bond) (aldehyde)

β-hydroxy aldehyde/ketone (aldol/ketol) looses H_2O to form α-β unsaturated aldehyde/ketone (enal) is called Aldol Condensation.

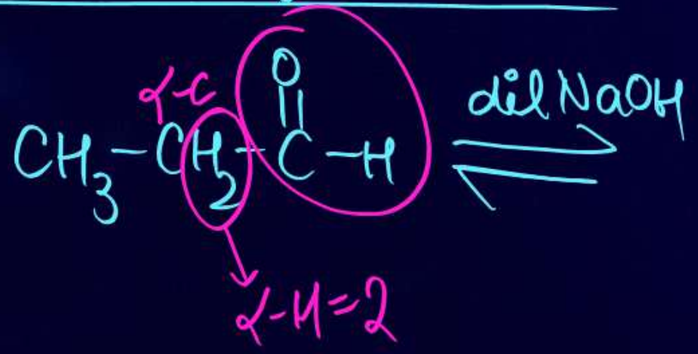
REACTION DUE TO ALPHA HYDROGEN

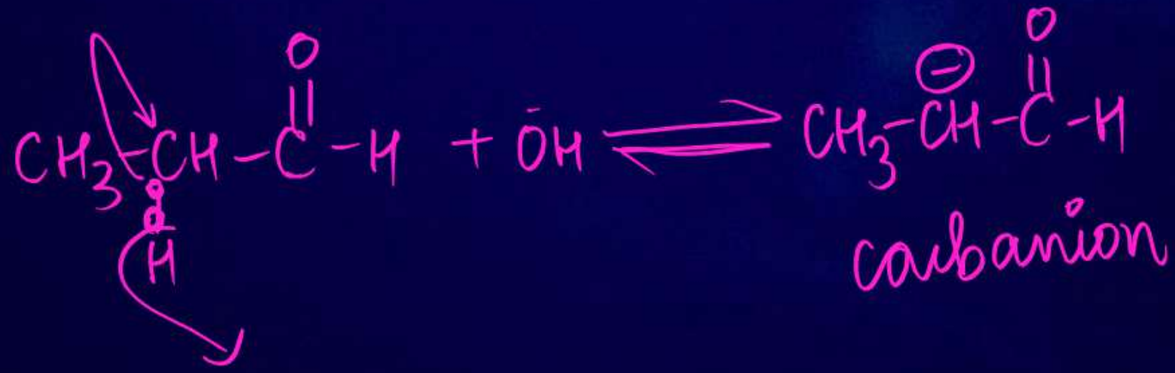
Aldol condensation

$\Rightarrow 2\,CH_3-CH_2-CHO \xrightleftharpoons{dil\ NaOH}$

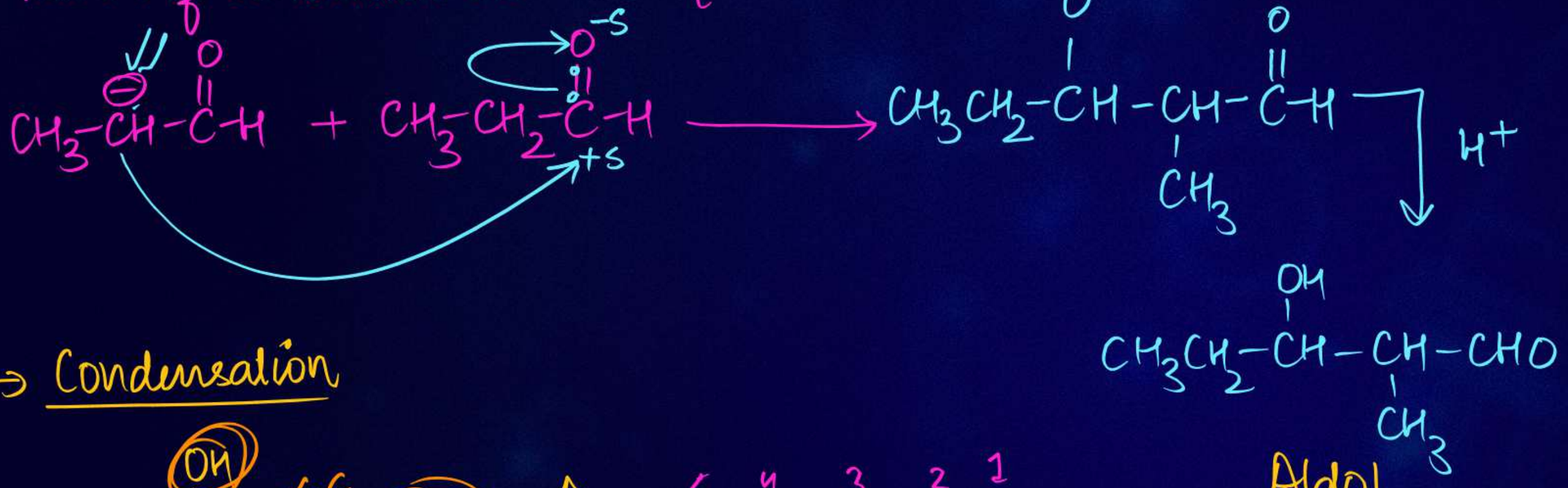
Aldol

→ Formation of carbanion

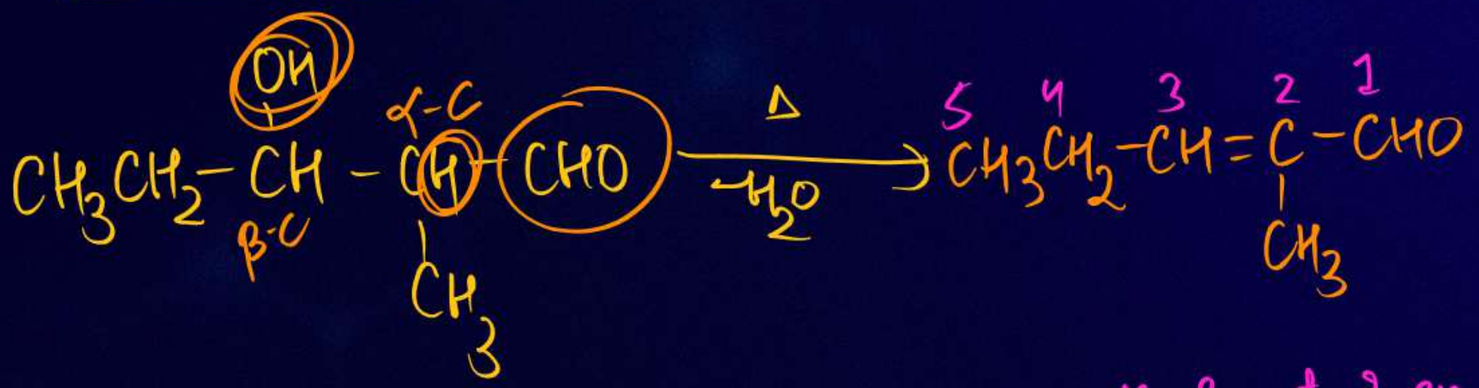




→ Attack of Carbanion on other Molecule



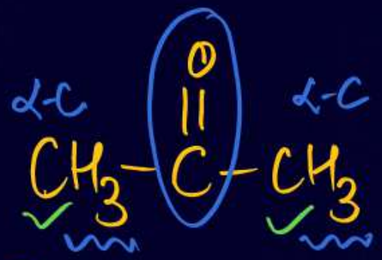
→ Condensation



Aldol

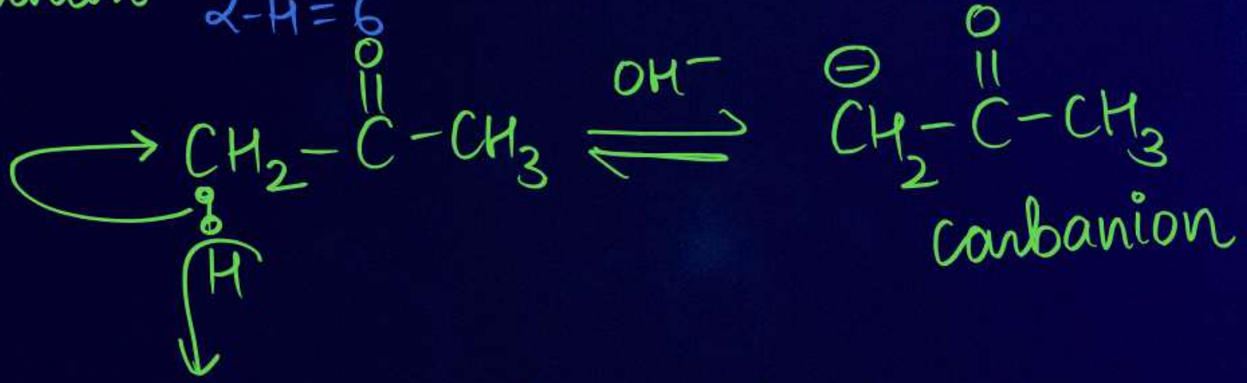
2-methylpent-2-en-1-al

Q. $CH_3COCH_3 \xrightleftharpoons{Ba(OH)_2}$



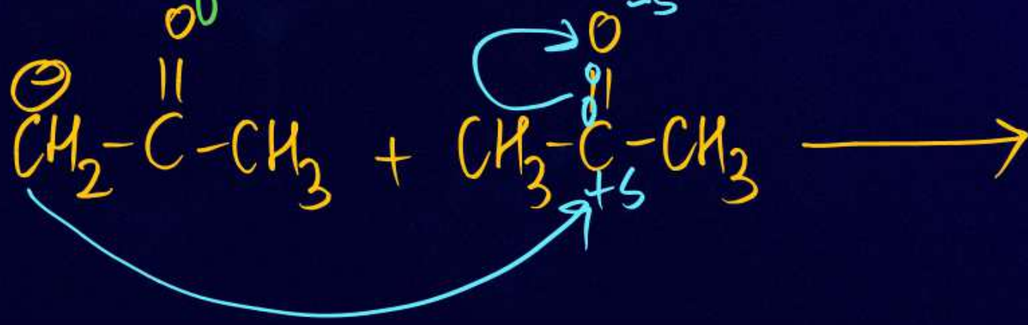
$\xrightleftharpoons{Ba(OH)_2}$

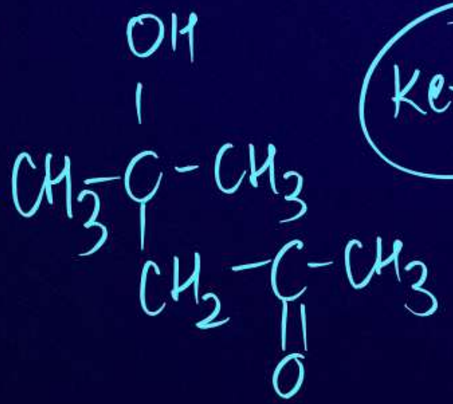
Carbanion



carbanion

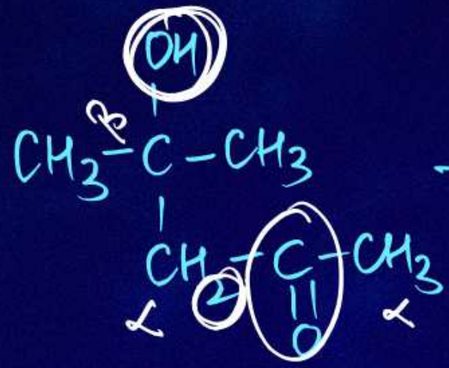
→ Attack of carbanion on other Molecule



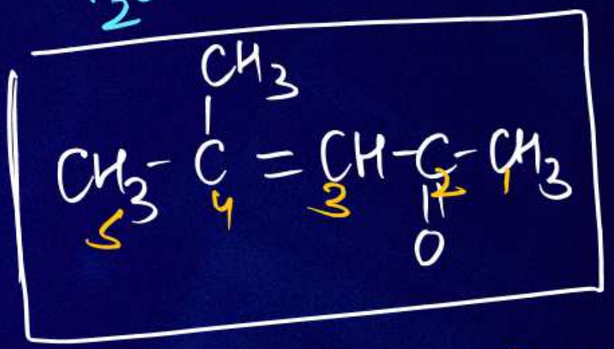


Ketol

→ Condensation



$\xrightarrow{\Delta}$ $-H_2O$



4-methylpent-3-en-2-one

Q. $2HCHO \xrightleftharpoons{dil\ NaOH}$ It wont undergo aldol condensation

No α-H.

REACTION DUE TO ALPHA HYDROGEN

Cross Aldol condensation

$CH_3CHO + CH_3CH_2CHO \xrightleftharpoons{\text{dil NaOH}}$ $CH_3-CH=CH-CHO$ + $CH_3-CH_2-\underset{H}{\overset{|}{C}}=\underset{CH_3}{\overset{|}{C}}-CHO$

(Self aldol of CH_3CHO)

(Self aldol of CH_3CH_2CHO)

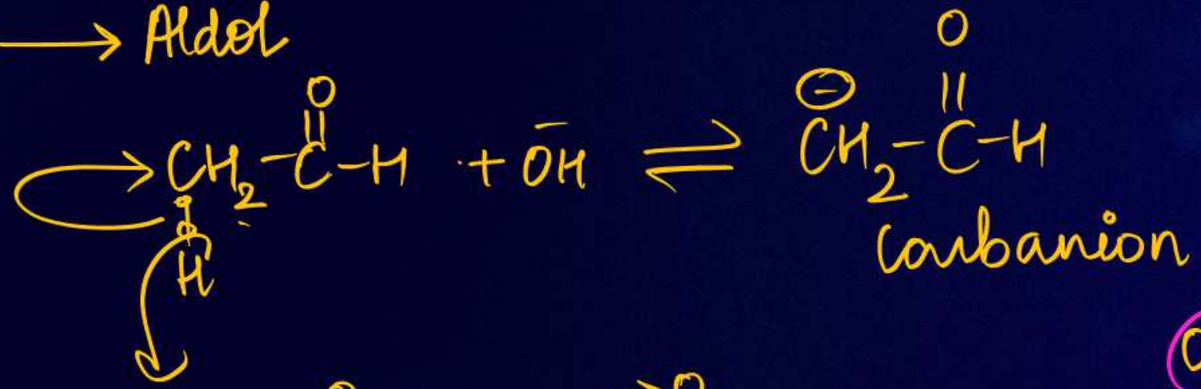
+ $CH_3-CH_2-CH=CH-CHO$

+ $CH_3-CH=\underset{CH_3}{\overset{|}{C}}-CHO$

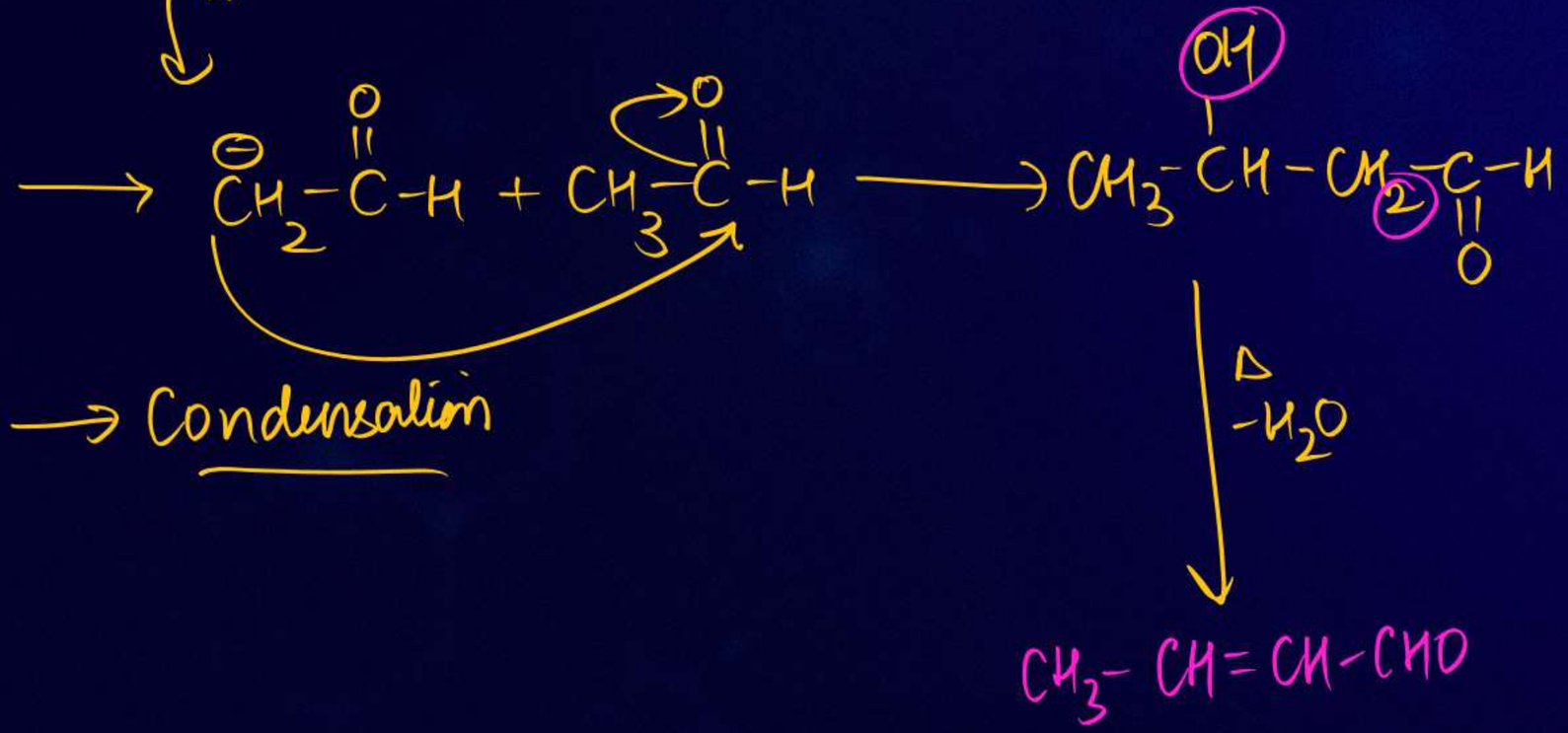
1st product formation

CH_3CHO

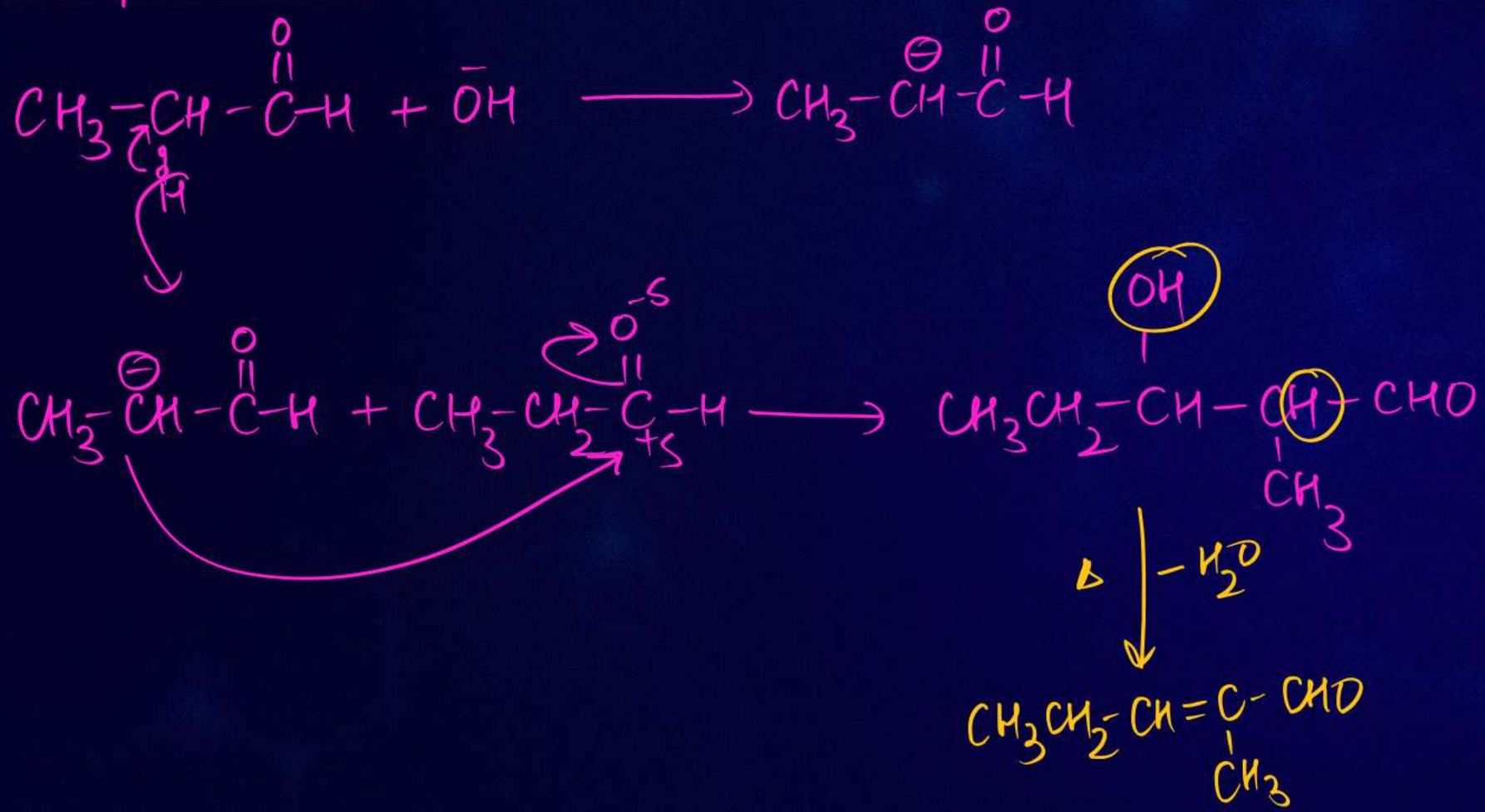
→ Aldol



→ Condensation

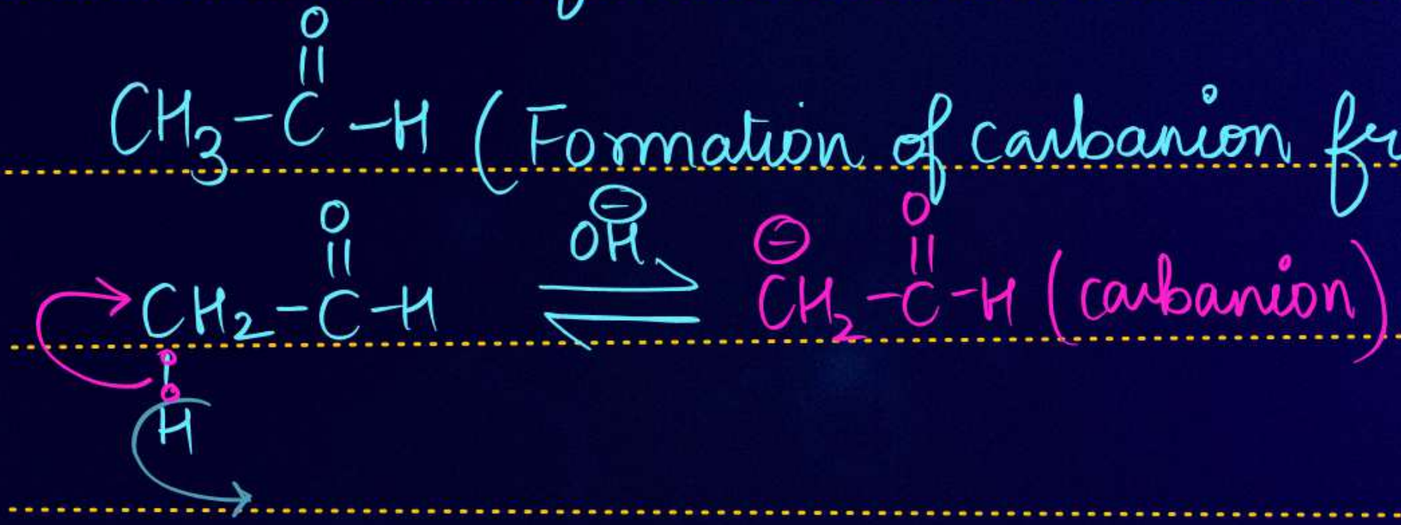


2nd product Formation

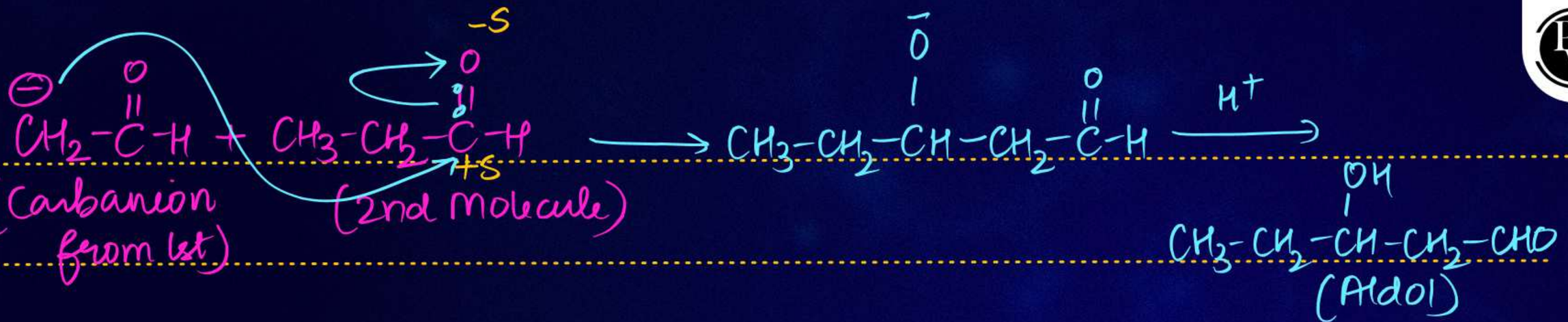


3rd product formation

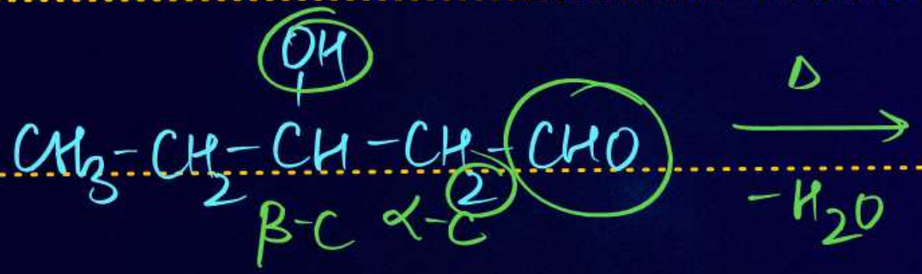
→ Formation of Aldol



→ Attack of Carbanion on other (2nd) Molecule



Condensation



4th product formation

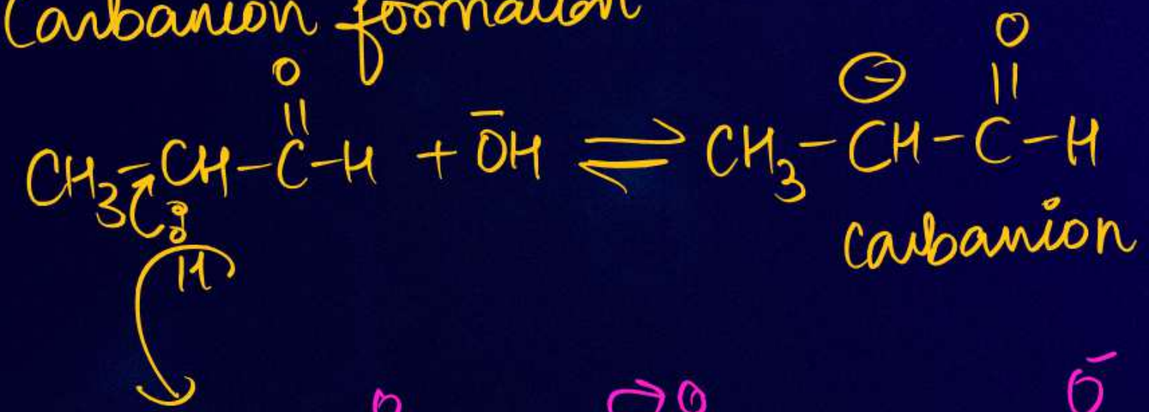
↓

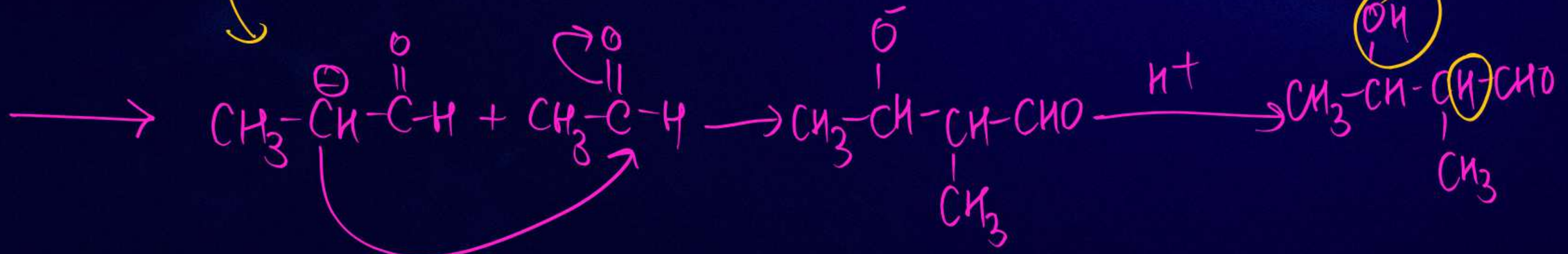
Carbanion from 2nd Molecule

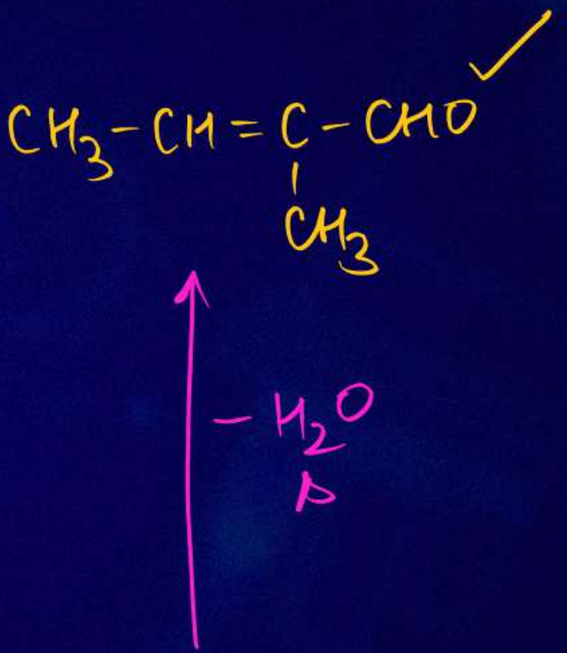
&

attack on 1st Molecule.

→ Carbanion formation







CHEMICAL PROPERTIES

OXIDATION

Aldehydes differ from ketones in their oxidation reactions.
Aldehydes are easily oxidised to carboxylic acids on treatment with common oxidising agents like nitric acid, potassium permanganate, potassium dichromate, etc.
Even mild oxidising agents, mainly Tollens' reagent and Fehlings' reagent also oxidise aldehydes.

Kal Milte hai 3 pm

extra class.

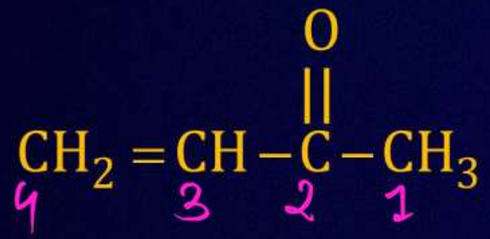
QUESTIONS

CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. Why?

Steric hinderance
bulky gp
Nu⁻ attack is tough

CN^-

Write the IUPAC name of the following compound:



but-3-en-2-one

Write structures of main compounds A and B in each of the following reaction:

(i) $CH_3CH_2CN \xrightarrow{CH_3MgBr/H_3O^+} A \xrightarrow{LiAlH_4} B$

(ii)

$$\xrightarrow[(ii)\ H_3O^+/\Delta]{(i)\ CrO_3/(CH_3CO)_2O} A \xrightarrow{H_2N-NH_2} B$$

(i) $CH_3CH_2-C\equiv N + CH_3MgBr$

$CH_3CH_2-C(=N-H)(CH_3)-MgBr(OH)$

$CH_3-CH_2-CO-CH_3$ (A)

$\xrightarrow{LiAlH_4}$

$CH_3-CH_2-CH(OH)-CH_3$ (B)

HOMEWORK

1. COMPLETE NOTES

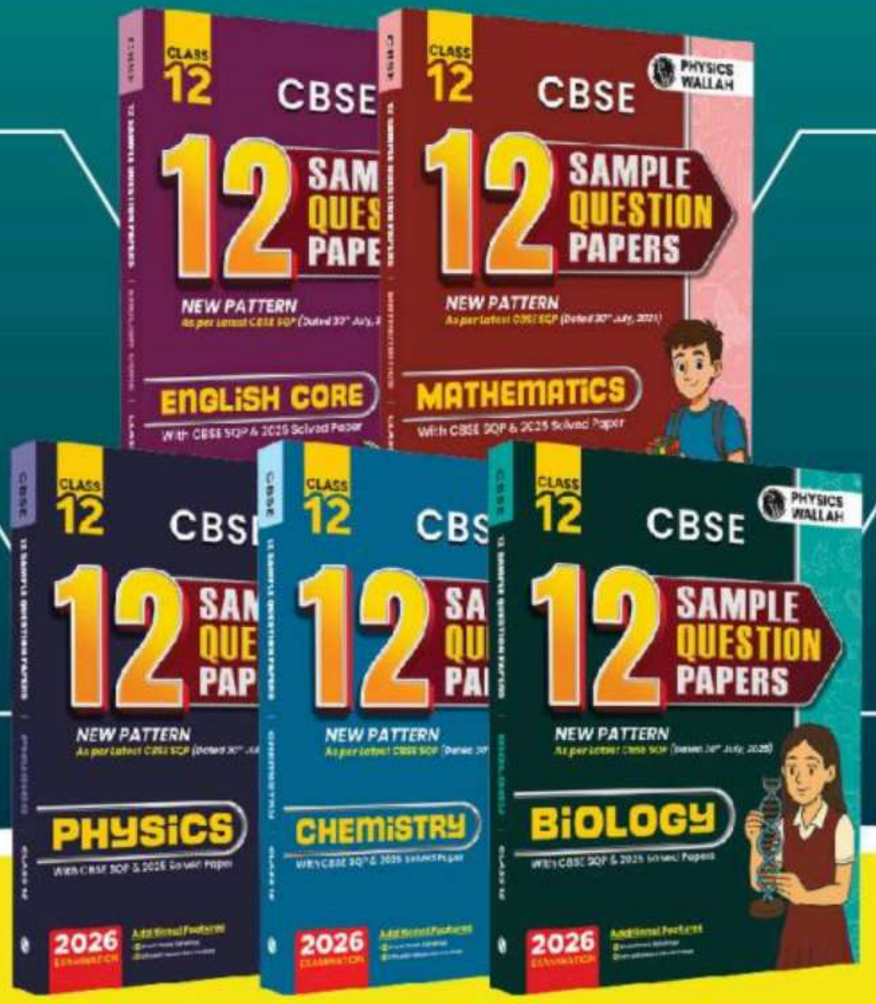
2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 4

Boards ke Tricky Sawaal,
Ab Simple with Sample Papers!

- Cheat Sheets & One-Shot Revision Videos
- 28 Sample Papers with Explanations
- Step-wise Marking Scheme
- CBSE PYQs 2025 & SQP 2025-26 with Marking Scheme
- 12 Handwritten Papers via QR Code
- Level-wise Difficulty (Easy, Medium, Hard)




SHOURYA MAM
JOIN MY OFFICIAL TELEGRAM CHANNEL
@CHEMISTRYBY
SHOURYAMAM
Physics Wallah

Thank You

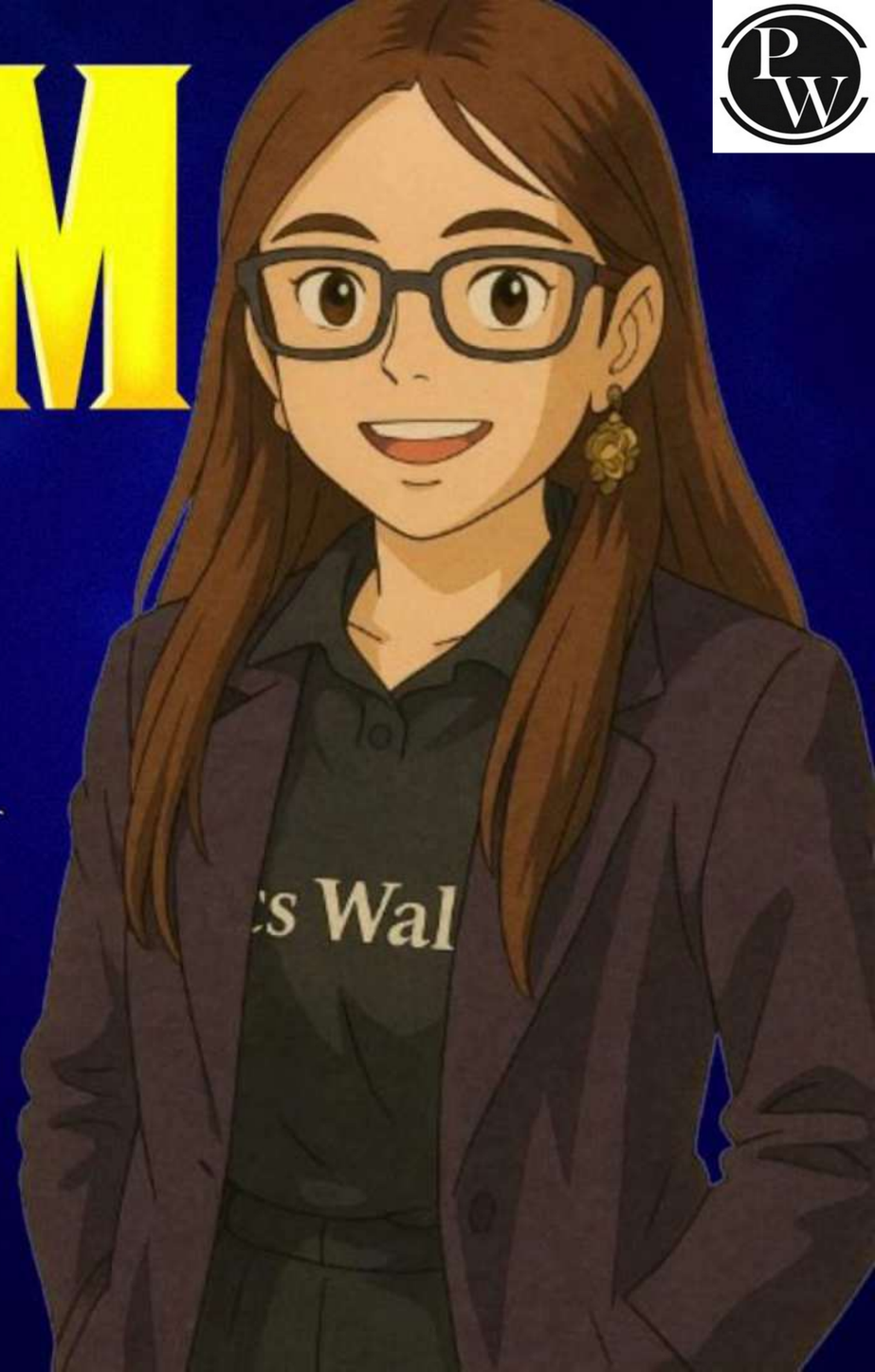
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-7

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. **Chemical Properties - IV**
2. FLOWCHART
3. NCERT READING
4. QUESTIONS




SHOURYA MAM
JOIN MY OFFICIAL TELEGRAM CHANNEL
@CHEMISTRYBY
SHOURYAMAM
Physics Wallah

MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

CHEMICAL PROPERTIES

CHEMICAL PROPERTIES

REACTION DUE TO ALPHA HYDROGEN

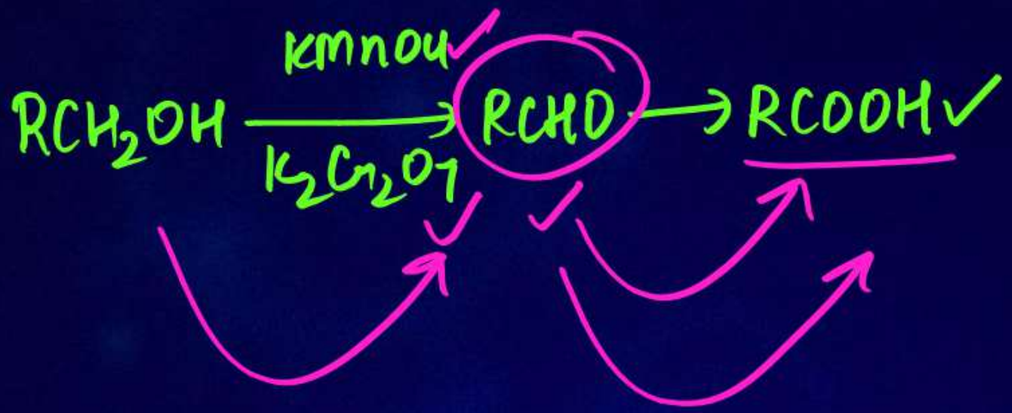
Aldol condensation

CHEMICAL PROPERTIES

REACTION DUE TO ALPHA HYDROGEN

Cross Aldol condensation

CHEMICAL PROPERTIES



OXIDATION

Aldehydes differ from ketones in their oxidation reactions.
Aldehydes are easily oxidised to carboxylic acids on treatment with common oxidising agents like nitric acid, potassium permanganate, potassium dichromate, etc.
Even mild oxidising agents, mainly Tollens' reagent and Fehlings' reagent also oxidise aldehydes.

CHEMICAL PROPERTIES

OXIDATION

Ketones are generally oxidised under vigorous conditions, i.e., strong oxidising agents and at elevated temperatures.
Their oxidation involves carbon-carbon bond cleavage to afford a mixture of carboxylic acids having lesser number of carbon atoms than the parent ketone.

CHEMICAL PROPERTIES

OXIDATION

Tollen's Reagent

Aldehydes on reaction with ammonical silver nitrate solution in presence of alkaline Medium yields carboxylate ion and bright Silver Mirror.

$$RCHO + \underset{\text{Silver ammonical nitrate solution/ ammonical silver nitrate}}{[Ag(NH_3)_2]^+} + \underset{\text{alkaline Medium}}{\bar{O}H} \longrightarrow \underset{\text{(Silver Mirror) Bright}}{Ag} + \underset{\text{carboxylate ion}}{RCOO^-} + NH_3 + H_2O$$

NCERT HIGHLIGHT

The mild oxidising agents given below are used to distinguish aldehydes from ketones:

(i) Tollens' test: On warming an aldehyde with freshly prepared ammoniacal silver nitrate solution (Tollens' reagent), a bright silver mirror is produced due to the formation of silver metal. The aldehydes are oxidised to corresponding carboxylate anion. The reaction occurs in alkaline medium.

$$RCHO + 2[Ag(NH_3)_2]^+ + 3\,\bar{O}H \longrightarrow RCO\bar{O} + 2Ag + 2H_2O + 4NH_3$$

CHEMICAL PROPERTIES

OXIDATION

fehling test

* used for aliphatic aldehydes distinction.
* Aromatic aldehyde do not show this Test

Fehling solution

↳ Mixture of Fehling solution A + Fehling solution B

(aq. Copper Sulphate)

(alKaline solution of potassium tartarate

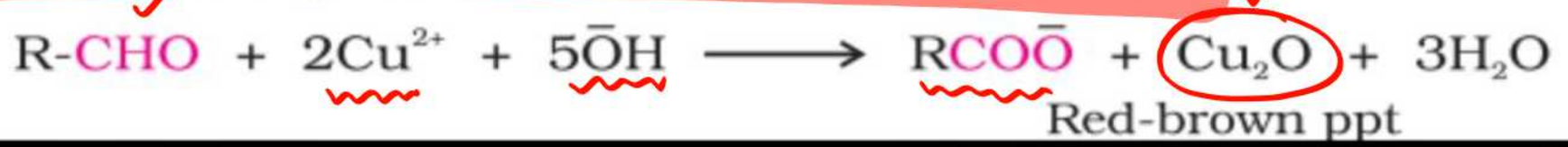
⇓

Rochelle salt

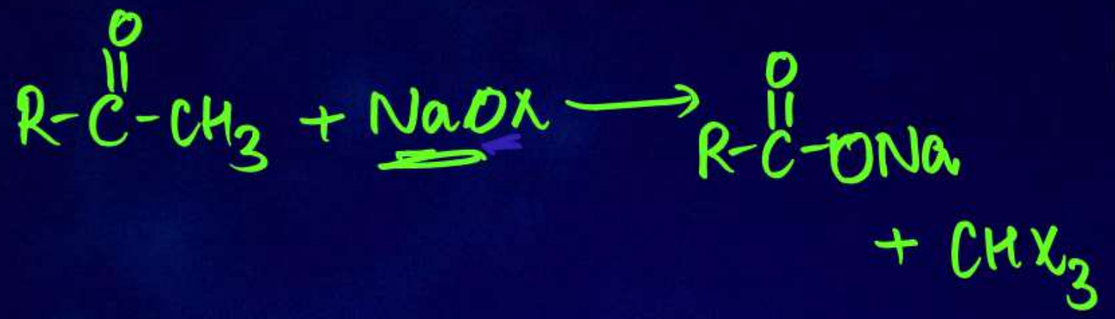
They are equally Mixed before reacting

NCERT HIGHLIGHT

(ii) *Fehling's test:* Fehling reagent comprises of two solutions, Fehling solution A and Fehling solution B. Fehling solution A is aqueous copper sulphate and Fehling solution B is alkaline sodium potassium tartarate (Rochelle salt). These two solutions are mixed in equal amounts before test. On heating an aldehyde with Fehling's reagent, a reddish brown precipitate is obtained. Aldehydes are oxidised to corresponding carboxylate anion. Aromatic aldehydes do not respond to this test.



CHEMICAL PROPERTIES



OXIDATION

Haloform test / Iodoform Test

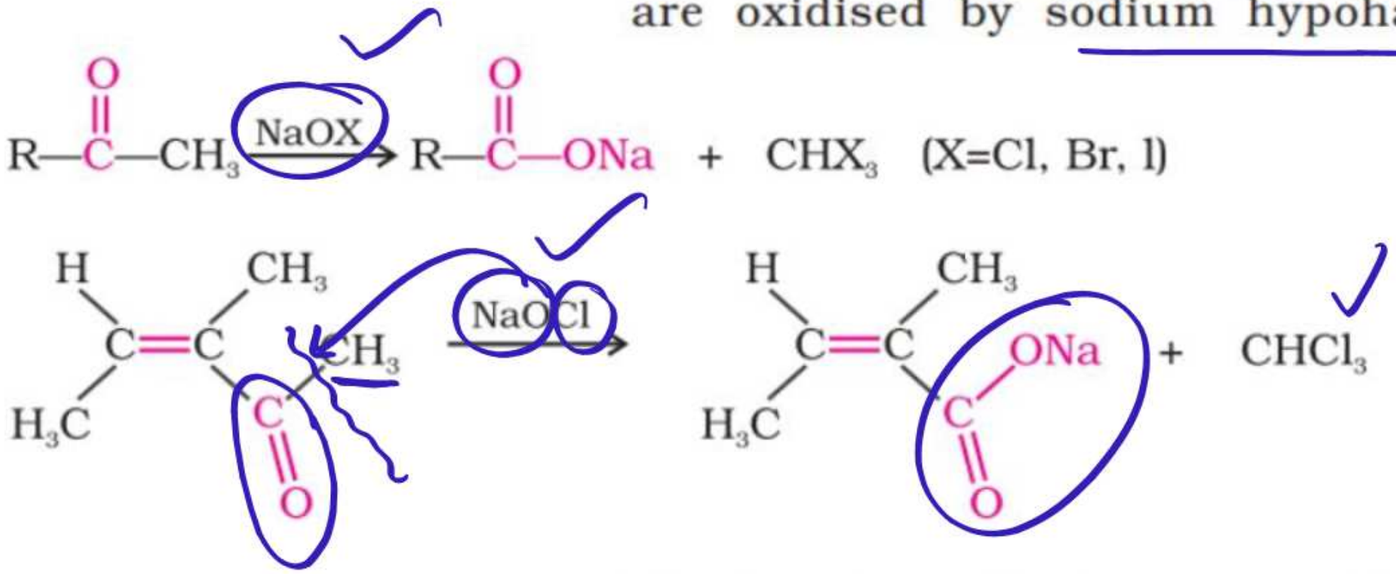
Oxidation of Methyl ketone

→ CH_3 group should be attached to carbonyl gp.

→ CH_3 group attached to $-\overset{O}{\overset{\|}{C}}-$ (Carbonyl group) leads to formation of salt of Carboxylic acid by reacting it with sodium hypohalite (NaOX)
Haloform is obtained as a byproduct.

NCERT HIGHLIGHT

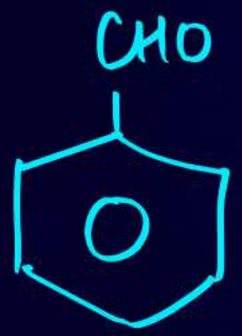
(iii) Oxidation of methyl ketones by haloform reaction: Aldehydes and ketones having at least one methyl group linked to the carbonyl carbon atom (methyl ketones) are oxidised by sodium hypohalite to sodium salts of corresponding carboxylic acids having one carbon atom less than that of carbonyl compound. The methyl group is converted to haloform. This oxidation does not affect a carbon-carbon double bond, if present in the molecule.



Iodoform reaction with sodium hypoiodite is also used for detection of CH_3CO group or $CH_3CH(OH)$ group which produces CH_3CO group on oxidation.

ELECTROPHILIC SUBSTITUTION REACTION

Ring deactive
&
meta-directing

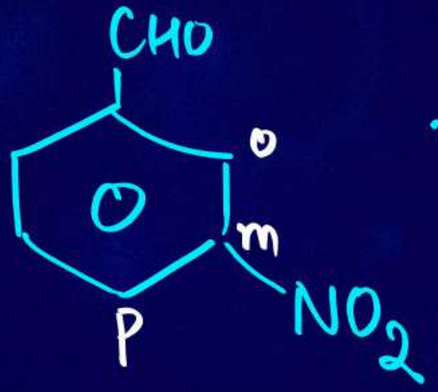


Benzaldehyde

$+HNO_3, H_2SO_4$

meta directing

meta

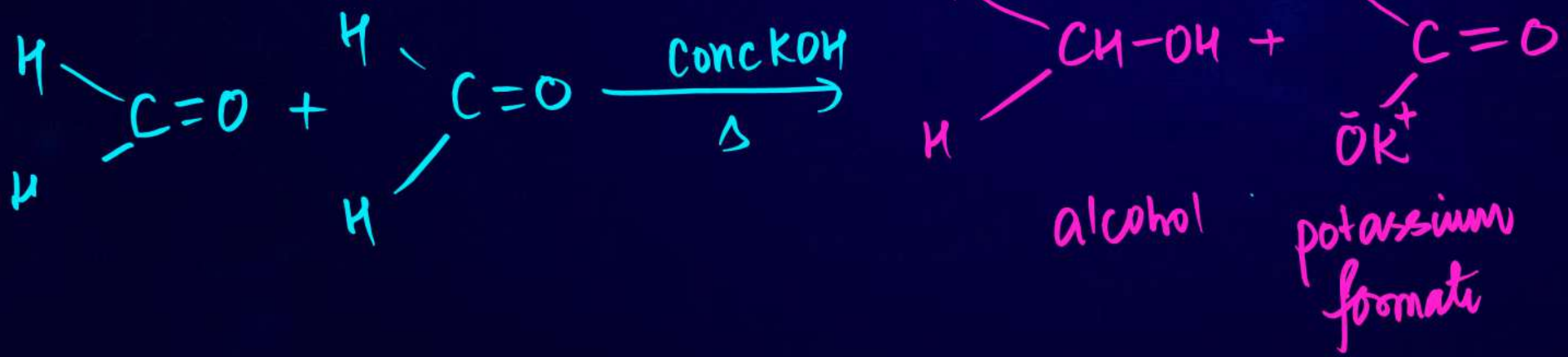


m-directing product

CANNIZARO REACTION

Condition :- α-hydrogen should be absent.

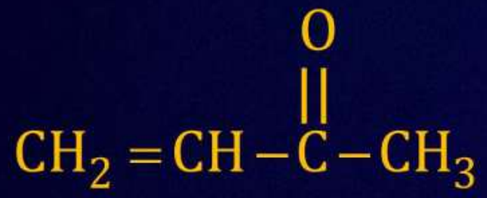
→ In this Reaction, self oxidation & self reduction occurs.
Also called as disproportionation Rx.



QUESTIONS

CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. Why?

Write the IUPAC name of the following compound:



Why is oxidation of CH_3CHO easier than CH_3COCH_3?

Write structures of main compounds A and B in each of the following reaction:

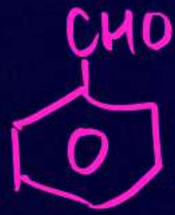
(i) $CH_3CH_2CN \xrightarrow{CH_3MgBr/H_3O^+} A \xrightarrow{LiAlH_4} B$

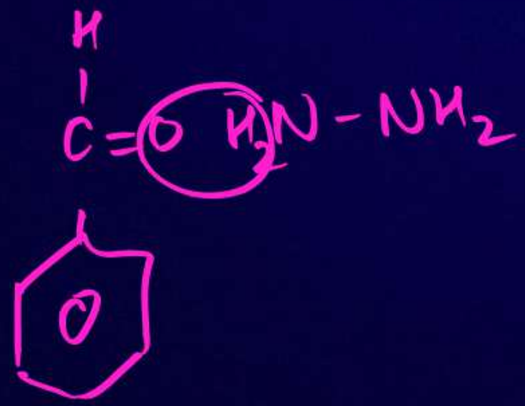
(ii)

$\xrightarrow[(ii)\ H_3O^+/\Delta]{(i)\ CrO_3/(CH_3CO)_2O} A \xrightarrow{H_2N-NH_2} B$

$CH=N-NH_2$

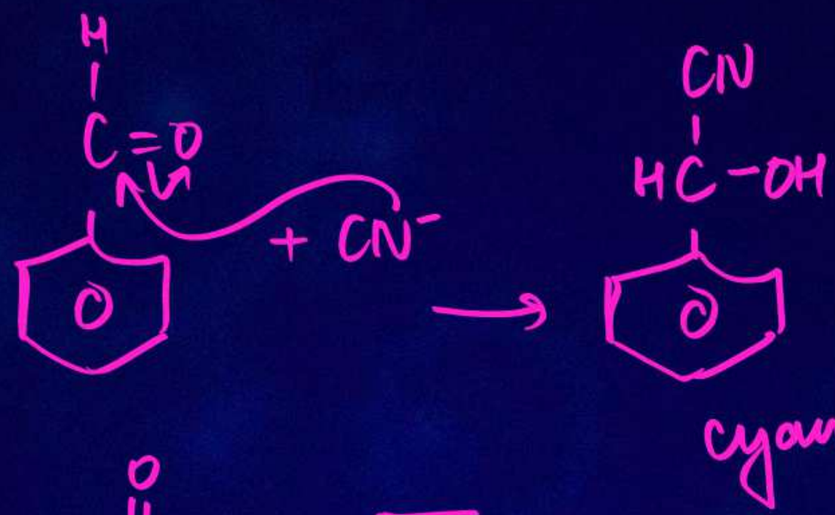
hydrazone





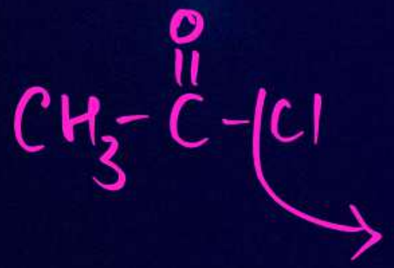
Complete the following reactions:

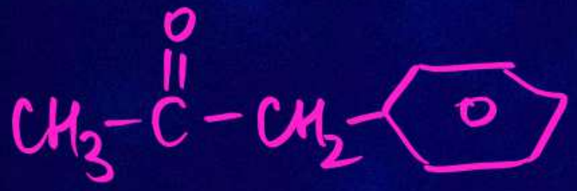
(i) 



(ii) $(C_6H_5CH_2)_2Cd + 2CH_3COCl \rightarrow$

$R_2Cd + CH_3COCl \longrightarrow$





(a) How will you carry out following conversions:

(i) Acetone to Propane

(ii) Toluene to Benzoic acid ✗ (Carboxylic Acid)

(iii) Acetone to tert. Butyl alcohol

(b) Give chemical test to distinguish between following compounds:

Ethanoic acid and Methanoic acid ✗ (Carboxylic Acid)

(i) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \longrightarrow CH_3CH_2CH_3$

Clemmenson / Wolff Kishner

(iii) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[H_3O^+]{CH_3MgBr} H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$ ✓

Write the equation involved in the following reactions:

(i) Wolff-Kishner reduction

(ii) Etard reaction

Write the reaction involved in the following reactions:

(i) Clemmensen reduction

(ii) Cannizzaro reaction

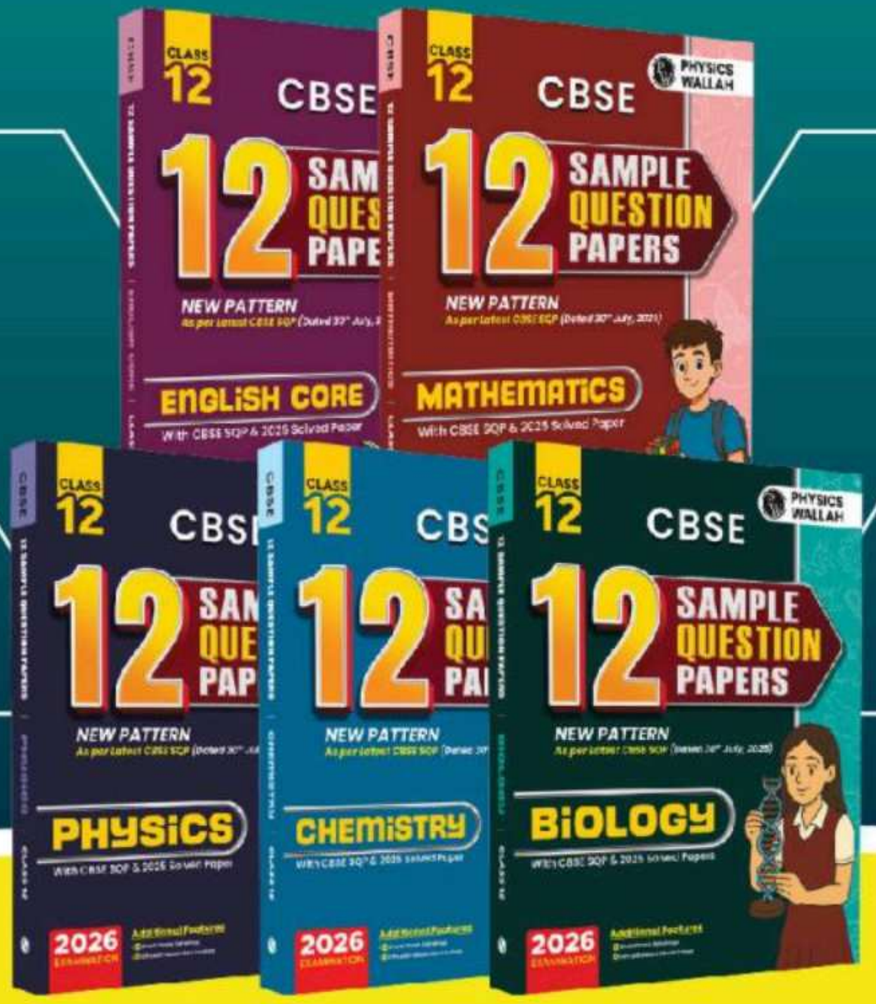
Write the reactions involved in the following:

(i) Etard reaction

(ii) Stephan's reduction

Boards ke Tricky Sawaal,
Ab Simple with Sample Papers!

- Cheat Sheets & One-Shot Revision Videos
- 28 Sample Papers with Explanations
- Step-wise Marking Scheme
- CBSE PYQs 2025 & SQP 2025-26 with Marking Scheme
- 12 Handwritten Papers via QR Code
- Level-wise Difficulty (Easy, Medium, Hard)



HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 4

Thank You

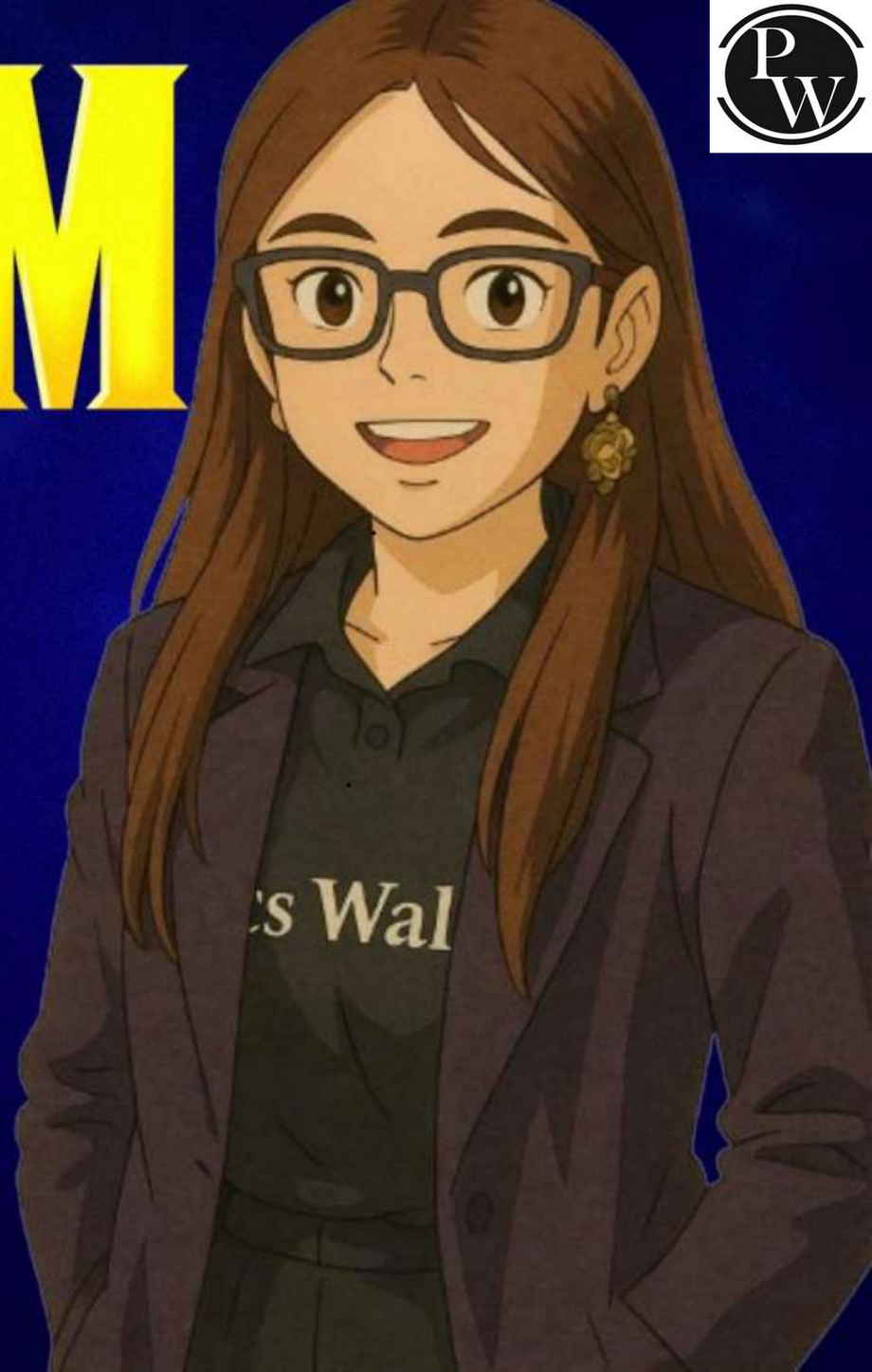
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE-8

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. CARBOXYLIC ACID
2. FLOWCHART
3. NCERT READING
4. QUESTIONS

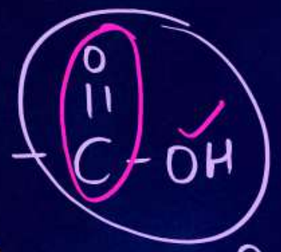
MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

CARBOXYLIC ACID

INTRODUCTION



Carboxyl gp

CARBOXYLIC ACID

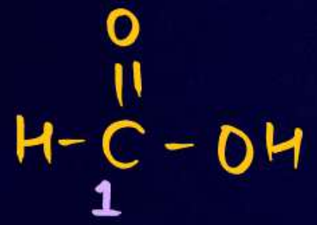
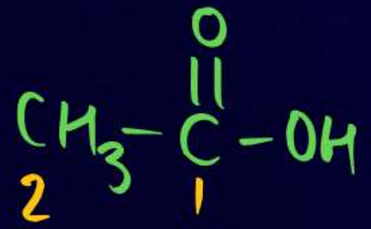
Carbon compounds containing a carboxyl functional group, –COOH are called carboxylic acids.

The carboxyl group, consists of a carbonyl group attached to a hydroxyl group, hence its name carboxyl

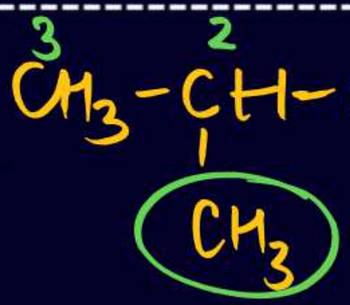
OH

NOMENCLATURE

oic acid → 2° suffix

Structure/compound	Common Name	IUPAC
$HCOOH$ or 	formic acid	methane + oic acid methanoic acid
CH_3COOH or 	acetic acid	ethanoic acid
CH_3CH_2COOH	propionic acid	propanoic acid

NOMENCLATURE

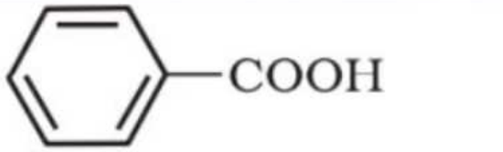
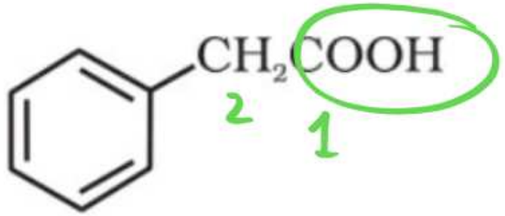
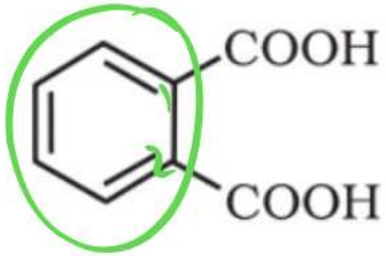
$CH_3CH_2CH_2COOH$	butyric acid	butan-1-oic acid
	iso-butyric acid	2-methylpropan-1-oic acid
$HOOC-COOH$ or 	Oxalic acid	ethane-1,2-dioic acid
$HOOC-CH_2-COOH$	Malonic acid	propane-1,3-dioic acid

NOMENCLATURE

$HOOC-(CH_2)_2-COOH$	Succinic acid	butane-1,4-dioic acid
$HOOC-(CH_2)_3-COOH$	glutaric acid	pentane-1,5-dioic acid
$HOOC-(CH_2)_4-COOH$	adipic acid	hexane-1,6-dioic acid

NOMENCLATURE

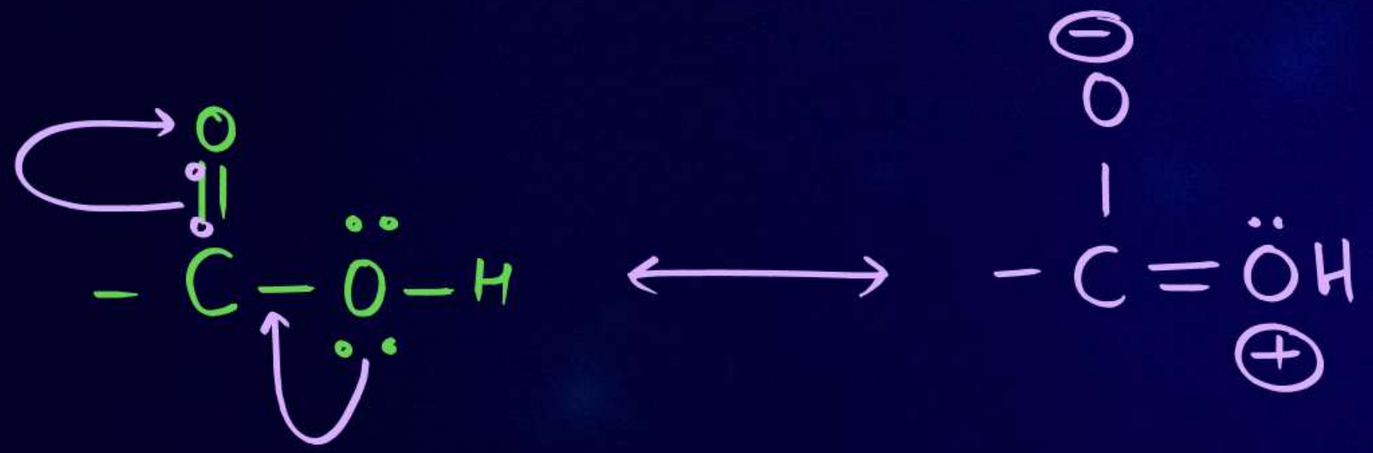
IUPAC

	Benzoic acid
	Phenylacetic acid
	Phthalic acid

2-phenylethanoicacid

Benzene-1,2-di carboxylic acid

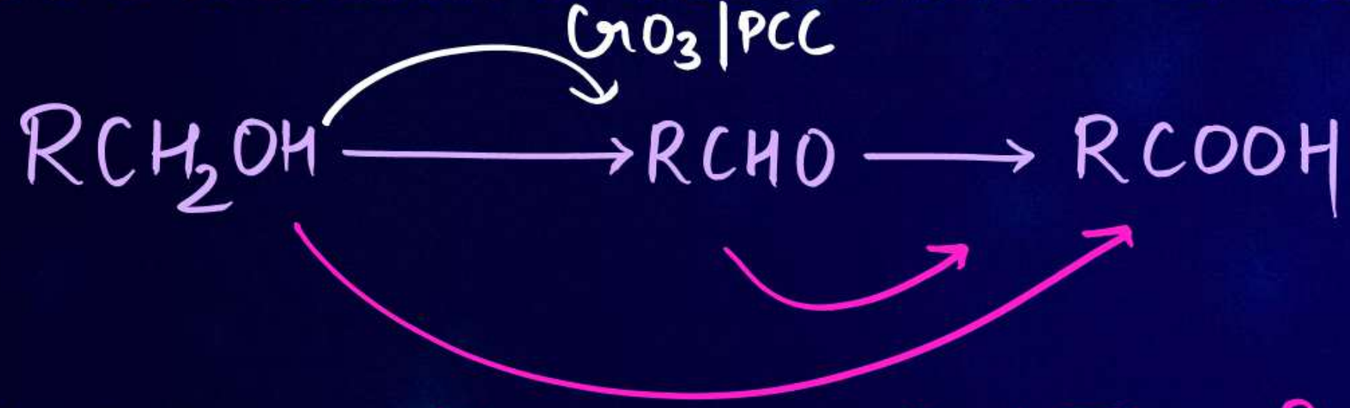
STRUCTURE OF CARBOXYL GROUP



Carboxyl group shows Resonance.

METHOD OF PREPARATION

FROM PRIMARY ALCOHOL & ALDEHYDE



$KMnO_4$ | $K_2Cr_2O_7$ | Jones Reagent

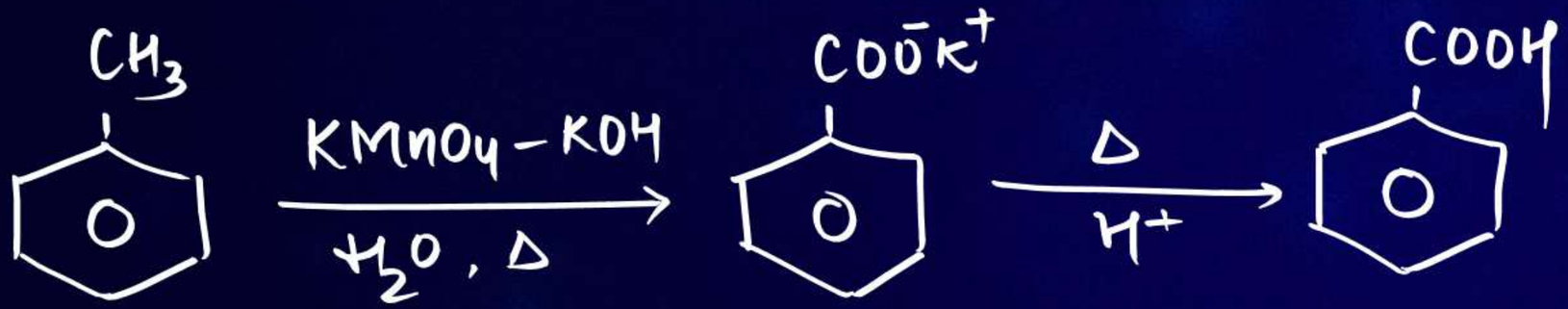
↓

($CrO_3 + H_2SO_4$)

Primary alcohol aldehydes can be converted into Carboxylic Acid by Reacting it with $KMnO_4$ | $K_2Cr_2O_7$ | Jones Reagent

METHOD OF PREPARATION

FROM ALKYL BENZENE



Irrespective of length of alkyl gp attached to Benzene ring, on Rx with KMnO4 & KOH, it yields Benzoic Acid

METHOD OF PREPARATION

$R\text{-}NH_2$ amine

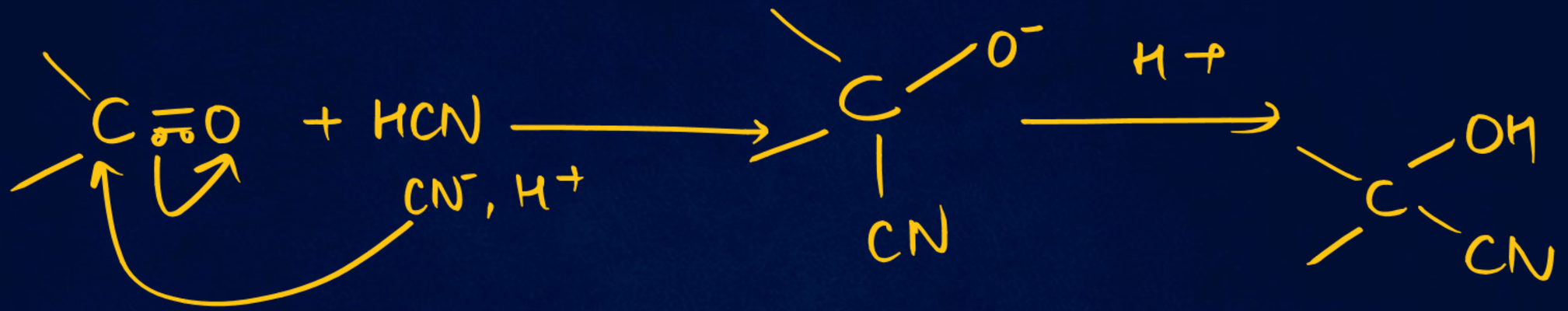
FROM NITRILES & AMIDES

RCN $\qquad$ $R\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH_2$

H^+ & OH^- is used as catalyst.

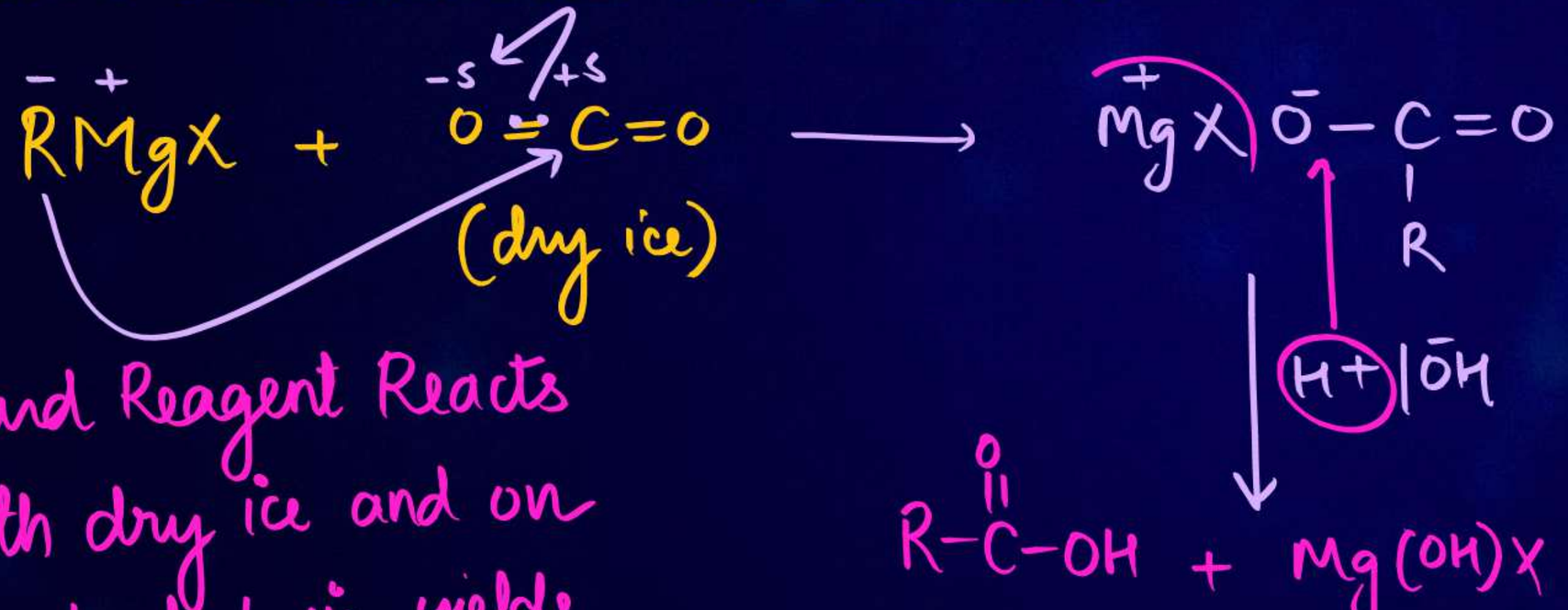
$$R\text{-}C^{\overset{O}{\cdot}}\equiv N^{\overset{H}{\cdot}\overset{H}{\cdot}} \xrightarrow[H^+ \; OH^-]{H_2O} R\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH_2 \xrightarrow[H^+ \; OH^-]{H_2O} R\text{-}\overset{\overset{O}{\|}}{C}\text{-}OH$$

Q. $CH_3CN \xrightarrow[H^+/OH^-]{H_2O} CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH_2 \longrightarrow CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}OH$ (amide)

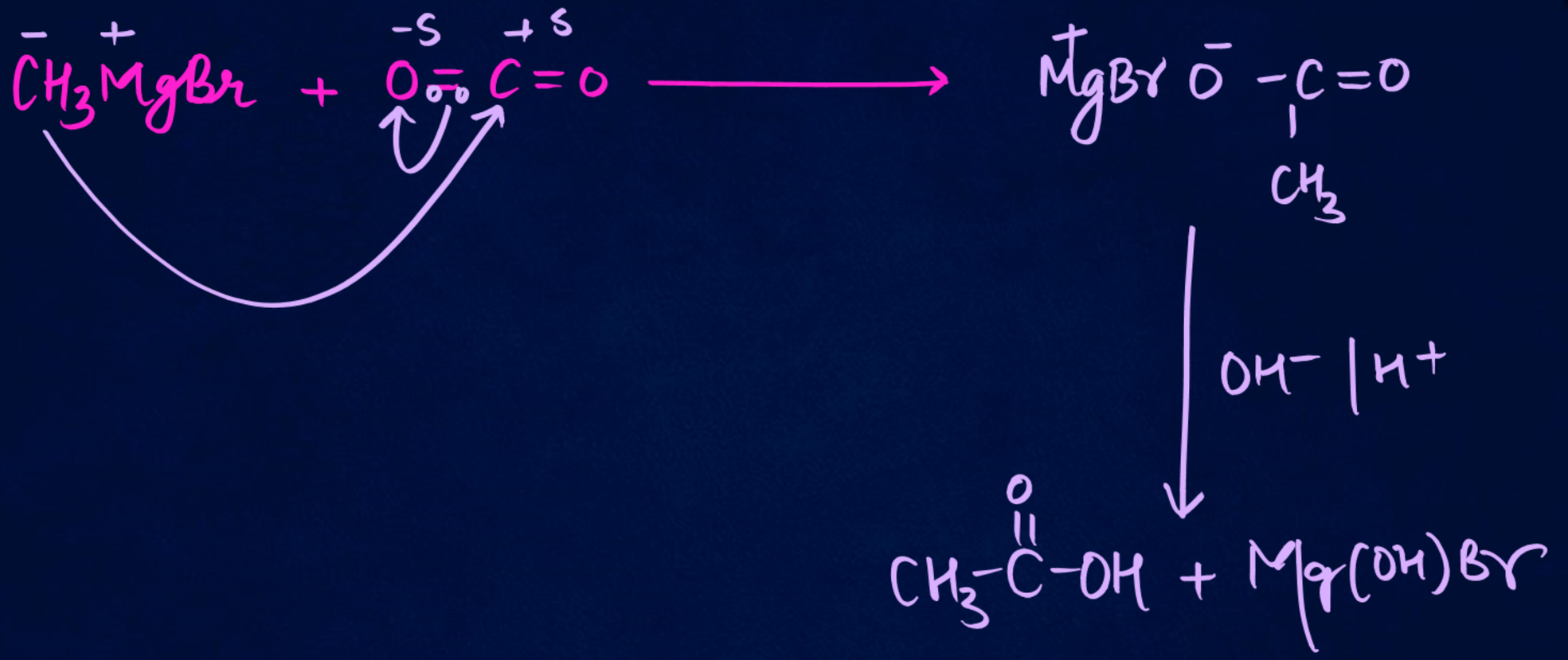

C=O
+ HCN
CN⁻, H⁺
O⁻
C
CN
H⁺
OH
C
CN

METHOD OF PREPARATION

FROM GRIGNARD REAGENT



Grignard Reagent Reacts with dry ice and on further hydrolysis yields Carboxylic Acid.

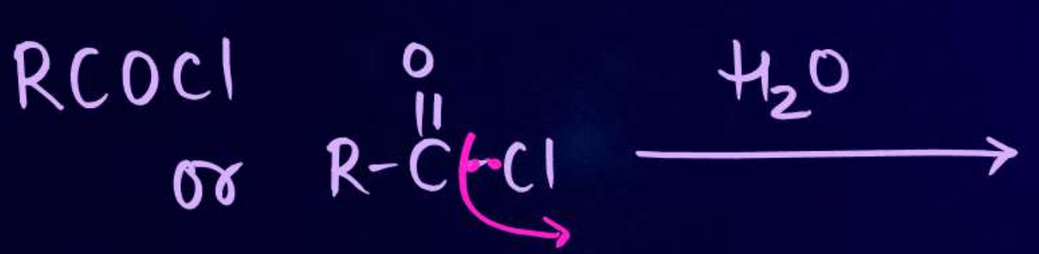

CH3MgBr + O=C=O
MgBrO-C=O
CH3
OH- | H+
CH3-C-OH + Mg(OH)Br

METHOD OF PREPARATION

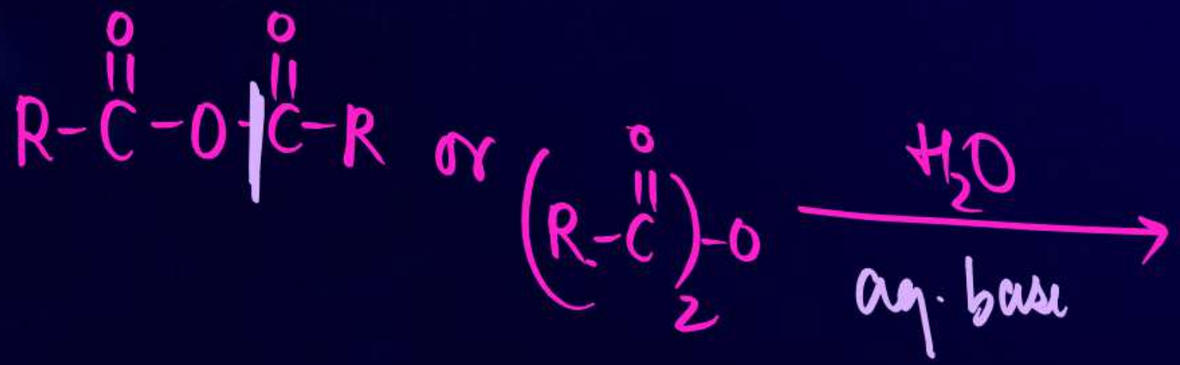
FROM ACYL CHLORIDE & ANHYDRIDE

Acid chloride

Acyl chloride & anhydride are hydrolysed or Reacted with aq. Base to form Carboxylic Acid.



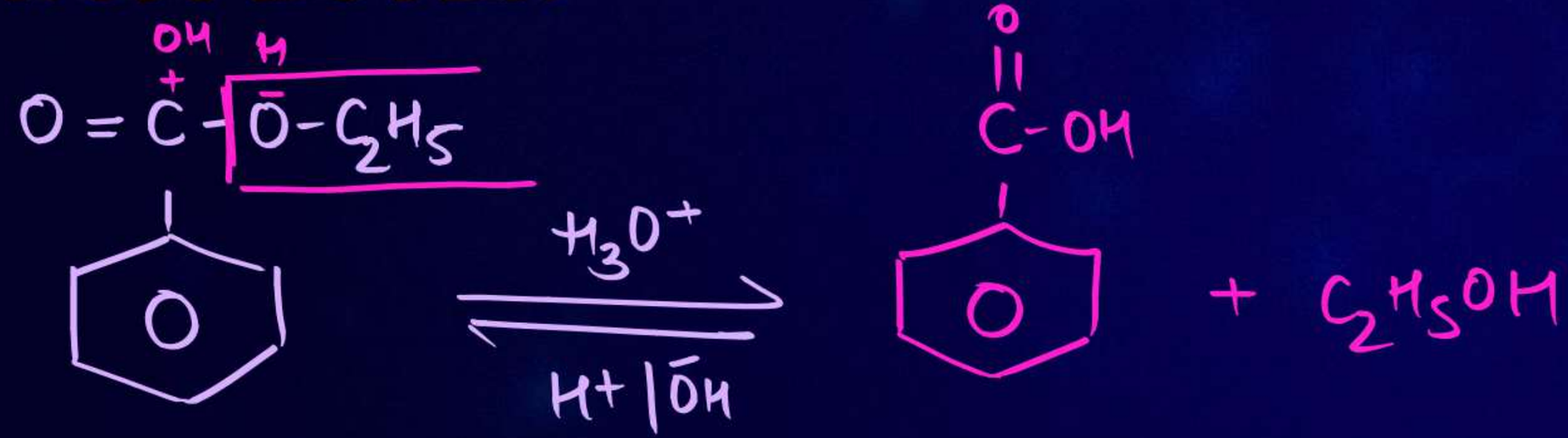
$$R-\overset{O}{\overset{\|}{C}}-OH + Cl^-$$



$$R-\overset{O}{\overset{\|}{C}}-OH$$

METHOD OF PREPARATION

FROM ESTER



PHYSICAL PROPERTIES

1. State

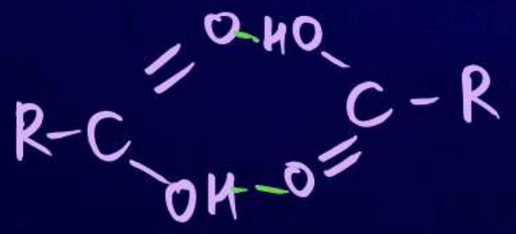
upto 9 carbon atom they are liquid, after this solid state is seen.

2. Boiling point → Carboxylic Acid > Alcohol > Aldeh/Kelone > Ether > Hydrocarb

It has highest Bpt

→ H bond

→ Dimer



3) Solubility

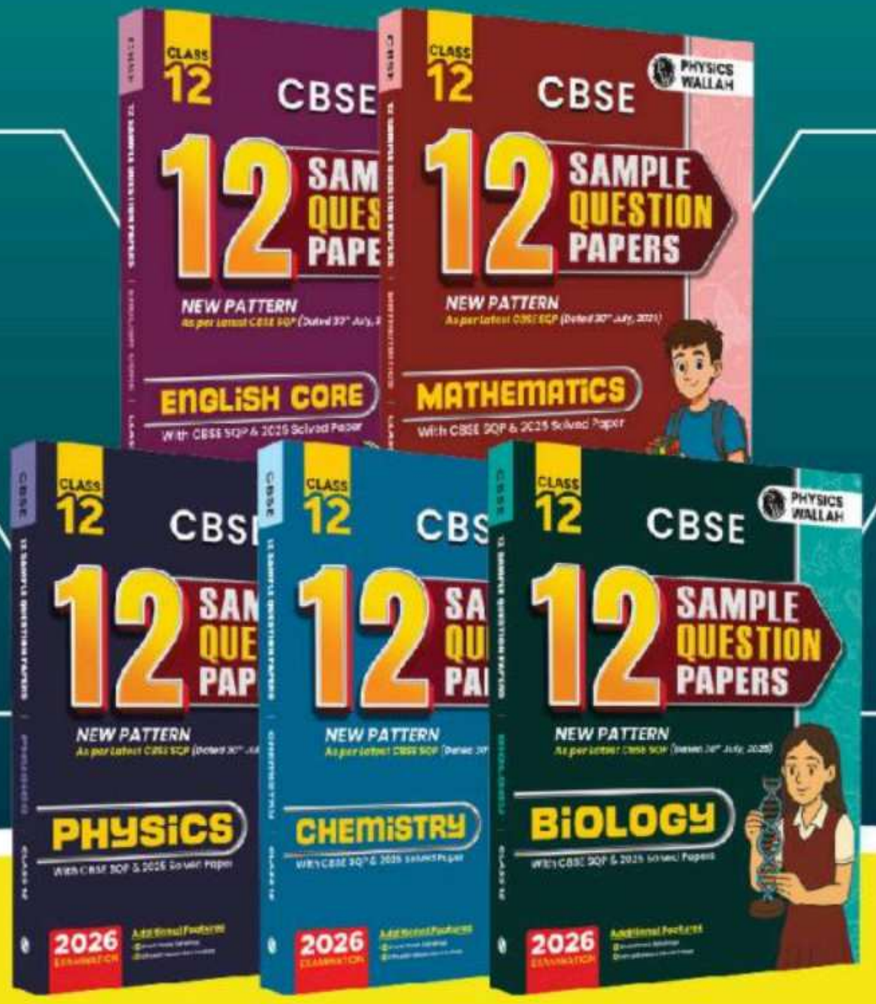
Upto 4 carbon atom they are soluble in water due to the formation of H bond.

But after this on increasing no of Carbon atoms, hydrophobic part increases, which decreases solubility.


SHOURYA MAM
JOIN MY OFFICIAL TELEGRAM CHANNEL
@CHEMISTRYBY
SHOURYAMAM
Physics Wallah

Boards ke Tricky Sawaal,
Ab Simple with Sample Papers!

- Cheat Sheets & One-Shot Revision Videos
- 28 Sample Papers with Explanations
- Step-wise Marking Scheme
- CBSE PYQs 2025 & SQP 2025-26 with Marking Scheme
- 12 Handwritten Papers via QR Code
- Level-wise Difficulty (Easy, Medium, Hard)



HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 5

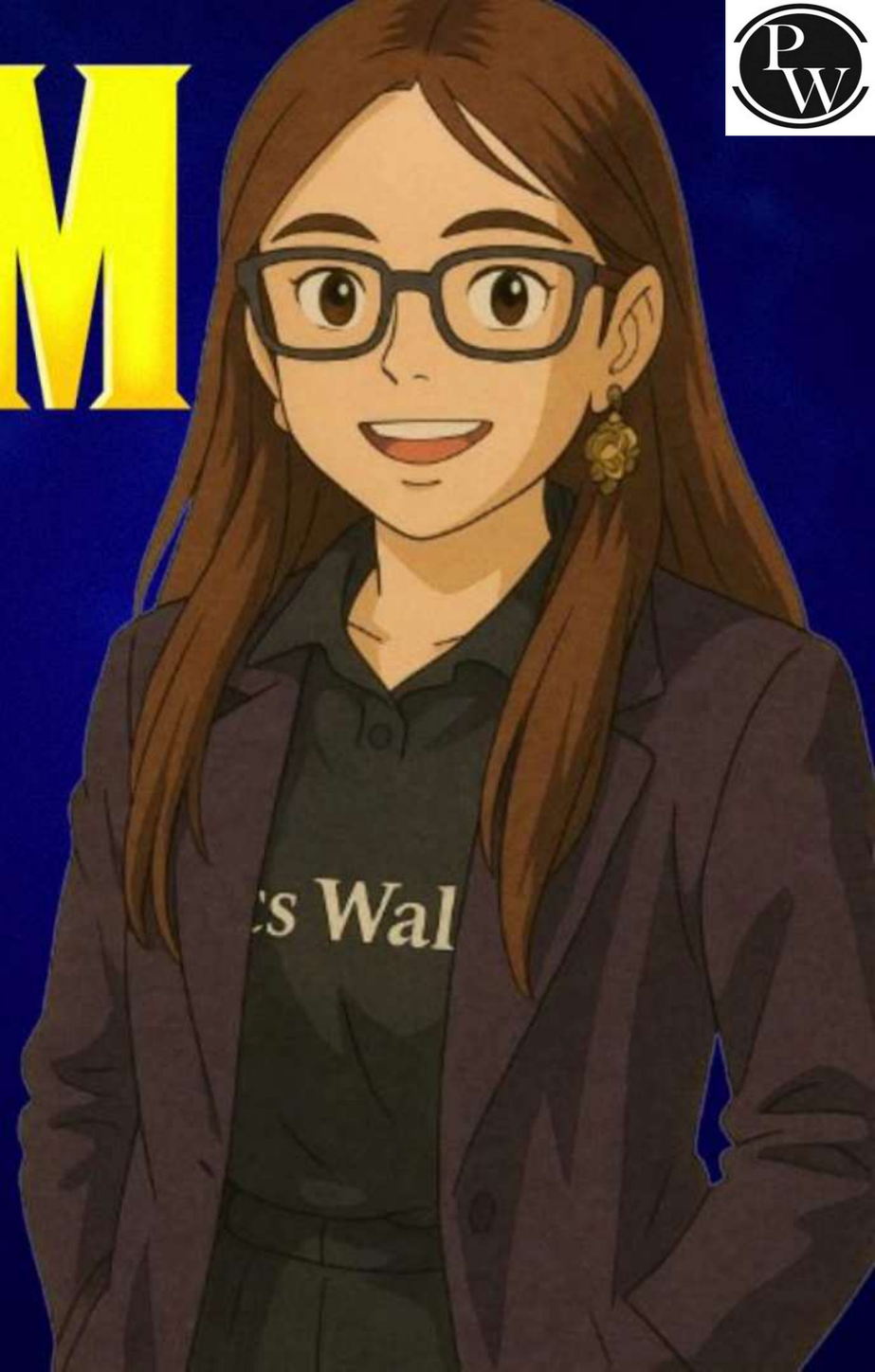
PARISHRAM

2026

ALDEHYDE , KETONE & CARBOXYLIC ACID

CHEMISTRY LECTURE- 9

BY – SHOURYA GROVER (SG) MA'AM



TOPICS TO BE COVERED

1. CARBOXYLIC ACID – Chemical properties.
   Properties of Carboxylic Acid
2. FLOWCHART
3. NCERT READING
4. QUESTIONS

MY SHIMMERING STARS

#SHOURYA'SGALAXY


START

CARBOXYLIC ACID

CHEMICAL PROPERTIES

Cleavage of $-O\overset{}{\underset{}{\sim}}H$

* Cleavage/Breakage of $-\overset{O}{\overset{\|}{C}}\sim OH$

* Cleavage of $R\sim COOH$

* Cleavage of O-H

$$R-O\overset{}{\underset{}{\sim}}H + Na \downarrow RONa + H_2$$

a) ACIDITY ⟶ They behave same as alcohols & Reacts with Metals & alkalies producing hydrogen gas & salt respectively.

→ $2\,RCOO^{-}H^{+} + 2Na \longrightarrow 2RCOO^{-}Na^{+} + H_2$

(Electropositive Metal)

Sodium Carboxylate

or

$R-\overset{\overset{O}{\|}}{C}-\underset{-}{O}Na^{+}$

→ $RCOOH + NaOH \longrightarrow H_2O + RCOONa$

→ Carboxylic Acid reacts with weaker Base such as carbonates & sodium carbonate liberating CO_2 gas.

$\longrightarrow RCOOH + NaHCO_3 \longrightarrow RCOO^-Na^+ + H_2O + CO_2$

Ex. $2CH_3COOH + 2Na \longrightarrow CH_3COO^-Na^+ + H_2$

$CH_3COOH + NaOH \longrightarrow H_2O + CH_3COO^-Na^+$

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COO^-Na^+ + H_2O + CO_2$

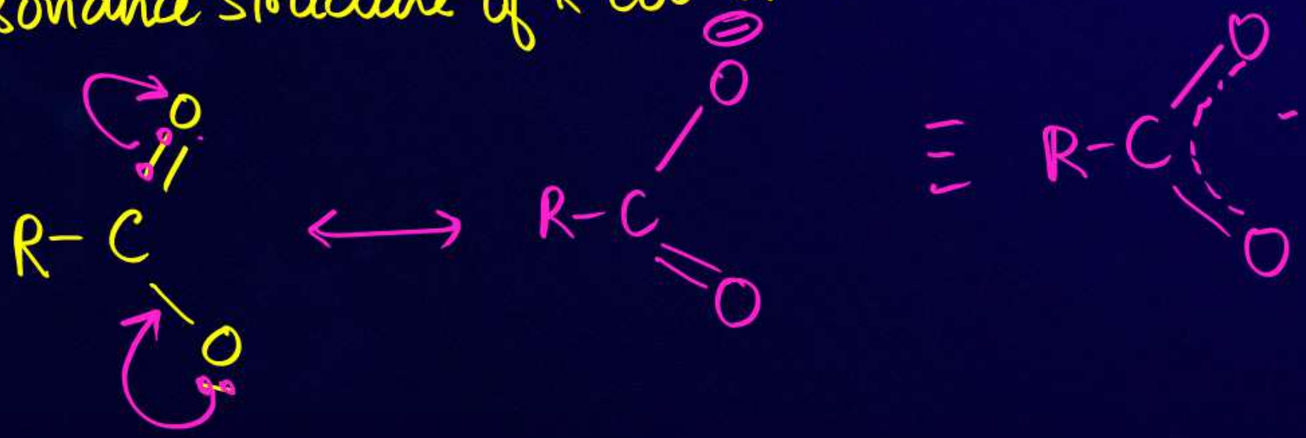
Carboxylic Acid reacts with H_2O prodiuum carboxylate ion & hydronium ion

The Carboxylate ion shows resonance, which decides the strength of acid

hydronium ion.

carboxylate ion

Resonance structure of $R-COO^-$ or $R-C(=O)-O^-$.



$$K_{eq} = \frac{[H_3O^+][RCOO^-]}{[RCOOH][H_2O]}$$

$$\underbrace{K_{eq} \times H_2O}_{K_a} = \frac{[H_3O^+][RCOO^-]}{[RCOOH]}$$

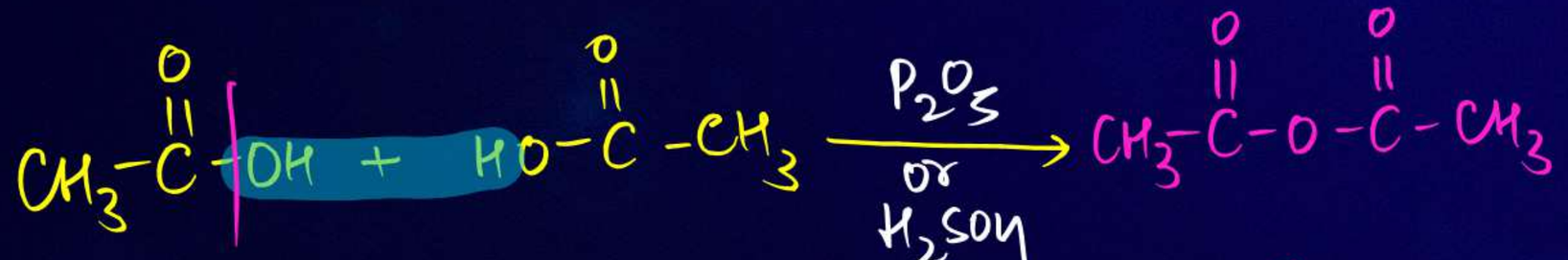
$$K_a = \frac{[H_3O^+][RCOO^-]}{[RCOOH]}$$

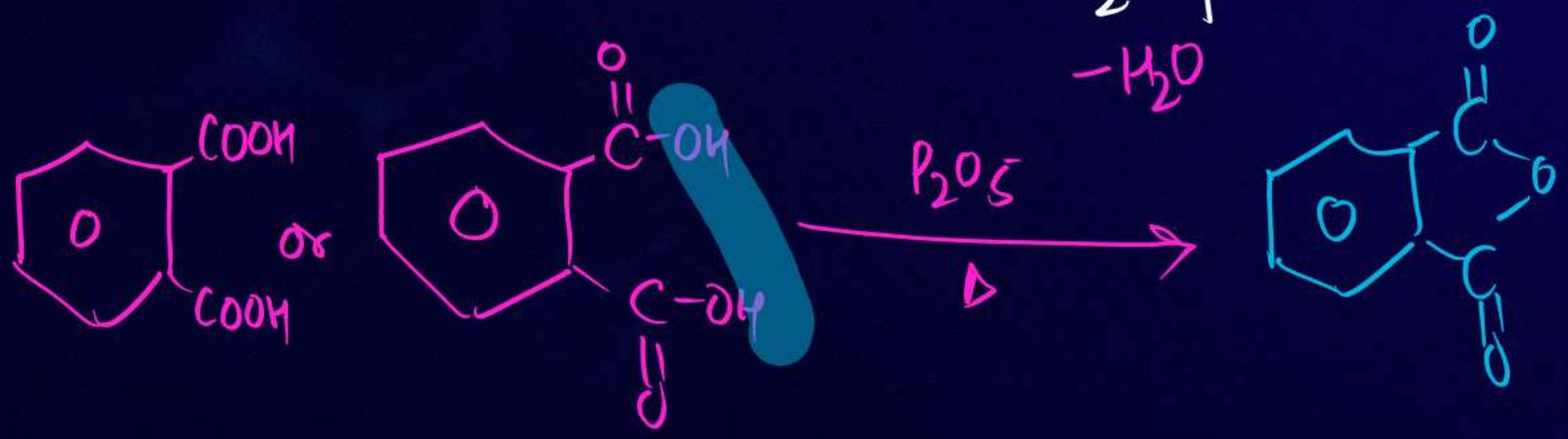
K_a ↓ Acid dissociation const

2) Cleavage of $\overset{O}{\overset{\|}{C}}\!\!\sim\!\!OH$ (C-O)

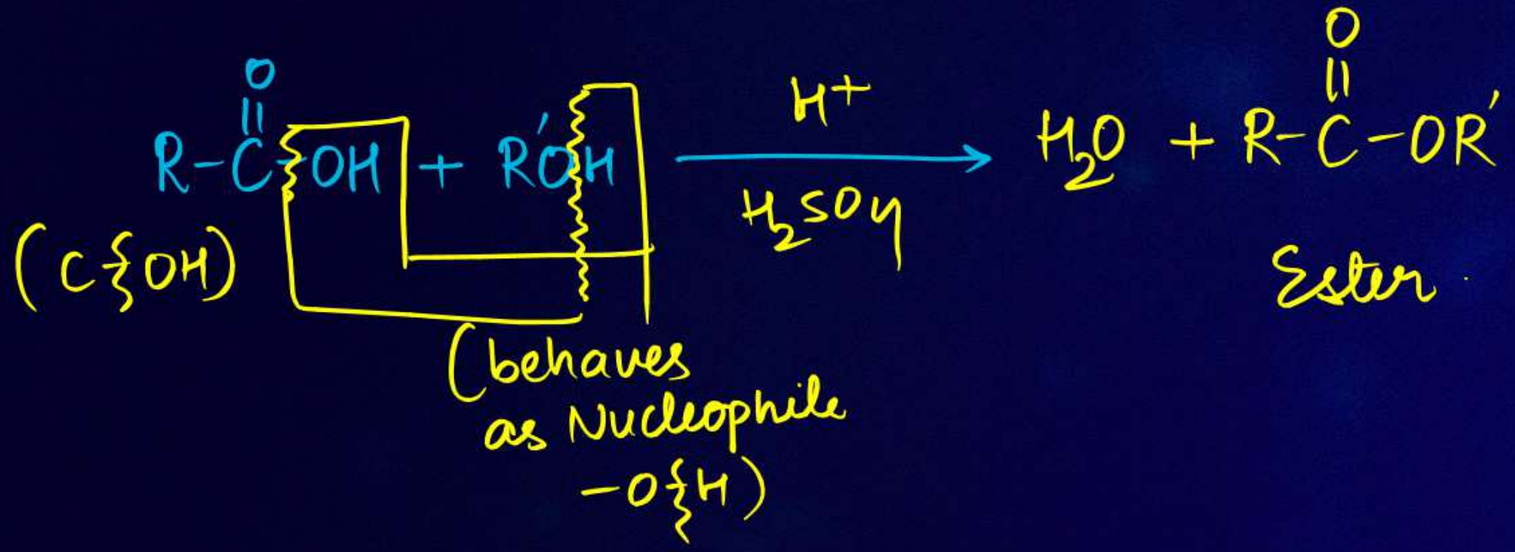
a) Formation of Anhydride

This Reaction occurs in the presence of mineral acid H_2SO_4 or P_2O_5





(b) Esterification



Ex. $CH_3-C(=O)-OH + CH_3CH_2OH \xrightarrow[\Delta]{H^+} H_2O + CH_3-C(=O)-O-CH_2CH_3$

(C) Reaction with PCl_3, PCl_5 & $SOCl_2$

$$RCOOH + PCl_5 \longrightarrow R-\overset{\overset{O}{\|}}{C}-Cl + POCl_3 + HCl$$

or

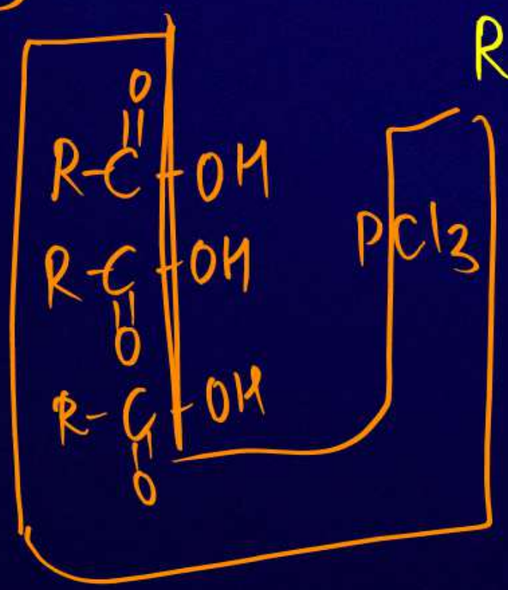
$RCOCl$

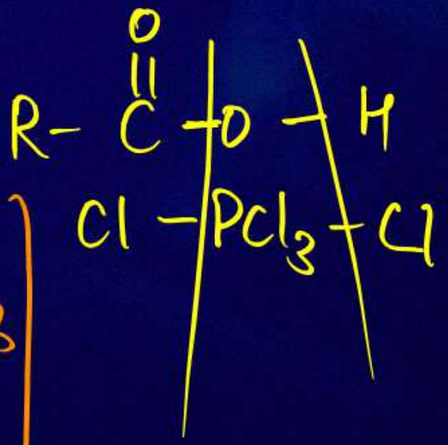
acid chloride

$R - O - H$

$Cl - PCl_3 - Cl$

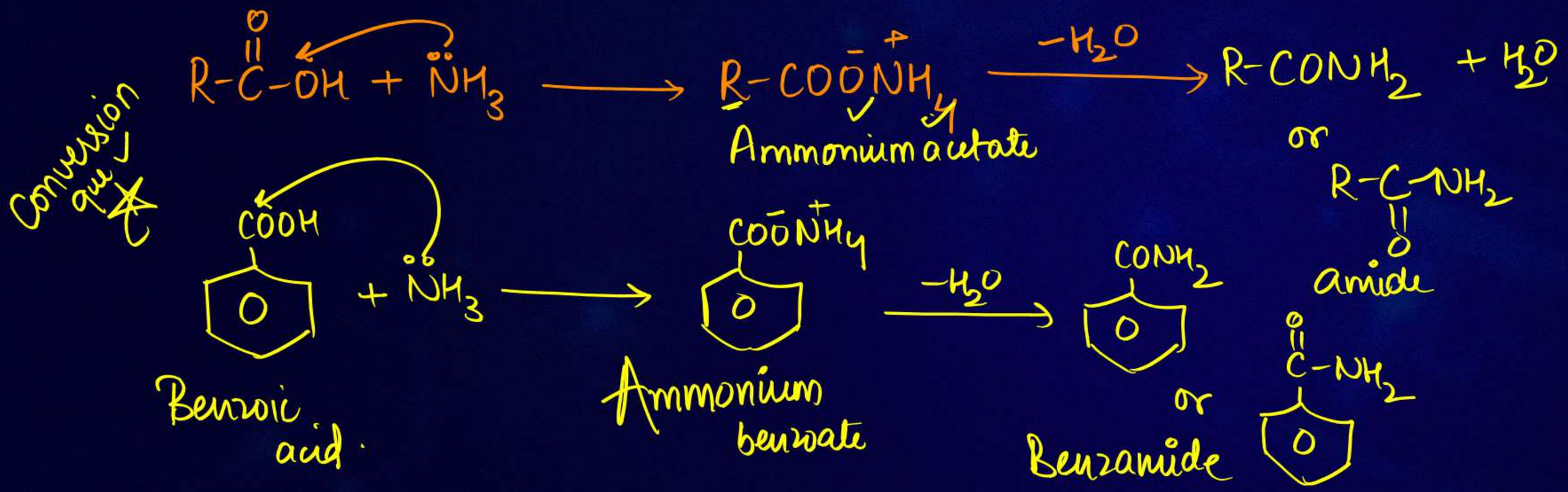
$$3RCOOH + PCl_3 \longrightarrow 3RCOCl + H_3PO_3$$

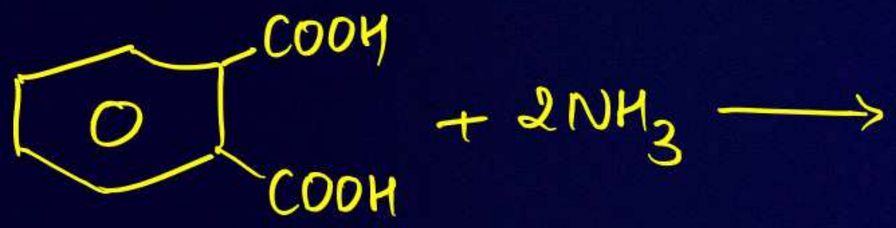




Method = Preferable ✓

(d) Rx with Ammonia





$+ 2NH_3 \longrightarrow$

3) Cleavage of R–COOH

a) Reduction to alcohol

Carboxylic acid can be converted to primary Alcohol by Reacting it with lithium aluminium hydride or diborane.

$$RCOOH \xrightarrow[\text{or } B_2H_6]{LiAlH_4} RCH_2OH$$

~~$NaBH_4$~~

(b) Decarboxylation

Removal of CO_2

Salt of carboxylic acid is reacted with sodalime ($NaOH + CaO$) 3 : 1 to produce CO_2 and hydrocarbon is formed.

$$RCOOH \xrightarrow[3:1]{NaOH + CaO} R\text{-}H + Na_2CO_3$$

SUBSTITUTION Rx

HVZ ✓ Hell Volhard Zelinsky Rx.

a) Halogenation

α-carbon is substituted with halogen such as chlorine | Bromine

This Rx occurs in presence of Red P with Cl_2 & Br_2

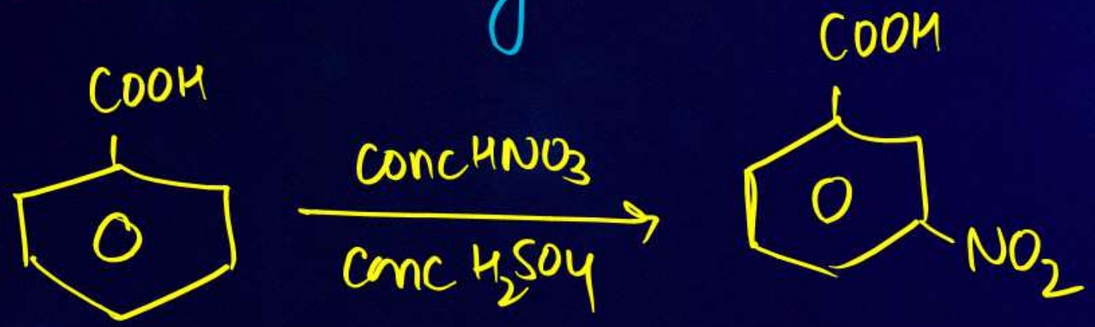
$$R-\overset{\alpha\text{-C}}{CH_2}-COOH \xrightarrow[Cl_2,\ Br_2]{\text{Red P}} R-\underset{X}{CH}-COOH$$

α-halocarboxylic Acid.

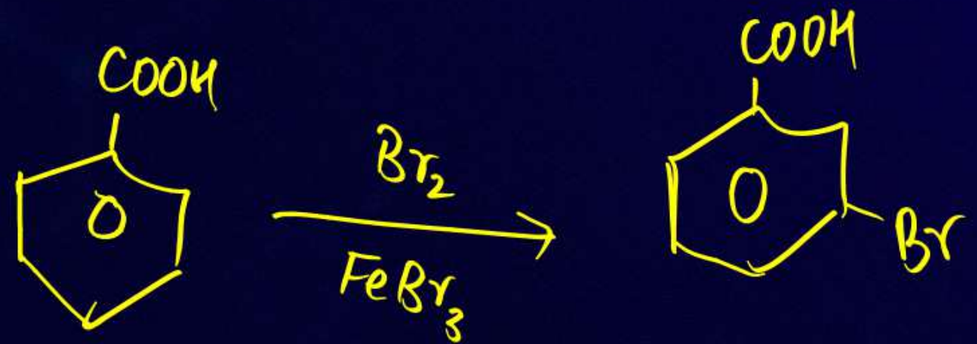
(X - Cl, Br)

(b) Ring substitution

Friedel craft Rx is not possible.
Because COOH gp is deactivating gp.
∴ Meta directing.



m-nitrobenzoic acid

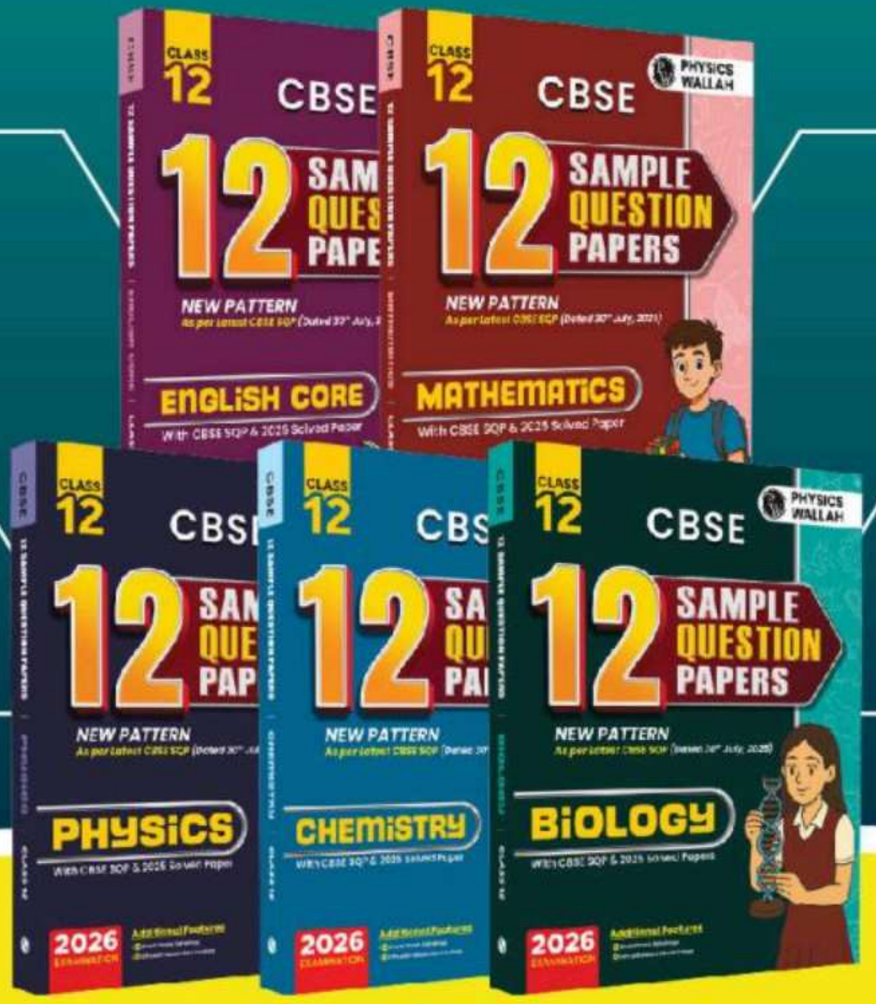


m-bromobenzoic acid


SHOURYA MAM
JOIN MY OFFICIAL TELEGRAM CHANNEL
@CHEMISTRYBY
SHOURYAMAM
Physics Wallah

Boards ke Tricky Sawaal,
Ab Simple with Sample Papers!

- Cheat Sheets & One-Shot Revision Videos
- 28 Sample Papers with Explanations
- Step-wise Marking Scheme
- CBSE PYQs 2025 & SQP 2025-26 with Marking Scheme
- 12 Handwritten Papers via QR Code
- Level-wise Difficulty (Easy, Medium, Hard)



HOMEWORK

1. COMPLETE NOTES

2.CREATE FLOWCHART WITHOUT SEEING NOTEBOOK

3.REVISE NOTES

4.FINISH DHA 5