ULTIMATE KCET

CRASH COURSE 2026

Chemistry | Lecture - 01

Aldehydes ketones and carboxylic acids

By – Sreeja Ma'am

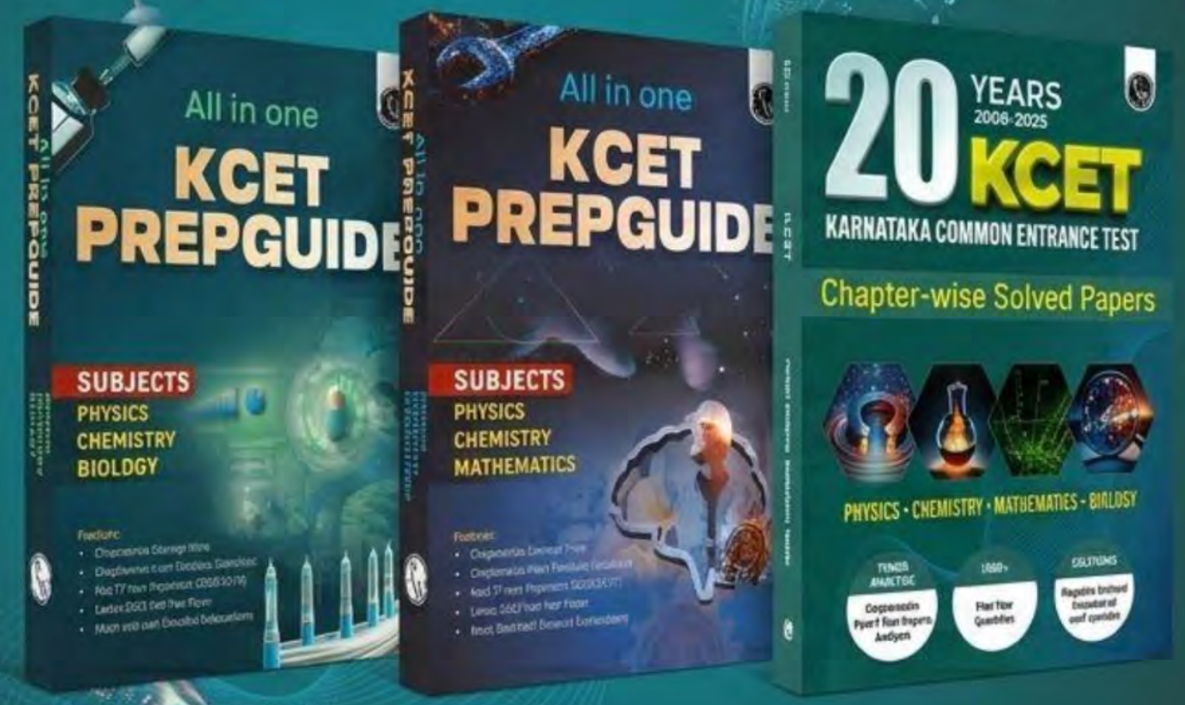
Recap *of previous lecture*

1. Optical activity – Synopsis , Haloalkanes – MCQS
2. Alcohols, phenols and ethers – Synopsis and mcqs

Topics *to be covered*

1. Mcqs – Alcohols, phenols and ethers
2. Aldehydes, ketones and carboxylic acids – Synopsis and MCQ's

PHYSICS WALLAH



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Alcohols, phenols and ethers

2025 → 4 Questions
Ether → 2
phenol → 2

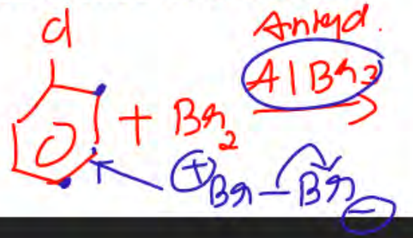
Year	Topics	Number of Questions
2024	Oxidation of alcohol – 02 , PCC .	3
2023	Heating phenylmethyl Ether, Nitration of phenol, Diazotisation of aliphatic compounds giving alcohol (sequence based questions), Optical isomers characteristics, Aspirin preparation	4
2022	Anisole+HI reaction, Heating ethanol at high temp , question on Meta cresol and its bromination reaction, Kolbe's reaction.	4
2021	Question on Meta cresol and its bromination reaction, sequence based question – giving optical active alcohol , Iodoform reaction .	3
2020	Ether, reagents based question, Boiling point of different compounds .	3
2019	Testing acidic nature of alcohol, Reagents based question.	2
2018	dehydration of 3^0 alcohol ,Acidic strength of phenol ,Test to distinguish phenol ,Intramolecular hydrogen bonding in phenol .	4
2017	Reagent based question, Acidic nature of phenol.	2
2016	Oxidation of alcohol, Acidic nature of phenol.	2

Aldehydes, ketones and carboxylic acids

Year	Topics	Number of Questions
2024	Functional isomers, decarboxylation reaction	02
2023	RCHO+ RMgBR + conc H_2SO_4 +B_2H_6 - Functional isomers	02
2022	Reagent to oxidise primary alcohols to aldehydes, IUPAC name, Aldehydes + alcohols = reactionn , Aldehyde preparation HVZ reaction	04
2021	Iodoform test, reaction of acetone undergoing aldol condensation reaction, Choosing reducing reagents which reduced carboxylic acids to alcohol, Sequence based reaction,	03
2020	Aldol condensation reaction,	02
2019	HVZ reaction, Rosenmund reduction reaction + Cannizaro reaction	02
2018	Haloform reaction, Cumene process – acetone , Wolf kishner reduction reaction, Étard reaction	04
2017	Decarboxylation reaction, Cannizaro reaction , Solubility of carboxylic acids, Reagent to reduce ketones	04
2016	Cannizaro reaction, sequence based reaction,	02

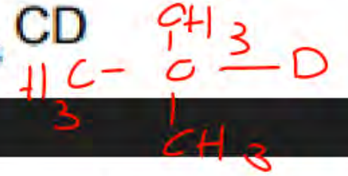
Chlorobenzene reacts with bromine gas in the presence of Anhyd $AlBr_3$ to yield p-Bromochlorobenzene. This reaction is classified as _____

(1) Elimination reaction
(2) Nucleophilic substitution reaction
(3) Electrophilic substitution reaction
(4) Addition reaction

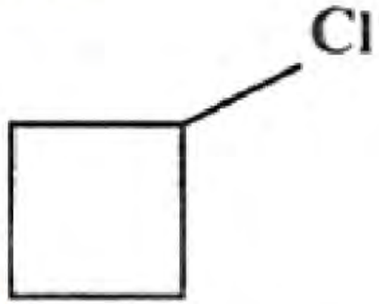


The organometallic compound $(CH_3)_3 CMgBr$ on reaction with D_2O produces _____

(1) $(CH_3)_3 COD$
(2) $(CD_3)_3 CD$
(3) $(CD_3)_3 COD$
(4) $(CH_3)_3 CD$



The major product formed when 1 – Bromo – 3 – Chlorocyclobutane reacts with metallic sodium in dry ether is

(1)


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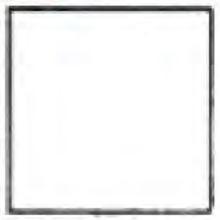

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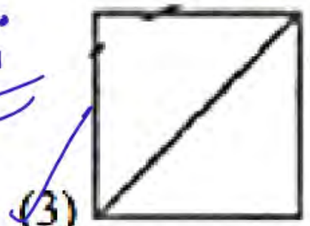

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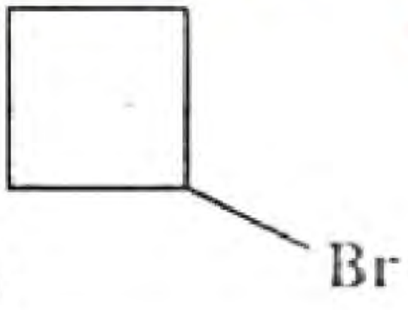
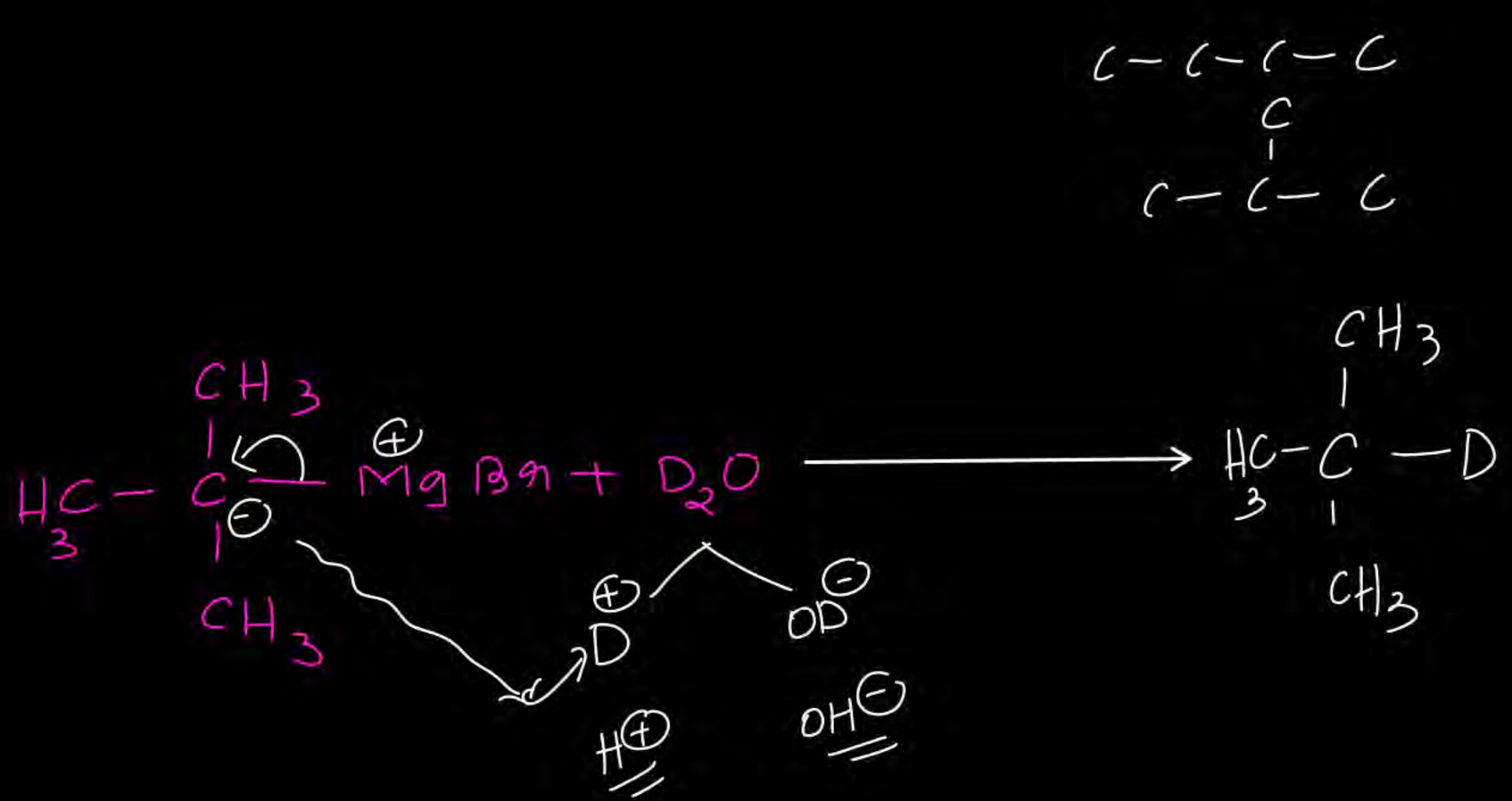



CH3
H3C – C – CH3
⊖
⊕
MgBr + D2O
⊕
D
OD⊖
H⊕
OH⊖
CH3
HC – C – D
3
CH3

Ethyl alcohol is heated with concentrated sulphuric acid at 413 K. The major product

(1) $C_2H_5-O-C_2H_5$ (2) $CH_3-O-C_3H_7$ (3) $CH_2=CH_2$ (4) $CH_3COOC_2H_5$

2025

Phenol can be distinguished from propanol by using the reagent

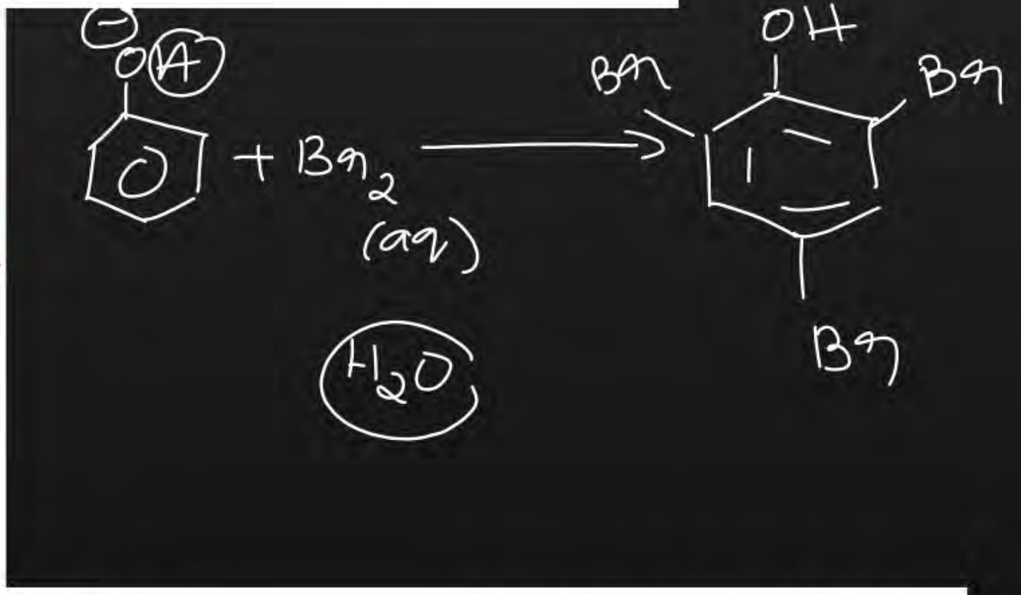
2025

(1) Bromine water (2) Iron metal (3) Iodine in alcohol (4) Sodium metal

Match the following with their pKa values

2025

Acid	pKa (low → strong acid)
(I) Phenol	(a) 16
(II) p-Nitrophenol	(b) 0.78
(III) Ethyl alcohol	(c) 10
(IV) Picric acid	(d) 7.1

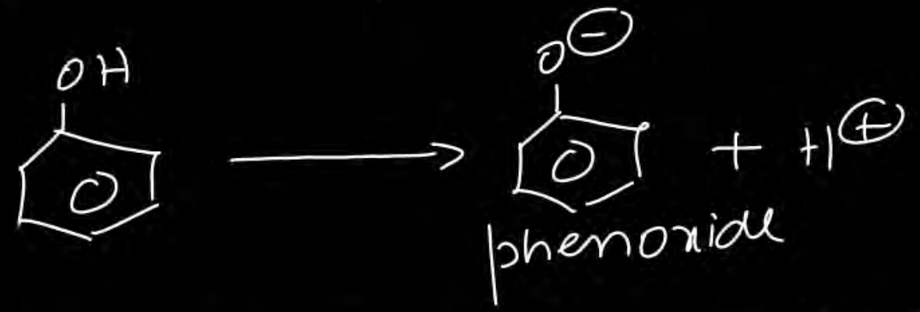


(1) I – c, II – d, III – a, IV – b (2) I – a, II – d, III – c, IV – b

(3) I – a, II – b, III – c, IV – d (4) I – b, II – a, III – d, IV – c

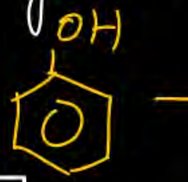
Strong acid → pK_a ↓ or K_a ↑

phenol acidity:



EWG → NO_2, CN, COOH, CHO, CO−

always increases acidity → K_a ↑ or pK_a ↓



→ phenol becomes more acidic.

EDG → OCH_3, OH, CH_3, NH_2 → These will decrease the acidity of phenol

pK_a ↑ or K_a ↓

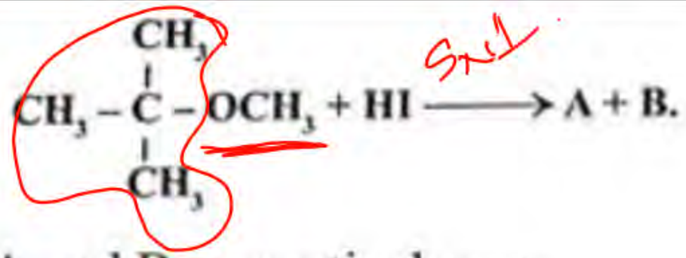
$$K_a = \frac{[H^+][\text{C}_6\text{H}_5\text{O}^-]}{[\text{C}_6\text{H}_5\text{OH}]}$$

K_a ↑ = [H^+] ↑ = strong acid

K_a ↑ pK_a ↓ → strong acid

More less

pK_a ↑ → weak acid.



$$\text{CH}_3\text{-C}(\text{CH}_3)_2\text{-OCH}_3 + \text{HI} \longrightarrow \text{A} + \text{B}.$$

S_N1

2025

Ether

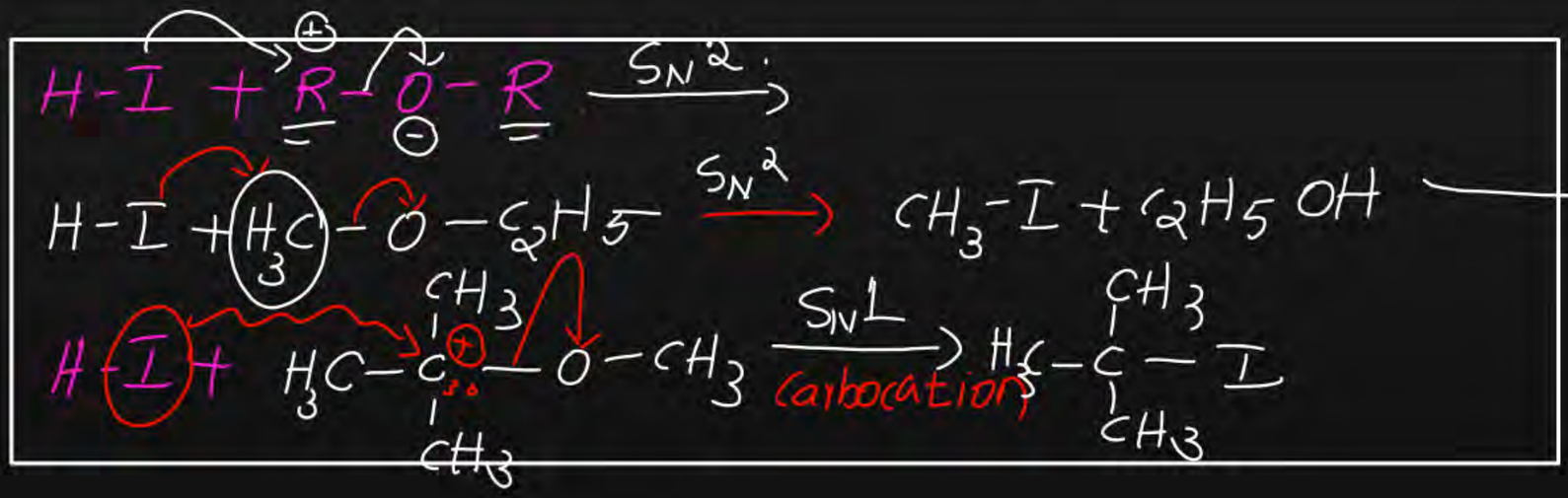
A and B respectively are

(1) $\text{A} = \text{CH}_3\text{OH}, \text{B} = \text{CH}_3\text{-C}(\text{CH}_3)_2\text{-OH}$

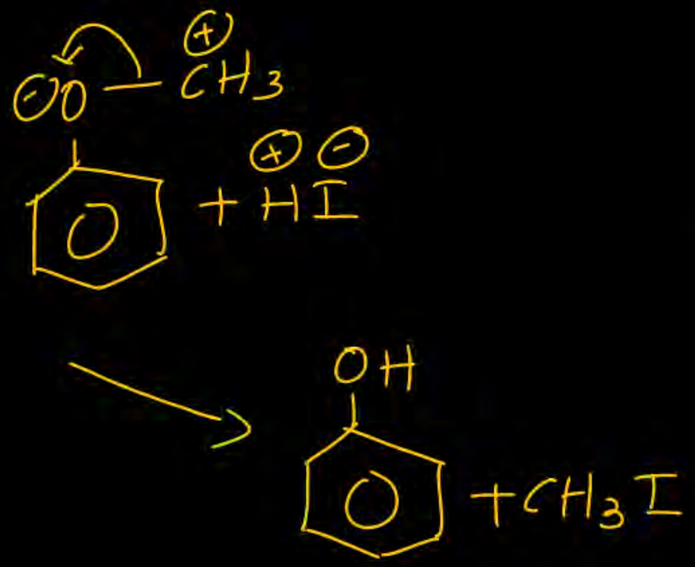
(2) $\text{A} = \text{CH}_3\text{-I}, \text{B} = \text{CH}_3\text{-C}(\text{CH}_3)_2\text{-OH}$

(3) $\text{A} = \text{CH}_3\text{OH}, \text{B} = \text{CH}_3\text{-C}(\text{CH}_3)_2\text{-I}$

(4) $\text{A} = \text{CH}_3\text{-I}, \text{B} = \text{CH}_3\text{-C}(\text{CH}_3)_2\text{-I}$

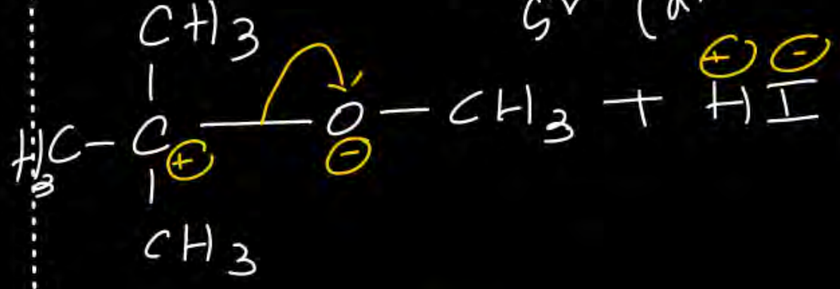


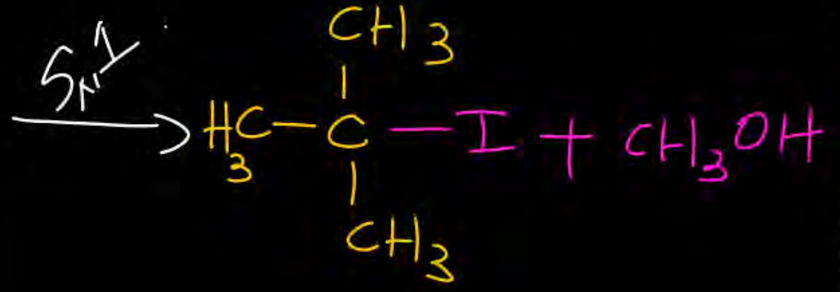
Example – 1



Example – 2

(Exception) Stability of carbocation





Example – 3

$H_3C-O-C_2H_5$

$+ HI \xrightarrow{S_N2}$

$CH_3I + C_2H_5OH$

Statement – I : Reduction of ester by DIABL-H followed by hydrolysis gives aldehyde.

Statement – II : Oxidation of benzyl alcohol with aqueous $KMnO_4$ leads to the formation to Benzaldehyde.

Among the above statements, identify the correct statement.

(1) Both statements – I and II are false

(2) Statement – I is true but statement – II is false

(3) Statement – I is false but statement – II is true

(4) Both statements – I and II are true.

2025

Arrange the following compounds in their decreasing order of reactivity towards Nucleop addition reaction.

$CH_3COCH_3, CH_3COC_2H_5, CH_3CHO$

(1) $CH_3CHO > CH_3COCH_3 > CH_3COC_2H_5$

(2) $CH_3COCH_3 > CH_3CHO > CH_3COC_2H_5$

(3) $CH_3COC_2H_5 > CH_3COCH_3 > CH_3CHO$

(4) $CH_3CHO > CH_3COC_2H_5 > CH_3COCH_3$

2025

Which of the following has most acidic Hydrogen ? 2025

(1) Propanoic acid

(2) Dichloroacetic acid

(3) Trichloroacetic acid

(4) Chloroacetic acid

Alcohols , phenols and ethers

Question

Saytzeff's rule ⟶ elimination

In the following reactions,

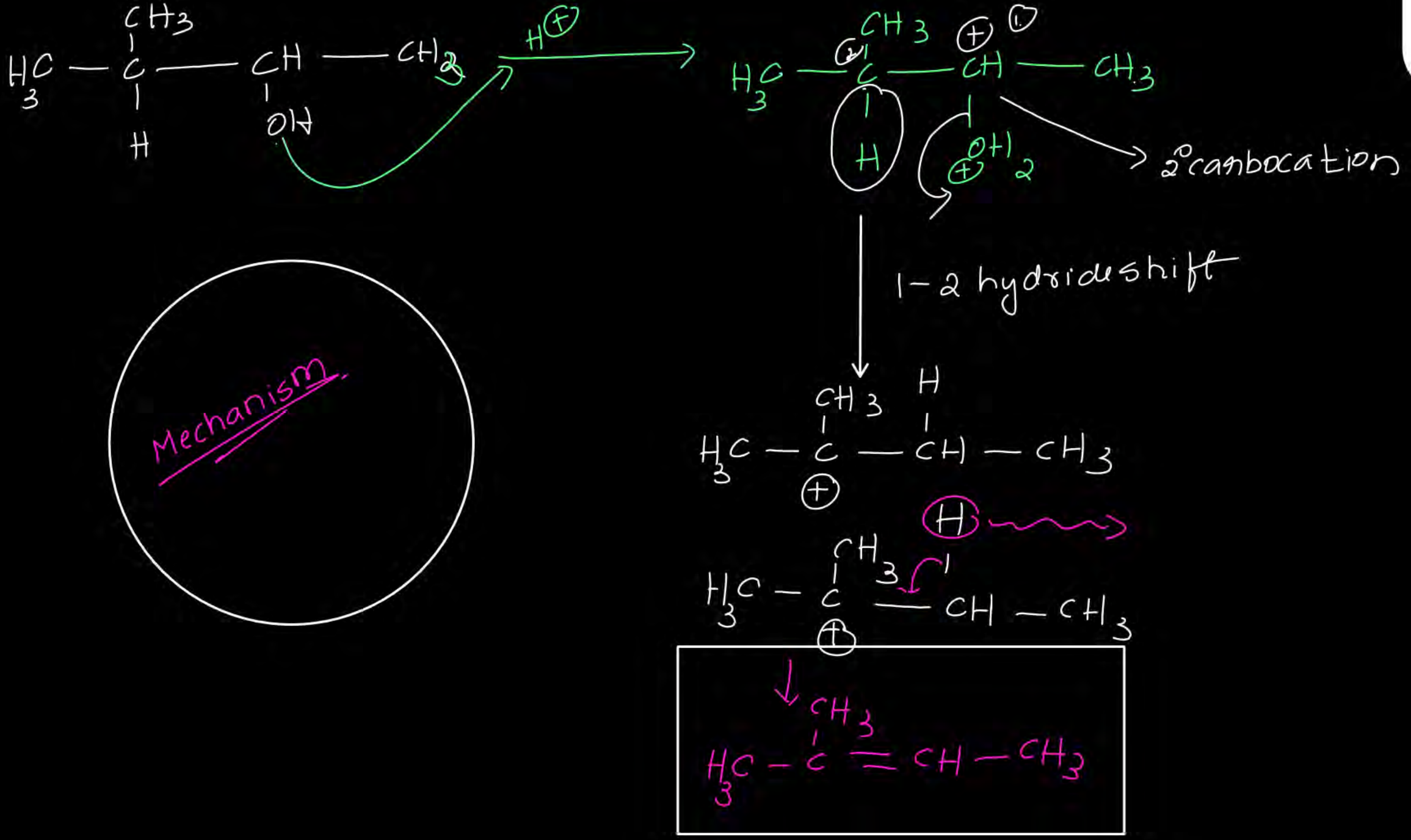
(i) $CH_3-\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{CH}}-\underset{\underset{OH}{|}}{CH_2}CH_3 \xrightarrow[\text{dehydration}]{H^+/\text{Heat}} \underset{\text{(Major product)}}{A} + \underset{\text{(Minor product)}}{B}$

$H_3C-\overset{\overset{CH_3}{|}}{C}=CH-CH_3$

(ii) $A \xrightarrow[\text{in absence of peroxide}]{HBr,\ \text{dark}} \underset{\text{(Major product)}}{C} + \underset{\text{(Minor product)}}{D}$

The major products (A) and (C) are respectively

$H_3C-\overset{\overset{CH_3}{|}}{C}=CH-CH_3 + \overset{\oplus}{H}\overset{\ominus}{Br} \xrightarrow[\text{Addition}]{\text{Markownikov's rule}} H_3C-\underset{\underset{Br}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-CH_3$


Mechanism
1-2 hydride shift
2° carbocation

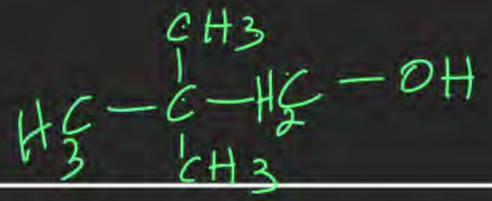
A $CH_2=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_2CH_3$ and $\underset{\displaystyle Br}{\underset{|}{CH_2}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2CH_3$

B $CH_2-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH-CH_3$ and $CH_3-\underset{\displaystyle Br}{\underset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-CH_2CH_3$

C $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CHCH_3$ and $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3$

D $CH_2=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_2CH_3$ and $CH_3-\underset{\displaystyle Br}{\underset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-CH_2CH_3$

QUESTION



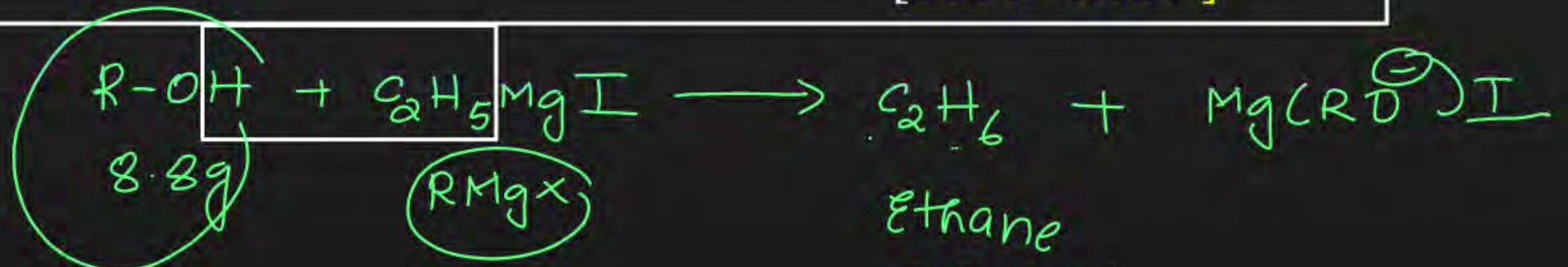
$12\times5+16+12$

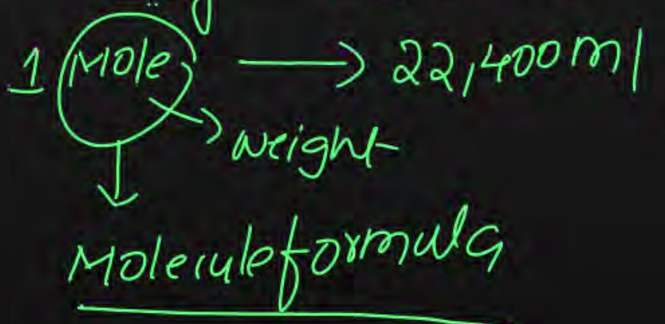
$60+16+2=88\,g$ //

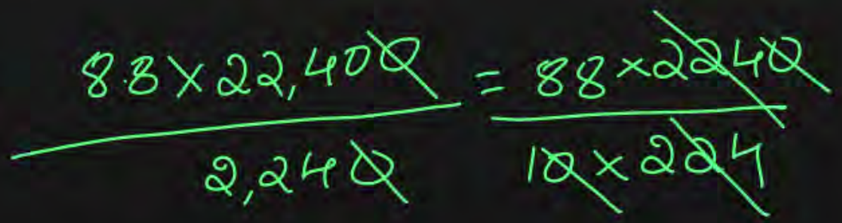
8.8 g of monohydric alcohol added to ethyl magnesium iodide in ether liberates 2240 cm^3 of ethane at STP.

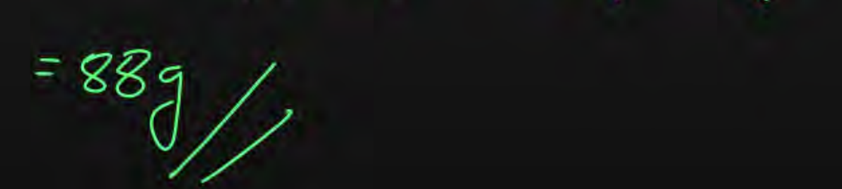
This monohydric alcohol when oxidised using pyridinium-chloromate, forms a carbonyl compound that answers silver mirror test (Tollen's test). The monohydric alcohol is

[2024 - KCET]









A butan-2-ol ✗

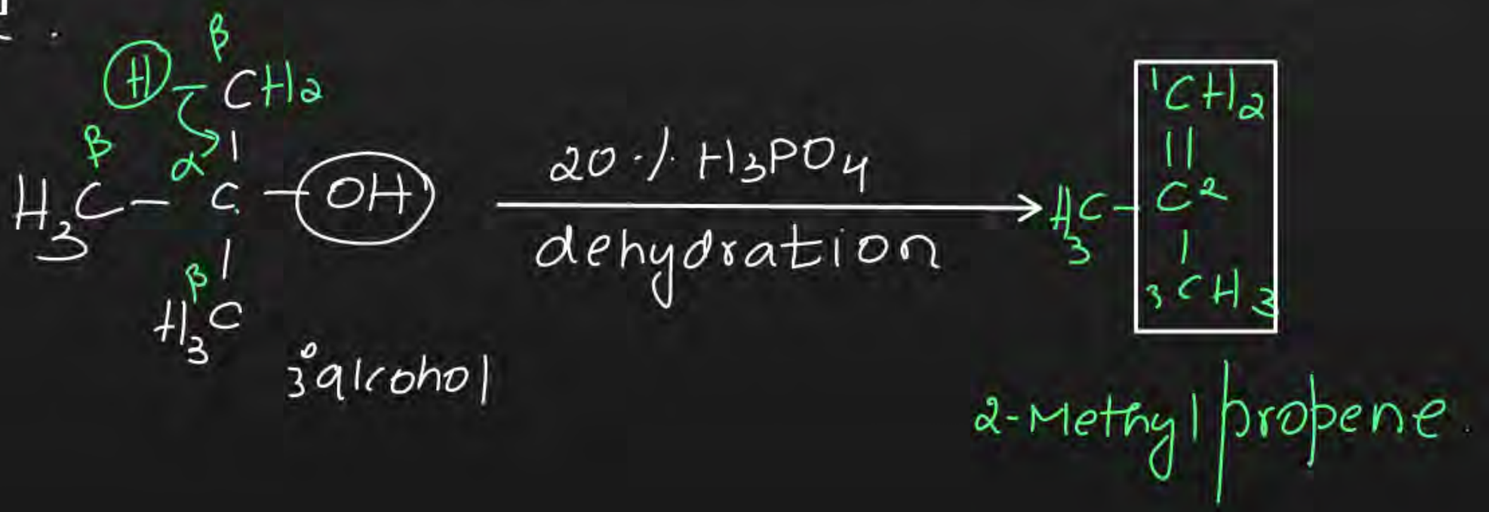
B 2, 2-dimethyl propan-1-ol //

C pentan-2-ol ✗

D 2, 2-dimethyl ethan-1-ol //

QUESTION

When a tertiary alcohol 'A' ($C_4H_{10}O$) reacts with 20% H_3PO_4 at 358 K, it gives a compound 'B' (C_4H_8) as a major product. The IUPAC name of the compound 'B' is [KCET - 2024]



A. But-1-ene

B. But-2-ene

C. Cyclobutane

D. 2-Methylpropene

QUESTION

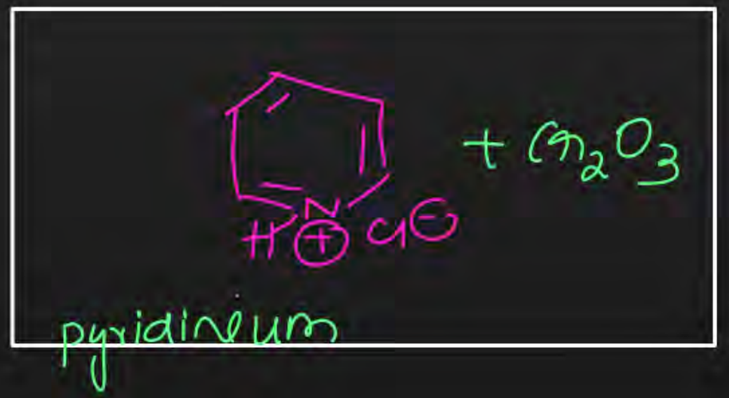
PCC is [2024-KCET]

A $K_2Cr_2O_7$ + Pyridine

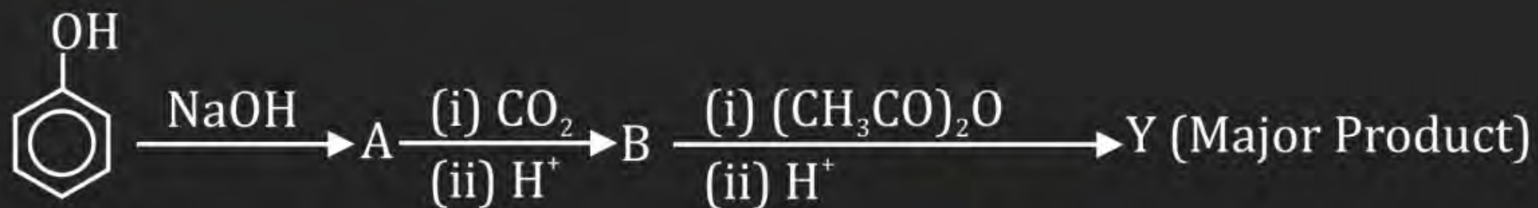
B CrO_3 + $CHCl_3$

C CrO_3 + H_2SO_4

D A complex of chromium trioxide with pyridine + HCl



QUESTION



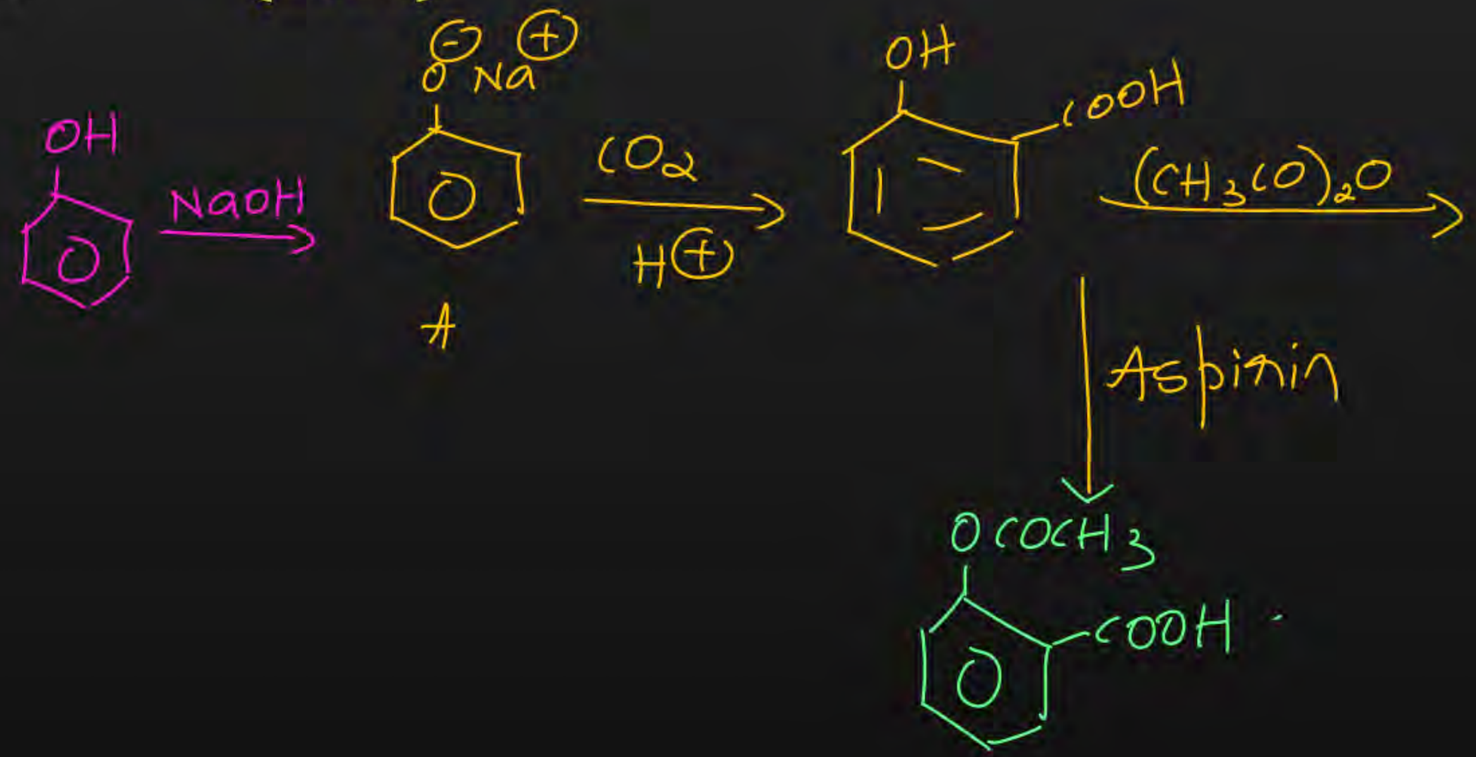
y in the above reaction is (2023)

A Salicylaldehyde

B aspirin

C cumene

D picric acid



QUESTION

The heating of phenyl methyl ether with HI produces an aromatic compound A which on treatment with conc. HNO_3, gives B. A and B respectively are

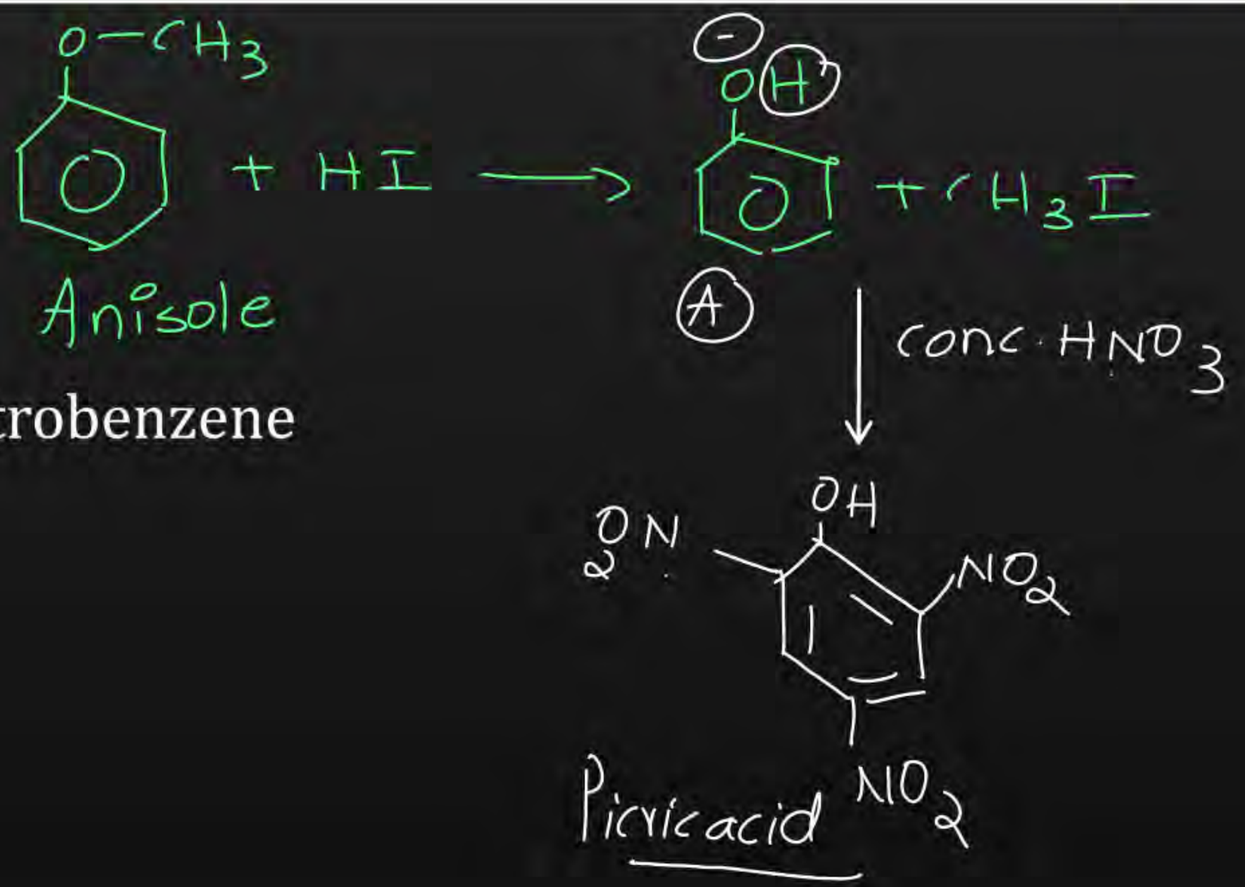
(2023)

A methanol, ethanoic acid

B picric acid, phenol

C iodobenzene, 1-iodo-4-nitrobenzene

D phenol, picric acid



QUESTION

Identify A, B and C in the sequence.

$$CH_3CH_2Br \xrightarrow[\text{Alc.}]{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[0°C]{HNO_2} C$$

(A) CH_3CH_2CN, $CH_3CH_2CH_2NH_2$, $CH_3CH_2CH_2OH$

(B) CH_3CH_2NC, CH_3CH_2OH, $CH_3CH_2CH_2NH_2$

(C) CH_3CH_2CN, C_2H_5OH, $C_2H_5NH_2$

(D) CH_3CH_2CN, $CH_3CH_2NH_2$, C_2H_5OH

$H_3C-CH_2-C\equiv N \xrightarrow{LiAlH_4} H^-$ (Reducing agent)

A

(2023)

$H_3C-CH_2-CH_2-NH_2 \xrightarrow{HNO_3}$

$H_3C-CH_2-CH_2-\overset{\oplus}{N_2}\,Cl^-$

$H_3C-CH_2-CH_2-OH$

QUESTION

A pair of compounds having the same boiling points are (2023)

More BP

More MP

A cis but-2-ene and trans but-2-ene

B n-hexane and neo-hexane

More B.P

C benzene and naphthalene

More BP

D (+) butan-2-ol and (−) butan-2-ol → optical isomers

QUESTION

Among the following, the products formed by the reaction of anisole with HI are (2022)

A sodium phenate + methanol

B benzene + methanol

C phenol + methane

D phenol + iodomethane

QUESTION

The major product obtained when ethanol is heated with excess of conc. H_2SO_4 at 443 K is (2022)

A ethyne

B ethane

C methane

D ethene

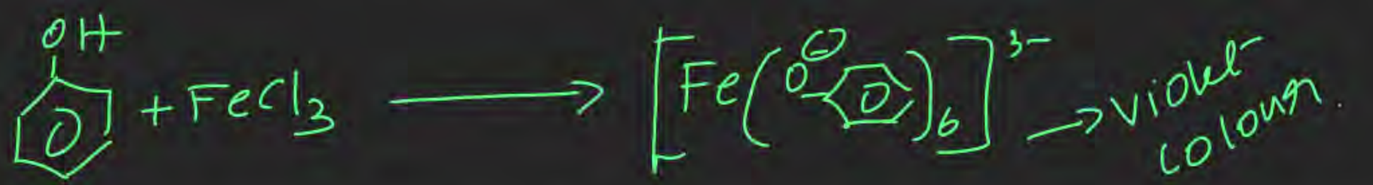
alcohol → OH → alkene.

H_3PO_4 20%.

H_3PO_4 85%.

Conc H_2SO_4

QUESTION



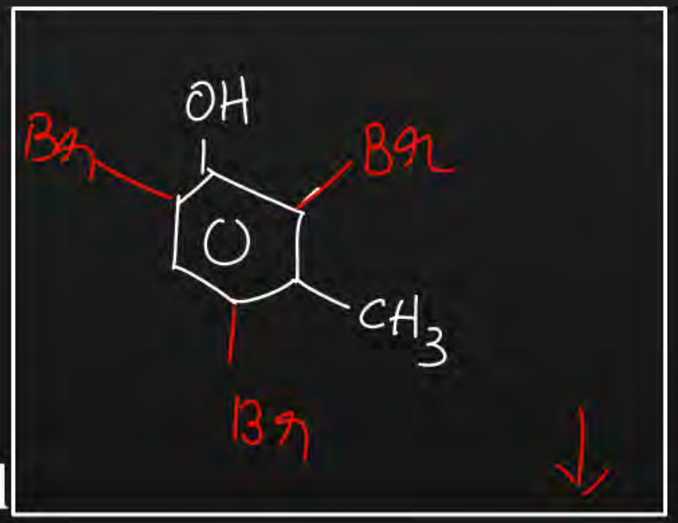
An organic compound with molecular formula C_7H_8O dissolves in NaOH and gives a characteristic colour with $FeCl_3$, On treatment with bromine, it gives a tribromo dervative $C_7H_5OBr_3$. The compound is (2022)

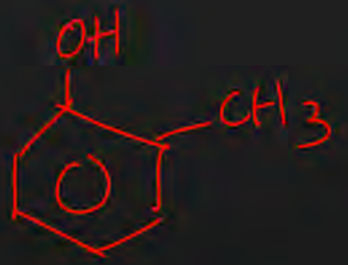
A o - cresol

B m-cresol

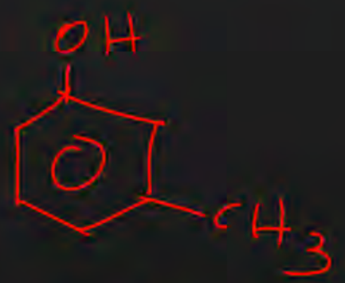
C P- cresol

D benzyl alcohol





o-cresol



M-cresol

p-cresol

QUESTION

In Kollbe's reaction the reacting substances are (2022)

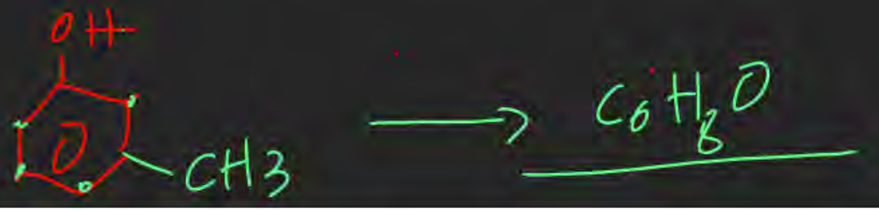
A phenol and CCl_4

B sodium phenolate and CCl_4

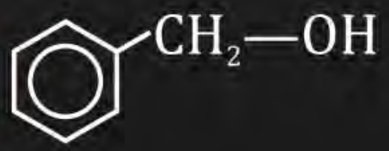
C phenol and $CHCl_3$

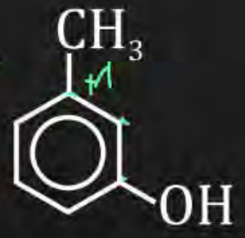
D sodium phenolate and CO_2

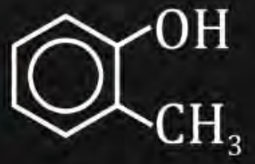
QUESTION



A compound ' A ' (C_7H_8O) is insoluble in $NaHCO_3$, solution but dissolve in NaOH and give a characteristic colour with neutral $FeCl_3$ solution. When treated with bromine water compound ' A ' forms the compound B with the formula $C_7H_5OBr_3$. ' A ' is (2021)

A 

B 

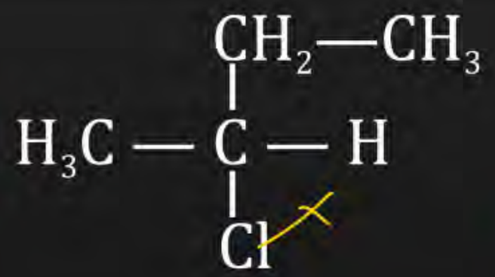
C 

D

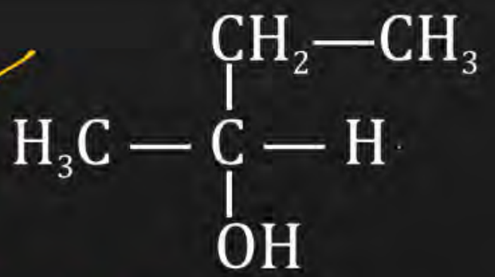
QUESTION

A hydrocarbon A (C_4H_8) on reaction with HCl gives a compound B (C_4H_9Cl) which on reaction with 1 mol of NH_3 gives compound C ($C_4H_{11}N$). On reacting with $NaNO_2$ and HCl followed by treatment with water. compound C yields an optically active compound D. The compound D is (2021)

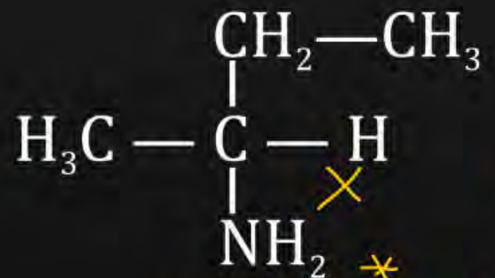
A



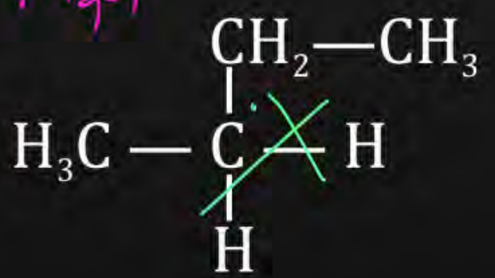
B

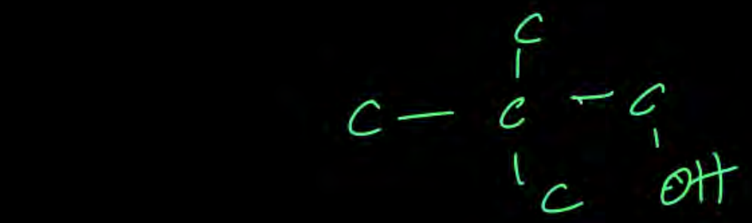


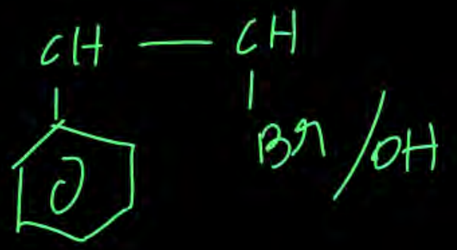
C

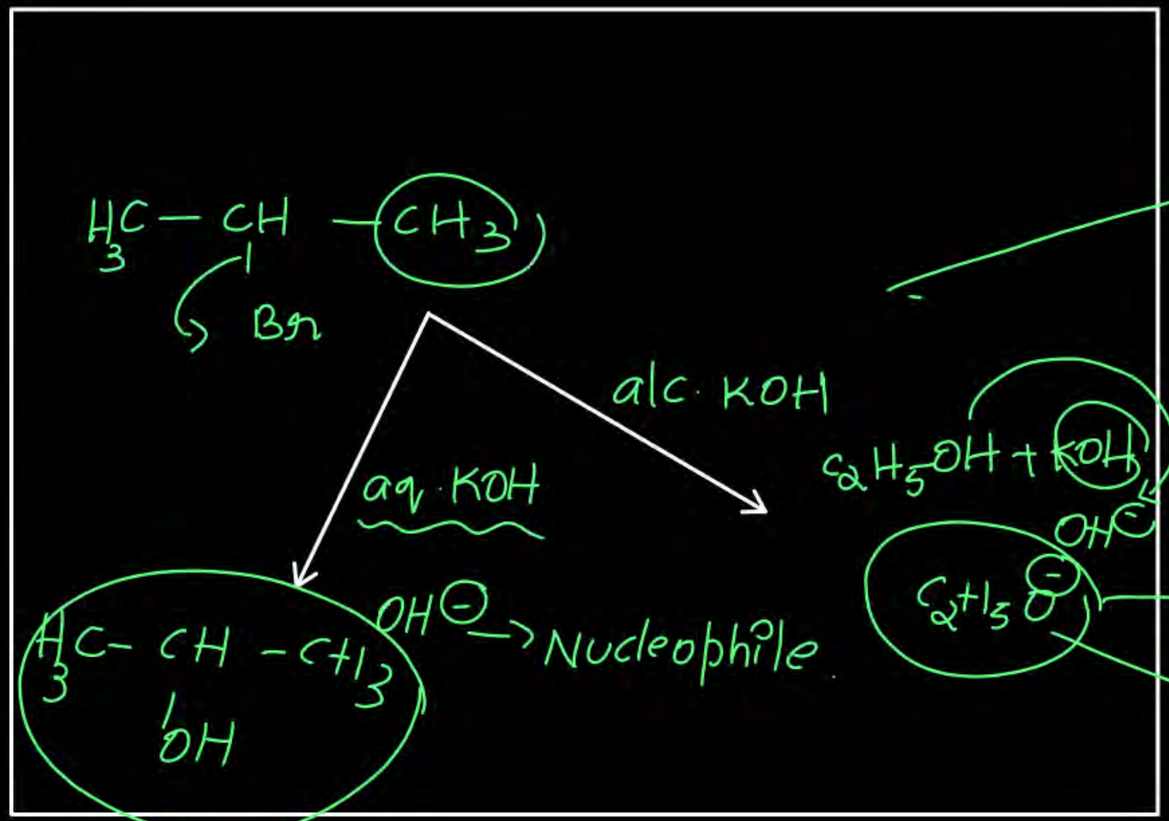


D









alc. KCN

CN^-

aq. KCN

OH^- CN^-

QUESTION

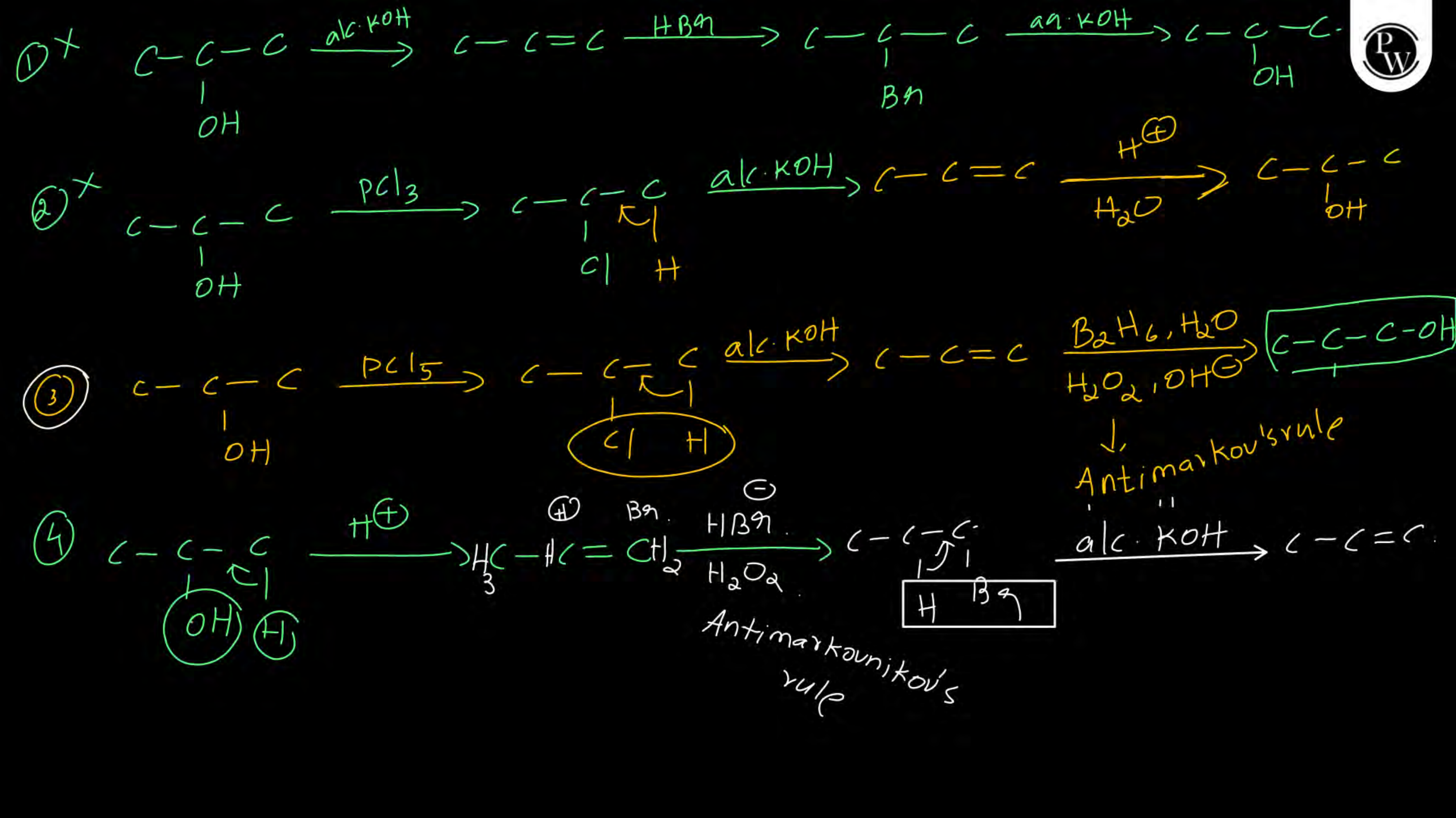
The steps involved in the conversion of propan – **2**- ol to propan-1-ol are in the order (2020)

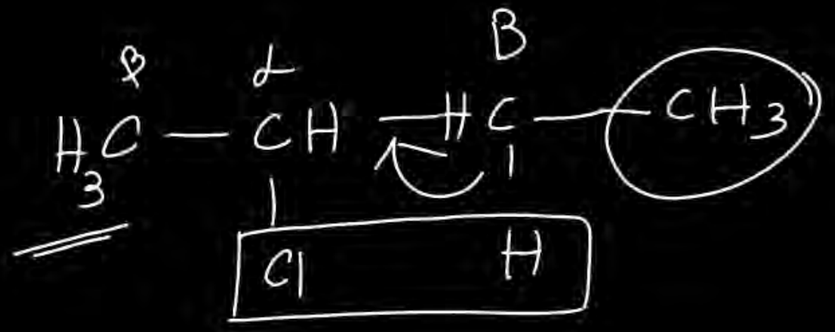
A dehydration, addition of HBr, heating with Aq. KOH

B heating with PCl_3, heating with alc KOH, acid catalysed addition of water

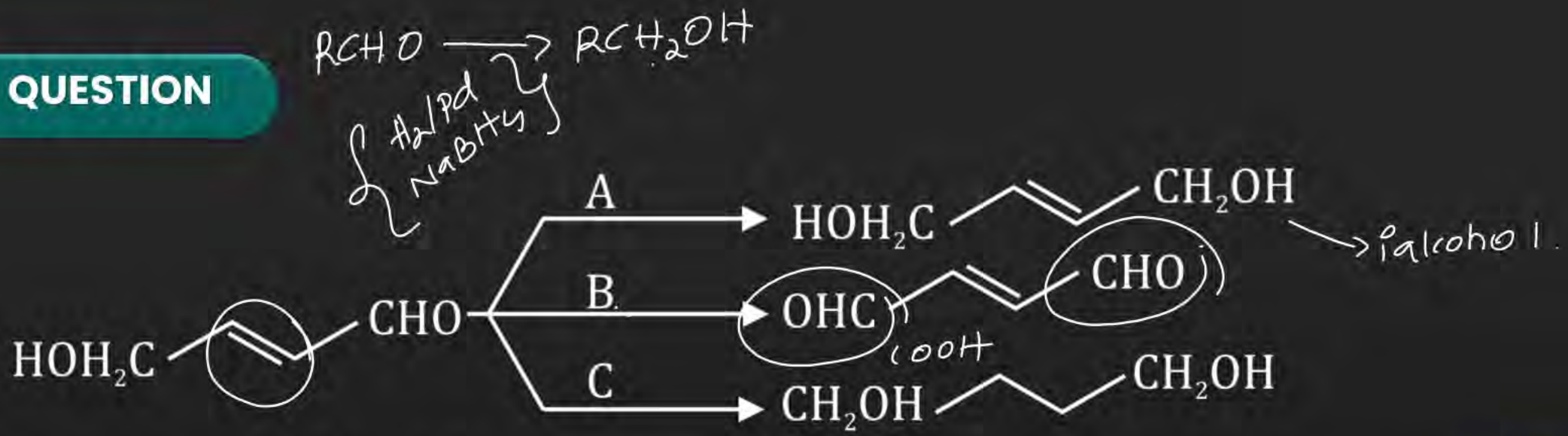
C heating with PCl_5, heating with alc KOH, hydroboration oxdation

D dehydration, addition of HBr in presence of peroxide. heating with alc. KOH

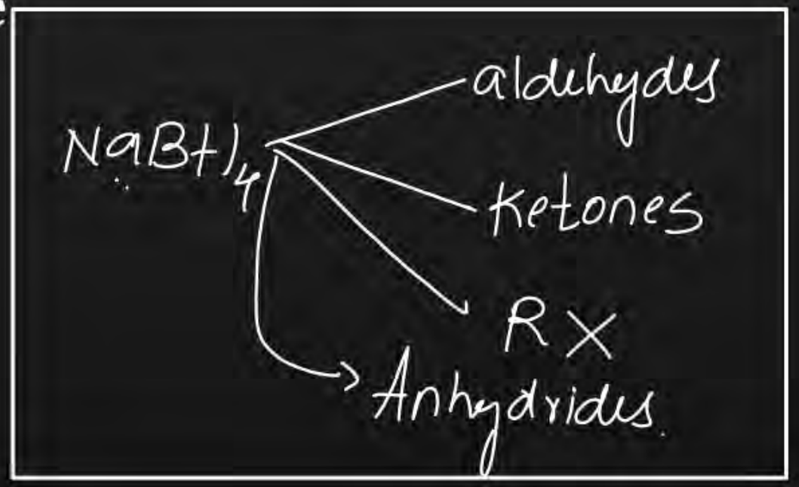

① X
alc. KOH
HBr
aq. KOH
OH
Br
② X
PCl3
alc. KOH
H⊕
H2O
Cl
H
③
PCl5
alc. KOH
B2H6, H2O
H2O2, OH⊖
Antimarkovnikov's rule
④
H⊕
Br
HBr
H2O2
Antimarkovnikov's rule
alc. KOH
OH
H
H
Br


β
α
B
H3C
CH
HC
CH3
Cl
H

QUESTION



The reagents A,B and C respectively are (2019)



A H_2/Pd, PCC. $NaBH_4$

B $NaBH_4$, alc. KOH, $KMnO_4$, H_2/Pd

C $NaBH_4$, PCC, H_2/Pd.

D H_2/Pd, alk, $KMnO_4$, $NaBH_4$

QUESTION

Power alcohol is a mixture of (2013)

A 80% petrol +20% ethanol + small quantity of benzene

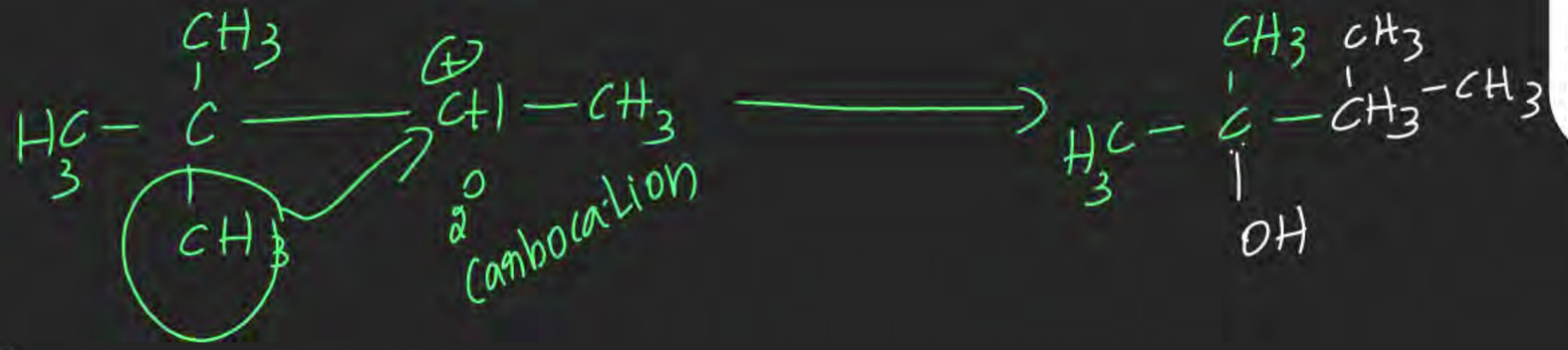
B 80% ethanol +20% benzene + small quantity of petrol

C 50% petrol +50% ethanol + small quantity of benzene

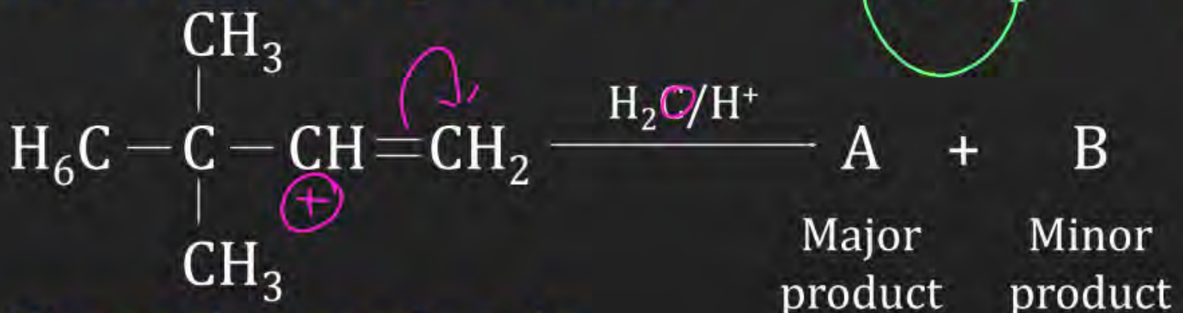
D 80% petrol +20% benzene + small quantity of ethanol

(This mixture is commonly used as an alternative fuel, where ethanol acts as a renewable additive to petrol, improving combustion and reducing carbon monoxide emissions. The small quantity of benzene is added to enhance the mixture's volatility and engine performance.)

Question



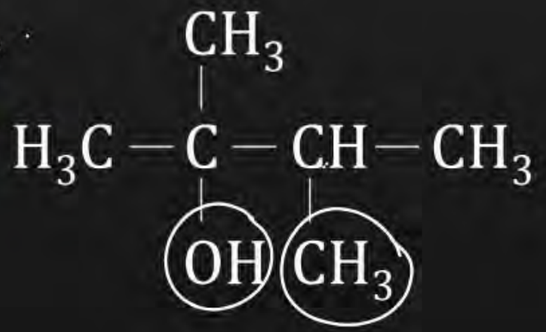
In the following reaction



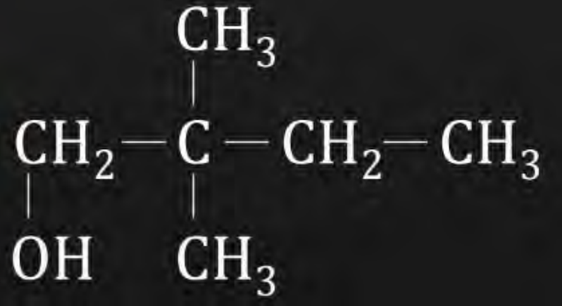
The major product is

[NCERT (New) Pg. 313, AIPMT 2012]

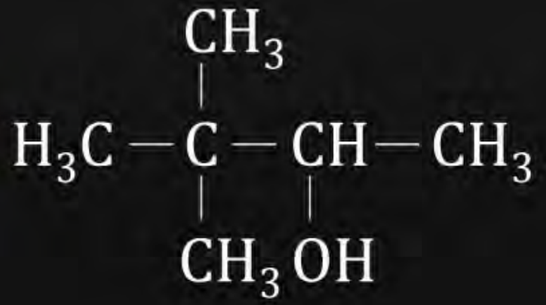
A



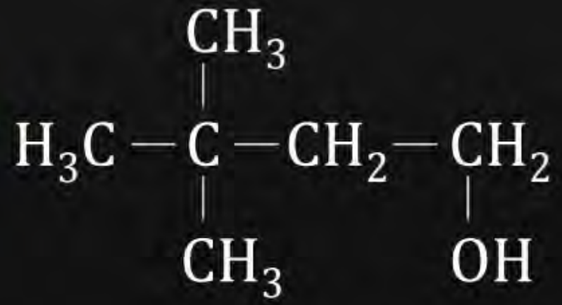
B



C



D

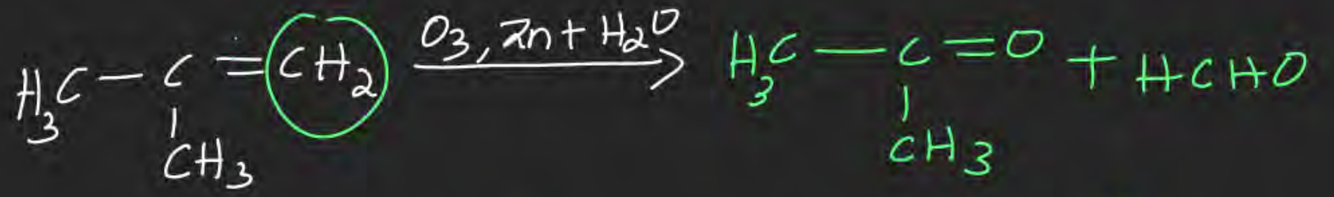


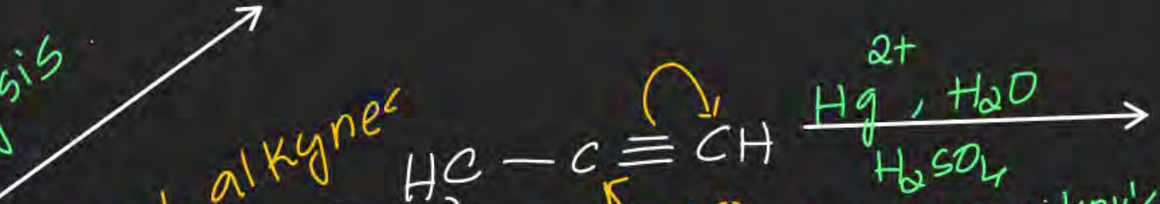
Aldehydes ketones carboxylic acids

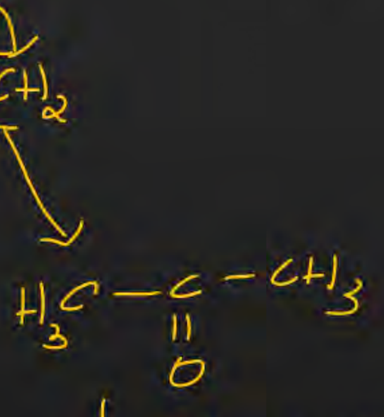
Synopsis

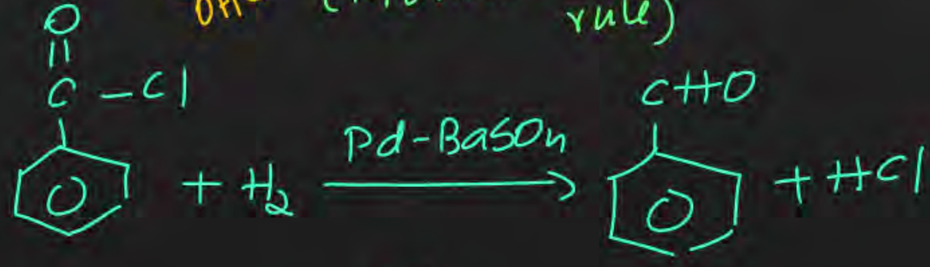
Methods of Preparation of Aldehyde & Ketones

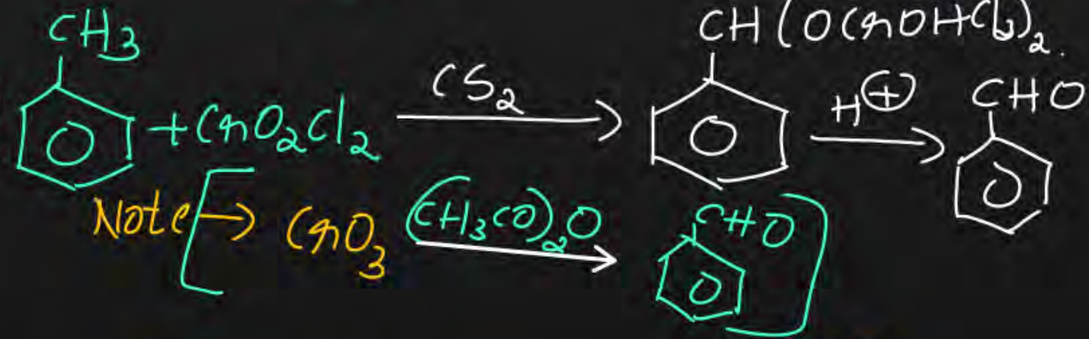
- Ozonolysis
- Hydration of alkyne
- Rosenmund
- Etard reaction (hydrocarbon)
- Gattermann-koch reaction
- From hydrocarbon

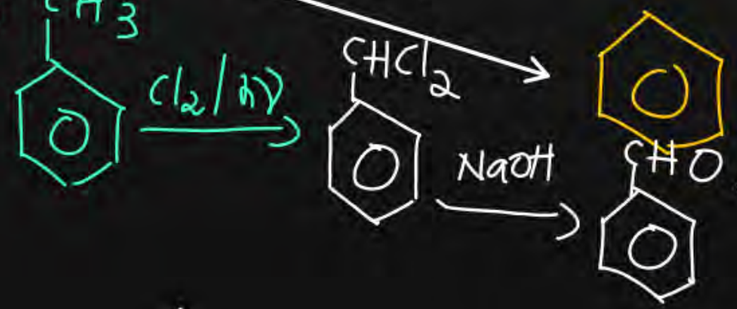


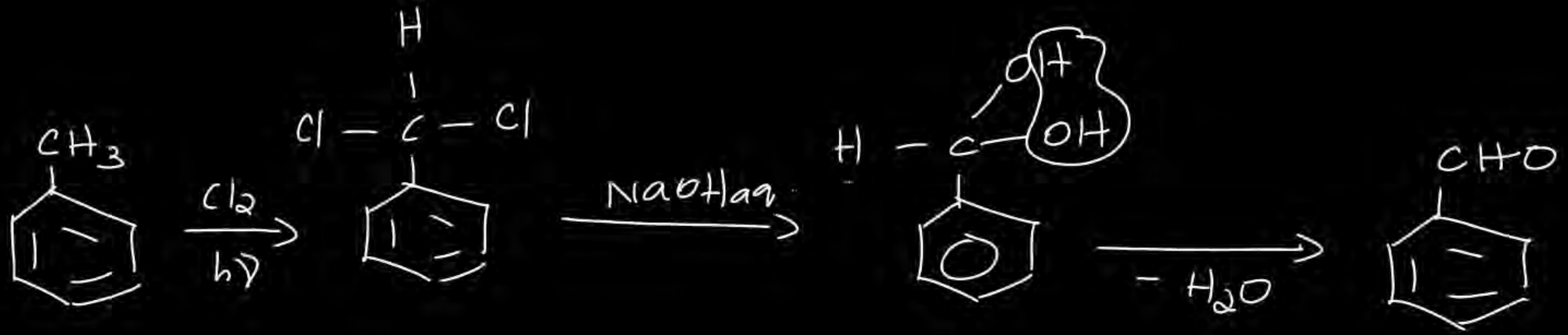











CH3
Cl2
hν
H
Cl – C – Cl
NaOH aq.
H – C
OH
OH
– H2O
CHO

Synopsis

DiBAL-H

Diisobutyl Aluminium hyaride.

Methods of Preparation of Aldehyde & Ketones

Stephen's reaction

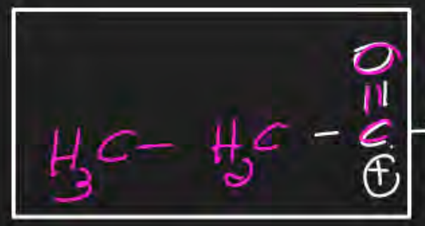
$$H_3C-C\equiv N \xrightarrow{SnCl_2+HCl} H_3C-CH=NH \xrightarrow{H_3O^{\oplus}} H_3C-CHO$$

RCN + DiBAL-H

$$R-C\equiv N \xrightarrow{DiBAL-H} R-CHO$$

$$H_3C-CH=CH-C\equiv N \xrightarrow{DiBAL-H} H_3C-CH=CH-CHO$$

Ester + DiBAL



$$\xrightarrow{DIBAL-H} H_3C-CH_2-\overset{O}{\overset{\|}{C}}-H + HOCH_3$$

Oxidation of alcohols

(1° alcohol)

$$R-CH_2OH \longrightarrow RCHO$$

$$R-\underset{OH}{\underset{|}{CH}}-R \longrightarrow R-\overset{O}{\overset{\|}{C}}-R$$

2° alcohol → ketone

($K_2Cr_2O_7/KMnO_4/CrO_3-H_2SO_4$)

Cu/573 K

DIBAL-H

Nitrile (CN) & ester to aldehyde.

→ can not reduce double bond.

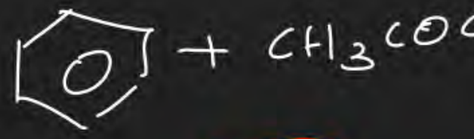
Synopsis

Methods of Preparation of Aldehyde & Ketones

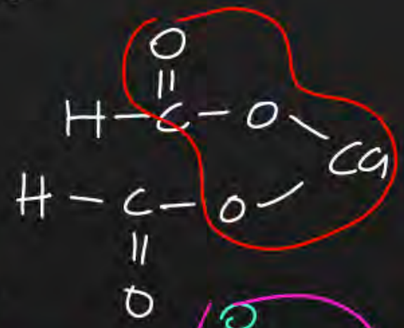
- $RMgX + CdCl_2$
- $R_2Cd + RCOCl$
- Friedel craft acylation
- Distillation of calcium formate or calcium ethanoate.
- Grignard reagent + RCN

$CdCl_2 + R\overset{\oplus}{M}g\overset{\ominus}{X} \longrightarrow R_2Cd + MgClX$

$R_2Cd + R-\underset{\underset{O}{\|}}{C}-Cl \longrightarrow R-\underset{\underset{O}{\|}}{C}-R$



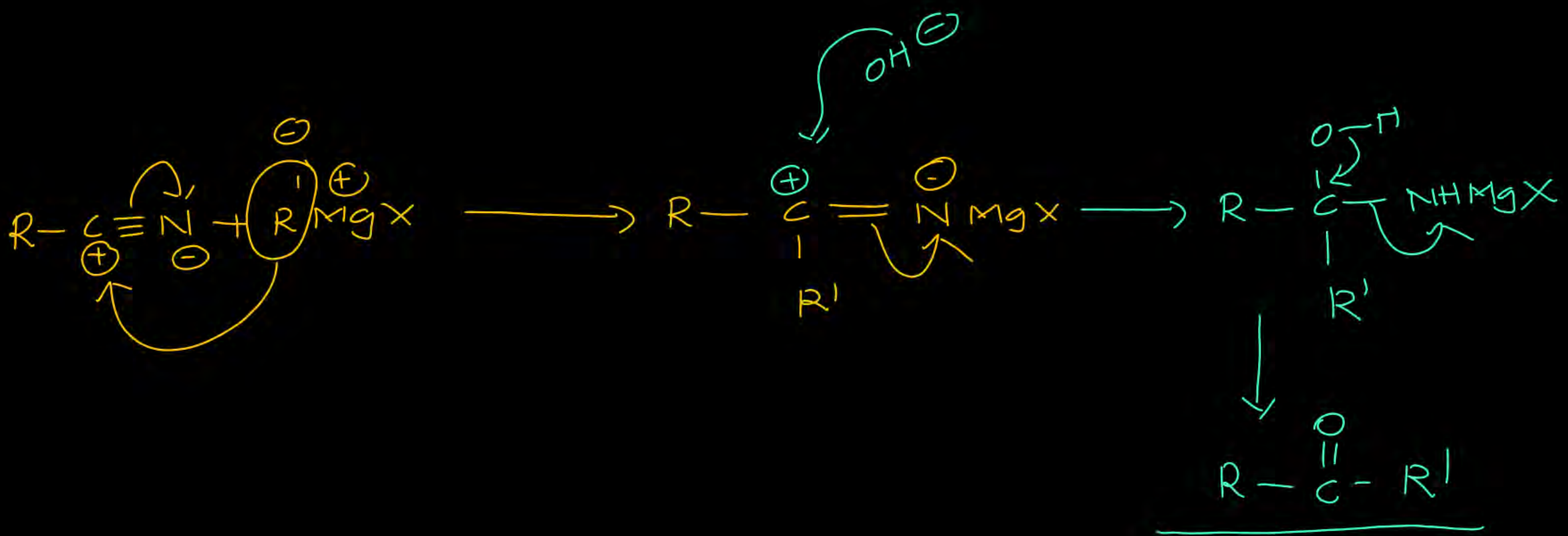
Acetophenone.



$H-\underset{\underset{O}{\|}}{C}-H + CaCO_3$

$H_3C-\underset{\underset{O}{\|}}{C}-CH_3 + CaCO_3$

$R\cdot MgX + R-C\equiv N \longrightarrow R-\underset{\underset{N(MgX)}{|}}{\overset{\overset{R}{|}}{C}}=N \xrightarrow{H_3O^{\oplus}} R-\underset{\underset{O}{\|}}{C}-R$


R— C ≡ N + R MgX
OH⊖
R— C = N MgX
R'
R— C — NHMgX
O—M
R'
R— C — R'
O

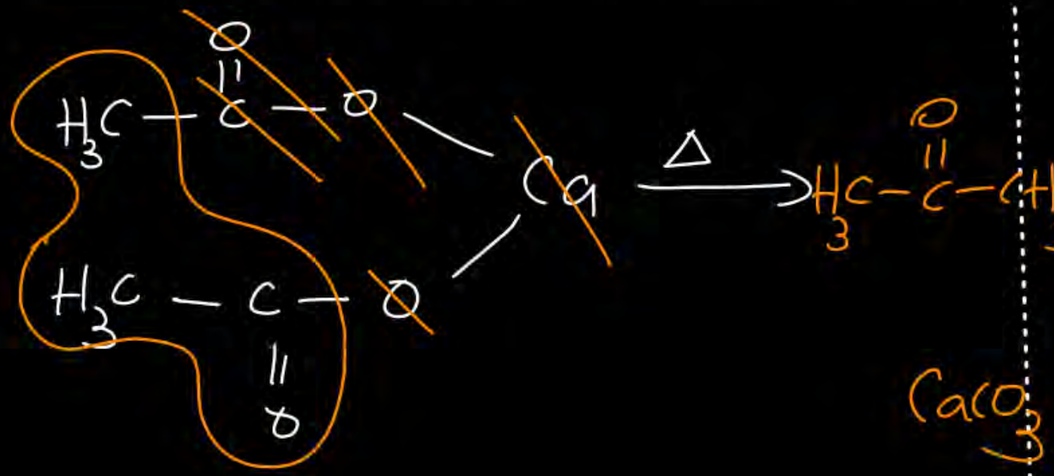
Extra

$HCOOH$

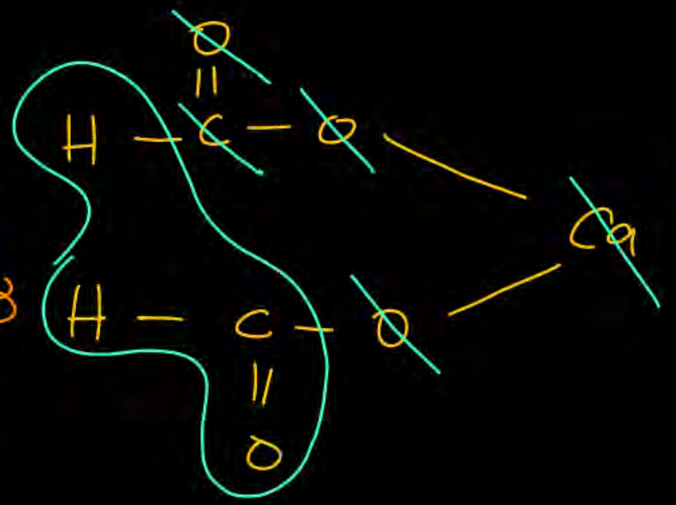
$HCOO^{\ominus} + Ca^{2+} \longrightarrow$ $(HCOO)_2Ca$

CH_3COOH

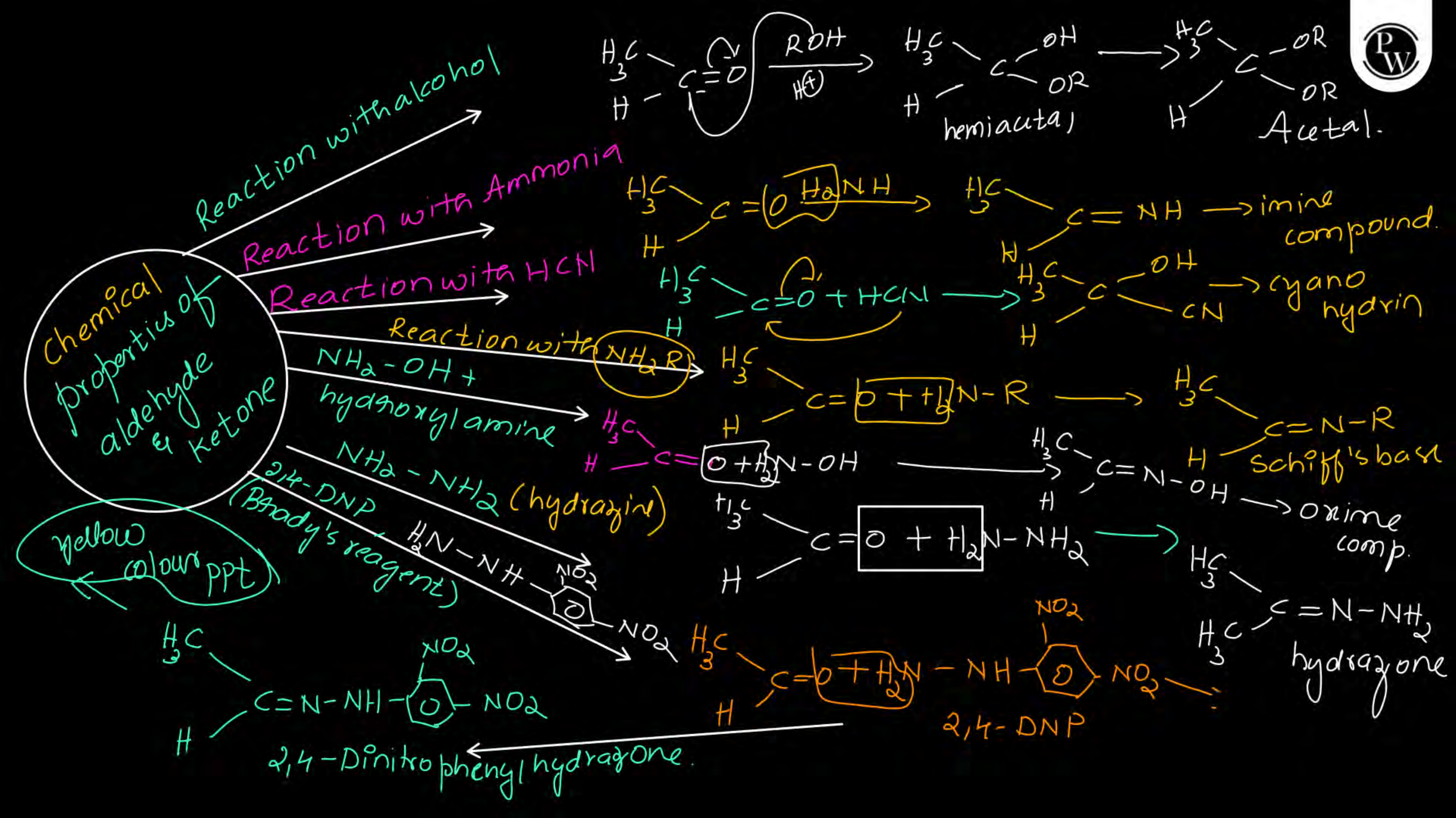
$CH_3COO^{\ominus} + Ca^{2+} \longrightarrow (CH_3COO)_2Ca$



$\xrightarrow{\Delta}$ $H_3C-\overset{O}{\overset{\|}{C}}-CH_3$ + $CaCO_3$

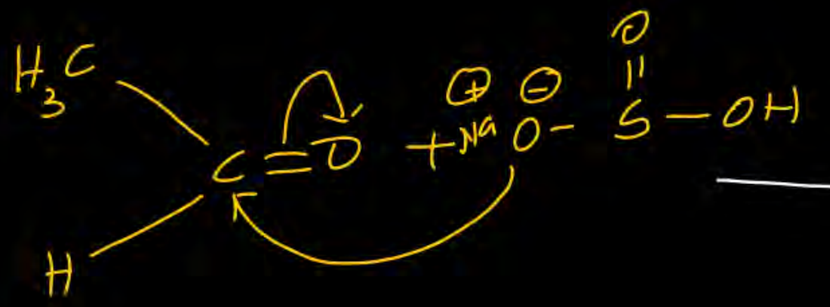


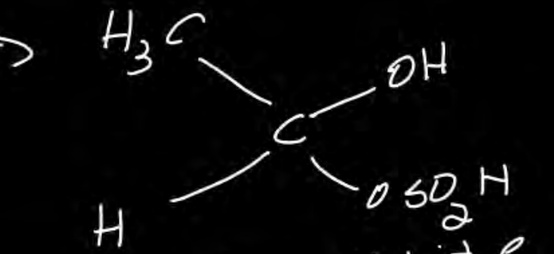
$\xrightarrow{\Delta}$ $H-\overset{O}{\overset{\|}{C}}-H + CaCO_3$


Chemical properties of aldehyde & ketone
Reaction with alcohol
Reaction with Ammonia
Reaction with HCN
Reaction with NH2R
NH2-OH + hydroxylamine
NH2-NH2 (hydrazine)
2,4-DNP (Brady's reagent)
yellow colour ppt
ROH
H(+)
hemiacetal
Acetal.
imine compound.
cyano hydrin
Schiff's base
oxime comp.
hydrazone
2,4-DNP
2,4-Dinitrophenyl hydrazone.

Chemical properties of aldehyde & ketone

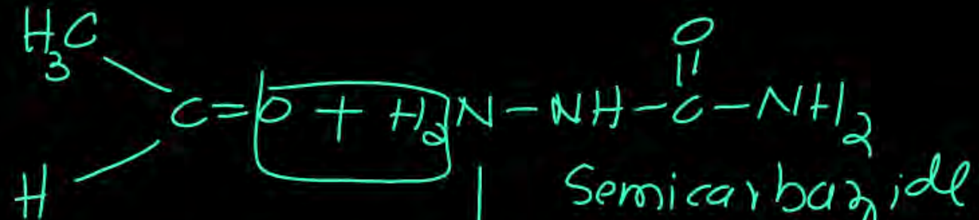
$NaHSO_3$



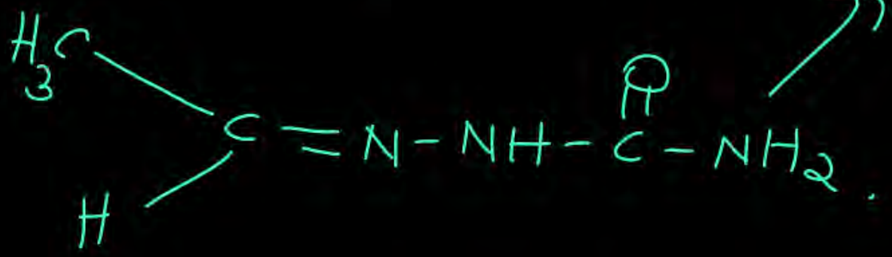


Sodium bisulphite addition compound.

$NH_2-NH-C(=O)-NH_3$



Semicarbazide



Semi carbazone.

Thank you