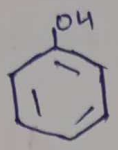
Alc., Phenol, Ether

Alc.

$R - \underset{\text{F.G}}{OH}$ Alc.

Phenol.



Ether.

$R - O - R$

Eg: $CH_3 - O - CH_3$.

* Classifications :- (Alc.)

① on the basis of no. of OH-groups.

a) Mono Alcohol (hydric)

$CH_3 - CH_2 - OH$.

b) Di hydric

2 - OH.

- Vicinal di hydric
  - पड़ोसी के C → 2 OH.
  - Glycol
  - Eg: $CH_2(OH) - CH_2(OH)$
- α,ω-diol hydric
  - 1st & last C पे OH.
  - $CH_2(OH) - CH_2 - CH_2 - CH_2(OH)$
- * Gem dihydric
  - * Unstable
  - $CH_3 - CH(OH)_2 \rightarrow CH_3 - CHO$
  - Aldehyde

NOTE: 2 hydric group in 1 C are not stable and they convert into aldehyde / Ketone.

c) Tri hydric

Glycerol

$CH_2(OH) - CH(OH) - CH_2(OH)$

(2) On the basis of Sp^3 Carbon.

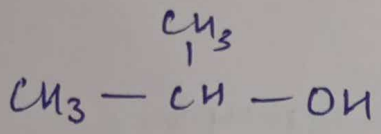
a) Methyl Alcohol

$CH_3 - OH$

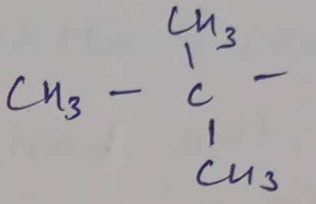
b) Primary Alcohol
1° Alcohol.

$CH_3 - CH_2 - OH$

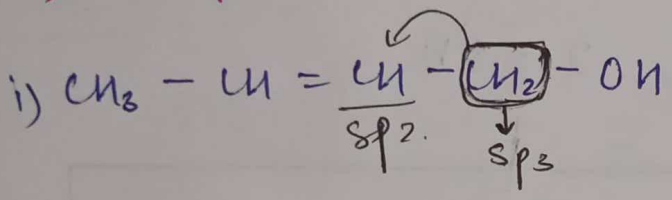
c) Sec Alcohol
2° Alc



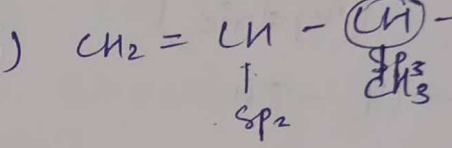
d) Ter - Alcohol
3° Alc.



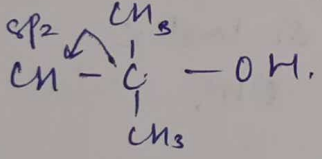
e) Allylic Alcohol.

i) 

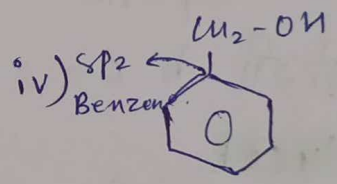
Primary Allylic Alc.

ii) 

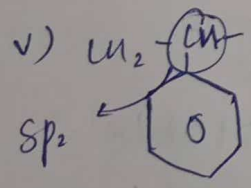
Sec Allylic Alco

iii) 

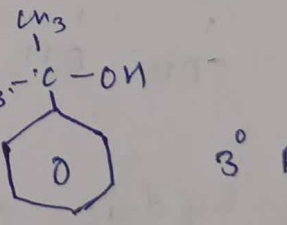
3° Allylic OH.

iv) 

1° Benzylic OH.

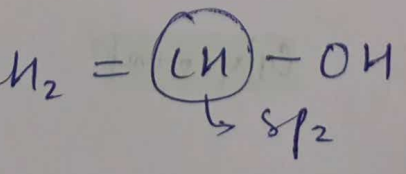
v) 

Benzylic 2°

vi) 

3° Benzylic Alc

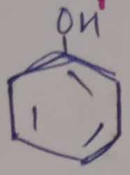
(3) On the Basis of SP_2 Carbon:

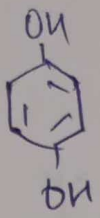
(a) Vinylic : 

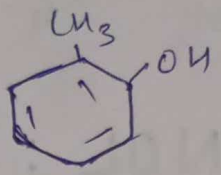
(b) Aryl Alc. does not exist as it has name Phenol seperate group.

*Classification: (Phenol)

(a) Monophenol.

i)  Monophenol.





* Classification. (Ether)

Symmetrical.

$CH_3 - O - CH_3$

$C_6H_5 - O - C_6H_5$

Mixture / Assymetrical.

$CH_3 - O - C_2H_5$

$C_6H_5 - O - CH_3$

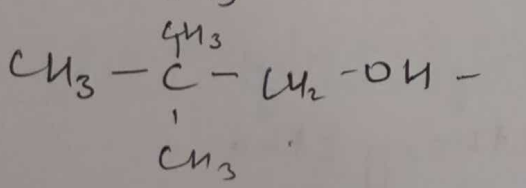
IUPAC NAME

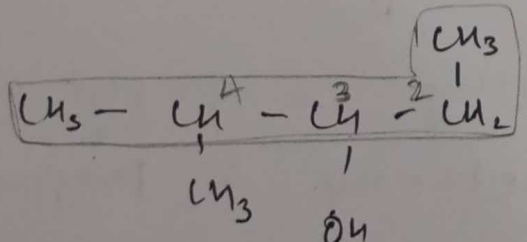
*Alcohol.
*F.G $-OH$, ol.

→ longest chain of C.
↳ OH nearby.

(1) $CH_3 - OH$ — Methanol.

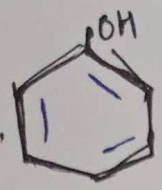
(2) $CH_3 - CH_2 - OH$ - Propan - 2 - ol

(3)  2, 2 Dimethyl propanol

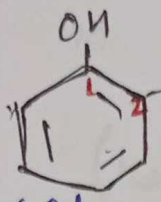
(4)  - 4 Methyl pentan 2-3-diol.

(5) $CH_2(OH)-CH(OH)-CH_2(OH)$ ⟶ Propan - 1, 2, 3 Tri-o

PHENOL :

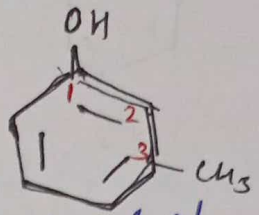
1) 

Phenol

2) 

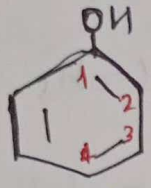
O-cresol.

2 Methyl phenol.

3) 

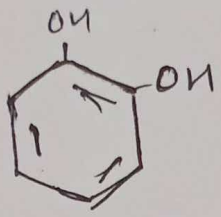
m-cresol

3-Methyl phenol

4) 

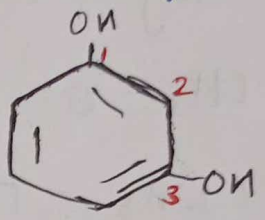
P-cresol

4-methyl phenol.

5) 

Benzene-1,2-diol

Catechol

6) 

Benzene-1,3-diol Rasorinol

7) 

Benze 1, 4 di-ol

Hydroquinone.

ALKANE / ALKENE (Ether)

(1) CH_3-O-CH_3 – Dimethyl Ether

Methoxy methane.

(2) $CH_3-O-CH_2-CH_3$ – Methyl Ethyl Ether.

Methoxy Ethane.

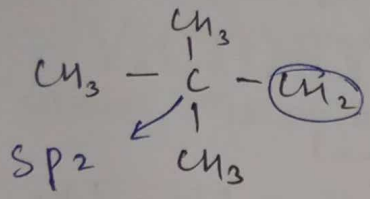
(3) $CH_3-O-CH(CH_3)-CH_3$ Methyl - 2 - propyl Ether

Methoxy - 2 - Propane.

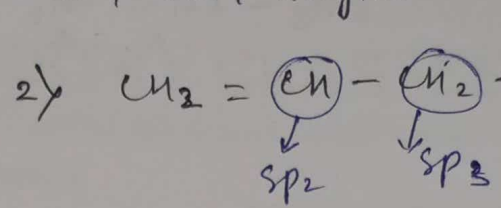
(4) $CH_3-CH_2-O-CH(CH_2-CH_3)-CH_3$ Ethyl - 2 - butyl ether

Ethoxy - 2 - butane.

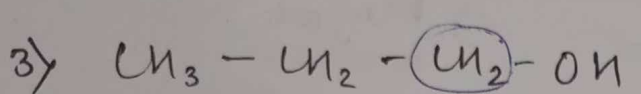
Classify the alcohol Pri / sec / Ter / Allylic / vinylic etc.

1) 

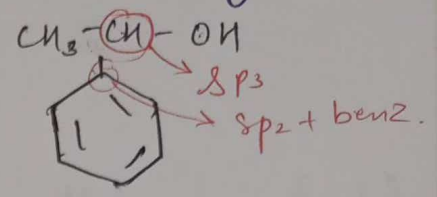
Primary Alc.

2) 

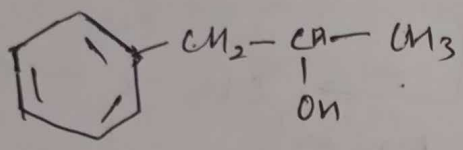
Allylic Primary Alc.

3) 

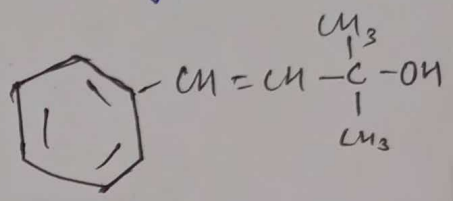
Primary Alc.

4) 

Benzylic sec Alc.

5) 

Sec. Alc.

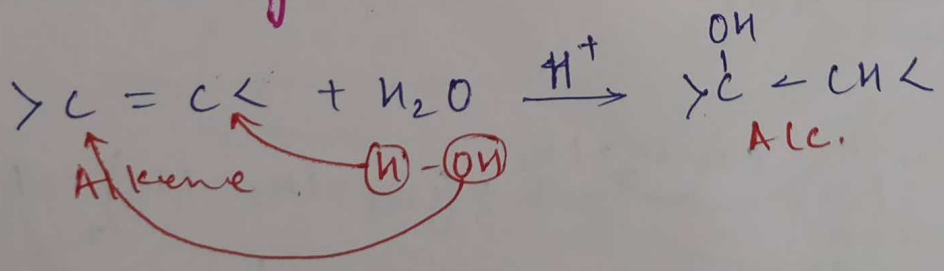
6) 

Ter / Allylic.

METHOD OF PREPRATION.

(1) From Alkene.

a) Acid catalysis of Alkene :-

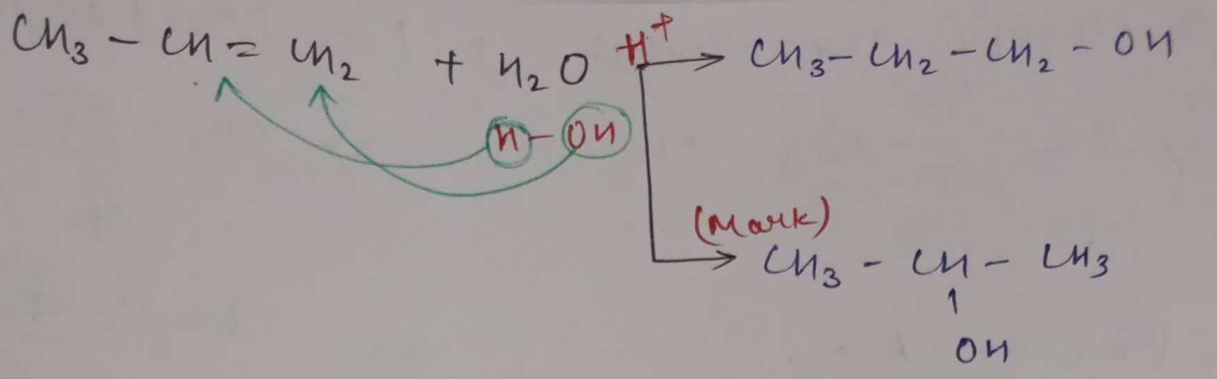


*Addition Reaction.

Follows Markovnikov addition:-

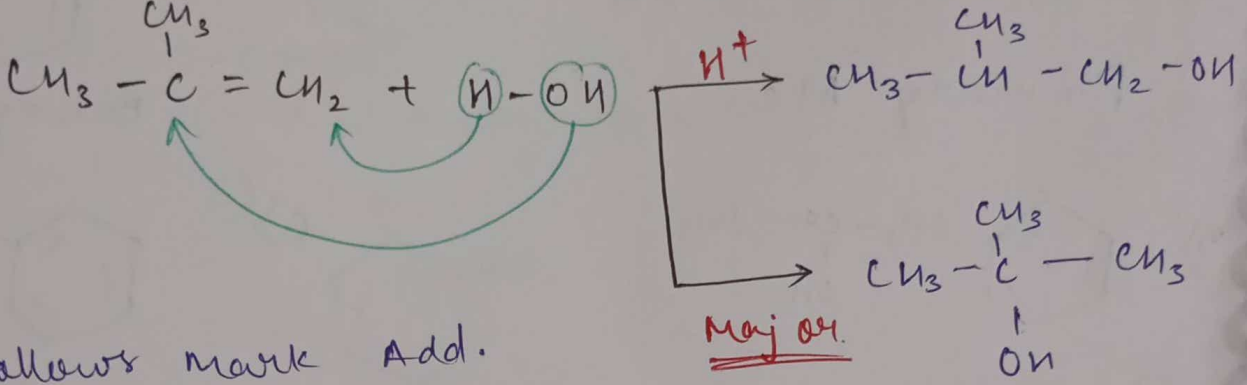
1. H → more H
2. OH → less H.
3. Intermediate → Carbocation.

Eg. 1



⇒ Major.

Eg. 2

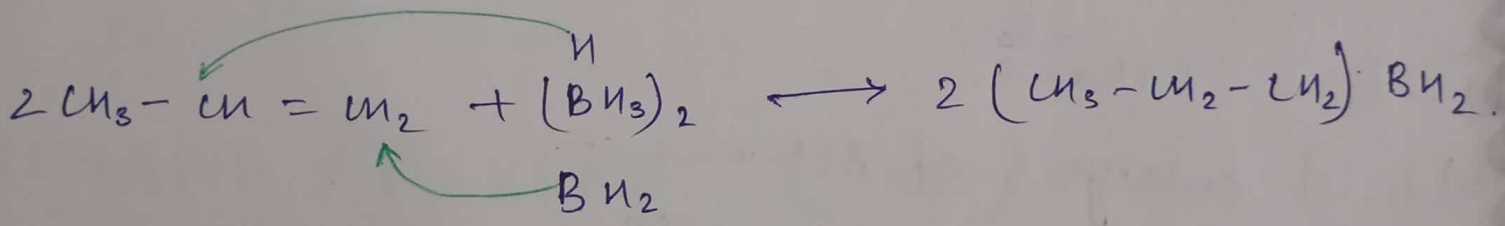


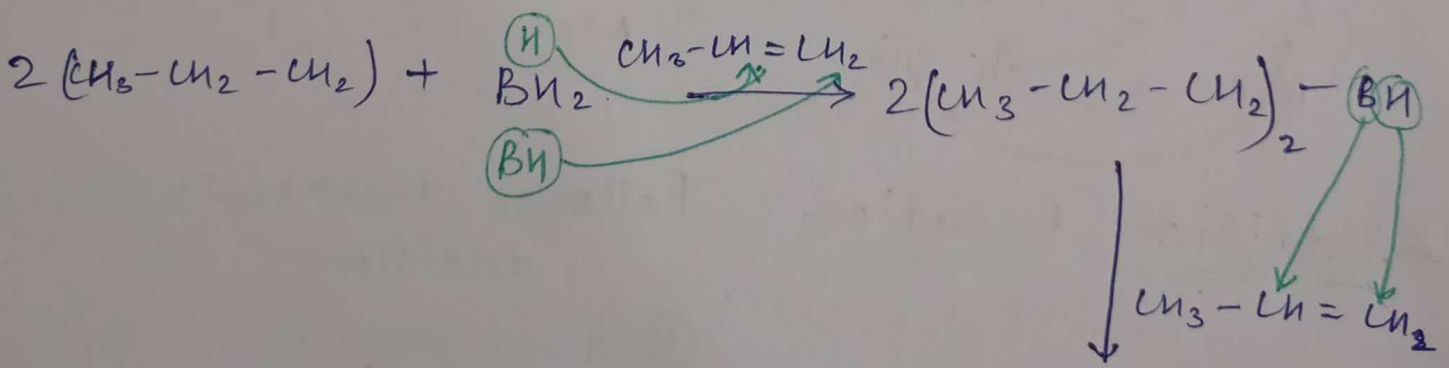
Major.

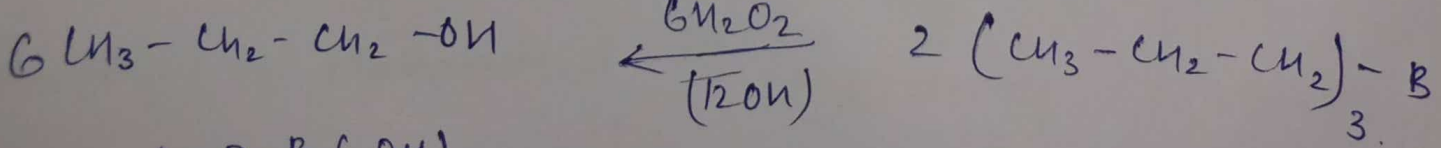
* It follows mark Add.

b) From Hydro Boration of Alkene.

$$B_2H_6 \rightarrow (BH_3)_2.$$







VICTORY ZONE CHEMISTRY CLASSES

ADDRESS – 1ST FLOOR PRADEEP PLAZA, IN FRONT OF CHOPRA PALACE , ADARSH NAGAR DURG

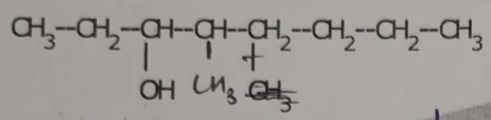
MO 9424168056,8269055301

CBSE TEST PAPER-01

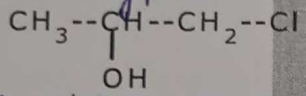
CLASS - XII CHEMISTRY (Alcohols, phenols and Ethers)

Topic:- Nomenclature.

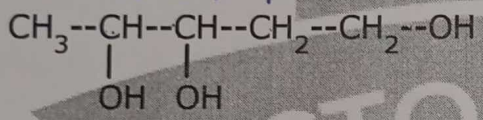
1. Write IUPAC names of :-

i. 

4 Methyl octan-3-ol.

ii. 

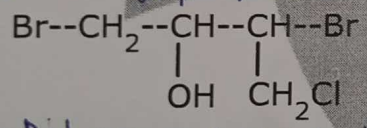
1-chloro propan-2-ol

iii. 

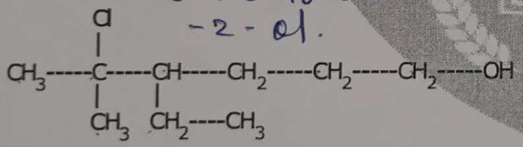
Pentan-1,3,4-triol.

iv. $(CH_3)_3COH$

2 Methyl propan-2-ol.

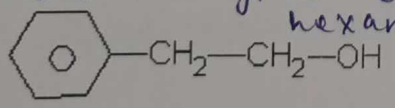
v. 

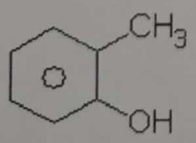
1,3-Dibromo 4 chloro butane

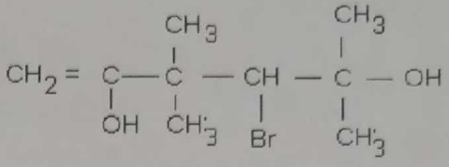
vi. 

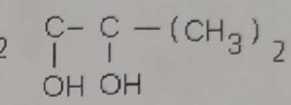
-2-ol.

5-chloro-4-ethyl-5 methyl hexan-ol

vii. 

viii. 

ix. 

x. 

2. Write structural formula and give IUPAC names :-

i. Benzyl Alcohol

ii. Ethylene Glycol

iii. Glycerol

iv. m- cresol

v. 

vi. Ethylphenylether

vii. Methylpropylether

viii. Anisole

ix. Isopropyl methylether

x. Phenetole

TRICK

Anti Markovnikov Rule → When Peroxide H_2O_2

(1) H → less H

(2) OH → more H.

(3) Carbon free Radical

eg: $CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2 + B_2H_6 \xrightarrow[2-OH.]{H_2O_2.} CH_3-\overset{CH_3.}{\overset{|}{CH}}-CH_2-OH$

less H. OH more H

eg: $CH_3-\overset{CH_3}{\overset{|}{CH}}-CH=CH_2 + B_2H_6 \xrightarrow[2-OH.]{H_2O_2} CH_3-\overset{CH_3.}{\overset{|}{CH}}-CH_2-\underset{OH}{\underset{|}{CH_2}}$

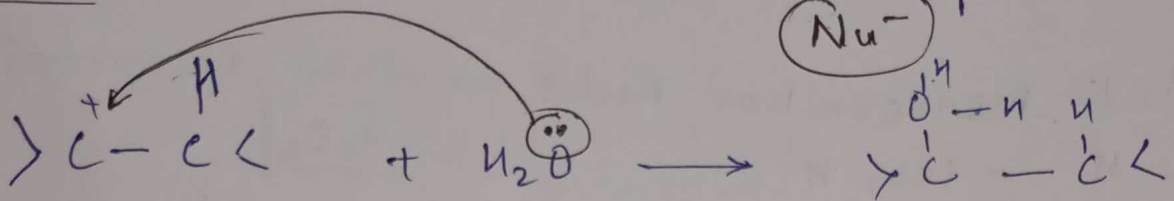
H less H OH more H

MECHANISM OF ACID CATALYSIS OF ALKENE

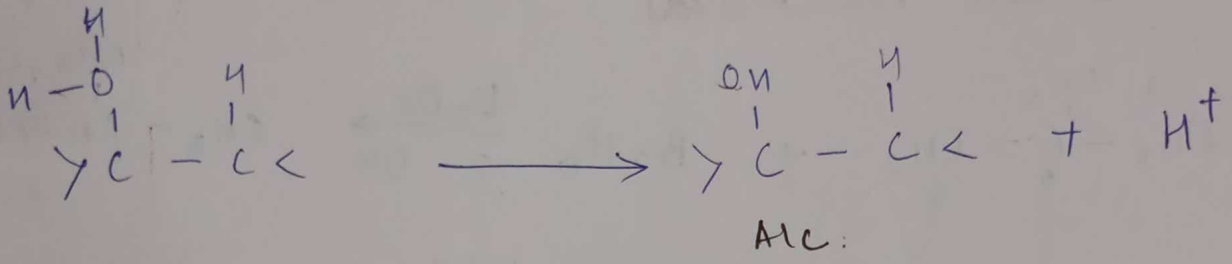
Step: 1 Addition of proton & generate Electrophile & Attacking of E^+ in Alkane.

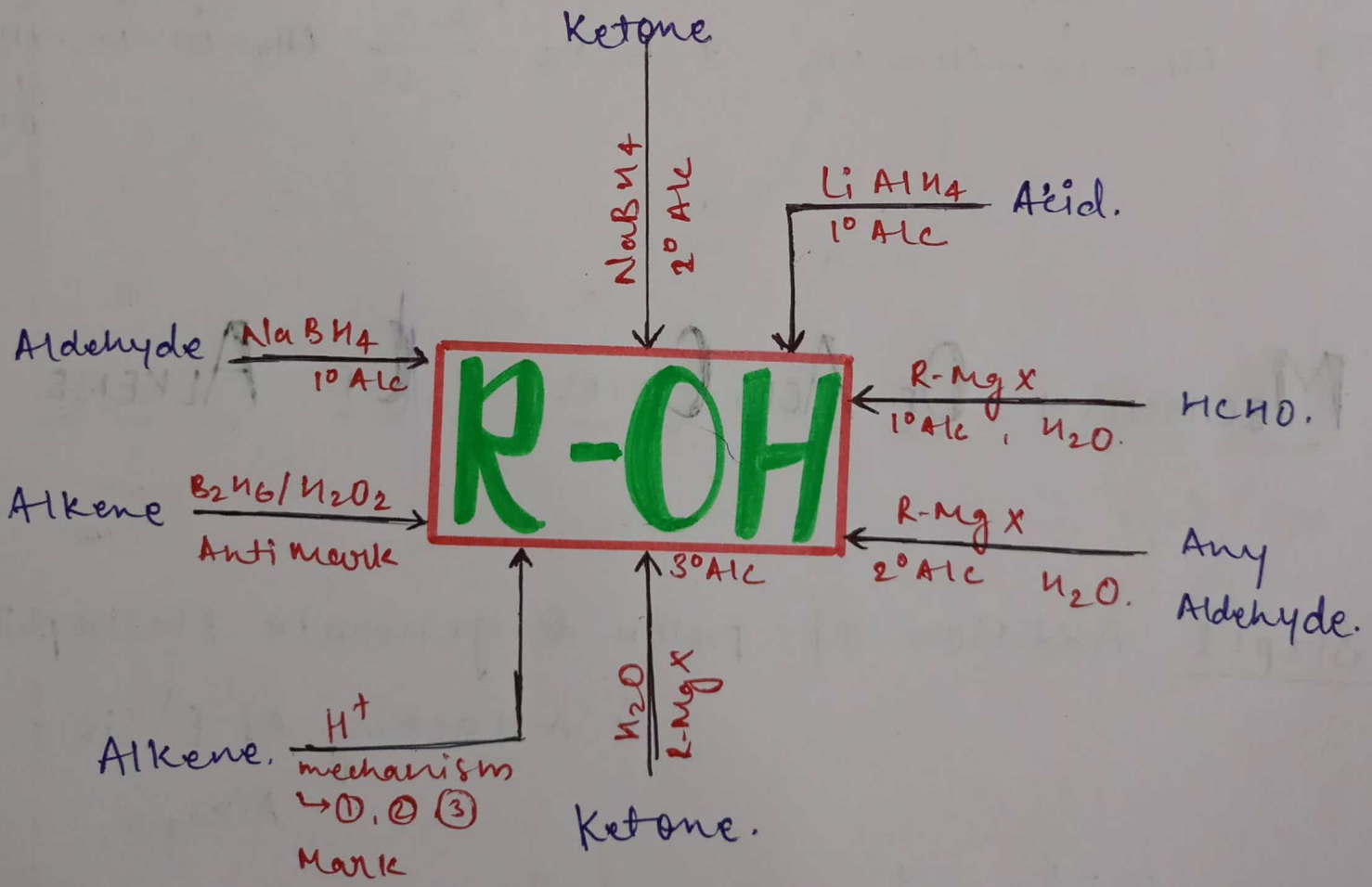
$H_2\ddot{O} + H^+ \longrightarrow H_3O^+$

Step - II Attacking of Nucleophiles :—



Step - III Removal of proton





REDUCTION:

① Pd/H_2 1 times $\longrightarrow$ 2H

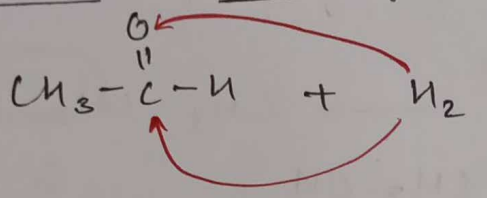
② $C_2H_5OH/Zn \longrightarrow$ 1 time $\longrightarrow$ 2H

③ Zn/Hg HCl $\longrightarrow$ 1 time $\longrightarrow$ 2H

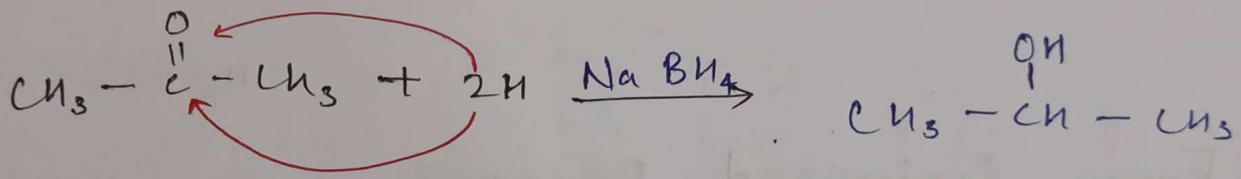
④ $NaBH_4 \longrightarrow$ 1 time $\longrightarrow$ 2H

⑤ $LiAlH_4 \longrightarrow$ 2 time $\longrightarrow$ 4H.

2.a From Carbonyl compounds.

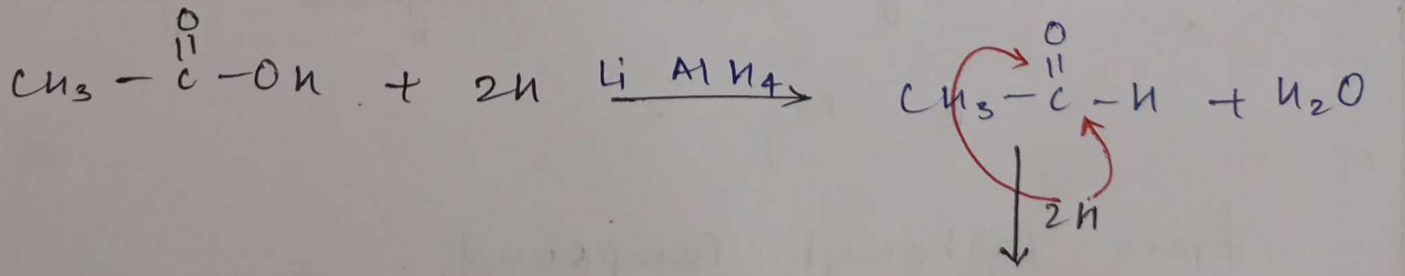
eg.1 

1° Alc

eg.2. 

2° Alc.

2.b From Acid.

eg.1 

$CH_3 - COOH + 4H \xrightarrow{LiAlH_4} CH_3 - CH_2 - OH.$

$CH_3 - CH_2 - COOH + 4H \xrightarrow{LiAlH_4} CH_3 - CH_2 - CH_2 - OH$

Commercialy Production.

① $CH_3-\overset{O}{\overset{\|}{C}}-OH + CH_3-OH \xrightarrow{H_2O}$ $CH_3-\overset{O}{\overset{\|}{C}}-O-CH_3$ + CH_3-OH.

Acid — ester.

$CH_3-\overset{O}{\overset{\|}{C}}-O-CH_3 \xrightarrow[\text{Catalyst}]{H_2} CH_3-\overset{O}{\overset{\|}{C}}-H \xrightarrow[\text{Catalyst}]{H_2} CH_3-CH_2-OH$

② $CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-COOH \xrightarrow{LiAlH_4} CH_3-CH_2-\underset{CH_3}{\underset{|}{C}}-CH_2-OH$

$CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-COOH \xrightarrow{CH_3-OH} CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-CO-CH_3 \xrightarrow{-CH_3-OH} CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-CHO$

$CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-CHO \xrightarrow{} CH_3-CH_2-\underset{CH_2}{\underset{|}{CH}}-CH_2-OH$

c) From Grignard Reagent.

$R-X + Mg \xrightarrow[\text{ether}]{\text{dry}} R-Mg-X$

Grignard Reagent.

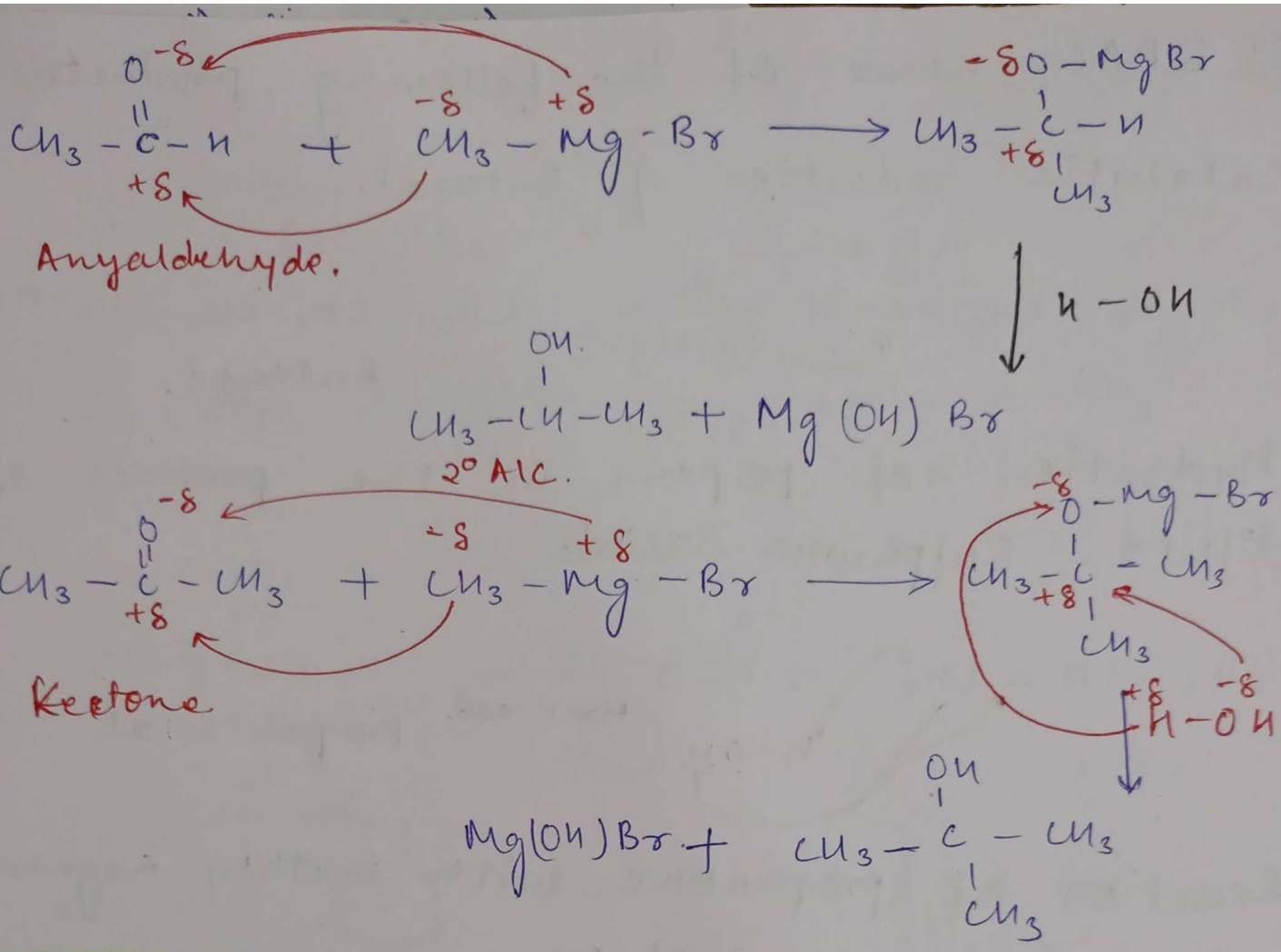
$R^{-\delta}-Mg^{+\delta}-X^{-\delta}$

From Carbonyl Compound.

$H-\overset{O}{\overset{\|}{C}}-H + CH_3-Mg-Br \longrightarrow$ [Adduct] $\xrightarrow{H-OH}$ $CH_3-CH_2-OH + Mg(OH)Br$

Methanol

Formaldehyde 1° Alc



Example :

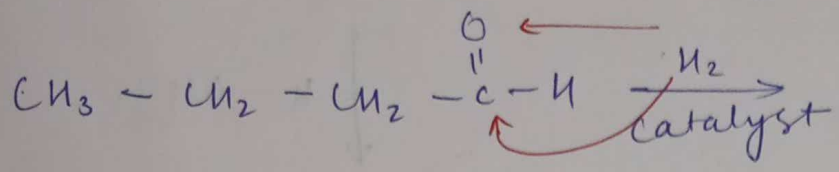
(1) Formaldehyde + R – Mg – X $\xrightarrow{H_2O}$ 1° Alc.

(2) Anyaldehyde + R – Mg – X $\xrightarrow{H_2O}$ 2° Alc.

(3) Ketone + R – Mg – X $\xrightarrow{H_2O}$ 3° Alc.

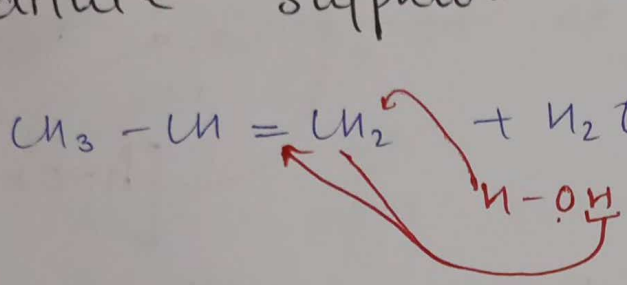
Q. IUPAC name of the following products:

(1) Catalytic reduction of Butanal.



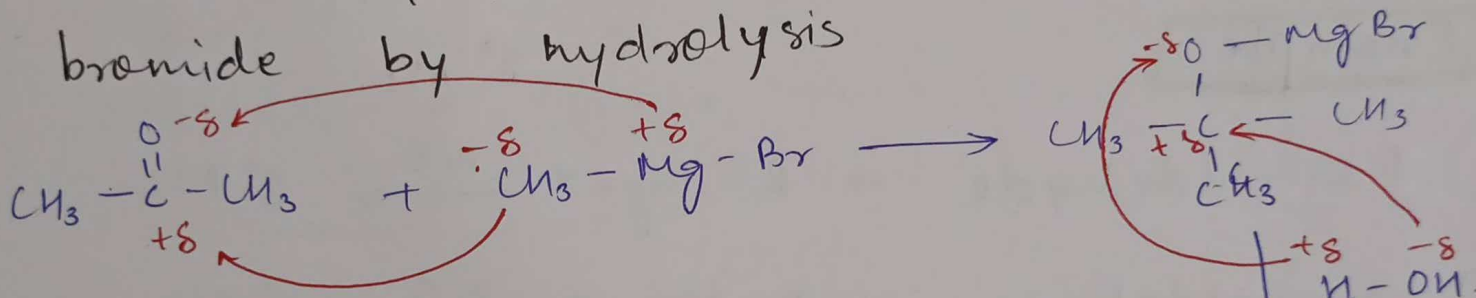
Butanol.

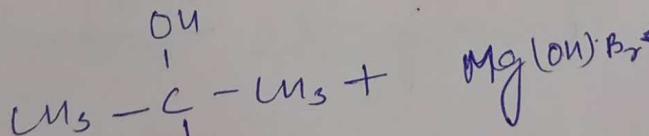
(2) Hydration of propene in the presence of dilute sulphuric acid.



Propan-2-ol.

(3) Reaction of propanone with methly magnesium bromide by hydrolysis

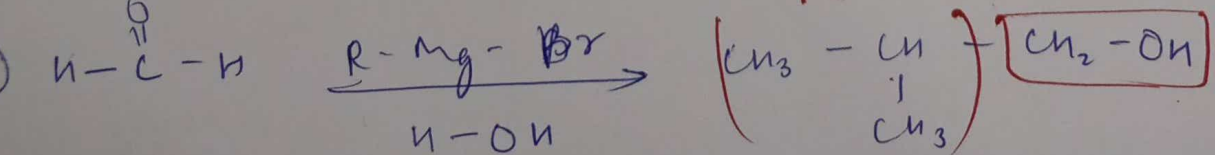


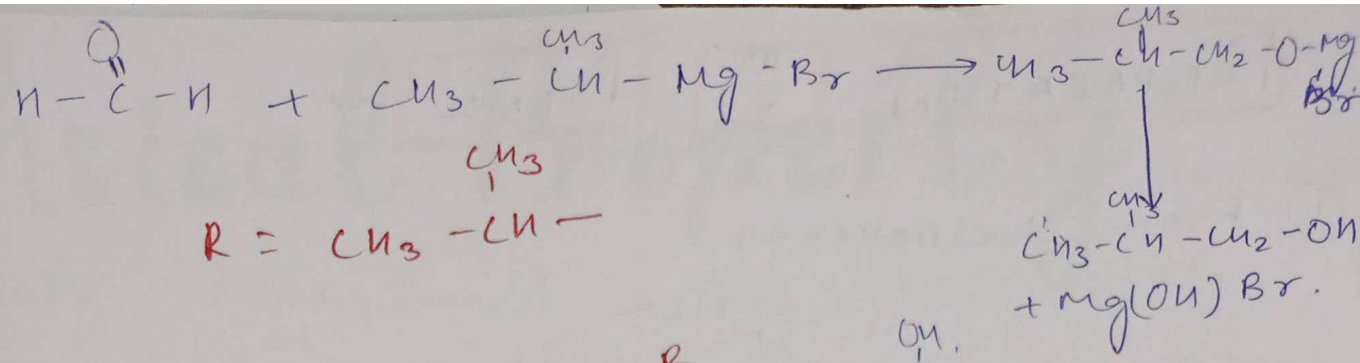


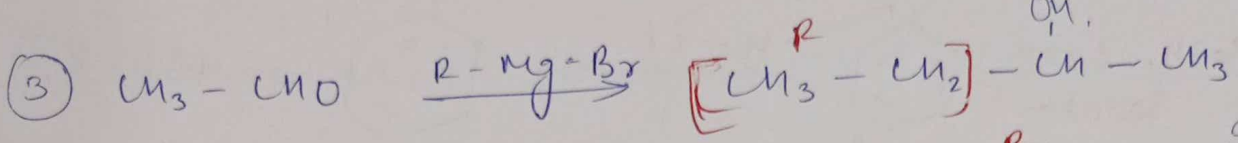
2 Methyl propan-2-ol.

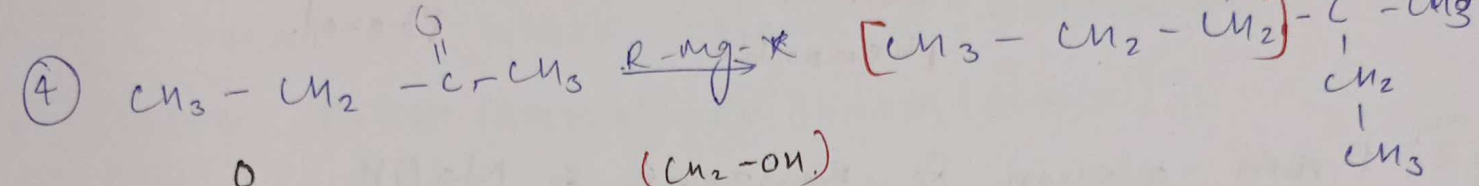
Q. The following alcohol from by which grignard reagent (Alkyl group) with Reaction with methanol.

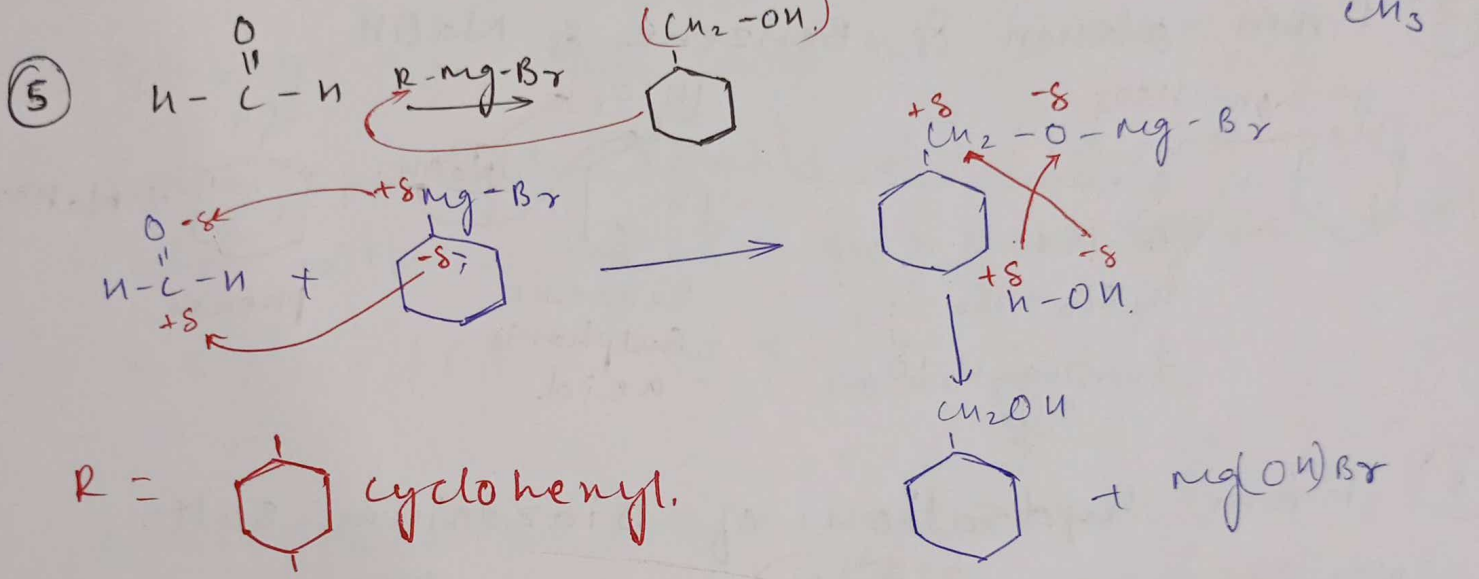
$R = CH_3 - CH(CH_3) -$

(1) 

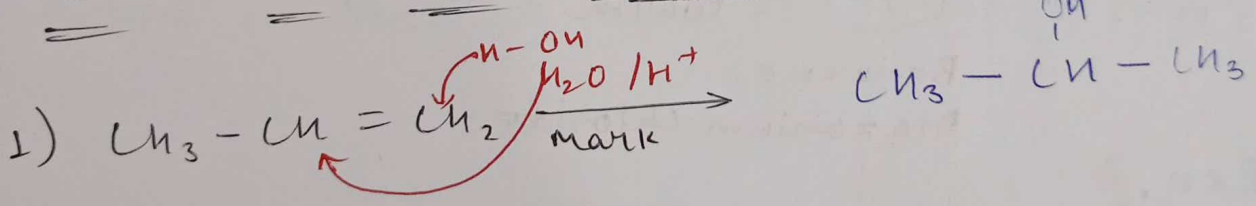
② 

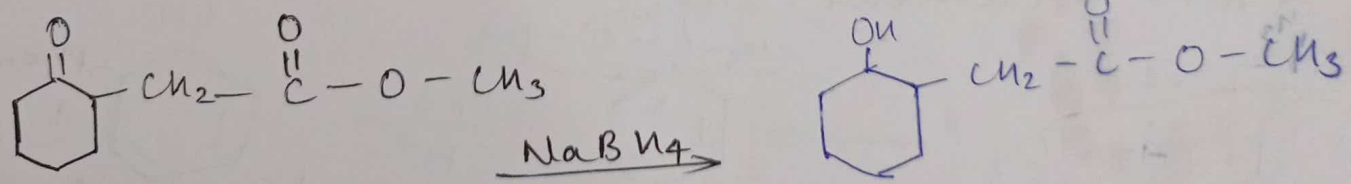
③ 

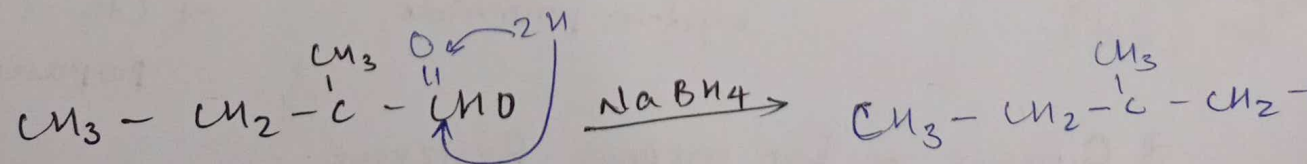
④ 

⑤ 

What is the product?

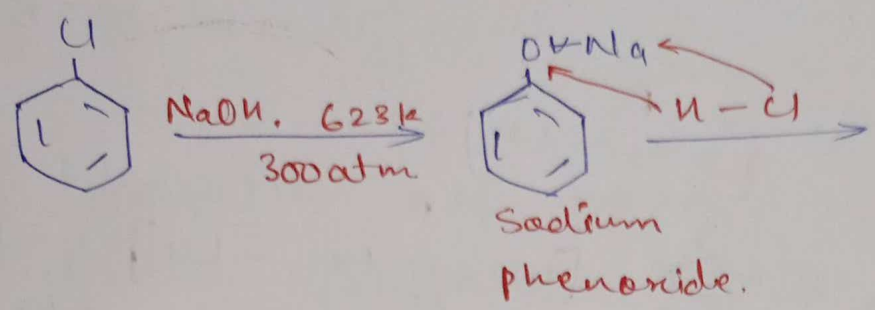
1) 

2) 

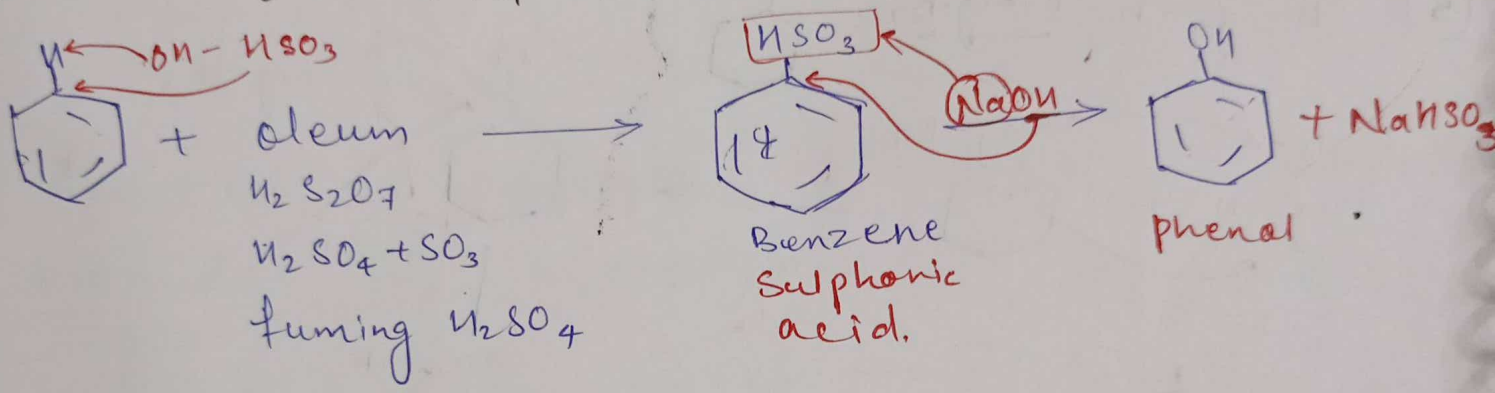
3) 

PREPARATION OF PHENOL ~

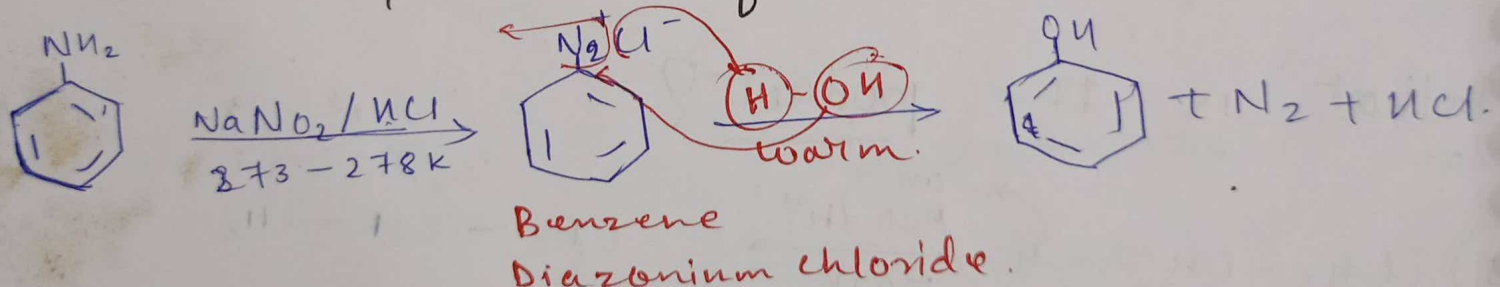
(1) From haloarenes.



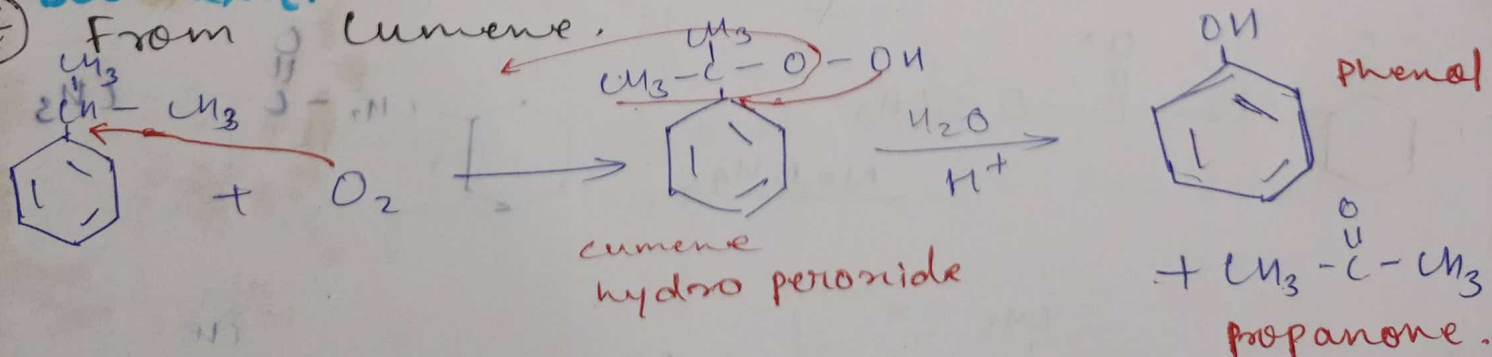
(2) From oleum & Benzene & NaOH.



(3) From hydration of Diazonium salt.



(4) From Cumene. **Best Rxn.**



* Cumene – Iso propene Benzene

Physical Property (Alc, phenol)

(1) State - It is found in the liquid state.

(2) They have pungent smell.

(3) Phenol is black colour liq, Colourless.

(4) Taste : Bitter (Alcohol) Poisoness (phenol).

(5) Density : High but lower then water $\propto$ Mw.

(6) Solubility : Highly soluble due to making of H-bond with water. (Both Alc & Phenol soluble in water).

(7) M.P / B.P / F.P $\propto$ Mw $\propto \frac{1}{\text{Branching}}$.

Alkane / Haloalkane / Ether / Alde. / Ketone

They are higher Alkane; Haloalkane, Ether, Aldehyde Ketone etc. because they for H Bond with itself.

(1) Arrange in the order of Melting Point:

Pentan-1-ol, Butan-1-ol, Butan-2-ol, Ethanol, Propan-1-ol, methanol.

Methanol < Ethanol < Propan-1-ol < Butan-2-ol < Butan-1-ol < pentan-1-ol.

(2) Pentan-1-ol, n-butane, pentanol, ethoxyethan

n butane < ethoxy ethane < Pentanol < Pentan-1-ol

Chemical Prop.

Acidic Effect

$$R-O+H \longrightarrow R-O^- + H^+$$

Nucleophilic Substitution Rxn

$$R+OH \longrightarrow R^+ + OH^-$$

$$R^+ \xrightarrow{Nu^-} R-Nu + OH^-$$

Acidic Properties.

① Acid + Metal ⟶ Salt + H_2

Acid + Base ⟶ Salt + H_2O

Acid + Carbonate or Bicarbonate ⟶ Salt + CO_2 + H_2O

② CH_3-OH + Na ⟶ $CH_3O^-Na^+ + \frac{1}{2}H_2\uparrow$

CH_3-OH + NaOH ⟶ $CH_3O^-Na^+ + H_2O$

CH_3-OH + Na_2CO_3 ⟶ $CH_3O^-Na^+ + H_2O + CO_2$

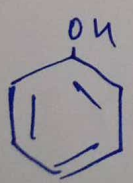
CH_3-OH + $NaHCO_3$ ⟶ $CH_3O^-Na^+ + H_2O + CO_2$

③ CH_3OH ⟶ Methyl Alcohol.

CH_3-CH_2OH ⟶ 1° Alcohol.

$CH_3-\underset{\underset{CH_3}{|}}{CH}-OH$ ⟶ 2° Alcohol.

$CH_3-\underset{\underset{CH_3}{|}}{\overset{CH_3}{\overset{|}{C}}}-OH$ ⟶ 3° Alcohol.



⟶ Phenol

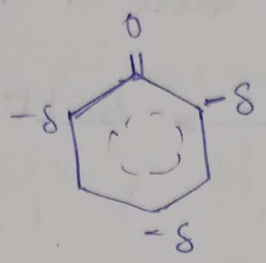
ACIDIC EFFECT

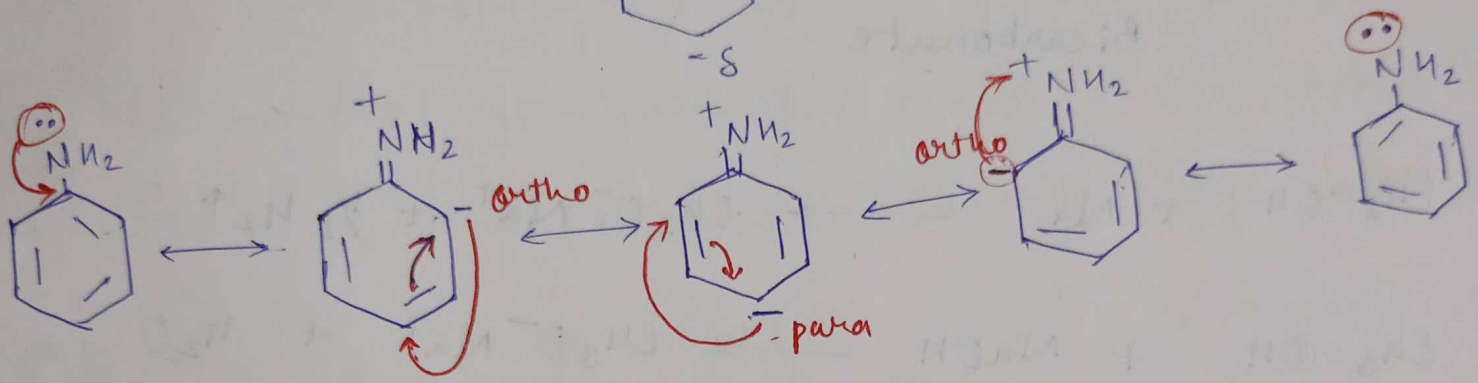
I effect ⟶ $\alpha \frac{-I}{+I}$ = A.E.

-ve ↓ = stable.

-ve ↑ = unstable.

M effect ⟶

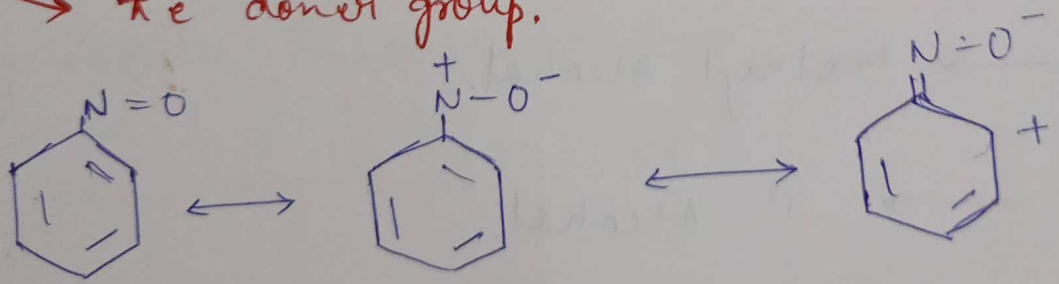




+M group $\cdot \alpha \frac{1}{A.E}$

$-NH_2$, $-OH$, $-OCH_3$, $-ONH_2$ etc [ortho, para] $-OMe$.

→ πe^- donor group.

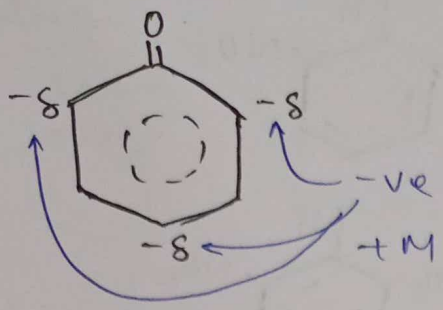


-M ⟶ πe^- acceptor group.

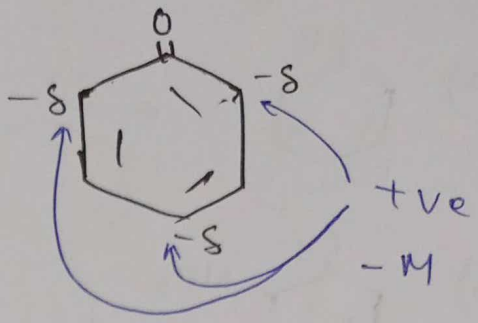
$-NO_2$, $-CN$, $-CHO$, $-COOH$, $-CONH_2$, $-COCl$

$-M \propto A.E$

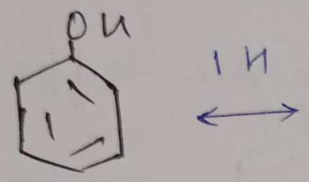
less Stable

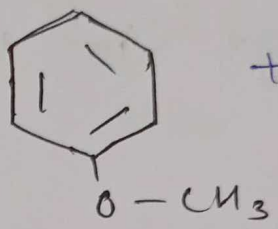


More Stable

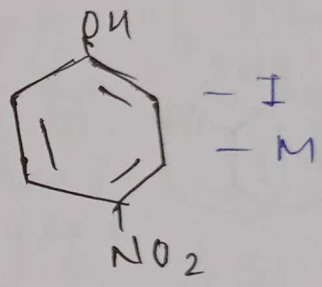


Q. Arrange in the order of Acidic effect.

a) 

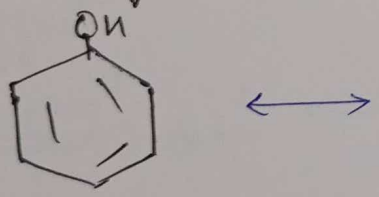
b) 

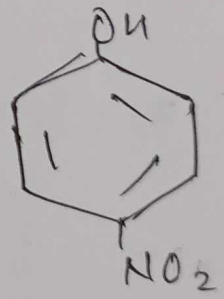
c) 

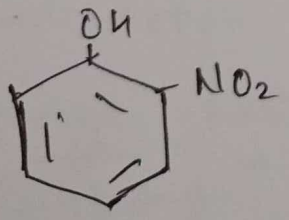
d) 

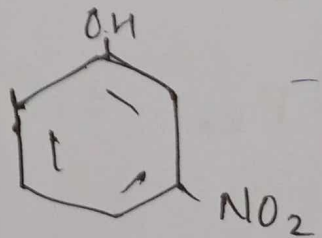
d > a > c > b

Q. Arrange in the order of Acidic effect.

a) 

c) 

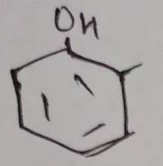
b) 

d) 

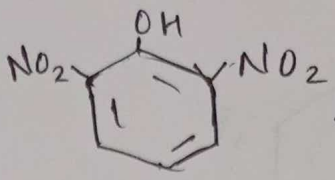
b > c > d > a.

Q. Arrange in the order of acidic effect?

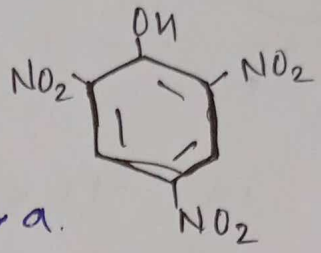
a) 

b) 

$-I \times 1$
$-M \times 1$.

c) 

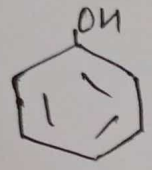
$-I \times 2$
$-M \times 2$

d) 

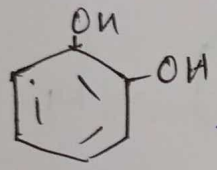
$-I \times 3$
$-M$

d > c > b > a.

Q. Arrange in the order of acidic effect?

a) 

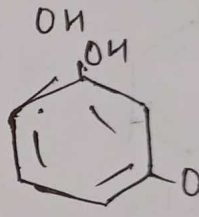
1 H

b) 

2H
$-I$ near
$+M$.

c) 

2H
$-I$ far
$+M$

d) 

2H
$-I$

d > a > b > c

P Ka

P_{kw} =

a) P_H = Strong Acid → P_H → 1 (max.) – 7 (min)

b) P_{OH} = Strong Base → P_{OH} 7 (min) – 14 (max)

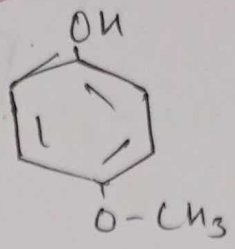
c) P_{ka} = Weak Acid → $P_{ka} \propto \frac{1}{\text{Acidic eff.}}$

Q. Arrange in the increasing order of Pka value.

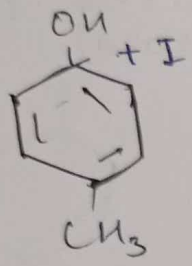
$Pka \propto \frac{1}{\text{acidic effect}}$

a) 

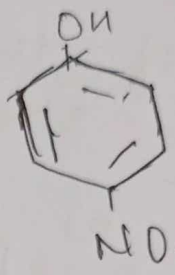
$-M$
$-I$ min.

b) 

$-I$
$+M$

c) 

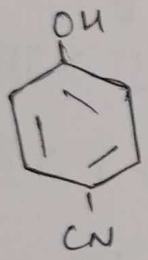
$Pka \propto \frac{1}{\text{acid eff.}}$

d) 

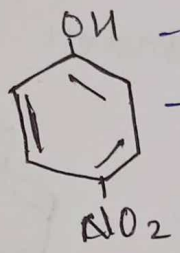
$-I$ max
$-M$.

$d < a < c < b$

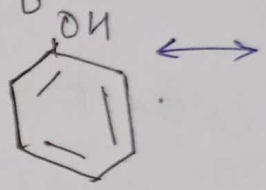
Q. Arrange in the increasing of Pka value.

a) 

$-I$ 2nd max
$-M$

b) 

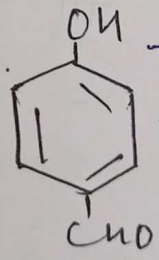
$-I$ max
$-M$.

c) 

acid effect

~~b > a > d > c~~

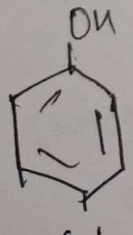
$Pka \propto \frac{1}{\text{acid effe.}}$

d) 

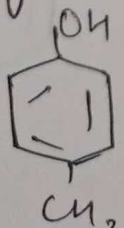
$-I$ min
$-M$

$b < a < d < c$

Q. Arrange following compounds in order of decreasing.. [JM - 2013]

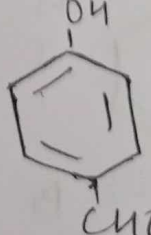


I



II

III



IV

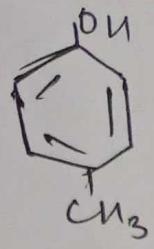
a) II > IV > I > III

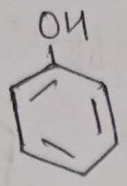
b) I > II > III > IV

c) III > I > II > IV

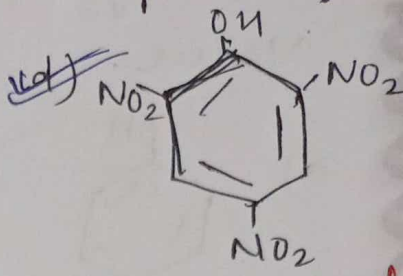
d) IV > III > I > II

Q. Which one is the most acidic compound? [NEET 2017]

a) 

b) 

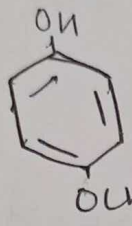
c) 

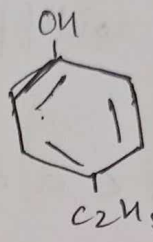
~~d)~~ 

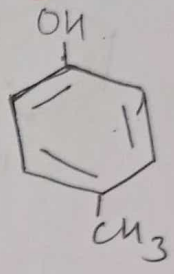
Picric Acid

Q. Which of the following Substituted phenols is the strongest acid? [NEET Oct 2020]

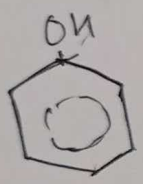
~~a)~~ 

b) 

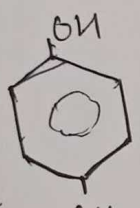
c) 

d) 

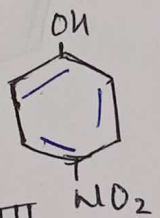
Q. correct acidic order of the following compounds.



I



II



III

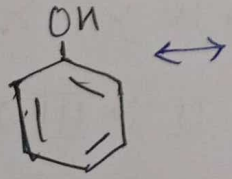
a) I > II > III

~~b)~~ III > I > II

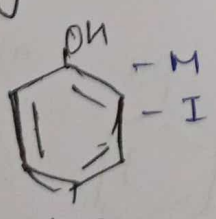
c) II > III > I

d) I > III > II

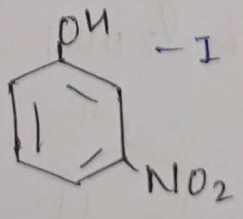
Q. The increasing order of the pka values of the following compounds: [JM 2019]



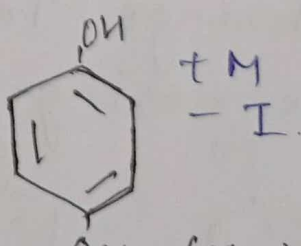
A



B



C



D

a) D < A < C < B

b) B < C < D < A

c) C < B < A < D

~~d)~~ B < C < A < D.

min acid
Pka max

ESTRIFICATION

Alc + Acid / Derivatives

(1) CH_3-COOH
Carboxylic Acid.

(2) $CH_3-COOCl$
Acyl Chloride

(3) $CH_3-CO-NH_2$
Amide

(4) $CH_3-CO-O-CO-CH_3$
Acid Anhydride.

eg: CH_3-OH + $CH_3-C(=O)-OH$ ⟶ $CH_3-O-C(=O)-CH_3$ + H_2O
Alc. — Carboxylic Acid — Dehydrating agent H_2SO_4 $CaCl_2$.

eg: CH_3-OH + $CH_3-C(=O)-Cl$ ⟶ $CH_3-O-C(=O)-CH_3$ + HCl Acid
Acyl Chloride — Pyridine Remove

eg: CH_3-OH + $CH_3-C(=O)-NH_2$ ⟶ $CH_3-O-C(=O)-CH_3$ + NH_3
Anide. — Any acid Remove

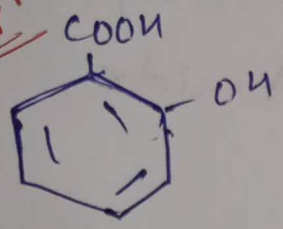
eg: CH_3-OH + $(CH_3-C(=O))_2O$ ⟶ $CH_3-O-C(=O)-CH_3$ + CH_3-COOH
Acid Anhydride. — Pyridine.

Eg: CH_3-O + Acyl ⟶ $CH_3-\overset{O}{\overset{\|}{C}}-$

Alkoxy — Acylation.

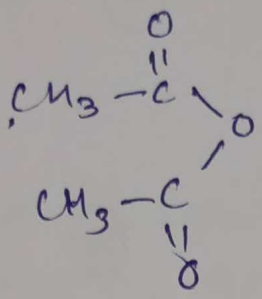
Analgesis
pain killer.

M.Imp.
Eg 25★

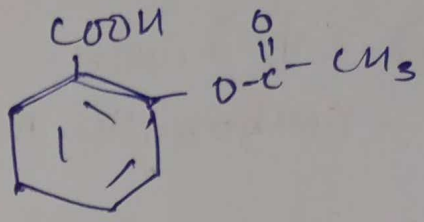


Salicylic Acid

+



⟶



Acetyl Salicylic Acid.
(ASpirin)

Estrification:

Estrification process are reversible so, it is very imp. to remove bi-product from Reaction.

(i) H_2O remove by dehydrating reagent like ~~H_2SO_4~~, $CaCl_2$

(ii) HCl is acid so, it can be removed by any base like pyridine.

(iii) NH_3 removed by any acid.
like → H_2SO_4, HNO_3, HCN.

(iv) Acetic Acid CH_3COOH can removed by base like pyridine.

* Reaction involving when bond clevage B/w C-O.

$R - CH_2 \overset{+}{-} OH$

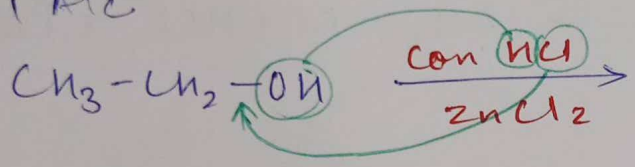
$R-CH_2^+ + (OH^-)$ Nucleophile.

Nucleophilic Sub. Rxn.

→ Rxn with $ZnCl_2$ / con HCl Lucas Reagent

→ Test of turbidity.

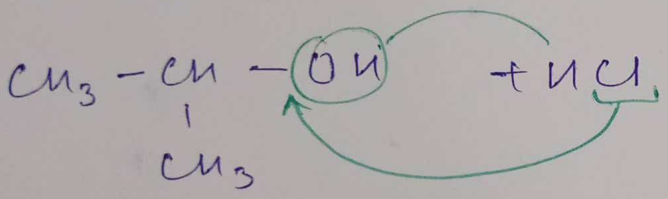
1° Alc



$CH_3-CH_2-Cl + H_2O$.

Turbidity after heating.

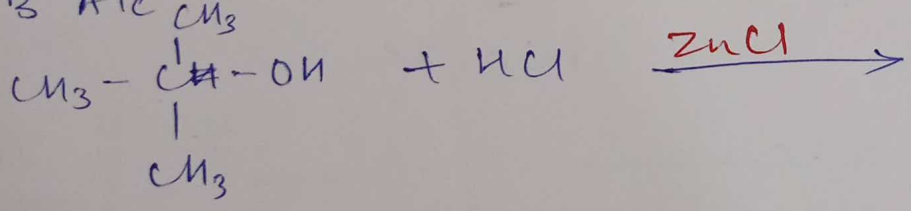
2° Alc



$\xrightarrow{ZnCl}$ $CH_3-CH(CH_3)-Cl + H_2O$.

Turbidity after 10-15 min

3° Alc



Immediately turbit.

Turbidity Test

1° Alc + Lucas Reagent → No turb / Turbidity after heating.

2° Alc + Lucas Reagent → Turbidity after 15-10 min

3° Alc + Lucas Reagent ⟶ Immediately turbidit
1'-2 min.

$3^\circ > 2^\circ > 1^\circ >$ Methyl.

2) Rxn with PCl_3, PCl_5 & $SOCl_2$

Eg:1 $3\,CH_3-OH + PCl_3 \longrightarrow 3CH_3-Cl + \underset{\text{ortho Phosphorous Acid.}}{H_3PO_3}$

Eg:2 $CH_3-OH + PCl_5 \longrightarrow CH_3-Cl + HCl + POCl_3$

Eg:3 $CH_3-OH + SOCl_2 \longrightarrow CH_3-Cl + SO_2 + HCl.$

3) Dehydration ; α, β elimination Rxn.
min. 2C

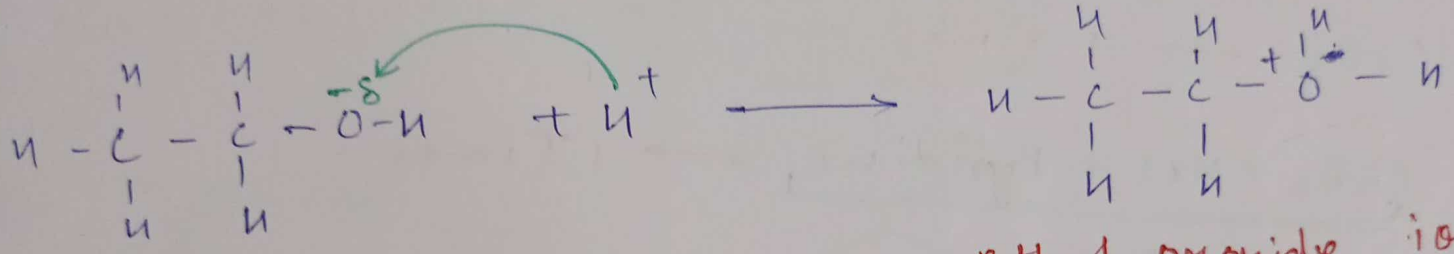
$CH_3 - \underset{\alpha}{CH_2} - OH$ (β: CH_3; α: CH_2; H on β-C)

$CH_3 - CH_2 - OH \xrightarrow[\text{100\% pure.}]{443\ K,\ H_2SO_4} CH_2 = CH_2$

3) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-OH \xrightarrow[358\,K]{20\%\ H_3PO_4} CH_3-C(CH_3)=CH_2$

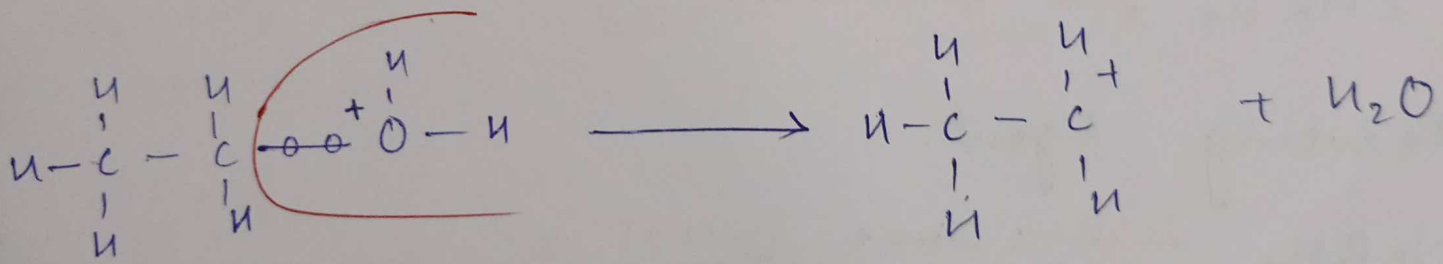
Mechanism No-2

Step-1 Attacking of proton in Alcohol & form protonated Alc.

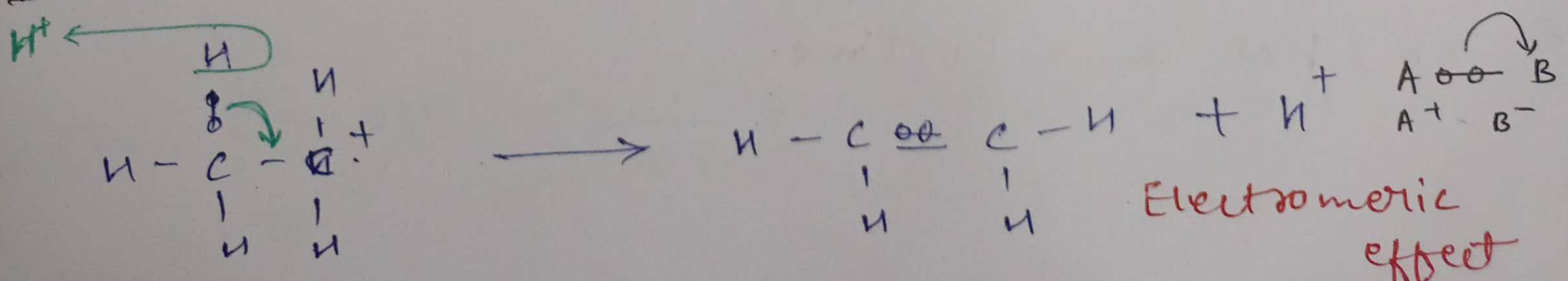


ethyl oxonide ion
protonated Alc.

Step-2 Removal of H_2O & form carbocation intermediate.



Step-3 : Removal of H^+ & form Alkene.



Electromeric effect

$\sigma e^- \longrightarrow \pi e^-$

Oxidation

Removal of H_2 ⟶ Dehydrogenation.

Hydrocarbon
Alkane
Alkene
Alkyne

oxi (1 time) ⟶ Alc ⟶ oxi (1 time) ⟶ Aldehyde / Ketone ⟶ oxi (1 time) ⟶ Acid

Alc ⟵ Red. (1 time) ⟵ Aldehyde / Ketone

Aldehyde / Ketone ⟵ Red (1 time) ⟵ Acid

Acid ⟶ oxi (1 time) ⟶ $CO_2 + H_2O$

Acid ⟵ Red (1 time) ⟵ $CO_2 + H_2O$

Oxidation Agents :

1) Cu / 573 / 300 atm ⟶ 1 Times.

2) CrO_3 ⟶ 1 Times

3) $CrO_3 + HCl +$ Pyridine ⟶ 1 Times.

PCC
Pyridinium chloro chromate

4) MO_2O_3 ⟶ 2 Times

5) $KMnO_4$ ⟶ 3 Times.

Reducing Agent.

① $NaBH_4$ ⟶ 1 Time

② $LiAlH_4$ ⟶ 2 Time

③ Zn / HCl. ⟶ 1 Time.

OXIDATION ~

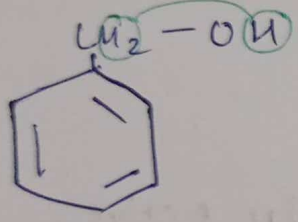
$CH_3 - CH_2 - OH \xrightarrow[300\ atm.]{Cu/573K} CH_3 - CHO$

1° Alc — Aldehyde.

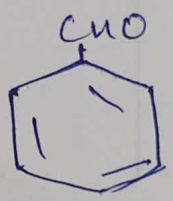
$CH_3 - CH(CH_3) - OH \xrightarrow{CrO_3} CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$

2° Alc — ketone.

$CH_3 - CH = CH - CH_2 - OH \xrightarrow[\text{Only Be only alc. attack}]{PCC} CH_3 - CH = CH - CHO$



$\xrightarrow{PCC}$



Benzaldehyde

$CH_2 - CH_2 - OH \xrightarrow[300\ atm]{Cu/573K} CH_3 - CHO$

1° Alc — Aldehyde

$CH_2 - CH(CH_3) - OH \xrightarrow[300\ atm]{Cu/573K} CH_3 - \overset{CH_3}{\overset{|}{C}} = O$

2° Alc — ketone.

$CH_3 - C(CH_3)_2 - OH \xrightarrow[300\ atm]{Cu/573K} CH_3 - \overset{CH_3}{\overset{|}{C}} = CH_2$

3° Alc — Alkane

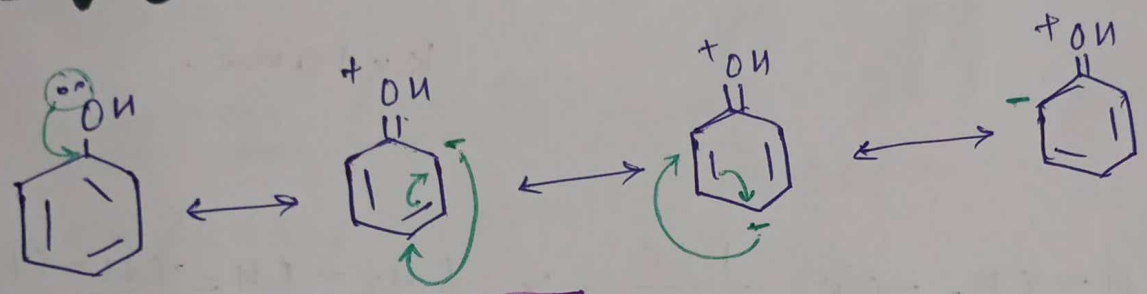
α, β elimination Rxn.

1° Alc $\xrightarrow{Oxi}$ Aldehyde

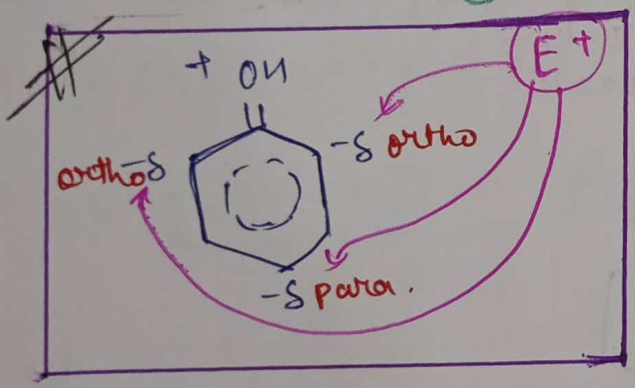
2° Alc $\xrightarrow{Oxi}$ Ketone.

3° Alc $\xrightarrow{Oxi}$ Alkane.

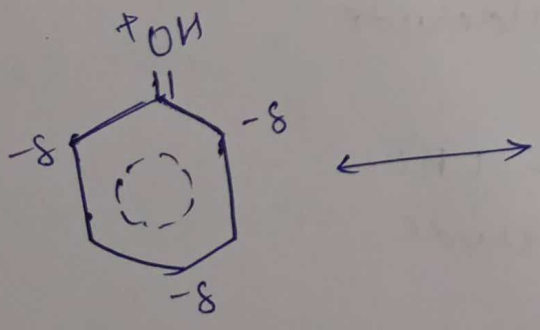
Chemical Prop. Of Phen

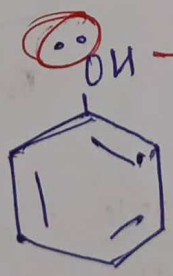


l.p → +ve
→ Per =
→ alt, -ve



OH → ortho / para directing group.

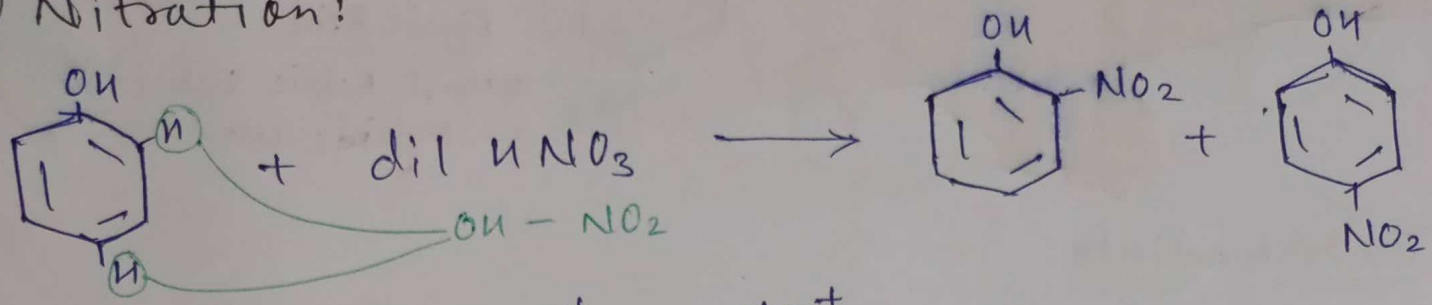




→ Highly Active.

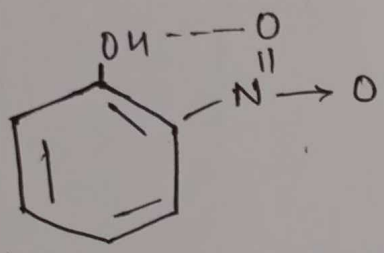
Electrophilic Sub. Rxn Of Phenol.

① Nitration:

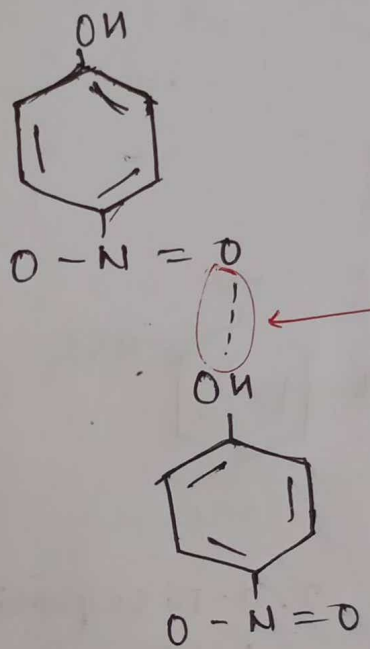


→ Electrophiles = $E^+ \longrightarrow NO_2^+$

→ Major: Para Major.



Intra molecular Bond.



← Inter molecule H-Bond.

→ Ortho Nitro Phenol B.P / M.P lesser then para nitro phenol.

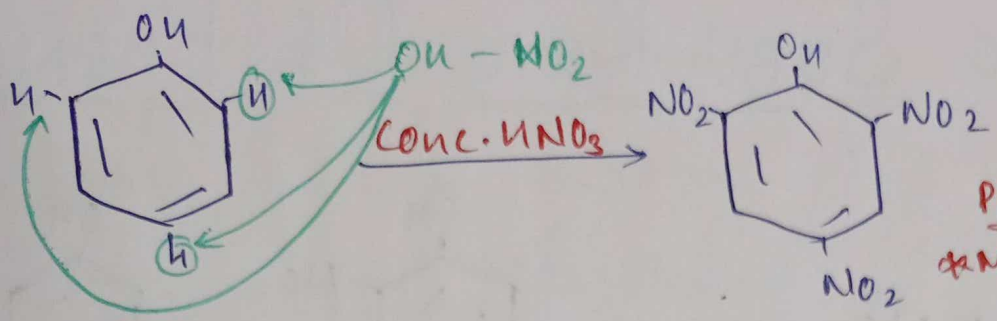
→ they can easily diff. by distilation bcz they have ~~large~~ huge diff. in B.P / M.P

Ortho Nitro Phenol < Para Nitro Phenol.

voletile — less volatile

B.P / M.P — B.P / M.P

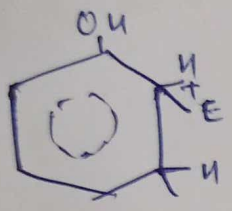
less — high.



Picric Acid

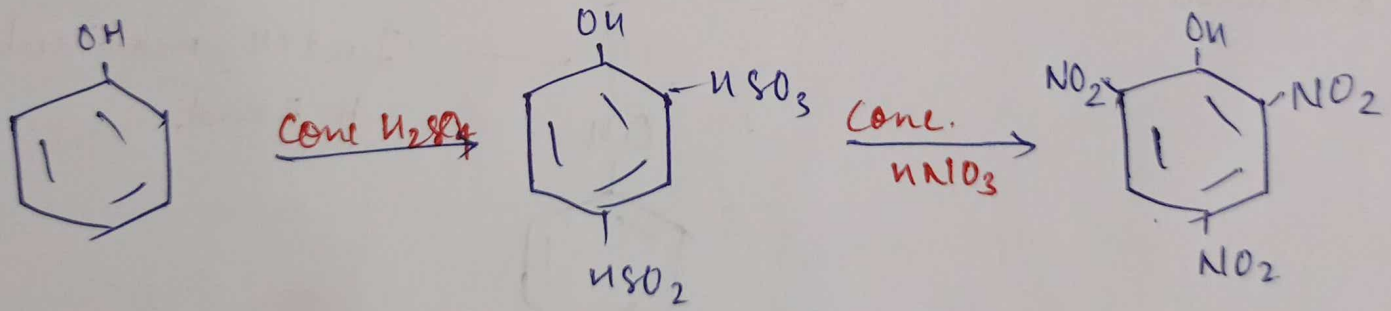
Most Acidic sub in organic world.

Intermediate



Phenolium Ion.

Commercially

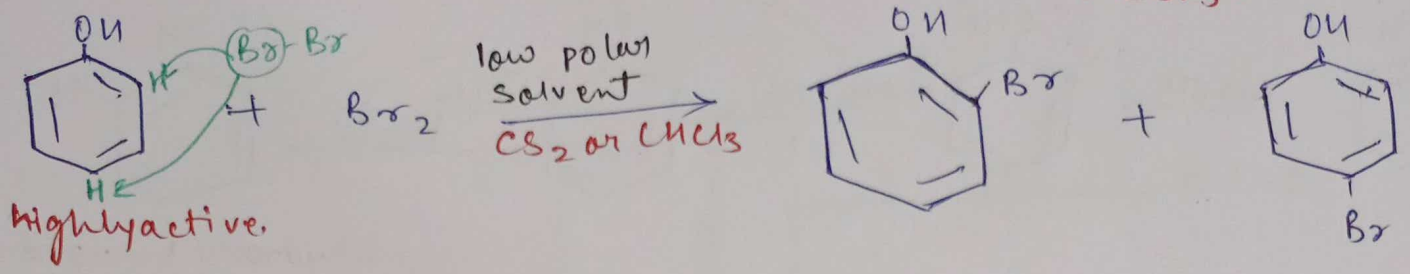


2, 4-Di sulphonic Acid

Picric Acid.

② Halogenation : Lewis Base

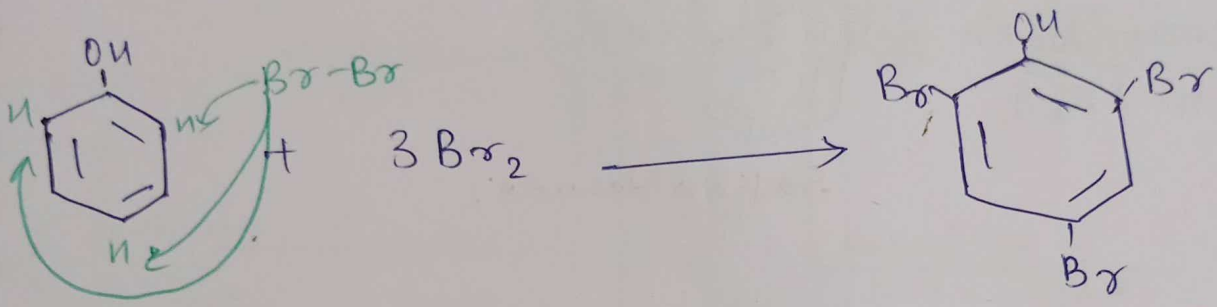
$FeCl_3$, $AlCl_3$, $FeBr_3$



Highly active.

Electrophile → Br^+

Major — Para

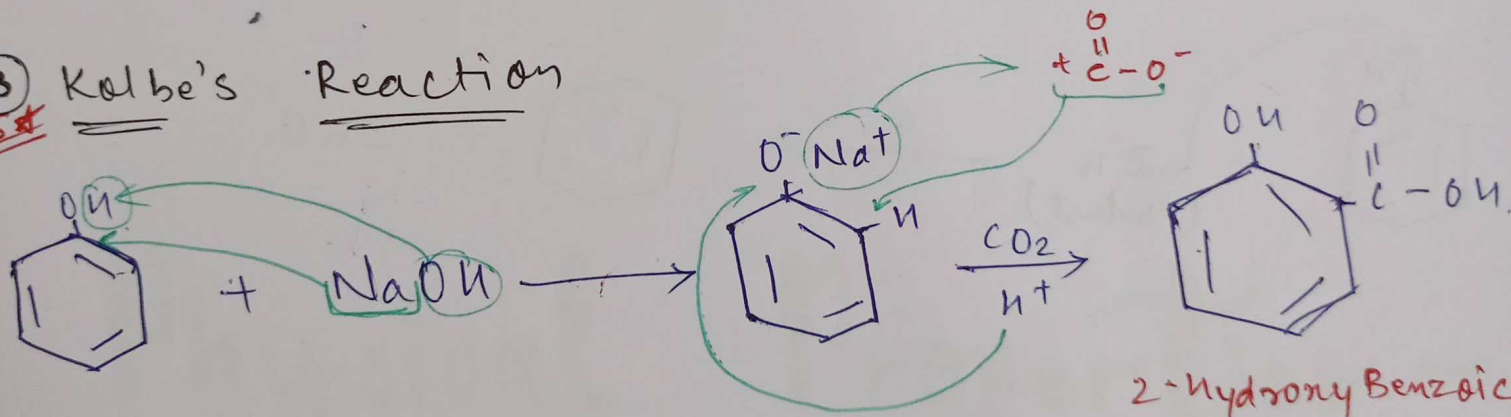


Phenol.

2, 4, 6 - Tri Bromo phenol.

③ Kolbe's Reaction

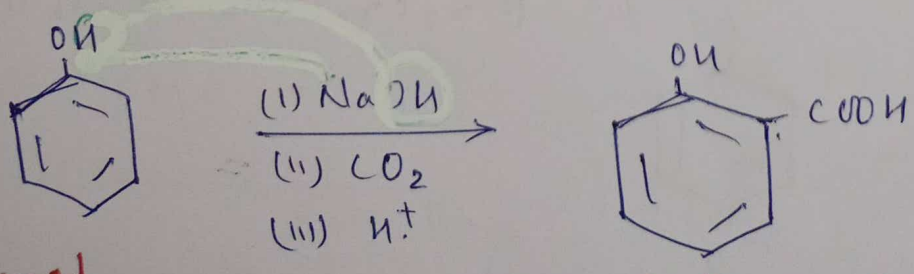
25 ★



2-Hydroxy Benzoic Acid.

Salicylic Acid

Electrophile → CO_2



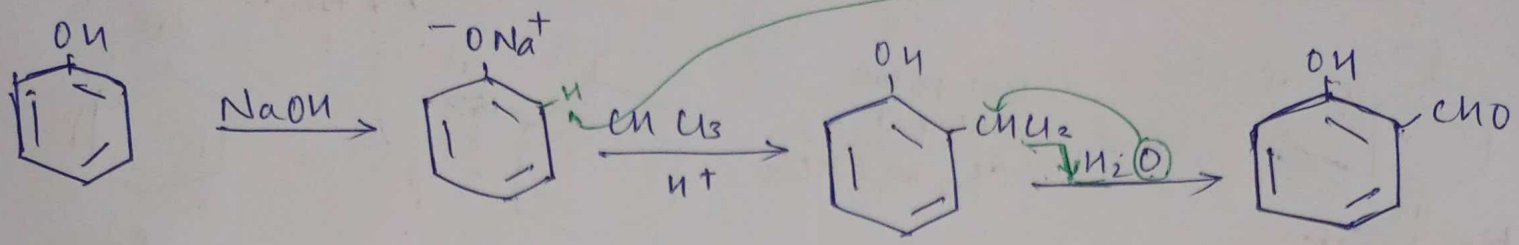
phenol

Salicylic Acid.

④ Reimer Tiemann Rxn

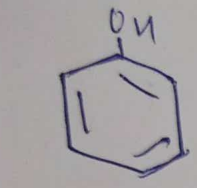
25*

$CHCl_3 \longrightarrow CCl_2 + HCl$ (1+7=8)



2 hydroxy benzaldehyde.

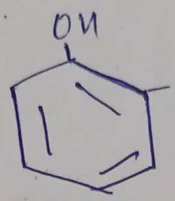
Salicaldehyde.



Phenol

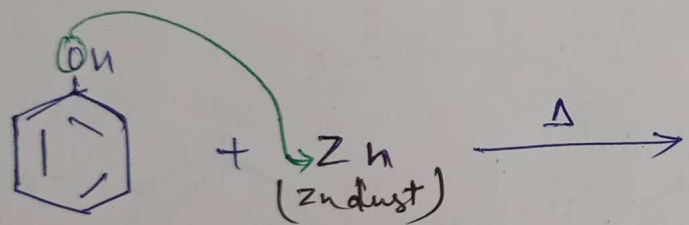
$CHCl_3 / NaOH$

H^+ / H_2O



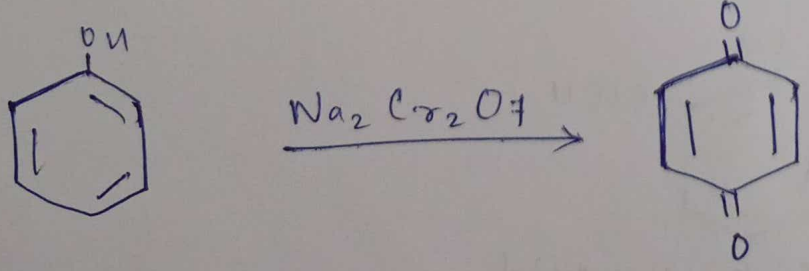
Salicaldehyde.

⑤ Rxn with Zin Dust



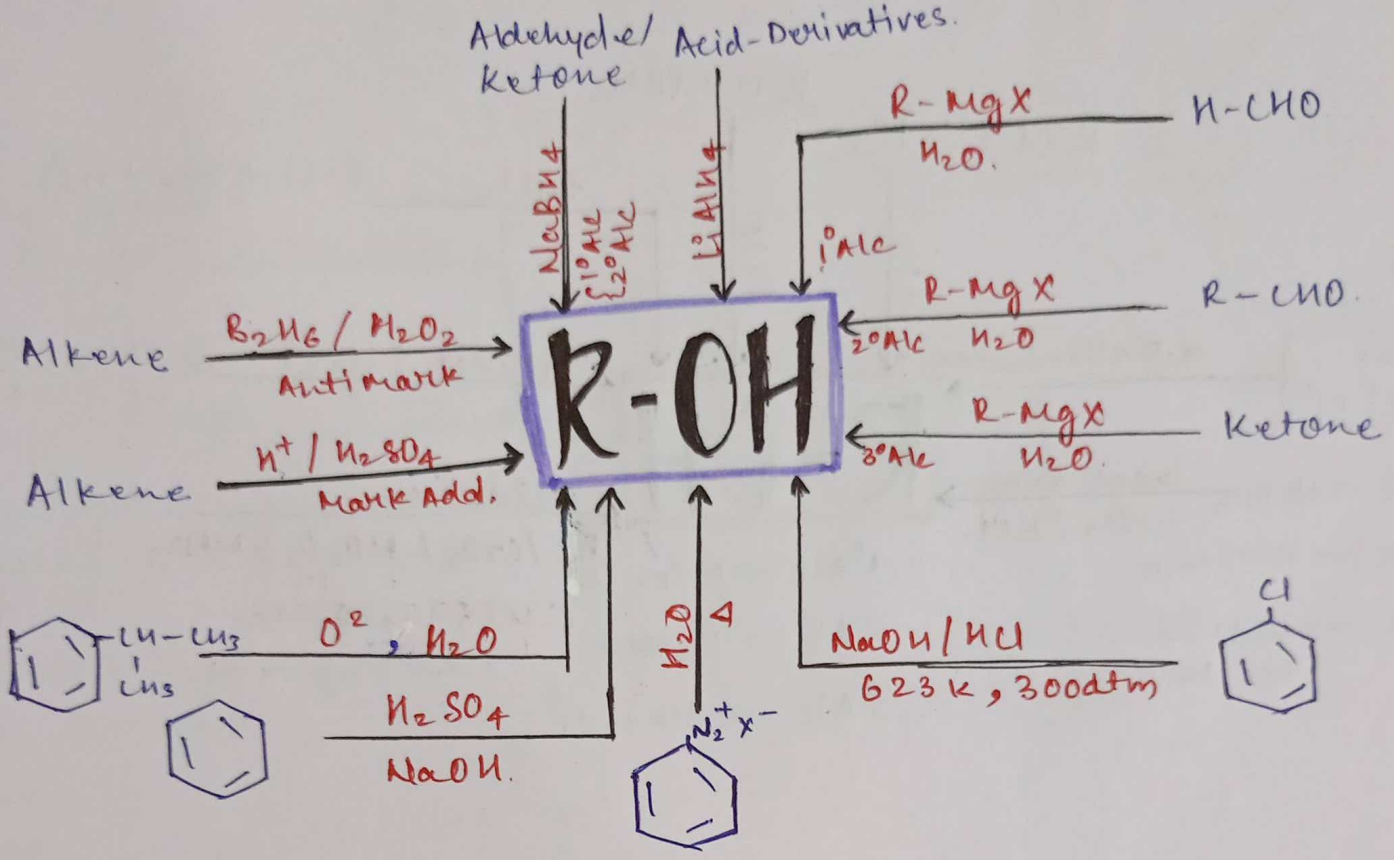
⑥ Oxidation.

① $KMnO_4$ } high
② $K_2Cr_2O_7$ ③ $Na_2Cr_2O_7$.



Benzoquinone

Preparation Of Alcohol & Phenols



Physical Properties :-

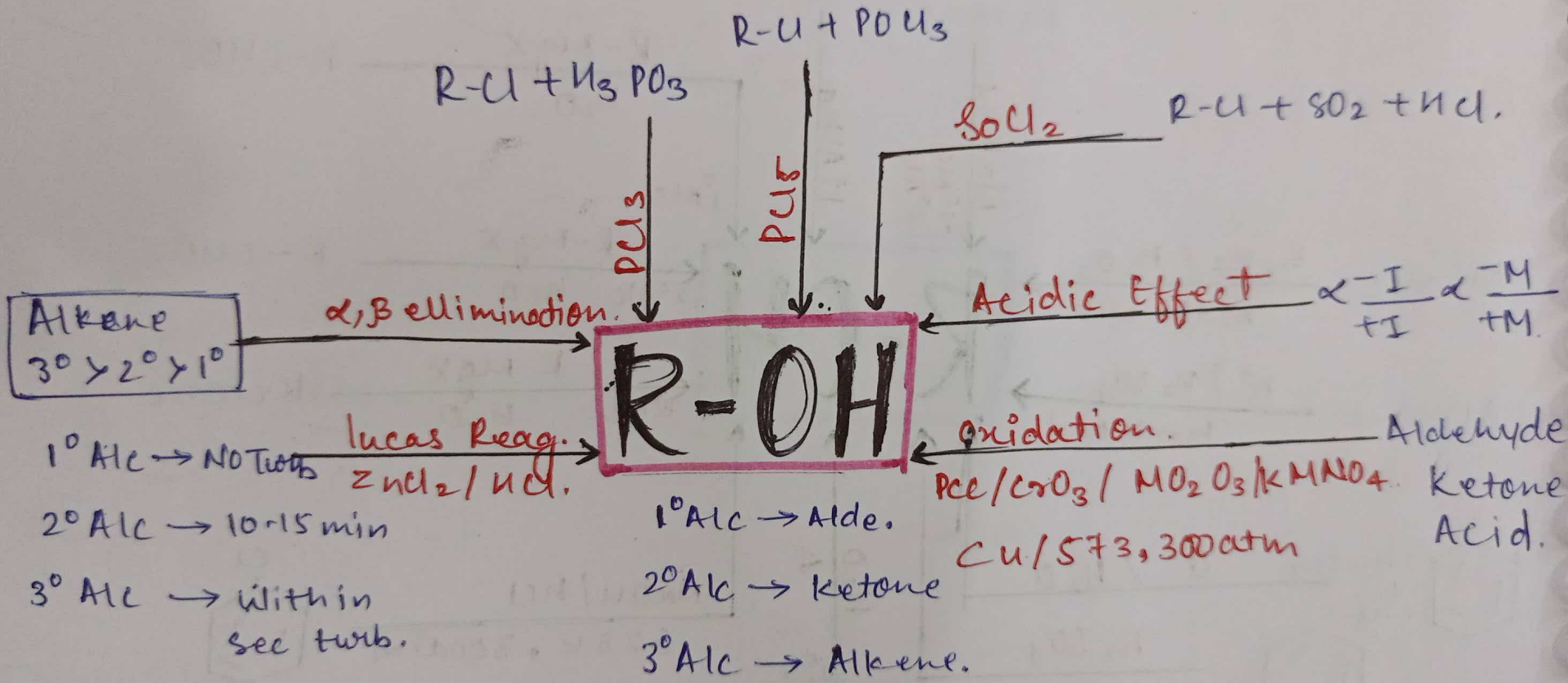
Alcohol

1. Bitter
2. Pungent
3. B.P / M.P → high
   ∝ Mw ∝ 1/Branching.
4. High soluble.
5. H.A/Hydrocarbon < Ether < Ketone < Aldehyde < Alco.

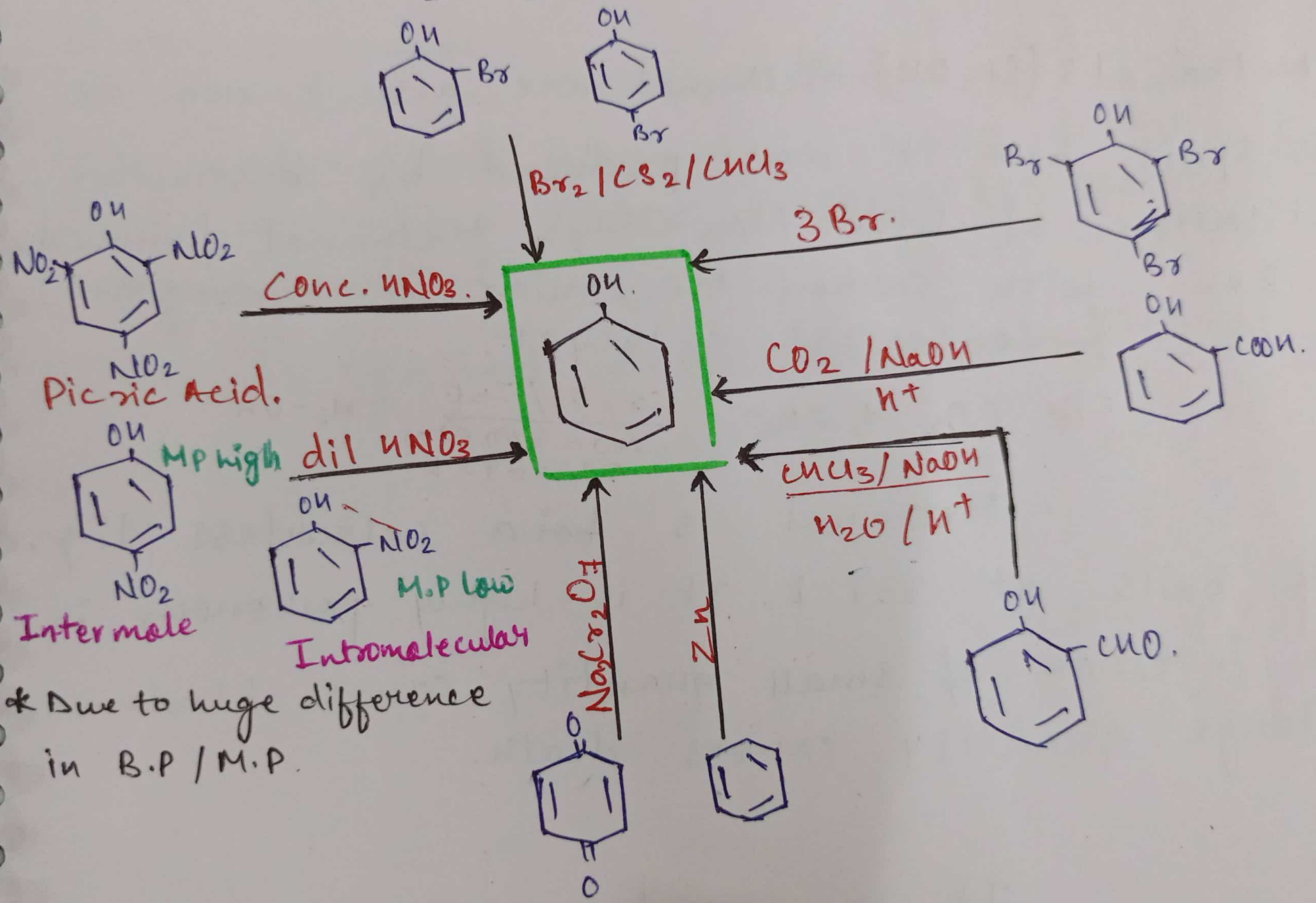
Phenol.

1. Toxic
2. Pungent
3. B.P / M.P → high.
4. High soluble
5. Due to the making of H-Bond with H_2O.

Chemical Property Of Alcohol



Chemical Properties Of Phenol ~



* Due to huge difference in B.P / M.P.

Some Commercial Imp Alcohol ~

(1) Methanol: (CH_3OH) Methanol are also known as Wood spirit bcz it was produced by destructive distilation of wood. Nowadays Methanol formed by Rxn with carbon Monooxide & hydrogen in the presence of catalyst.

$$CO_2 + 2H_2 \xrightarrow[200-300\ atm,\ 573-673\ K]{Cr_2O_3/ZnO} CH_3-OH$$

Methanol is ~~boi~~ a colourless liq. which boils at 337 k. It is highly poisonous in nature injection of small quantity causes blindness and large quantity causes death.

It is used as solvent in paint, varnishes, making of formeldehyde.

(2) Ethanol: Ethanol is commercially obtain by fermentation from Sugar in molasses, Sugar cane, Grapes.

$$\text{Sugar} \xrightarrow{\text{Invertase}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + \underset{\text{(Fructose)}}{C_6H_{12}O_6}$$

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase}} \underset{(13-14\%)}{2C_2H_5OH} + 2CO_2$$

$$\text{Alc} \xrightarrow{\text{Distilation}} \underset{95\%}{\text{Alc}} \xrightarrow[\text{Dry agent}]{\text{Dehyd. Agent}} 99.9\%\ \text{Pure}$$

13-14%.

Azeotropic Mix $\xrightarrow[CaCl_2]{-H_2SO_4}$

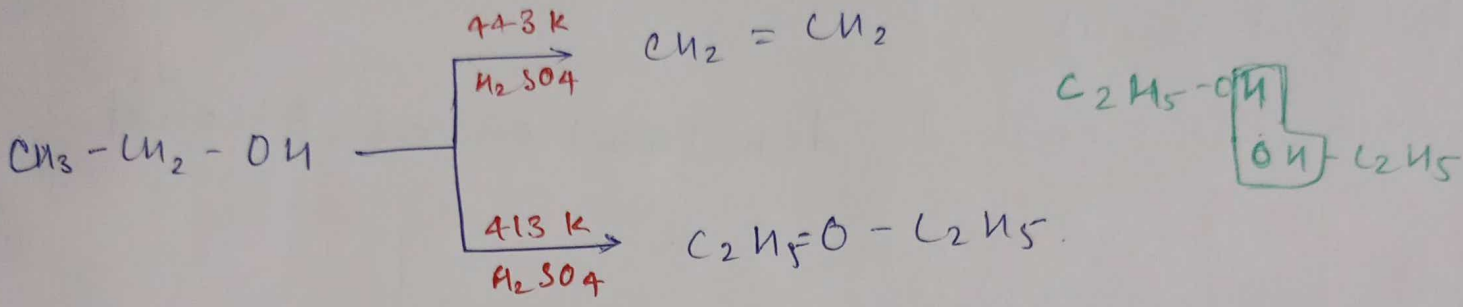
*Properties:

Ethanal is colourless liq with boils at 351 k.
It is used as solvent in ~~pla~~ paint and other substances.
It is used as spirit, sanitizer
The commercial alcohol is made unfit to drink by mixing copper sulphate for (color) Pyridine (for foul smell)
This is called denaturation of Alcohol.

ETHER

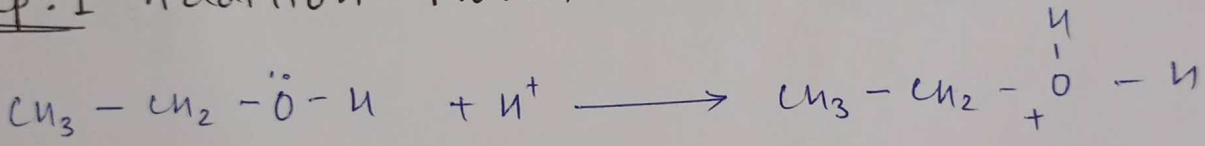
METHODS OF PREPARATION ~

① From Alcohol

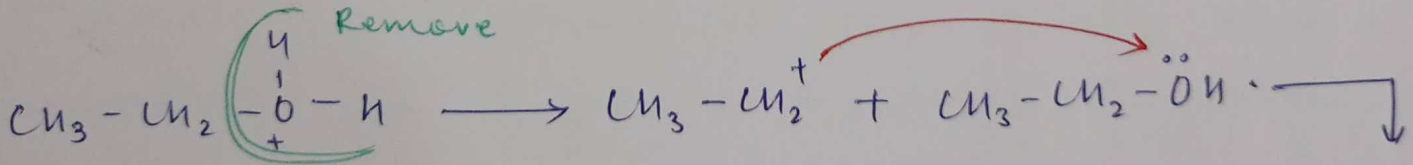


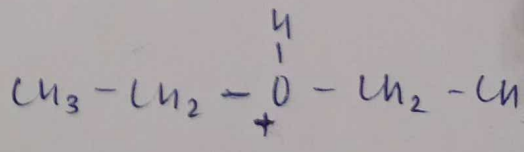
Mechanism :-

Step : I Addition Proton in Alcohol.

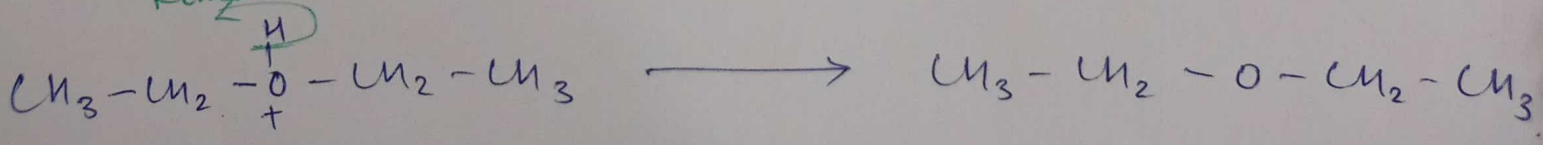


Step : II Removal of H_2O & Formation of Carbocation & Attacking of Electrophile in Alcohol.





Step : III Removal of Proton.



(2) Williamson Synthesis.

SN-2 Mechanism

$1^\circ > 2^\circ > 3^\circ$ Not show Ether prep.

$CH_3-CH_2-OH + NaOH \longrightarrow CH_3-CH_2-O^-Na^+$

1° Alc

$CH_3-CH_2-O^-Na^+ + CH_3Cl \longrightarrow CH_3CH_2-O-CH_3$

1° Alc + 1° H.A → Ether

2° Alc + 1° H.A → Ether

3° Alc + 1° H.A → Ether.

1° Alc + 2° H.A → Ether

2° Alc + 2° H.A → Ether

3° Alc + 2° H.A → Ether.

#Exception.

5A

1° Alc + 3° H.A → Alkene

2° Alc + 3° H.A → Alkene

3° Alc + 3° H.A → Alkene

*H.A – $1^\circ, 2^\circ, 3^\circ$

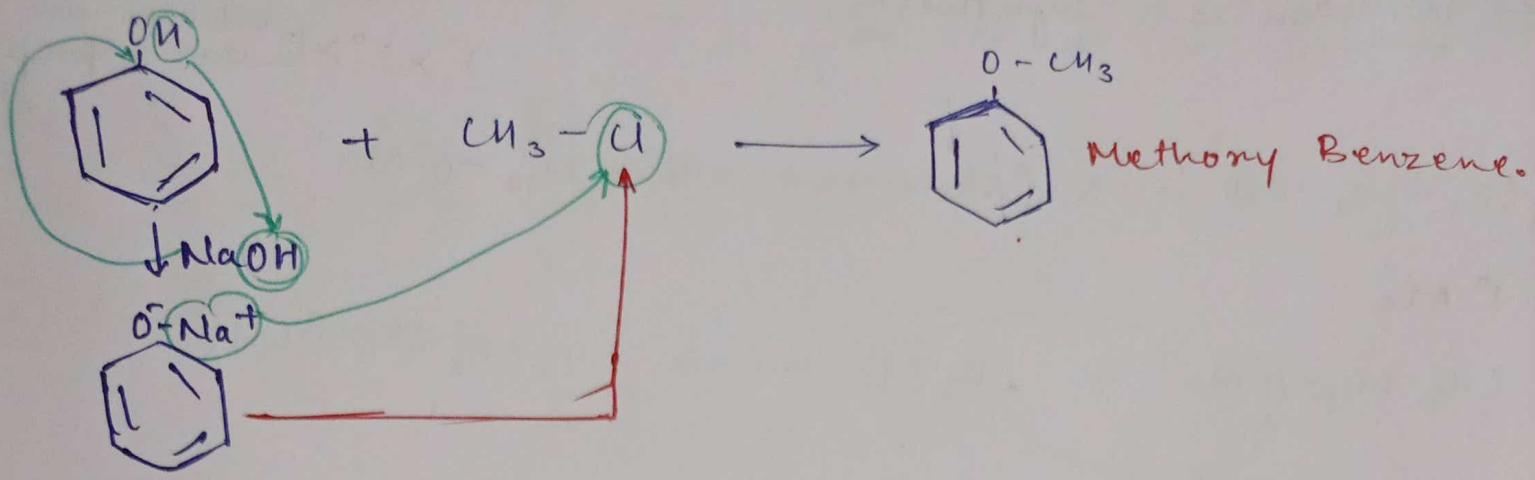
*Alc – $1^\circ, 2^\circ, 3^\circ$

Exception.

$CH_3-O^-Na^+ + CH_3-C(CH_3)_2-I \longrightarrow CH_3-OH + NaI$

$+ CH_3-C(CH_3)=CH_2$

$CH_3-C(CH_3)_2-O^-Na^+ + CH_3-CH_2-I \longrightarrow CH_3-C(CH_3)_2-O-CH_2-CH_3$



Physical Properties:-

(I) Melting Point / Boiling Point.

They are weak polar in nature. So M.P & B.P are less than Alcohol. Also they have huge difference in melting point & boiling point due to the availability of extra hydrogen in alc. infact ether does not form any hydrogen bond with each other.

HBond ∝ M.P / B.P / Solubility.

R-O-R

R-O-H

H Bond form.

R-O-H

R-O-R

No H-Bond

(II) Solubility: They both are soluble in water but Solubility are more in alcohol due to availaibility of extra hydrogen in Alcohol.

Solubility

R-O-R

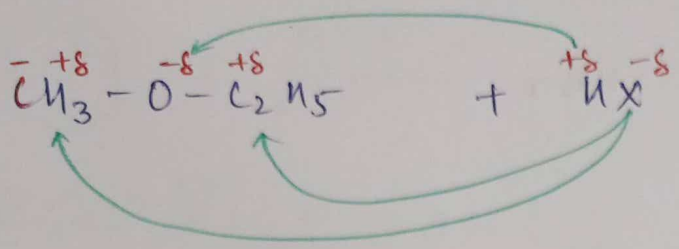
H-O-H

R-O-H

H-O-H

Chemical Properties

① Rxn with HX.



Rule : 1

Carbocation

$3^\circ > 2^\circ$

$3^\circ > 1^\circ$

$2 > 1^\circ$.

Rule : 2

Both are

1° 1°

OH → large group

Br → small group

$1^\circ +$.

SN-1

Eg: $CH_3-\underset{\underset{CH_3}{|}}{CH}+O+CH_3$ + H-Br ⟶ $CH_3-\underset{\underset{CH_3}{|}}{CH}-Br + CH_3OH$

Condition -1

$CH_3-\underset{\underset{CH_3}{|}}{CH^+} + CH_3-O^-$

2° cc

Condition-2

$CH_3^+ + CH_3-\underset{\underset{CH_3}{|}}{CH}-O^-$

1° cc

Q.1 $CH_3-CH_2\overset{①}{-}O\overset{②}{-}CH_3 + H-Br \longrightarrow CH_3-CH_2-OH + CH_3-Br.$

condition - 1

$CH_3-CH_2^+ + CH_3-O^-$

1^0

condition - 2

$CH_3-CH_2-O^- + CH_3^+$

1^0 Br

Q. $CH_3-\overset{CH_3}{\overset{|}{C}}(CH_3)\overset{①}{-}O\overset{②}{-}CH_2-CH_3 + HBr \longrightarrow$

$CH_3-\overset{CH_3}{\overset{|}{C}}(CH_3)-Br + CH_3-CH_2-OH.$

condition - 1

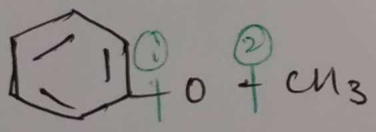
$CH_3-\overset{CH_3}{\overset{|}{C}}(CH_3)\overset{+}{-}Br + CH_3-CH_2-O^-$

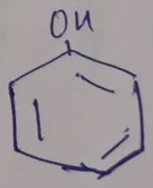
$3^0 cc$ CH_3 H.

condition - 2

$CH_3-\overset{CH_3}{\overset{|}{C}}(CH_3)-O^+ + CH_3-CH_2^+$

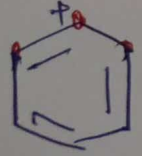
CH_3 $1^0 cc$

Q. 

$+HBr \longrightarrow$ 

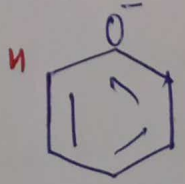
$+ CH_3-Br.$

condition - 1

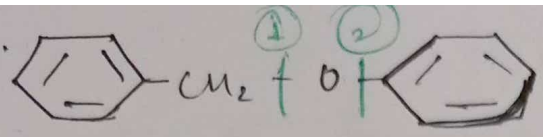


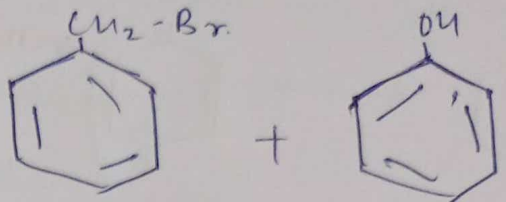
$+ CH_3-O^-$

condition - 2

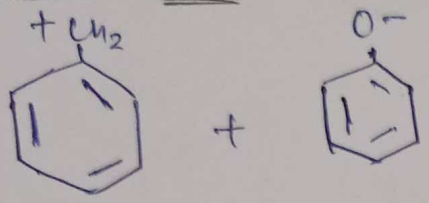


$+ \overset{Br}{CH_3}^+$

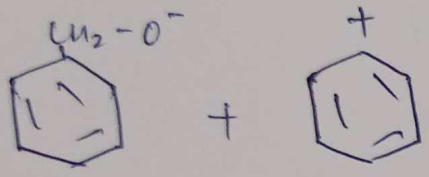
Q.  + HBr →



Condition (1)



Condition (2)



Q. $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2\overset{(1)}{-}O\overset{(2)}{-}CH_2-CH_3 + HBr \rightarrow$

$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-OH$ + CH_3-CH_2-Br.

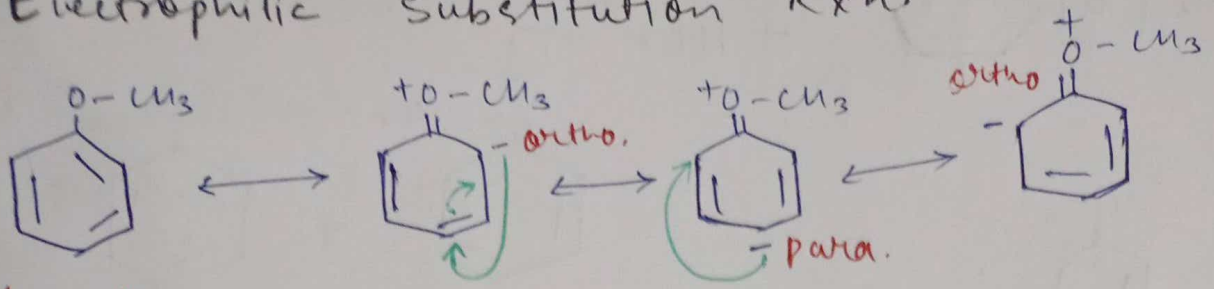
Condition -1

$CH_3-\underset{\underset{CH_3}{|}}{CH}-\overset{+}{C}H_2$ (1°) + $CH_3-CH_2-O^-$

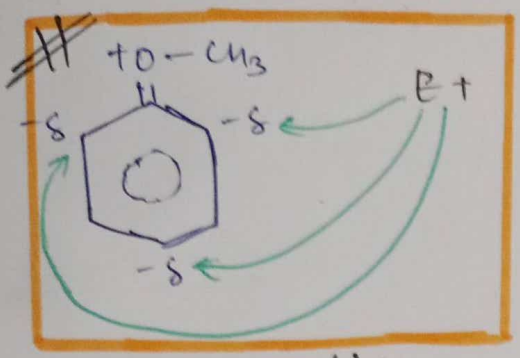
Condition - 2

$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-O^-$ + $CH_3-\overset{+}{C}H_2$ (1°)

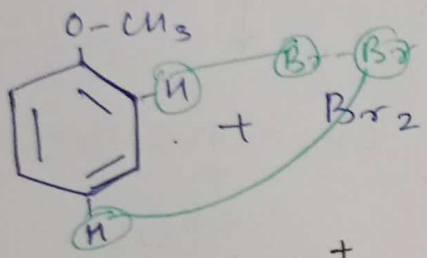
Electrophilic Substitution Rxn.



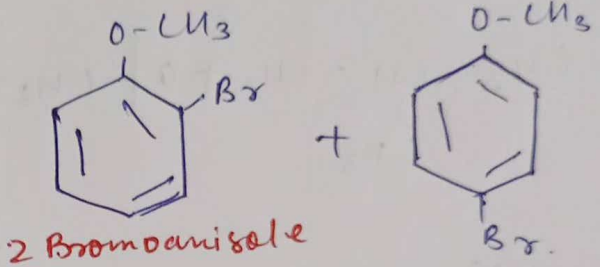
Anisole.



(i) Halogenation.



Acetic acid
CH_3-COOH



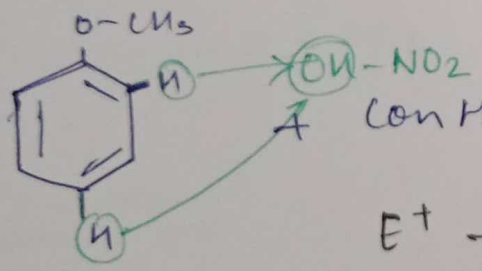
2 Bromoanisole

4-Bromoanisole

$E^+ \longrightarrow Br^+$

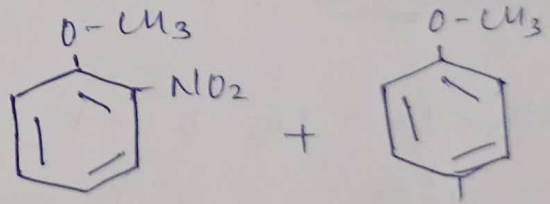
Major → para 90%.

(ii) Nitration.



Conc H_2SO_4

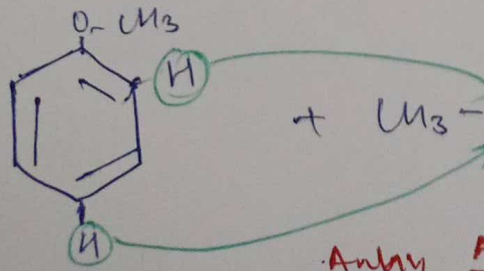
Conc HNO_3 / Δ



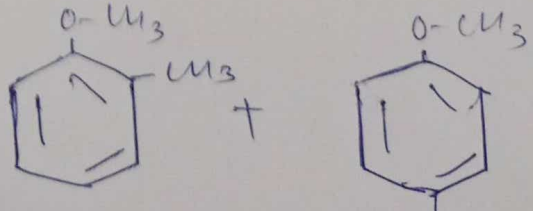
$E^+ \longrightarrow NO_2^+$

Major → Para.

(iii) Friedel Craft Alkylation.



Anhy $AlCl_3$



Anhy $AlCl_3$ + CH_3-Cl → $[AlCl_4^-] + CH_3^+$

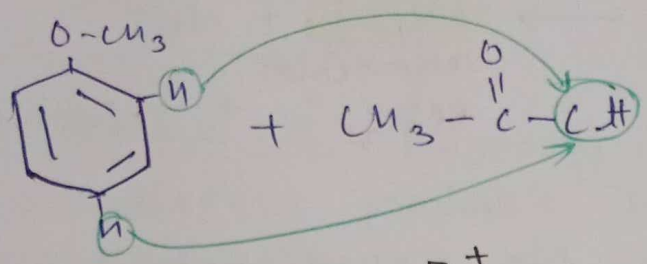
$[AlCl_4^-] + H^+ \downarrow AlCl_3 + HCl$

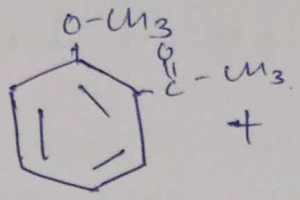
$E^+ \longrightarrow CH_3^+$

Major $\longrightarrow$ para.

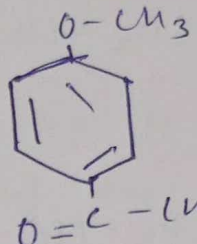
(iv) Friedel Craft Acylation Rxn.

$CH_3-\overset{O}{\overset{\|}{C}}-Cl$.





2 methoxy Acetophenone



4-methoxy acetophenone

$E^+ \longrightarrow CH_3-C^+=O$

Major $\longrightarrow$ para.

TEST OF ALCOHOL / PHENOL.

(1) Alc & Phenol.

Phenol + $FeCl_3$ $\longrightarrow$ $[Fe(OC_6H_5)_6]^{-3}$

Ferric chloride. Purple colour Sol.

Alcohol + $FeCl_3$ $\longrightarrow$ No Rxn / No colour.

(2) 1° / 2° / 3° Alcohol.

Lucas Reagent – $ZnCl_2$ + Conc HCl.

1° Alc + Lucas Reagent $\longrightarrow$ No Rxn

2° Alc + Lucas Reagent $\longrightarrow$ 10-15 min white turbid solution

3° Alc + Lucas Reagent $\longrightarrow$ few sec. white turbid sol.

(3) Methyl Alcohol / Ethyl Alcohol.

I_2 Test → NaOH

(Iodoform Test)

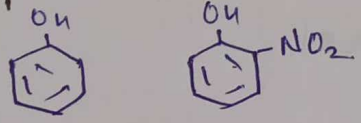
$CH_3-CH_2-OH + I_2 + NaOH \longrightarrow \underset{\text{Yellow colour ppt.}}{CHI_3} + NaI + HCOONa.$

$CH_3-OH + I_2 + NaOH \longrightarrow$ No yellow ppt.

QUESTIONS :-

1. Given below are two statements.

Statement I : The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group.



Statement II : O-nitrophenol, m-nitrophenol & p-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring.

a) Both statement I and statement II are incorrect.

b) statement I is correct but statement II is incorrect

c) statement I is in correct but statement II is correct.

d) Both statement I and statement II are correct.

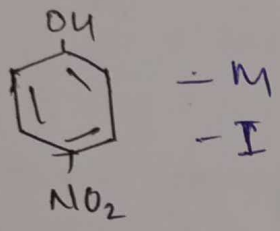
(2) Given below are two statements.

Statement I. In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. HCl + $ZnCl_2$, known as lucas reagent.

Statement II: Primary alc. are most reactive & immediately produce turbidity at room temp on reaction with lucas reagent.

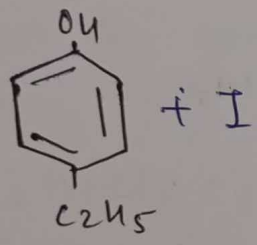
Ans (b)

(3) Which of the following substituted Phenols is the strongest acid?

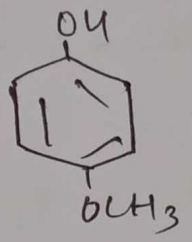
a) 

−M
−I

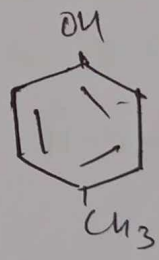
$\alpha \frac{-M}{+M} \quad \alpha \frac{-I}{+I}$

b) 

+I

c) 

+M
−I

d) 

+I

(4) The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is pent-2-ene. This product formation is based on.

a) Saytzeff's Rule

α, β elimination rxn = Saytzeff's Rule.

b) Hund's Rule

c) Hoffmann Rule

d) Huckel's Rule.

(5) $CH_3-CH_2CH=CH_2 \xrightarrow[H_2O,\ H_2O_2,\ OH^-]{B_2H_6} Z$. what is Z?

Anti mark

Peroxide

OH

H

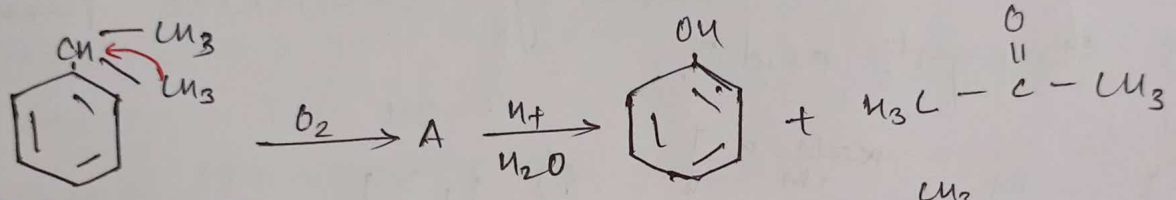
~~a)~~ $CH_3CH_2CH_2CH_2OH$

b) $CH_3CH_2\underset{\underset{OH}{|}}{CH}CH_3$

c) $CH_3CH_2CH_2CHO$

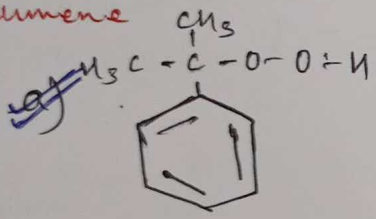
d) $CH_3CH_2CH_2CH_3$

(6) The structure of intermediate A in the following reaction, is:

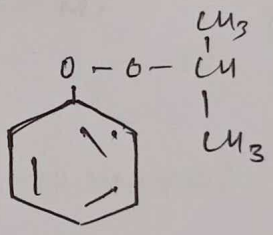


Cumene

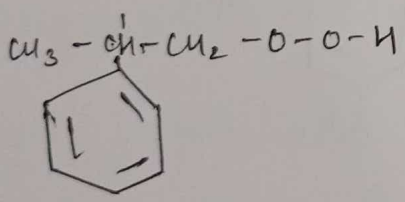
~~a)~~



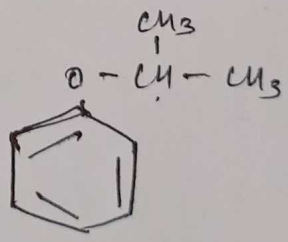
b)



c)

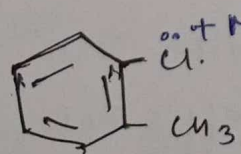


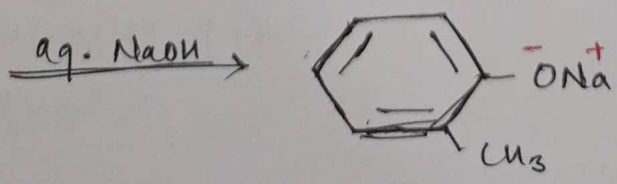
d)



(7) The hydrolysis reaction that takes place at the slowest rate, among the following is

~~a)~~

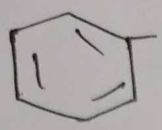




$\propto \frac{-M}{+M}$ $\propto \frac{-I}{+I}$

b) $H_3C-CH_2-Cl \xrightarrow{aq.\ NaOH} H_3C-CH_2-OH$

c) $H_2C = CH - CH_2Cl \xrightarrow{aq.\ NaOH}$

d)  $CH_2Cl \xrightarrow{aq.\ NaOH}$  CH_2OH.

(8) When vapours of a secondary alcohol is passed over heated copper at 573 k, the product formed is

a) a carboxylic acid
b) An aldehyde
c) A ketone.
d) An alkene.

1° Alc $\xrightarrow[573]{Cu}$ Acid

2° Alc $\xrightarrow[573]{Cu}$ ketone.

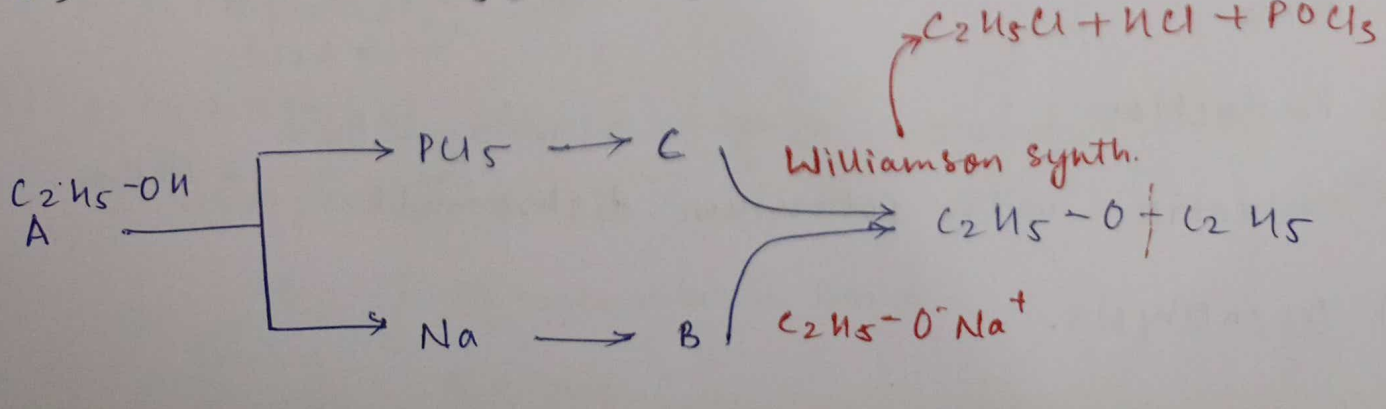
(9) The compound A on treatment with Na gives B, and with PCl_5 gives C. B and C react together to give diethyl ether. A, B & C are in the order.

a) C_2H_5Cl, C_2H_6, C_2H_5OH

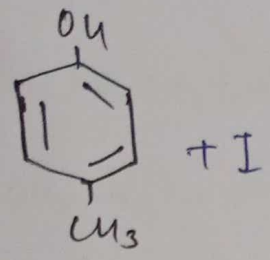
b) C_2H_5OH, C_2H_5Cl, C_2H_2ONa.

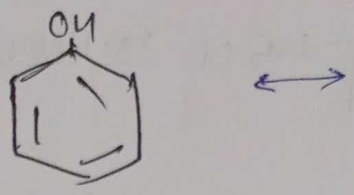
c) C_2H_5OH, C_2H_6, C_2H_5Cl.

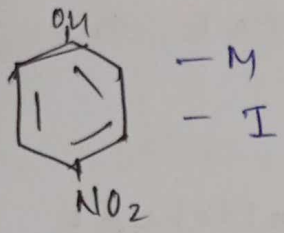
d) C_2H_5OH, C_2H_5ONa, C_2H_5Cl.

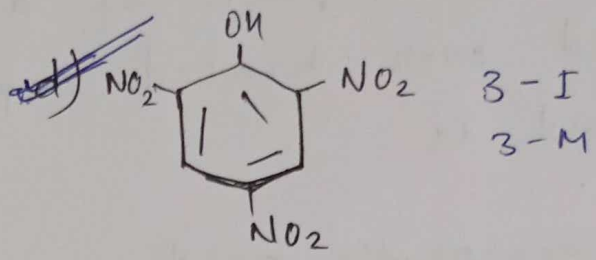


(10) Which one is the most acidic compound?

a) 

b) 

c) 

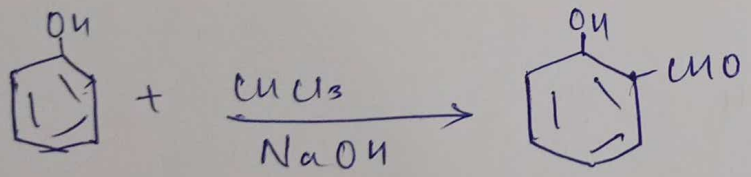
d) 

(11) Reaction of phenol with chloroform in the presence of dilute sodium hydroxide finally introduces, which one of the following functional group?

a) $-CH_2Cl$ b) $-COOH$

c) $-CHCl_2$ d) $-CHO$.

Reimer Tiemann Rxn.



Salicyaldehyde.

(12) n-propyl alcohol and iso-propyl alcohol can be chemically distinguished by which reagent?

(a) PCl_5

$CH_3-CH_2-CH_2-OH$ → Acid.

(b) Reduction

(c) Oxidation with potassium dichromate. $CH_3-\underset{CH_3}{CH}-OH$ → No Rxn

(d) Ozonolysis.

(13) When phenol is treated with $CHCl_3$ and NaOH, the product formed is.

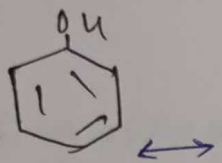
a) benzaldehyde

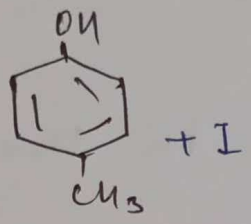
~~b)~~ salicyladehyde

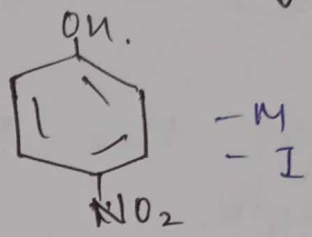
c) salicylic acid

d) benzoic acid.

(14) The correct acidic order of the following:

(I) 

(II) 

(III) 

a) I > II > III

~~b)~~ III > I > II

c) II > III > I

d) I > III > II

(15) The boiling point of p-nitrophenol is higher than o-nitrophenol bcz.

a) NO_2 group at p-position behaves in a different way from that at o-position.

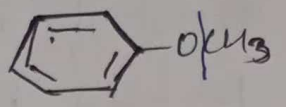
b) Intramolecular hydrogen bonding exists in p-nitrophenol.

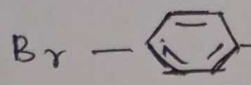
~~c)~~ There is intermolecular hydrogen bonding in p-nitrophenol.

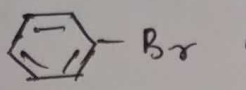
d) p-nitrophenol has a higher molecular weight than o-nitrophenol.

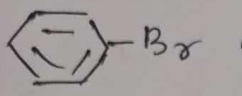
Intramolecular H-Bond

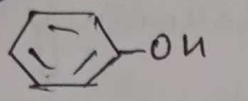
B.P less

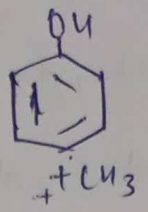
Q. In the reaction  $\xrightarrow{HBr}$ the products are.

a) 

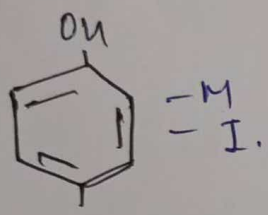
b) 

c) 

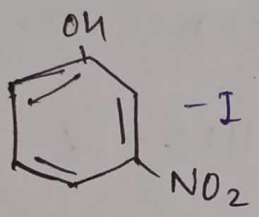
~~d)~~ 



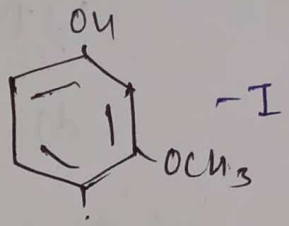
Q. Arrange the following in the decreasing acidic strength.



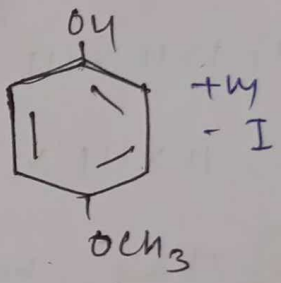
(I)



(II)



(III)



(IV)

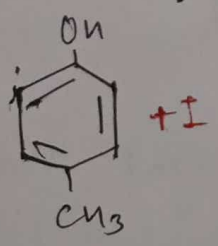
~~a)~~ A > B > C > D

b) B > A > C > D.

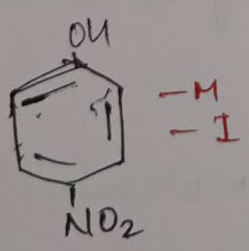
c) D > C > A > B

d) D > C > B > A.

Q. The increasing order of boiling points of the following compounds is:

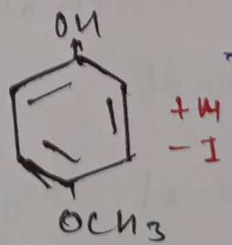


(I)



(II)

(III)



(IV)

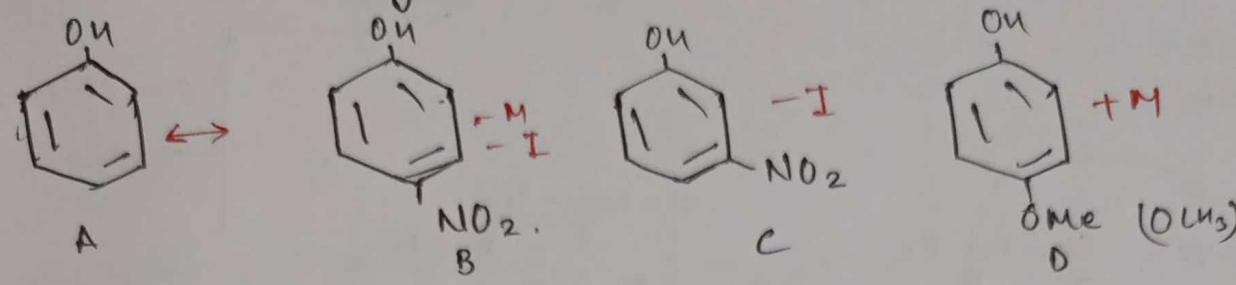
a) I < IV < III < II

~~b)~~ IV < I < III < II

c) I < III < IV < II

d) III < I < II < IV

The increasing order of the Pka values of the following compound is.



A B C D

a) ~~D < A < C < B~~

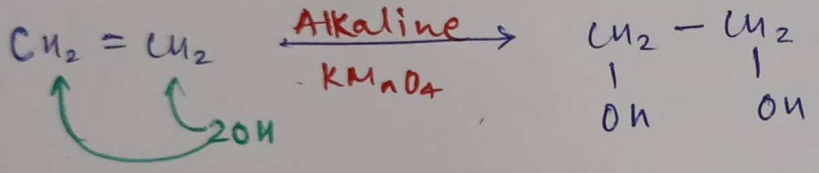
b) B < C < D < A

c) C < B < A < D

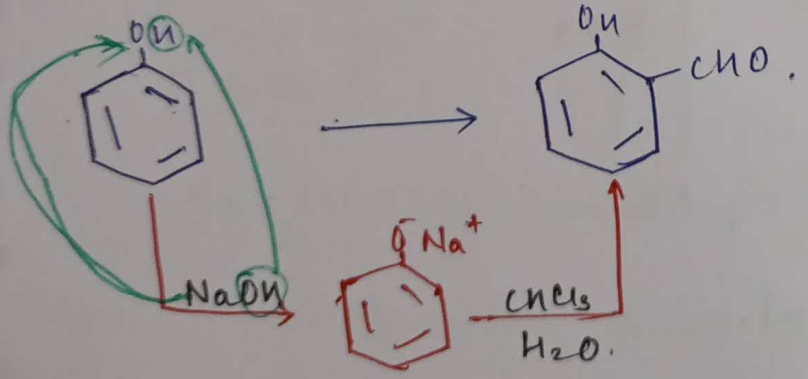
d) B < C < A < D

CONVERSION :-

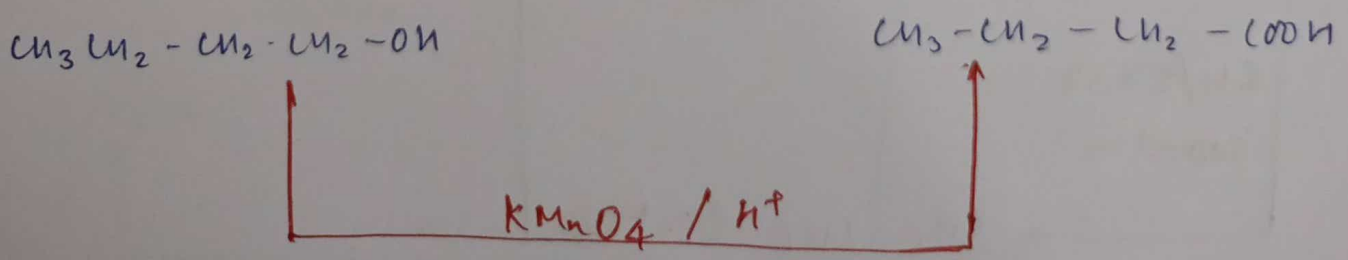
(1) Ethene ⟶ Ethandiol.



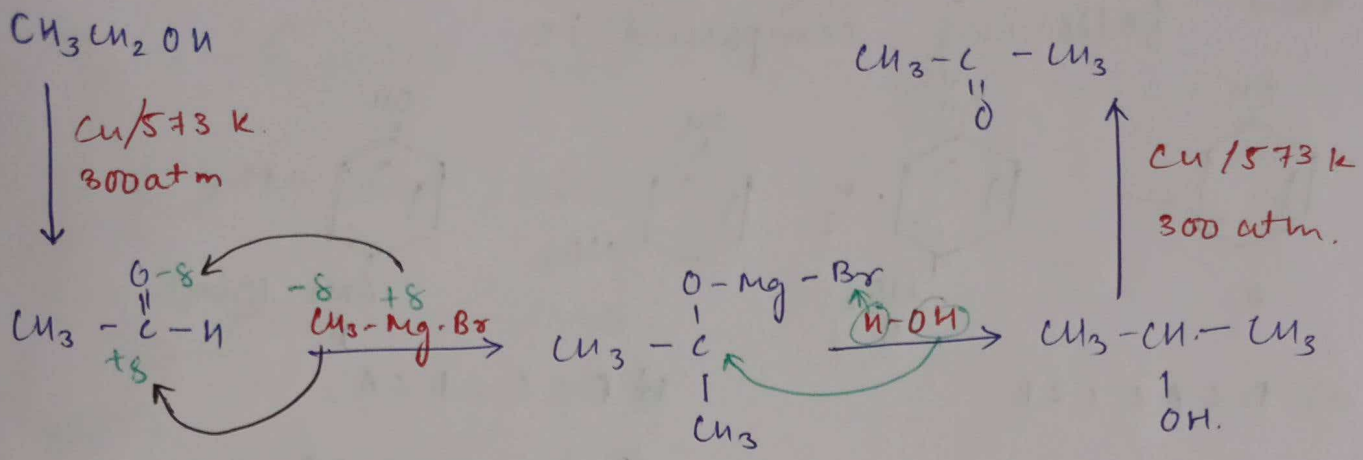
(2) Phenol ⟶ Salicaldehyde.



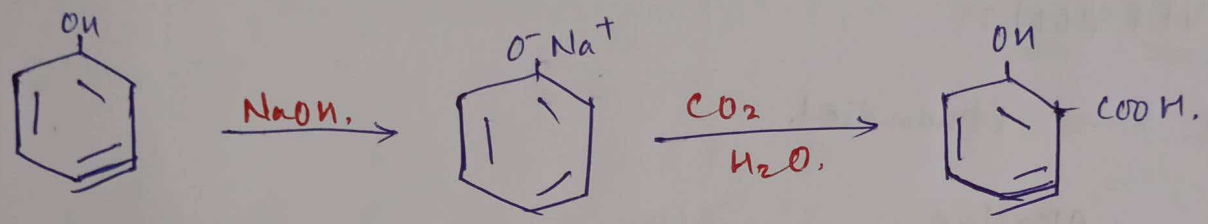
(3) Butanol ⟶ Butanoic Acid.



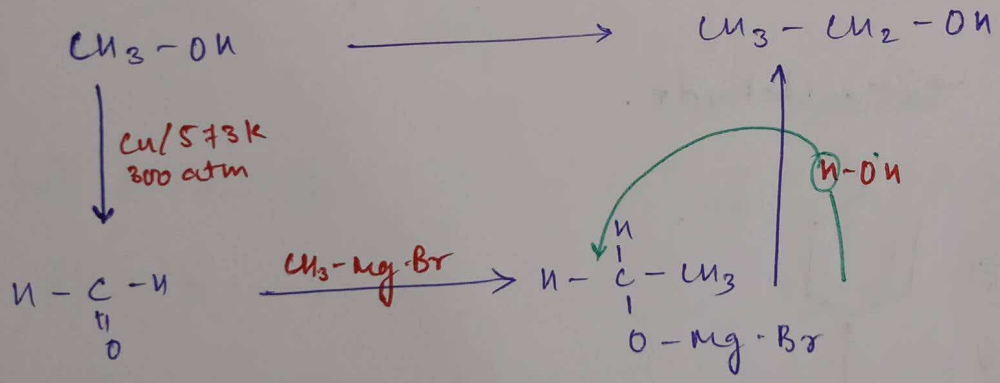
④ Ethanal to Propanone.



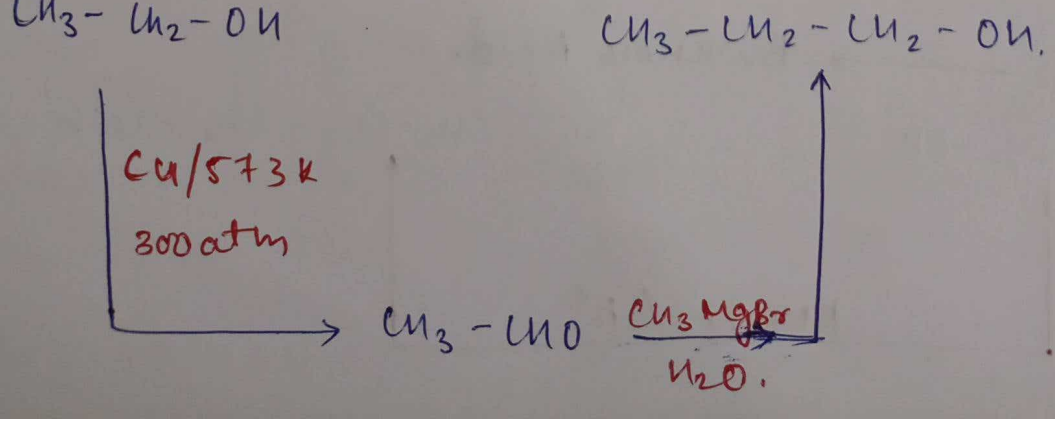
⑤ Phenol to Salicylic Acid.



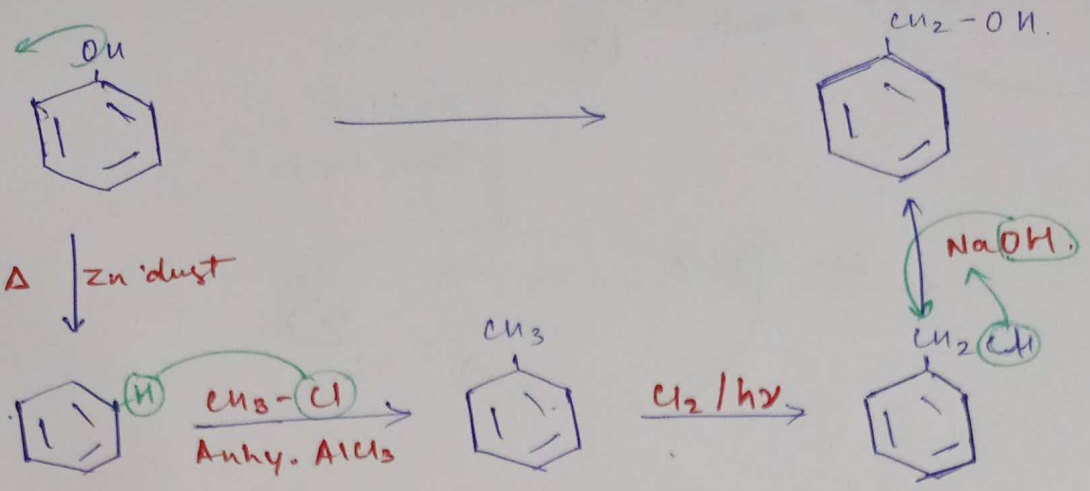
⑥ Methanol to Ethanol.



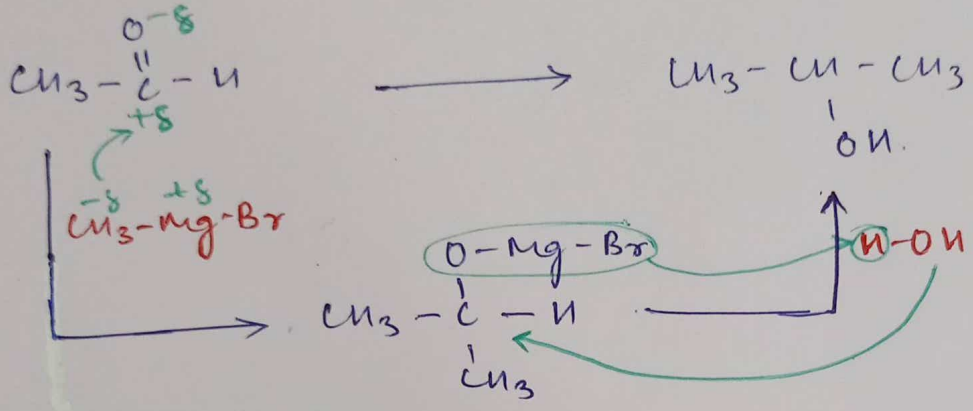
⑦ Ethanal to Propanol.



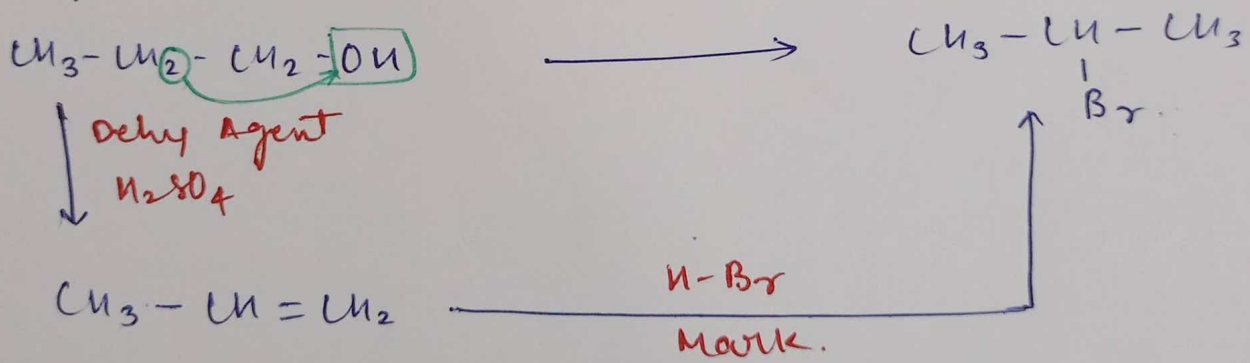
(8) Phenol ⟶ Benzyl Alc.



(9) Ethanal to Propan-2-ol.

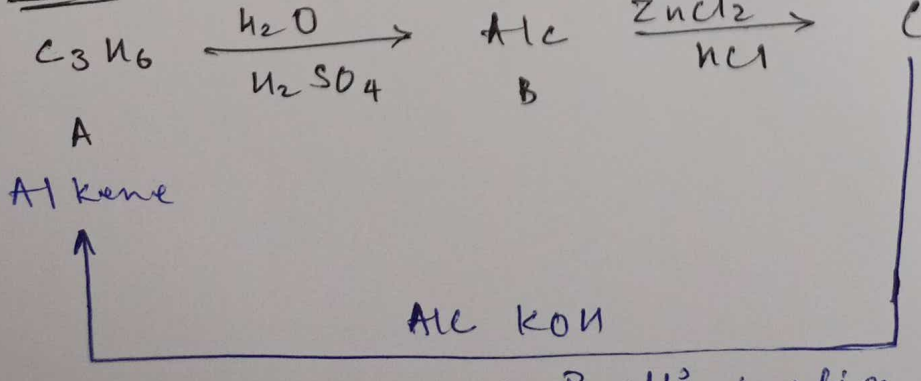


(10) Propanol to 2-Bromopropane.

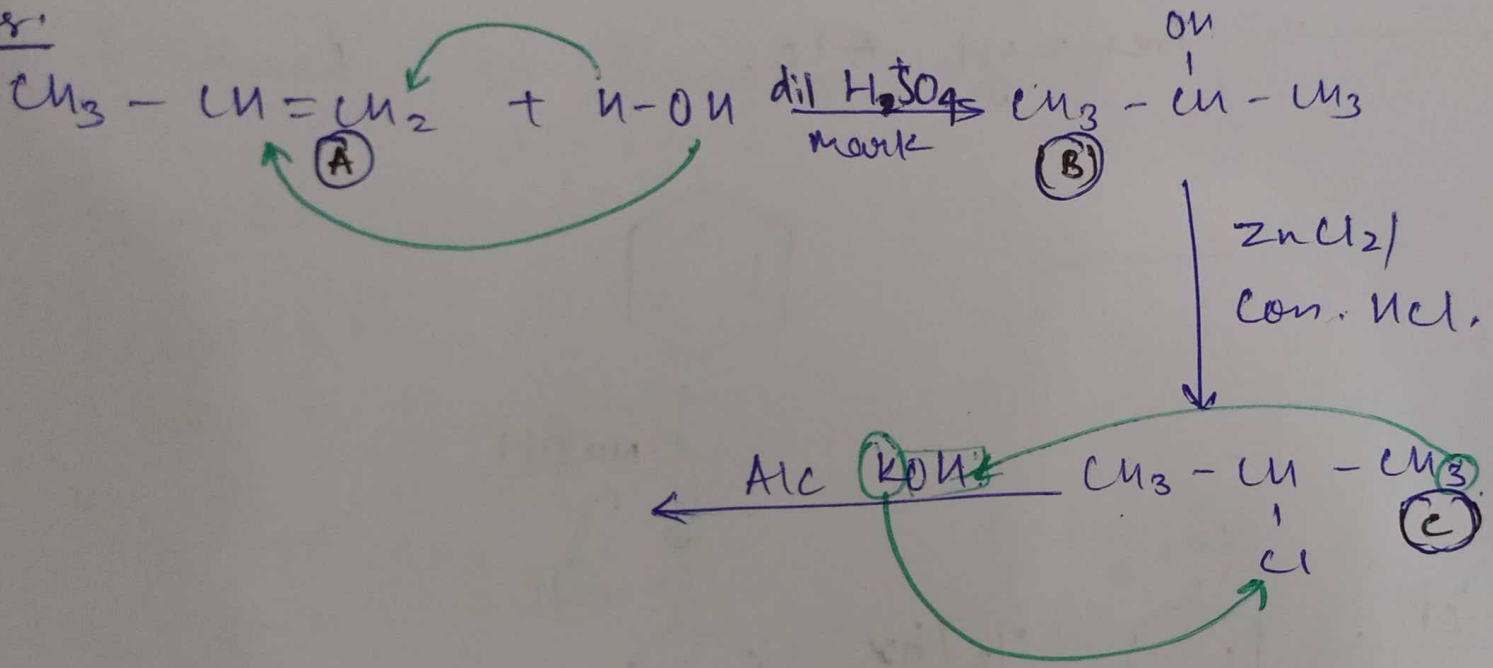


Topic - Identification Question.

(1) Quest



Ans:


CH3 – CH = CH2
(A)
+ H–OH
dil H2SO4
Markownikoff
CH3 – CH(OH) – CH3
(B)
ZnCl2/
Con. HCl.
CH3 – CH(Cl) – CH3
(C)
Alc KOH

VICTORY ZONE CHEMISTRY CLASSES

ADDRESS – 1ST FLOOR PRADEEP PLAZA, IN FRONT OF CHOPRA PALACE , ADARSH NAGAR DURG

MO 9424168056,8269055301

CBSE TEST PAPER-02

CLASS - XII CHEMISTRY (Alcohols, phenols and Ethers)

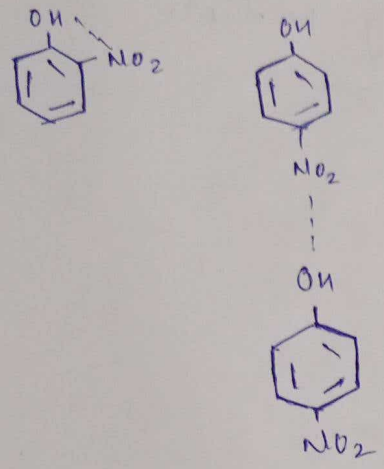
Topic:-Reasoning Questions

Give Reasons for the followings :-

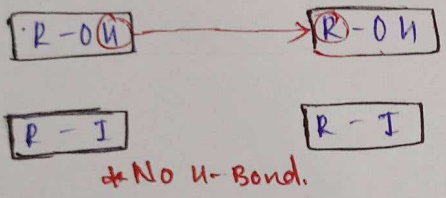
1. Phenol is acidic in nature.
After giving (H+) phenol are converted into phenoxide ions due to the resonance, which is stable. by
2. Phenol has a smaller dipole moment than methanol. That's why
All carbon of phenol are sp_2 which have higher EN than sp_3 carbon so in phenol difference b/w EN are of O_2 & sp_2 carbon are very less.
3. o- nitrophenol has lower boiling point (is more volatile) than p – nitrophenol.
4. Methanol is miscible with water while iodomethane is not.
5. Alcohols have higher boiling points than isomeric ethers.
6. Ethers are soluble in water alkanes are not.
7. The order of acidic strength in alcohols is $R\,CH_2OH > R_2\,CHOH > R_3\,COH$
8. During preparation of ester from alcohol and acid, water has to be removed as soon as it is formed.
9. Ethers can not be prepared by dehydration of secondary or tertiary alcohols.
10. Reaction of anisole with HI gives methyl iodide and phenol.

1. After giving (H^+) phenol are converted into phenoxide ions due to the Resonance, which is stable.

2. All carbon of phenol are sp_2 which have higher EN than sp_3 carbon so in phenol difference b/w EN are of O_2 & sp_2 carbon are very less.

3. 

Ortho Nitrophenol have intra molecular H-Bond. & Para Nitrophenol have inter molecular H-Bond. So, P-Nitrophenol need more temp to Break H-Bond.

4. 

*No H-Bond.

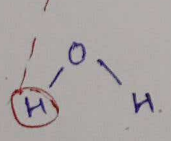
Methanol form intermolecular H-Bond with eachother but CH_3I doesn't. They also form H-Bond in water, that's why it is miscible.

5. R-OH form intermolecular H-Bond with each other.
Ether doesnot form H-Bond. with eachother.

R - OH

R - O - R

6. R — O — R



They form intermolecular H-Bond with H_2O so, they are easily soluble.

7. Bcz Acidic effect $\propto \frac{-I}{+I}$ & 3° have 3 +I & Primary have 1 +I that's why primary are more acidic.

* $RCH_2OH > R_2CHOH > R_3COH$.
3° < 2° < 1°

8. Estrification is reversible process so it is very imp to remove product for ~~yeild~~ good yeild of product / Ester according to the Le chatlier's Rxn.

9. 3° Alc goes to α, β ellimination with conc. H_2SO_4.

$2^\circ/3^\circ$ Alc ⟶ α, β elliminations with H_2SO_4. Mech - SN1

10. Rxn with H-I most stable in phenoide Ion and primary carbocation. which is followed by following products.