

ALCOHOL PHENOL & ETHER

Class XII
BOARD EXAM

↳ These notes
have been verified by
top faculties & CBSE
Science Toppers

↳ As per
updated
syllabus

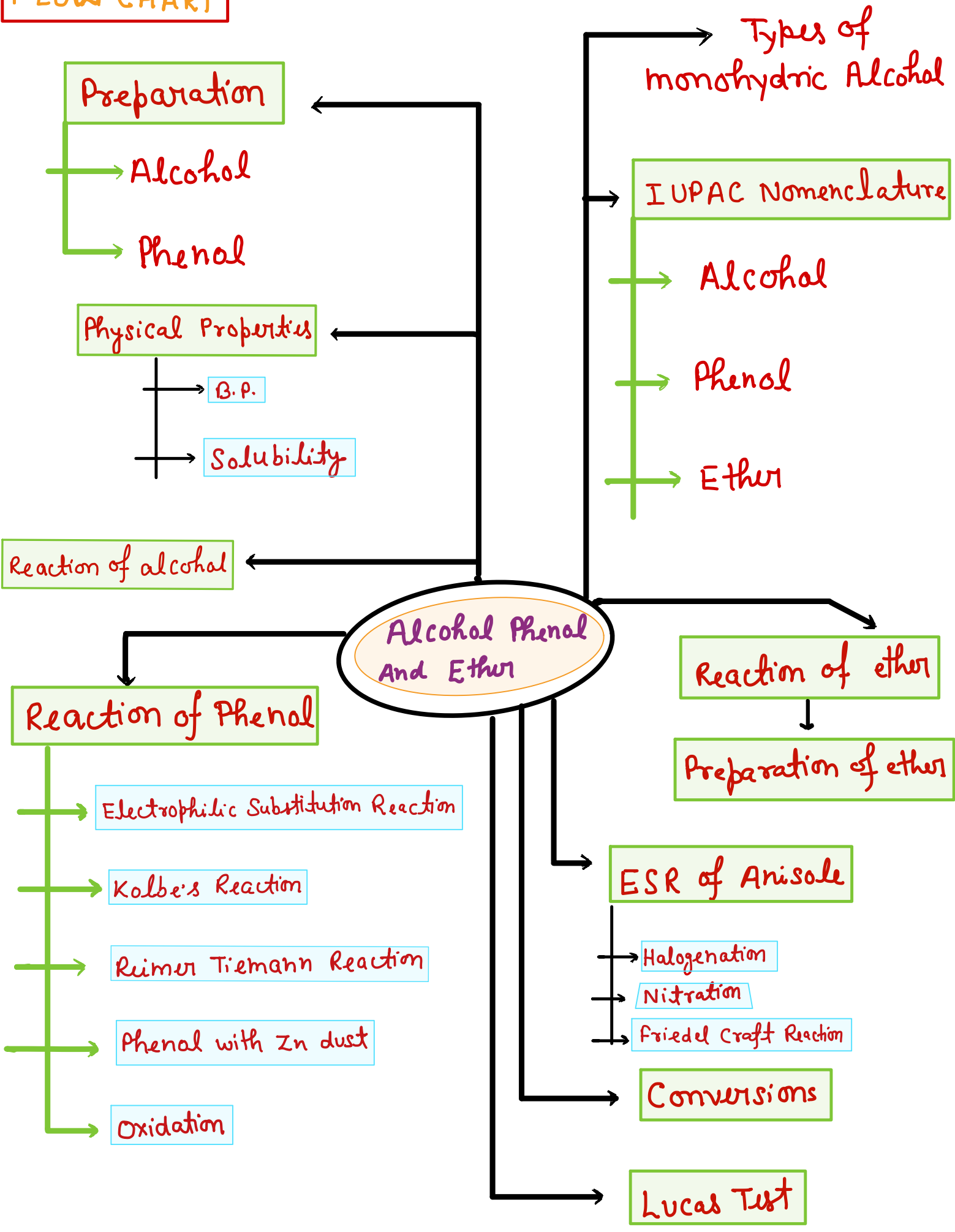
↳ Target 100
↳ Previous Year Q's

JAO AB
PHODO!

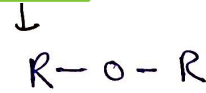
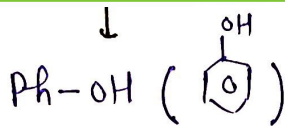
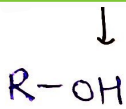


Aman
Dhattarwal

FLOW CHART



Alcohols, Phenols and Ethers

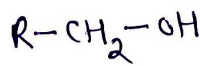


Apni Kaksha

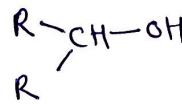
Monohydric Alcohols

Compounds containing Csp³-OH bond

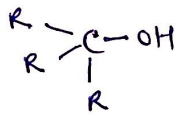
Primary Alcohol



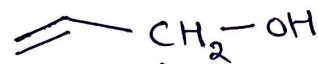
Secondary Alcohol



Tertiary Alcohol



Allylic Alcohols :-

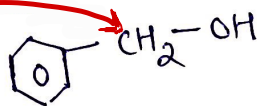


Allylic carbon
[Carbon next to double bond]

Benzylic Alcohols :-

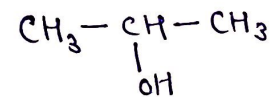
Benzylic Carbon

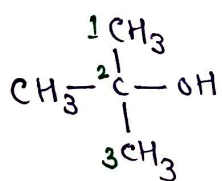
[Carbon next to benzene]



IUPAC Nomenclature of Alcohols

→ The longest carbon chain is numbered starting at the end nearest to the hydroxyl group (-OH).
Alkane - e + ol = Alkanol

Examples :- CH₃-OH : Methanol (Methyl alcohol) ; 



: 2-Methylpropan-2-ol

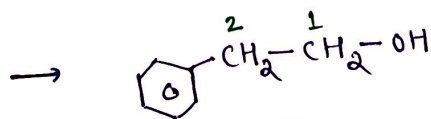
↳ IUPAC

↳ Common Name

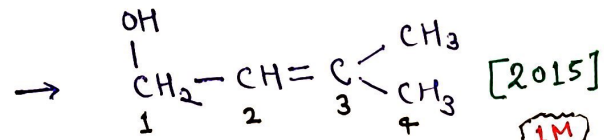
Propan-2-ol

(Isopropyl alcohol)

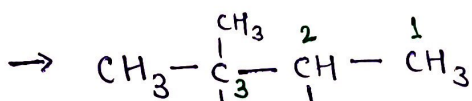
(tert-Butyl alcohol) : [Delhi 2012] **1M**



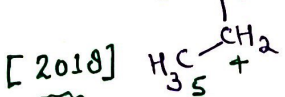
: 2-Phenylethan-1-ol



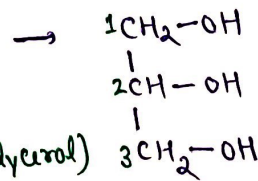
: 3-Methylbut-2-en-1-ol



: 3,3-Dimethylpentan-2-ol



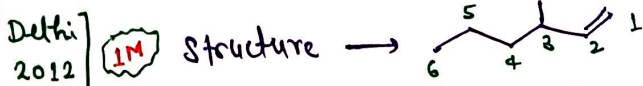
1M



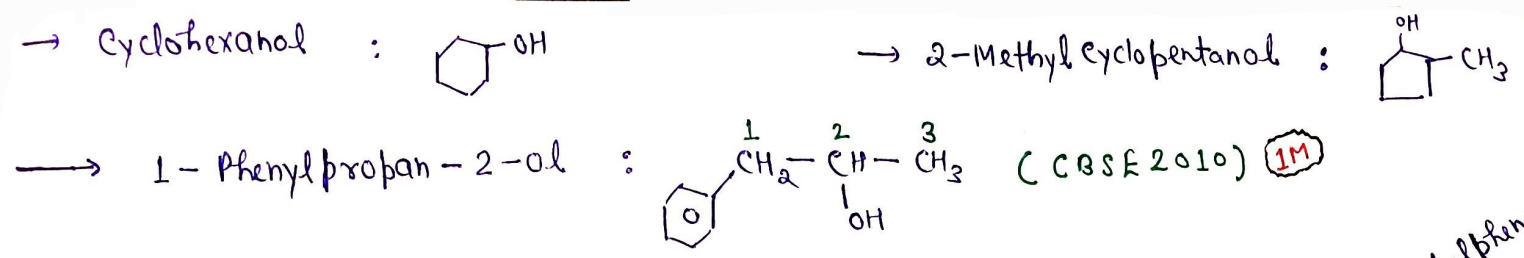
(Glycerol)

: Propan-1,2,3-triol

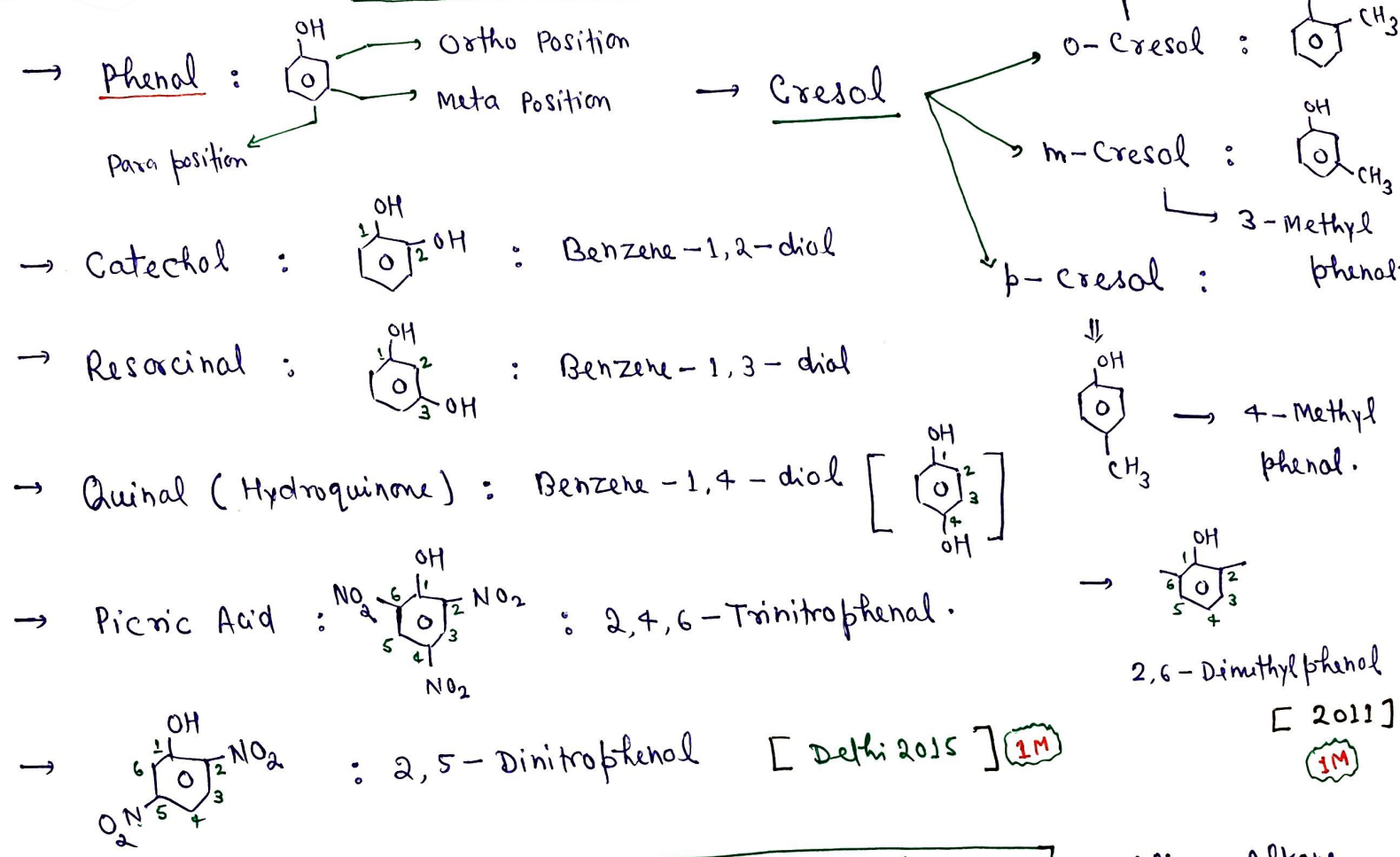
→ Hex-1-en-3-ol



Apni Kaksha



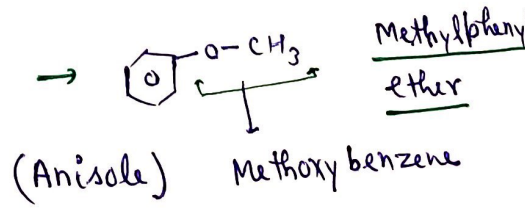
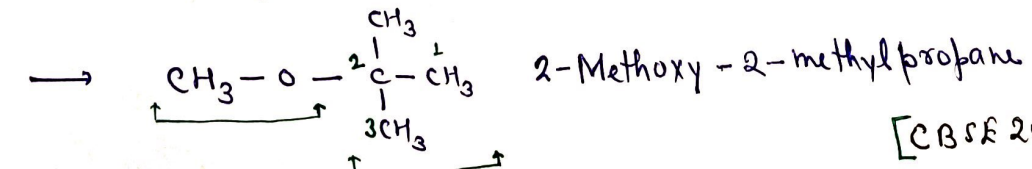
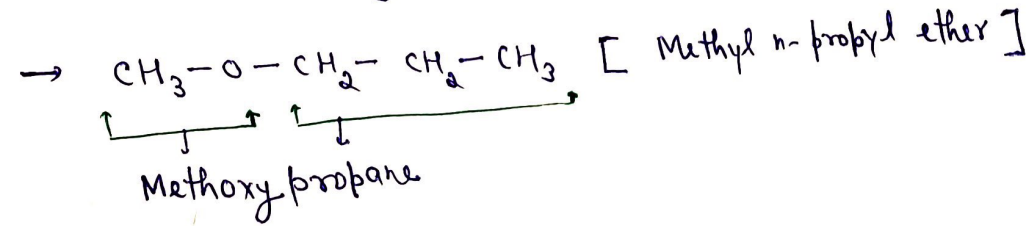
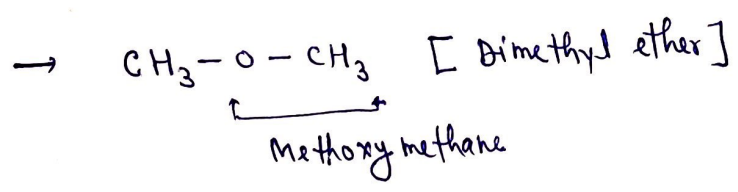
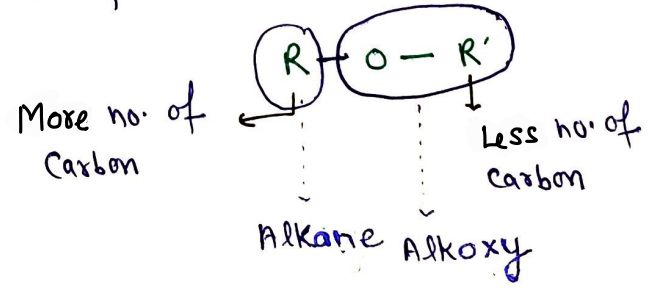
IUPAC Nomenclature of Phenols

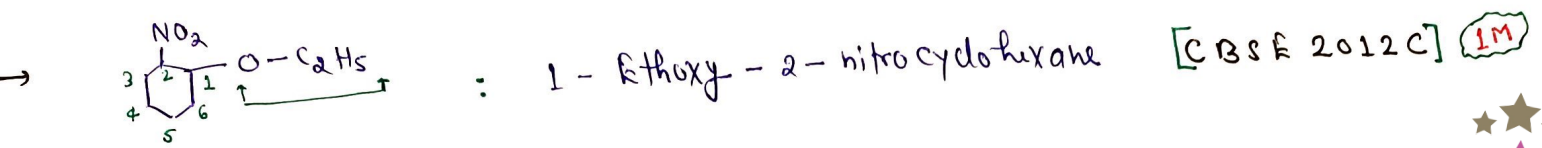
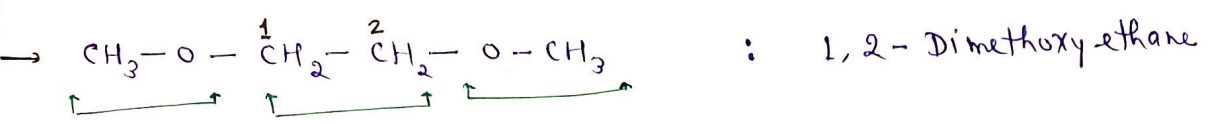
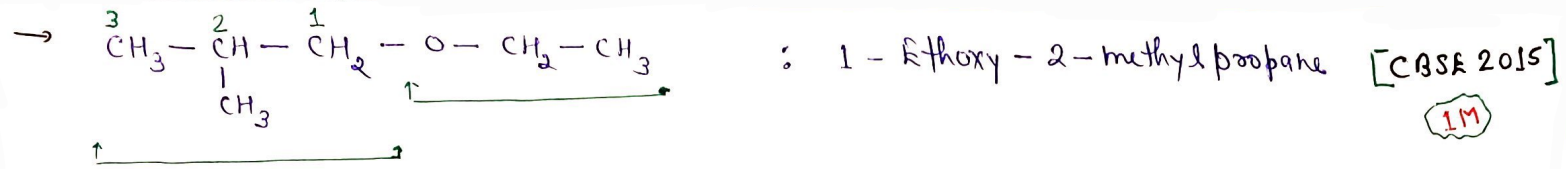


IUPAC Nomenclature of Ethers

Alkoxy Alkane
R-O-R'

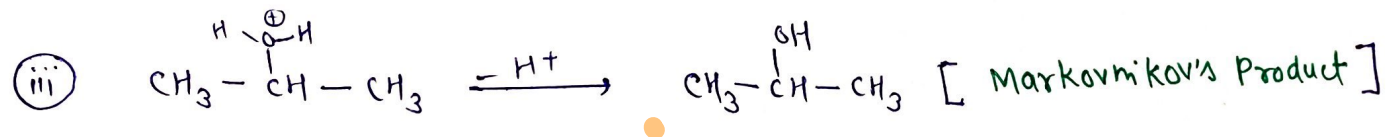
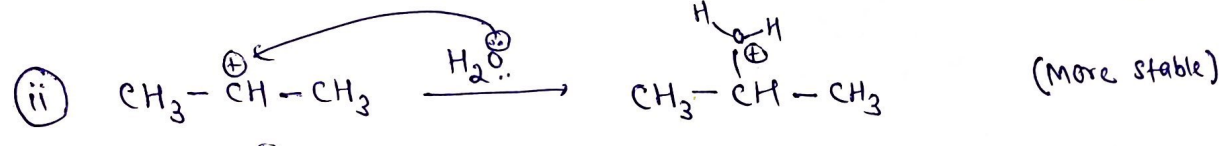
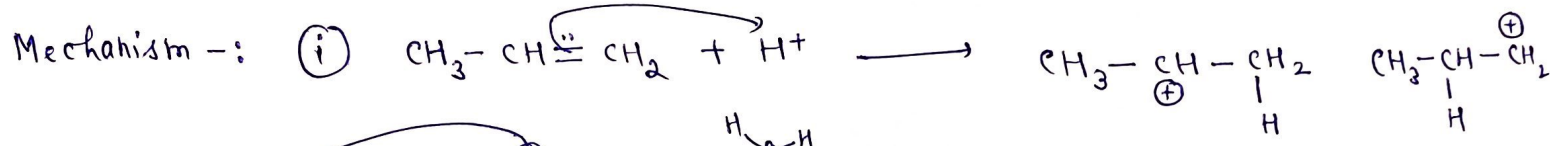
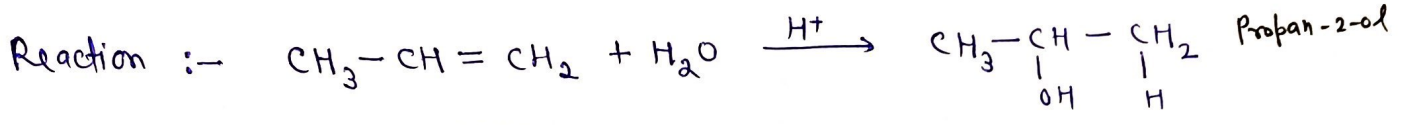
→ Common name of ethers are derived from the names of alkyl/aryl groups written as separate words in alphabetical order and adding the word "ether" at the end.



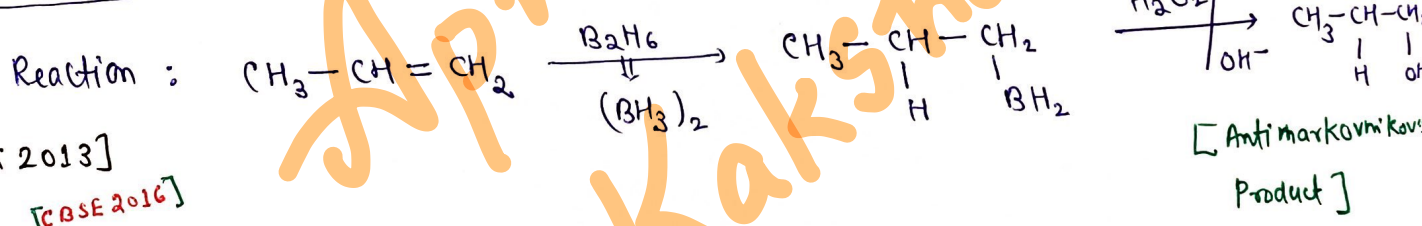


Preparation of alcohols

1.] From alkenes :- [a.] Acid catalysed hydration :-



[b.] Hydroboration - Oxidation Method :-



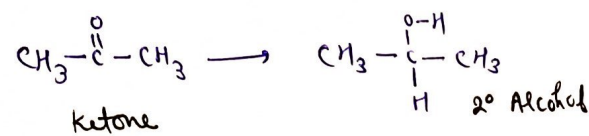
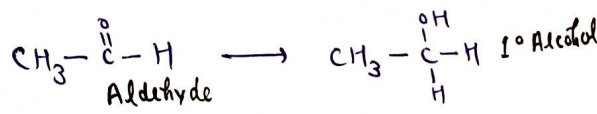
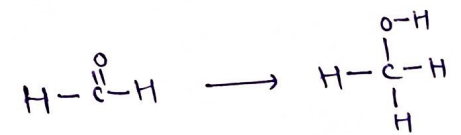
[Delhi 2013] 1M [CBSE 2016]

2.] From Carbonyl Compounds :-

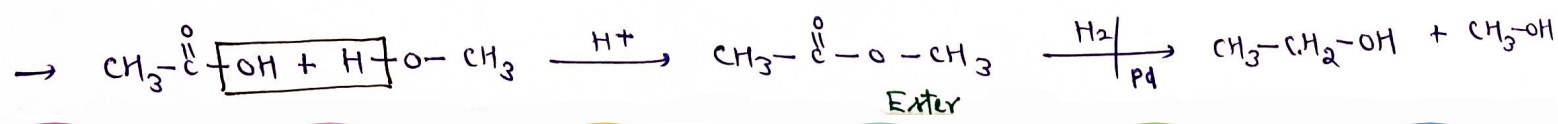
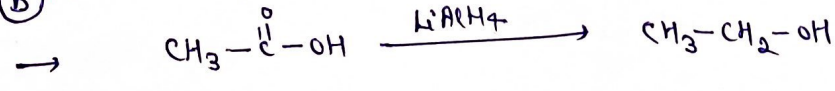
(a.) Reduction of aldehyde and ketone :-

Reducing agent : NaBH_4 / LiAlH_4 / H_2 with Pd

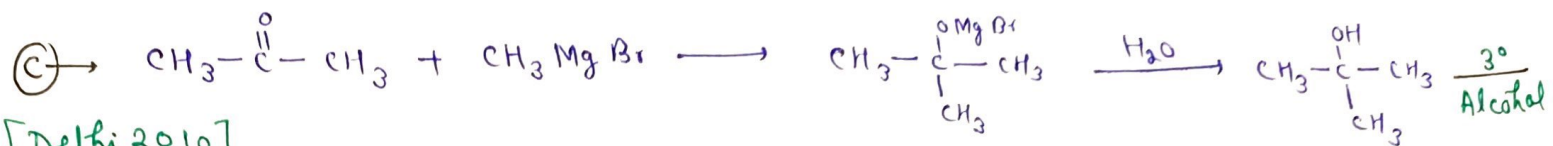
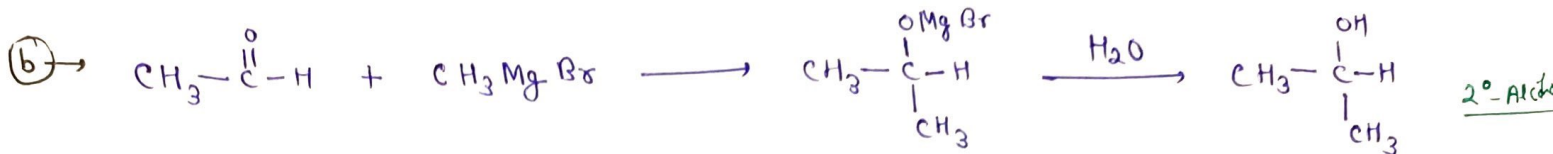
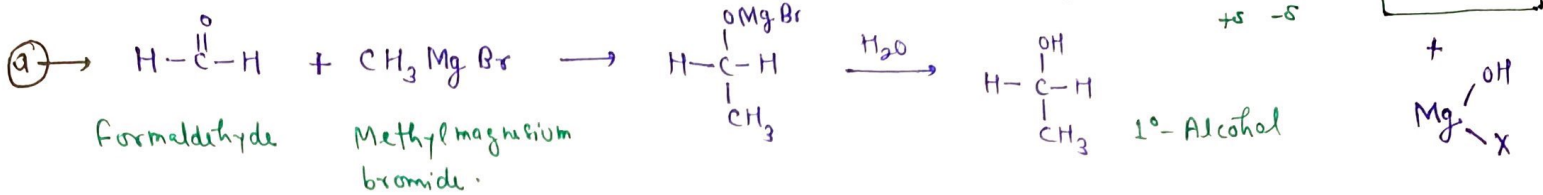
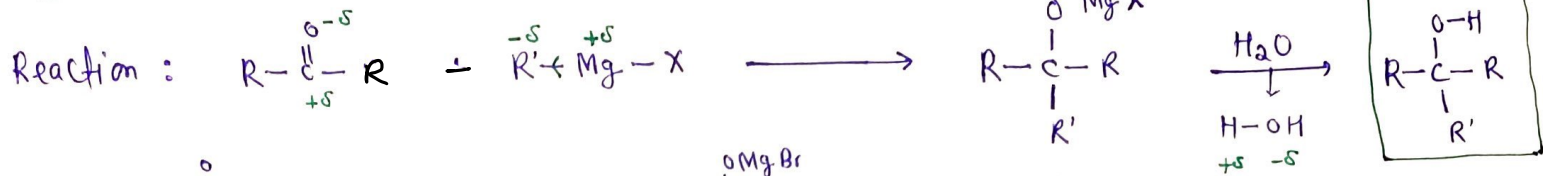
only for ketone/aldehyde \leftarrow ketone/aldehyde/acid Ester



(b.) Reduction of carboxylic Acid :-



3.] From Grignard Reagents -:



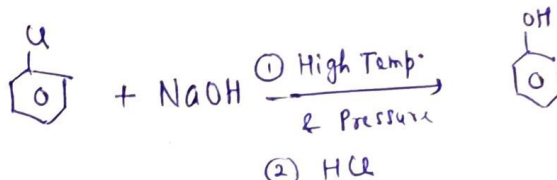
[Delhi 2010]

1M

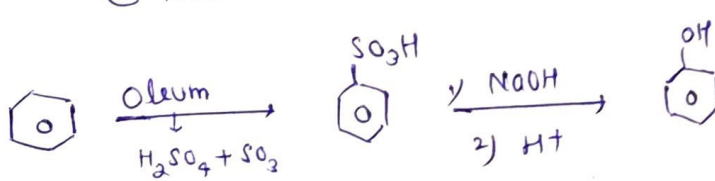


Preparation of Phenol

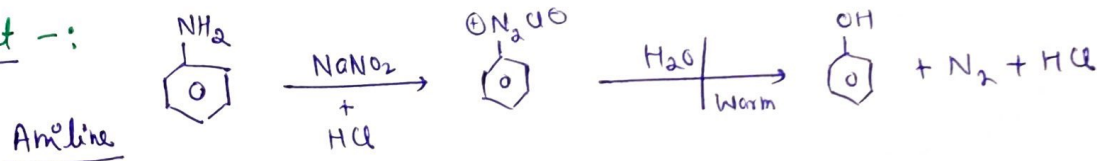
1. From Haloarenes -:



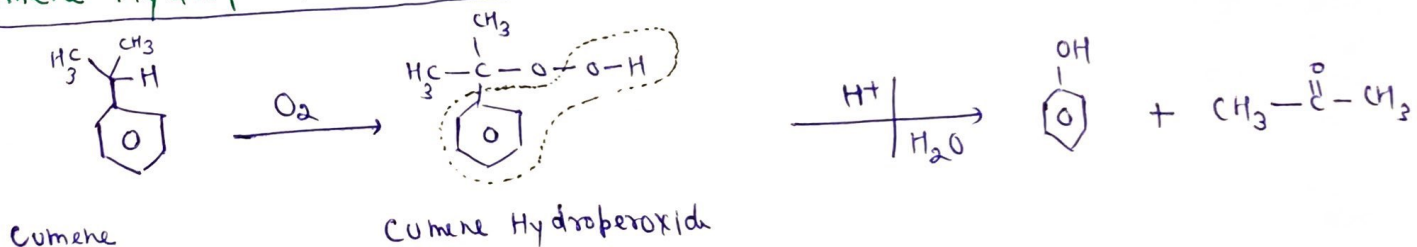
2. From Benzenesulphonic Acid -:



3. From diazonium salt -:



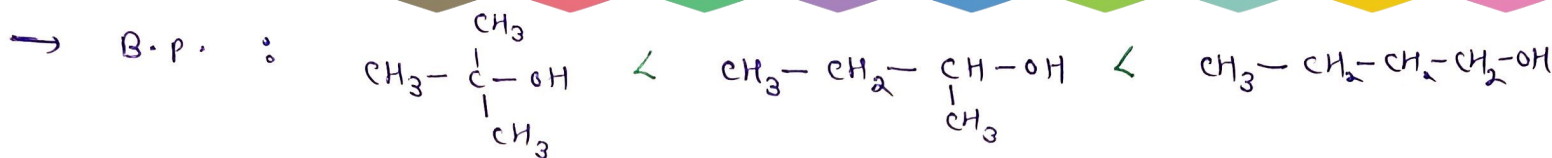
4. Cumene Hydroperoxide Method -:



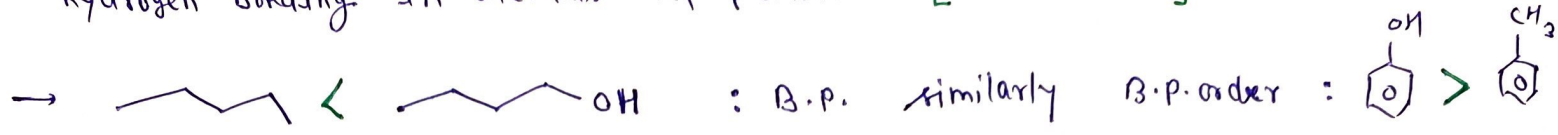
Physical Properties

Boiling Point -: B.P. of alcohols and phenols ↑ as no. of carbon atoms increases

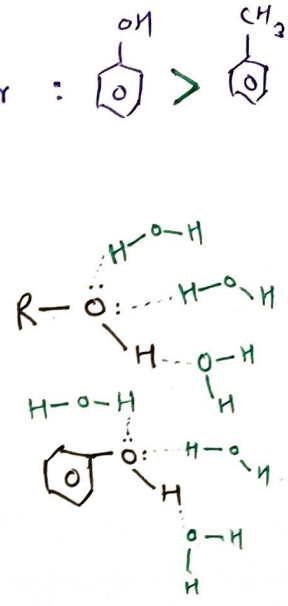
→ In alcohols -: As branching ↑ ⇒ B.P. ↓ : This is because of decrease in Vander Waals forces with decrease in surface area.



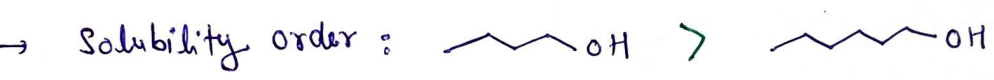
→ B.P. of alcohols and phenols are higher in comparison to hydrocarbons, ethers, haloalkanes and haloarenes of comparable molecular masses. This is because of hydrogen bonding in alcohols and phenols. [CBSE 2012] **1M**



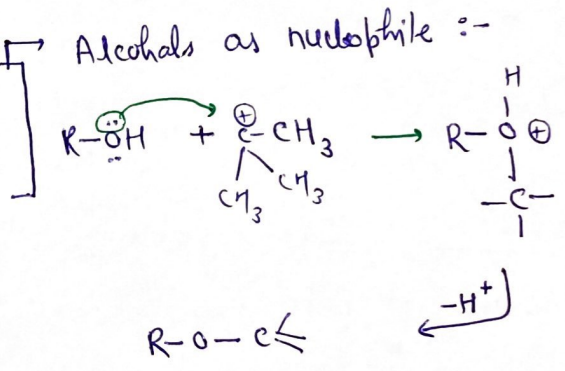
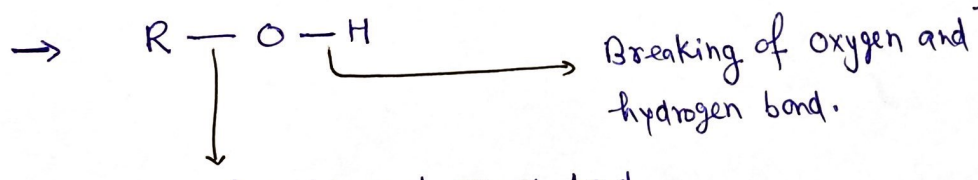
Solubility - : Solubility of alcohols and phenols in water is due to their ability to form hydrogen bonds with water.



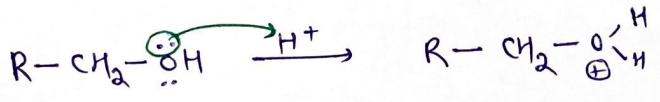
→ Solubility \downarrow \Rightarrow size of alkyl / aryl group \uparrow
(Hydrophobic part.)



Chemical Reactions

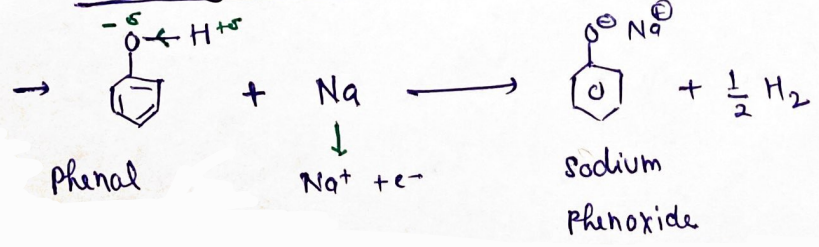
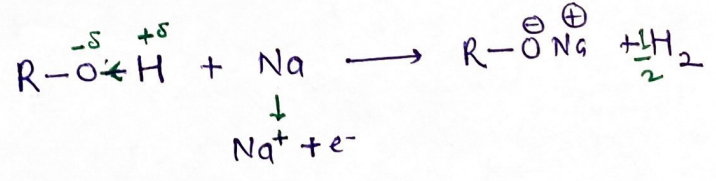


→ Protonated alcohols as electrophiles

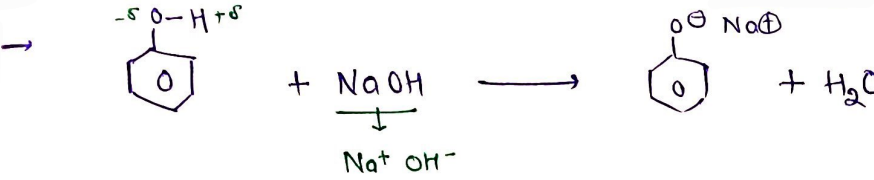


Apni Kaksha :-

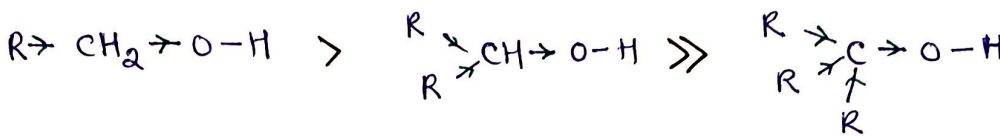
Acidity of alcohols & phenols :-



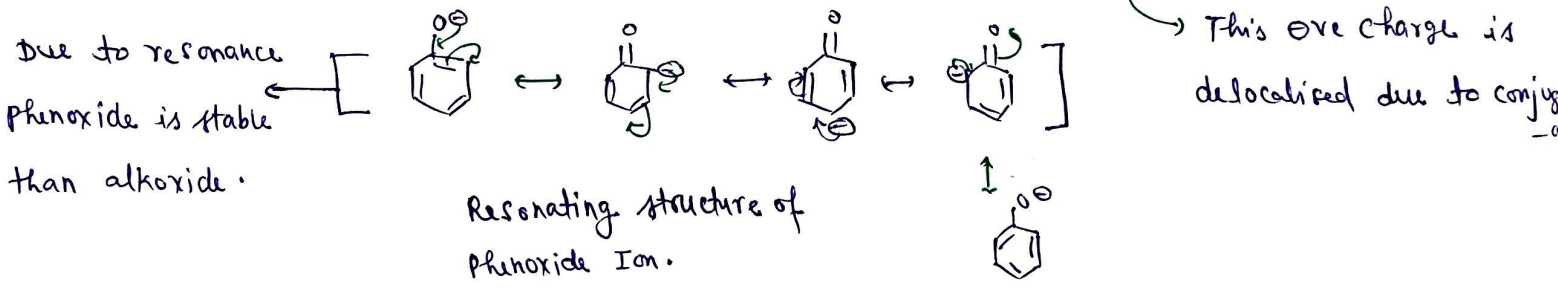
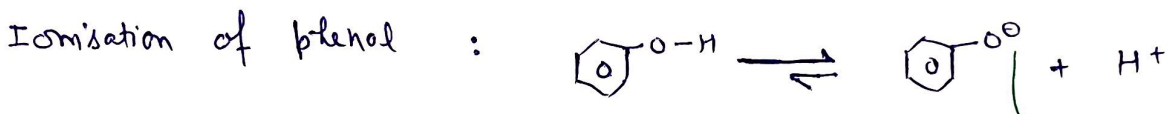
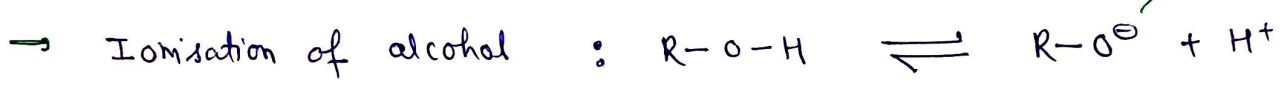
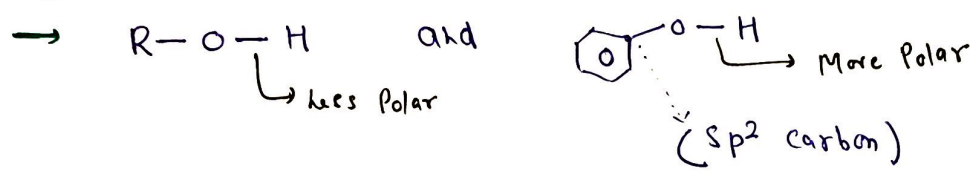
This reaction shows that alcohols and phenols can donate H^+ , means that they are acidic.



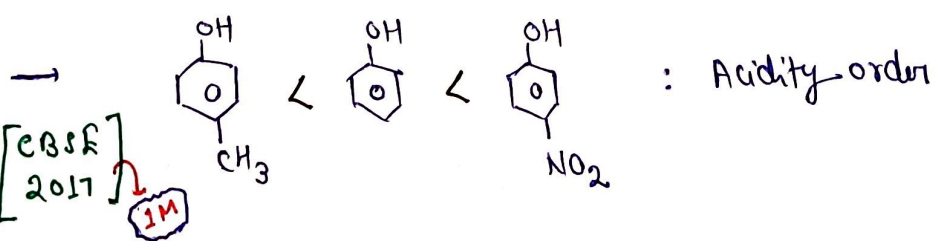
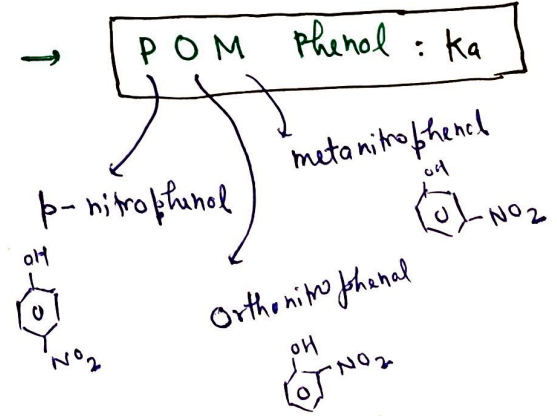
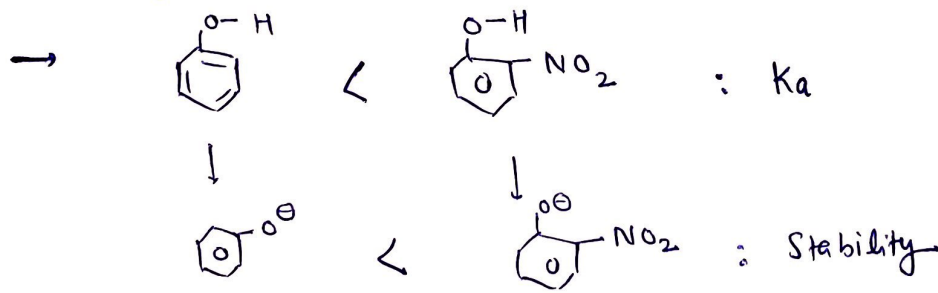
#] The acidic character of alcohols is due to the polar nature of -O-H bond. An electron releasing group (-CH₃ / -C₂H₅ etc.) increases electron density on oxygen tending to decrease the polarity of -O-H bond. This decrease the acidic strength.



★★★ #] Phenols are more acidic than alcohols? [CBSE 2015] 1M ★★★

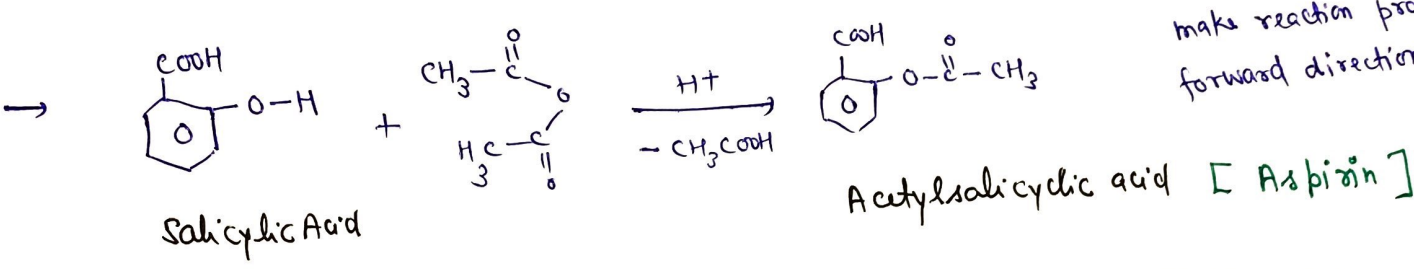
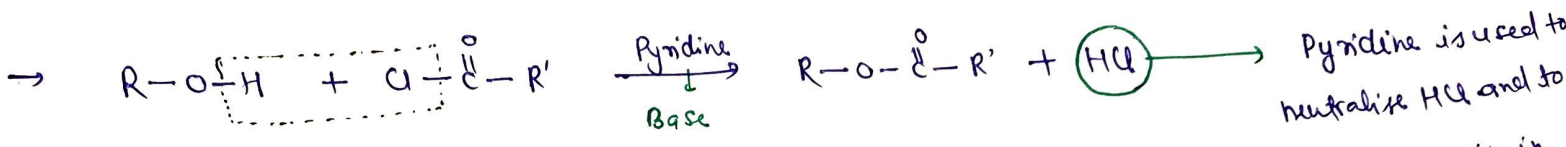
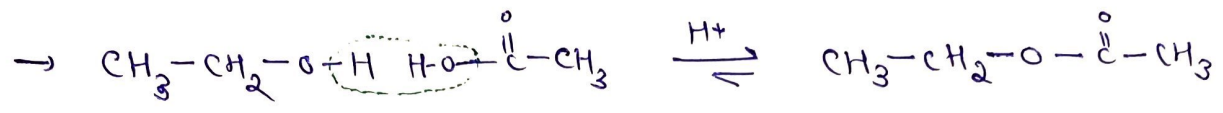
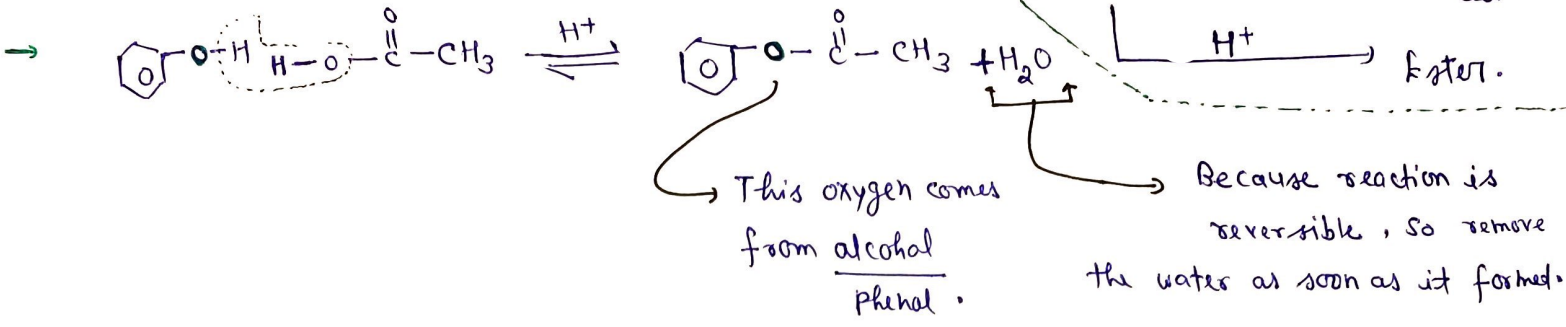


NOTE -: In resonating structure of phenoxide ion -ve charge is present at ortho and para position. So, -ve charge stabilising groups (-I / -M) can increase stability of substituted phenoxide ion. Thus it can increase the acidity.

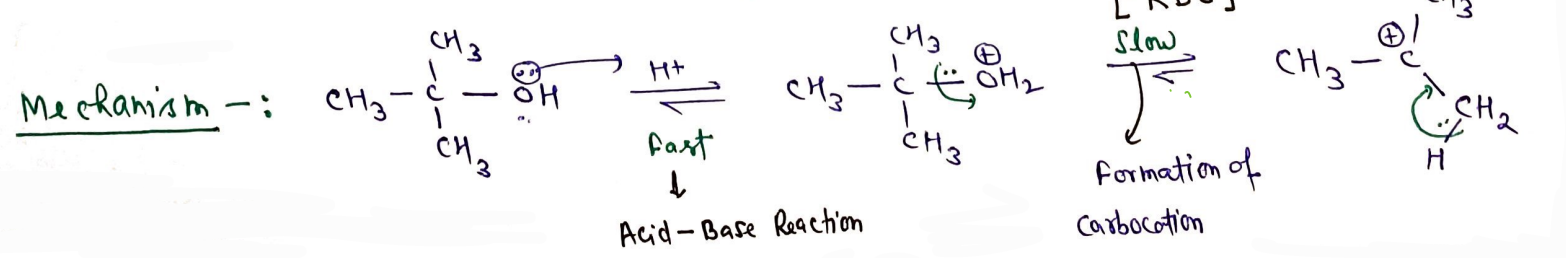
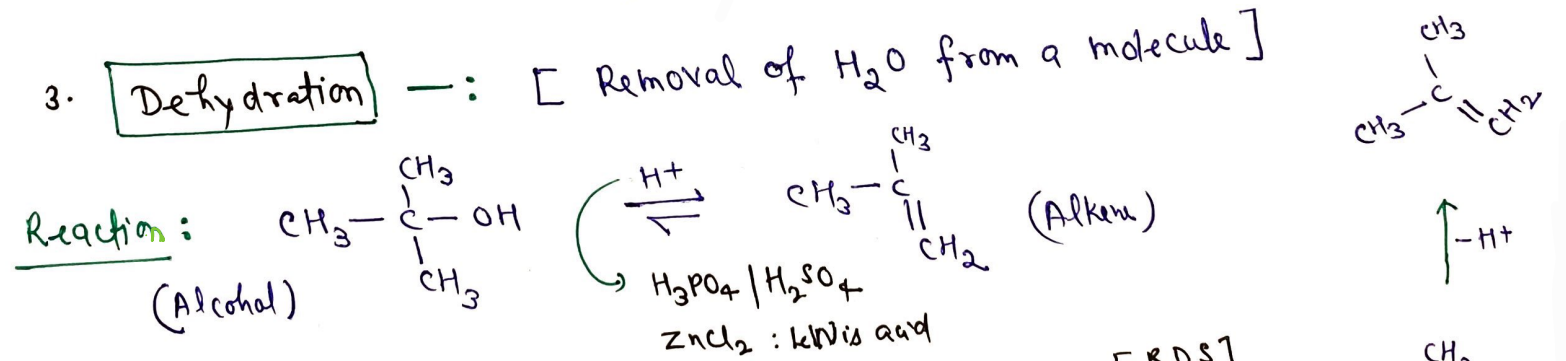
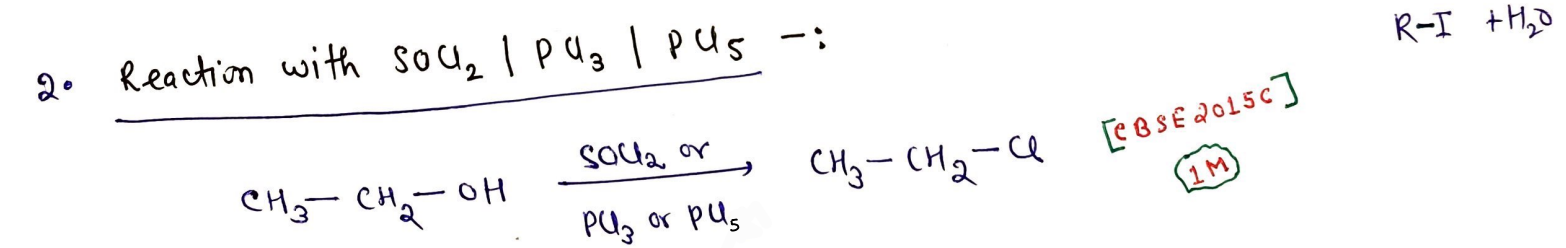
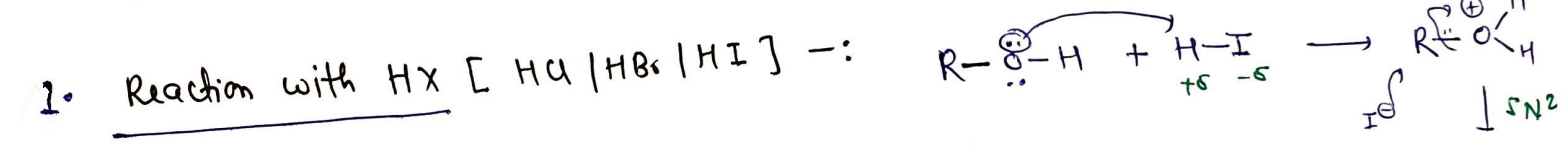


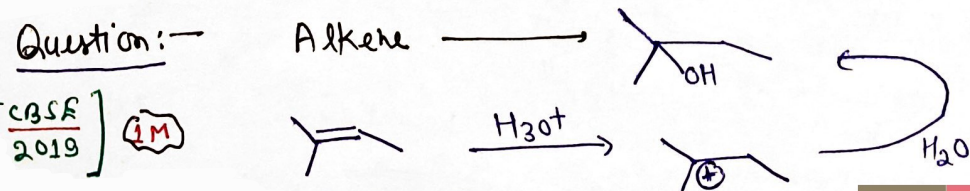
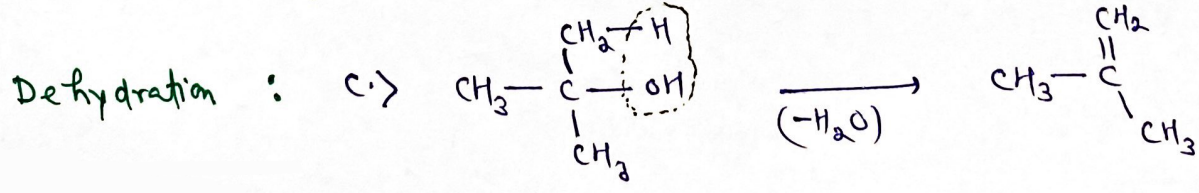
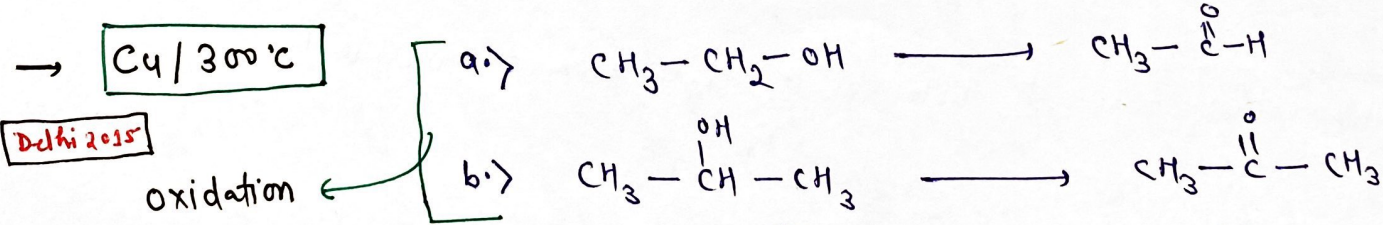
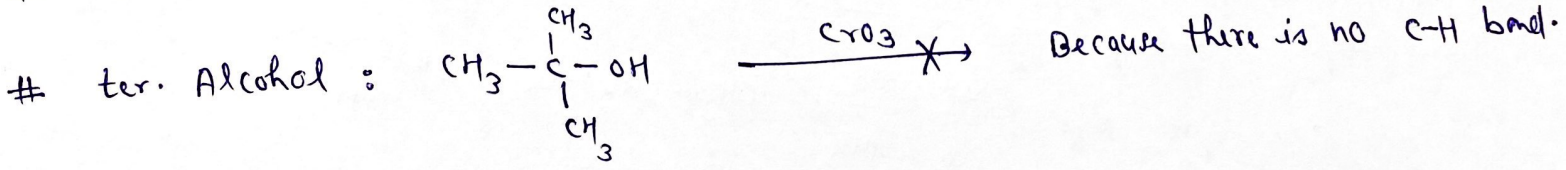
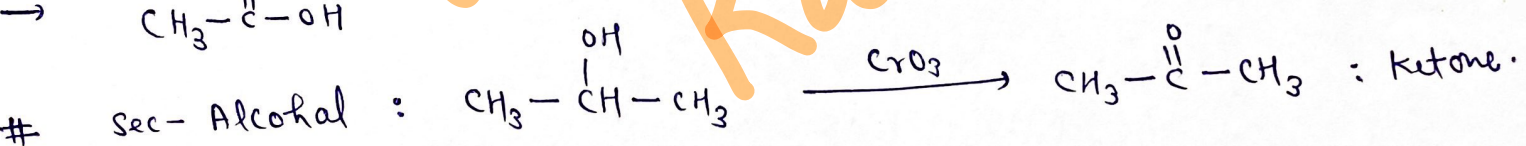
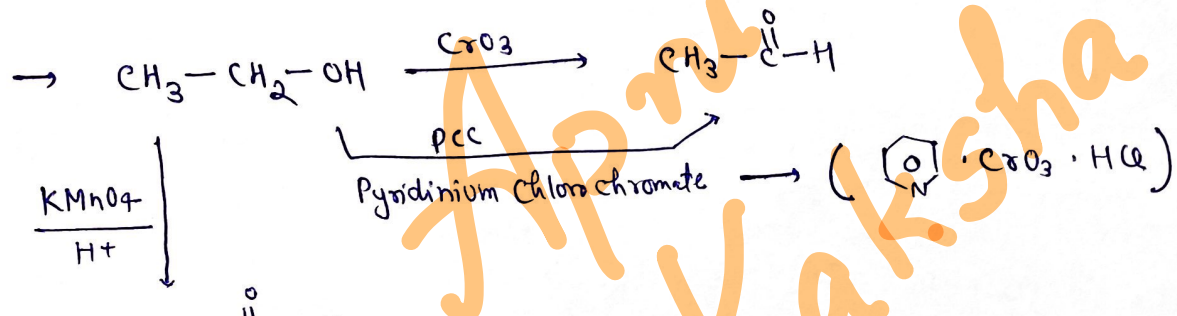
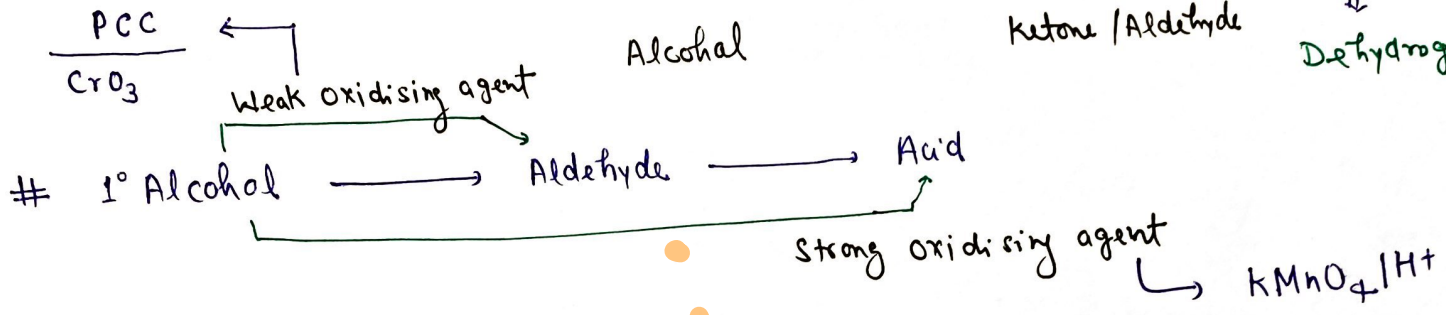
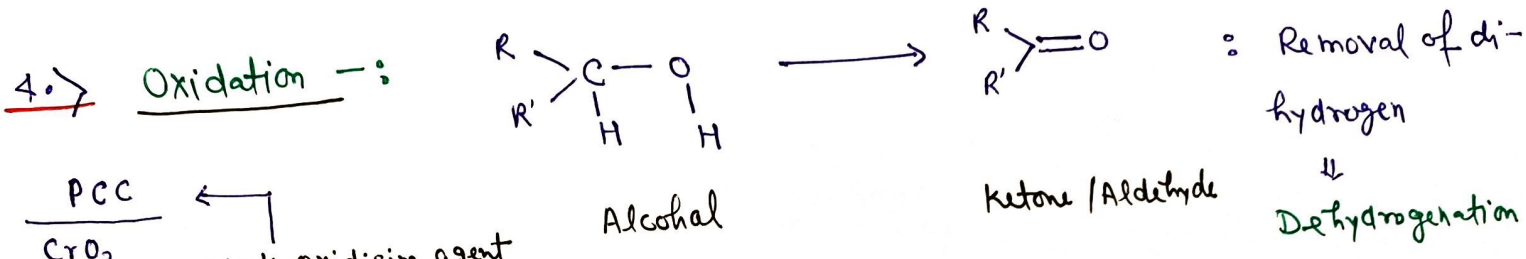
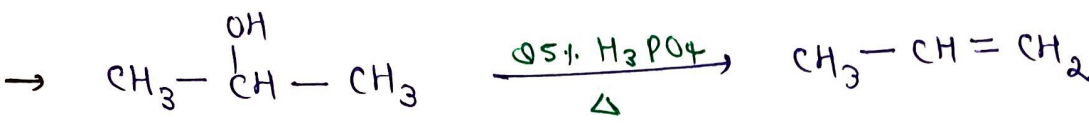
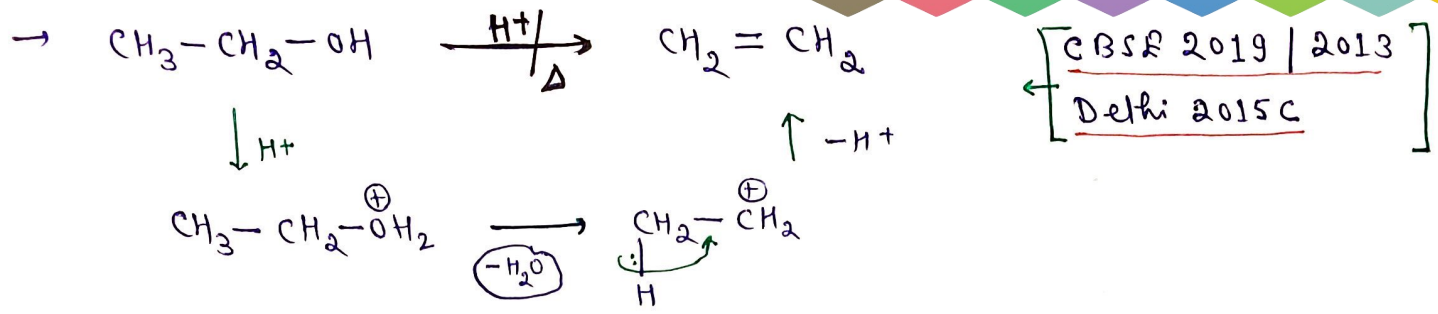
Apni Kaksha :-

→ Esterification :- (Formation of ester) # Alcohols / Phenols + carboxylic acid or its derivatives



→ Reactions involving cleavage of carbon-carbon bond in alcohols :-



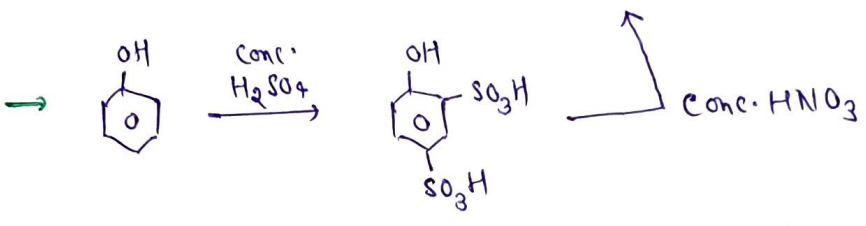
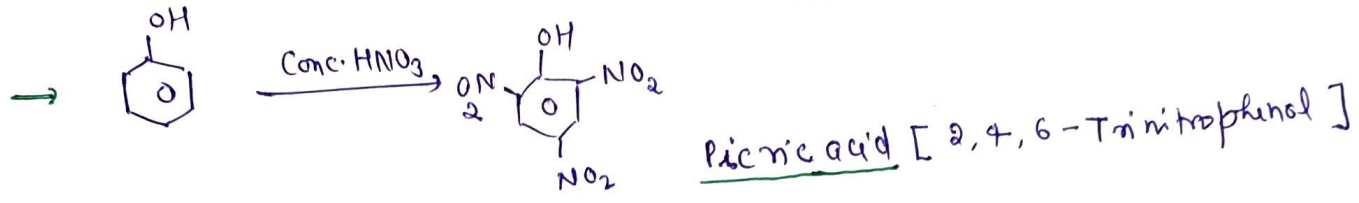
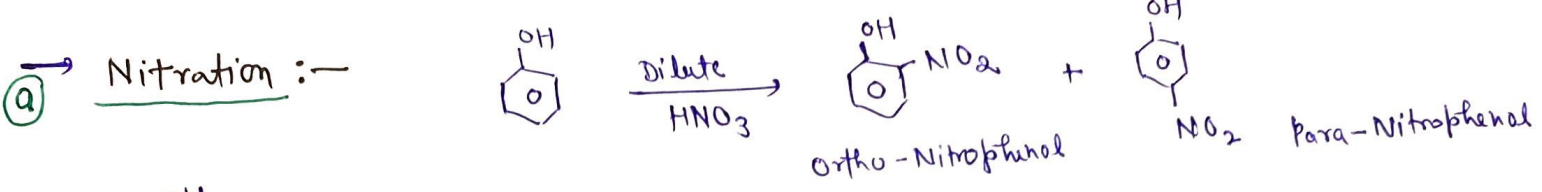


[CBSE 2019] (1M)

Apni Kaksha

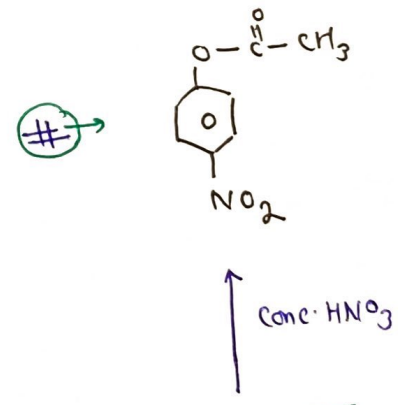
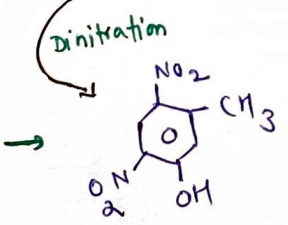
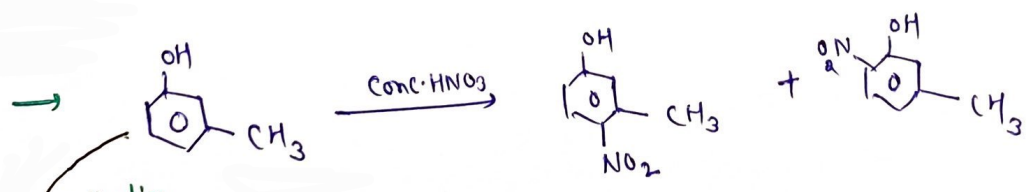
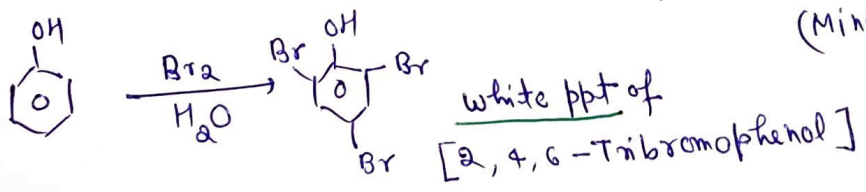
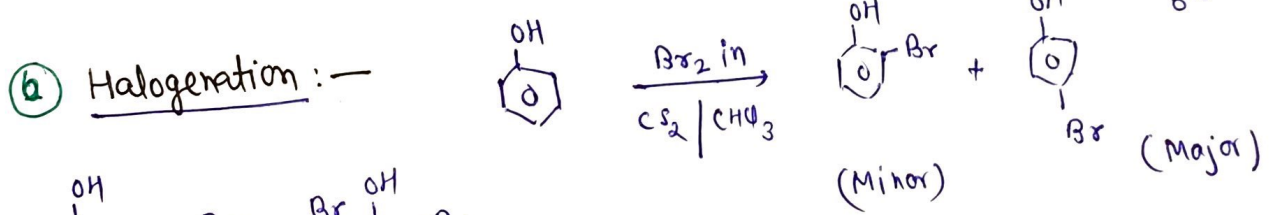
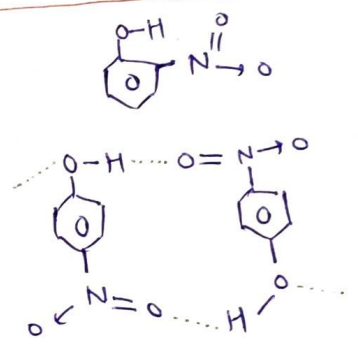
Reactions of Phenol

① Electrophilic aromatic substitution :- Phenol and phenoxide ion, direct the incoming electrophile to ortho and para positions in the ring as these position becomes electron rich due to resonance effect caused by -OH & -O[⊖] group.

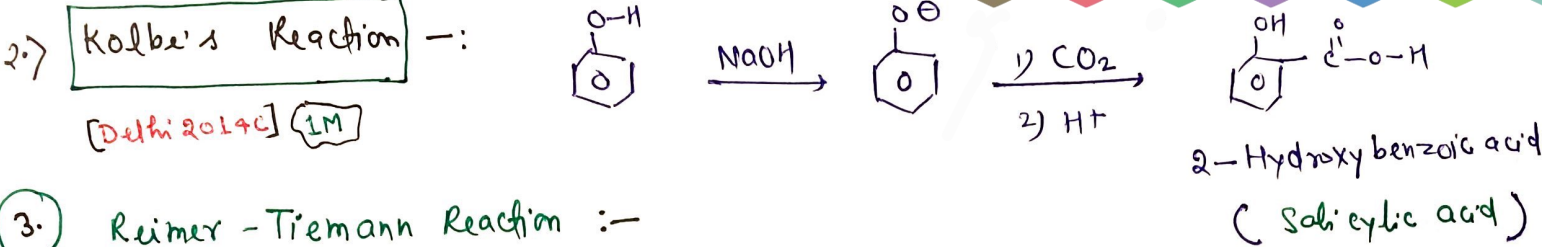


Question :- o-Nitrophenol is more steam volatile than p-Nitrophenol, why?
 [Delhi 2019 / CBSE 2014]

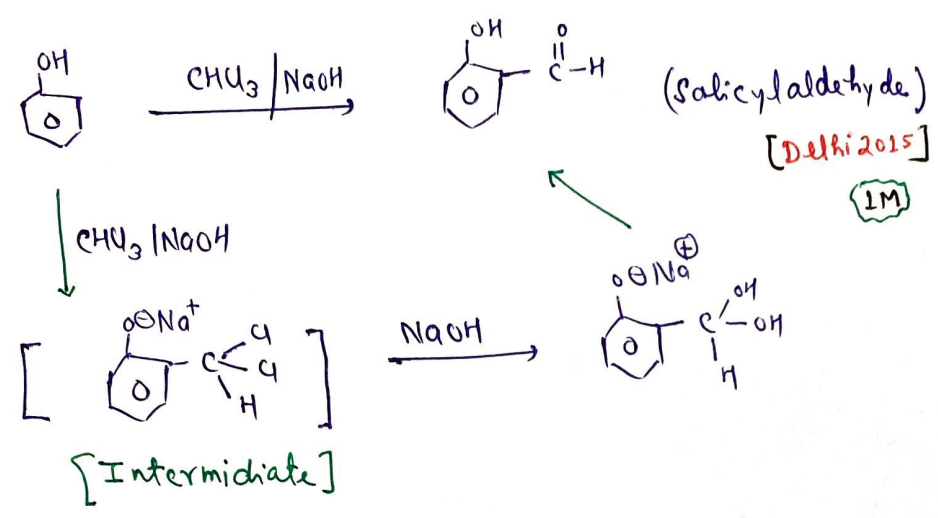
Answer :- o-Nitrophenol is steam volatile due to intramolecular hydrogen bonding while p-nitrophenol is less volatile due to intermolecular hydrogen bonding which causes the association of molecules.



Phenyl methanoate
 Apni Kaksha 😊



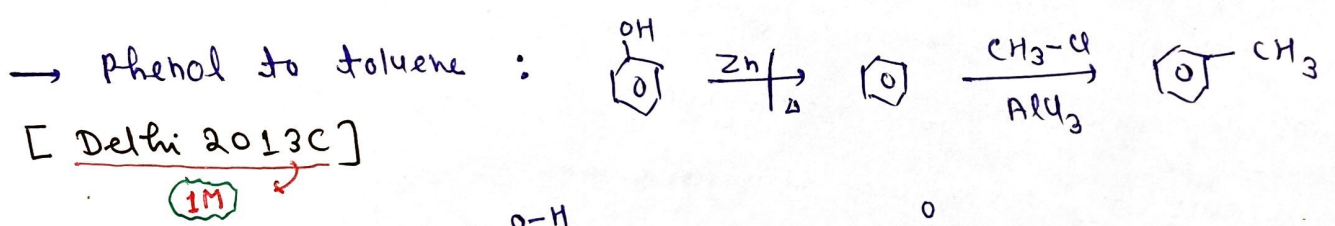
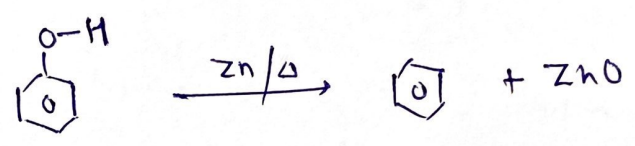
3. **Reimer-Tiemann Reaction** :-



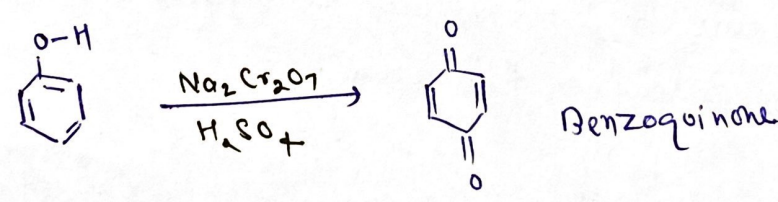
On treating phenol with chloroform and NaOH, a -C(=O)H group is introduced at ortho position of benzene ring. This reaction is known as RT Reaction.

(1M) [2011 / 2012 / 2019] CBSE

4. **Phenol with Zn dust** :-



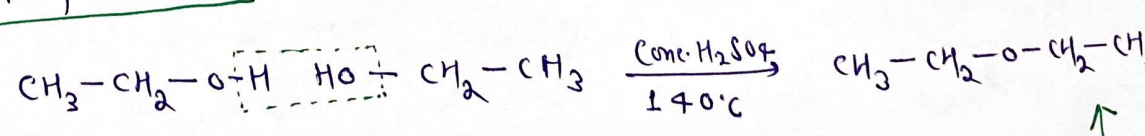
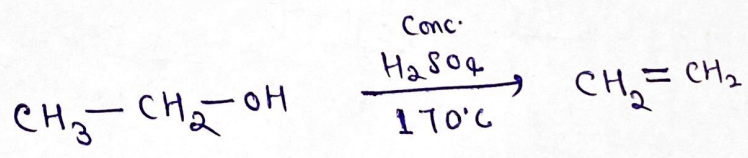
5. **Oxidation** :-



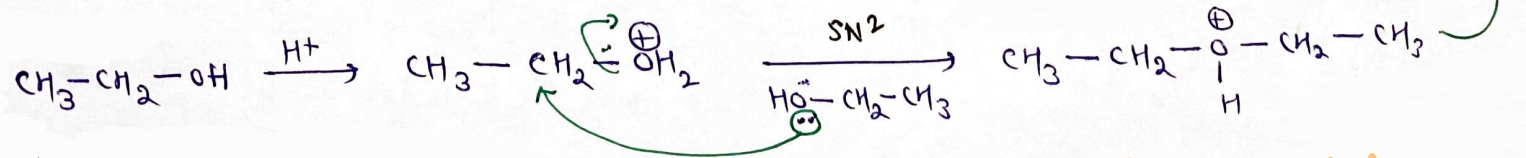
Ethers

Preparation of ethers :-

① **By dehydration of alcohols** :-



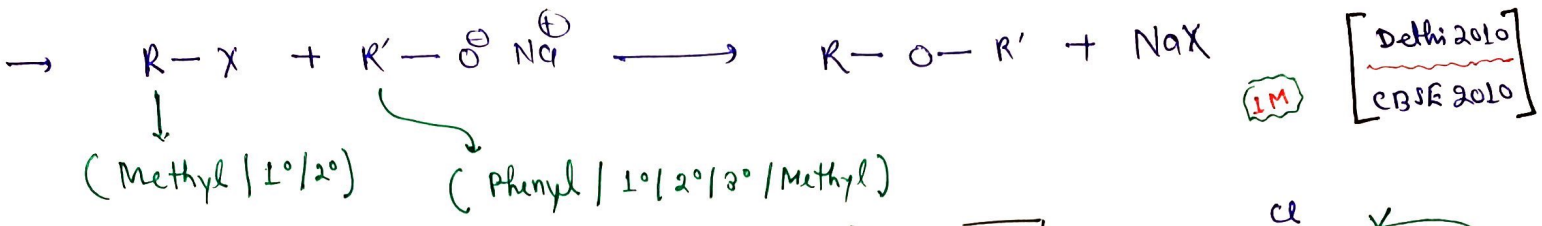
→ **Formation of ether [Mechanism]**



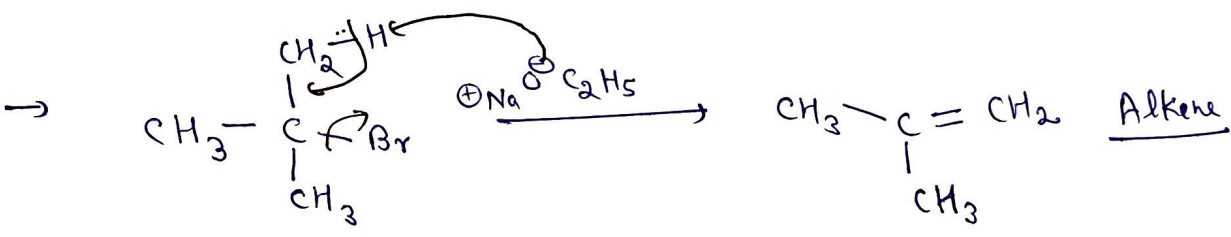
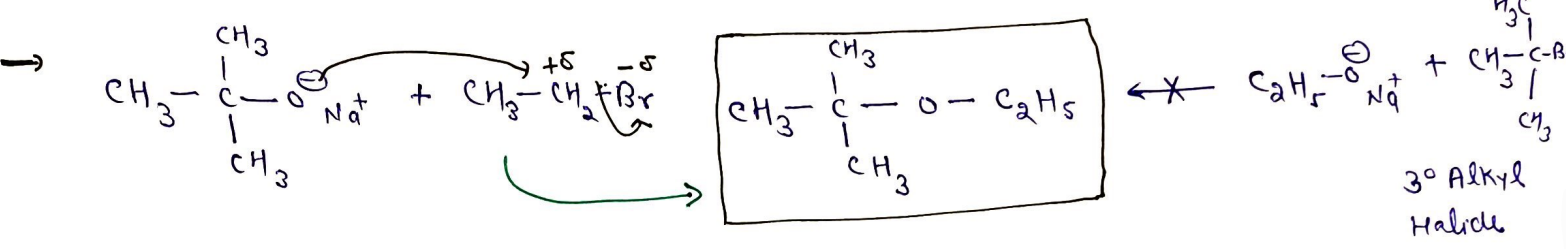
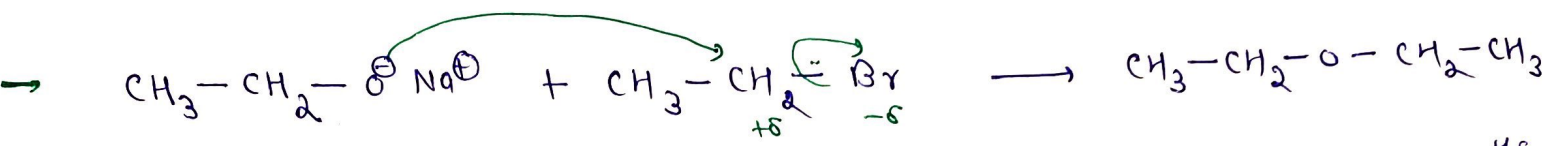
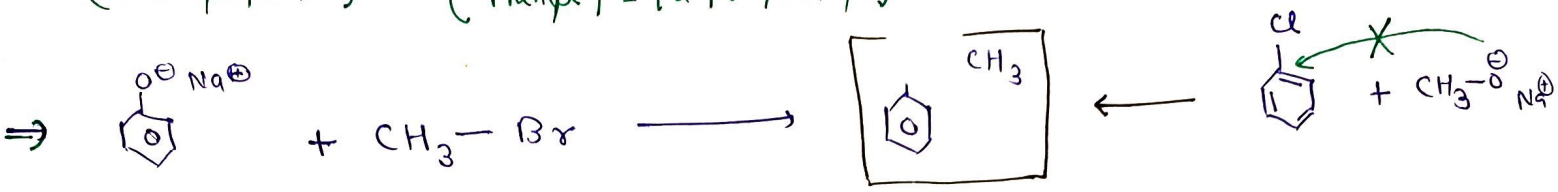
②

Williamson Synthesis :-

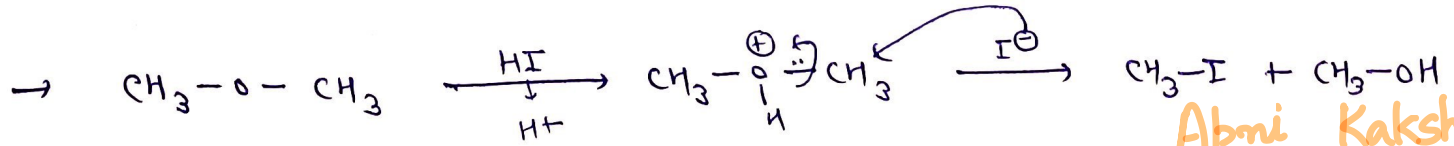
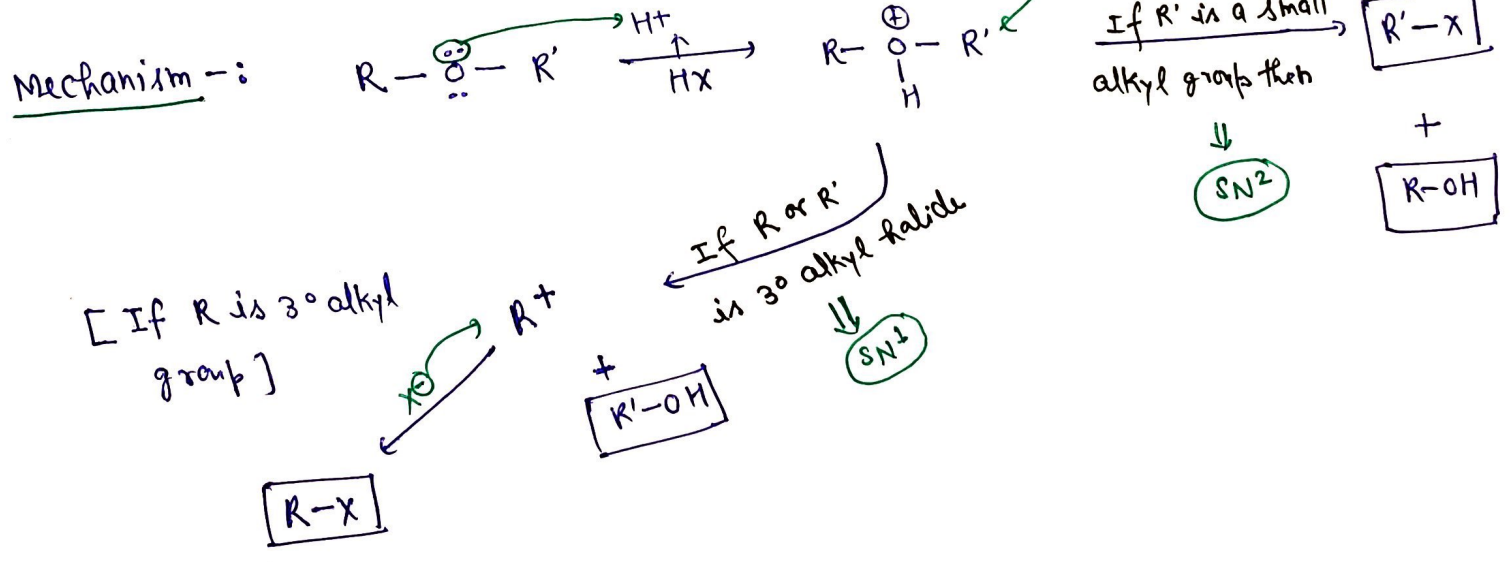
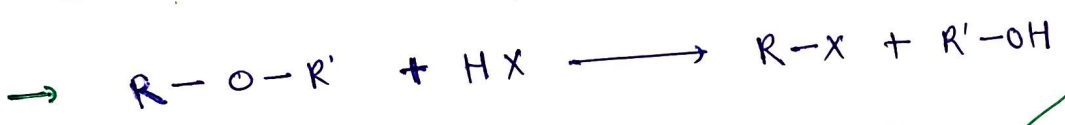
Alkyl halide + Sodium Alkoxide → Ether

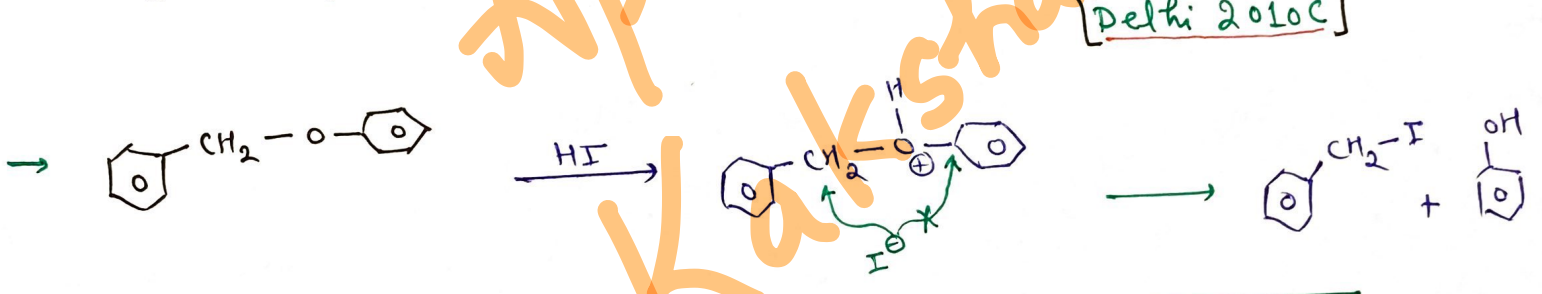
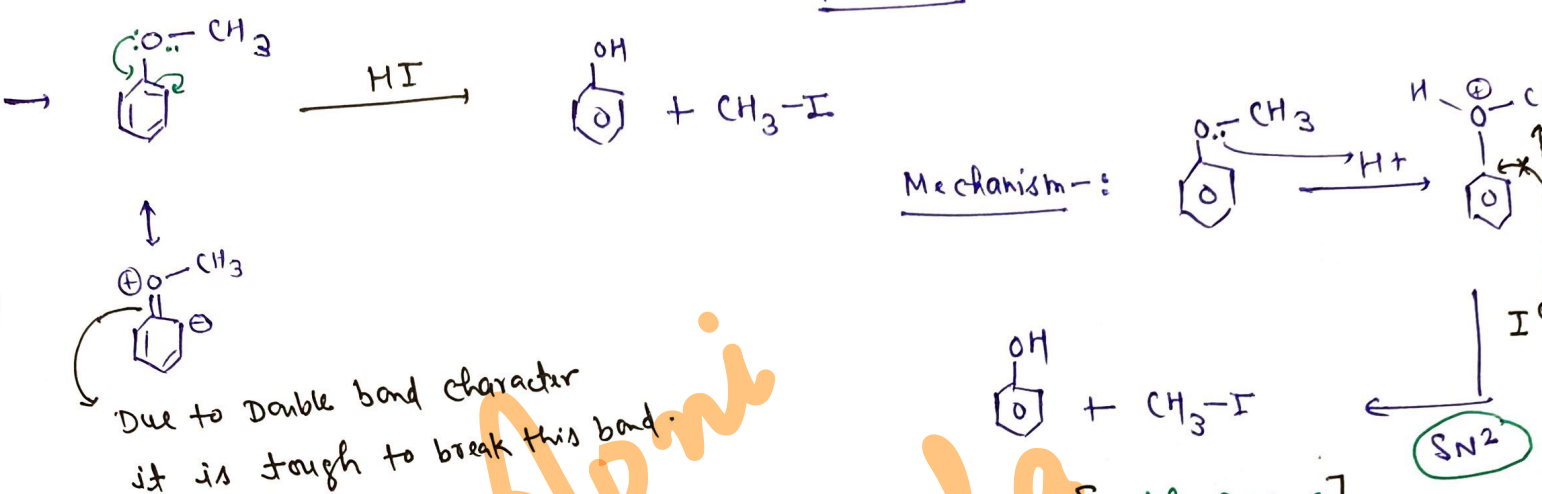
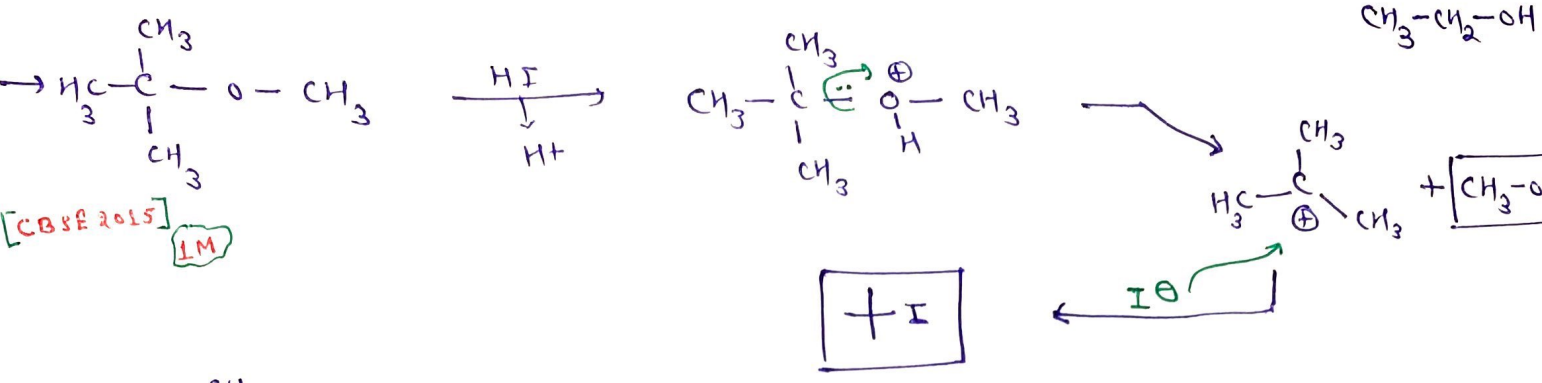
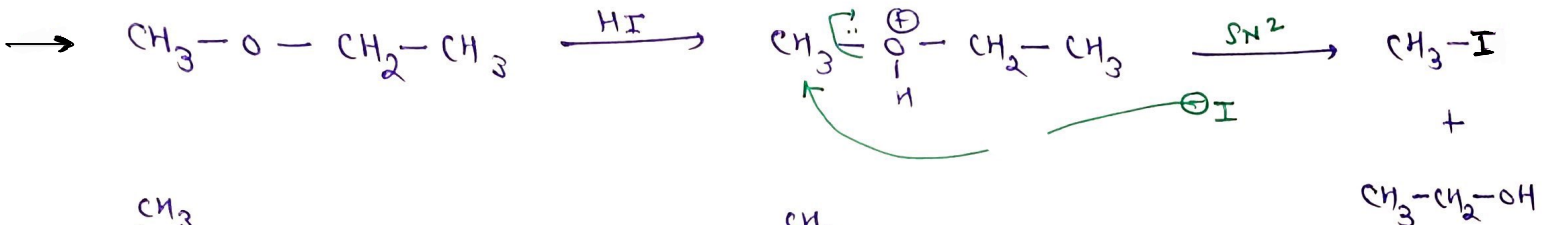


Dethi 2010
CBSE 2010



Chemical Reaction of ether

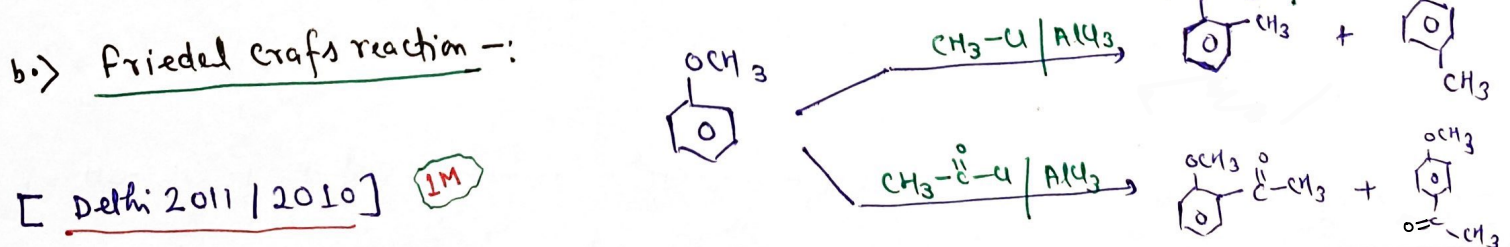
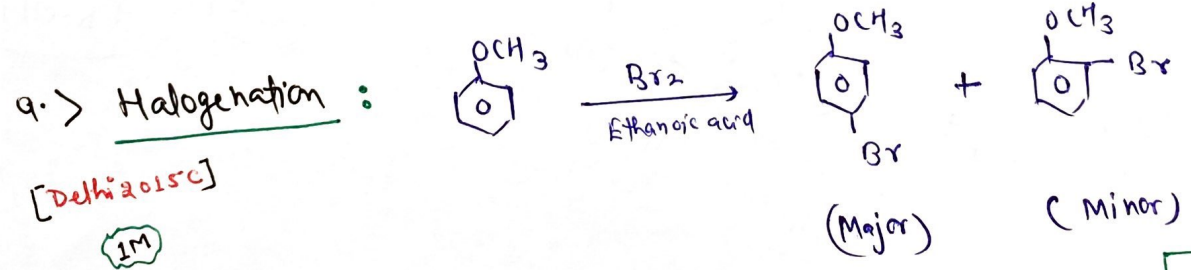




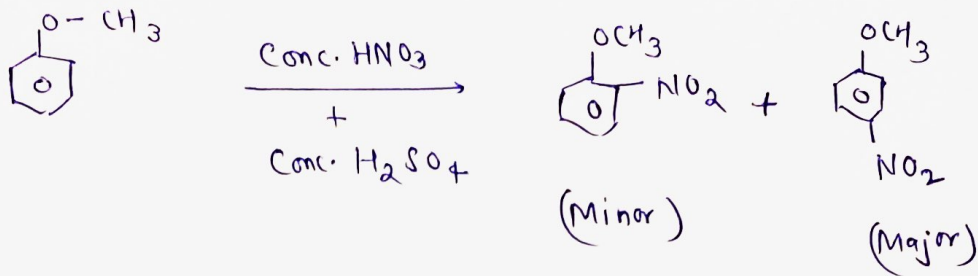
Electrophilic Substitution Reaction of Anisol

Anisol: $\text{C}_6\text{H}_5\text{-O-CH}_3$

(-O-CH₃ is a +M group which is ortho-para directing in nature)

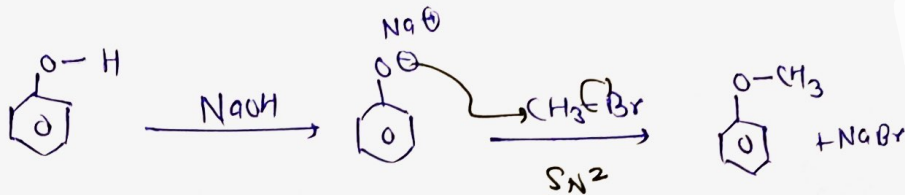


c.) Nitration :-

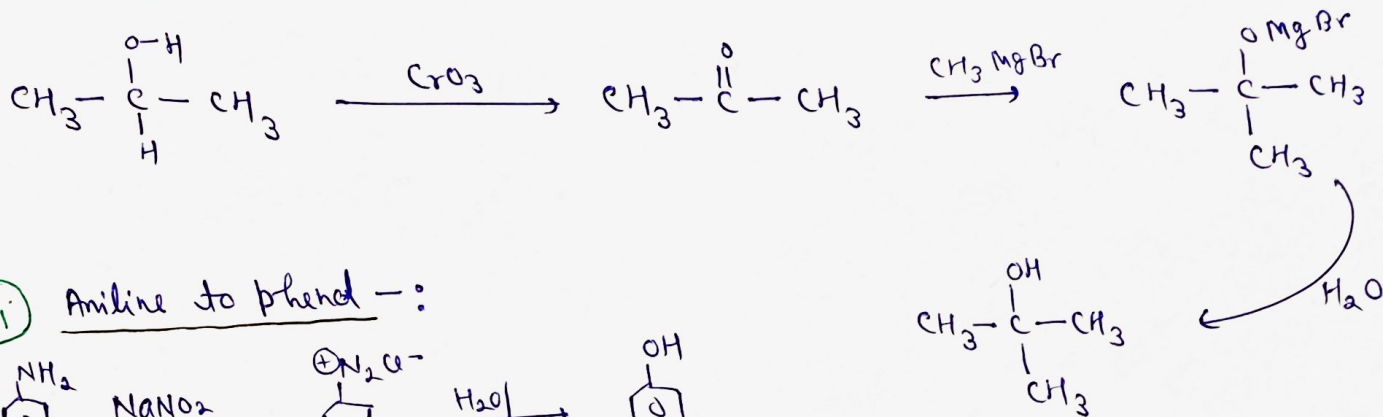


Conversions

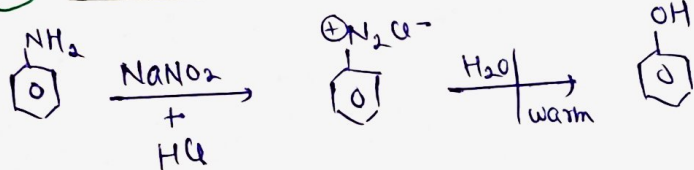
(i) Phenol to anisole :-



(ii) Propan-2-ol to 2-methyl propan-2-ol :-

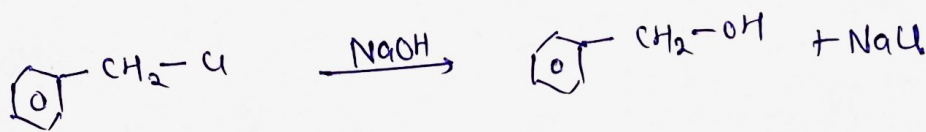


(iii) Aniline to phenol :-



Above three \leftarrow [Delhi 2015]
3M

(iv) Benzyl chloride \rightarrow Benzyl Alcohol

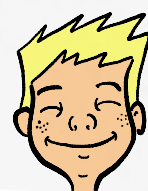
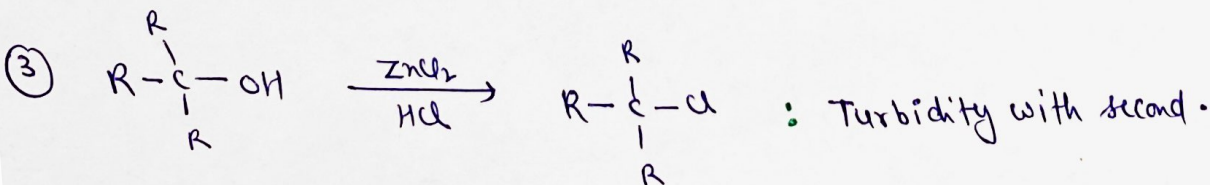
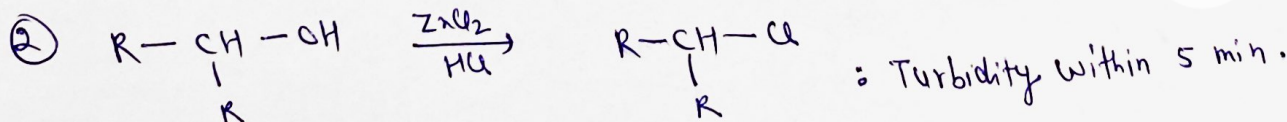
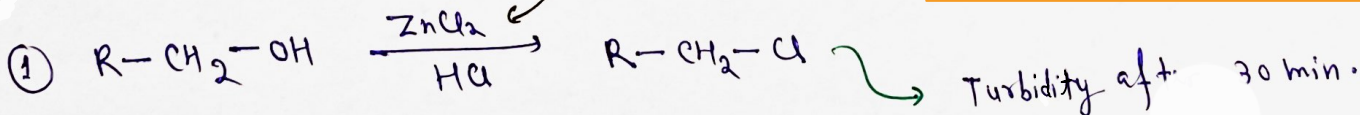


Lucas Reagent

Lucas Test

To differ. 1°/2°/3° Alcohol

Phenol does not give this test.



समाप्त