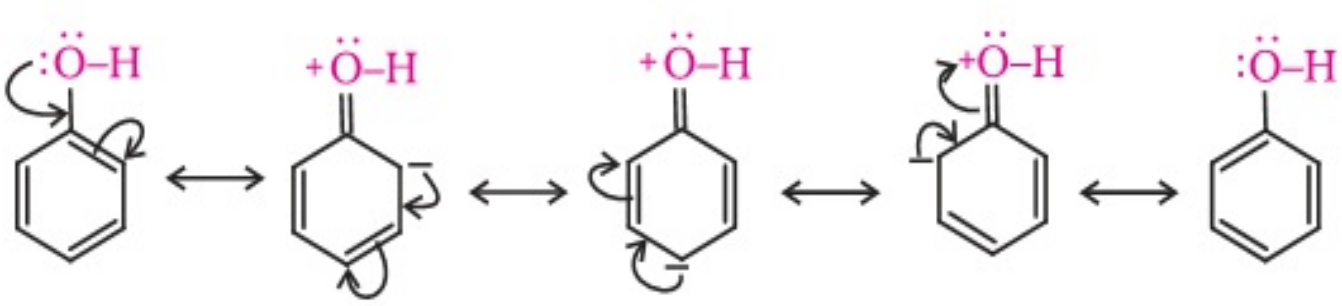
CBSE Class 12 physics
Important Questions
Chapter 11
Alcohols Phenols and Ethers

3 Mark Questions

1. Phenol is acidic in nature.

Ans. Phenol is acidic in nature because

(a) phenol, due to resonance, the positive charge rests on oxygen making the shared pair of electrons more towards oxygen and hydrogen as H^+



(b) The carbon attached to OH is SP^2 hybridize and is more electronegative, this decreases the electron density on oxygen, increasing the polarity of O-H bond and ionization of phenol.

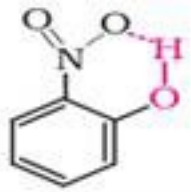
The phenoxide ion formed by loss of H^+ is more resonance stabilized than phenol itself.

2. Phenol has a smaller dipole moment than methanol.

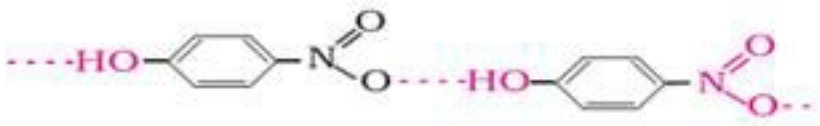
Ans. In phenol due to electron rich benzene ring the C-O bond is less polar whereas in methanol the C-O bond is highly polar. Therefore the dipole moment of methanol is higher than phenol.

3. o- nitrophenol has lower boiling point (is more volatile) than p – nitrophenol.

Ans. P- nitrophenol has intermolecular hydrogen bonding which increases the boiling point while in o- nitro phenol due to presence of intra molecular hydrogen bonding, there is a decrease in boiling point and increase in volatility.



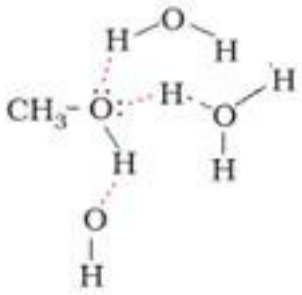
o-Nitrophenol
(Intramolecular
H-bonding)



p-Nitrophenol
(Intermolecular
H-bonding)

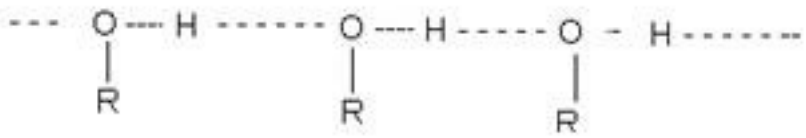
4. Methanol is miscible with water while iodomethane is not.

Ans. Methanol can form intermolecular hydrogen bonding with water but there is no hydrogen bonding in iodomethane and water. Therefore methanol in miscible in water.



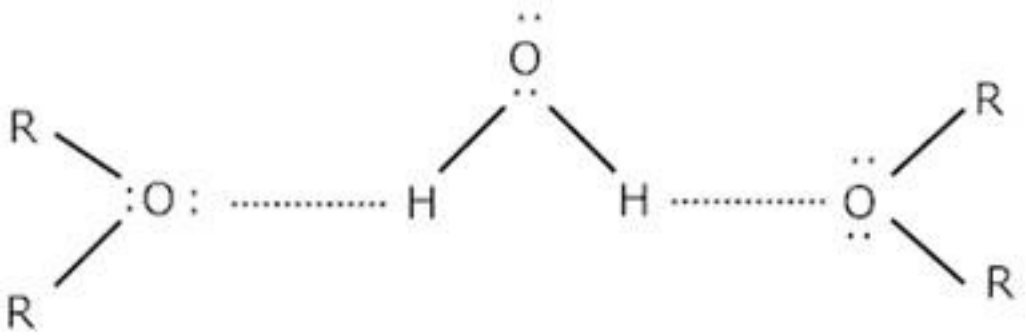
5. Alcohols have higher boiling points than isomeric ethers.

Ans. Alcohols can form intermolecular hydrogen bonds due to their high polarity whereas, ether cannot. Therefore alcohols have higher boiling points than isomeric ethers.



6. Ethers are soluble in water alkanes are not.

Ans. Ethers can form H- bonding with water molecule whereas alkenes cannot. Therefore ethers are soluble in water and alkanes are not.



7. The order of acidic strength in alcohols is R $CH_3OH > R_2CHOH > R_3COH$

Ans. In alcohols, the acidic strength is due to polar nature of O-H bond. An electron releasing group e.g., alkyl groups, increases electron density on oxygen tending to decrease the polarity of O-H bond. This decreases the acid strength. Therefore the order of acid strength is .

8. During preparation of ester from alcohol and acid, water has to be removed as soon as it is formed.

Ans. The reaction between alcohol and carboxylic acid is reversible and goes in backward direction if water is not removed as soon as it is formed.

$$ROH + RCOOH \overset{H^+}{\rightleftharpoons} RCOOR' + H_2O$$

9. Ethers can not be prepared by dehydration of secondary or tertiary alcohols.

Ans. For secondary and tertiary alcohols, elimination competes over substitution and alkenes are formed on acidic dehydration as the reaction follows Sn1 mechanism. Therefore the acidic dehydration of secondary or tertiary alcohols does not give ethers.

10. Reaction of anisole with HI gives methyl iodide and phenol.

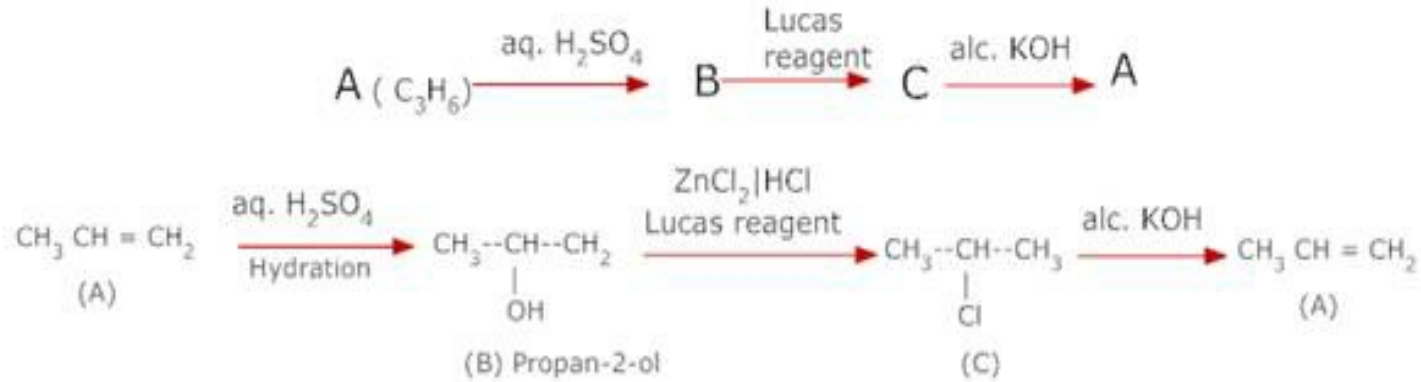
Ans. In case of anisole, methyl phenyl oxonium ion, $C_6H_5-\overset{\oplus}{\underset{H}{O}}-CH_3$ is formed by

protonation of ethers during reaction with HI. The bond between O- CH_3 is weaker than the bond between $O-C_6H_5$ because carbon of phenyl group is SP^2 hybridised and there is a partial double bond character. Therefore the attack by I^- ion breaks $O-CH_3$ bond to form CH_3I.

$$C_6H_5\ OCH_3 + HI \rightarrow C_6H_5OH + CH_3I$$

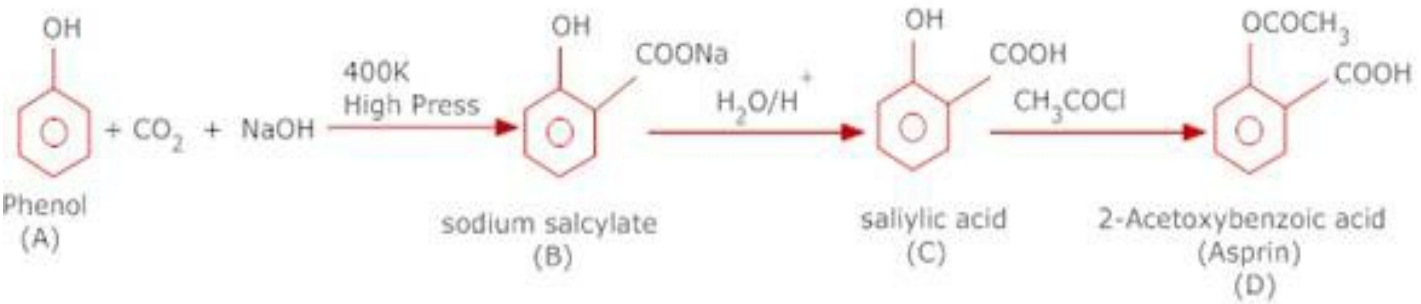
11. An organic compound ' A ' having molecular formula C_3H_6 on treatment with aq. H_2SO_4 give 'B' which on treatment with Lucas reagent gives 'C'. The compound 'C' on treatment with ethanolic KOH gives back 'A' .Identify A, B, C .

Ans.



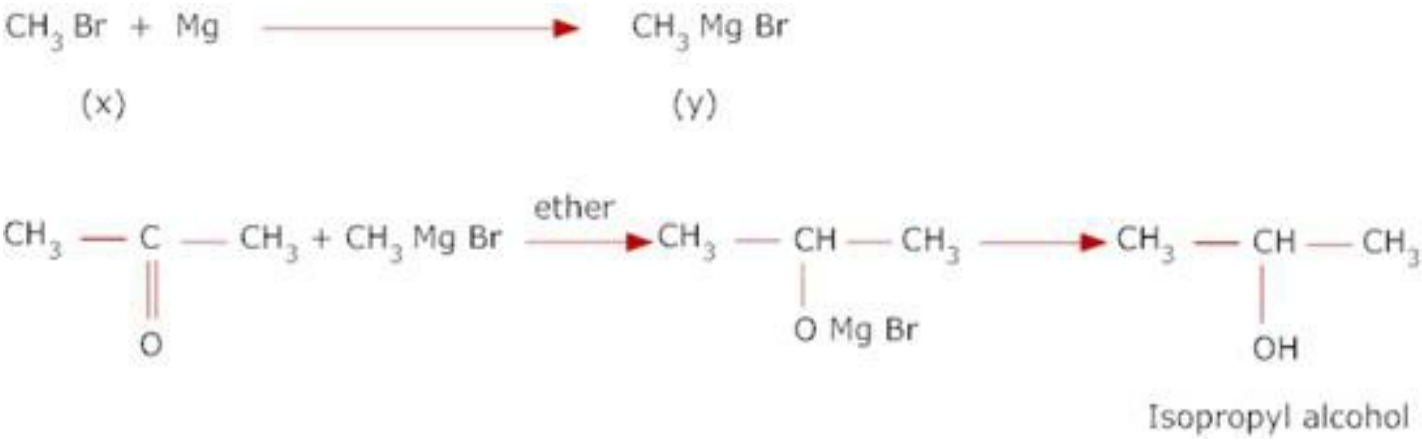
12. An organic compound $A(C_6H_6O)$ gives a characteristic colour with aq. $FeCl_3$ solution. (A) On reacting with CO_2 and NaOH at 400k under pressure gives (B) which on acidification gives a compound (C) .The compound (C) reacts with acetyl chloride to give (D) which is a popular pain killer. Deduce the structure of A,B,C & D.

Ans.



13. An organic compound (X) when dissolved in ether and treated with magnesium metal forms a compound Y. The compound, Y, on treatment with acetaldehyde and the product on acid hydrolysis gives isopropyl alcohol. Identify the compound X. What is the general name of the compounds of the type Y.

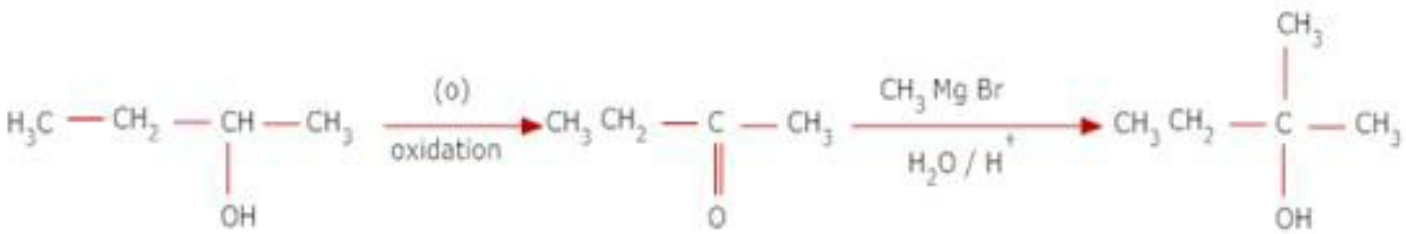
Ans. The compound X is CH_3Br and Y is CH_3MgBr The compounds of the type 'Y' are called Grignard reagent.



14. A compound 'A' with molecular formula $C_4H_{10}O$ on oxidation forms compound 'B' gives positive iodoform test and on reaction with CH_3MgBr followed by hydrolysis gives (c). Identify A, B & C.

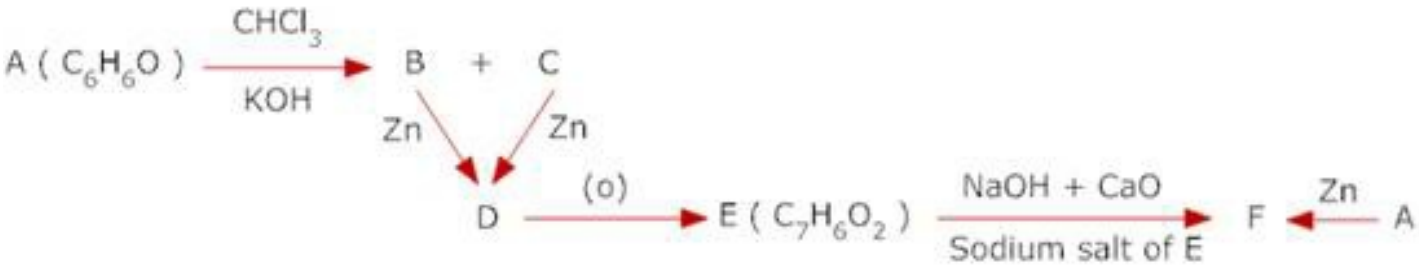
Ans. The compound 'B' is obtained by oxidation of $C_4H_{10}O$ and gives positive iodoform test and also reacts with CH_3MgBr , it must be methyl Ketone , it must be methyl ketone having four carbon atoms i.e, $CH_3COCH_2CH_3$.

This can be obtained by oxidation of 2 – butanol i.e , $CH_3\underset{HO}{CH}\ CH_2CH_3$ Therefore , the reactions are.

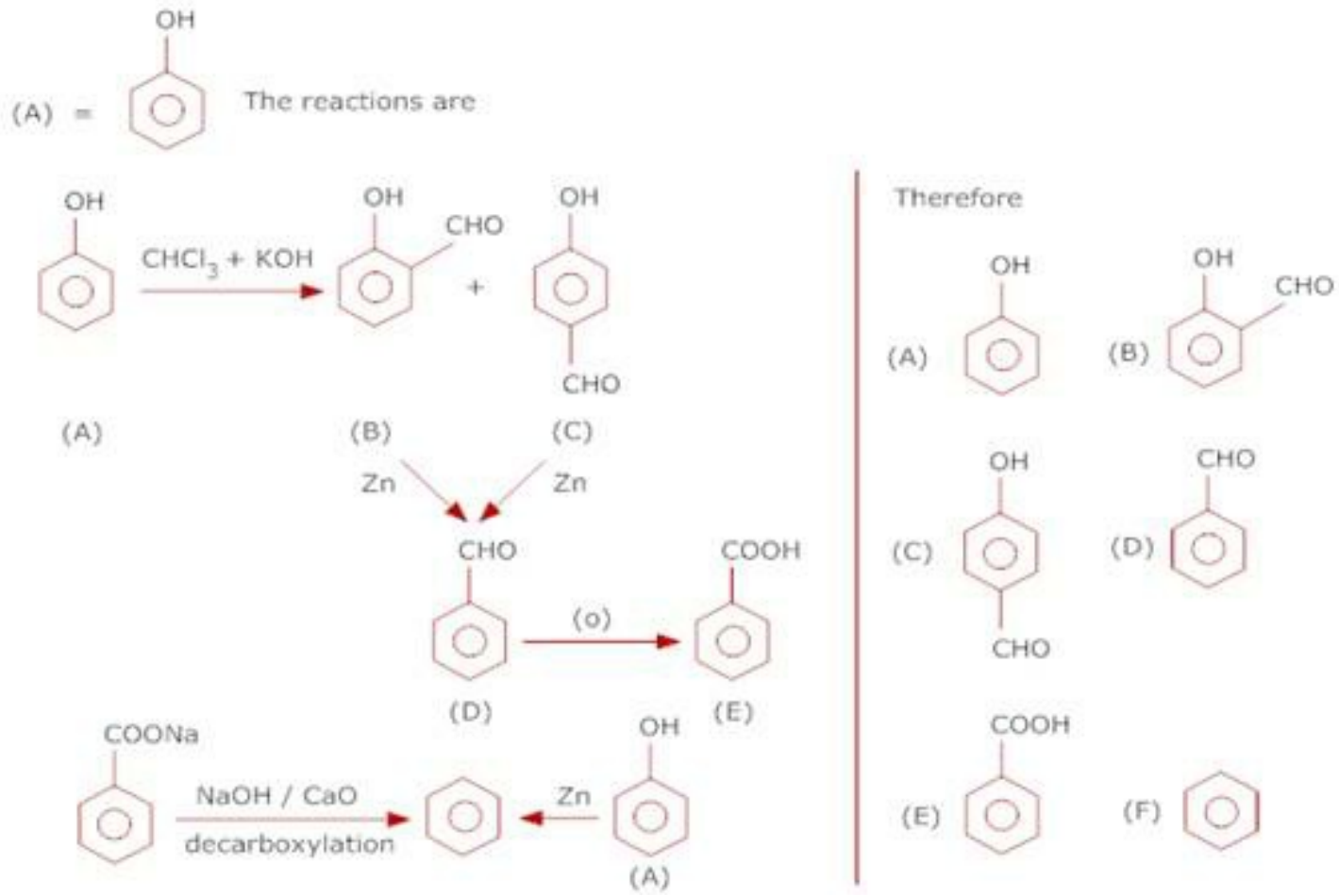


15. An aromatic compound (A) having molecular formula C_6H_6O on treatment with $CHCl_3$ and KOH gives a mixture two isomers 'B' and 'C' both of 'B' & 'C' give same product 'D' when distilled with Zn dust. Oxidation of 'D' gives 'E' of formula $C_7H_6O_2$. The sodium salt of 'E' on heating with soda lime gives 'F' which may also be obtained by distilling 'A' with zinc dust. Identify compounds 'A' to 'F' giving sequence of reactions.

Ans.



The aromatic compound having molecular formula C_6H_6O and which gives a mixture of two isomers on reacting with $CHCl_3$ and KOH is phenol i.e.



16. Compound 'A' of molecular formula $C_5H_{11}Br$ gives a compound 'B' of molecular formula $C_5H_{12}O$ when treated with aq. NaOH. On oxidation the compound yields a mixture of acetic acid & propionic acid. Deduce the structure of A, B & C.

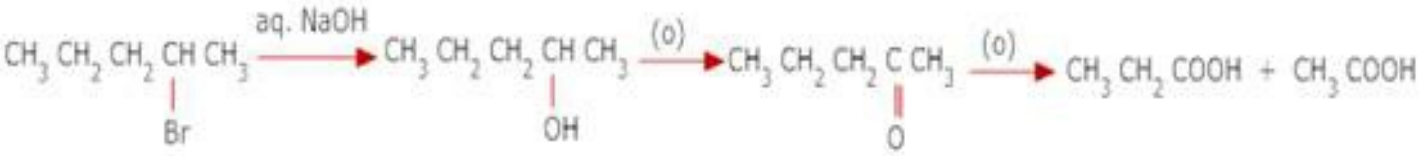
Ans.

$$\underset{(A)}{C_5H_{11}Br} \xrightarrow{\text{aq. NaOH}} \underset{(B)}{C_5H_{12}O} \xrightarrow{(o)} \underset{(C)}{\text{Ketone}} \xrightarrow[(o)]{KMnO_4} CH_3CH_2COOH + CH_3COOH$$

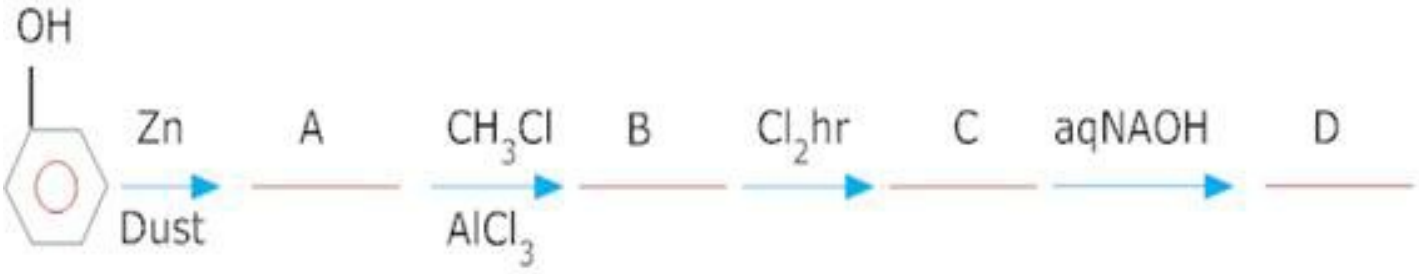
Since acetic acid & propionic acid are the products of oxidation of C which is a ketone, C is $CH_3CH_2CH_2CO\ CH_3$. Since it is the oxidation product of B, therefore

A is $CH_3CH_2CH_2\underset{\displaystyle Br}{\underset{|}{C}}HCH_3$ and B is $CH_3CH_2CH_2\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$

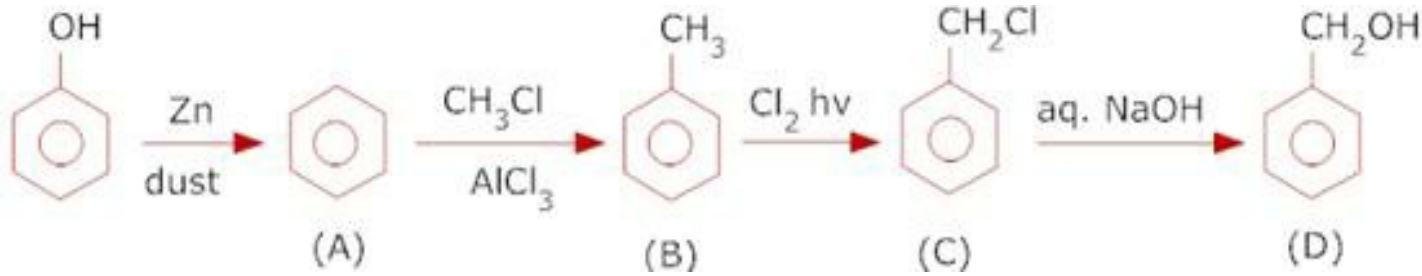
The reactions are


aq. NaOH
(o)
(o)
Br
OH
O

17.


OH
Zn
Dust
A
CH3Cl
AlCl3
B
Cl2hr
C
aqNAOH
D

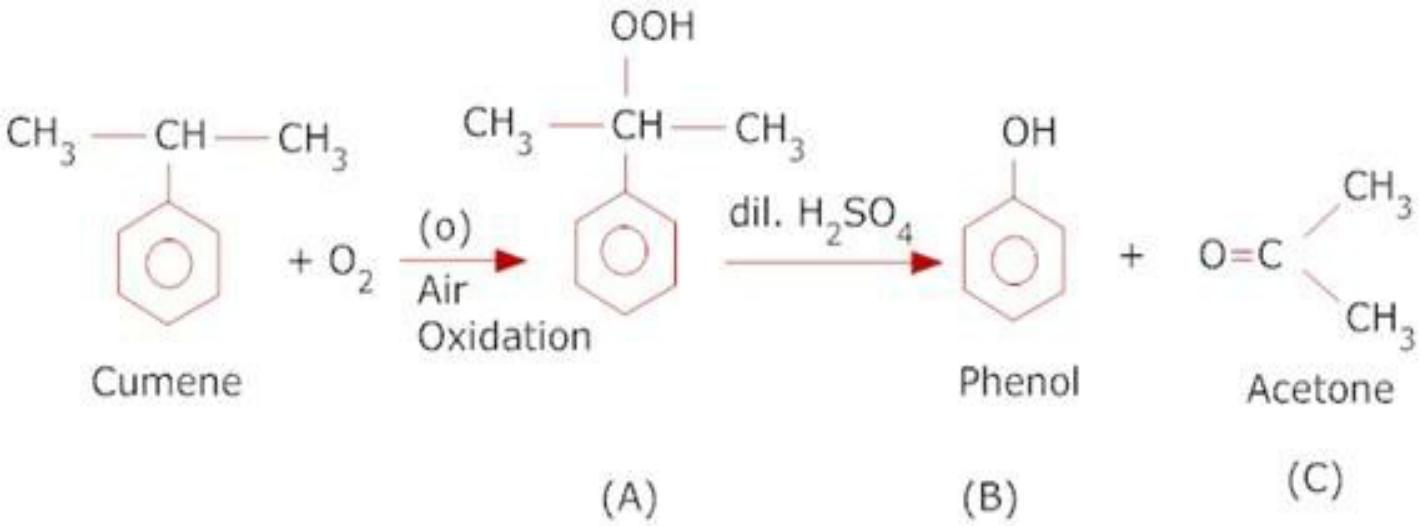
Ans.


OH
Zn
dust
(A)
CH3Cl
AlCl3
CH3
(B)
Cl2 hv
CH2Cl
(C)
aq. NaOH
CH2OH
(D)

18.

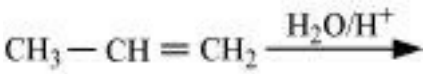

CH3-CH-CH3
+ O2
[0]
A
dil H2SO4
B
+
C

Ans.

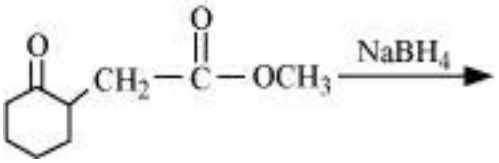


19. **Write structures of the products of the following reactions:**

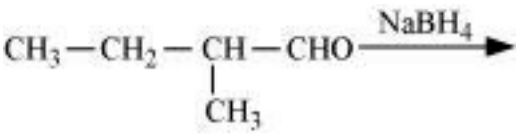
(i)



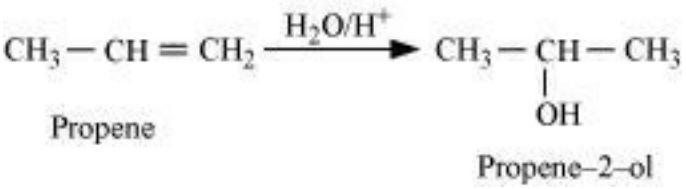
(ii)



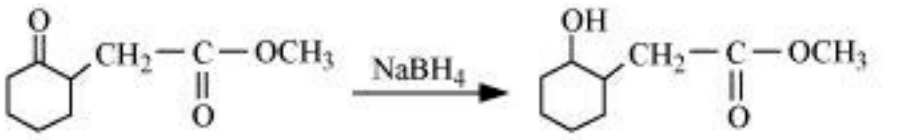
(iii)



Ans. (i)



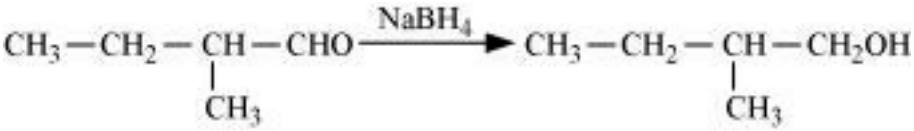
(ii)



Methyl (2 – oxocyclohexyl) ethanoate

Methyl (2 – hydroxycyclohexyl) ethanoate

(iii)

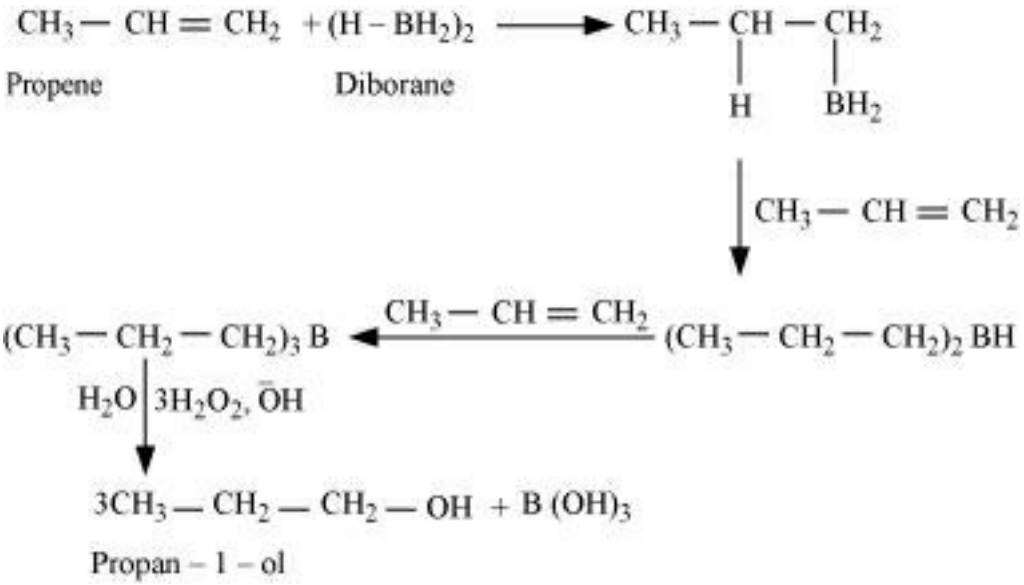


2 – Methylbutanal

2 – Methylbutan – 1 – ol

20. **What is meant by hydroboration-oxidation reaction? Illustrate it with an example.**

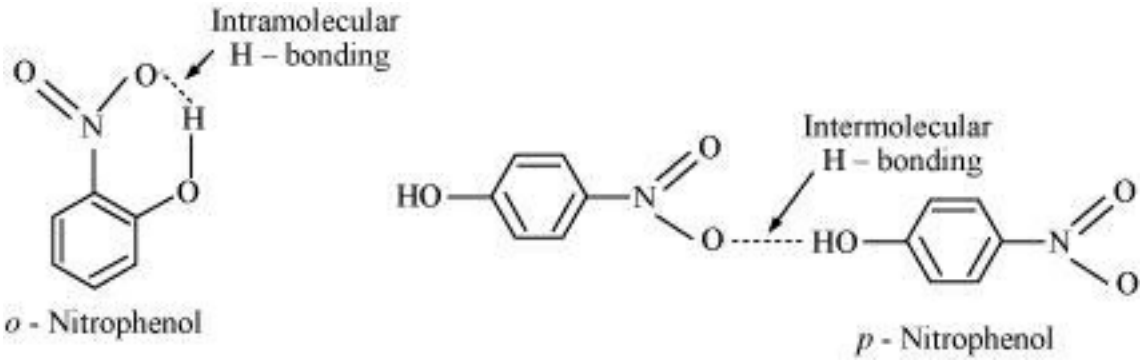
Ans. The addition of borane followed by oxidation is known as the hydroboration-oxidation reaction. For example, propan-1-ol is produced by the hydroboration-oxidation reaction of propene. In this reaction, propene reacts with diborane $(BH_3)^2$ to form trialkyl borane as an addition product. This addition product is oxidized to alcohol by hydrogen peroxide in the presence of aqueous sodium hydroxide.



Propan – 1 – ol

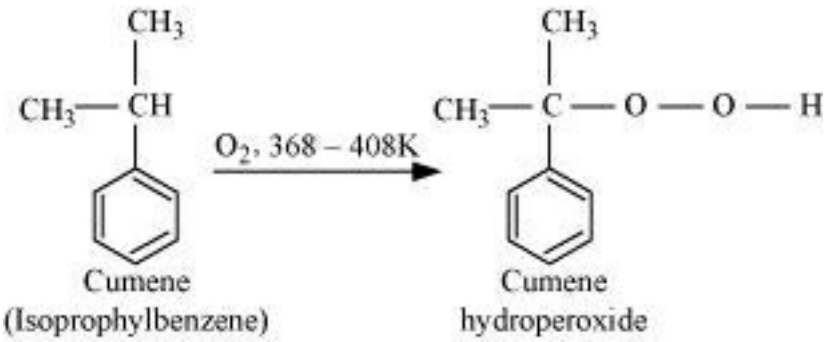
21. **While separating a mixture of *ortho* and *para* nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.**

Ans. Intramolecular H-bonding is present in *o*-nitrophenol. In *p*-nitrophenol, the molecules are strongly associated due to the presence of intermolecular bonding. Hence, *o*-nitrophenol is steam volatile.

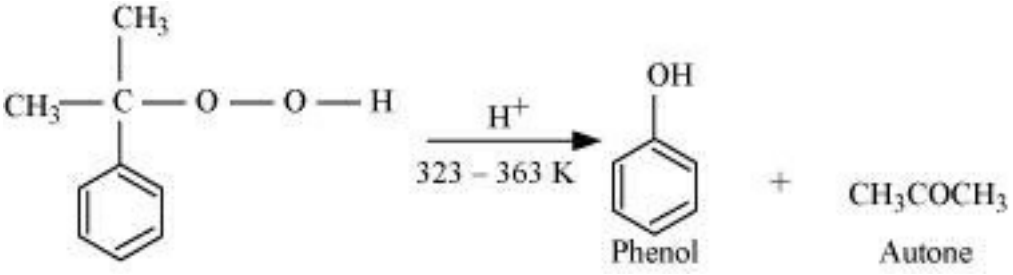


22. Give the equations of reactions for the preparation of phenol from cumene.

Ans. To prepare phenol, cumene is first oxidized in the presence of air of cumene hydro-peroxide.

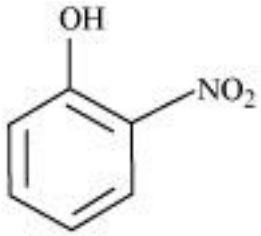


Then, cumene hydroxide is treated with dilute acid to prepare phenol and acetone as by-products.

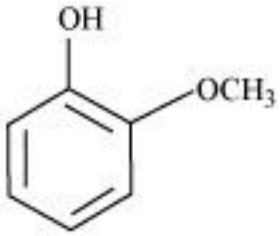


23. **Explain why is *ortho* nitrophenol more acidic than *ortho* methoxyphenol?**

Ans.



o – Nitrophenol



o – Methoxyphenol

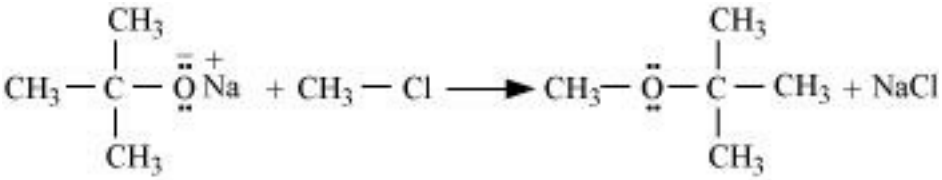
The nitro-group is an electron-withdrawing group. The presence of this group in the ortho position decreases the electron density in the O-H bond. As a result, it is easier to lose a proton. Also, the *o*-nitrophenoxide ion formed after the loss of protons is stabilized by resonance. Hence, *ortho* nitrophenol is a stronger acid.

On the other hand, methoxy group is an electron-releasing group. Thus, it increases the electron density in the O-H bond and hence, the proton cannot be given out easily.

For this reason, ortho-nitrophenol is more acidic than ortho-methoxyphenol.

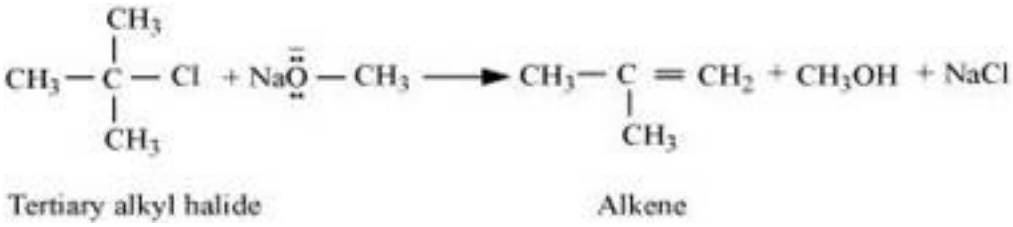
24. **Illustrate with examples the limitations of Williamson synthesis for the preparation of certain types of ethers.**

Ans. The reaction of Williamson synthesis involves S_N^2 attack of an alkoxide ion on a primary alkyl halide.



But if secondary or tertiary alkyl halides are taken in place of primary alkyl halides, then elimination would compete over substitution. As a result, alkenes would be produced. This is because alkoxides are nucleophiles as well as strong bases. Hence, they react with alkyl

halides, which results in an elimination reaction.



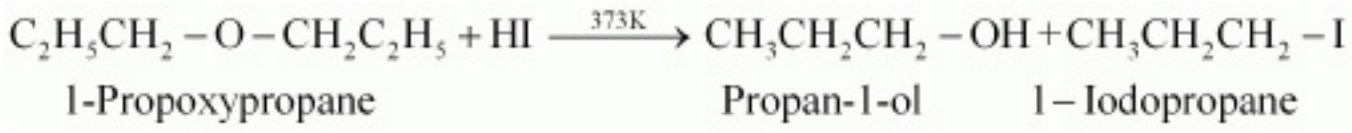
25. **Write the equation of the reaction of hydrogen iodide with:**

(i) 1-propoxypropane

(ii) Methoxybenzene and

(iii) Benzyl ethyl ether

Ans. (i)



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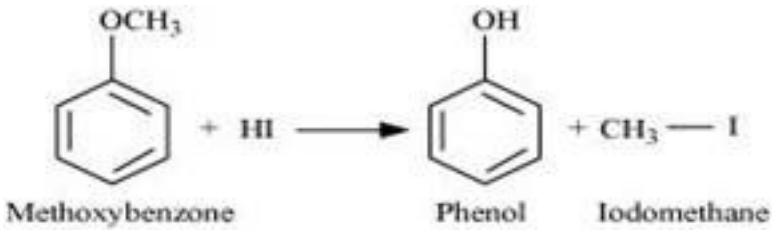

(iii)