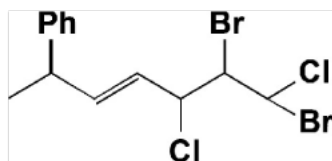


Q1. Give IUPAC name of:



Q2. Give IUPAC name of:  $(\text{CH}_3)_3\text{CCH} = \text{ClC}_6\text{H}_4\text{-}i{p}$ .

Q3. Give IUPAC name of:  $\text{CH}_3\text{C}(p\text{-ClC}_6\text{H}_4)_2\text{CH}(\text{Br})\text{CH}_3$ .

Q4. Give IUPAC name of:  $(\text{CCl}_3)_3\text{CCl}$ .

Q5. Give IUPAC name of:  $\text{ClCH}_2\text{C} \equiv \text{CCH}_2\text{Br}$ .

Q6. Give IUPAC name of:  $\text{CHF}_2\text{CBrClF}$ .

Q7. Give IUPAC name of:  $\text{CH}_3\text{CH}(\text{Cl})\text{CH}(\text{Br})\text{CH}_3$ .

Q8. Give IUPAC name of:  $o\text{-Br-C}_6\text{H}_4\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$ .

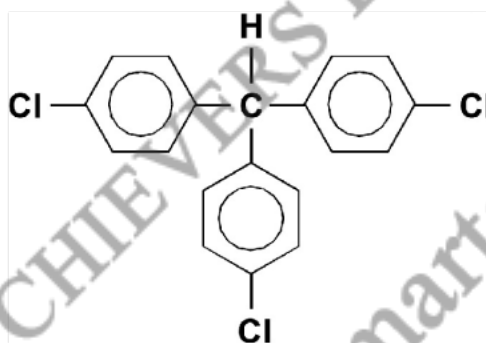
Q9. Give IUPAC name of:  $m\text{-ClCH}_2\text{C}_6\text{H}_4\text{CH}_2\text{C}(\text{CH}_3)_3$ .

Q10. Give IUPAC name of:  $p\text{-ClC}_6\text{H}_4\text{CH}(\text{CH}_3)_2$ .

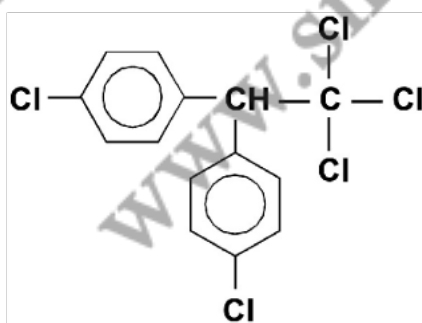
Q11. Give IUPAC name of:  $\text{CH}_3\text{CH} = \text{CHC}(\text{Br})(\text{CH}_3)_2$ .

Q12. Give IUPAC name of:  $\text{CH}_3\text{CH} = \text{C}(\text{Cl})\text{CH}_2\text{CH}(\text{CH}_3)_2$ .

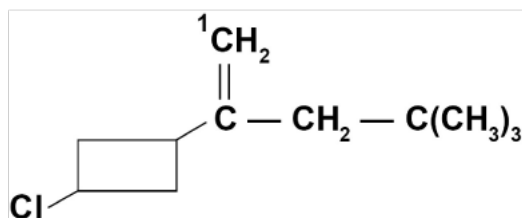
Q13. Give IUPAC name of:



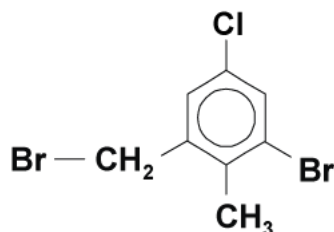
Q14. Give IUPAC name of:



Q15. Give IUPAC name of:

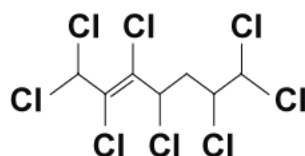


Q16. Give IUPAC name of:

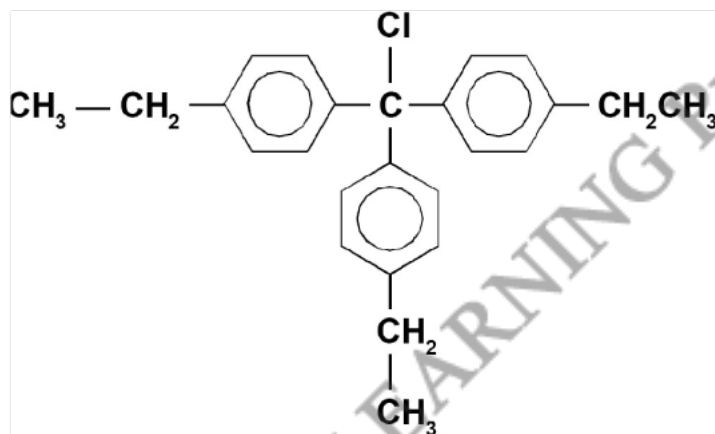


Q17. Give IUPAC name of:  $\text{CCl}_3 - \text{CH}_2 - \text{CH}_2 - \text{C} \equiv \text{CH}$

Q18. Give IUPAC name of:



Q19. Give IUPAC name of:



Q20. Give IUPAC name of Isobutyliodide.

Q21. Give IUPAC name of propylene dichloride.

Q22. Give IUPAC name of Benzoylchloride.

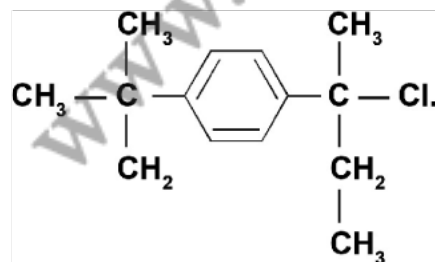
Q23. Give IUPAC name of Ethylidene chloride.

Q24. Give IUPAC name of per fluoropropane.

Q25. Give IUPAC name of 666.

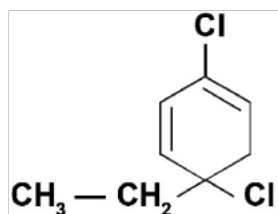
Q26. Give IUPAC name of benzylchloride.

Q27. Give IUPAC name of:

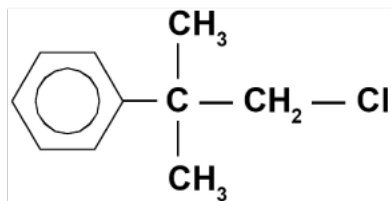


Q28. Give IUPAC name of tert pentylbromide.

Q29. Give IUPAC name of:



Q30. Give IUPAC name of:



Q31. Write structure of 1,1,1,2,3,3,3-heptachloro-2-(1,1,1-trichloromethyl propane).

Q32. Write structure of 1-chloro-1-(4-iodophenyl)-3,3-dimethyl-butene.

Q33. Write structure of 1-chloromethyl-3-(2,2-dimethylpropyl) benzene.

Q34. Write structure of 4-isobutyl-2-chloro octane.

Q35. Write structure of 2-(2-iodophenyl)-1-chloroheptane.

Q36. Write structure of 1-bromo-4-secbutyl-2-methyl benzene.

Q37. Give bond notation of 4-tert-butyl-3-iodoheptane:

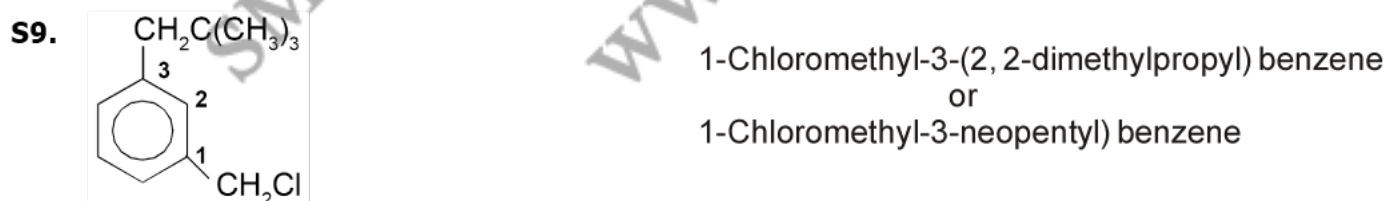
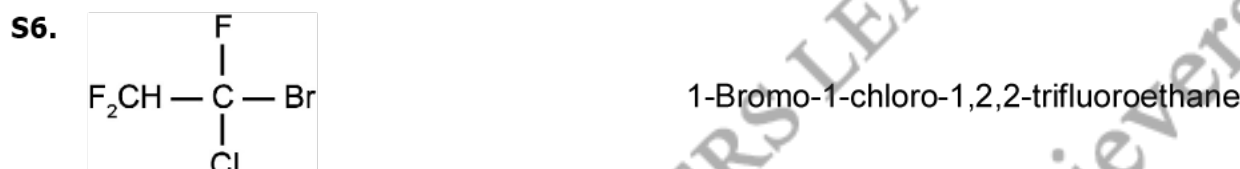
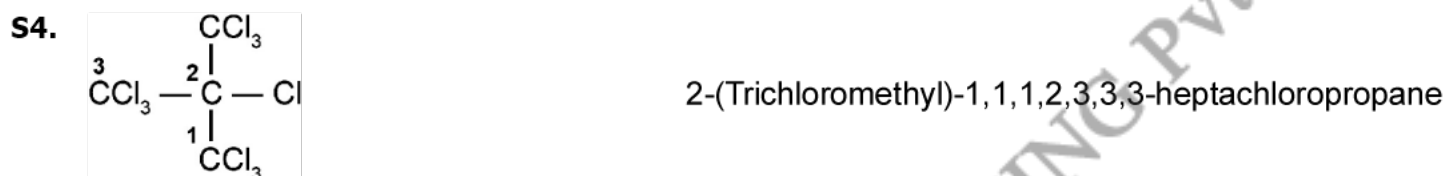
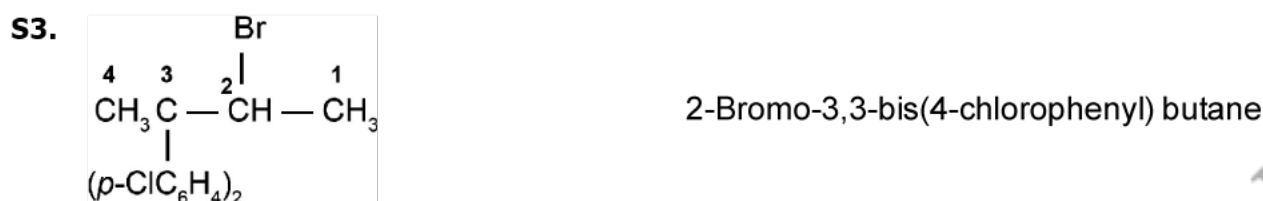
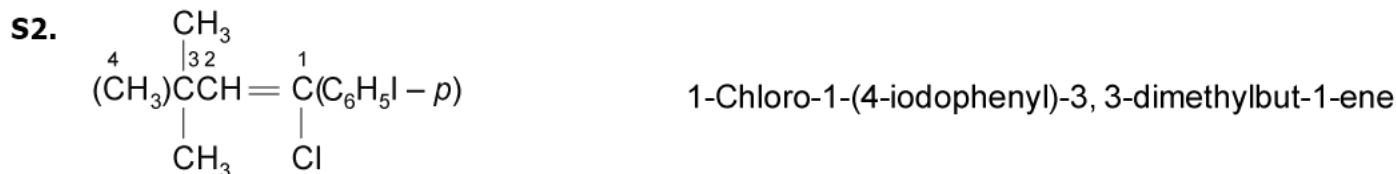
Q38. Give bond notation of 2-chloromethyl-1,1-dimethyl-cyclopentane.

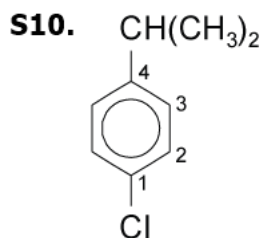
Q39. Give bond notation of 1-bromo-2-methylbut-2-ene.

Q40. Give bond notation of 4-bromo-3-methylpent-2-ene.

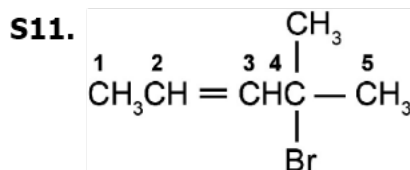
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S1. 6,7-dibromo,5,7-dichloro-2-phenylhept-3-ene

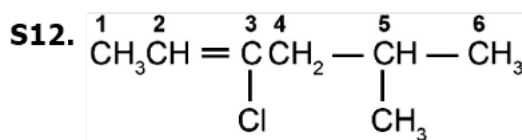




1-Chloro-4-(2-methylpropyl) benzene  
or  
1-Chloro-4-isopropyl benzene  
or  
1-Chloro-4-secpropyl benzene



4-Bromo-4-methylpent-2-ene



3-Choloro-5-methylhex-2-ene

S13. Tris (*p*-chlorophenyl) methane.

S14. 2,2-bis(*p*-chlorophenyl)-1,1,1-trichloroethane.

Extra-trival/commercial name D.D.T.

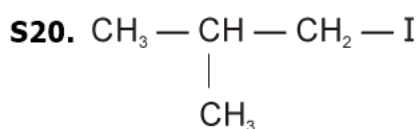
S15. 3-(chlorocyclobutyl)-4,4-dimethyl pentene

S16. 1-bromo-3-(bromomethyl)-5-chloro-2-methyl benzene.

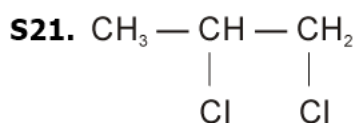
S17. 5,5,5-trichloropentyne.

S18. 1,1,2,3,4,6,7,7-octachlorohept-2-ene.

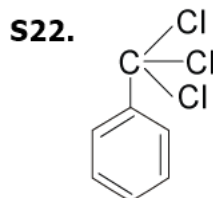
S19. Chloro-tris (*p*-ethylphenyl) methane



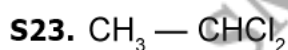
1-iodo-2-methyl propane.



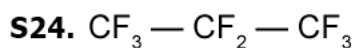
1,2-dichloropropane.



Trichlorophenyl methane.



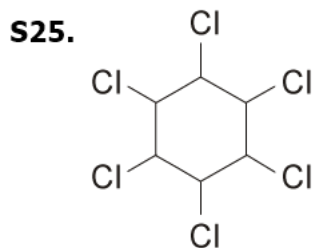
1,1-dichloroethane.



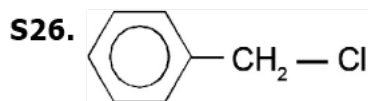
IUPAC. Octa fluoropropane

Or

1,1,1,2,2,3,3,3-octa fluoropropane



1,2,3,4,5,6-hexachlorocyclohexane.

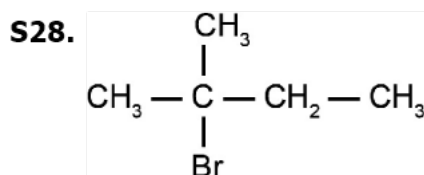


Chlorophenyl methane.

S27. 2-chloro-2-(*p*-tertbutyl phenyl) butane.

Or

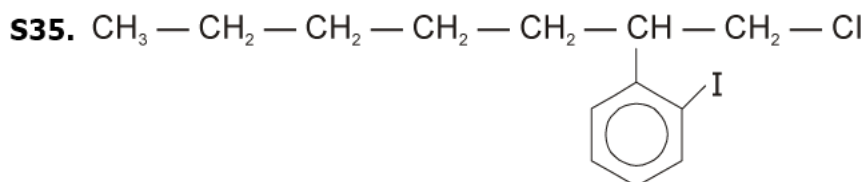
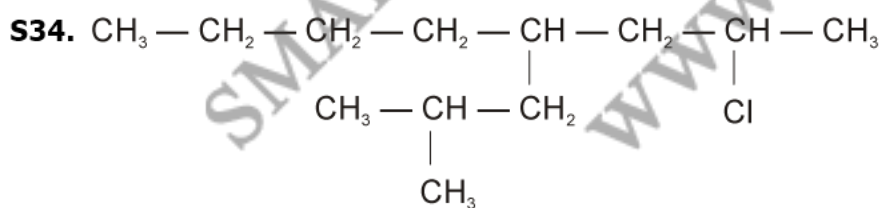
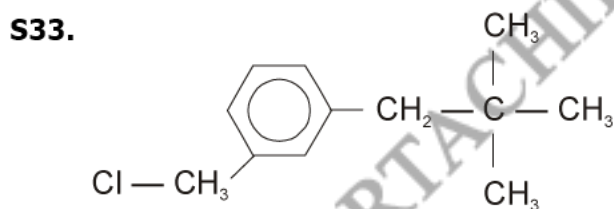
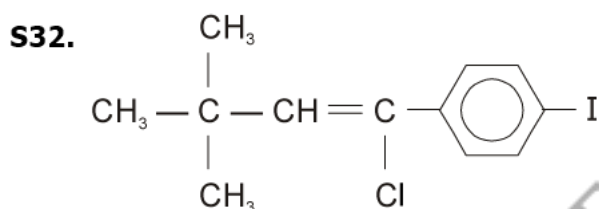
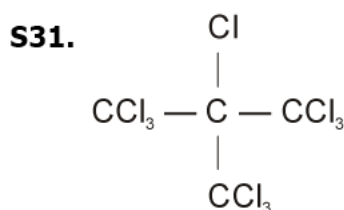
2-chloro-2-(*p*-Neobutyl phenyl) butane.

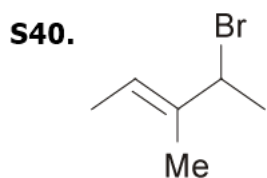
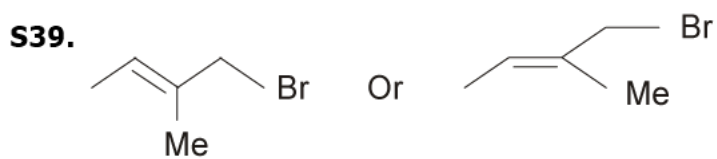
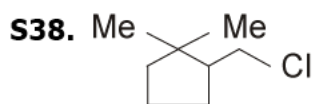
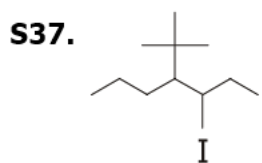
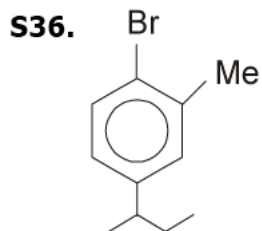


2-bromo-2-methyl butane.

S29. 2,4-dichloro-5-ethyl cyclohex-1,3-diene.

S30. 1-chloro-2-methyl-2-phenyl propane





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**Q1. Write short notes on:**

- (a) Kolbe reaction (b) Reimer-Tiemann reaction  
(c) Williamson ether synthesis (d) Unsymmetrical ether

**Q2. Give the equations of the following reactions:**

- (a) Oxidation of propan-1-ol with alkaline  $\text{KMnO}_4$  solution.  
(b) Bromine in  $\text{CS}_2$  with phenol.  
(c) Dilute  $\text{HNO}_3$  with phenol.  
(d) Treating phenol with chloroform in presence of aqueous  $\text{NaOH}$  at 343 K.

**Q3. Distinguish between the given below pairs:**

- (a) (I)  $\text{Me}-\text{CH}_2-\text{CH}_2-\text{OH}$  and (II)  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{OH}$   
(b) (I)  $\text{Ph}-\text{CH}_2-\text{OH}$  and (II)  $\text{Ph}-\text{CH}_2-\text{O}-\text{Me}$   
(c) (I)  $(\text{Me})_3\text{C}-\text{OH}$  and (II)  $\text{Me}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{OH}$

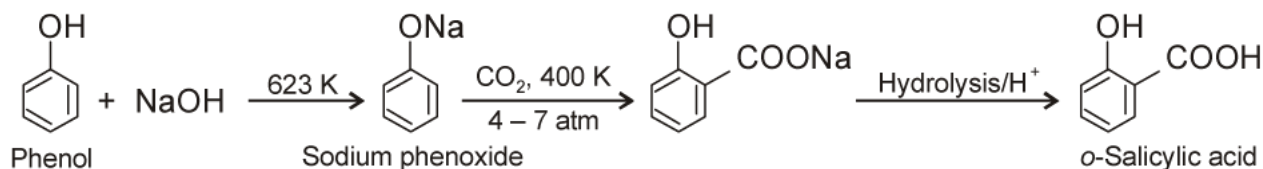
**Q4. What is the order of reactivity of various types of alcohols in the reactions involving cleavage of carbon-oxygen bond? Explain.**

**Q5. How are the following conversions carried out?**

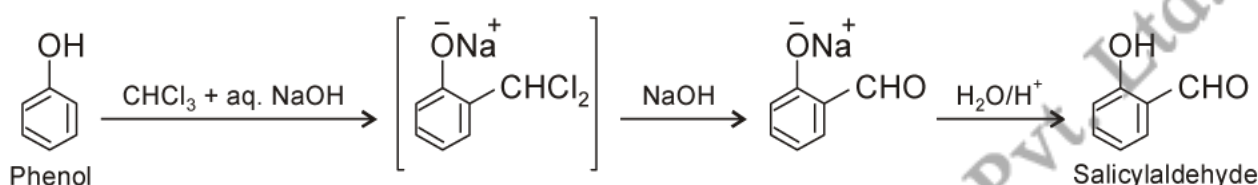
- (a) Propene  $\longrightarrow$  Propan-2-ol  
(b) Benzyl chloride  $\longrightarrow$  Benzyl alcohol  
(c) Ethyl magnesium chloride  $\longrightarrow$  Propan-1-ol  
(d) Methyl magnesium bromide  $\longrightarrow$  2-methylpropan-2-ol.



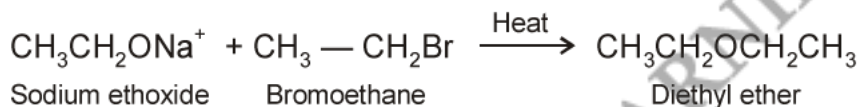
- S1. (a) **Kolbe reaction:** When sodium phenoxide is treated with carbon dioxide under 4 to 7 atm. pressure and at 400 K, then sodium salicylate is formed.



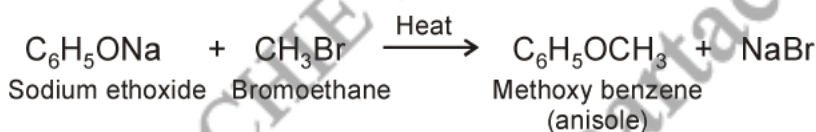
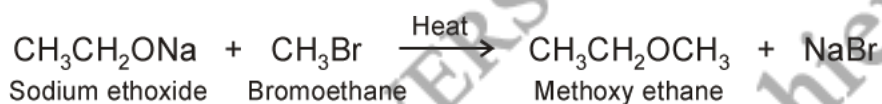
- (b) **Reimer-Tiemann reaction:** When phenol is reacted with  $\text{CHCl}_3$  in presence of alkali at 343 K an aldehyde group is introduced at the *ortho* position of the benzene ring.



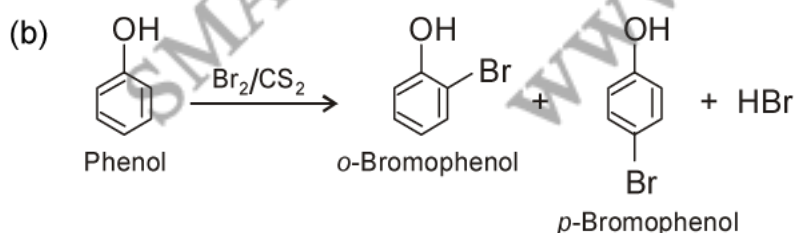
- (c) **Williamson's Synthesis:** It involved the treatment of an alkyl halide with a suitable sodium alkoxide, as a result ether will be produced.

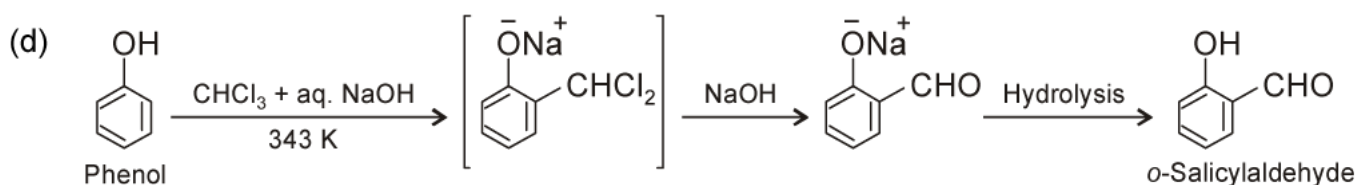
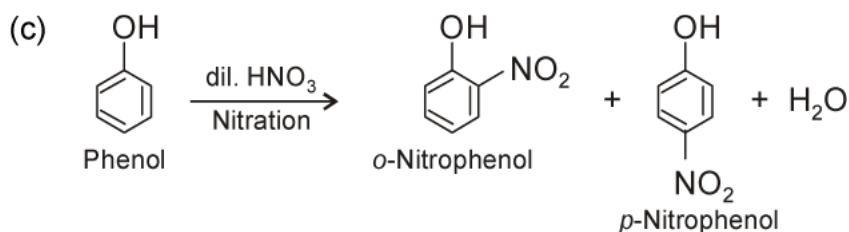


- (d) **Unsymmetrical ether:** If two alkyl or aryl group different in ether are called unsymmetrical ether for example:

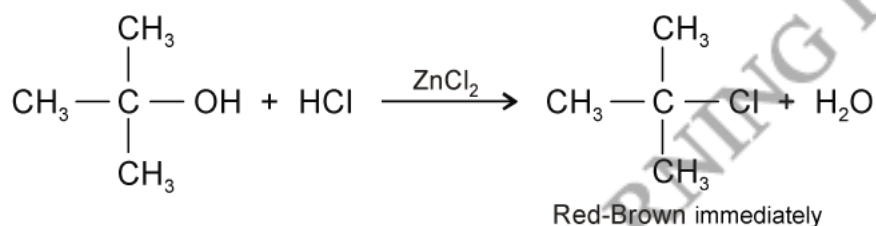


- S2. (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow[\text{Oxidation}]{\text{KMnO}_4/\text{OH}^-} \text{CH}_3\text{CH}_2\text{CHO} \xrightarrow[\text{Oxidation}]{\text{KMnO}_4/\text{OH}^-} \text{CH}_3\text{CH}_2\text{COOH}$   
 Propan-1-ol                      Propan-1-al                      Propanoic acid





- S3.** (a) (II) is unsaturated alcohol (allyl alcohol). When Br<sub>2</sub>/CCl<sub>4</sub> solution is added to it, orange colour of Br<sub>2</sub>/CCl<sub>4</sub> disappears. However, (I) (propyl alcohol) does not react with Br<sub>2</sub>/CCl<sub>4</sub> and orange colour persists.
- (b) (I) (benzyl alcohol) (1° ROH) is oxidised by acid Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> and orange colour of Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> changes to green (Cr<sup>3+</sup>), whereas (II) (benzyl methyl ether) does not react.
- (c) I is *tert*-alcohol gives Lucas test at normal temperature.

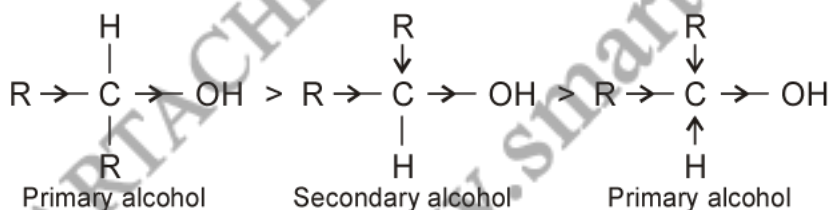


II is primary alcohol cannot give Lucas test at normal temperature.

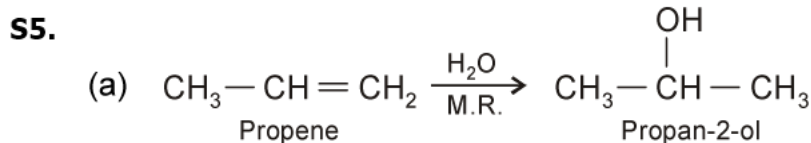
- S4.** The order of reactivity of various alcohols towards this type of reactions is

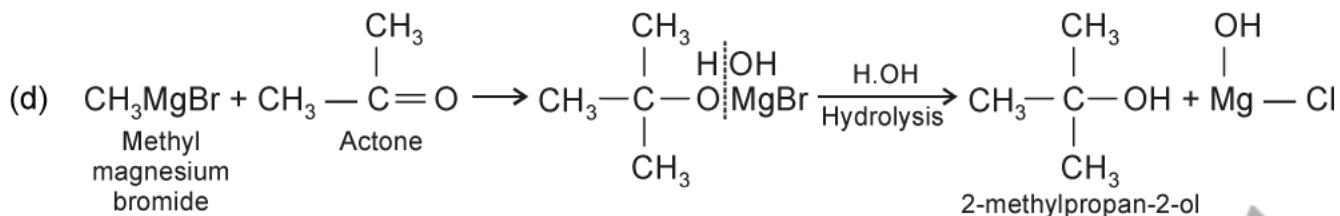
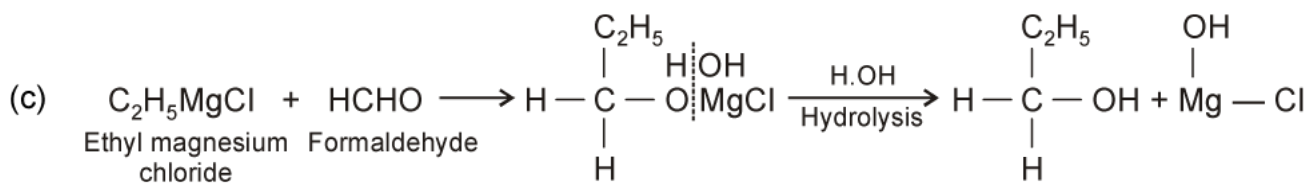
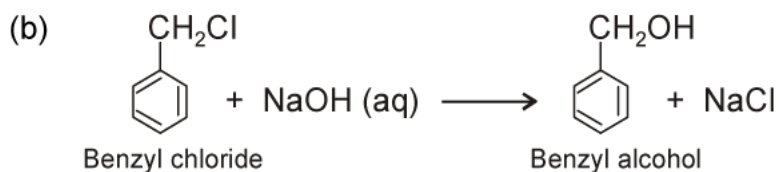
**tertiary > secondary > primary**

This can be explained in terms of electron releasing inductive effect of alkyl groups. The alkyl groups by their electron releasing effect tend to increase the electron displacement towards oxygen.



In other words, the polarity of C — O bond increases and this makes the breaking of the bond between carbon and oxygen easier. Therefore, the alcohols with greater number of alkyl groups attached to the carbon carrying — OH will be more reactive.





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- Q1. How do you account for the fact that, unlike most phenols, 2, 4-dinitrophenol and 2, 4, 6-trinitrophenol are soluble in aqueous sodium bicarbonate solution?
- Q2. Can we use sodium metal to remove last traces of water from (a) benzene (b) ethanol?
- Q3. Explain why alcohols do not react with NaBr, but when  $H_2SO_4$  is added they form alkyl bromides?
- Q4. While separating a mixture of ortho and para nitrophenols by steam distillation, name the isomer which is steam volatile. Give reason.
- Q5. Explain why does propanol have higher boiling point than that of the hydrocarbon, butane?
- Q6. Explain why phenols do not undergo substitution of — OH group like alcohols.
- Q7. Explain why is *ortho*-nitrophenol more acidic than *ortho*-Methoxyphenol?
- Q8. Explain why *o*-nitrophenol is less soluble in water than *p*-nitrophenol?
- Q9. Explain why ethers can be cleaved with acids in nucleophilic substitution reaction?
- Q10. Cyclic ethers can be cleaved readily with HI, whereas diarylethers are very difficult to cleave, why?
- Q11. Unlike phenols, alcohols are easily protonated. Explain.
- Q12. Alcohols react with halogen acids to form haloalkanes but phenol does not form halobenzenes. Explain.
- Q13. Does diethyl ether  $C_2H_5OC_2H_5$  has dipole moment? Explain.
- Q14. Explain why *p*-nitrophenol is more acidic than phenol?
- Q15. Ethers can be prepared by Williamson synthesis in which an alkyl halide is reacted with sodium alkoxide. *Di-tert*-butyl ether can't be prepared by this method. Explain.
- Q16. In Kolbe's reaction, instead of phenol, phenoxide ion is treated with carbon dioxide. Why?
- Q17. Nitration is an example of aromatic electrophilic substitution and its rate depends upon the group already present in the benzene ring. Out of benzene and phenol, which one is more easily nitrated and why?
- Q18. Out of *o*-nitrophenol and *p*-nitrophenol, which is more volatile? Explain.
- Q19. What is denatured alcohol?
- Q20. Give reason for higher boiling point of ethanol in comparison to methoxy methane.
- Q21. Why is the (C — O) bond in alcohol larger than in phenol?

- Q22. Why is the dipole moment of *p*-nitro phenol (5.0 D) is greater than that of nitro benzene (4.0 D) or phenol?
- Q23. Why are the dipole moments of phenol (1.7 D) and methanol (1.6 D) in opposite directions?
- Q24. *Ortho*-methoxy phenol and *P*-methoxy phenol is less acidic than the *M*-methoxy phenol. Explain.
- Q25. Phenol is more acidic than cyclohexanol. Explain.
- Q26. Sodium metal can be used for drying diethylether or benzene but not for ethanol. Explain.
- Q27. Explain why nucleophilic substitution reactions are not very common in phenols?
- Q28. Compare the boiling points and water solubilities of phenol and toluene.
- Q29. Dipole moment of *p*-dichlorobenzene is zero, but *p*-dihydroxybenzene has a definite value of dipole moment. Explain.
- Q30. Which is more soluble in H<sub>2</sub>O: hexanol (I) or cyclohexanol (II)?
- Q31. Why is it that tertiary alcohols show greater reactivity towards hydrogen halides than secondary and primary alcohols?
- Q32. What is the order of reactivity of various types of alcohols in the reactions involving cleavage of carbon-oxygen bond? Explain.
- Q33. Alcohols react with active metals e.g. Na, K etc. to give corresponding alkoxides. Write down the decreasing order of reactivity of sodium metal towards primary, secondary and tertiary alcohols.
- Q34. Arrange the following compound in increasing order of acidity and give a suitable explanation.  
Phenol, *o*-nitrophenol, *o*-cresol.
- Q35. Explain why is  $O = C = O$  nonpolar while  $R - O - R$  is polar?
- Q36. Explain why alcohols and ethers of comparable molecular mass have different boiling points?
- Q37. Arrange water, ethanol and phenol in increasing order of acidity and give reason for your answer.
- Q38. The carbon-oxygen bond in phenol is slightly stronger than that in methanol. Why?
- Q39. Cyclic C<sub>4</sub>H<sub>7</sub>OH has five isomers. Write their structure and names.

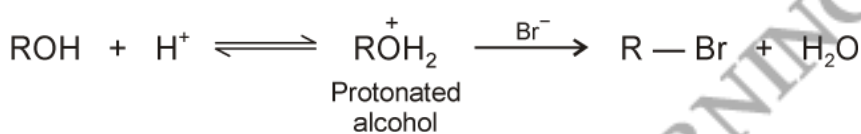
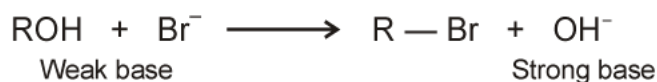
**S1.** The presence of electron withdrawing into groups in 2, 4-dinitrophenol and 2, 4, 6-trinitrophenol increases the acidic strength of these phenols and they react with weakly basic  $\text{HCO}_3^-$  ion to form their salts which dissolve in water.

**S2.** (a) Sodium metal can be used to remove last traces of water from benzene because it does not react with benzene.

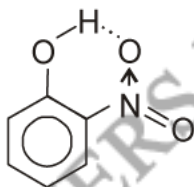
(b) Sodium metal cannot be used to remove traces of water from ethanol because it reacts with ethanol.



**S3.**  $\text{Br}^-$  is very weak base. It cannot displace the strong base  $\text{OH}^-$ . When  $\text{H}_2\text{SO}_4$  is added, it leads to protonation of alcohol. Now  $\text{Br}^-$  can displace  $\text{H}_2\text{O}$  which is a very weak base.



**S4.** *ortho*-Nitrophenol is volatile because in it there is intramolecular H-bonding.



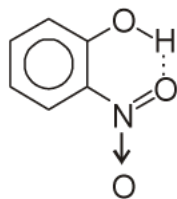
Due to intramolecular H-bonding, the intermolecular forces in *ortho*-nitrophenol are weaker than in *para*-nitrophenol (which has intermolecular H-bonding) and hence it undergoes less association.

**S5.** Propanol has higher boiling point than butane because it has intermolecular H-bonding is present whereas in butane intermolecular forces are weak van der Waal's forces. A lot of heat is required to break intermolecular H-bonding among propanol molecules while butane is gas at room temperature

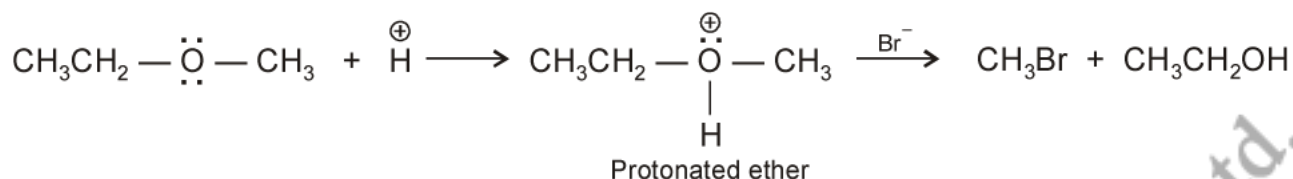
**S6.** C — OH bond in phenols has partial double bond character due to resonance. As a result, this bond is stronger and hence difficult to cleave. Therefore, phenols do not undergo substitution of — OH group like alcohols. In alcohols C — OH bond is pure single bond and hence can be cleaved relatively easily.

**S7.** *ortho*-Nitrophenol is more acidic than *ortho*-methoxyphenol because nitro group by its electron withdrawing resonance effect (– M effect) stabilizes the phenoxide ion whereas methoxy group by its electron releasing effect (+M effect) destabilizes the phenoxide ion. Greater the stability of the phenoxide ion, greater is the dissociation of phenol and greater is its acid strength.

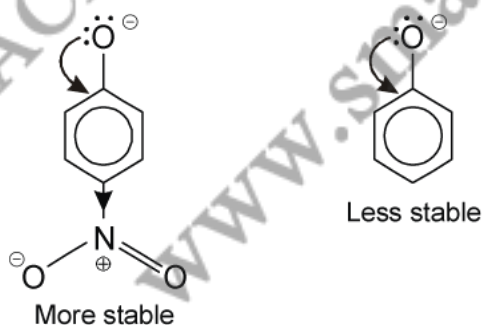
- S8.** In *o*-nitrophenol there is intramolecular hydrogen bonding. This inhibits its hydrogen bonding with water and reduces its solubility in water.



- S9.** The C —  $\ddot{\text{O}}$  — C bond in ethers is very strong because CH<sub>3</sub>O<sup>-</sup> is very weak leaving group. The addition of acids shall protonate the oxygen atom as a result of which the attack by nucleophiles as Br<sup>-</sup> or I<sup>-</sup> on the less hindered alkyl group makes the process facile.

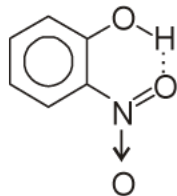


- S10.** Because in cyclic ether — O — attached with two *sp*<sup>3</sup> hybridized carbon while in diphenyl ether O attached with two *sp*<sup>2</sup> hybridized carbon and also partial double bond character due to benzene — O resonance. These factors increase B.d.E of C — O bond in diphenylether.
- S11.** In phenols, the lone pair of electrons on the oxygen atom is **delocalized** over the benzene ring due to resonance and hence is not easily available for protonation. While in alcohols, the lone pairs of electrons on the oxygen atom are **localized** due to absence of resonance and hence are easily available for protonation.
- S12.** The C — O bond in phenols has *sp*<sup>2</sup> hybridisation and some double bond character due to resonance and hence is stronger and cannot be easily cleaved to form halobenzenes. While, the C — O bond in alcohols *sp*<sup>3</sup> hybridisation and pure single bond and hence can be easily cleaved by X<sup>-</sup> ions in presence of halogen acids to form haloalkanes.
- S13.** It has dipole moment because the C — O — C bond angle is not 180° but it is bent and the two C — O bond moments do not cancel.
- S14.** Due to -M effect of — NO<sub>2</sub> group withdraw and disperses the negative charge of conjugate base phenoxide ion, and give more stability. Hence, *p*-nitrophenol is more acidic than phenol.

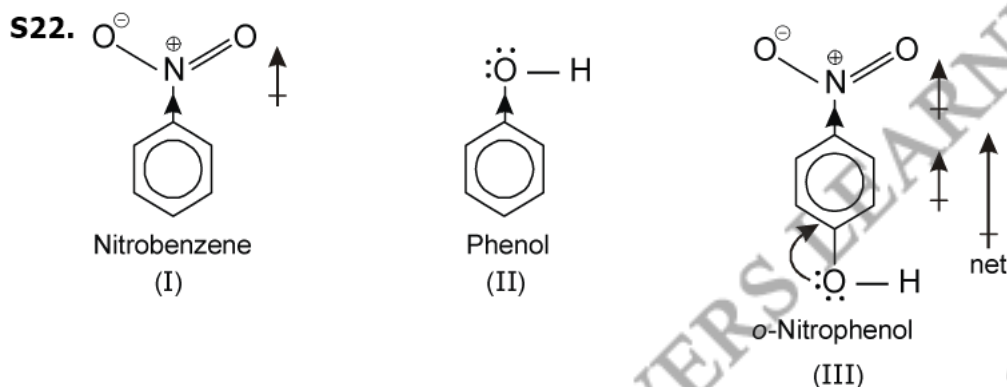


- S15.** Because tert-butylhalide take place in  $\beta$ -elimination than substitution reaction. Hence, alkene is formed as major product.
- S16.** Phenoxide ion is more reactive than phenol towards electrophilic aromatic substitution. There it undergoes electrophilic substitution with carbon dioxide which is a weak electrophile.

- S17.** Phenol is more easily nitrated than benzene. The presence of —OH group in phenol increases the electron density at ortho and para positions in benzene ring by +R effect. Since nitration is an electrophilic substitution reaction, it will be more reactive at position where the electron density is more.
- S18.** Orthonitrophenol is more volatile because there is intramolecular hydrogen bonding in *o*-nitrophenol its intermolecular bonding is very weak. *p*-Nitrophenol has intermolecular hydrogen bonding.



- S19.** It is 95% ethyl alcohol. To avoid misuse of alcohol for drinking it is made unfit by mixing some copper sulphate and pyridine in it. This is called denatured alcohol.
- S20.** In ethanol the intermolecular forces are hydrogen bonds whereas in methoxymethane the intermolecular forces are dipole-dipole forces. Since the intermolecular forces in ethanol are stronger than those in methoxymethane, therefore, it has higher boiling point than methoxymethane.
- S21.** Because in alcohol C is  $sp^3$  hybridised and in phenol C is  $sp^2$  hybridized.  $sp^3$  bond length is longer than  $sp^2$ , and phenol has partial double bond due to resonance.

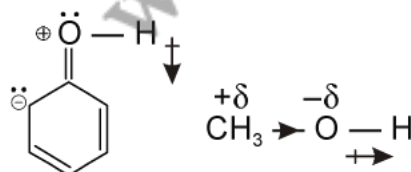


The  $\bar{e}$ -donating power by the resonance of (OH) group and  $\bar{e}$ -withdrawing power ( $-I$  and  $-R$ ) of ( $\text{NO}_2$ ) group in (III) are in the same direction, so net vector is more than (I) and (II).

$\mu$  order : III > I > II

( $\therefore -I$  effect of ( $-\text{NO}_2$ ) > ( $-\text{OH}$ ) group)

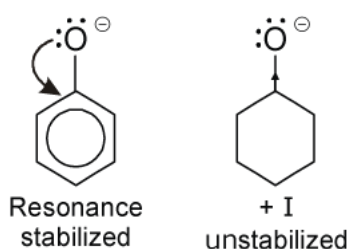
- S23.** Due to resonance, O of phenol acquires positive charge and is the positive end of dipole. However, in methanol, due to strongly EW electronegative, O acquires negative charge and is the negative end of molecular dipole.



- S24.** Because of +M effect in *O*-methoxyphenol and *P*-methoxy phenol electron density increase in benzene ring, and conjugate base stability decrease while due to  $-I$  effect in metaposition decrease electron density and stabilize conjugate base phenoxide ion.



- S25.** Because phenol conjugate base phenoxide ion is more stable due to resonance. (–ve charge disperse) while cyclohexanol conjugate base cyclohexoxide is less stable (–ve charge is not disperse),

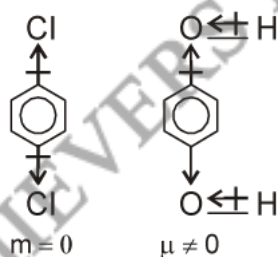


- S26.** Ethanol has an active hydrogen atom ( $C_2H_5O - H$ ) and therefore, reacts with sodium metal to form sodium ethoxide and  $H_2$  gas as:

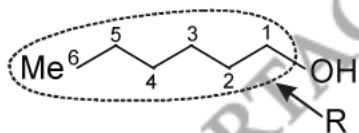


On the other hand, diethyl ether or benzene do not have any replaceable H-atoms and therefore, do not react with sodium metal. Hence, they can be dried by sodium metal.

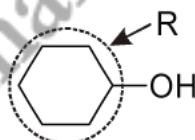
- S27.** In phenols the  $-OH$  group is activating group and take part in resonance, produce partial double bond between O and C of benzene. Hence C — O BdE increase, and not take part in nucleophilic substitution reaction.
- S28.** Boiling point as well as water solubility of phenol is greater than that of toluene because of phenol is polar and has intermolecular H-bonding, while toluene is nonpolar and has weak van der Waals force.
- S29.** In *p*-dichlorobenzene, both  $-Cl$  groups are in same plane, the dipoles are equal and opposite, therefore, net dipole moment is zero. In *p*-dihydroxybenzene both  $-OH$  groups are not in same plane, therefore net dipole moment is not zero.



- S30.** (I)

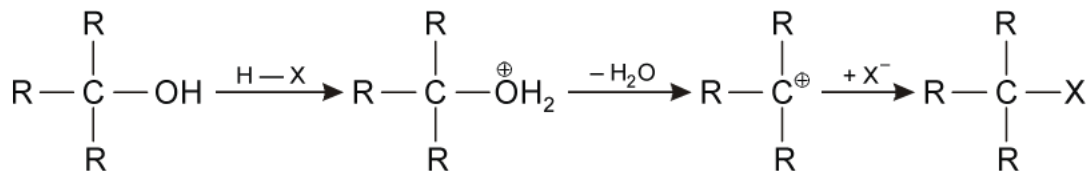


- (II)



The alkyl group (R) in (II) is more compact than in (I) and hence (OH) group is more exposed and available for H-bonding with  $H_2O$ . In other words, (II) has less surface area than (I), and hence more solubility.

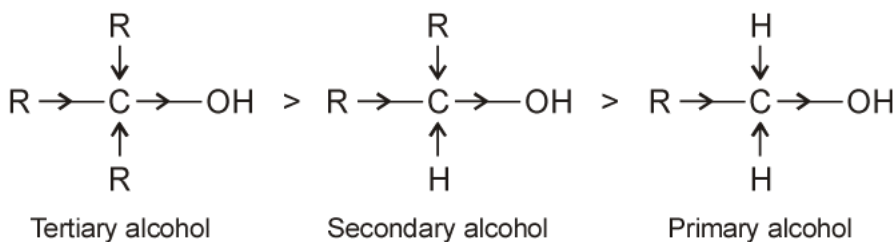
- S31.** Tertiary alcohols react with hydrogen halides through  $3^\circ$  carbocation as intermediate which being most stable (among  $3^\circ$ ,  $2^\circ$  and  $1^\circ$  carbocations) is formed at fastest rate. Hence, tertiary alcohols show greater reactivity towards hydrogen halides. On the other hand, secondary and primary alcohols react through  $2^\circ$  and  $1^\circ$  carbocations respectively.



**S32.** The order of reactivity of various alcohols towards this type of reactions is

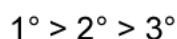


because electron releasing inductive effect of alkyl groups. The alkyl groups by their electron releasing effect tend to increase the electron displacement towards oxygen.

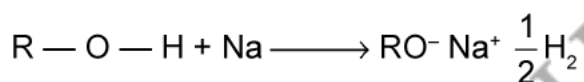


In other words, the polarity of C — O bond increases and this makes the breaking of the bond between carbon and oxygen easier. Therefore, the alcohols with greater number of alkyl groups attached to the carbon carrying — OH will be more reactive.

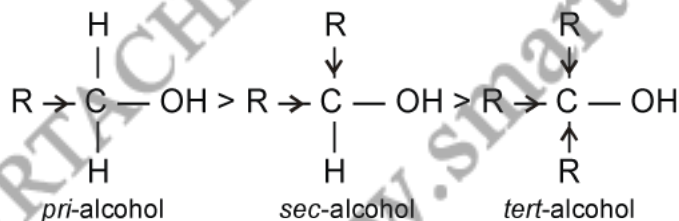
**S33.** Decreasing order of reactivity of sodium metal is



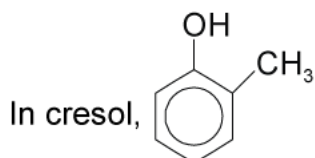
Alcohols reacts with sodium metal to form alkoxides and hydrogen is liberated:



The order of reactivity of alcohols is primary > secondary > tertiary. This can be explained on the basis of cleavage of O — H bond. The alkyl groups are electron releasing group (+I effect) and they increase the electron density around the oxygen. As a result, the electrons of O — H bond cannot be withdrawn strongly towards oxygen and O — H remains strong. Therefore, greater is the number of alkyl groups present, smaller will be reactivity of alcohol.



**S34.** Increasing order of acidity:

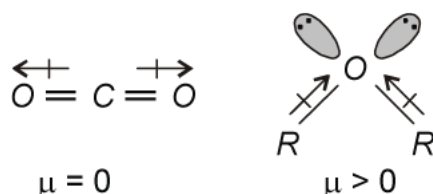


, the electron donating group (— CH<sub>3</sub>) gives electrons and intensify the

charge on phenoxide ion and therefore makes it unstable. Therefore, *o*-cresol is less acidic than phenol. In *o*-nitrophenol, the electron withdrawing ( $-\text{NO}_2$ ) group withdraws electrons and disperses the  $-ve$  charge and stabilizes the phenoxide ion. Therefore, *o*-nitrophenol is more acidic than phenol.

- S35.**  $\text{O}=\text{C}=\text{O}$  molecule is linear so that the polarities of two  $\text{C}-\text{O}$  bonds get cancelled and the molecule is linear.

Ethers have structures similar to water and have angular or bent structure. Therefore, the polarity of two  $\text{R}-\text{O}$  groups does not get cancelled and these have net dipole moment. Thus,  $\text{R}-\text{O}-\text{R}$  is polar.



- S36.** Ethers have low polarity and as a result do not show any association by intermolecular hydrogen bonding. Therefore, ethers have low boiling points and lower than that of isomeric alcohols and almost same as those of alkenes of comparable molecular masses.

$\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
Diethyl ether	<i>n</i> -Butyl alcohol	<i>n</i> -Pentane
307.6 K	390 K	309.1 K

The large difference in boiling points of alcohols and ethers is due to the presence of hydrogen bonding in alcohols.

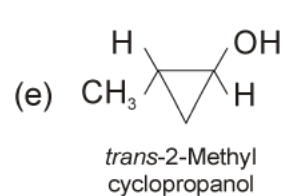
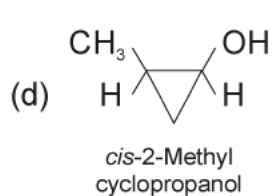
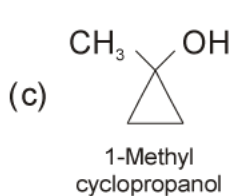
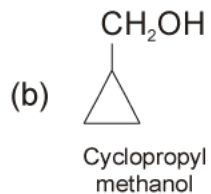
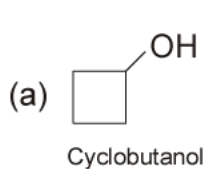
- S37.** Increasing order of acidity is: ethanol < water < phenol. The phenoxide ion obtained after the removal of a proton is stabilised by resonance whereas the ethoxide ion obtained after the removal of a proton is destabilised by '+I' effect of  $-\text{C}_2\text{H}_5$  group. Therefore phenol is stronger acid than ethanol.



On the other hand ethanol is weaker acid than water because electron releasing  $-\text{C}_2\text{H}_5$  group in ethanol increases the electron density on oxygen and hence the polarity of  $\text{O}-\text{H}$  bond in ethanol decreases. This results in the decreasing acidic strength. Hence acidic strength increases in the order given above.

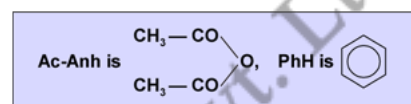
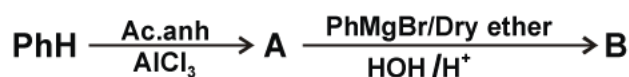
- S38.**  $\text{C}-\text{O}$  bond in phenol is stronger than that in methanol due to the fact that
- In phenol, conjugation of lone pair of electrons on oxygen with aromatic ring results in partial double bond character in carbon-oxygen bond.
  - In phenol, oxygen is bonded to a  $sp^2$  hybridised carbon atom while in methanol, it is bonded to a  $sp^3$  hybridised carbon atom. The bond formed between oxygen and  $sp^2$  hybridised carbon is more stable than that formed between oxygen and  $sp^3$  hybridised carbon.

S39.

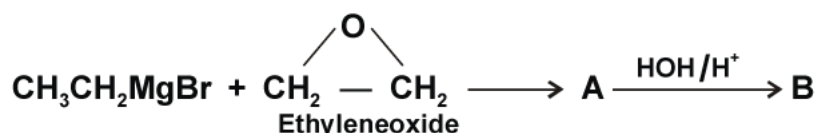


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- Q1. Write notes on oxymercuration-demercuration.
- Q2. Write a short note on the following with equation of Coupling reaction.
- Q3. Write a short note on the following with equation of Friedel-Crafts reaction
- Q4. Write the chemical reaction of: Reimer-Tiemann reaction
- Q5. What happens when (give equation only) ethylene is treated with hypochlorous acid?
- Q6. What happens when (give equation only) cumene is treated with oxygen and the product is hydrolysed with dilute acid?
- Q7. Complete the following reaction

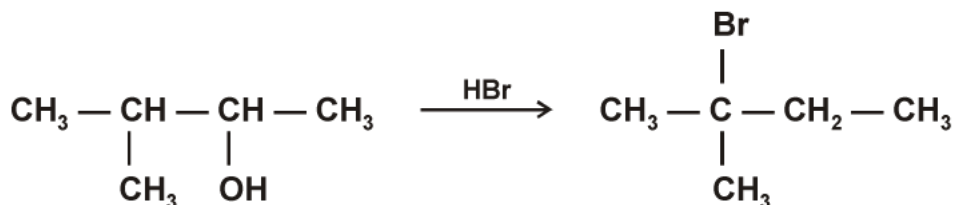


- Q8. Complete the following reaction:



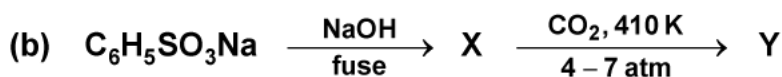
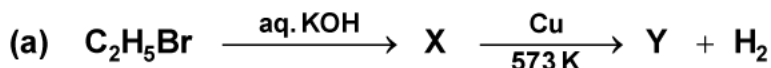
- Q9. Write notes on hydroboration.
- Q10. What happen when aluminium react with *tert*-butyl alcohol.
- Q11. Acid-catalysed dehydration of *tert*-butanol is faster than that of n-butanol. Explain.
- Q12. Neopentyl alcohol reacts with concentrated HBr to give 2-bromo-2-methylbutane. Write the mechanism for the formation of this product.
- Q13. Alcohols do not react with NaBr but when H<sub>2</sub>SO<sub>4</sub> is added they form alkyl bromides. Explain.
- Q14. Cyclobutyl bromide on treatment with magnesium in dry ether forms an organometallic (A). The organo-metallic reacts with ethanal to give an alcohol (B) after mild acidification. Prolonged treatment of alcohol (B) with an equivalent amount of HBr gives 1-bromo-1-methyl cyclopentane (C). With the structures of (A), (B) and explain how (C) is obtained from (B)?
- Q15. *Di-tert*-butyl ether cannot be prepared by Williamson's synthesis. Explain.
- Q16. Give the product and show the steps in (a) the hydration of cyclobutylethene in dil. H<sub>2</sub>SO<sub>4</sub>. (b) dehydration of cyclobutylcarbinol.
- Q17. Compare and explain the acidities of ClCH<sub>2</sub>CH<sub>2</sub>OH and CH<sub>3</sub>CH<sub>2</sub>OH.
- Q18. Hydration of 3-phenyl-1-butene with dil.H<sub>2</sub>SO<sub>4</sub> is not a satisfactory method for preparing 3-phenyl-2-butanol because 2-phenyl-2-butanol is obtained instead. Explain.

Q19. When 3-methylbutan-2-ol is treated with HBr following reaction takes place:

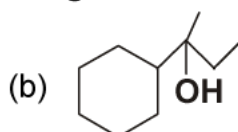
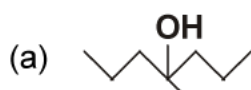


Give a mechanism for this reaction.

Q20. Identify the compound X and Y in the following reactions:



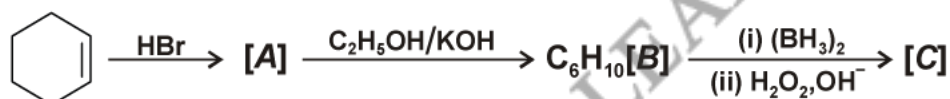
Q21. Show how would you synthesize the following alcohols from appropriate alkenes?



Q22. Give the product and write a mechanism for acid dehydration of *n*-Butyl alcohol.

Q23. Cyclobutylbromide on treatment with magnesium in dry ether forms an organometallic (A). The organometallic compound reacts with ethanal to give an alcohol (B) after mild acidification. Prolonged treatment of alcohol (B) with an equivalent amount of HBr gives 1-bromo-1-methylcyclopentane (C). Write the structures of (A), (B) and explain how (C) is obtained from B.

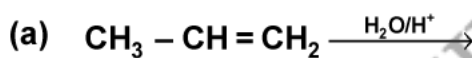
Q24. What are [A] to [C] in the scheme of reactions given below?



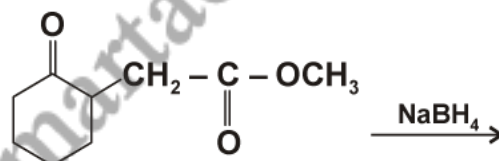
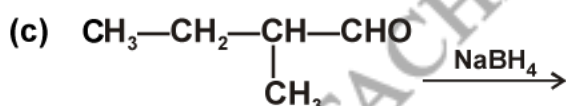
Q25. How will you distinguish between 1-phenylethanol and 2-phenylethanol?

Q26. What is iodoform test? What are reactions involved in this test?

Q27. Write structures of the products of the following reactions:



(b)



Q28. Write mechanism of the reaction of HI with methoxymethane.

Q29. What is the mechanism of Reimer Tiemann reaction?

Q30. What is the mechanism of acid catalysed dehydration of alcohols? What is the order of reactivity of different types of alcohols towards this reaction?

Q31. How is 1-propoxypropane synthesised from propan-1-ol? Write mechanism of this reaction?

Q32. Write equations for the following reactions:

- Nitration of anisole.
- Bromination of anisole in ethanoic acid medium.
- Friedel Craft's acetylation of anisole.

**Q33. Write the equation of the reaction of hydrogen iodide with**

- (a) 1-Propoxypropane      (b) Methoxybenzene, and      (c) Benzyl ethyl ether.

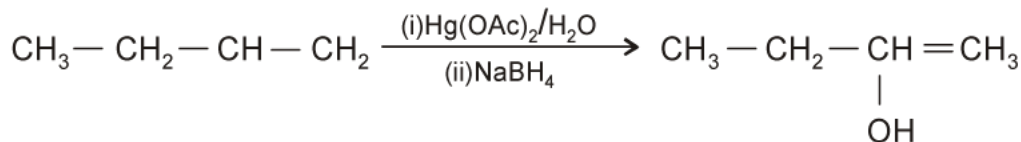
**Q34. A compound (A) with molecular formula  $C_4H_{10}O$  on oxidation forms compound (B). The compound (B) gives positive iodoform test. Compound (B) on reaction with  $CH_3MgBr$  followed by hydrolysis gives (C). Identify (A), (B) and (C), and give sequence of reactions.**

**Q35. Name the reagents used in the following reactions:**

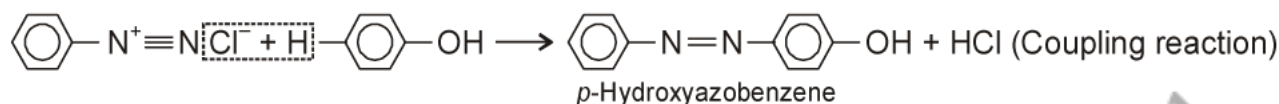
- (a) Oxidation of a primary alcohol to aldehyde.  
(b) Bromination of phenol to 2, 4, 6-tribromophenol.  
(c) Benzyl alcohol to benzoic acid.  
(d) Dehydration of propan-2-ol to propene  
(e) Butan-2-one to butan-2-ol.

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**S1. Oxymercuration-demercuration:**

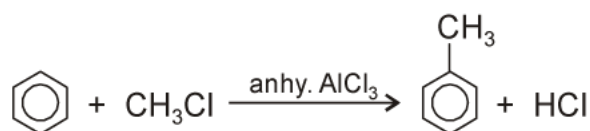


**S2. Coupling reaction:** Benzene diazonium chloride reacts with phenol to give *p*-hydroxyazobenzene.



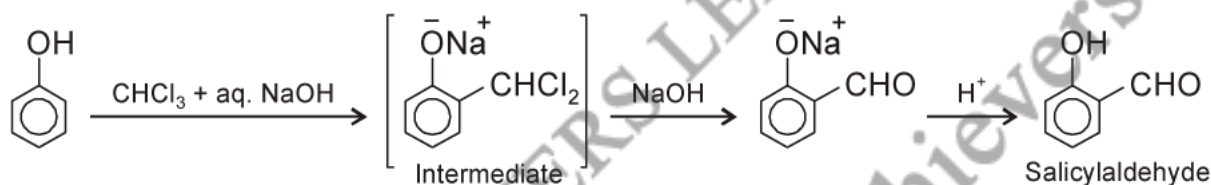
This is known as **Coupling reaction**.

**S3. Friedel-Crafts reaction:** When benzene or its derivatives react with alkyl halide in presence of anhy.  $\text{AlCl}_3$ , we get alkyl substituted product. For example,



This is known as **Friedel-Crafts reaction**.

**S4. Reimer-Tiemann reaction:**



**S5.**  $\text{CH}_2 = \text{CH}_2 + \text{HOCl} \rightarrow \text{CH}_2\text{OHCH}_2\text{Cl}$   
Ethylene chlorohydrin

**S6.**

$$\text{CH}_3 - \underset{\text{C}_6\text{H}_5}{\text{CH}} - \text{CH}_3 + \text{O}_2 \xrightarrow{\text{Heat}} \text{H}_3\text{C} - \underset{\text{C}_6\text{H}_5}{\text{C}} - \text{O} - \text{O} - \text{H} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{C}_6\text{H}_5\text{OH} + \text{CH}_3\text{COCH}_3$$

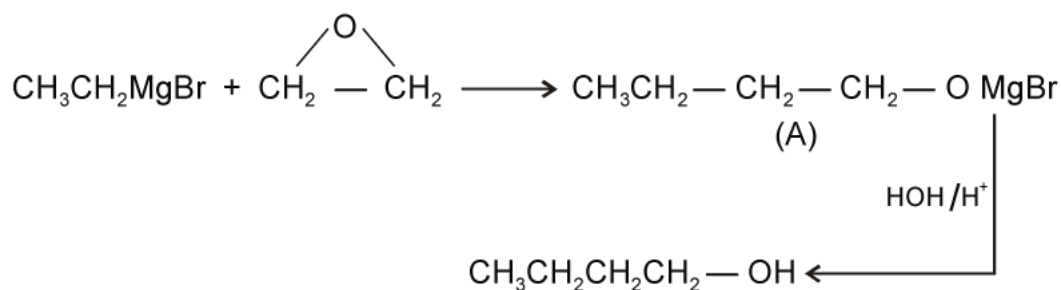
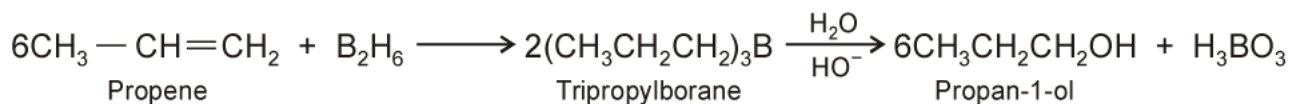
Cumene  Cumene hydroperoxide  Phenol  Acetone

**S7.**

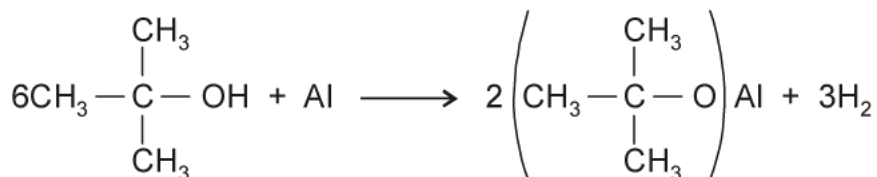
$$\text{C}_6\text{H}_6 \xrightarrow[\text{AlCl}_3]{(\text{CH}_3\text{CO})_2\text{O}} \text{C}_6\text{H}_5\text{COCH}_3 \xrightarrow[\text{HOH}/\text{H}^+]{\text{PhMgBr}/\text{Dry ether}} \text{CH}_3 - \underset{\text{C}_6\text{H}_5}{\text{C}}(\text{OH}) - \text{C}_6\text{H}_5$$



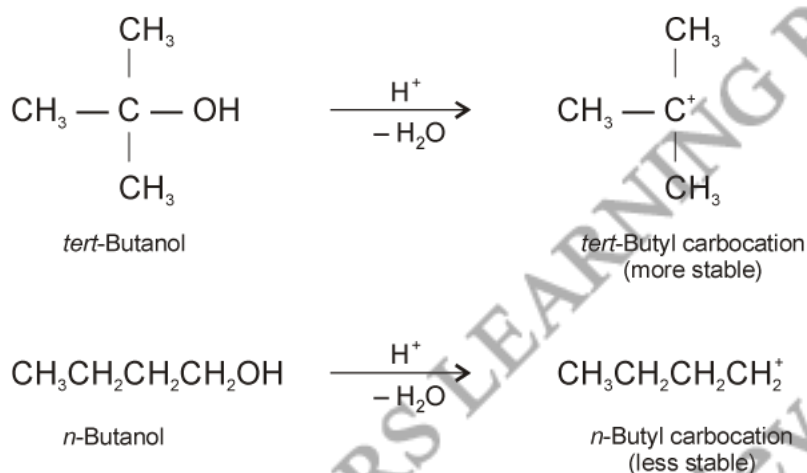
S8.

S9. **Hydroboration:**

S10.

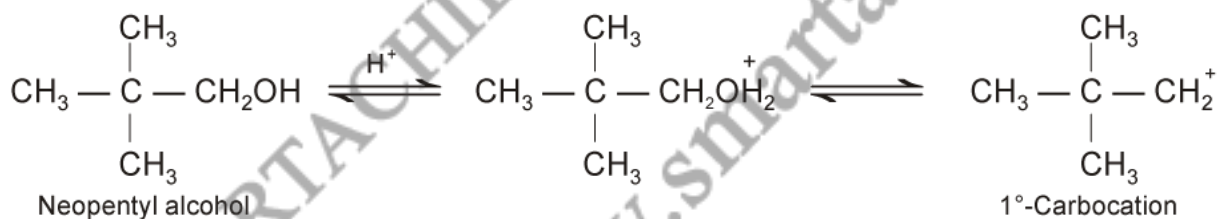


S11. Acid-catalysed dehydration of alcohols occurs through the formation of carbocation intermediate as:

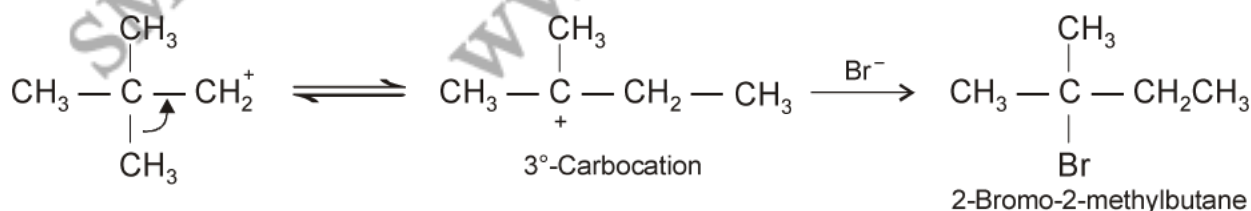


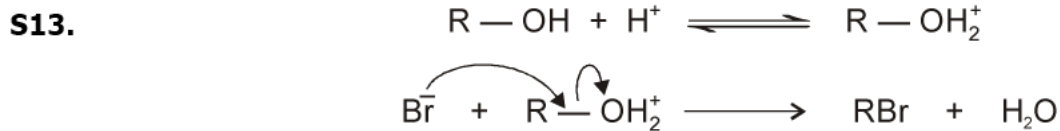
Since *t*-butyl carbocation (3°) is more stable than *n*-butyl carbocation (1°), therefore, acid-catalysed dehydration of *t*-butanol takes place faster than that of *n*-butanol.

S12.



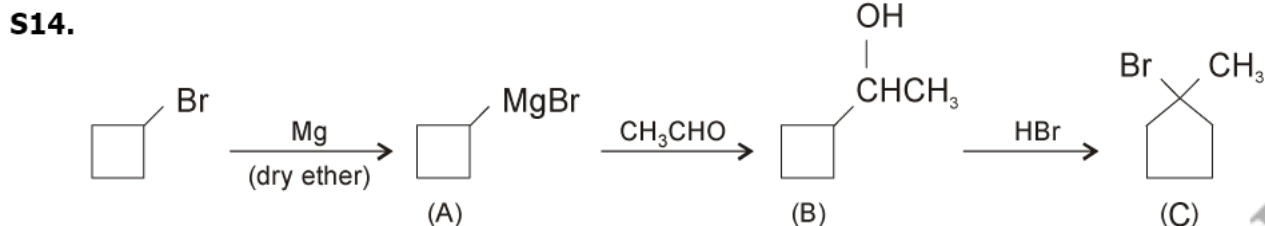
A methyl shift changes 1° carbocation to a stable 3° carbocation.



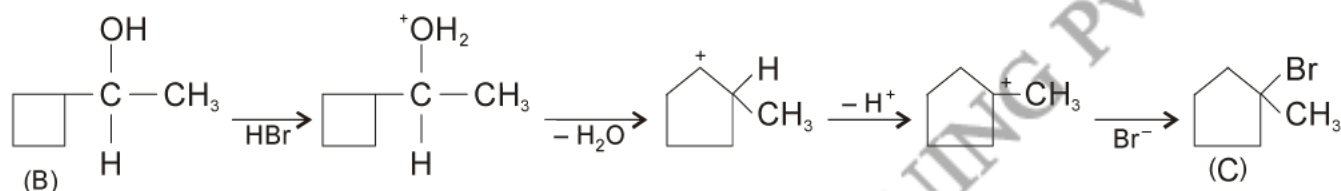


Although  $Br^-$  is a strong nucleophile, yet  $OH^-$  being a strong base is a very poor leaving group. Therefore,  $Br^-$  cannot displace  $OH^-$  from ROH to form RBr. Hence, alcohols do not react with NaBr.

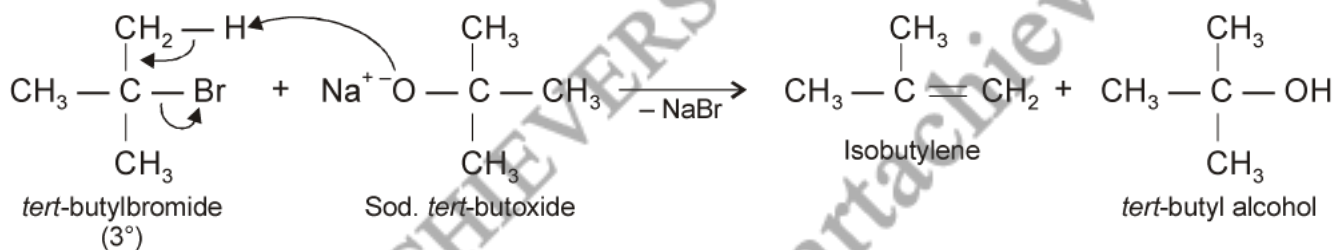
However, when  $H_2SO_4$  is added, protonation of alcohols takes place and  $-OH$  group gets converted to  $-OH_2^+$ . Since water is a weak base, therefore, it is a good leaving group. Hence,  $Br^-$  can displace  $H_2O$  from protonated alcohol to form RBr.



Conversion of B to C occurs as:



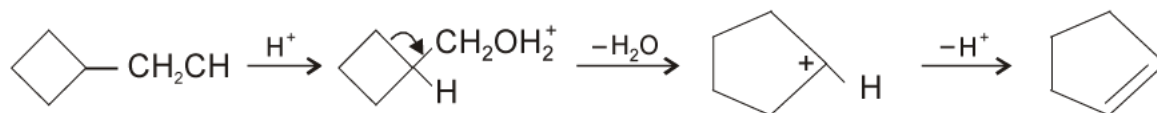
**S15.** For the preparation of di-*tert*-butyl ether by Williamson's synthesis, we require *tert*-butyl bromide and sodium *tert*-butoxide. *Tert*-butyl bromide is a  $3^\circ$  alkyl halide and prefers to undergo elimination rather than substitution and therefore, the product obtained is isobutylene rather than di-*tert*-butyl ether.

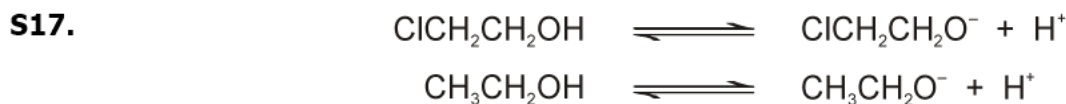


**S16.** (a) In this reaction, the addition of  $H^+$  to  $C^1$  gives carbocation, which rearranges by ring expansion. Finally, it gives 2-methylcyclopentanol.



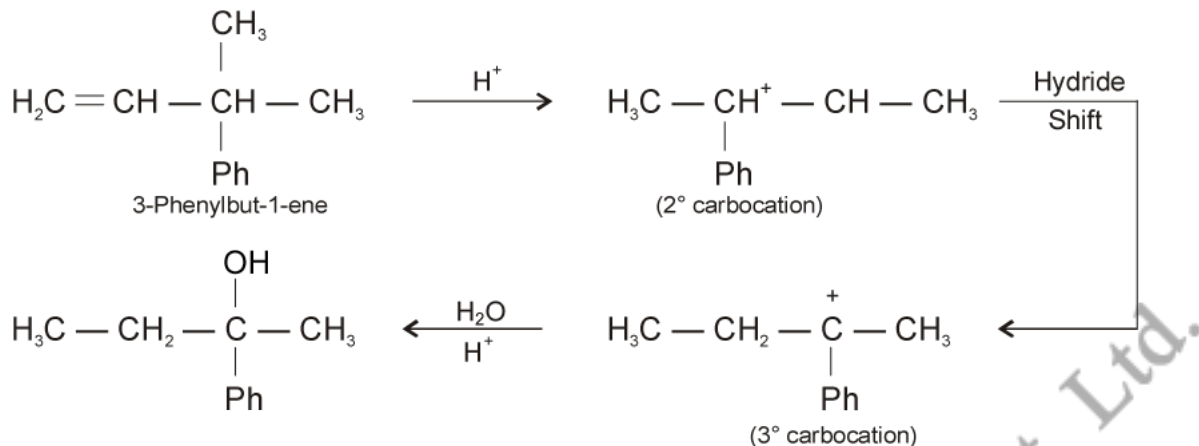
(b) This reaction results in the expansion of four membered to a five membered ring.



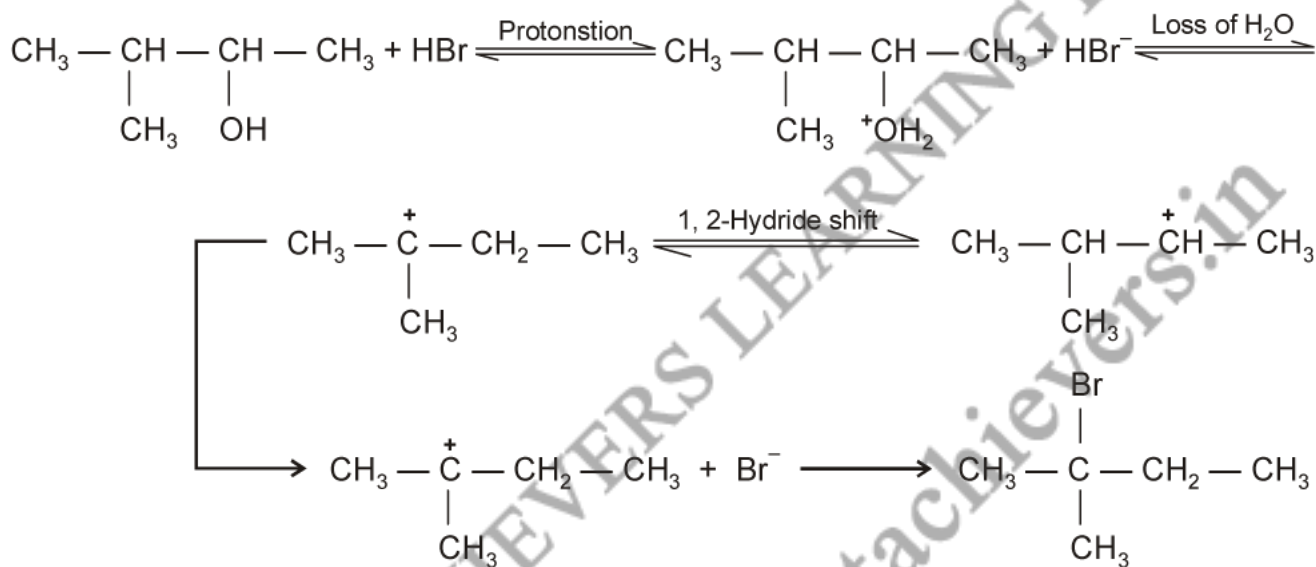


Cl is electron withdrawing group and therefore, it delocalizes the negative charge of  $\text{ClCH}_2\text{CH}_2\text{O}^-$  by induction and makes it more stable than  $\text{CH}_3\text{CH}_2\text{O}^-$ . Hence, 2-chloroethanol is more acidic.

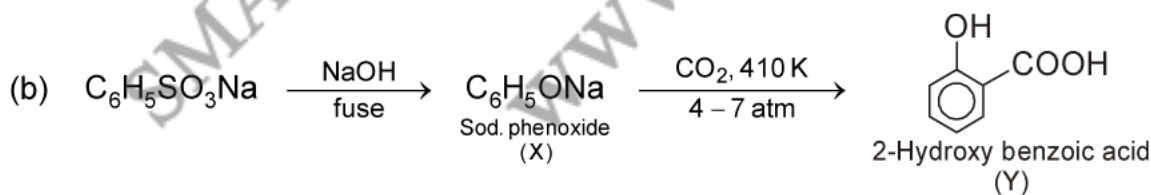
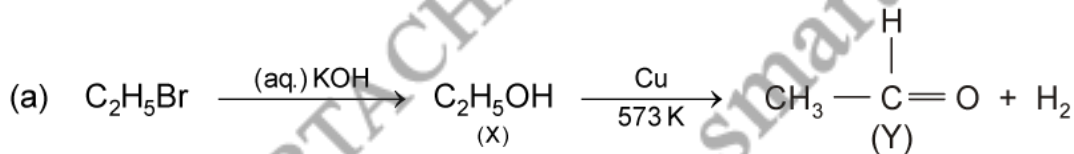
**S18.** Hydration form 2 carbocation which undergoes a hydride shift to stable benzylic carbocation.



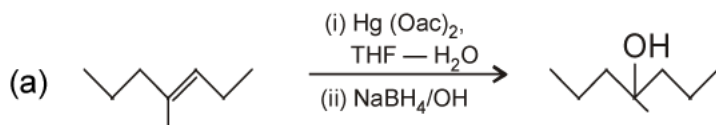
**S19.** The reaction takes place through the following mechanism:

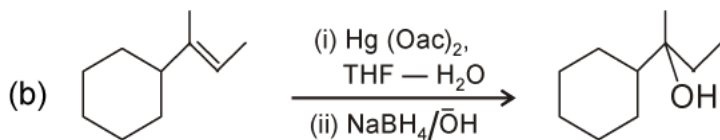


**S20.**

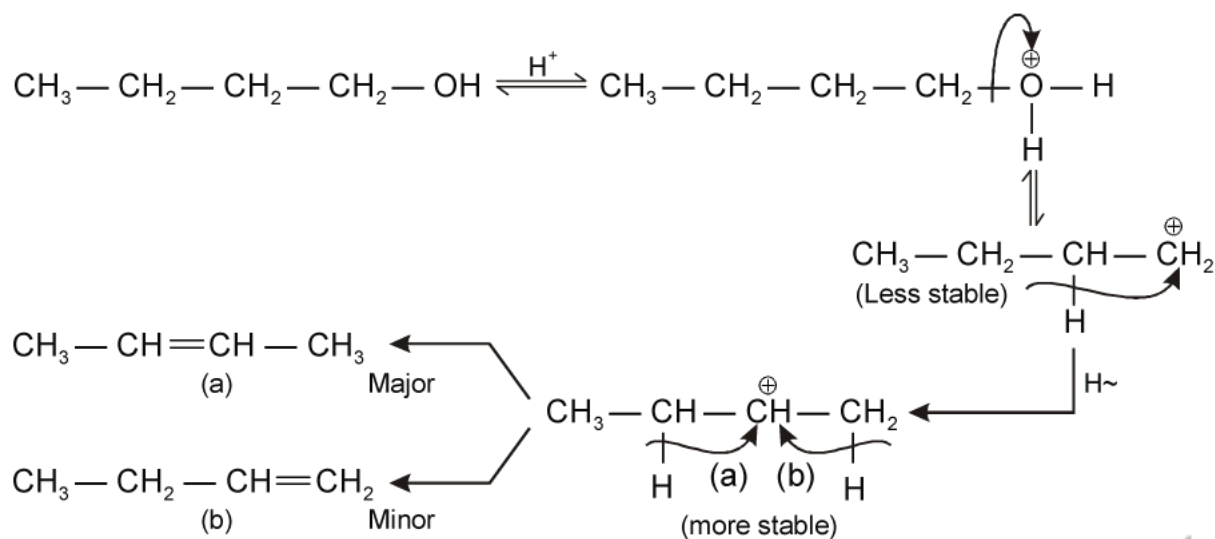


**S21.**

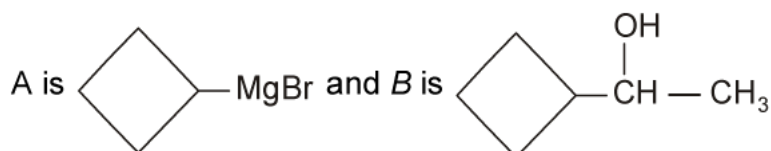




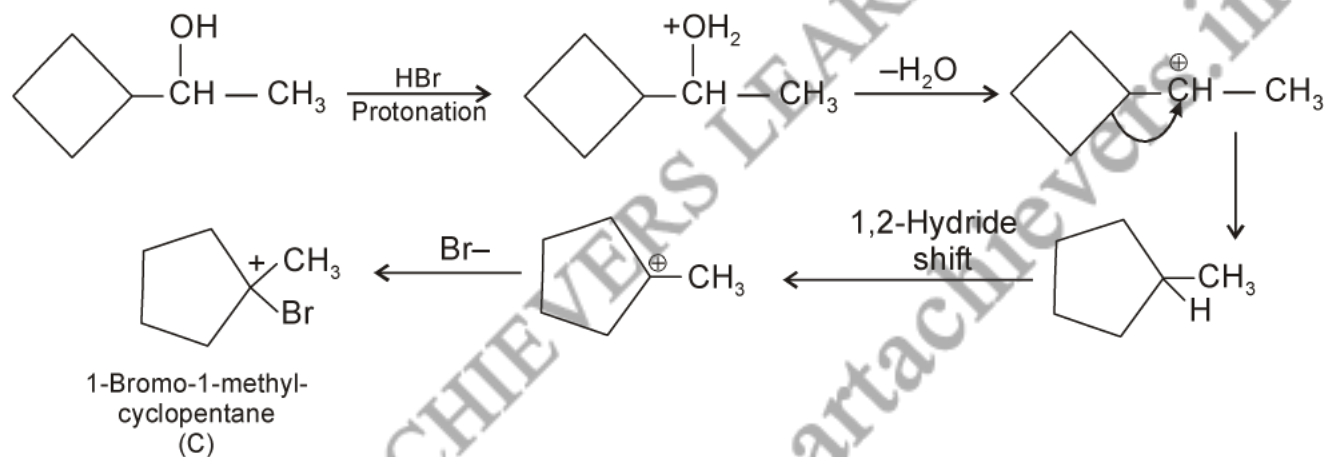
S22.



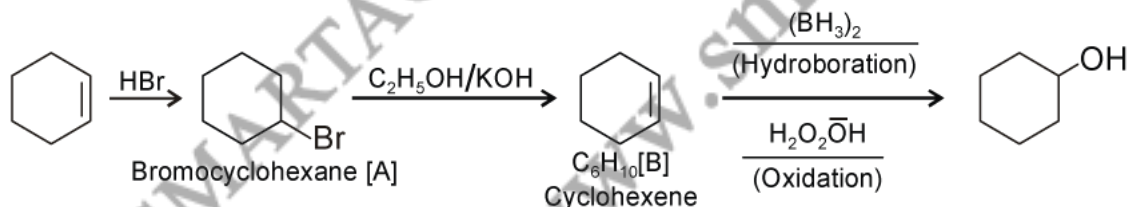
S23.



The alcohol B on prolonged treatment with an equivalent amount of HBr undergoes following series of changes.



S24.

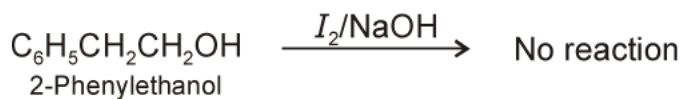
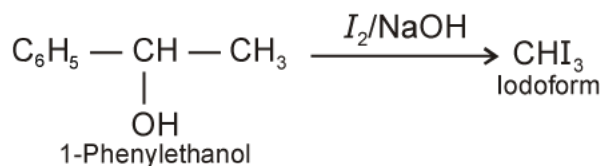


S25. 1-Phenylethanol and 2-phenylethanol can be distinguished by iodoform test. 1-phenylethanol contains the grouping  $\text{CH}_3-\text{CH}-$  and hence gives iodoform test while 2-phenylethanol does

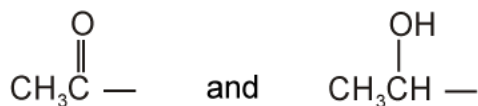


not contain the grouping  $\text{CH}_3-\text{CH}-$  and hence does not give iodoform test.



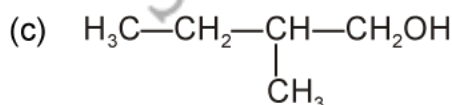
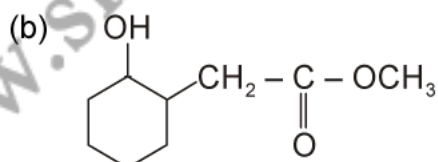
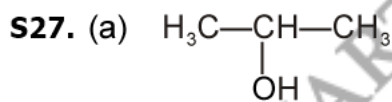
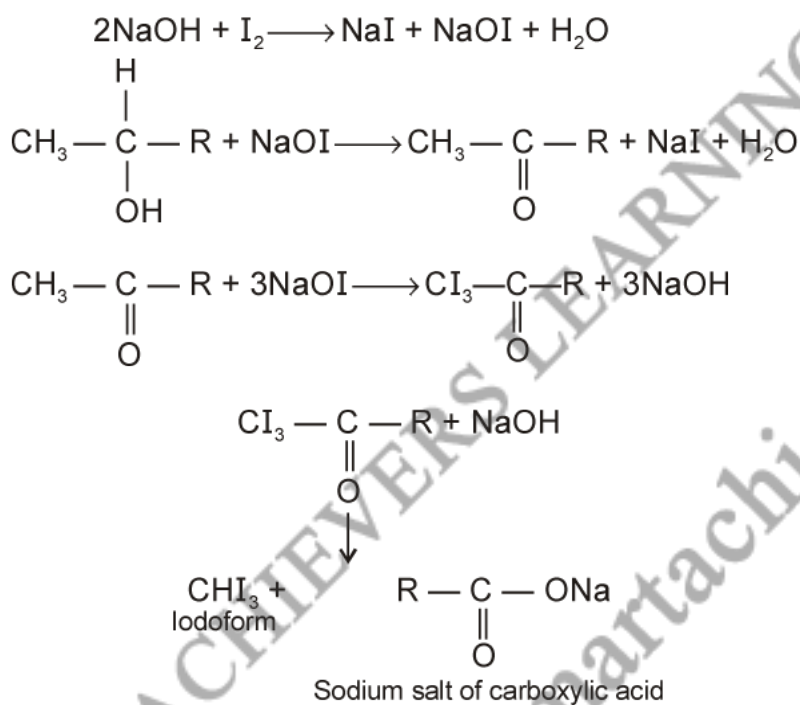


**S26.** This test is used for the identification of following functional groups in organic compound.

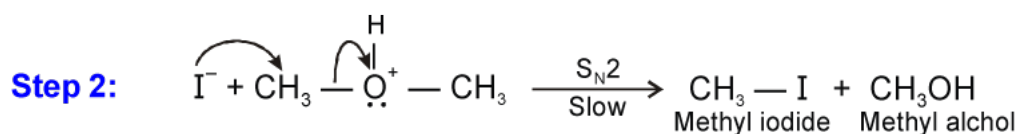
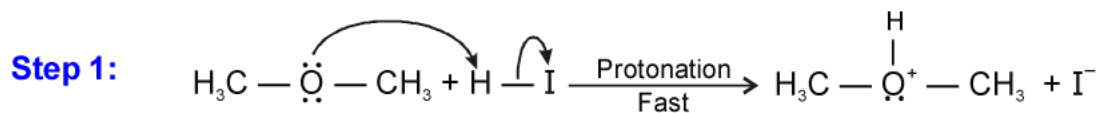


It is observed that when the compounds containing such functional groups are heated with an aqueous solution of  $\text{Na}_2\text{CO}_3$  or  $\text{NaOH}$  containing iodine, a yellow precipitate of iodoform is obtained.

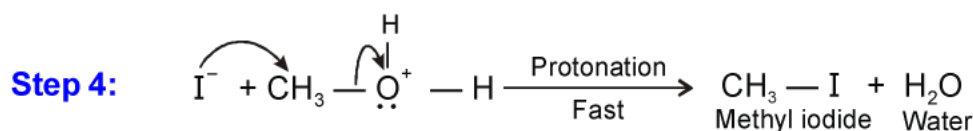
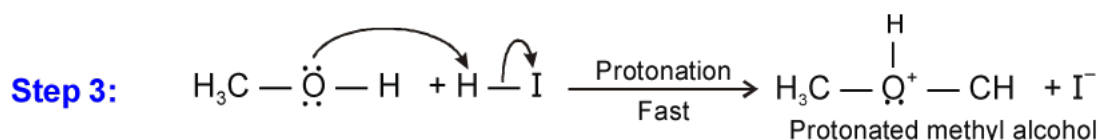
Thus, the test helps us to identify such type of groupings in the organic compounds. The reactions involved are:



**S28.** A mixture of methyl alcohol and methyl iodide is formed with equimolar amounts of HI and methoxymethane. The mechanism is as follows:

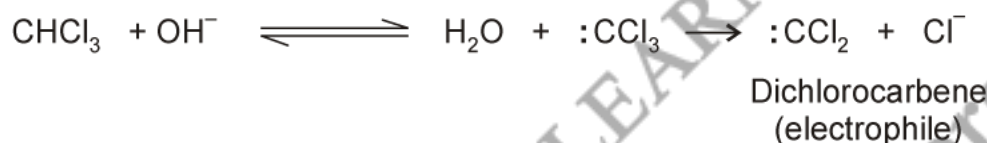


If, however, excess of HI is used, methyl alcohol formed in step 2 is also converted into methyl iodide by the following mechanism.

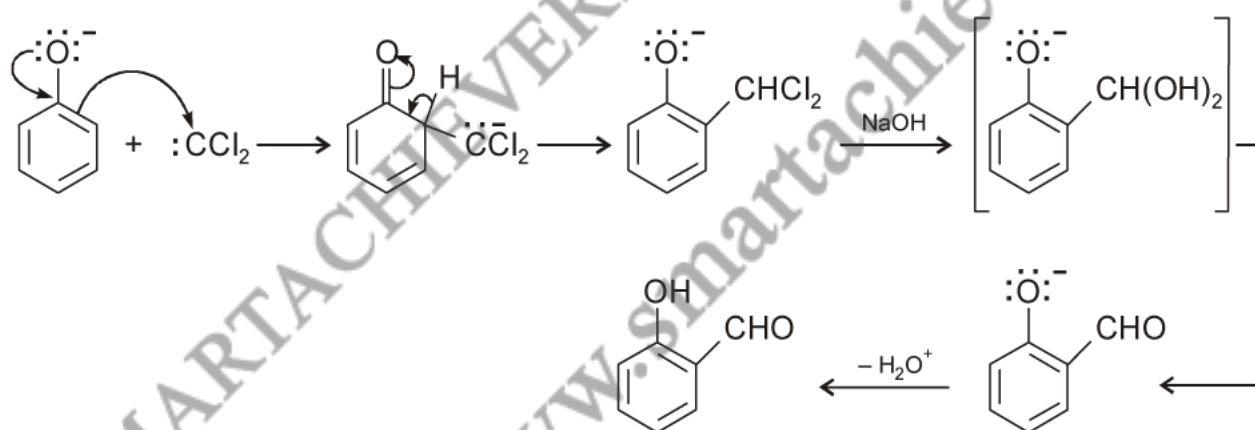


**S29.** Reimer Tiemann reaction is an **electrophilic substitution** reaction. The reaction takes place through the following steps:

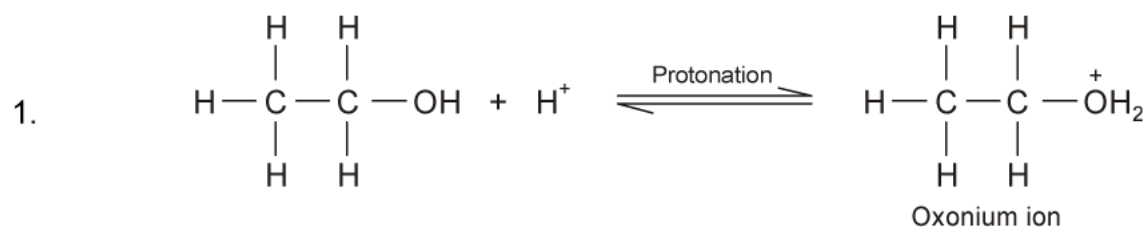
1. **Generation of electrophile:**

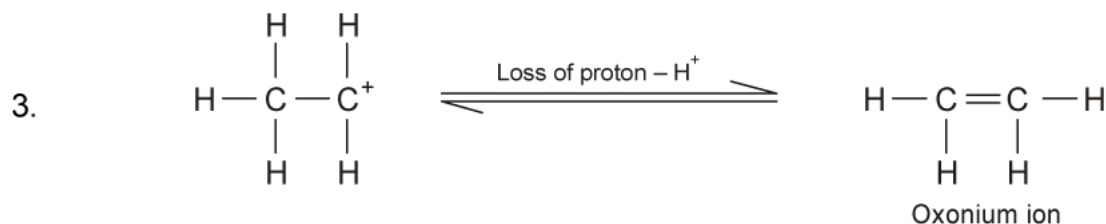
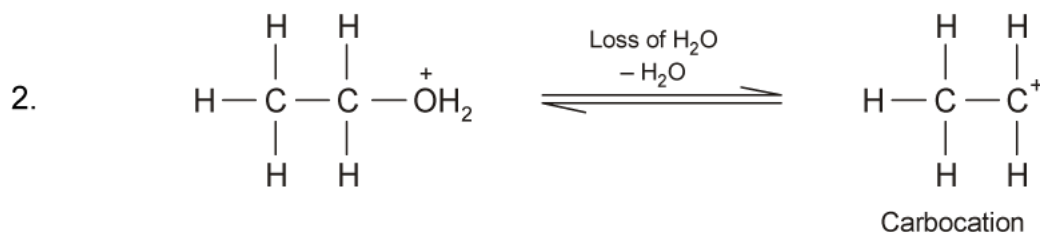


2. **Attack of electrophile:**



**S30.** The mechanism of this reaction involves protonation of the alcohol followed by loss of a water molecule and a proton.



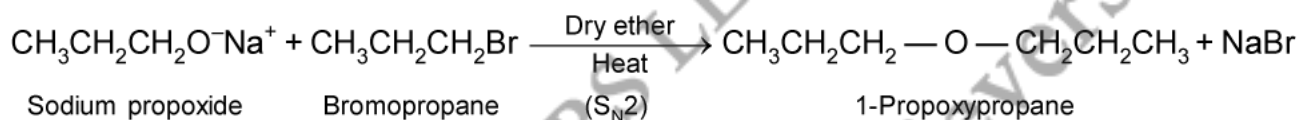
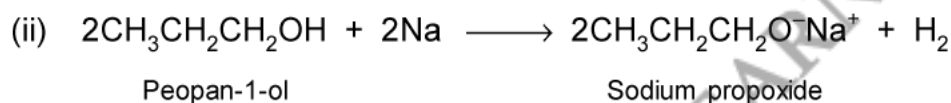
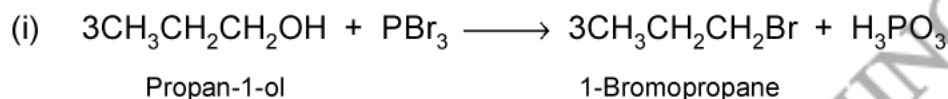


The case of dehydration of alcohols follows the order:

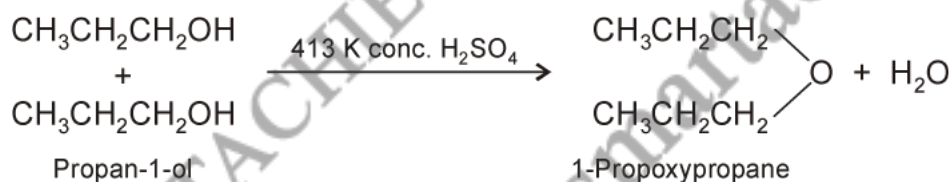


This order of reactivity can be explained in terms of stability of the intermediate carbocation. Tertiary alcohols react via 3° carbocation as intermediate, which being most stable is formed at fastest rate. Hence, 3° alcohols are most reactive followed by 2° and 1° alcohols.

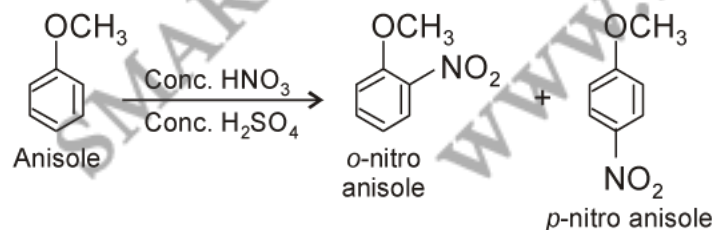
**S31. (a) Williamson's synthesis:**

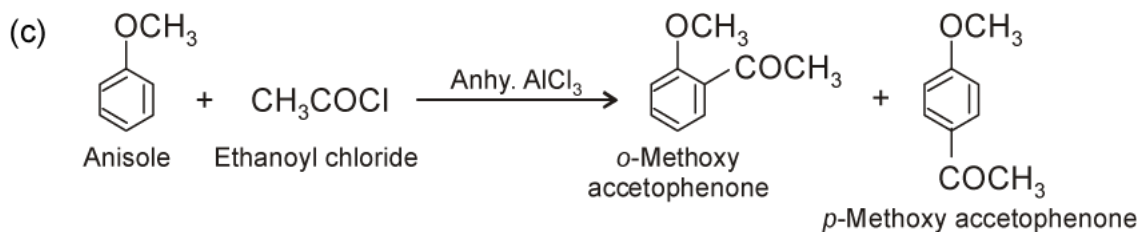
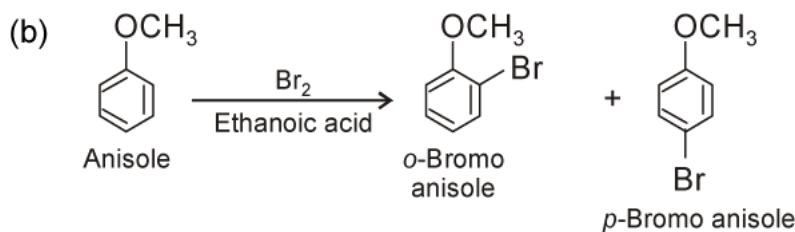


**(b) By dehydration of 1-propanol with conc. H<sub>2</sub>SO<sub>4</sub> at 413 K.**

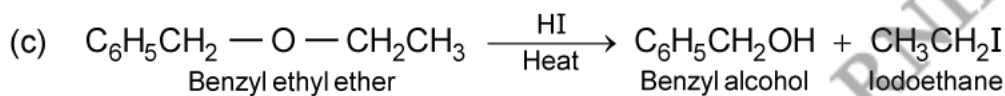
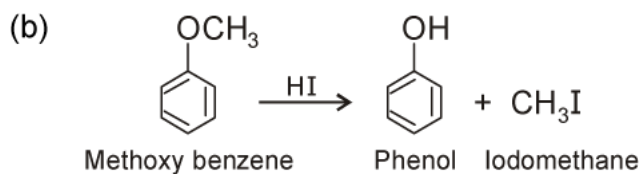
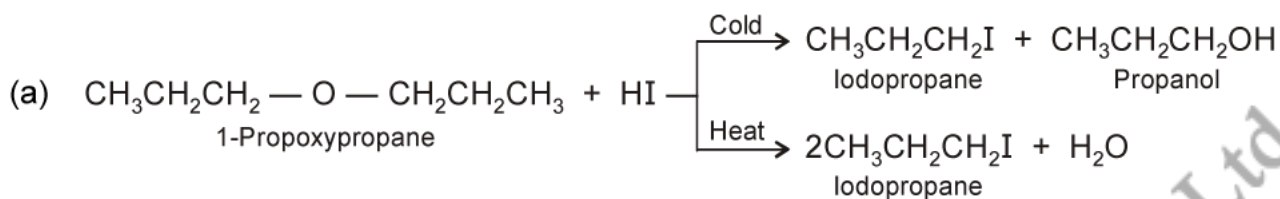


**S32. (a)**

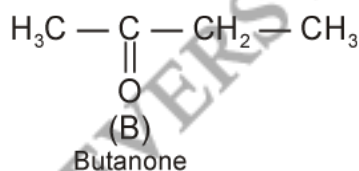




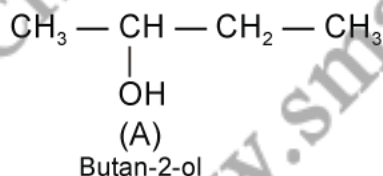
S33.



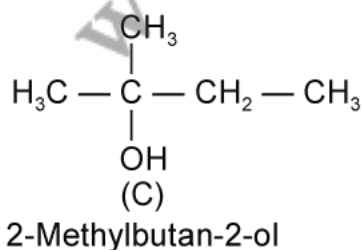
S34. (B) gives positive iodoform test it must be a methyl ketone. The only methyl ketone with four carbon atoms is



Butanone will be obtained by oxidation of butan-2-ol. Hence, (A) is butan-2-ol. (C<sub>4</sub>H<sub>10</sub>O)

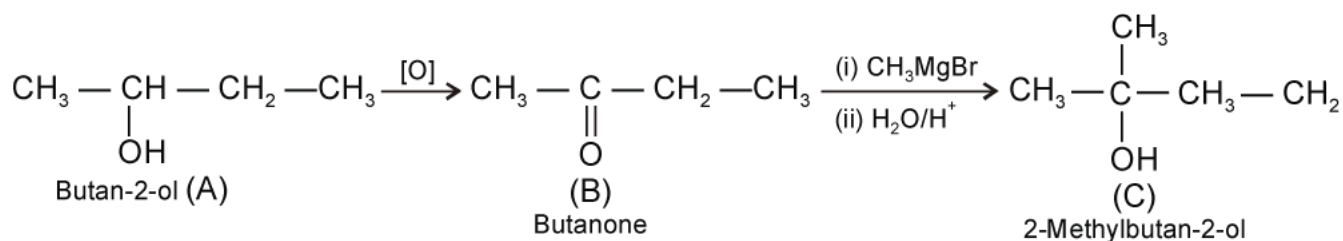


Butanone on reaction with CH<sub>3</sub>MgBr followed by hydrolysis will give a tertiary alcohol.

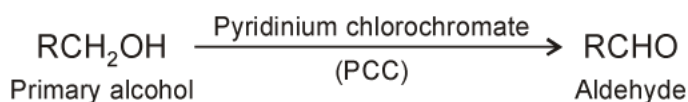




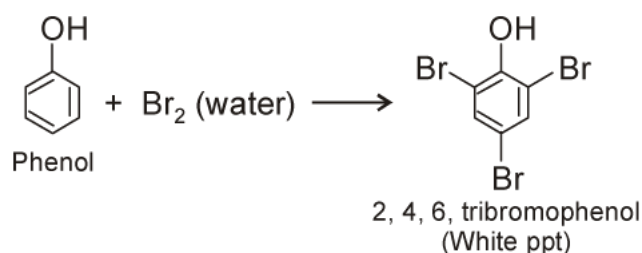
The reactions is



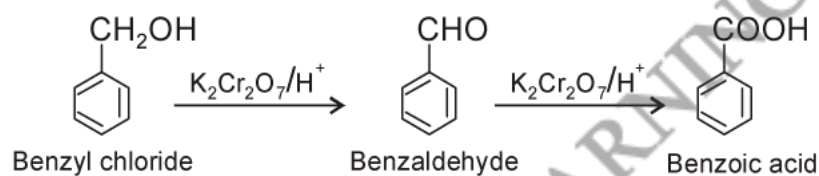
S35. (a) Pyridinium chlorochromate (PCC)  $\text{C}_5\text{H}_5\text{NH}^+\text{ClCrO}_3^-$



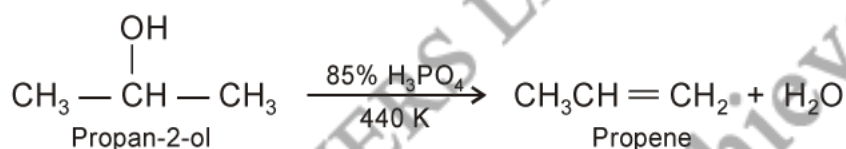
(b) Bromide water ( $\text{Br}_2/\text{H}_2\text{O}$ )



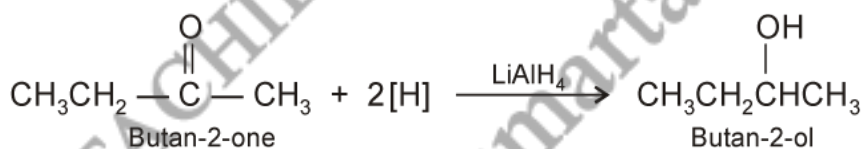
(c) Alkaline  $\text{KMnO}_4$  or acidified  $\text{K}_2\text{Cr}_2\text{O}_7$



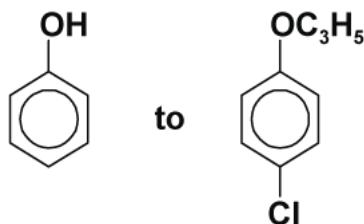
(d) 85%  $\text{H}_3\text{PO}_5/440 \text{ K}$  or conc.  $\text{H}_2\text{SO}_4/443 \text{ K}$



(e)  $\text{LiAlH}_4$  or  $\text{NaBH}_4$  or  $\text{H}_2/\text{Ni}$

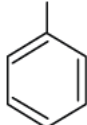


Q1. How will you convert



Q2. How will you convert Ethylalcohol to Propanamine.

Q3. How will you convert Cl to phenyl ethyl ether?



Q4. How will you convert benzene to *m*-nitro toluene?

Q5. How will you convert propene to acetone?

Q6. How will you convert Neopentylalcohol to Neohexylalcohol?

Q7. How will you convert ethyl, magnesium chloride to propanol?

Q8. How will you convert benzyl chloride to benzyl alcohol?

Q9. How will you convert, propene to Isopropyl alcohol?

Q10. How will you convert acetaldehyde to Isopropyl alcohol.

Q11. How will you convert phenol to aspirin?

Q12. How will you convert  $\text{CH}_3\text{CH}_2 - \text{OH}$  to  $\text{CH}_3\text{CH}_2 - \text{C} \equiv \text{CH}$  (Butyne)

Q13. How will you convert cumene to phenol?

Q14. How will you convert propene to *n*-butylalcohol?

Q15. How will you convert aniline to phenol?

Q16. How will you convert chlorobenzene to picric acid?

Q17. How will you convert the following

(a) Ethanol to 2-propanol

(b) Phenol to acetophenone.

Q18. How will you obtain

(a) Phenol to picric acid.

(b) 2-methyl propanol to 2-methyl propene

Q19. How will you convert

(a) Bromobenzene to 1-phenylethanol

(b) 1-propanol to 2-Bromopropane

**Q20. How will you convert the following change**

- (a) 1-propanol to propylmethyl ether?
- (b) 2-methyl-1-pentene to 2-methyl-2-pentanol?
- (c) Phenol to salicylic acid?

**Q21. Write the reactions and the conditions involved in the conversion of**

- (a) Propene to 1-propanol.
- (b) Phenol to salicylic acid.

**Q22. How will you convert**

- (i) Acetylene to *n*-butylalcohol?
- (ii) Propene to Allylalcohol?

**Q23. How are the following conversions carried out?**

- (a) Propane  $\longrightarrow$  Propan-2-ol
- (b) Ethyl magnesium chloride  $\longrightarrow$  Propan-1-ol
- (c) Methyl magnesium bromide  $\longrightarrow$  2 Methylpropan-2-ol

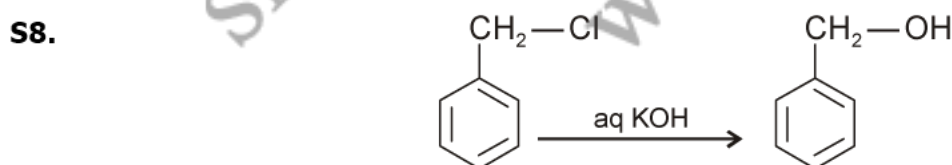
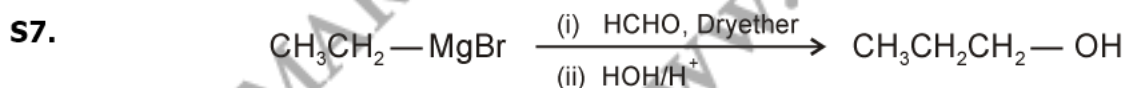
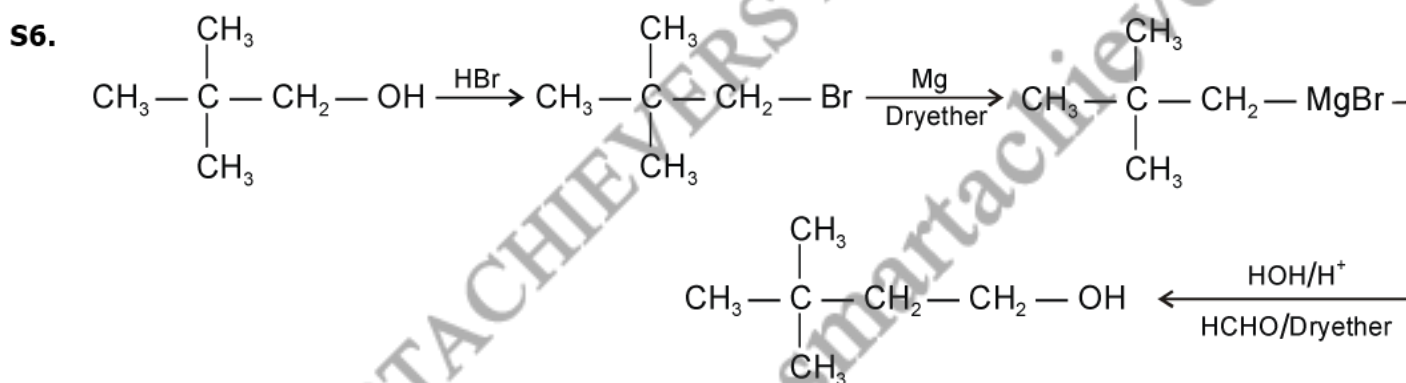
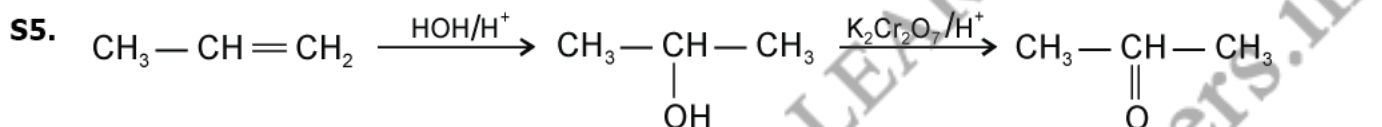
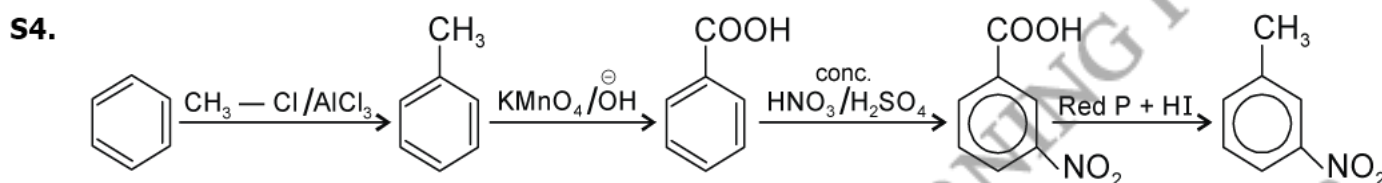
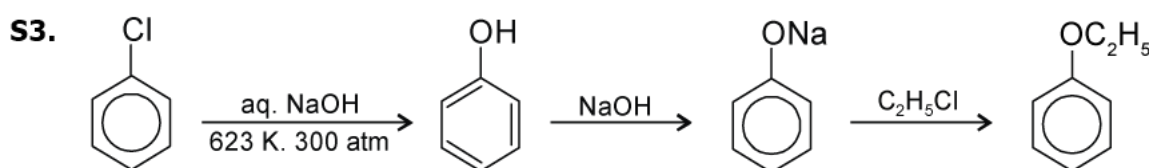
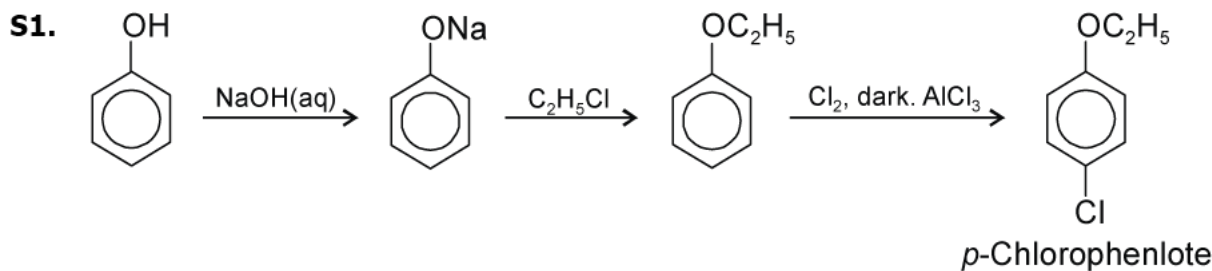
**Q24. How will you obtain**

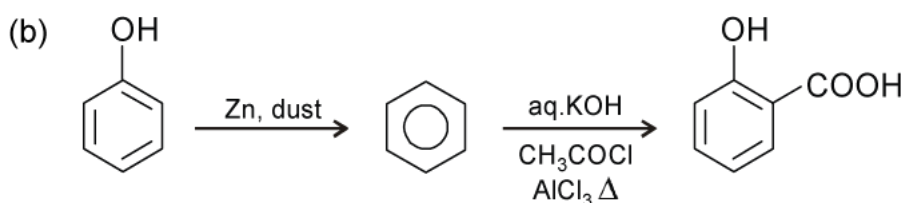
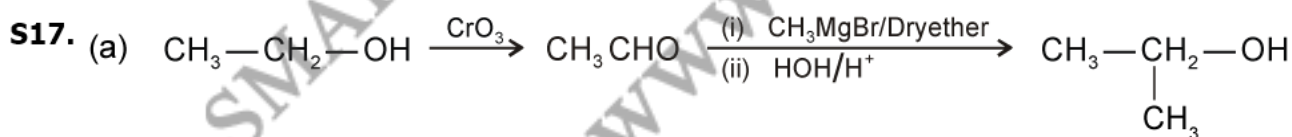
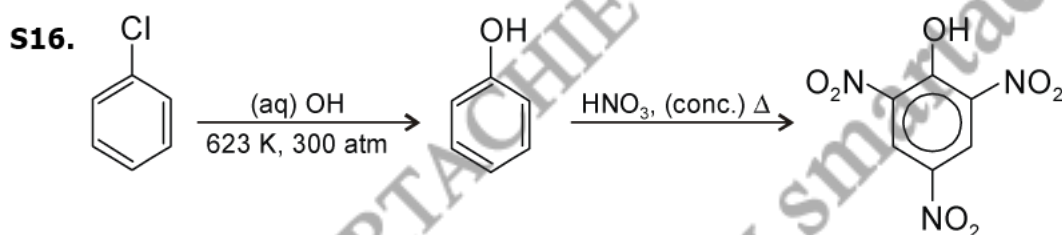
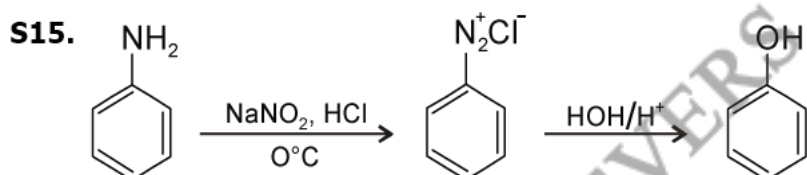
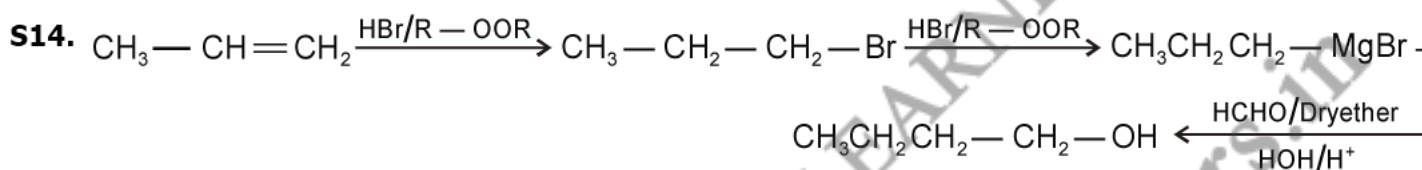
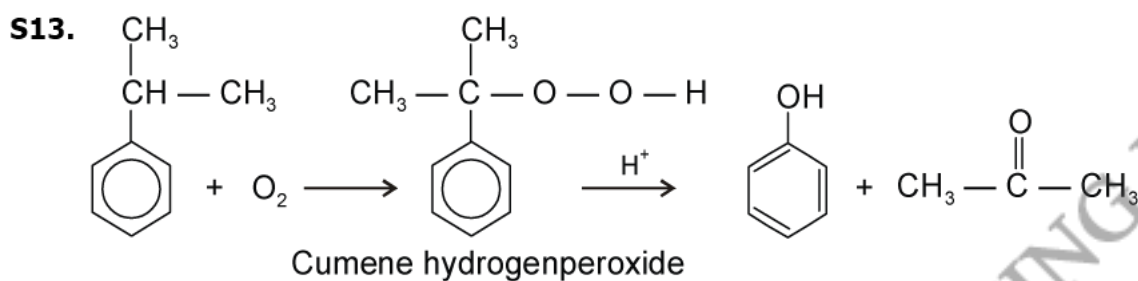
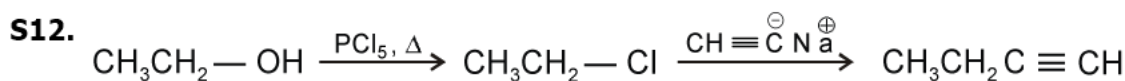
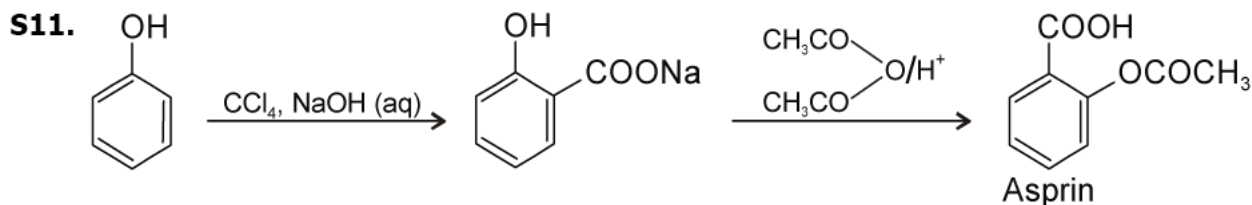
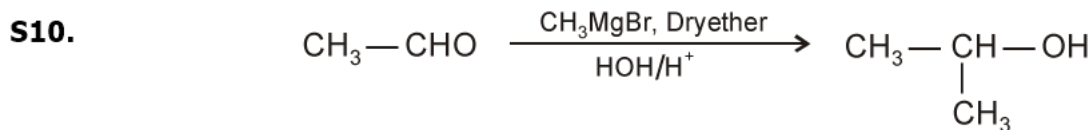
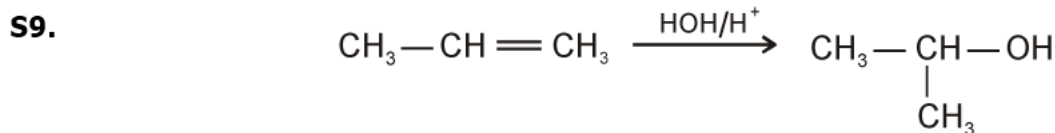
- (a) phenol to benzoquinone?
- (b) methyl magnesium bromide to 2-methylpropan-2-ol?
- (c) propene to propan-2-ol.

**Q25. Show how will you synthesize**

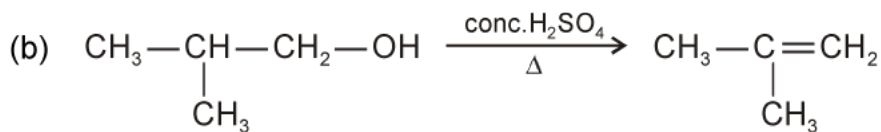
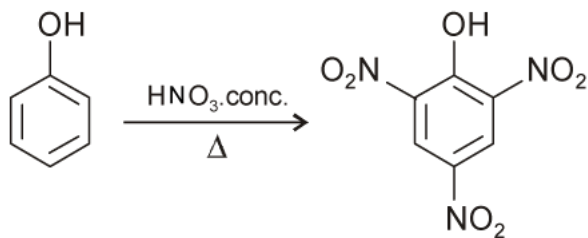
- (a) 1-phenylethanol from a suitable alkene?
- (b) Cyclohexyl nitrite from cyclohexyl chloride?
- (c) pentan-1-ol using a suitable alkyl halide?

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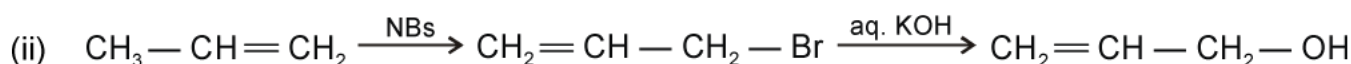
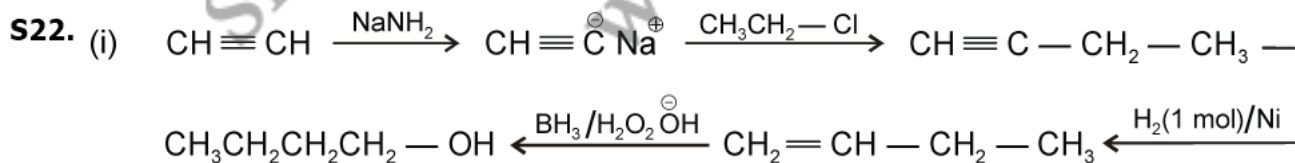
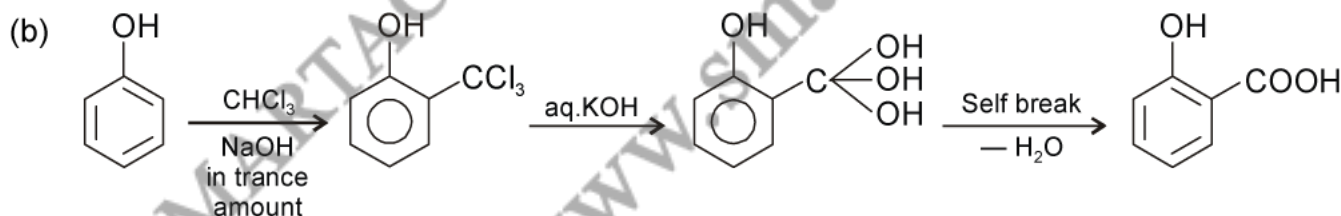
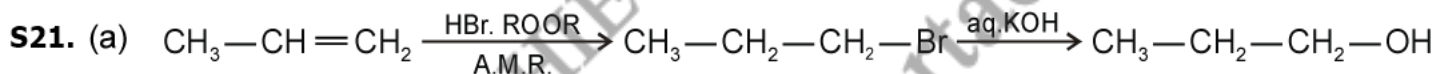
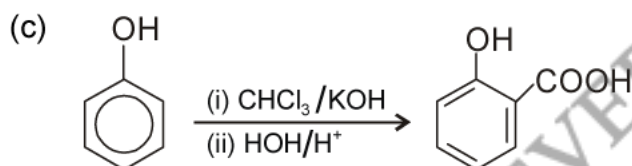
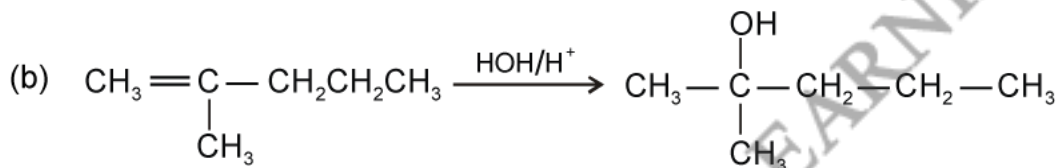
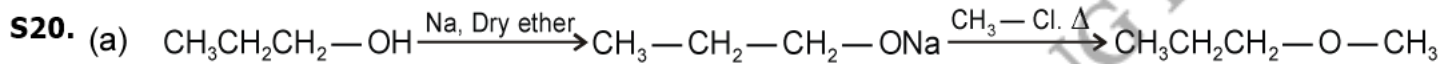
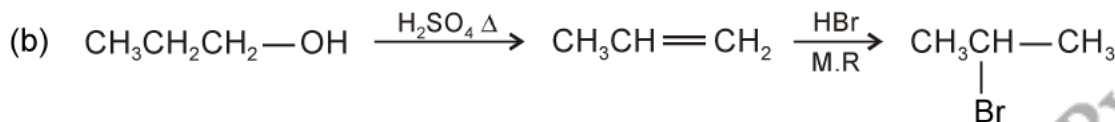
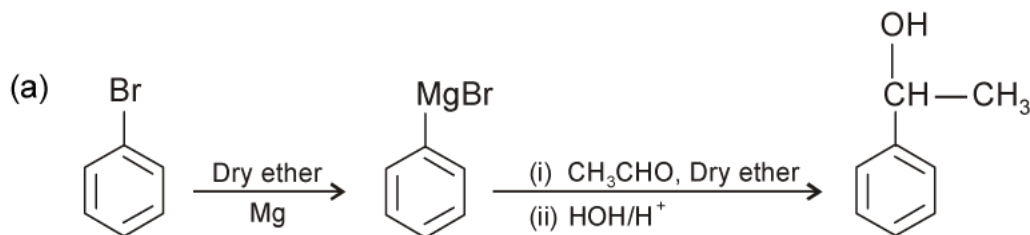


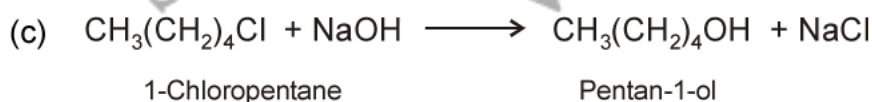
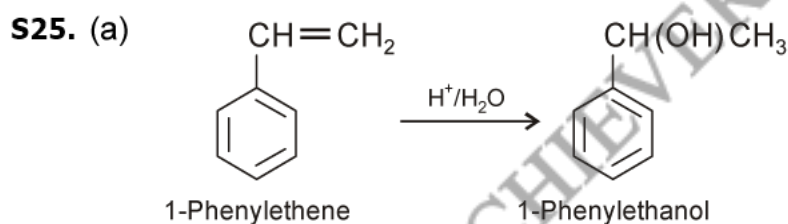
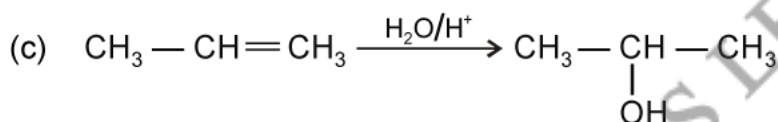
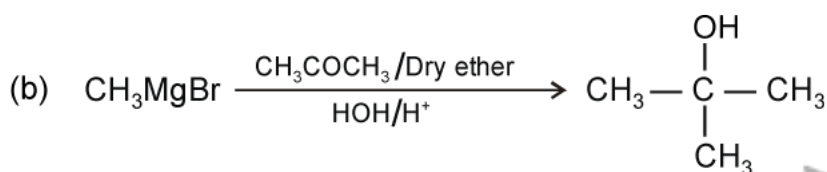
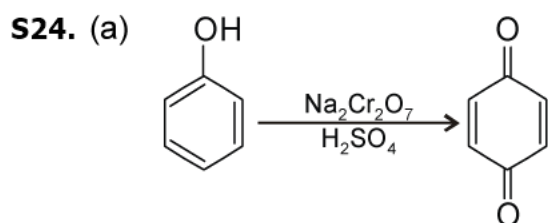
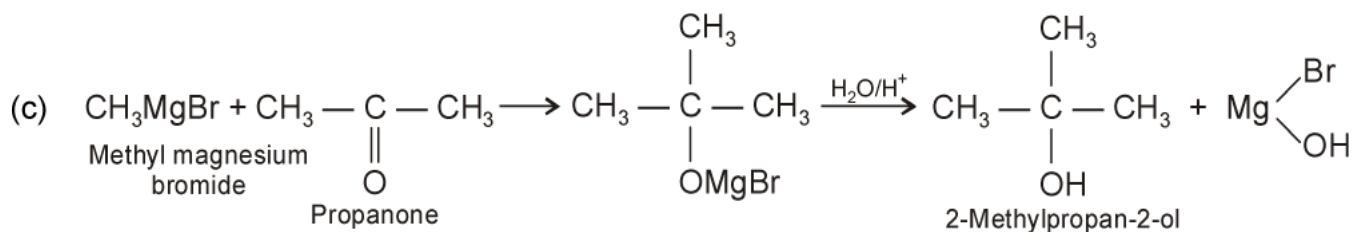
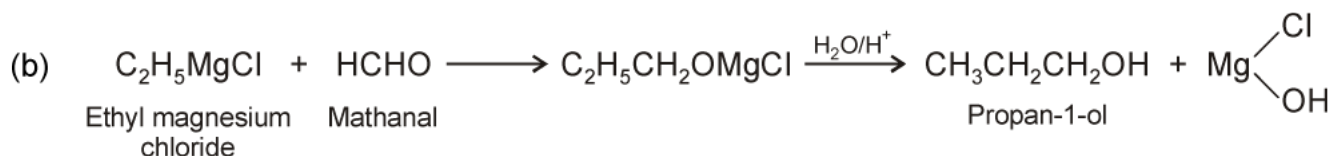
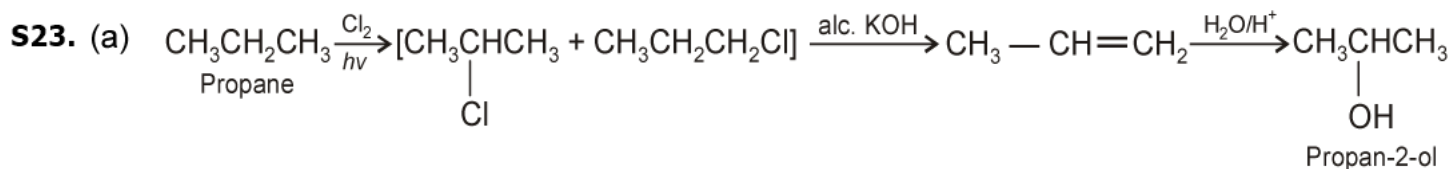


S18. (a)



S19.





- Q1. How will you distinguish between phenol and cyclohexanol (alcohol)
- Q2. How will you distinguish between ethylalcohol and *iso*-propylalcohol?
- Q3. How will you distinguish between phenyl ethanol and 2-phenyl ethanol?
- Q4. How will you distinguish between  $C_2H_5OH$  and  $CH_3 - OH$ ?
- Q5. How can phenol be distinguished from carboxylic acid?
- Q6. How will you distinguish between 1-phenylethanol and 2-phenylethanol?
- Q7. How will you distinguish between 2-pentanol and 3- pentanol?
- Q8. Give chemical tests to distinguish between  
(a) Isopropyl alcohol and *n*-propyl alcohol (b) Phenol and alcohol
- Q9. Distinction between primary, secondary and tertiary alcohols:

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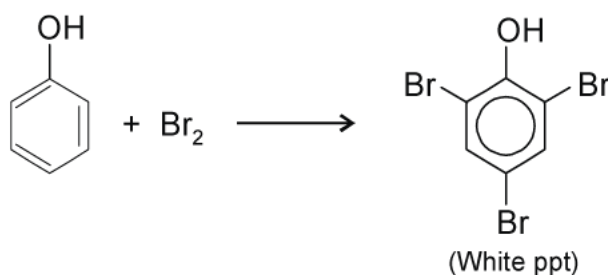


**S1. FeCl<sub>3</sub> test:**

- Phenol react with FeCl<sub>3</sub> and give characteristic colours.
- Alcohols do not give any colour with neutral FeCl<sub>3</sub> solution.

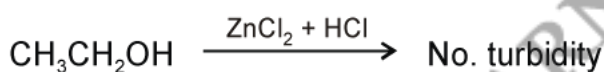
OR

Phenol with Br<sub>2</sub> gives white ppt of 2, 4, 6-tribromophenol

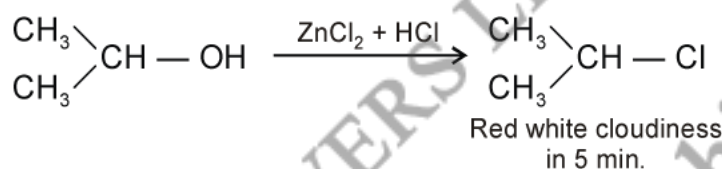


Alcohol do not react with bromine water.

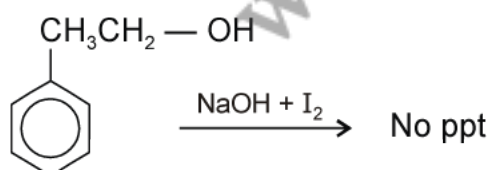
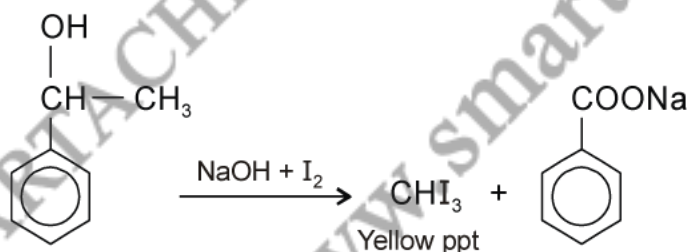
**S2. ethylalcohol is 1°, cannot gives Lucas test at room temperature.**



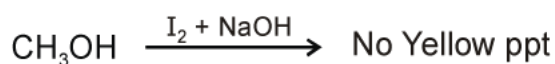
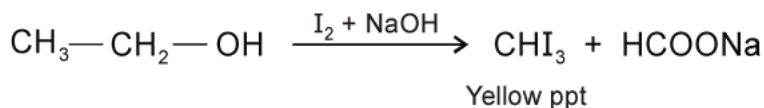
*iso*-propylalcohol is 2°, gives Lucas test at room temperature.



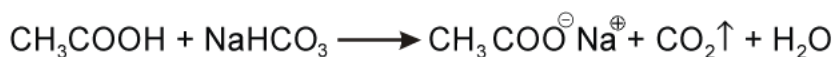
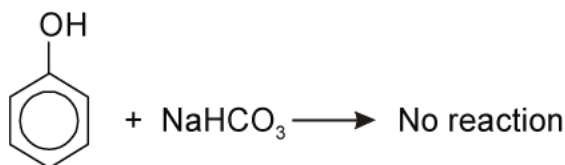
**S3. Phenyl ethanol gives iodoform test, while 2phenyl ethanol does not gives iodoform test**



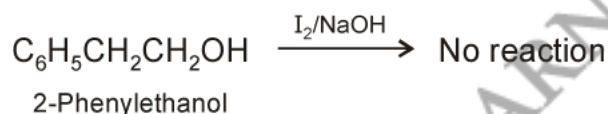
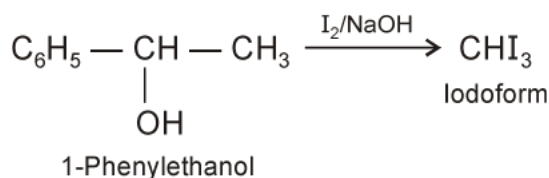
**S4. C<sub>2</sub>H<sub>5</sub>OH gives iodoform test, while CH<sub>3</sub> — OH give –ve iodoform test.**



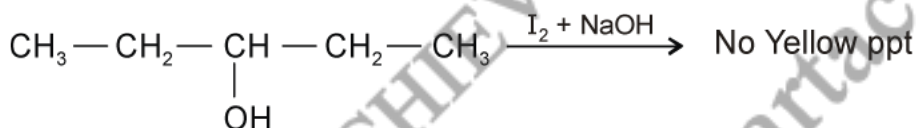
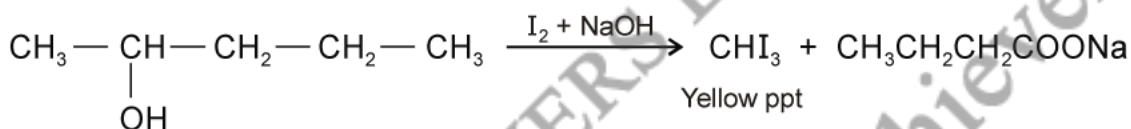
- S5.** Phenol cannot react  $\text{NaHCO}_3$  while carboxylic acid gives  $\text{CO}_2$  gas with  $\text{NaHCO}_3$  which can turn lime water milky.



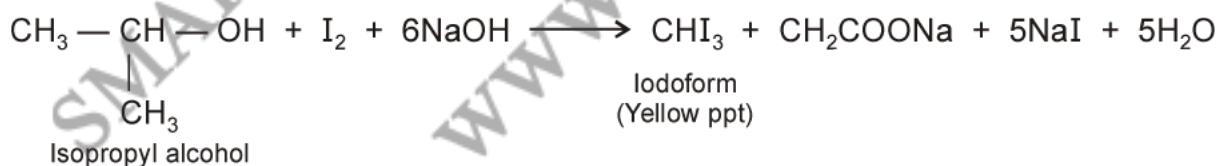
- S6.** 1-Phenylethanol and 2-phenylethanol can be distinguished by iodoform test.



- S7.** 2-Pentanol give iodoform test, while 3-pentanol gives iodoform test



- S8.** (a) Isopropyl alcohol gives iodoform test. On heating with  $\text{NaOH}/\text{I}_2$  or  $\text{NaOI}$ , isopropyl alcohol forms yellow precipitate of iodoform ( $\text{CHI}_3$ ).



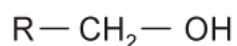
*n*-Propyl alcohol does not give this test.

- (b) Phenol reacts with neutral  $\text{FeCl}_3$  solution to give red-violet complex whereas alcohol does not give this test.

**S9.** A Mixture of conc. HCl + anhy.  $\text{ZnCl}_2$  is known as Lucas reagent.

The three types of alcohols may be distinguished by Lucas test.

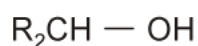
**Primary (1°) alcohol**



↓ Lucas reagent

No turbidity at room temp.

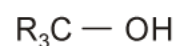
**Secondary (2°) alcohol**



↓ Lucas reagent

$\text{R}_2\text{CH} - \text{Cl}$   
Redwhite cloudiness  
(turbidity appears after 5 min)

**Tertiary (3°) alcohol**



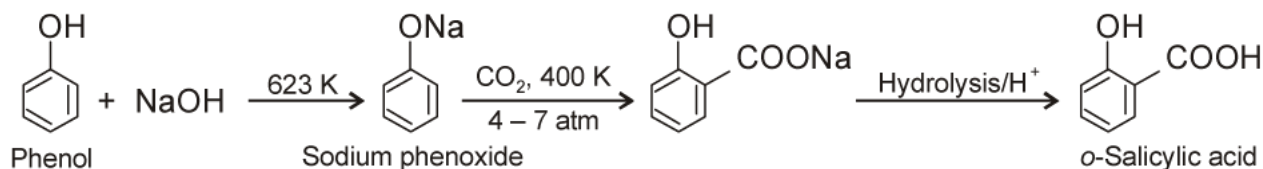
↓ Lucas reagent

$\text{R}_3\text{C} - \text{Cl} + \text{H}_2\text{O}$   
Redwhite cloudiness  
(turbidity appears immediately)

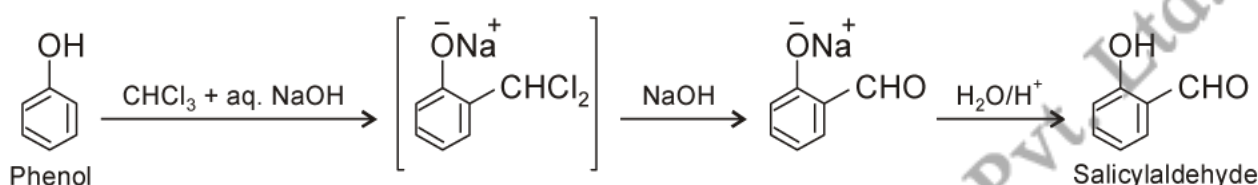
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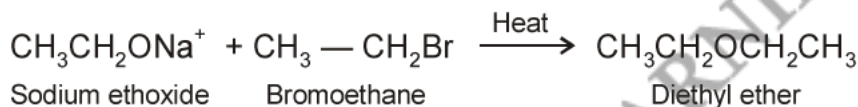
- S1. (a) **Kolbe reaction:** When sodium phenoxide is treated with carbondioxide under 4 to 7 atm. pressure and at 400 K, then sodium salicylate is formed.



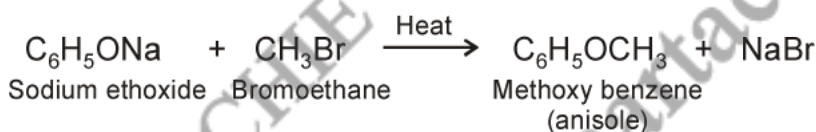
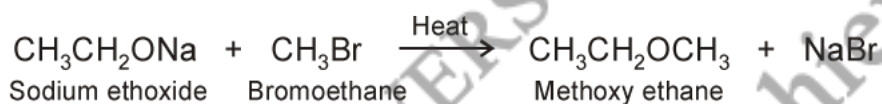
- (b) **Reimer-Tiemann reaction:** When phenol is reacted with  $\text{CHCl}_3$  in presence of alkali at 343 K an aldehyde group is introduced at the *ortho* position of the benzene ring.



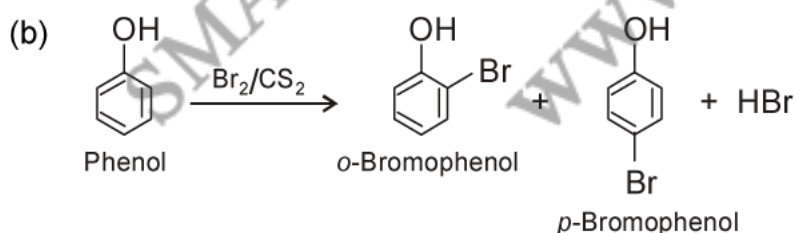
- (c) **Williamson's Synthesis:** It involved the treatment of an alkyl halide with a suitable sodium alkoxide, as a result ether will be produced.

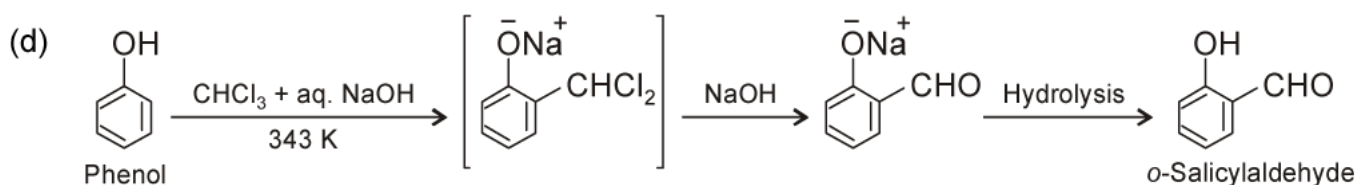
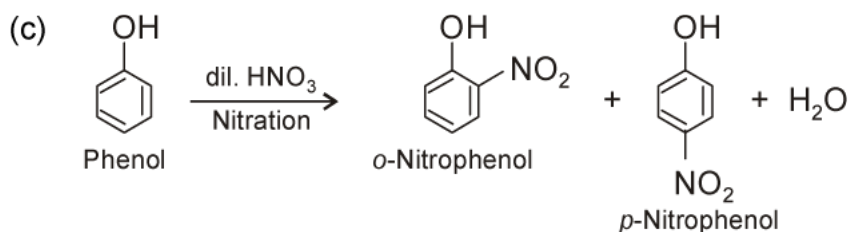


- (d) **Unsymmetrical ether:** If two alkyl or aryl group different in ether are called unsymmetrical ether for example:

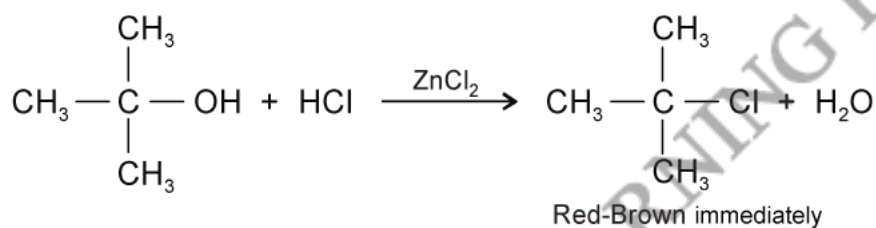


- S2. (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow[\text{Oxidation}]{\text{KMnO}_4/\text{OH}^-} \text{CH}_3\text{CH}_2\text{CHO} \xrightarrow[\text{Oxidation}]{\text{KMnO}_4/\text{OH}^-} \text{CH}_3\text{CH}_2\text{COOH}$   
 Propan-1-ol                      Propan-1-al                      Propanoic acid





- S3.** (a) (II) is unsaturated alcohol (allyl alcohol). When  $\text{Br}_2/\text{CCl}_4$  solution is added to it, orange colour of  $\text{Br}_2/\text{CCl}_4$  disappears. However, (I) (propyl alcohol) does not react with  $\text{Br}_2/\text{CCl}_4$  and orange colour persists.
- (b) (I) (benzyl alcohol) ( $1^\circ$  ROH) is oxidised by acid  $\text{Cr}_2\text{O}_7^{2-}$  and orange colour of  $\text{Cr}_2\text{O}_7^{2-}$  changes to green ( $\text{Cr}^{3+}$ ), whereas (II) (benzyl methyl ether) does not react.
- (c) I is *tert*-alcohol gives Lucas test at normal temperature.

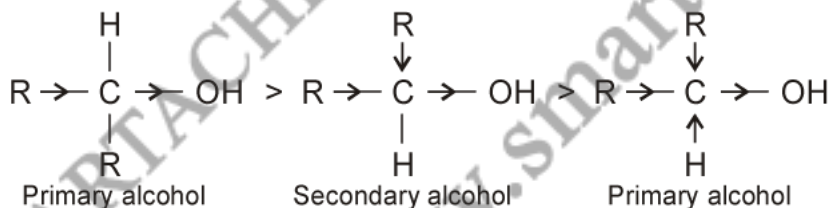


II is primary alcohol cannot give Lucas test at normal temperature.

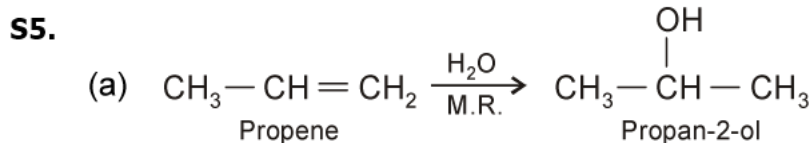
- S4.** The order of reactivity of various alcohols towards this type of reactions is

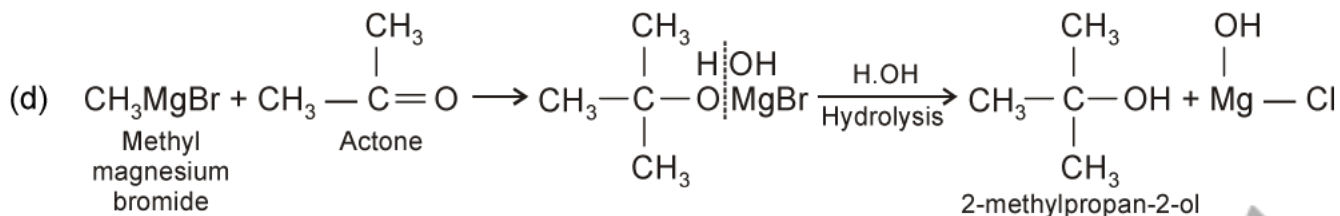
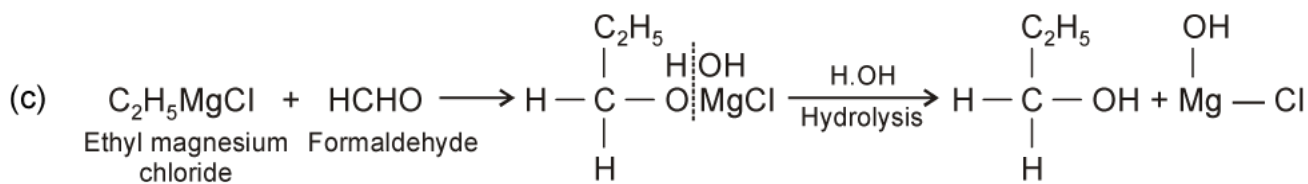
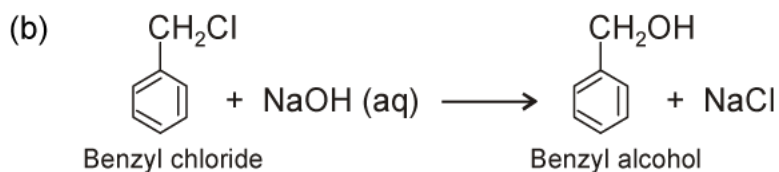
**tertiary > secondary > primary**

This can be explained in terms of electron releasing inductive effect of alkyl groups. The alkyl groups by their electron releasing effect tend to increase the electron displacement towards oxygen.



In other words, the polarity of C — O bond increases and this makes the breaking of the bond between carbon and oxygen easier. Therefore, the alcohols with greater number of alkyl groups attached to the carbon carrying — OH will be more reactive.





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