

**CLASS XII**

# CBSE DRILL



Chapterwise practice questions for CBSE Exams as per the latest syllabus issued by CBSE for the academic session 2018-19.

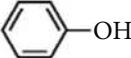
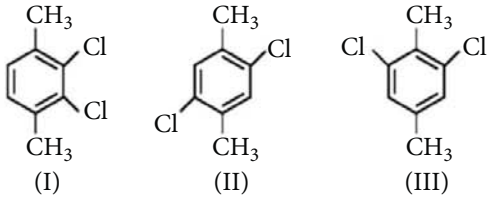
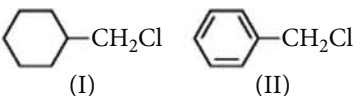
## GENERAL INSTRUCTIONS

- (i) All questions are compulsory. (ii) Q. no. 1 to 5 are very short answer questions and carry 1 mark each.  
(iii) Q. no. 6 to 12 are short answer questions and carry 2 marks each. (iv) Q. no. 13 to 24 are also short answer questions and carry 3 marks each.  
(v) Q. no. 25 to 27 are long answer questions and carry 5 marks each. (vi) Use log tables if necessary, use of calculators is not allowed.

Time Allowed : 3 hours

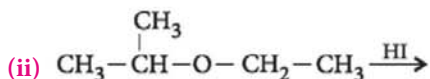
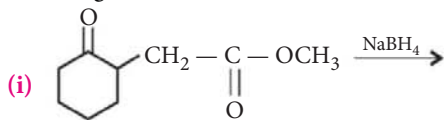
Maximum Marks : 70

## Haloalkanes and Haloarenes | Alcohols, Phenols and Ethers

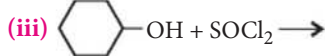
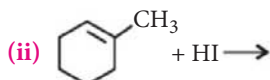
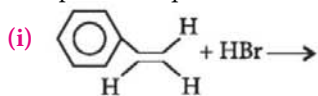
- Write the structure of the following compound:  
2-(2-chlorophenyl)-1-iodooctane
- Explain the completion of the following reactions with NaBr and conc.  $\text{H}_2\text{SO}_4$ .
  - $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
  - 
- Account for the following :  
Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method.
- Phenols and alcohols behave as Bronsted acids. Explain.
- What are the oxidation products of  $(\text{CH}_3)_3\text{COH}$  using very strong oxidising agents?
- Why is the reactivity of all the three classes of alcohols with conc. HCl and  $\text{ZnCl}_2$  (Lucas reagent) different?
- Select the species with the highest melting point.  

  - Select the species that undergoes faster  $\text{S}_{\text{N}}1$  reaction.  

- Explain why the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride?  
**OR**  
Although chlorine is an electron withdrawing group, yet it is *ortho*-, *para*-directing in electrophilic aromatic substitution reactions. Why?



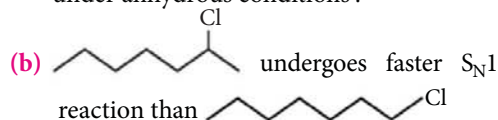
9. Write the structures of the products formed in the following reactions :



10. (i) Write the isomers of  $\text{C}_3\text{H}_5\text{Br}$  having  
 (a) Br at vinylic position  
 (b) Br at allylic position.  
 (ii) What is the advantage of using  $\text{SOCl}_2$  in the preparation of  $\text{R}-\text{Cl}$  from alcohol?  
 11. In Kolbe's reaction, instead of phenol, phenoxide ion is treated with carbon dioxide. Why?  
 12. Out of the various possible isomers of  $\text{C}_7\text{H}_7\text{Cl}$  containing benzene ring, suggest the structure with the weakest  $\text{C}-\text{Cl}$  bond.  
 13. Complete the equations for the following reactions :



14. (i) Write complete reaction for the bromination of phenol in aqueous and non aqueous medium.  
 (ii) Explain why Lewis acid is not required in bromination of phenol?  
 15. (i) Of the two bromo derivatives,  $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$  and  $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$ , which one is more reactive in  $\text{S}_{\text{N}}1$  substitution reaction and why?  
 (ii) How would you account for the following :  
 (a) Grignard reagents are prepared strictly under anhydrous conditions?

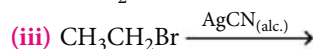
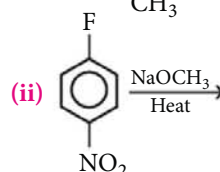
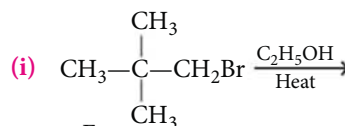


16. A compound of molecular formula  $\text{C}_7\text{H}_8\text{O}$  is insoluble in water and dilute sodium bicarbonate solution but dissolves in aqueous sodium hydroxide. On treatment with bromine water, it readily gives a precipitate of  $\text{C}_7\text{H}_5\text{OBr}_3$ . Deduce the structure of the compound.

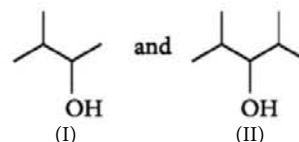
17. (i) Write the reactions of Williamson synthesis of 2-ethoxy-3-methylpentane starting from ethanol and 3-methylpentan-2-ol.

(ii) Explain why nucleophilic substitution reactions are not very common in phenols.

18. What would be the major products in each of the following reactions?



19. (i) Identify the chiral molecule in the following pair :



(ii) Why is butan-1-ol optically inactive but butan-2-ol is optically active?

20. A compound  $\text{A}(\text{C}_4\text{H}_{10}\text{O})$  is found to be soluble in concentrated  $\text{H}_2\text{SO}_4$  and does not react with sodium metal or  $\text{KMnO}_4$ . (A) when heated with excess of  $\text{HI}$ , it gives a single alkyl halide. Deduce the structure of the compound (A) and explain all the reactions involved.

OR

(i) The treatment of alkyl chloride with aqueous  $\text{KOH}$  leads to the formation of alcohol but in the presence of alcoholic  $\text{KOH}$ , alkene is the major product. Give reason.

(ii) Write the mechanism of the following reaction :  
 $n\text{-BuBr} + \text{KCN} \xrightarrow{\text{EtOH}, \text{H}_2\text{O}} n\text{-BuCN}$

21. (i) Arrange the following compounds in the increasing order of the property indicated against each. Give reasons for your answers.

(a)  $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CF}_3\text{CH}_2\text{OH}$ ,  $\text{CCl}_3\text{CH}_2\text{OH}$   
 (Acidic strength)

(b) 2-Methyl-2-propanol, 1-butanol, 2-butanol  
 (Reactivity towards sodium)

(ii) Which structural isomer of butanol cannot be dehydrogenated by copper at 573 K?

22. Name the reagents used in the following reactions :

- (i) Oxidation of primary alcohol to carboxylic acid
- (ii) Oxidation of primary alcohol to aldehyde
- (iii) Bromination of phenol to 2,4,6-tribromophenol
- (iv) Benzyl alcohol to benzoic acid
- (v) Dehydration of propan-2-ol to propene
- (vi) Butan-2-one to butan-2-ol

23. (i) One mole of an organic compound (A) having molecular formula  $C_2H_6O$  reacts with  $MeMgI$  to liberate one mole of methane. (A) reacts with  $CH_3COCl$  to yield a sweet smelling liquid (B). Identify (A) and (B).

(ii) Name the products when anisole is heated with HI.

24. (i) Arrange the following in increasing order of basicity :  $H_2O$ ,  $OH^-$ ,  $CH_3OH$ ,  $CH_3O^-$

(ii) Which of the following is the correct method for synthesising methyl *tert*-butyl ether and why?

- (a)  $(CH_3)_3CBr + NaOCH_3 \longrightarrow$
- (b)  $CH_3Br + NaO\text{-}tert\text{-butyl} \longrightarrow$

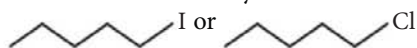
(iii) Of the two hydroxy organic compounds ROH and  $R'OH$ , the first one is basic and the other is acidic in behaviour. How is  $R$  different from  $R'$ ?

25. (i) How do you convert?

- (a) Chlorobenzene to biphenyl
- (b) 2-Bromobutane to but-2-ene

(ii) Answer the following questions:

- (a) What is meant by chirality of a compound? Give an example.
- (b) Which one of the following compounds is more easily hydrolysed by KOH and why?  $CH_3CHClCH_2CH_3$  or  $CH_3CH_2CH_2Cl$
- (c) Which one undergoes  $S_N2$  substitution reaction faster and why?

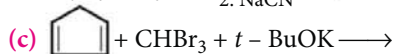
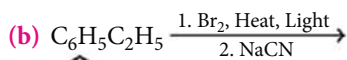
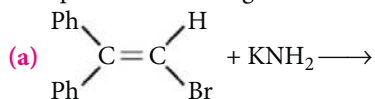


**OR**

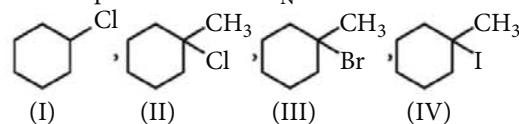
(i) Why are alkyl halides generally not prepared in the laboratory by free radical halogenation of alkanes?

(ii)  $RCl$  is hydrolysed slowly to ROH but the reaction is rapid if a catalytic amount of KI is added to the reaction mixture. Explain.

(iii) Complete the following reactions :



26. (i) Predict the order of reactivity of the following compounds towards  $S_N1$  reaction.



(ii) Which out of 2-cyclopentenol or 3-cyclopentenol has a chiral centre?

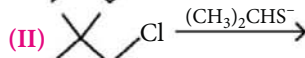
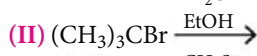
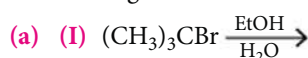
(iii) Racemisation occurs in  $S_N1$  reactions. Why?

(vi) State one use each of DDT and iodoform.

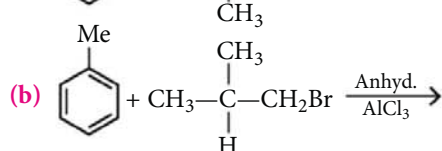
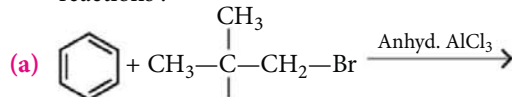
(v) Racemic mixture is optically inactive.

**OR**

(i) Which reaction in each pair shown below will show the faster rate of disappearance of starting material?



(ii) Write the major product of the following reactions :



27. How will you convert :

(i) Phenol to anisole

(ii) Propan-2-ol to 2-methylpropan-2-ol

(iii) Aniline to phenol

(iv) 2-Methyl-1-pentene to 2-methylpentan-2-ol

(v) Phenol to acetophenone?

**OR**

(i) Ethers are decomposed by HX. Arrange reactivity of ethers with HCl, HBr, HI in the increasing order.

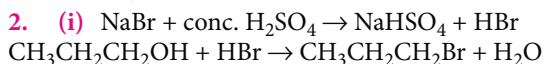
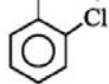
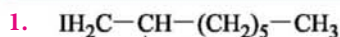
(ii) Explain the reaction of  $CH_3CH_2OCH_3$  with

(a) limited amount of HI

(b) excess of HI

(iii) Why boiling point of ethers are lower than isomeric alcohols?

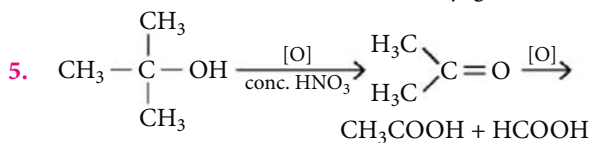
## SOLUTIONS



(ii) Phenol is acidic in nature hence it does not react with HBr.

3. Acid dehydration of 2° and 3° alcohols give alkenes rather than ethers. Due to steric hindrance the nucleophilic attack by the alcohol molecule on the protonated alcohol molecule does not occur.

4. Bronsted acids are proton donors. Since, alcohols and phenols can donate protons, hence, they are Bronsted acids. Acids are converted to conjugate base.



6. The reaction of alcohols with Lucas reagent occurs through carbocation formation. Order of ease of cleavage of C—OH bond and reactivity of different alcohols is : Tertiary > Secondary > Primary. Tertiary carbocation is most stable due to hyperconjugation and primary carbocation the least. Hence, on reaction with HCl and ZnCl<sub>2</sub> (Lucas reagent) tertiary alcohols react immediately to give cloudiness.

7. (i) All are derivatives of *p*-xylene.

(II) has maximum melting point since it is symmetrical and it fits into crystal lattice more easily than others and force of attraction is larger thus maximum melting point.

(ii) As benzyl carbocation  $\text{C}_6\text{H}_5-\text{CH}_2^+$  is resonance stabilised thus, II undergoes faster S<sub>N</sub>1 reaction

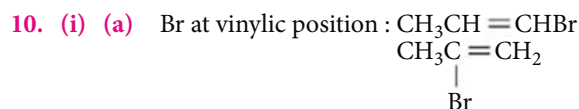
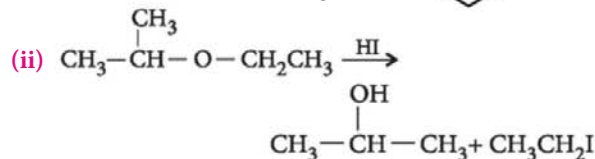
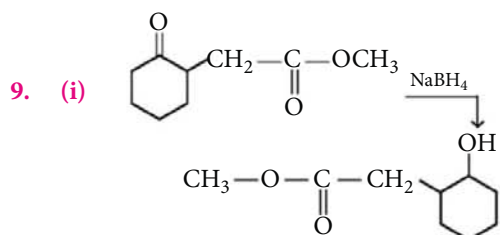
8. There are two reasons :

(a) In case of chlorobenzene, carbon to which chlorine is attached is sp<sup>2</sup>-hybridised and is more electronegative than the corresponding carbon in cyclohexyl chloride which is sp<sup>3</sup>- hybridised. So the net dipole moment is lower in chlorobenzene.

(b) In chlorobenzene C—Cl bond has some double bond character so its bond length is smaller. Hence, dipole moment is lower than cyclohexyl chloride which has a longer C—Cl single bond.

OR

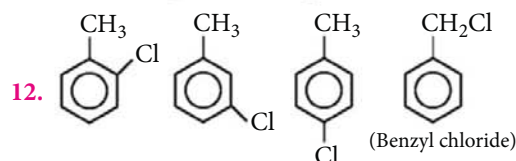
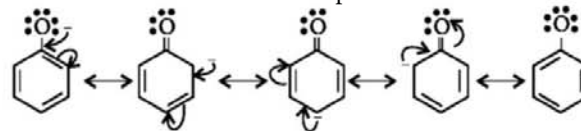
Refer to answer 74 (ii), Page no. 205 (MTG CBSE Champion Chemistry Class 12)



(b) Br at allylic position :  $\text{CH}_2=\text{CHCH}_2\text{Br}$

(ii)  $\text{R}-\text{OH} + \text{SOCl}_2 \rightarrow \text{R}-\text{Cl} + \text{SO}_2 \uparrow + \text{HCl} \uparrow$   
 SO<sub>2</sub> and HCl in the gaseous form escape from the reaction mixture hence R—Cl is isolated in pure form.

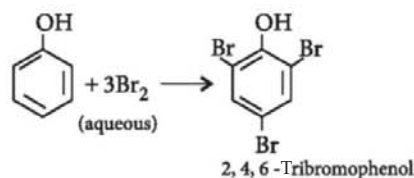
11. Phenoxide ion is more reactive than phenol towards electrophilic substitution reaction as O<sup>−</sup> has greater ability to donate electrons to benzene ring and hence undergoes electrophilic substitution with carbon dioxide which is a weak electrophile.



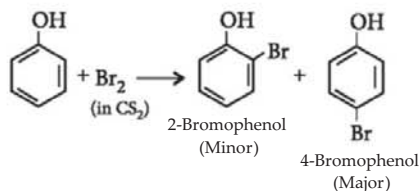
Among these isomers, benzyl chloride has the weakest C—Cl bond. Because in all other isomers C—Cl bond has some double bond character due to resonance.

13. Refer to answer 39, Page no. 202 (MTG CBSE Champion Chemistry Class 12)

14. (i) In aqueous medium



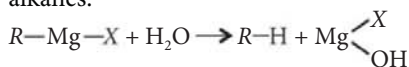
(b) In non-aqueous medium



(ii) In bromination of benzene, Lewis acid is used to polarise  $\text{Br}_2$  to form electrophile  $\text{Br}^+$ . In case of phenol polarisation of bromine takes place even in absence of Lewis acid as the O-atom of phenol itself polarises  $\text{Br}_2$  molecule to form  $\text{Br}^+$ . Also, +R-effect of  $-\text{OH}$  group makes phenol highly activated towards electrophilic substitution reactions.

15. (i)  $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$  is more reactive than  $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$  for  $\text{S}_{\text{N}}1$  reaction because its carbocation is resonance stabilised by two phenyl groups.

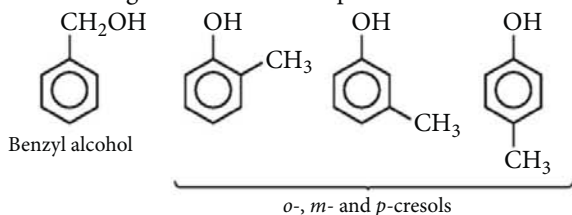
(ii) (a) Grignard reagents react with water to form alkanes.



So, they must be prepared under anhydrous conditions.

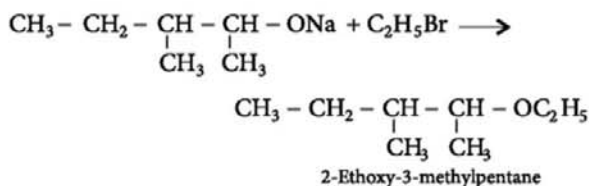
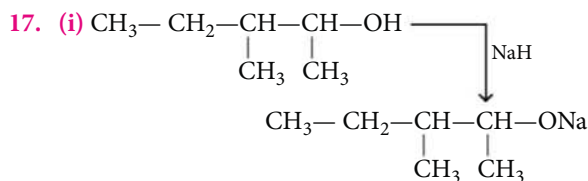
(b) undergoes faster  $\text{S}_{\text{N}}1$  reaction as it is a secondary halide and give more stable carbocation than primary halide.

16. High carbon percentage in the compound suggests it to be aromatic and thus, the formula  $\text{C}_7\text{H}_8\text{O}$  represents the following four isomeric compounds.



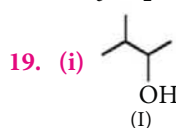
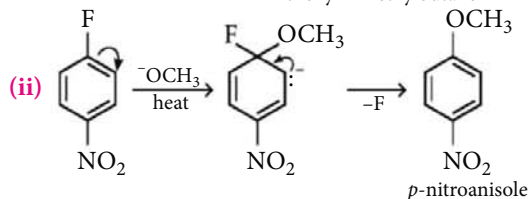
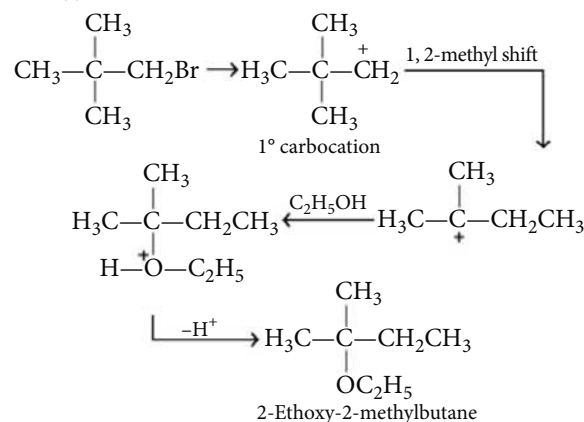
Since the compound is insoluble in water and dil.  $\text{NaHCO}_3$  but dissolves in aqueous  $\text{NaOH}$ , it must be a phenol, i.e.,  $o$ -,  $m$ - or  $p$ -cresols. As on reaction with bromine water, it gives a precipitate of  $\text{C}_7\text{H}_5\text{OBr}_3$ .

Thus, it should be  $m$ -cresol.



(ii) In phenols, oxygen atom of  $-\text{OH}$  group delocalise its lone pair of electrons over the benzene ring. This resonance phenomenon increases the electron density over benzene ring which makes it difficult for nucleophile to attack phenol molecule.

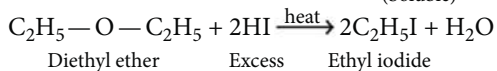
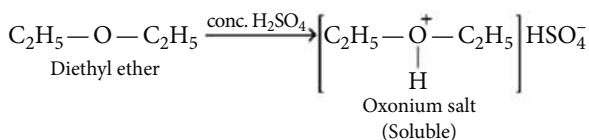
18. (i)



(ii) Refer to answer 74 (i), Page no. 204 (MTG CBSE Champion Chemistry Class 12)

20. The compound (A),  $\text{C}_4\text{H}_{10}\text{O}$ , may be an alcohol or ether. Since (A) does not react with Na metal or  $\text{KMnO}_4$ , it cannot be an alcohol. Since the compound dissolves in concentrated  $\text{H}_2\text{SO}_4$ , it may be an ether. Since ether (A) when heated with excess of HI gives a single alkyl halide, (A) must be symmetrical ether. The only symmetrical ether with molecular formula  $\text{C}_4\text{H}_{10}\text{O}$  is diethyl ether,  $\text{C}_2\text{H}_5-\text{O}-\text{C}_2\text{H}_5$ .

The reactions can be explained as follows :



**OR**

(i) In aqueous solution, KOH is almost completely involved to give OH<sup>-</sup> ion which being a better nucleophile gives a substitution reaction on alkyl halides to form alcohol. But an alcoholic solution of KOH containing alkoxide (RO<sup>-</sup>) ions which being a much stronger base than OH<sup>-</sup> ion preferentially snatches a H<sup>+</sup> ion from an alkyl chloride to form alkenes.

(ii) Refer to answer 85, Page no. 206 (MTG CBSE Champion Chemistry Class 12)

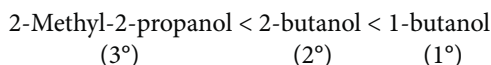
21. (i) (a) Due to electron withdrawing effect (-I effect) of halogens, electron pair of O—H is drawn towards oxygen atom. This facilitates the release of hydrogen atom as proton. Thus, electron withdrawing groups increase the acidic character of alcohol. As F has higher -I effect than Cl, CF<sub>3</sub>CH<sub>2</sub>OH is stronger acid than CCl<sub>3</sub>CH<sub>2</sub>OH.

Thus, the acidic strength increase in the order :

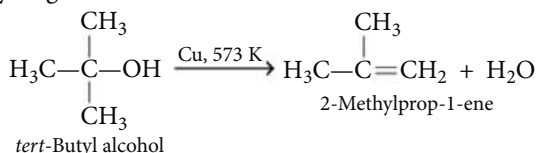


(b) In the reaction of alcohol with Na, the O—H is cleaved and in such reactions, the reactivity of alcohols is in the order: primary > secondary > tertiary.

Therefore, reactivity of these alcohols towards sodium follows the order :



(ii) *t*-Butyl alcohol undergoes dehydration instead of dehydrogenation.



22. (i) Alkaline KMnO<sub>4</sub>

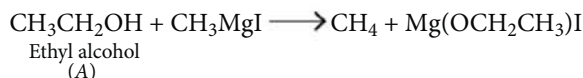
(ii) Pyridinium chlorochromate in chloromethane (CH<sub>2</sub>Cl<sub>2</sub>)

(iii) Br<sub>2</sub>/H<sub>2</sub>O (iv) Alkaline KMnO<sub>4</sub>

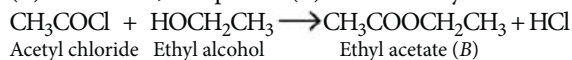
(v) Conc. H<sub>2</sub>SO<sub>4</sub> or H<sub>3</sub>PO<sub>4</sub> at 433-443 K

(vi) H<sub>2</sub>/Ni or NaBH<sub>4</sub> or LiAlH<sub>4</sub>

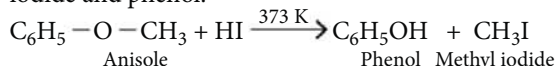
23. (i) Since compound (A) with molecular formula C<sub>2</sub>H<sub>6</sub>O reacts with MeMgI to give one mole of CH<sub>4</sub>, the compound (A) must be ethyl alcohol.



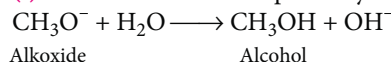
Compound A, i.e., ethyl alcohol reacts with acetyl chloride (CH<sub>3</sub>COCl) to form sweet smelling compound (B). Therefore, compound (B) must be ethyl acetate.



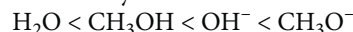
(ii) In anisole (C<sub>6</sub>H<sub>5</sub>—O—CH<sub>3</sub>), C<sub>6</sub>H<sub>5</sub>—O bond has some double bond character due to resonance and hence more difficult to break. As a result, nucleophilic attack by I<sup>-</sup> ion occurs on CH<sub>3</sub> group forming methyl iodide and phenol.



24. (i) Alkoxides are decomposed by water.

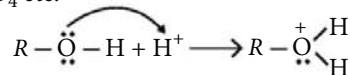


Therefore, CH<sub>3</sub>O<sup>-</sup> is a stronger base than OH<sup>-</sup> and CH<sub>3</sub>OH is a stronger base than H<sub>2</sub>O. Therefore, the order of basicity is as follows :

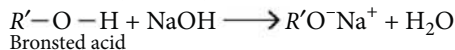


(ii) Substitution and elimination reactions are always competitive reactions. Since tertiary (3°) alkyl halides preferentially undergo elimination and primary (1°) alkyl halides preferentially undergo substitution, therefore, reaction (a) will undergo elimination reaction to give *iso*-butylene and the reaction (b) will undergo substitution reaction to give methyl *tert*-butyl ether.

(iii) When R = alkyl, ROH behaves as a weak Bronsted base since it accepts a proton from strong acids such as HCl, H<sub>2</sub>SO<sub>4</sub> etc.



However, when R' = aryl, R'OH behaves as a weak Bronsted acid since it donates a proton to strong bases such as Na, NaOH, etc.



25. Refer to answer 70 and 96, Page no. 204 and 207 (MTG CBSE Champion Chemistry Class 12)

**OR**

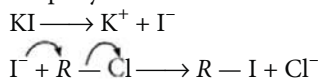
(i) Free radical halogenation of alkanes is not a suitable method to obtain an alkyl halide because :

(a) It gives a mixture of isomeric monohalogenated products whose boiling points are so close that their separation is difficult.

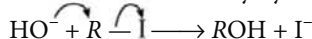
(b) Polyhalogenation may also occur making the product mixture more complex and hence, difficult to separate.



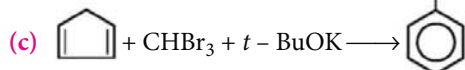
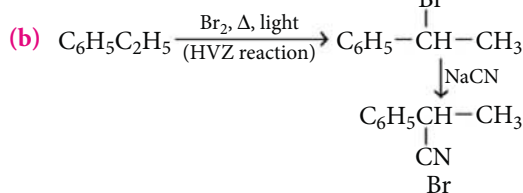
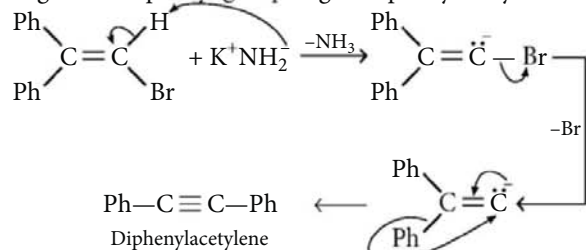
(ii) Iodide is a powerful nucleophile and therefore, it reacts rapidly with RCl to form RI



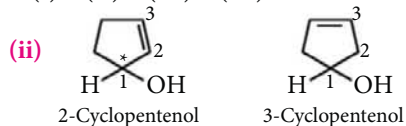
Also,  $\text{I}^-$  ion is a better leaving group than  $\text{Cl}^-$  ion and therefore, RI is more readily hydrolysed to form ROH.



(iii) (a) Dehydrobromination takes place with the migration of phenyl group to give diphenylacetylene.



26. (i) The first compound is a 2° alkyl halide while all others are 3° alkyl halide. Since 3° alkyl halides are more reactive than 2° alkyl halides in  $\text{S}_{\text{N}}1$  reaction, therefore, first compound is the least reactive. Further reactivity increases in the order : chloride < bromide < iodide. Thus, the increasing order of reactivity in  $\text{S}_{\text{N}}1$  reactions is (I) < (II) < (III) < (IV).



2-Cyclopentanol has a chiral centre at  $\text{C}_1$  while 3-cyclopentanol is symmetrical (*i.e.*, has a plane of symmetry) and hence is not chiral.

(iii) Carbocations are formed in  $\text{S}_{\text{N}}1$  reaction which are planar species, thus, racemisation occurs.

(iv) DDT is used as an insecticide and iodoform is used as a mild antiseptic.

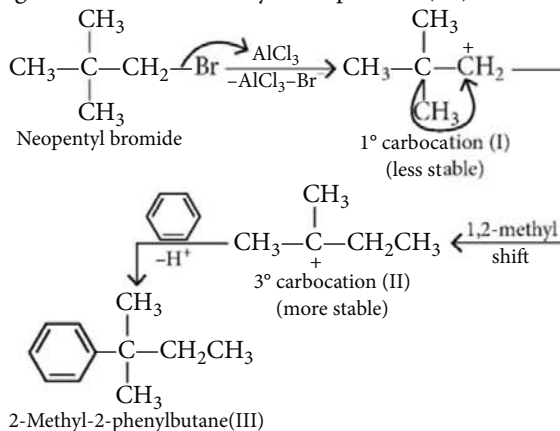
(v) Racemic mixture contains equal amount of *d*- and *l*-forms, hence rotation due to one enantiomer is cancelled by another.

OR

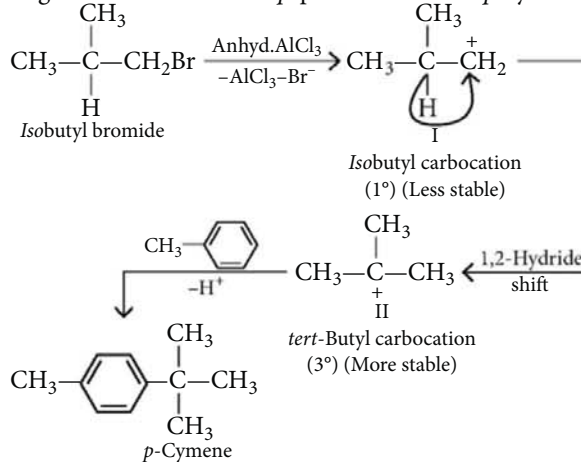
(i) (a) EtOH/ $\text{H}_2\text{O}$  being more polar than EtOH facilitates ionization of  $(\text{CH}_3)_3\text{CBr}$  and hence reaction (I) occurs faster than reaction (II).

(b)  $(\text{CH}_3)_2\text{CHS}^-$  being bigger in size than  $\text{CH}_3\text{S}^-$  causes steric hindrance and hence reaction (I) proceeds faster than reaction (II).

(ii) (a) The initially formed less stable 1° carbocation (I) undergoes 1,2-methyl shift to give the more stable 3° carbocation (II) which then attacks the benzene ring to give Friedels-Crafts alkylation product (III).

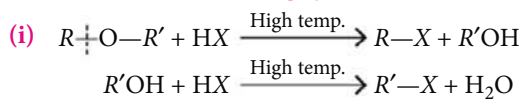


(b) The initially formed less stable 1° carbocation (I) undergoes rearrangement by 1,2-hydride shift to form more stable 3° carbocation (II) which then attacks the toluene ring at the less hindered *p*-position to form *p*-cymene.



27. Refer to answer 62 and 71, Page no. 222 and 224 (MTG CBSE Champion Chemistry Class 12)

OR

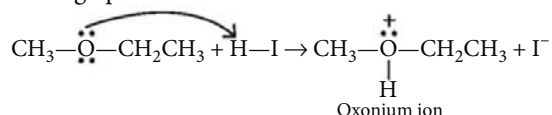


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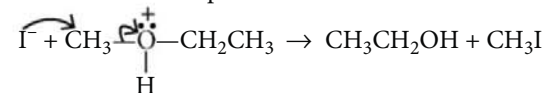
The cleavage of C—O bond in ethers takes place under drastic conditions with excess of HX. Order of reactivity of HCl, HBr, HI is



(ii) (a) **Step I** : With limited amount of HI, ether undergo protonation to form oxonium ion.

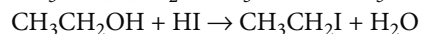
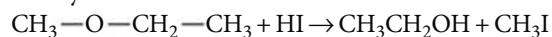


**Step II** : Iodide is good nucleophile and attacks the least substituted carbon of the oxonium ion of step I and alcohol is displaced.



Thus, we get mixture of alcohol and alkyl iodide when HI reacts with mixed ether.

(b) With excess of HI alcohol formed is converted to alkyl iodide.



(iii) The boiling points of ethers are much lower than, those of alcohol of comparable molar masses because like alcohols they cannot form intermolecular hydrogen bonds.

