

OPEN STUDENT FOUNDATION

Chapters: 7

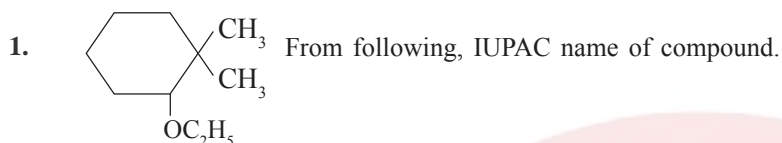
STD:12th Chemistry Practice Sheet Day -7

Date : 25/02/24

Section A

● Choose correct answer from the given options. [Each carries 1 Mark]

[10]



- (A) 5-ethoxy-6, 6-dimethyl cyclohexane (B) 1-ethoxy-2, 2-dimethyl cyclohexane
(C) 2-ethoxy-1, 1-dimethyl cyclohexane (D) 1-ethoxy-6, 6-dimethyl cyclohexane

2. Which of the organic products of the following reactions has the least boiling point ?



3. How many σ (sigma) and π (pie) bonds are present respectively in the final product obtained by the Reimer-Tiemann reaction of phenol ?

- (A) 15 and 3 (B) 14 and 4 (C) 15 and 4 (D) 14 and 3

4. Which of the following compound is more acidic ?



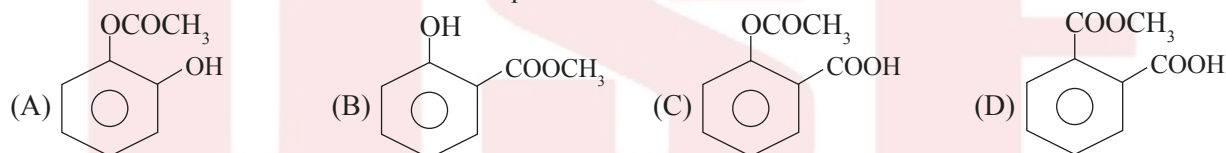
5. Which of the following has highest boiling point ?

- (A) Pentan-1-ol (B) Ethoxy ethane (C) Pentanal (D) n-Butane

6. Which product is obtained between reaction of CH_3ONa and $(\text{CH}_3)_3\text{CBr}$?

- (A) Only Alkene (B) Only Ether
(C) Both alkene and Ether (D) Alcohol

7. Which is the correct structural formula of Aspirin ?



8. Which of the following alcohol has highest solubility in water ?

- (A) Secondary butyl alcohol (B) Tertiary butyl alcohol
(C) Ethelene glycol (D) Glycerol

9. An IUPAC name of p-cresol is _____ .

- (A) 2-Methylphenol (B) 4-Methylphenol (C) 2-Methylbenzene (D) 4-Methylbenzene

10. Match the following:

Group-1		Group-2	
(A)	Bromination of phenol	(I)	Ortho hydroxybenzoic acid
(B)	Reimer- Tiemann reaction	(II)	Ortho hydroxyphenyl alkyl ketone
(C)	Fries rearrangement	(III)	Electrophilic substitution reaction
(D)	Kolbe-Schmitt reaction	(IV)	Ortho hydroxyl benzaldehyde

(A) A-III, B-II, C-IV, D-I (B) A-III, B-IV, C-I, D-II (C) A-III, B-IV, C-II, D-I (D) A-III, B-I, C-IV, D-II

Section B

● Write the answer of the following questions. [Each carries 2 Marks] [10]

1. What happens when the vapours of a primary, secondary and tertiary alcohol are passed over heated copper at 573 K temperature? Explain with chemical equation.
2. Short note: Lucas test
3. Write the equations involved in the following reactions :
(i) Reimer - Tiemann reaction (ii) Kolbe's reaction
4. 'Alcohols are versatile compounds' discuss exactness of this statement by giving suitable example.
5. Arrange the following sets of compounds in order of their increasing boiling points :
(a) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol.
(b) Pentan-1-ol, n-butane, pentanal, ethoxyethane.

Section C

● Write the answer of the following questions. [Each carries 3 Marks] [12]

6. Explain the preparation of ethers with mechanism by dehydration of alcohols.
7. Explain dehydration of alcohols with chemical equations. And also give the order for relative ease of dehydration of alcohols.
8. Explain acidic nature of alcohols and phenols by their reaction with metals..
9. Explain the following with an example : (iii) Williamson ether synthesis :

Section D

● Write the answer of the following questions. [Each carries 4 Marks] [16]

10. What is meant by hydroboration-oxidation reaction? Illustrate it with an example.
11. Explain the preparation of alcohol from alkene by acid catalyzed hydration with its mechanism.
12. Explain the preparation of phenol from chlorobenzene, benzenesulphonic acid, aniline and cumene.
13. Name the reagents used in the following reactions :
(i) Oxidation of a primary alcohol to carboxylic acid.
(ii) Oxidation of a 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.

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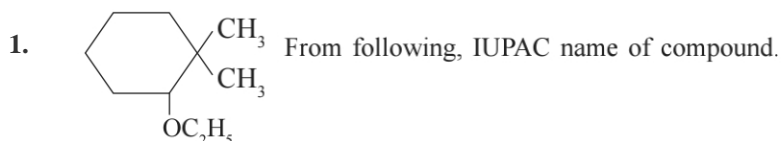
STD:12th Chemistry Practice Sheet Day -7

Date : 25/02/24

Section A

● Choose correct answer from the given options. [Each carries 1 Mark]

[10]



- (A) 5-ethoxy-6, 6-dimethyl cyclohexane (B) 1-ethoxy-2, 2-dimethyl cyclohexane
(C) 2-ethoxy-1, 1-dimethyl cyclohexane (D) 1-ethoxy-6, 6-dimethyl cyclohexane

➡ Ans : (C)

2. Which of the organic products of the following reactions has the least boiling point ?

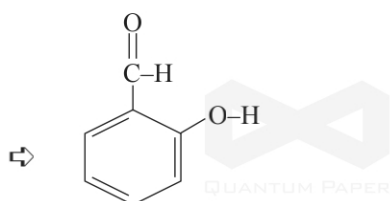


➡ Ans : (B)

3. How many σ (sigma) and π (pie) bonds are present respectively in the final product obtained by the Reimer-Tiemann reaction of phenol ?

- (A) 15 and 3 (B) 14 and 4 (C) 15 and 4 (D) 14 and 3

Ans (C)



4. Which of the following compound is more acidic ?



➡ Ans : (D)

5. Which of the following has highest boiling point ?

- (A) Pentan-1-ol (B) Ethoxy ethane (C) Pentanal (D) n-Butane

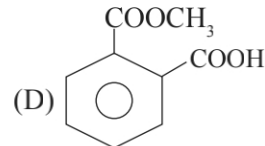
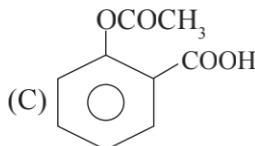
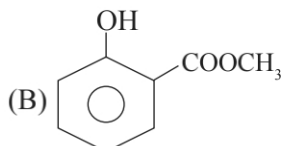
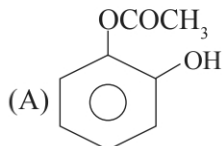
➡ Ans : (A)

6. Which product is obtained between reaction of CH_3ONa and $(\text{CH}_3)_3\text{CBr}$?

- (A) Only Alkene (B) Only Ether
(C) Both alkene and Ether (D) Alcohol

➡ Ans : (A)

7. Which is the correct structural formula of Aspirin ?



Ans : (C)

8. Which of the following alcohol has highest solubility in water ?

(A) Secondary butyl alcohol

(B) Tertiary butyl alcohol

(C) Ethelene glycol

(D) Glycerol

Ans (D)

⇨ $\left(\begin{array}{c} \text{CH}_2 - \text{CH} - \text{CH}_2 \\ | \quad | \quad | \\ \text{OH} \quad \text{OH} \quad \text{OH} \end{array} \right)$ In glycerol 3 -OH group is present so it has highest solubility in water.

9. An IUPAC name of p-cresol is _____ .

(A) 2-Methylphenol

(B) 4-Methylphenol

(C) 2-Methylbenzene

(D) 4-Methylbenzene

Ans : (B)

10. Match the following:

Group-1		Group-2	
(A)	Bromination of phenol	(I)	Ortho hydroxybenzoic acid
(B)	Reimer- Tiemann reaction	(II)	Ortho hydroxyphenyl alkyl ketone
(C)	Fries rearrangement	(III)	Electrophilic substitution reaction
(D)	Kolbe-Schmitt reaction	(IV)	Ortho hydroxyl benzaldehyde

(A) A-III, B-II, C-IV, D-I (B) A-III, B-IV, C-I, D-II (C) A-III, B-IV, C-II, D-I (D) A-III, B-I, C-IV, D-II

Ans : (C)

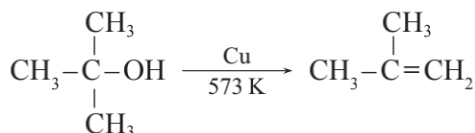
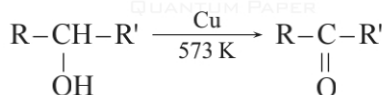
Section B

● Write the answer of the following questions. [Each carries 2 Marks]

[10]

1. What happens when the vapours of a primary, secondary and tertiary alcohol are passed over heated copper at 573 K temperature? Explain with chemical equation.

⇨ When the vapours of a primary, secondary and tertiary alcohol are passed over heated copper at 573 K, dehydrogenation takes place and an aldehyde or a ketone is formed while tertiary alcohols undergo dehydration.



2. Short note: Lucas test

⇨ Alcohols react with hydrogen halides to form alkyl halides.



⇨ The difference in reactivity of three classes of alcohols with HCl distinguishes them from one another.

⇨ Alcohols are soluble in Lucas reagent (conc. HCl and ZnCl_2) while their halides are immiscible and produce

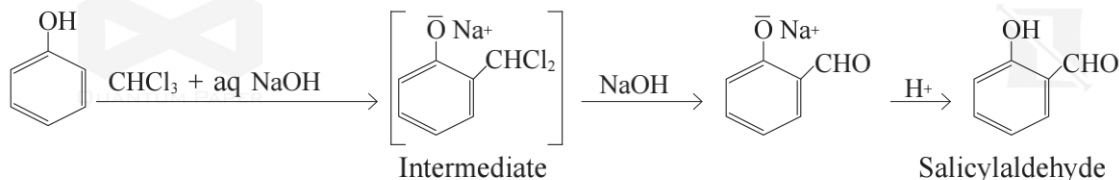
turbidity in solution.

- ⇨ In case of tertiary alcohols, turbidity is produced immediately as they form the halides easily.
- ⇨ Primary alcohols do not produce turbidity at room temperature.
- ⇨ This is how alcohols can be distinguished by Lucas test.

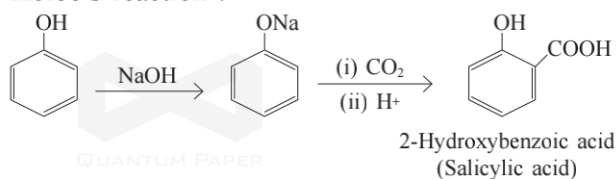
3. Write the equations involved in the following reactions :

- (i) Reimer - Tiemann reaction (ii) Kolbe's reaction

⇨ (i) Reimer-Tiemann reaction :



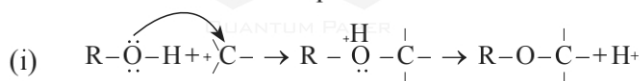
⇨ (ii) Kolbe's reaction :



4. 'Alcohols are versatile compounds' discuss exactness of this statement by giving suitable example.

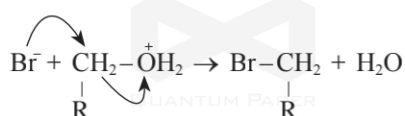
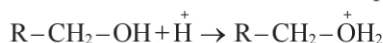
⇨ Alcohols are versatile compounds. They react both as nucleophiles and electrophiles. The bond between O-H is broken when alcohols react as nucleophiles.

⇨ Alcohols as nucleophiles



(ii) The bond between C - O is broken when they react as electrophiles. Protonated alcohols react in this manner.

⇨ Protonated alcohols as electrophiles



5. Arrange the following sets of compounds in order of their increasing boiling points :

- (a) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol.
(b) Pentan-1-ol, n-butane, pentanal, ethoxyethane.

⇨ (i) Methanol, ethanol, propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol.
(ii) n-Butane, ethoxyethane, pentanal and pentan-1-ol.

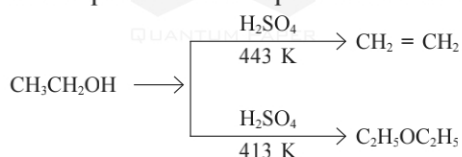
Section C

● Write the answer of the following questions. [Each carries 3 Marks]

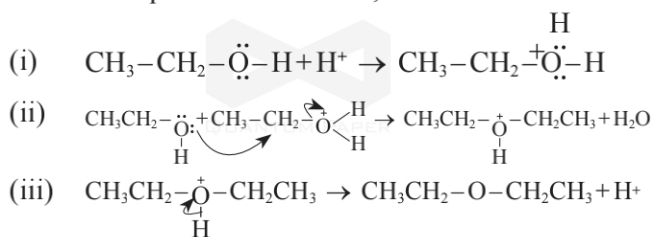
[12]

6. Explain the preparation of ethers with mechanism by dehydration of alcohols.

⇨ Alcohols undergo dehydration in the presence of protic acids (H_2SO_4 , H_3PO_4). The formation of the reaction product, alkene or ether depends on the reaction conditions. For example, ethanol is dehydrated to ethene in the presence of sulphuric acid at 443 K. At 413 K, ethoxyethane is the main product.



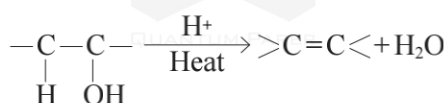
⇨ The formation of ether is a nucleophilic bimolecular reaction (S_N2) involving the attack of alcohol molecule on a protonated alcohol, as indicated below :



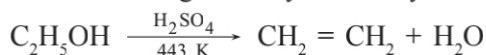
⇨ Acidic dehydration of alcohols, to give an alkene is also associated with substitution reaction to give an ether.

7. Explain dehydration of alcohols with chemical equations. And also give the order for relative ease of dehydration of alcohols.

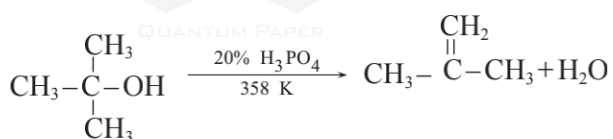
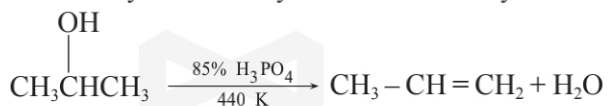
⇨ Dehydration : Alcohols undergo dehydration (removal of a molecule of water) to form alkenes on treating with a protic acid e.g., concentrated H_2SO_4 or H_3PO_4 , or catalysts such as anhydrous zinc chloride or alumina.



⇨ Ethanol undergoes dehydration by heating it with concentrated H_2SO_4 at 443 K.



⇨ Secondary and tertiary alcohols are dehydrated under milder conditions. For example



⇨ Thus, the relative ease of dehydration of alcohols follows the following order :

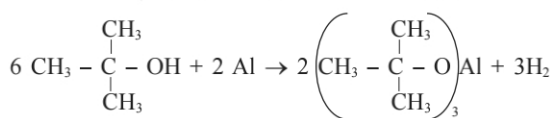
Tertiary > Secondary > Primary

8. Explain acidic nature of alcohols and phenols by their reaction with metals..

⇨ Reaction with metals : Alcohols and phenols react with active metals such as sodium, potassium and aluminium to yield corresponding alkoxides/phenoxides and hydrogen.

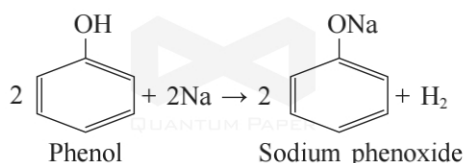


Sodium alkoxide



tert-Butyl alcohol

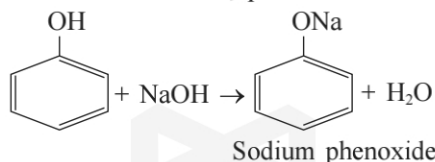
Aluminium tert-butoxide



Phenol

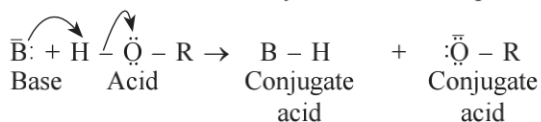
Sodium phenoxide

⇨ In addition to this, phenols react with aqueous sodium hydroxide to form sodium phenoxides.



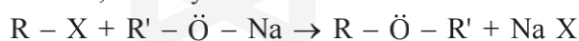
Sodium phenoxide

- ⇒ The above reactions show that alcohols and phenols are acidic in nature. In fact, alcohols and phenols are bronsted acids i.e., they can donate a proton to a stronger base (B:).

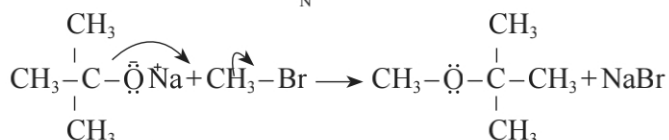


9. Explain the following with an example : (iii) Williamson ether synthesis :

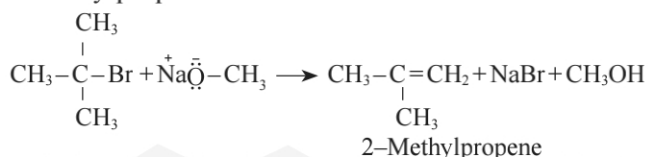
- ⇒ It is an important laboratory method for the preparation of symmetrical and unsymmetrical ethers. In this method, an alkyl halide is allowed to react with sodium alkoxide.



- ⇒ Ethers containing substituted alkyl groups (secondary or tertiary) may also be prepared by this method. The reaction involves S_N2 attack of an alkoxide ion on primary alkyl halide.

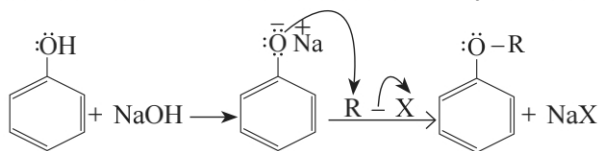


- ⇒ Better results are obtained if the alkyl halide is primary. In case of secondary and tertiary alkyl halides, elimination competes over substitution. If a tertiary alkyl halide is used, an alkene is the only reaction product and no ether is formed. For example, the reaction of CH₃ONa with (CH₃)₃C-Br gives exclusively 2-methylpropene.



- ⇒ It is because alkoxides are not only nucleophiles but strong bases as well. They react with alkyl halides leading to elimination reactions

- ⇒ Phenols are also converted to ethers by this method. In this, phenol is used as the phenoxide moiety.



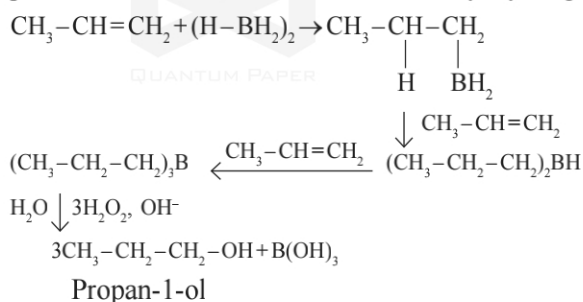
Section D

- Write the answer of the following questions. [Each carries 4 Marks]

[16]

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

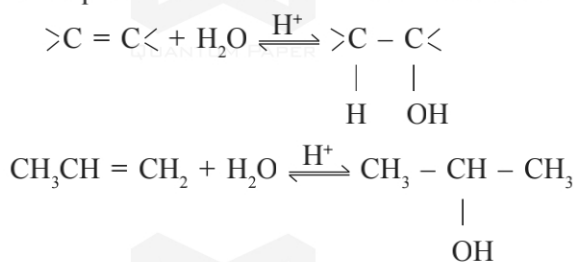
- ⇒ By hydroboration-oxidation : Diborane (BH₃)₂, reacts with alkenes to give trialkyl boranes as addition product. This is oxidised to alcohol by hydrogen peroxide in the presence of aqueous sodium hydroxide.



- ⇒ The addition of borane to the double bond takes place in such a manner that the boron atom gets attached to the sp² carbon carrying greater number of hydrogen atoms. The alcohol so formed looks as if it a way opposite to the Markovnikov's rule. In this reaction, alcohol is obtained in excellent yield.

11. Explain the preparation of alcohol from alkene by acid catalyzed hydration with its mechanism.

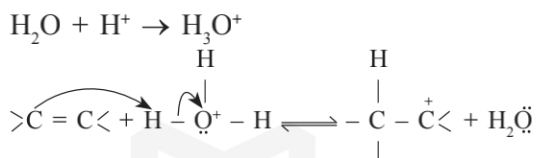
⇨ By acid catalysed hydration : Alkenes react with water in the presence of acid as catalyst to form reaction takes place in accordance with Markovnikov's rule.



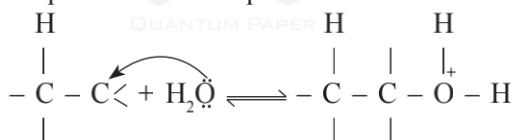
⇨ Mechanism :

⇨ The mechanism of the reaction involves the following three steps :

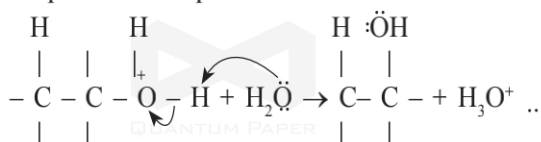
⇨ Step - 1 : Protonation of alkene to form carbocation by electrophilic attack of H_3O^+ .



⇨ Step - 2 : Nucleophilic attack of water on carbocation.



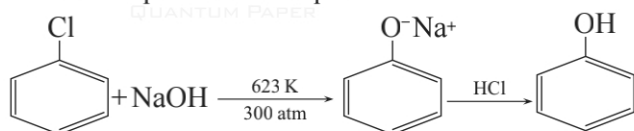
⇨ Step - 3 : Deprotonation to form an alcohol.



12. Explain the preparation of phenol from chlorobenzene, benzenesulphonic acid, aniline and cumene.

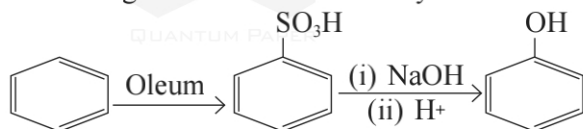
(1) From haloarenes :

◆ Chlorobenzene is fused NaOH at 623 K and 320 atmospheric pressure. Phenol is obtained by acidification of sodium phenoxide so produced.



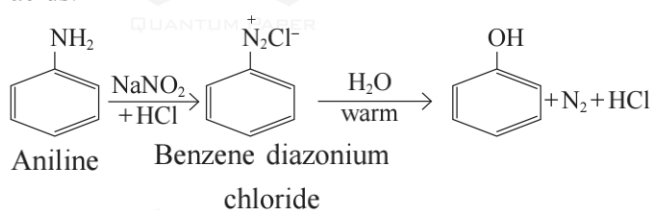
(2) From benzenesulphonic acid :

⇨ Benzene is sulphonated with oleum and benzene sulphonic acid so formed is converted to sodium phenoxide on heating with molten sodium hydroxide. Acidification of the sodium salt gives phenol.



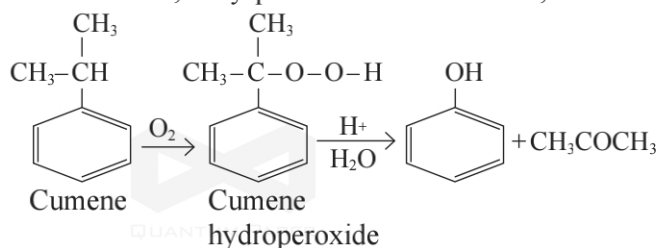
(3) From diazonium salts :

⇨ A diazonium salt is formed by treating an aromatic primary amine with nitrous acid ($\text{NaNO}_2 + \text{HCl}$) at 273-278 K. Diazonium salts are hydrolysed to phenols by warming with water or by treating with dilute acids.



(4) From cumene :

⇒ Phenol is manufactured from the hydrocarbon, cumene. Cumene (isopropylbenzene) is oxidised in the presence of air to cumene hydroperoxide. It is converted to phenol and acetone by treating it with dilute acid. Acetone, a by-product of this reaction, is also obtained in large quantities by this method.



13. Name the reagents used in the following reactions :

- (i) Oxidation of a primary alcohol to carboxylic acid.
 - (ii) Oxidation of a 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.
- ⇒
- (i) Acidic potassium dichromate or neutral/acidic/alkaline $KMnO_4$.
 - (ii) Pyridinium chlorochromate (PCC), a complex of chromium trioxide with pyridine and HCl.
 - (iii) Bromine water Br_2/H_2O .
 - (iv) Acidic or alkaline potassium permanganate.
 - (v) 85% H_2SO_4 at 440 K temperature.
 - (vi) Ni/H_2 or $NaBH_4$ or $LiAlH_4$.