

**ENTRANCE TEST – 2020**

**MDCAT – CHEMISTRY**

TEST # 06 UHS TOPIC – 3 + 4 (Organic Chemistry)

TOPIC: ALKYL HALIDES, ALCOHOLS AND PHENOLS

**Q.51 \*\*Which one of the following is nucleophilic substitution reaction (NSR)?**

- A)  $\text{CH}_4 + \text{HONO}_2(\text{conc.}) \xrightarrow{450^\circ\text{C}} \text{CH}_3 - \text{NO}_2 + \text{H}_2\text{O}$   
 B)  $\text{H}_2\text{C} = \text{CH}_2 + \text{Br}_2 \xrightarrow{\text{CCl}_4} \text{H}_2\text{C}(\text{Br}) - \text{CH}_2(\text{Br})$   
 C)  $\text{H}_3\text{C} - \text{CH}_2 - \text{NH}_2 + \text{HCl}(\text{dil.}) \longrightarrow \text{H}_3\text{C} - \text{CH}_2 - \overset{+}{\text{N}}\text{H}_3 \overset{-}{\text{Cl}}$   
 D)  $\text{CH}_3 - \text{CH}_2 - \text{Br} + \text{OH}^- \longrightarrow \text{H}_3\text{C} - \text{CH}_2 - \text{OH} + \text{Br}^-$

**Q.52 \*\*Rectified spirit contains alcohol about?**

- A) 80%  
 B) 85%  
 C) 90%  
 D) 95%

**Q.53 \*\*Which of the following statement does not match correctly?**

Opt.	Reagent / State	Ethanol	Phenol
A)	State at room temperature	Liquid	Solid
B)	Organic acid ( $\text{CH}_3\text{COOH}$ )	Ethyl ethanoate (an ester) is formed	No reaction
C)	$\text{Br}_2, \text{H}_2\text{O}$	No reaction	White ppt.
D)	Conc. $\text{H}_2\text{SO}_4$	Dehydration $\rightarrow$ only ether is formed	No reaction

**Answer Explanation: (D)**

Opt	Reagent / State	Ethanol	Phenol
(D)	Conc. $\text{H}_2\text{SO}_4$	Dehydration $\rightarrow$ ethene or ether formed	Sulplonation $\rightarrow$ $\text{HOC}_6\text{H}_4\text{SO}_3\text{H}$

**Q.54 \*\*Which of the following has higher boiling point?**

- A)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{Br}$   
 B)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{OH}$   
 C)  $\text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_2 - \text{CH}_2 - \text{OH}$   
 D)  $\text{CH}_3 - \underset{\text{Cl}}{\text{CH}} - \text{CH}_3$

**Answer Explanation: (C)**

- The boiling point is greatly influenced by
  - The extent of hydrogen bonding
  - Atomic mass of the substituent group
  - The molecular mass of the compound
- The molecules (A), (B) and (C) have the same number of carbon atoms in their chains. The molecule (A) has a bromine atom as a substituent.
- The molecule (B) has only one – OH group.
- The molecule (C) has two hydroxyl groups. Therefore, the molecule (C) will have boiling point higher than the molecule (B), and molecule (B) will have boiling point higher than the molecule (A).
- The molecule (A) has higher molar mass (larger chain), and a bromine atom, while molecule (D) has short chain, and a Cl atom as the substituent. Therefore, the boiling point of molecule (A) is higher than that of the molecule (D).

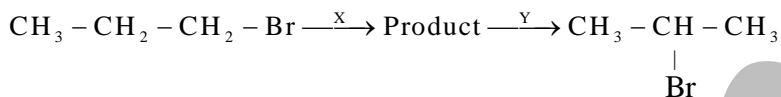
The expected order of increasing boiling point is,

Molecule (D) < Molecule (A) < Molecule (B) < Molecule (C)

**Q.55 \*\*Which of these molecular formulas represent the first three members of the alcohol family?**

- A)  $\text{C}_2\text{H}_5\text{OH}, \text{C}_3\text{H}_7\text{OH}, \text{C}_4\text{H}_9\text{OH}$   
 B)  $\text{CH}_3\text{OH}, \text{C}_2\text{H}_5\text{OH}, \text{C}_3\text{H}_7\text{OH}$   
 C)  $\text{C}_2\text{H}_4\text{OH}, \text{C}_2\text{H}_6\text{OH}, \text{C}_3\text{H}_8\text{OH}$   
 D)  $\text{HOH}, \text{CH}_3\text{OH}, \text{C}_2\text{H}_5\text{OH}$

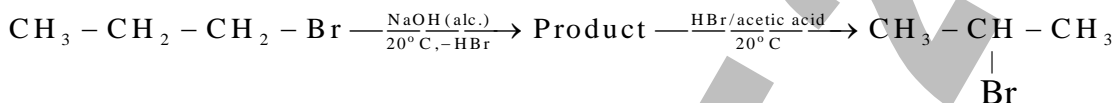
- Q.56** \*\*Consider the following reactions having the conditions 'X' and 'Y' in the following set of transformations.



In the above transformations 'X' and 'Y' stand for conditions

- A) X = dilute aqueous NaOH, 20°C; Y = HBr/acetic acid, 20°C  
 B) X = concentrated alcoholic NaOH, 80°C; Y = HBr/acetic acid, 20°C  
 C) X = dilute aqueous NaOH, 20°C; Y = Br<sub>2</sub>/CHCl<sub>3</sub>, 0°C  
 D) X = concentrated alcoholic NaOH, 80°C; Y = Br<sub>2</sub>/CHCl<sub>3</sub>, 0°C

**Answer Explanation: (A)**



- Q.57** \*\*Chloroethane is converted into a carboxylic acid containing one more carbon atom through a two stage process.

Which of the following compounds could be the intermediate in the synthesis of the carboxylic acid?

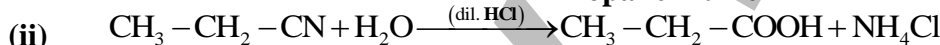
- A) CH<sub>3</sub>CH<sub>2</sub>OH  
 B) CH<sub>3</sub>CH<sub>2</sub>CN  
 C) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub>  
 D) CH<sub>3</sub>CH<sub>2</sub>CO<sub>2</sub>CH<sub>3</sub>

**Answer Explanation: (B)**

The following compound propane nitrile (CH<sub>3</sub>-CH<sub>2</sub>-CN) is the intermediate in the synthesis of carboxylic acid.



**Propane nitrile**



**Proanoic acid**

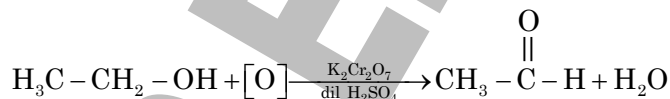
- Q.58** \*\*Which of these equations correctly represents the fermentation of glucose?

- A) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (aq) → C<sub>2</sub>H<sub>5</sub>OH (aq) + 2CO<sub>2</sub> (g)  
 B) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (aq) → 2C<sub>2</sub>H<sub>5</sub>OH (aq) + 4CO<sub>2</sub> (g)  
 C) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (aq) → 2C<sub>2</sub>H<sub>5</sub>OH (aq) + 2CO<sub>2</sub> (g)  
 D) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (aq) → C<sub>2</sub>H<sub>5</sub>OH (aq) + 4CO<sub>2</sub> (g)

- Q.59** \*\*Identify the incorrect statement about phenol.

- A) It is colourless crystalline hygroscopic solid  
 B) It is poisonous in nature  
 C) It is used as a disinfectant in hospitals and washrooms  
 D) It is sparingly soluble in water

- Q.60** \*\*Consider the following reaction of alcohol:

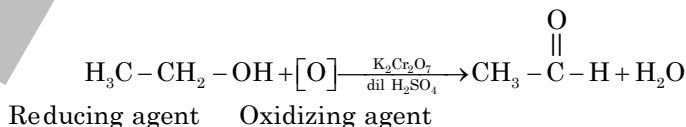


In the above reaction ethanol can act as:

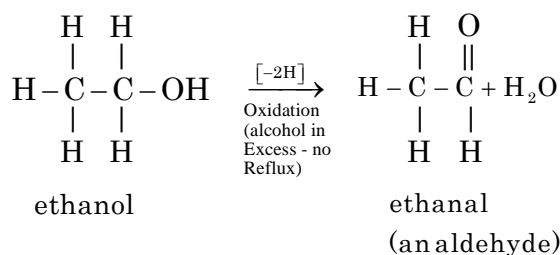
- A) Reducing agent only  
 B) Oxidizing agent only  
 C) Both A and B  
 D) Neither A nor B

**Answer Explanation: (A)**

In the following given reaction, ethanol acts as a reducing agent



**More Explanation**

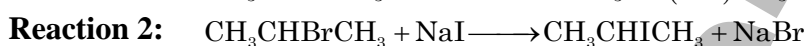


Oxidation no. of C (-II)

Oxidation no. of C (-I)

**Note:** Ethanal boiling point ( $T_b = 294 \text{ k}$ ) vaporizes as soon as it is formed. It is distilled immediately in order to avoid further oxidation to ethanoic acid.

**Q.61** \*\*Under identical conditions, even though it proceeds by the same mechanism, reaction 1 is faster than reaction 2.



**What factor will explain this result?**

- A) The C - I bond is a stronger bond than the C - Br bond
- B) The C - N bond is a stronger bond than the C - I bond
- C) The cyanide ion is a stronger nucleophile than the iodide ion
- D) The cyanide ion is a weaker nucleophile than the iodide ion.

**Answer Explanation: (C)**

In the above given reactions

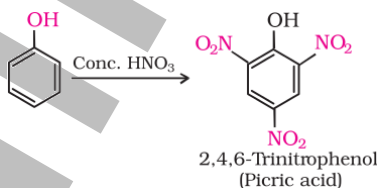
- Reaction 1 is faster than reaction 2 because
- The cyanide ion is a stronger nucleophile than the iodide ion

**Q.62** Which of the following reagents produces picric acid by the reaction with phenol?

- A)  $\text{Br}_2$  /water
- B) dil.  $\text{HNO}_3$
- C) Conc.  $\text{HNO}_3$
- D)  $\text{CH}_3 - \text{Cl}$

**Answer Explanation: (C)**

Picric acid is produced by the reaction of phenol with conc.  $\text{HNO}_3$  as shown in the reaction.



**Characteristic features of picric acid:**

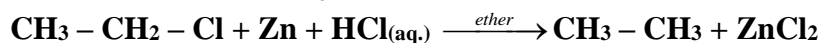
- "Trinitrophenol (picric acid), Wetted, with not less than 10% water by mass" is a yellow mass of moist crystals or a slurry.
- An explosive, but wetting lowers the risk of detonation.
- Used in synthesis of dyes, as a drug, to manufacture explosives and matches, to etch copper and to make colored glass.

**Q.63** Which of the following is not  $\text{S}_\text{N}$  reaction?

- A)  $\text{CH}_3 - \text{CH}_2 - \text{Br} + \text{OH}^- \longrightarrow \text{H}_3\text{C} - \text{CH}_2 - \text{OH} + \text{Br}^-$
- B)  $\text{CH}_3 - \text{CH}_2 - \text{Br} + \text{CH}_3\text{O}^- \longrightarrow \text{CH}_3 - \text{CH} - \text{O} - \text{CH}_3$
- C)  $\text{CH}_3 - \text{CH}_2 - \text{Br} + \text{NH}_3 \longrightarrow \text{CH}_3 - \text{NH}_2 + \text{HBr}$
- D)  $\text{CH}_3 - \text{CH}_2 - \text{Cl} + \text{Zn} + \text{HCl}_{(\text{aq.})} \xrightarrow{\text{ether}} \text{CH}_3 - \text{CH}_3 + \text{ZnCl}_2$

**Answer Explanation: (D)**

It is not  $\text{S}_\text{N}$  reaction. Alkyl halides can be reduced with zinc in the presence of an aqueous acid such as  $\text{HCl}$  or  $\text{CH}_3\text{COOH}$ .



**Q.64** In the upper atmosphere chlorofluoroalkanes (CFCs) are broken down to give chlorine radical but not fluorine radicals. What is the best explanation for this?

- A) Fluorine is more electronegative than chlorine
- B) Fluorine radicals are less stable than chlorine radicals
- C) The C – F bond is stronger than the C – Cl bond
- D) The chlorine atom is larger in size than the fluorine atom

**Answer Explanation: (C)**

In the upper atmosphere chlorofluoroalkanes (CFCs) are broken down to give chlorine radical but not fluorine radicals. The best explanation for this is the C – F bond is stronger than the C – Cl bond i.e. C – F bond energy is greater than that of C – Cl bond as shown below:

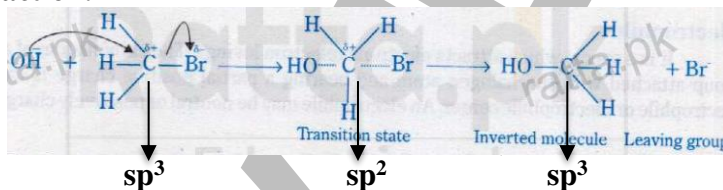
Bond	C – F	C – H	C – Cl	C – Br	C – I
Bond energy (kJmol <sup>-1</sup> )	467	413	346	290	228

**Q.65** During S<sub>N</sub>2 reaction, configuration of the alkyl halide molecule:

- A) Remains same
- B) Depends on the Electronegativity of halogen
- C) Depends upon the carbon-atom
- D) Gets inverted

**Answer Explanation: (D)**

During S<sub>N</sub>2 reaction, configuration of the alkyl halide molecule gets inverted as shown in the reaction.



**Q.66** Which of the following is not use of chloroform (CHCl<sub>3</sub>)?

**Chloroform is used:**

- A) As an anaesthetic substances
- B) As a solvent form fats, waxes and resins
- C) As a preservative for anatomical specimens
- D) As an antiseptic

**Answer Explanation: (D)**

It is incorrect statement in fact chloroform is used as an antiseptic substance.

**Q.67** Which of the followings is good nucleophile as well as good leaving group?

- A) OH<sup>-</sup>
- B) I<sup>-</sup>
- C) NH<sub>2</sub><sup>-</sup>
- D) OR<sup>-</sup>

**Answer Explanation: (B)**

I<sup>-</sup> (iodide ion) is good nucleophile as well as good leaving group.

**Q.68** Which of the following type of reaction is shown by phenol?

- A) Reaction due to -OH group only
- B) Reaction due to benzene ring only
- C) Both A and B
- D) Neither A nor B

**Answer Explanation: (C)**

The following type of reactions are shown by phenol.

- Due to -OH group
- Due to benzene ring

**Q.69** Which of the following is correct order of ease of S<sub>N</sub>1 reaction shown by alkyl halide?

- A) (R)<sub>2</sub>CHX > CH<sub>3</sub>X > (R)<sub>3</sub>C-X > RCH<sub>2</sub>X
- B) CH<sub>3</sub>X > RCH<sub>2</sub>X > (R)<sub>2</sub>CHX > (R)<sub>3</sub>C-X
- C) (R)<sub>2</sub>CHX > (R)<sub>3</sub>C-X > RCH<sub>2</sub>X > CH<sub>3</sub>X
- D) (R)<sub>3</sub>C-X > (R)<sub>2</sub>CHX > RCH<sub>2</sub>X > CH<sub>3</sub>X

**Answer Explanation: (D)**

The correct order of ease of S<sub>N</sub>1 reaction shown by alkyl halides is as follow:



**Q.70** The relative strength of phenol, water, ethanol and carboxylic acid has the following order of increasing acid strength:

- A) Carboxylic Acid > Phenol > Ethanol > Water  
 B) Carboxylic Acid > Phenol > Water > Ethanol  
 C) Phenol > Carboxylic Acid > Ethanol > Water  
 D) Water > Ethanol > Phenol > Carboxylic Acid

**Answer Explanation: (B)**

Name of compounds	K <sub>a</sub> (mol dm <sup>-3</sup> )
Carboxylic acid e.g. (CH <sub>3</sub> COOH)	1.7 x 10 <sup>-5</sup>
Phenol	1.3 x 10 <sup>-10</sup>
Water	10 <sup>-16</sup>
Ethanol	10 <sup>-18</sup>

**Q.71** Which of the following is correct order of acidic strength of different types of alcohols?

- A) 3° > 2° > 1°  
 B) 1° > 2° > 3°  
 C) 2° > 1° > 3°  
 D) 3° > 1° > 2°

**Answer Explanation: (B)**

Correct order of acidic strength of different types of alcohols is as follow:

1° alcohol > 2° alcohol > 3° alcohol

**Q.72** Which of the following mechanism of reaction is shown by alcohol when C-O bond is broken?

- A) Electrophilic substitution reaction  
 B) Nucleophilic substitution reaction  
 C) Acid base reaction  
 D) Redox reaction

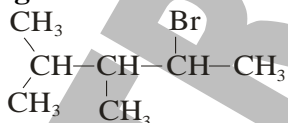
**Answer Explanation: (B)**

Nucleophilic substitution reaction is shown by alcohol when C – O bond is broken as shown in the reaction:



In this reaction OH<sup>-</sup> nucleophile is displaced by Cl<sup>-</sup> nucleophile.

**Q.73** Consider the following structural formula of alkyl halide:



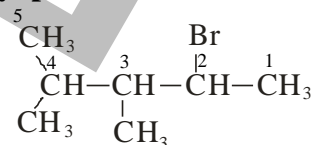
The correct name of the above structure according to IUPAC is:

- A) 4-Bromo-2,3-dimethyl pentane  
 B) 2-Bromo-2,3-dimethyl pentane  
 C) 2-Bromo-3,4-dimethyl pentane  
 D) 4-Bromo-3,3-dimethyl pentane

**Answer Explanation: (C)**

The correct name of the given structure according to IUPAC is

2-Bromo-3,4-dimethyl pentane

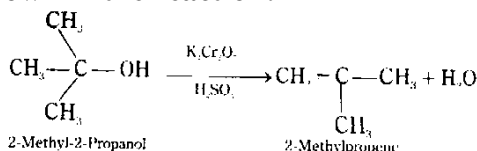


**Q.74** A compound “X” has molecular formula C<sub>4</sub>H<sub>10</sub>O, and is unreactive towards acidified K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and its elimination takes place:

- A) CH<sub>3</sub>-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-OH  
 B) (CH<sub>3</sub>)<sub>2</sub>-CH-CH<sub>2</sub>-OH  
 C) CH<sub>3</sub>-CH<sub>2</sub>-CH(OH)-CH<sub>3</sub>  
 D) (CH<sub>3</sub>)<sub>3</sub>COH

**Answer Explanation: (D)**

(CH<sub>3</sub>)<sub>3</sub>COH is a compound ‘X’ which has molecular formula C<sub>4</sub>H<sub>10</sub>O and is unreactive towards acidified potassium dichromate. It shows β-elimination reaction as shown in the reaction:



**Q.75 General formula of alcohol is:**

- A)  $C_nH_{2n}O$  C)  $C_nH_{2n+1}O$   
B)  $C_nH_{2n+2}O$  D)  $C_nH_{n-2}O$

**Answer Explanation: (B)**

General formula of alcohol is  $C_nH_{2n+2}O$ .

**Q.76 Methanol and ethanol are soluble in water due to:**

- A) Their acidic character C) **Hydrogen bonding**  
B) Dissociation in water D) Alkyl group

**Answer Explanation: (C)**

Methanol and ethanol are soluble in water due to hydrogen bonding. Solubility of alcohol decreases with the increase of carbon atom as shown in the tabular form:

Name	Formula	Solubility/g per 100g of water
Methanol	$CH_3 - OH$	Infinite
Ethanol	$CH_3 - CH_2 - OH$	Infinite
Propan-1-ol	$CH_3 - (CH_2)_2 - OH$	Infinite
Butan-1-ol	$CH_3 - (CH_2)_3 - OH$	8.0
Pentan-1-ol	$CH_3 - (CH_2)_4 - OH$	2.7
Hexan-1-ol	$CH_3 - (CH_2)_5 - OH$	0.6

**Q.77 Which of the following is the most reactive alcohol when bond is to be broken between carbon and oxygen?**

- A)  $CH_3-OH$  C)  $R_2CHOH$   
B)  $R-CH_2-OH$  D)  $R_3COH$

**Answer Explanation: (D)**

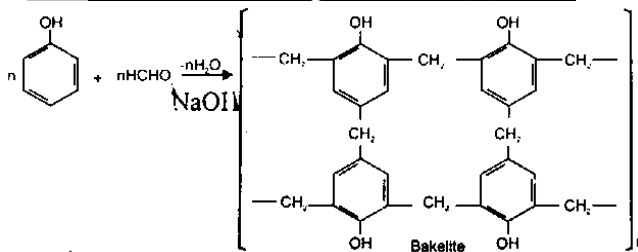
$R_3COH$  is the most reactive alcohol when bond is to be broken between carbon and oxygen. The order of reactivity of alcohols when C - O bond breaks.



**Q.78 Bakelite is first synthetic plastic and it is prepared by the reaction of following two monomers:**

- A) Propanone and benzyl alcohol C) Ethanal and phenol  
B) Methanal and phenol D) Methanol and phenol

**Answer Explanation: (B)**

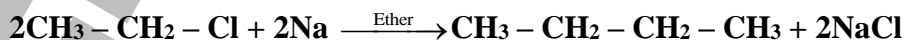


**Q.79 Halo-alkanes can be converted into higher alkanes by:**

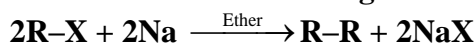
- A) Kolbe's electrolytic method C) Hydrolysis reaction  
B) Wurtz's reaction D) Redox reaction

**Answer Explanation: (D)**

- Halo-alkanes can be converted into higher alkanes by Wurtz's reaction as shown below:



- The Wurtz reaction, named after Charles-Adolphe Wurtz, is a coupling reaction in organic chemistry, organometallic chemistry and recently inorganic main group polymers, whereby two alkyl halides are reacted with sodium metal in dry ether solution to form a higher alkane:



- Other metals have also been used to effect the Wurtz coupling, among them silver, zinc, iron, activated copper, indium and a mixture of manganese and copper chloride.

- The related reaction dealing with aryl halides is called the Wurtz-Fittig reaction. This can be explained by the formation of free radical intermediate and its subsequent disproportionation to give alkene. The Wurtz's reaction occurs through a free radical mechanism.

**Limitations**

- The Wurtz's reaction is limited to the synthesis of symmetric alkanes. If two dissimilar alkyl halides are taken as reactants, then the product is a mixture of alkanes that is often difficult to separate by fractional distillation.
- Methane cannot be obtained by this method. This type of reaction fails in case of tertiary halides.

- Q.80** Which of the following compounds is used as a refrigerant?  
 A)  $\text{CCl}_4$  C)  $\text{CH}_2\text{Cl}_2$   
 B)  $\text{CHCl}_3$  D)  $\text{CF}_2\text{Cl}_2$

**Answer Explanation: (D)**

Dichlorodifluoromethane ( $\text{CF}_2\text{Cl}_2$ ) is used as a refrigerant inside fridges.

- Q.81** Which of the following is comparatively a poor leaving group?  
 A)  $\text{Cl}^-$  C)  $\text{I}^-$   
 B)  $\text{Br}^-$  D)  $\text{F}^-$

**Answer Explanation: (D)**

$\text{F}^-$  is comparatively a poor leaving group.

Good leaving group	Poor leaving group
They have Less electronegativity	They have more electronegativity
And more polarizability	And less polarizability
$\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ and $\text{HSO}_4^-$	$\text{OH}^-$ , $\text{O}^-$ and $\text{NH}_2^-$ , $\text{F}^-$

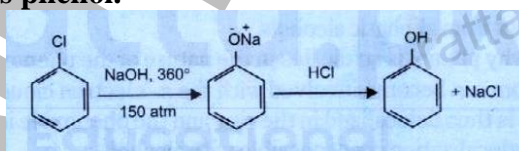
- Q.82** Sodium phenoxide on treating with hydrochloric acid yields?  
 A) Benzene C) Phenol  
 B) Benzoic acid D) Benzaldehyde

**Answer Explanation: (C)**

Sodium phenoxide on treating with hydrochloric acid yields phenol as shown in the reaction.

**Dow's method:**

In this method chlorobenzene is treated with 10% NaOH at  $360^\circ\text{C}$  and 150 atmosphere pressure. Sodium phenoxide is produced which on treating with HCl gives phenol.

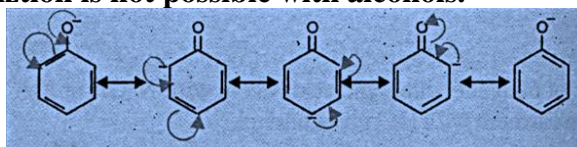


**RIKING INFORMATIONS**

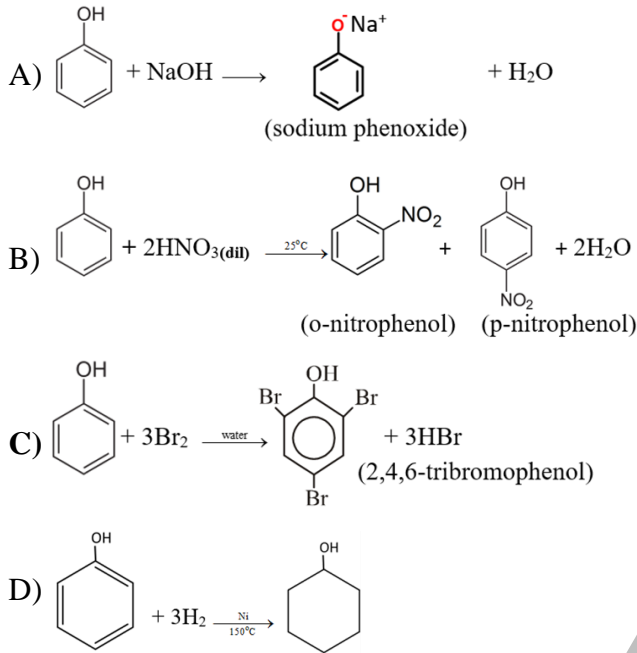
- Q.83** The acidity of phenol is due to its \_\_\_\_\_:  
 A) Nature of benzene C) Nature of phenoxide  
 B) Double bond in benzene ring D) Hydroxal group

**Answer Explanation: (C)**

- Phenol is much more acidic than ethanol its ( $K_a$ ) value is  $1.3 \times 10^{-10}$ .
- The reason why phenol is acidic in nature lies in the nature of phenoxide.
- The negative charge on the oxygen atom can become involved with the pi electron cloud on the benzene ring.
- The negative charge is thus delocalized in the ring and the phenoixde ion becomes relatively stable.
- This type of delocalization is not possible with alcohols.

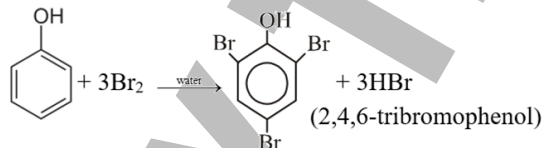


**Q.84** In which of the following reactions of phenol, white precipitate are obtained as a result of reaction?

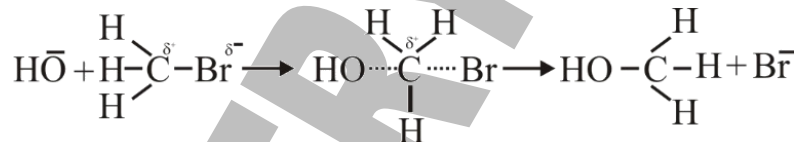


**Answer Explanation: (C)**

In the reaction of phenol with bromine/water white ppt. are obtained as shown in the reaction:



**Q.85** In the below reaction, the configuration of product is:



- A) 100% same of the configuration of reactant      C) 50% retained  
B) 100% opposite from configuration of reactant      D) 50% inverted

**Answer Explanation: (B)**

In the above reaction, the configuration of product is 100% opposite from configuration of reactant.