# ALCOHOLS, PHENOLS AND ETHERS

# PREVIOUS YEARS' QUESTIONS

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2019

# Very Short Answer Type Questions [1 Mark]

1. Arrange the following in increasing order of acidic character: Benzonic acid, phenol, cresol.

[AI Panchkula]

Cresol < Phenol < Benzoic acid

one is more easily indrolysed and why?

# **Short Answer Type Questions [2 Marks]**

- 2. Define with equation:
  - (a) Reimer-Tiemann reaction is assessed research to be live ensured in the components.
  - (b) Williamson's synthesis

[CBSE]

(a) Reimer-Tiemann reaction: 19800 garantiol and two naveral sidileton a 129gau Ans.

When phenol is heated with CHCl<sub>3</sub> and KOH, salicylaldehyde is formed.

OH OH 
$$+ \text{CHCl}_3 + 3\text{KOH} \xrightarrow{\text{heat}} - \text{CHO} + 3\text{KCl} + 2\text{H}_2\text{O}$$
Phenol Salicyldehyde

Phenol

(b) Williamson's ether synthesis:

When sodium ethoxide is treated with methyl iodide, methoxy ethane and sodium iodide are formed.

$$C_2H_5ONa + CH_3I \longrightarrow C_2H_5OCH_3 + NaI$$
  
Sodium ethoxide Methoxy ethane

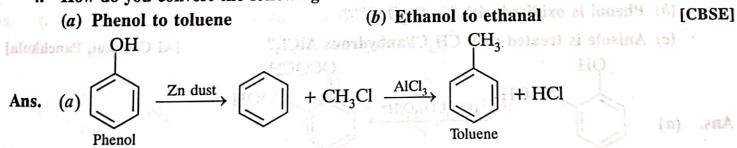
3. An aromatic compound 'A' on treatment with CHCl<sub>3</sub> and KOH gives two compounds which gave the same product when distilled with zinc dust. Oxidation of 'B' gives 'C' with molecular formula C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>. Sodium salt of 'C' on heating with soda lime gives 'D' which may be obtained by distilling 'A' with zinc dust. Identify A, B, C and D.

[AI Chandigarh, HOTS]

'A' is phenol, 'B' is benzaldehyde, 'C' is benzoic acid and 'D' is benzene.

(a) Salicylle acid is treated with (CM, CO)

How do you convert the following:



(b) 
$$CH_3CH_2OH \xrightarrow{Cu} CH_3 \longrightarrow CH_3 \longrightarrow CH + H_2$$
  
Ethanol Ethanal

# Long Answer Type [I] Questions [3 Marks]

(a) How will you synthesise the following from appropriate alkene: 5.

ABS.

(b) Write the mechanism of the following reaction:

CH<sub>3</sub>CH<sub>2</sub>OH 
$$\xrightarrow{H^+}_{443 \text{ K}}$$
 CH<sub>2</sub>=CH<sub>2</sub> + H<sub>2</sub>O

CH<sub>3</sub>

CH

(b) When ethanol is heated with concentrated sulphuric acid at 443 K, ethene is formed.

OCOCH,

$$CH_{3}CH_{2}OH \xrightarrow{Conc. H_{2}SO_{4}} CH_{2} = CH_{2} + H_{2}O$$

$$H_{2}O + H^{+} \longrightarrow H_{3}O^{+}$$

Mechanism:

(i) 
$$CH_3CH_2\ddot{O}H + H_3O^+ \longrightarrow CH_3 - CH_2 - \ddot{O} - H + H_2O$$

(iii) 
$$H - C - C + H_2O \longrightarrow H - C = C - H + H_3O + H_2O + H_3O + H$$

6. What happens when "Die bioxned at "Die obvdeblarned at "B

OH

- (a) Salicylic acid is treated with (CH<sub>3</sub>CO)<sub>2</sub>O/H<sup>+</sup>?
- (b) Phenol is oxidised with Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>/H<sup>+</sup>?
  - (c) Anisole is treated with CH<sub>3</sub>Cl/anhydrous AlCl<sub>3</sub>?

[AI Chennai, Panchkula]

[AI Uttarakhand]

Ans. (a) 
$$(CH_3CO)_2O/H^+$$
 COOH

(b)  $Na_2Cr_2O_7$ 
Phenol

Phenol

P-Benzoquinone

$$CH_3$$
  $CH_3$   $CH_3$ 

- 7. Give one chemical test to distinguish between the following
  - (a) Phenol and 1-Propanol
  - (b) Ethanol and Diethyl ether
  - (c) 1-Propanol and 2-Methyl 2-propanol

[AI Chandigarh]

Ans.

- (a) Add neutral FeCl<sub>3</sub>. Phenol will give violet colour, 1-propanol will not react.
- (b) Add I<sub>2</sub> and NaOH. Ethanol will give yellow ppt. Diethyl ether will not react.
- (c) Add Lucas reagent (conc. HCl + Anhy. ZnCl<sub>2</sub>) 1-Propanol will not react at room temperature, 2-methyl propan-2-ol will give turbidity immediately due to formation of tert. butyl chloride.

o- and p-hydroxy accombinencing

Long Answer Type [III] Questions

8. Write the products of the following reactions:

(a) 
$$CH_3$$
— $CH_2$ — $O$ — $CH_3$  +  $HI$ 

(b)  $CH_3$ — $CS_2$ 
 $CS_2$ 

[AI Chandigarh]

Ans.

(a) 
$$CH_3$$
— $CH_2$ — $O$ — $CH_3$  +  $HI$  —  $CH_3$ — $CH_2$ — $OH$  +  $CH_3I$ 

$$(b) \bigcirc H + Br_2 \xrightarrow{CS_2} \bigcirc H + \bigcirc HBr$$

$$+ \bigcirc HBr$$

- 9. What happen when and the feetless
  - (a) Sodium phenoxide is treated with CH3Cl
  - (b) CH<sub>2</sub>=CH-CH<sub>2</sub>OH is oxidised by PCC
  - (c) Phenol is treated with CH3COCl/anhy AlCl3

Write chemical equation in support of your answer. [AI Panchkula]

ion second and L-Propagol

Anisole is formed.

$$(b)$$
 CH<sub>2</sub>=CH—CH<sub>2</sub>OH  $\xrightarrow{PCC}$  CH<sub>2</sub>=CH—CHO  $(a)$ 

Prop-2-en-1-al is formed.

$$(c) \bigcirc OH \bigcirc OH \bigcirc OH$$

$$+ CH_3COCI \xrightarrow{anhy AlCl_3} \bigcirc + \bigcirc COCH_3$$

$$+ \bigcirc COCH_3$$

o- and p-hydroxy acetophenone is formed.

## Long Answer Type [II] Questions [5 Marks]

- (a) How do you convert the following: 10.
  - (i) Phenol to Anisole
  - (ii) Ethanol to Propan-2-ol
  - (b) Write the mechanism of the following reaction:

$$CH_3CH_2OH \xrightarrow{H_2SO_4} CH_2 = CH_2 + H_2O$$

(c) Why phenol undergoes electrophilic substitution more easily than benzene? [Delhi]

Ans. (a) (i) 
$$OH$$
  $ONa$   $OCH_3$ 

$$+ CH_3I \longrightarrow OH$$

$$(ii) CH_3CH_2OH \xrightarrow{Cu} CH_3 \longrightarrow CH_4$$

$$Ethanol CH_3 \longrightarrow OH$$

$$(ii) CH_3CH_2OH \xrightarrow{Cu} CH_3 \longrightarrow CH_4$$

$$(ii) CH_3MgBr$$

$$(ii) CH_3MgBr$$

$$(iii) H_2O/H^+ CH_3 \longrightarrow CH_4$$

$$(iii) H_2O/H^+ CH_3 \longrightarrow CH_5$$

$$(iii) H_2O/H^+ CH_5$$

- (b) Refer Ans. to Q.5 (b).
- (c) It is because -OH group is electron releasing, activating, therefore, it undergoes electrophilic substitution more readily than benzene due to +R effect.

#### 11. (a) Account for the following:

- (i) o-nitrophenol is more steam volatile than p-nitrophenol.
- (ii) t-butyl chloride on heating with sodium methoxide gives 2-methylpropene instead of t-butylmethylether.

(c) Ethanol < water < phenoi

(a) How can you obtain pheno

- (b) Write the reaction involved in the following:
  - (i) Reimer-Tiemann reaction
  - (ii) Friedal-Crafts Alkylation of Phenol.
- (c) Give simple chemical test to distinguish between Ethanol and Phenol. [Delhi]
- Ans. (a) (i) Ortho nitrophenol is steam volatile because of weak intra-molecular H-bonding, whereas p-nitrophenol is associated with inter-molecular H-bonding. Therefore, it is not steam volatile.
  - (ii) It is due to -I and -R effect of -NO<sub>2</sub> group and +I and +R effect of CH<sub>3</sub> group, p-nitrophenoxide ion is more stable than p-methyl phenoxide ion.
  - (b) (i) Refer Ans. to Q.2 (a).

$$(ii) \bigcirc OH \\ + CH_3Cl \xrightarrow{AlCl_3(anhyd.)} \bigcirc CH_3 \\ + \bigcirc CH_3$$

$$+ \bigcirc CH_3$$

$$OH$$

$$OH$$

$$OH$$

- (c) Add neutral FeCl<sub>3</sub>. Ethanol does not react. Phenol gives violet colour.
- 12. (a) Give equations for the following reactions:
  - (i) Phenol is treated with conc. HNO<sub>3</sub>
  - (ii) Propene is treated with  $B_2H_6$  followed by  $H_2O_2/OH^-$ .
  - (iii) Sodium tert. butoxide is treated with CH3Cl.
  - (b) How will you distinguish between butan-1-ol and butan-2-ol?
  - (c) Arrange the following in increasing order of acidity:

Phenol, Ethanol, Water.

[CBSE]

Ans. (a) (i) 
$$OH \rightarrow O_2N \rightarrow O_2$$

(ii) 
$$CH_3$$
— $CH$ = $CH_2$   $\xrightarrow{(i)} \frac{B_2H_6}{(ii)} \frac{CH_2}{H_2O_2/OH^{-1}}$   $CH_3$ — $CH_2$ 

(iii) 
$$CH_3$$
— $C$ — $CH_3$   $CH_3$ — $C$ — $CH_3$   $CH_3$   $CH_3$   $CH_3$   $CH_3$ 

- (b) Add I<sub>2</sub> and NaOH. Butan-2-ol will give yellow ppt of iodoform where as butan-1-ol will not react.
- (c) Ethanol < water < phenol

#### 13. (a) How can you obtain phenol from

- (i) Cumene (ii) Benzene sulphonic acid
  - (iii) Benzene diazonium chloride?
- (b) Write the structure of major product obtained from dinitration of 3-methyl phenol.
- (c) Write the reaction involved in Kolbe's reaction.

CH<sub>3</sub>—CH—CH<sub>3</sub>

$$CH_3$$

(iii) 
$$\begin{array}{c} N_2^+\text{Cl}^- & \text{OH} \\ \hline \\ Benzene \\ \text{diazonium chloride} \end{array} + N_2 + \text{HCl}$$

OH
$$\begin{array}{c} OH \\ \hline CH_3 \\ \hline \end{array}$$
CH<sub>3</sub>

$$\begin{array}{c} O_2N \\ \hline CH_3 \\ \hline \end{array}$$
3-Methyl phenol
$$\begin{array}{c} OH \\ CH_3 \\ \hline \end{array}$$

$$\begin{array}{c} O_2N \\ \hline \end{array}$$

$$\begin{array}{c} NO_2 \\ \hline \end{array}$$
2,4-Dinitro-5-methyl phenol

## 14. (a) How are following conversions carried out:

[CBSE]

- (i) Aniline to phenol
- (ii) Ethanal to propan-2-ol
- (b) Give chemical test to distinguish between the following pairs of compounds:
  - (i) n-propyl alcohol and iso propyl alcohol
  - (ii) Phenol and Benzyl alcohol

(c) Write IUPAC name of 
$$CHO$$

NH<sub>2</sub>

NaNO<sub>2</sub> + HCl

OH

NaNO<sub>2</sub> + HCl

Diazotization

Aniline

OH

CHO

Phenol

$$(ii) CH_3-C-H \xrightarrow{CH_3MgBr} CH_3-CH-CH_3 \xrightarrow{H_2O/H^+} CH_3-CH-CH_3$$
Ethanal Isopropoxy magnesium bromide Propan-2-ol

- (b) (i) Heat both the compounds with I<sub>2</sub> and NaOH at 330 K. Iso propyl alcohol will give yellow ppt. of iodoform n-propyl alcohol will not give yellow ppt.
  - (ii) Add neutral FeCl<sub>3</sub> solution to both the compounds, phenol give violet colour whereas benzyl alcohol does not react with FeCl<sub>3</sub>.
- (c) 3-Hydroxy benzaldehyde.
- 15. (a) Write mechanism of preparation of alcohol from alkene (acid catalysed hydration)
  - (b) Give reason:
    - (i) o-nitrophenol has lower boiling point than p-nitro phenol.
    - (ii) Methyl phenyl ether can not be prepared from bromo benzene. [CBSE for Blind]

Ans. (a)  $CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3 - CH_2 - OH$ 

Step I: Protonation of ethene (alkene) to form carbocation by electrophilic attack of H<sub>3</sub>O<sup>®</sup>:

$$\begin{array}{c} H_2O + H^+ \longrightarrow H_3 \overset{\oplus}{O} \\ \\ CH_2 = CH_2 + H_3 \overset{\oplus}{O} \longrightarrow H - \overset{\oplus}{C} - H + H_2 \overset{\oplus}{O} \\ \\ \text{Ethene} \end{array}$$
 Electrophile

Step II: Nucleophilic attack of water on carbocation:

Step III: Deprotonation to form ethanol (alcohol):

- (b) (i) p-nitro phenol has inter molecular H-bonding whereas in o-nitro phenol, there is weak intra-molecular H-bonding.
  - (ii) The C—Br bond in bromobenzene is difficult to break due to partial double bond character due to resonance.