Q.2. What happens when Toluene is reacted with Chromium trioxide?

Ans: When Toluene is reacted with chromium trioxide in presence of acetic anhydride, Toluene is oxidized into Benzal diacetate. When benzal diacetate is hydrolysed, it changes into Benzaldehyde.

CH₃

$$+ [O] \xrightarrow{\text{CrO}_3} \xrightarrow{\text{H}_2O} \xrightarrow{\text{CoCH}_3} \xrightarrow{\text{H}_2O} \xrightarrow{\text{H}_2O}$$
Toulene

Benzal diacetate

Benzaldehyde
$$+ 2 \text{ CH}_3\text{COOH}$$

Q.3. Give an example of Gattermann - Formylation reaction?

Ans: The reaction of Benzene with Hydrogen cyanide and dil.HCl in presence of anhydrous AlCl₃ to give benzaldehyde is called as Gattermann - Formylation reaction. Benzaldehyde is obtained as product.

$$\begin{array}{c}
H \\
C = O \\
\hline
\text{Benzene} + HCN + HCI \xrightarrow{\text{AlCl}_3} \\
\hline
\text{Benzaldehyde}
\end{array}$$

Q.4. How can we get acetophenone from benzene?

Ans: When Benzene is reacted with ethanoyl chloride in presence of anhydrous AlCl₃, it undergoes electrophilic substitution reacted to give acetophenone.

$$\begin{array}{c|c}
\hline
O \\
+ CH_3 - C - Cl \\
\hline
Ethanoyl \\
Chloride
\\
Acetophenone
\\
Acetophenone
\\
CH_3 + HCl
\\
Acetophenone$$

This type of chemical reaction is called as Friedel-craft's acylation reaction.

Q.5. What is Benzoin condensation?

Ans: On heating aromatic aldehyde with ethanolic solution of KCN, two molecules of aromatic aldehyde undergo condensation to form benzoin. It is called benzoin condensation.

$$2 \bigcirc - \overset{O}{C} - H \xrightarrow{\text{alc.KCN}} \bigcirc - \overset{OH}{CH} - \overset{O}{C} - \overset{OH}{C}$$
Benzoin

Benzoin

Short Questions-Answers

Q.1. Show your acquaintance with Perkin reaction.

Ans: Perkin's condensation: The reaction of aromatic aldehyde with aliphatic acid anhydride in presence of sodium or potassium salt of same acid to produce α, β-unsaturated acid is known as Perkin's condensation. e.g.

$$CH$$

O

O

CH = CH - C-OH

Benzaldehyde

Ethanoic anhydride

CH₃-C-O-Na⁺

CH₃-C-O-Na⁺

Δ, 220°C

Cinnamic acid
(α, β-unsaturated acid)

Mechanism:

Step I: Acetate ion abstracts α-hydrogen from the anhydride to produce a carbanion (I).

$$CH_3COO^-Na^+ \longrightarrow CH_3COO^- + Na^+$$
 $CH_3-COO + H)-CH_2-CO-O-CO-CH_3 \longrightarrow CH_3-COOH + CH_2-CO-O-CO-CH_3$

Step II: The carbanion (I) attacks carbonyl C-atom of benzaldehyde to form carbanion (II).

$$H-C=O$$
 $H-C-CH_2-CO-O-CO-CH_3$
 $+ CH_2-CO-O-CO-CH_3$
Carbanion (II)

Step III: The carbanion (II) abstracts proton from acid to give aldol type compound (III).

Step IV: The compound (III) undergoes dehydration followed by hydrolysis at 170° to give cinnamic acid.

OH
$$H - C - CH - CO - O - CO - CH_3$$

$$CH = CH - CO - O - CO - CH_3$$

$$H_2O$$

$$CH_3COOH$$

$$CH_3COOH$$

$$Cinnamic acid$$

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