Chemistry Study Materials for Class 12

(NCERT Based Notes of Chapter - 11)

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Aldehyde, Ketones and Carboxylic Acid

Preparation of Aldehydes and Ketones

1. **By oxidation of alcohols**: Primary alcohols on oxidation with mild oxidising agents like CrO_3 to give aldehydes while secondary alcohols give ketones.

$$\underset{\text{Primary alcohol}}{R\text{-}CH_2OH} \xrightarrow{[O]} \underset{\text{Aldehyde}}{R\text{-}CHO}$$

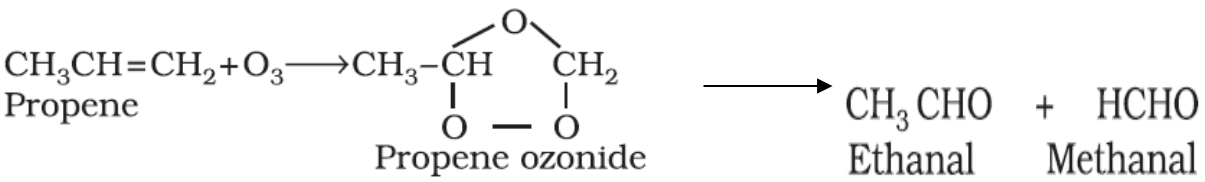
$$\underset{\text{Secondary alcohol}}{R_2CHOH} \xrightarrow{[O]} \underset{\text{Ketones}}{R_2CO}$$

2. **By dehydrogenation of alcohols**: Alcohols when heated with Cu or Silver catalyst at 573K, we get carbonyl compounds. Primary alcohols give aldehydes, while secondary alcohols give ketones.

$$\underset{\text{Primary alcohol}}{R\text{-}CH_2OH} \xrightarrow{\text{Cu/573 K}} \underset{\text{Aldehyde}}{R\text{-}CHO}$$

$$\underset{\text{Secondary alcohol}}{R_2CHOH} \xrightarrow{\text{Cu/573 K}} \underset{\text{Ketones}}{R_2CO}$$

3. **By ozonolysis of alkenes**: Alkenes add ozone followed by hydrolysis with zinc dust and water, we get aldehydes or ketones.



4. **By hydration of alkynes**: Alkynes add water in the presence of H_2SO_4 and $HgSO_4$ to give carbonyl compounds. Ethyne (acetylene) gives acetaldehyde and all other alkynes give ketones.

$$\underset{\text{Ethyne}}{CH \equiv CH} + H_2O \xrightarrow{H2SO4/HgSO4} \underset{\text{Acetaldehyde}}{CH_3\text{-}CHO}$$

$CH_3\text{-}C \equiv CH + H_2O \xrightarrow{H2SO4/HgSO4} CH_3\text{-}CO\text{-}CH_3$

Propyne Acetone

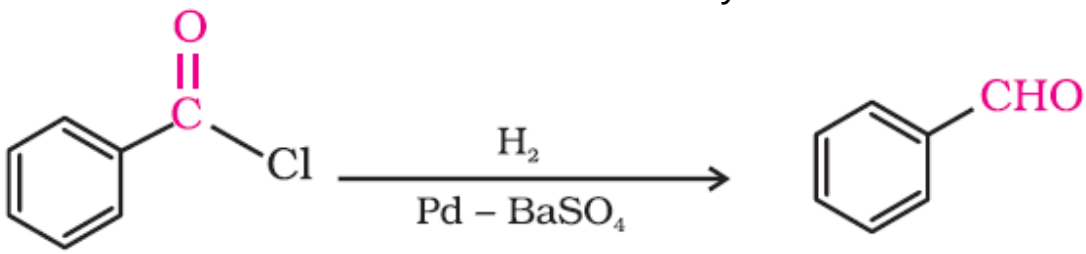
Preparation of Aldehydes

1. **From acyl chloride (Acid chloride) [*Rosenmund's Reduction*]:**

Acid chlorides react with hydrogen in presence of Pd supported on $BaSO_4$, we get aldehydes. This reaction is called Rosenmund's reduction.

$R\text{-}COCl + H_2 \xrightarrow{Pd/BaSO4} R\text{-}CHO + HCl$

Acid chloride Aldehyde



Benzoyl chloride Benzaldehyde

2. **From nitriles and esters**: ***(Stephen reaction)***

Nitriles when reduced with stannous chloride in the presence of hydrochloric acid, we get imines, which on hydrolysis give corresponding aldehyde. This reaction is called ***Stephen reaction***.

$RCN + SnCl_2 + HCl \longrightarrow R\text{-}CH{=}NH \xrightarrow{H3O+} R\text{-}CHO$

Nitrile Imines Aldehyde

Nitriles can also be selectively reduced by *diisobutylaluminium hydride* (DIBAL-H) to imines followed by hydrolysis to aldehydes. DIBAL-H does not affect other reducable groups like double bonds.

$R\text{-}CN \xrightarrow[2.\ H2O]{1.AlH\ (i\text{-}Bu)2} R\text{-}CHO$

Nitrile Aldehyde

$CH_3\text{-}CH{=}CH\text{-}CH_2\text{-}CN \xrightarrow[2\ H2O]{1.\ DIBAL\text{-}H} CH_3\text{-}CH{=}CH\text{-}CH_2\text{-}CHO$

Esters are also reduced to aldehydes with DIBAL-H.

$CH_3\text{-}CH_2\text{-}COOCH_3 \xrightarrow[2\ H2O]{1.\ DIBAL\text{-}H} CH_3\text{-}CH_2\text{-}CHO$

Methyl Propanoate Propanal

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