Aldehydes and ketones can be prepared using a wide variety of reactions. Although these reactions are discussed in greater detail in other sections, they are listed here as a summary and to help with planning multistep synthetic pathways. Please use the appropriate links to see more details about the reactions.

**Oxidation of $^{1}$o alcohols with PCC to form aldehydes**

\[
\begin{align*}
\text{R} & \quad \text{C} \quad \text{H} \\
\text{H} & \quad \text{C} \quad \text{OH} \\
\text{PCC} & \quad \text{CH}_2\text{Cl}_2 \\
\end{align*}
\]

**Hydration of an alkyne to form aldehydes**

Anti-Markovnikov addition of a hydroxyl group to an alkyne forms an aldehyde. The addition of a hydroxyl group to an alkyne causes tautomerization which subsequently forms a carbonyl.

**Reduction of an ester, acid chloride or nitrile to form aldehydes**

- **Ester**
  \[
  \begin{align*}
  \text{R} & \quad \text{O} \quad \text{O} \\
  \text{O} & \quad \text{R'} \\
  \end{align*}
  \]
  \[1) \text{DIBAL-H} \quad 2) \text{H}_2\text{O} \]

- **Acid Chloride**
  \[
  \begin{align*}
  \text{R} & \quad \text{C} \quad \text{Cl} \\
  \end{align*}
  \]
  \[1) \text{LiAlH(O-t-Bu)}_3 \quad 2) \text{H}_2\text{O} \]

- **Nitrile**
  \[
  \begin{align*}
  \text{R} & \quad \text{C} \quad \text{N} \\
  \end{align*}
  \]
  \[1) \text{DIBAL-H} \quad 2) \text{H}_2\text{O} \]
Oxidation of $2^\circ$ alcohols to form ketones

Typically uses Jones reagent ($\text{CrO}_3$ in $\text{H}_2\text{SO}_4$) but many other reagents can be used

\[
\begin{align*}
\text{H} & \quad \text{CrO}_3 \\
\text{R} & \quad \text{OH} \\
\text{R'} & \quad \text{H}_2\text{SO}_4 \\
\end{align*}
\]

$2^\circ$ Alcohol

Hydration of an alkyne to form ketones

The addition of a hydroxyl group to an alkyne causes tautomerization which subsequently forms a carbonyl. Markovnikov addition of a hydroxyl group to an alkyne forms a ketone.

\[
\text{R} - \text{C} = \text{C} - \text{H} \quad \text{H}_2\text{O} \quad \text{H}_2\text{SO}_4 \quad \text{Hg}^{2+} \\
\text{Alkyne} \\
\text{Acid Chloride} \\
\]

Friedel-Crafts acylation to form a ketone

\[
\begin{align*}
\text{C} & \quad \text{O} \\
\text{R} & \quad \text{Cl} \\
\text{Cl} & \quad \text{Cl} \\
\text{Acid Chloride} \\
\end{align*}
\]

Reaction of Grignard reagents with nitriles to form ketones

\[
\begin{align*}
\text{R} - \text{C} & \quad \text{N} \\
1) \text{R'MgBr} & \\
2) \text{H}_2\text{O} & \\
\text{Nitrile} \\
\end{align*}
\]

Alkenes can be cleaved using ozone ($\text{O}_3$) to form aldehydes and/or
ketones

This is an example of a Ozonolysis reaction.

Contributors

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