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 $1^\circ$ alcohols with PCC to form aldehydes

$\text{CHOH} \xrightarrow{\text{PCC, CH}_2\text{Cl}_2} \text{C=H}$

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
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

$$\text{H} \quad \begin{array}{c} \text{C} \\ \text{R} \end{array} \quad \text{OH} \quad \text{CrO}_3 \quad \begin{array}{c} \text{O} \\ \text{R} \end{array} \quad \text{C} \quad \text{R} \quad \text{H}_2\text{SO}_4$$

2° 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.

$$\begin{array}{c} \text{R} \\ \text{C} \end{array} \quad \text{C} \quad \text{H} \quad \begin{array}{c} \text{H} \\ \text{H}_2\text{SO}_4 \quad \text{Hg}^{2+} \end{array} \quad \begin{array}{c} \text{HO} \\ \text{R} \\ \text{C} \end{array} \quad \text{C} \quad \text{H} \quad \text{H}_2\text{SO}_4 \quad \text{Hg}^{2+} \quad \begin{array}{c} \text{R} \\ \text{C} \end{array} \quad \text{C} \quad \text{H}_3$$

Friedel-Crafts acylation to form a ketone

$$\begin{array}{c} \text{C} \\ \text{H} \end{array} + \begin{array}{c} \text{R} \\ \text{C} \end{array} \quad \begin{array}{c} \text{O} \\ \text{Cl} \end{array} \quad \text{AlCl}_3 \quad \begin{array}{c} \text{R} \\ \text{C} \end{array} \quad \text{R} \quad \text{C}$$

Acid Chloride

Reaction of Grignard reagents with nitriles to form ketones

$$\begin{array}{c} \text{R} \\ \text{C} \end{array} \quad \text{C} \quad \text{N} \quad \begin{array}{c} \text{R} \quad \text{MgBr} \quad \text{H}_2\text{O} \end{array} \quad \begin{array}{c} \text{R} \\ \text{C} \end{array} \quad \text{R} \quad \text{R} \quad \text{C} \quad \text{R}$$

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

This is an example of a Ozonolysis reaction.

Contributors

- Prof. Steven Farmer (Sonoma State University)