

# Carbanions Encyclopedia Article

## Carbanions

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# Carbanions

Carbanions are **carbon** anions, having the general formula  $R_3C^-$ . This negatively charged **ion** is highly reactive. Carbanions can be produced by the cleavage of certain single bonds such as those found between carbon and **hydrogen**, carbon and **halogens**, carbon and **metals**, and carbon and carbon. It is quite difficult to recognize the presence of these carbanions directly, they have to be inferred from their actions.

With rare exception carbanions are not isolated, but are intermediate in reactions. These reactions are both numerous and important. They include the biological biosynthesis of **fatty acids**, where the important event in the elongation of the acetate starting material is cyclization of the acetate carbanion.

Carbanions are commonly prepared by either deprotonation (cleavage of a carbon-**hydrogen bond**, invariably adjacent to a **functional group** that is capable of **resonance** or inductive stabilization of the negative charge on the carbon) or metalation of a carbon-halogen bond. In the process of metalation a metal (usually an alkali metal such as Li, Na, or K) inserts into the carbon-halogen bond (for example:  $2Li + R_3C-Br \rightarrow R_3C^-Li^+ + LiBr$ ).

Two important (and uncommon) examples of stable carbanions are the cyanide **anion** ( $NC^-$ ) and the metallocenes. The metallocenes, an extremely important class of catalysts for modern polymer synthesis, are made from the reaction of two cyclopentadienylide anions (obtained by deprotonation of cyclopentadiene by an organometallic reagent, such as a Grignard reagent) with a metal. The result is the metallocene **salt**, where the cationic metal is located between the two cyclopentadienylide rings in what is commonly called a "sandwich" arrangement.

Carbanions are negatively charged carbon atoms of extraordinary importance to the synthesis of both biologically and man-made chemicals.