Basic reaction of 1,4 addition

In 1,4 addition the Nucleophile is added to the carbon β to the carbonyl while the hydrogen is added to the carbon α to the carbonyl.

Mechanism for 1,4 addition

1) Nucleophilic attack on the carbon β to the carbonyl

2) Proton Transfer
Here we can see why this addition is called 1,4. The nucleophile bonds to the carbon in the one position and the hydrogen adds to the oxygen in the four position.

3) Tautomerization

Enolates undergo 1,4 addition to α, β-unsaturated carbonyl compounds is a process called a Michael addition. The reaction is named after American chemist Arthur Michael (1853-1942).

**Examples of Michael Additions**

\[
\begin{align*}
\text{EtO} & \quad \text{CO} \quad \text{CO} \quad \text{Et} \\
\text{H}_2 & \quad \text{O} \\
\end{align*}
\]

\[
\begin{align*}
\text{H} & \quad \text{C} \quad \text{H} \\
\text{H} & \quad \text{H} \\
\end{align*}
\]

\[
\begin{align*}
\text{NaOEt} & \quad \rightarrow \\
\text{EtO} & \quad \text{CO} \quad \text{CO} \quad \text{Et} \\
\end{align*}
\]

\[
\begin{align*}
\text{EtO} & \quad \text{OEt} \\
\text{H}_2 & \quad \text{C} \\
\end{align*}
\]

\[
\begin{align*}
\text{H} & \quad \text{C} \quad \text{H} \\
\text{H} & \quad \text{H} \\
\end{align*}
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\begin{align*}
\text{NaOEt} & \quad \rightarrow \\
\text{EtO} & \quad \text{CO} \quad \text{CO} \quad \text{Et} \\
\end{align*}
\]

\[
\begin{align*}
\text{EtO} & \quad \text{OEt} \\
\text{H}_2 & \quad \text{C} \\
\end{align*}
\]
Contributors

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