This page gives you the facts and a simple, uncluttered mechanism for the electrophilic substitution reaction between benzene and chloromethane in the presence of an aluminium chloride catalyst. Any other chloroalkane would work similarly.

### The electrophilic substitution reaction between benzene and chloromethane

Alkylation means substituting an alkyl group into something - in this case into a benzene ring. A hydrogen on the ring is replaced by a group like methyl or ethyl and so on.

Benzene is treated with a chloroalkane (for example, chloromethane or chloroethane) in the presence of aluminum chloride as a catalyst. On this page, we will look at substituting a methyl group, but any other alkyl group could be used in the same way. Substituting a methyl group gives methylbenzene - once known as toluene.

\[
[C_6H_6 + CH_3Cl \rightarrow C_6H_5CH_3 + HCl]
\]

or better:

\[
\text{C}_6\text{H}_6 + \text{CH}_3\text{Cl} \rightarrow \text{C}_6\text{H}_5\text{CH}_3 + \text{HCl}
\]

The aluminium chloride isn't written into these equations because it is acting as a catalyst. If you wanted to include it, you could write AlCl\textsubscript{3} over the top of the arrow.

### The formation of the electrophile

The electrophile is CH\textsubscript{3}\textsuperscript{+}. It is formed by reaction between the chloromethane and the aluminum chloride catalyst.

\[
[ CH_3\text{Cl} + \text{AlCl}_3 \rightarrow \text{CH}_3\textsuperscript{+} + \text{AlCl}_4\textsuperscript{-} ]
\]

### The electrophilic substitution mechanism

#### Stage one

#### Stage two
The hydrogen is removed by the $\text{AlCl}_4^-$ ion which was formed at the same time as the $\text{CH}_3^+$ electrophile. The aluminum chloride catalyst is re-generated in this second stage.

Contributors

Jim Clark (Chemguide.co.uk)