This page explains what acid anhydrides are and looks at their simple physical properties such as boiling points. It introduces their chemical reactivity in a general way. A carboxylic acid such as ethanoic acid has the structure:

\[
\text{CH}_3\text{C}-\overset{\text{O}}{\text{O}}\text{H}
\]

ethanoic acid

If you took two ethanoic acid molecules and removed a molecule of water between them you would get the acid anhydride, ethanoic anhydride (old name: acetic anhydride).

\[
\text{CH}_3\text{C}-\overset{\text{O}}{\text{O}}\text{H} \quad \overset{\text{O}}{\text{O}} \quad \text{CH}_3\text{C}-\overset{\text{O}}{\text{O}}
\]

ethanoic anhydride

You can actually make ethanoic anhydride by dehydrating ethanoic acid, but it is normally made in a more efficient, round-about way.

**Acid Anhydrides react with water to form carboxylic acids**

**General Reaction**

\[
\text{Acid Anhydride} + \text{H}_2\text{O} \xrightarrow{\text{Pyridine}} 2 \text{ Carboxylic acid}
\]

**Example 1:**

\[
\text{PhC}O\text{CPh} + \text{H}_2\text{O} \xrightarrow{\text{Pyridine}} 2 \text{PhCOH}
\]

**Mechanism**

1) Nucleophilic Attack by the water molecule
2) Deprotonation by pyridine

3) Leaving group removal

4) Protonation of the carboxylate

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**Acid Anhydrides react with alcohols to form esters**

Reactions of anhydrides use Pyridine as a solvent

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Example 1:
Mechanism

1) Nucleophilic Attack by the Alcohol

\[
\begin{align*}
\text{Acid Anhydrides react with amines to form amides}
\end{align*}
\]
General Reaction

Example 1:

![Chemical reaction diagram]

Mechanism

1) Nucleophilic Attack by the Amine

![Mechanism step 1 diagram]

2) Deprotonation by the amine

![Mechanism step 2 diagram]

3) Leaving group removal

![Mechanism step 3 diagram]

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