Organic Reactions

* During chemical reactions, bonds are broken and new bonds are formed.

* Covalent bonds are strong so many organic reactions are slow, a continuous supply of **energy** is needed and **catalysts** are often used to speed up reactions.

Types of Organic Reactions

* Substitutions
* Addition
* Combustion
* Elimination
* Condensation
* Esterification
* Hydrolysis
* Oxidation and Reduction

Substitution Reactions

* An atom replaces one that is present on the hydrocarbon
  * Common in hydrocarbons with single bonds (alkanes)

Substitution Reactions

* Substitution with Halogens in Alkanes
  * $C_2H_6 + Cl_2 \rightarrow C_2H_3Cl + HCl$

The halogen has replaced an H atom

Addition

* An atom is added on to the hydrocarbon
  * Common in unsaturated hydrocarbons (alkenes, alkynes)

Addition

* Addition of Hydrogen (Hydrogenation)

* $H_2C = CH_2 + H_2 \rightarrow H_3C - CH_3$

The double bond has been broken and the hydrogen has been added

Addition

* Addition of Hydrogen Halides

* $H_3C - HC = CH_2 + HCl \rightarrow H_3C - CH_2 - CH_2Cl$

The double bond has been broken and the hydrogen and halide has been added

Addition

* Addition of Hydrogen Halides

* $H_3C - HC = CH_2 + HCl \rightarrow H_3C - CHCl - CH_3$

Markovnikov's Rule: When adding hydrogen halides, the carbon with the most hydrogens already receives the hydrogen

Addition

* Addition of Halogens

* $H_2C = CH_2 + Br_2 \rightarrow H_2CBr - CH_2Br$

The double bond has been broken and the halogen has been added

Combustion

* The reaction of hydrocarbons with oxygen to produces water vapour and carbon dioxide
* Require some form of energy

Combustion

Complete:

$$C_nH_n + O_2 \xrightarrow{\triangle} CO_2 + H_2O$$

Incomplete:

$$C_nH_n + O_2 \xrightarrow{\triangle} C + CO + H_2O$$

Elimination Reaction

* Occurs when atoms are removed and a double bond is formed.

* Only take place in presence of a string acid.

* $CH_3 - CHOH - CH_3 \rightarrow CH_2{=}CH - CH_3 + H_2O$

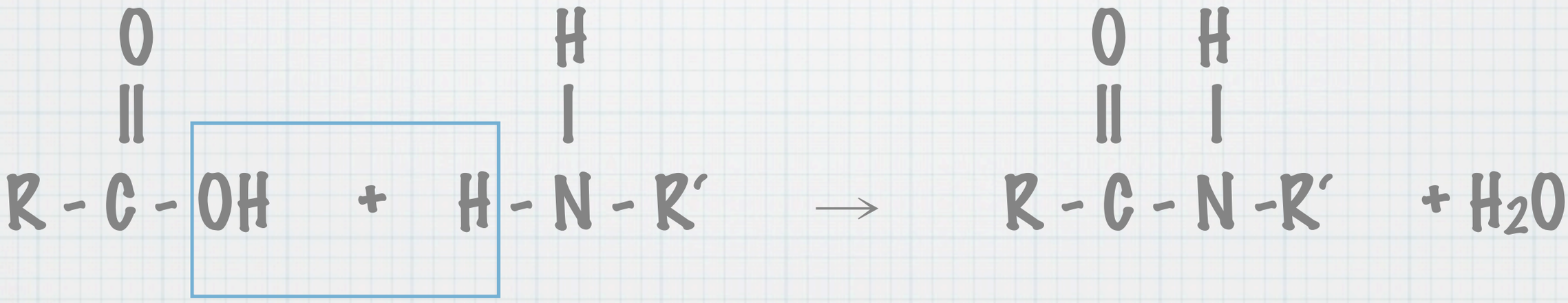
Elimination Reaction

* Occurs when atoms are removed and a double bond is formed.
* Only take place in presence of a string acid.
* $CH_3 - CHOH - CH_3 \rightarrow CH_2=CH - CH_3 + H_2O$

As a rule, the H is taken from the carbon with the most carbon carbon bonds

Condensation

* Two smaller molecules joined together by the removal of a water molecule



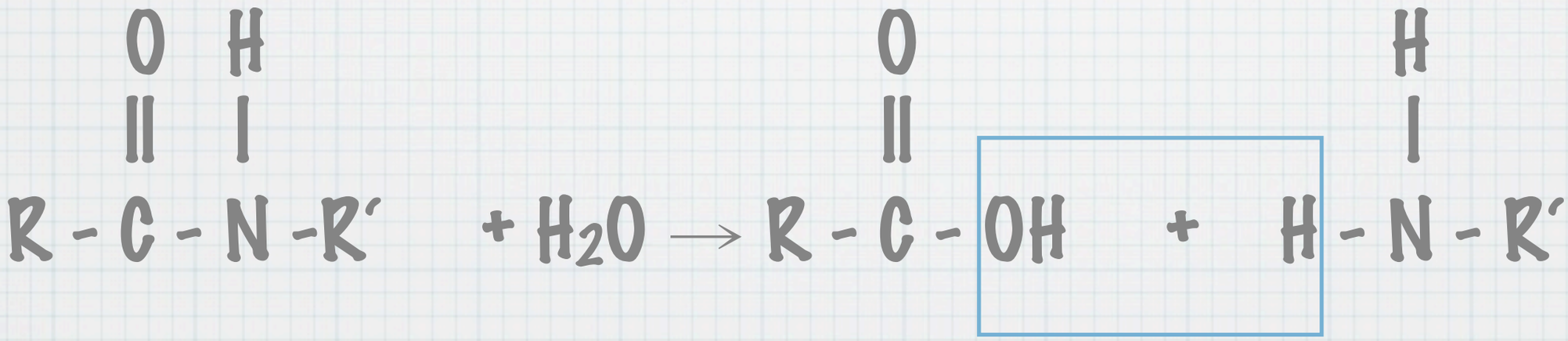
Esterification

* A carboxylic acid and an alcohol combine to form an ester in the presence of a catalyst.
* Specialized hydrolysis reaction

The bond formed is called an ester linkage

Hydrolysis

* A large molecule is broken down into smaller monomers using water.



Oxidation and Reduction Reactions

* Oxidation: Increases the number of carbon-oxygen bonds

* Must happen in the presence of and oxidizing agent [O] (ex. $KMnO_4$)

$$CH_3 - CH_2 - CH_2 - OH + [O] \rightarrow CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - OH$$

Oxidation and Reduction Reactions

* Reduction: Decreases the number of carbon-oxygen bonds

* Must happen in the presence of and reducing agent [H] (ex. $LiAlH_4$)