

Chemistry C10 - Organic Reactions

You must know how to balance equations for the reactions of alkenes and the combustion of alcohol, but no other reactions in this series.

	Alkene	Alcohol	Carboxylic acid	Ester
General formula	C_nH_{2n}	$C_nH_{2n+1}OH$	$C_nH_{2n-1}OOH$ (not required)	$C_nH_{2n}O_2$ (not required)
Functional group	C=C	-OH	-COOH	-COO-
Example formula	C_3H_6	$CH_3CH_2CH_2OH$	CH_3CH_2COOH	$CH_3COOCH_2CH_3$
Name of example	Propene	Propanol	Propanoic acid	Ethyl ethanoate
Solubility in water	Not soluble	Very soluble	Very soluble	Not soluble

Reaction of alkenes

Alkenes are described as "unsaturated". This means they have room to add two more atoms because they have a double bond **and** two fewer hydrogen atoms than the alkane with the same number of carbon atoms.

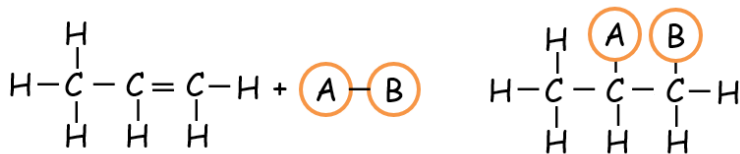
Combustion: (reaction with oxygen by burning). Compared to an alkane, alkenes are not as good fuels as they undergo **incomplete** combustion:

- Releases less energy
- Produce a smokier and orange flame

Addition of hydrogen H_2 needs a catalyst and heat about 300 °C. It produces an alkane.

Addition of a halogen Cl_2 or Br_2 or I_2 react easily at room temperature. Both atoms of the halogen add to the double bond. This is the TEST for an alkene - reacting bromine water (orange colour) with an alkene will form a colourless product.

Addition of steam H_2O needs a catalyst and heat. It produces an alcohol because an OH adds to one of the carbon atoms, and H adds to the other. This reaction is reversible \rightleftharpoons



For hydrogen A=H and B=H, for bromine A=Br and B=Br. For water A=OH B=H and the reaction arrow must be a reversible arrow!

Uses: Alkenes are turned into polymers, plastics, medicines and make-up

Formation and Reaction of alcohols

Two ways of making alcohols:

1. from alkenes which come from crude oil. (Non-renewable)
2. from fermentation of sugar. (Renewable)



Conditions: warm (25 - 30°C) and NO oxygen allowed (anaerobic) - the yeast will die when too much alcohol is made (about 15 %). A limewater test will find this happens by detecting if CO_2 is still being produced.

Sodium will react with alcohol just like it does with water. The Na replaces the H on the oxygen atom, forming hydrogen gas (H_2) and $-O^-Na^+$

Combustion of alcohol: Alcohols burn with a smokeless blue flame, the O atom in the alcohol means it burns with complete combustion.

Oxidation of alcohol: This turns the alcohol into a carboxylic acid. A reagent called potassium dichromate is used. Adding oxygen is shown by an O atom in square brackets [O]. Colour change orange to green.

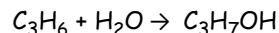
Uses: Alcohols are used as solvents (they dissolve substances and can also mix well with water) and are used in perfumes and hand sanitisers.

Reaction of alcohol with carboxylic acids: This forms an ester.
 $\text{carboxylic acid} + \text{alcohol} \rightleftharpoons \text{ester} + \text{water}$

pH of carboxylic acids - weak acids [higher content only]

Carboxylic acids will fizz gently with carbonates (e.g. $CaCO_3$). They have a pH of 4 to 5, meaning they are weak acids. (A weak acid is only partially ionised, whereas a strong acid is completely ionised).

Addition of steam to an alkene



Combustion example : Alcohol

