

C7 Alkenes and alcohols

Separate Chemistry Paper 2 extras | AQA 8462 | Core: Foundation + Higher

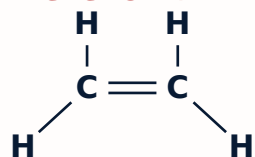
Supplement to shared topic notes: revise the main topic sheets as well.

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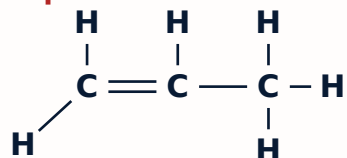
Recognise and draw alkenes

An alkene has a **C=C double bond**. Open-chain alkenes with one double bond follow C_nH_{2n} . They are unsaturated: more atoms can add across the double bond.

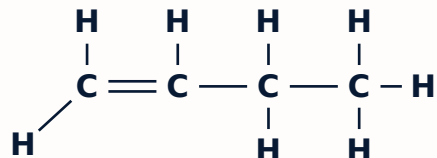
Ethene C_2H_4



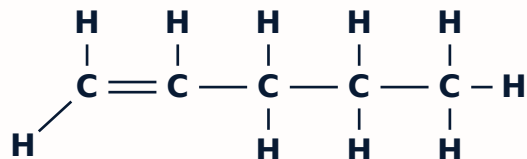
Propene C_3H_6



Butene C_4H_8



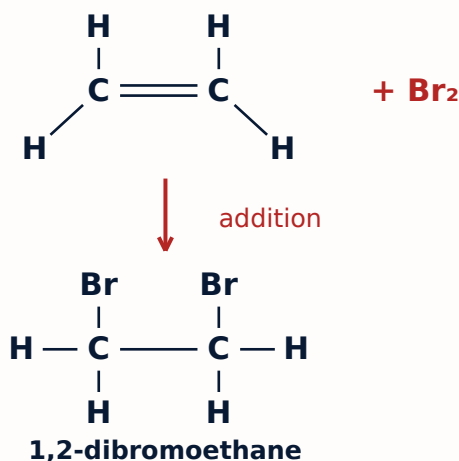
Pentene C_5H_{10}



The butene and pentene examples have the double bond at the end. Check every carbon has **four bonds** and every hydrogen has one.

Addition at the C=C bond

One bond of $C=C$ opens. Each carbon forms one new bond, leaving a C-C single bond. One organic product forms.



Add to alkene	Product and conditions
Hydrogen, H_2	Alkane; heated with a nickel catalyst.
Steam, H_2O	Alcohol; high temperature and pressure, acid catalyst.
Cl_2 , Br_2 or I_2	Two halogen atoms add; room temperature.

Bromine water changes from **orange to colourless**. Alkenes can burn with smoky flames in air because combustion is incomplete.

Alcohols: the -OH group

Name	Condensed formula
Methanol	CH_3OH
Ethanol	CH_3CH_2OH
Propanol	$CH_3CH_2CH_2OH$
Butanol	$CH_3CH_2CH_2CH_2OH$

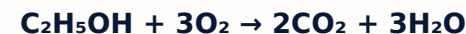
Alcohols are used as **fuels and solvents**. These first alcohols dissolve in water to form neutral solutions; longer chains are less soluble.

With sodium: hydrogen bubbles form and a salt is made.

In air: complete combustion makes carbon dioxide and water.

With an oxidising agent: these primary alcohols form carboxylic acids.

Ethanol combustion:



Fermentation produces ethanol

Yeast acts on a sugar solution in warm conditions, about **25-35°C**, without oxygen. Glucose produces ethanol and carbon dioxide. Too cold is slow; excessive heat denatures yeast enzymes.

Recognise the -OH group attached to carbon. The balanced combustion equation is the alcohol reaction equation you need to construct.

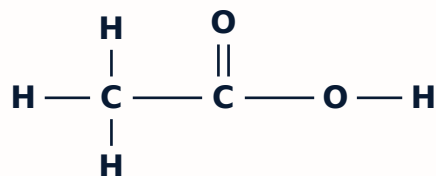
C7 Carboxylic acids and polymers

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Carboxylic acids and esters



Ethanoic acid: -COOH group

Name	Condensed formula
Methanoic acid	HCOOH
Ethanoic acid	CH ₃ COOH
Propanoic acid	CH ₃ CH ₂ COOH
Butanoic acid	CH ₃ CH ₂ CH ₂ COOH

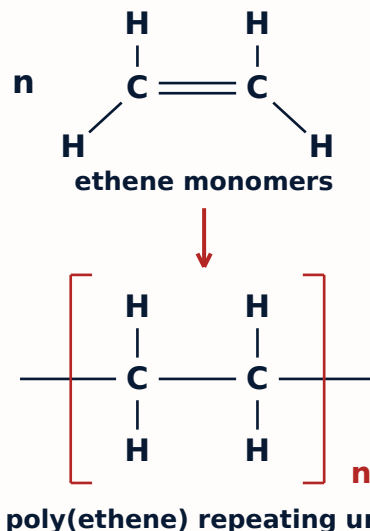
The **-COOH group** determines characteristic reactions. These acids dissolve in water to make acidic solutions.

With carbonates: a salt, water and carbon dioxide form. Fizzing is observed; the gas turns limewater cloudy.

With alcohols: an ester and water form. Warm with an acid catalyst. Ethanoic acid + ethanol form **ethyl ethanoate** + water.

Many esters have fruity smells and are used in perfumes or flavourings. Recognise ethyl ethanoate; further ester names are not required.

Addition polymerisation



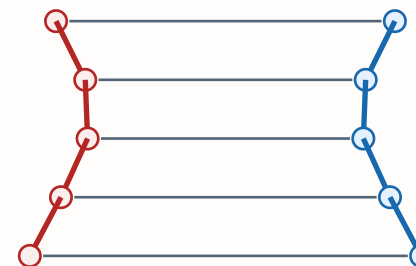
Many alkene **monomers** join to make one long polymer chain. The repeat unit contains the **same atoms** as the monomer: no small molecule is lost.

To draw a repeat unit: change C=C to C-C, retain the attached groups, show bonds continuing through both brackets, then add **n**.

To recover the monomer: remove the brackets and chain continuation bonds, then restore the C=C bond.

Poly(propene): the CH₃ side group stays attached to the same backbone carbon. Do not put it into the main chain or delete it.

Naturally occurring polymers



Untwisted DNA schematic

The molecule twists into a double helix

DNA stores genetic instructions. Most DNA molecules have two chains arranged as a double helix. Their monomers are **nucleotides**; four different nucleotide types are used.

Natural polymer	Monomers
DNA	Nucleotides
Protein	Amino acids
Starch	Glucose molecules
Cellulose	Glucose molecules

Different monomer sequences and structures give polymers different functions.

Tier boundary: addition polymers and this natural-polymer knowledge are core. Explaining amino-acid and condensation reactions belongs on the Higher page.

C7 Weak acids and condensation polymers

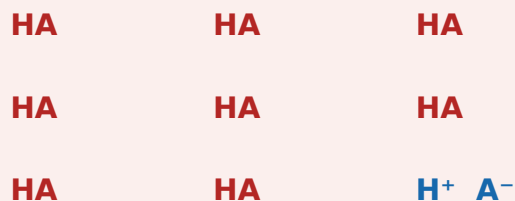
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Weak acids: partial ionisation

A carboxylic acid ionises only partly in water. Most acid particles remain molecules; only some release H^+ ions. Use a reversible arrow:



Mostly molecules; few ions

At the **same concentration**, a weak acid has fewer H^+ ions than a strong acid, so it has a **higher pH**. A strong acid is fully ionised in water.

Strength describes the fraction ionised.

Concentration describes the amount of acid per unit volume. A weak acid can be concentrated.

A decrease of one pH unit corresponds to a tenfold increase in hydrogen-ion concentration. For example, pH 3 has 100 times the H^+ concentration of pH 5.

The particle picture is schematic; its ionised fraction is not a measured value.

Condensation: two end groups

Monomers have **two functional groups**, so each molecule can link at both ends. When a link forms, a small molecule, often water, is eliminated.

A **diol** has two $-\text{OH}$ groups. A **dicarboxylic acid** has two $-\text{COOH}$ groups. Together they make a **polyester**.



Ester link: $-\text{C}(=\text{O})-\text{O}-$

At each ester link, $-\text{OH}$ from the acid group and H from the alcohol group leave as H_2O . R and R' represent the rest of the carbon-containing groups.

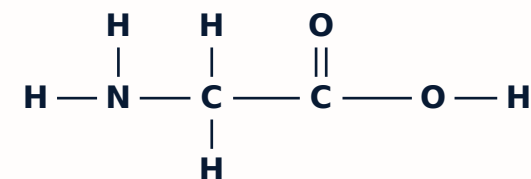
Example monomers:



A repeat unit contains residues of both monomers joined by ester links. Account for the atoms lost as water; do not copy both monomers unchanged.

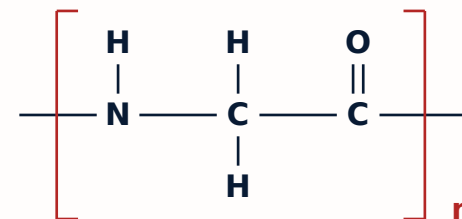
Compare: addition keeps all monomer atoms in the polymer. Condensation produces a small-molecule by-product; its monomers need not contain $\text{C}=\text{C}$.

Amino acids and polypeptides



Glycine: $\text{H}_2\text{NCH}_2\text{COOH}$

An amino acid has an **amino group**, $-\text{NH}_2$, and a **carboxyl group**, $-\text{COOH}$. These two different groups let amino acids join by condensation.



Polypeptide made from glycine

A peptide link is $-\text{C}(=\text{O})-\text{NH}-$. Water is released when the carboxyl group of one amino acid joins the amino group of another.

Many amino acids form a **polypeptide**.

Different amino acids can join in the same chain to produce proteins; their sequence affects the protein produced.

Check bonds: carbon has four, neutral nitrogen three, oxygen two and hydrogen one. The repeat-unit bonds pass through the brackets.