

Exercise walk-through

11.6

Alcohols

IGCSE Chemistry

Alkenes and the bromine test

shake with orange bromine water



alkene:
turns colourless



alkane:
stays orange

The $C=C$ makes alkenes reactive (**addition reactions**).

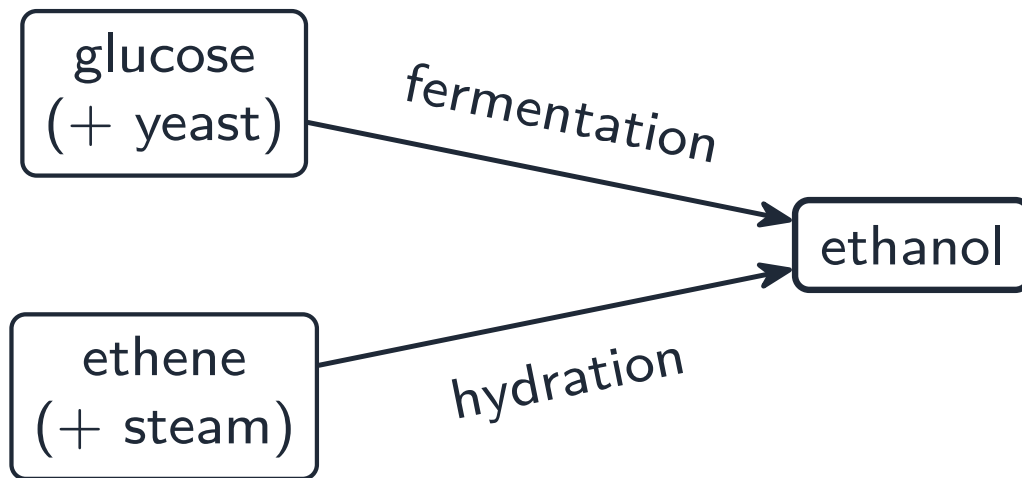
Test: shake with orange **bromine water**. An alkene **decolourises** it; an alkane does not.

Alcohols and ethanol

Ethanol (–OH) two ways:

- **fermentation** of glucose (yeast; renewable, slow)
- **hydration** of ethene (steam + catalyst; fast, pure)

Used as a fuel & **solvent** .



Two routes to ethanol, and what it becomes

Fermentation

Sugar with yeast at about 30 °C, no air – renewable, slow, and it gives a dilute product.

Hydration

Ethene plus steam over a catalyst – fast and pure, but it starts from crude oil.

Oxidation

Ethanol oxidises to **ethanoic acid** – which is what turns wine into **vinegar** .

Elsewhere in the topic

A **substitution reaction** swaps one atom for another – methane and chlorine under **ultraviolet light** – and **nickel** is the catalyst that adds hydrogen to an alkene.

Compare the two routes on the same three axes: raw material, energy, and purity of product.

Making ethanol, and making ethanoic acid

fermentation	glucose with yeast, about 30 °C, no air – slow, batch, and it uses a renewable feedstock
hydration of ethene	steam over a phosphoric acid catalyst, high temperature and pressure – fast, continuous, and it uses crude oil
the trade	fermentation is renewable and impure; hydration is pure and depends on a finite resource
oxidation of ethanol	gives ethanoic acid, using acidified potassium manganate(VII) or potassium dichromate(VI)
the acid's reactions	with metals, carbonates and alkalis – like any acid, and the salts formed are called ethanoates
lubricating oil	one of the crude-oil fractions – used for lubricants, waxes and polishes

The two routes to ethanol is a standard compare-and-evaluate question. Name the conditions for each **and** say which resource it depends on.

Carboxylic acids and esters



Carboxylic acids ($-\text{COOH}$)
react with metals, bases &
carbonates (giving ethanoates).

Acid + alcohol $\xrightarrow{\text{catalyst}}$ an
ester + water.

Exercises 2.1·2.2

2.1 State the functional group in an alcohol.

[1]

2.2 Name the two products of fermentation of glucose.

[2]

Exercises 2.1·2.2

2.1 State the functional group in an alcohol.

[1]

2.1

- the alcohol functional group is **–OH** (hydroxyl)

2.2 Name the two products of fermentation of glucose.

[2]

2.2

- fermentation of glucose: **ethanol** and **carbon dioxide**

Exercise 3.1

3.1 A use of ethanol is as a:

[1]

☐

A metal

B solvent and fuel

C fertiliser

D catalyst

Exercise 3.1

3.1 A use of ethanol is as a:

[1]

☐

A metal

B solvent and fuel

C fertiliser

D catalyst

3.1 B

- ethanol is used as a **solvent and a fuel**
- A, C and D are not uses of ethanol

Exercise 3.2 (a)

3.2 Ethanol can be made by fermentation or by adding steam to ethene.

(a) Give one advantage of making ethanol by fermentation.

[1]

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[1]

(a)

- fermentation uses **renewable sugar**

Exercise 3.2 (b)

3.2 Ethanol can be made by fermentation or by adding steam to ethene.

(b) Give one advantage of making ethanol from ethene.

[1]

Exercise 3.2 (b)

3.2 Ethanol can be made by fermentation or by adding steam to ethene.

(b) Give one advantage of making ethanol from ethene.

[1]

(b)

- the ethene route is **fast** and gives **pure ethanol**

Exercise 3.3

3.3 State the conditions needed for fermentation.

[3]

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[3]

3.3

- yeast
- about 25–35 °C
- absence of air/oxygen