

Exercise walk-through

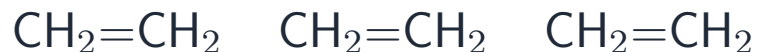
20.1

Addition polymerisation

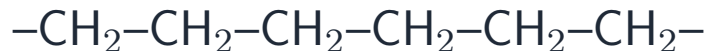
A-Level Chemistry

Addition polymerisation

many monomers (each has a C=C)



double bonds open and join

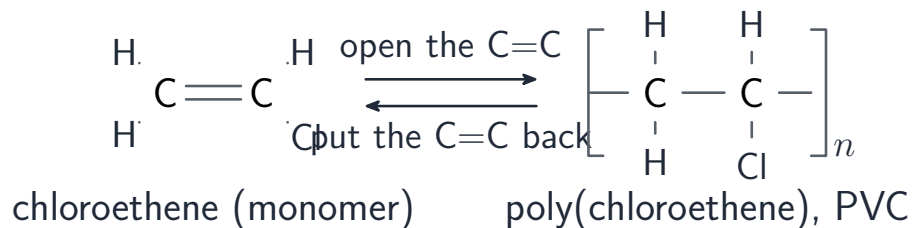


one long polymer chain (single bonds)

In **addition polymerisation**, many **monomers** join into one long chain – with **no other product**.

Each monomer must have a C=C; the double bond **opens** so they link end to end into the **polymer**.

Repeat units



The **repeat unit** is copied along the chain.

- ethene → **poly(ethene)**
- chloroethene → **PVC**

Change the C=C to a single bond;
draw bonds out at each end.

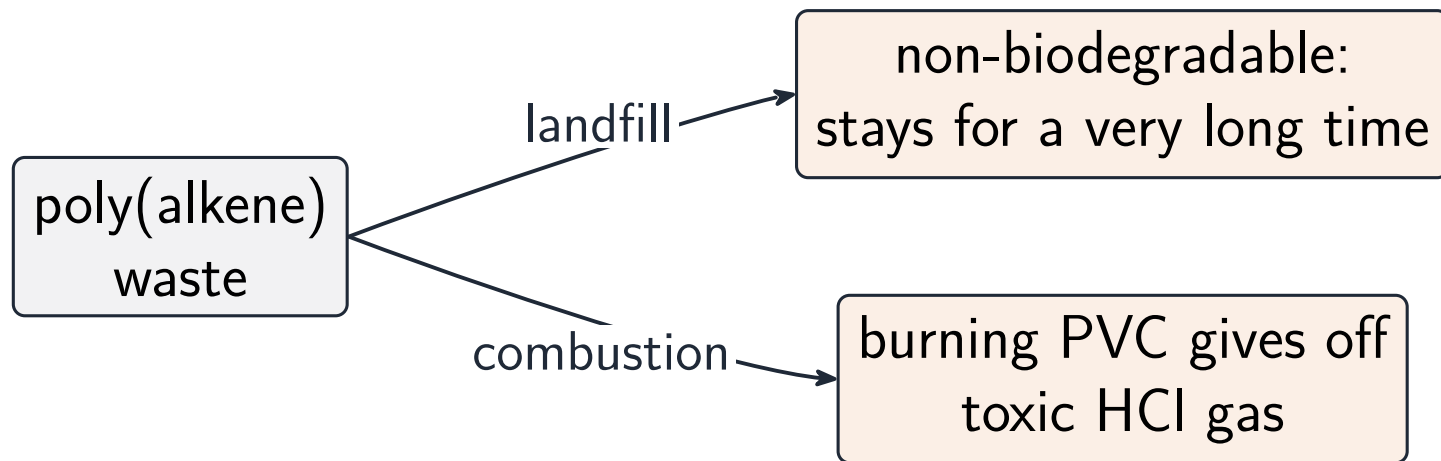
The problem of disposal



Poly(alkene)s are hard to dispose of:

- **non-biodegradable**
– microbes can't break them down
- **combustion** of PVC
releases toxic HCl

The problem of disposal, continued



Poly(alkene) waste is hard to dispose of: it is non-biodegradable, and burning PVC releases toxic hydrogen chloride

Exam tips

- Draw the **repeat unit** in brackets with the two bonds crossing them and n outside; keep the backbone carbons.
- Deduce the **monomer from a polymer** (and vice versa) – a very common question.
- Addition polymers are **inert and non-biodegradable** – link to landfill, recycling and incineration issues.
- Do not confuse with condensation (no small molecule is lost in addition polymerisation).

Exercises 2.1·2.2

2.1 State what is meant by the **repeat unit** of a polymer.

[1]

2.2 State **two** problems of disposing of poly(alkene)s.

[2]

Exercises 2.1·2.2

2.1 State what is meant by the **repeat unit** of a polymer. [1]

2.1

- the small part that is repeated again and again along the polymer chain
-

2.2 State **two** problems of disposing of poly(alkene)s. [2]

2.2

- non-biodegradable (microbes cannot break them down); combustion releases harmful/toxic gases

Exercises 3.1-3.2

3.1 Which feature must a monomer have to undergo addition polymerisation?

[1]

☐

A an -OH group

B a $\text{C}=\text{C}$ double bond

C a benzene ring

D an ionic bond

3.2 Burning PVC is a particular problem because it releases:

[1]

☐

A carbon dioxide only

B toxic hydrogen chloride

C water vapour

D nitrogen

Exercises 3.1·3.2

3.1 Which feature must a monomer have to undergo addition polymerisation?

[1]

☐

A an –OH group

B a C=C double bond

C a benzene ring

D an ionic bond

3.1 B

- The monomer needs a C=C double bond

3.2 Burning PVC is a particular problem because it releases:

[1]

☐

A carbon dioxide only

B toxic hydrogen chloride

C water vapour

D nitrogen

3.2 B

- Burning PVC releases toxic hydrogen chloride

Exercise 3.3 (a)

3.3 Propene is $\text{CH}_3\text{CH}=\text{CH}_2$.

(a) Draw the repeat unit of poly(propene).

[2]

Exercise 3.3 (a)

3.3 Propene is $\text{CH}_3\text{CH}=\text{CH}_2$.

(a) Draw the repeat unit of poly(propene).

[2]

(a)

- $-(\text{CH}_2\text{CH}(\text{CH}_3))_n-$ drawn with bonds out at each end

Exercise 3.3 (b)

3.3 Propene is $\text{CH}_3\text{CH}=\text{CH}_2$.

(b) A section of a polymer is $-(\text{CH}_2\text{CHCl})_n-$. Draw the monomer it was made from. [1]

Exercise 3.3 (b)

3.3 Propene is $\text{CH}_3\text{CH}=\text{CH}_2$.

(b) A section of a polymer is $-(\text{CH}_2\text{CHCl})_n-$. Draw the monomer it was made from. [1]

(b)

- chloroethene, $\text{CH}_2=\text{CHCl}$

Exercise 3.4

3.4 Explain why addition polymers are described as non-biodegradable.

[2]

Exercise 3.4

3.4 Explain why addition polymers are described as non-biodegradable. [2]

3.4

- the C–C backbone is strong and unreactive, so microbes/enzymes cannot break it down, and it persists in the environment