

Exercise walk-through

Addition polymerisation ■ 20.1

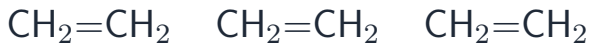
eXercise

You must be able to

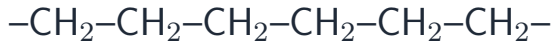
- describe addition polymerisation (poly(ethene), PVC)
- deduce the repeat unit from a monomer, and the monomer from a polymer
- explain the difficulty of disposing of poly(alkene)s

Method — Addition polymerisation

many monomers (each has a C=C)



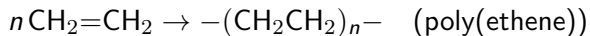
double bonds open and join



one long polymer chain (single bonds)

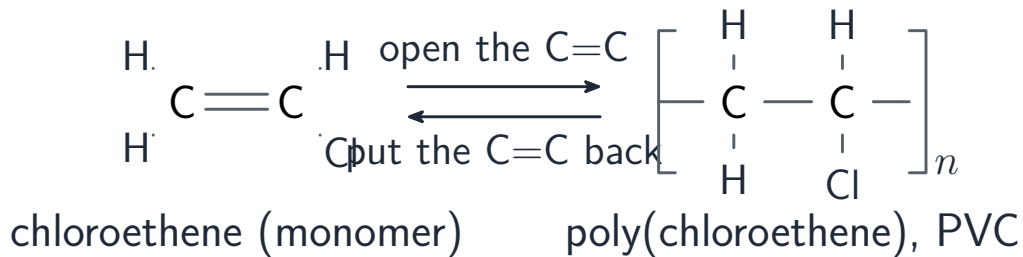
Ethene monomers opening their C=C double bonds and joining end to end into one long chain

Method — Repeat unit and monomer



To find the **monomer** from a polymer: take one repeat unit and put the C=C back.

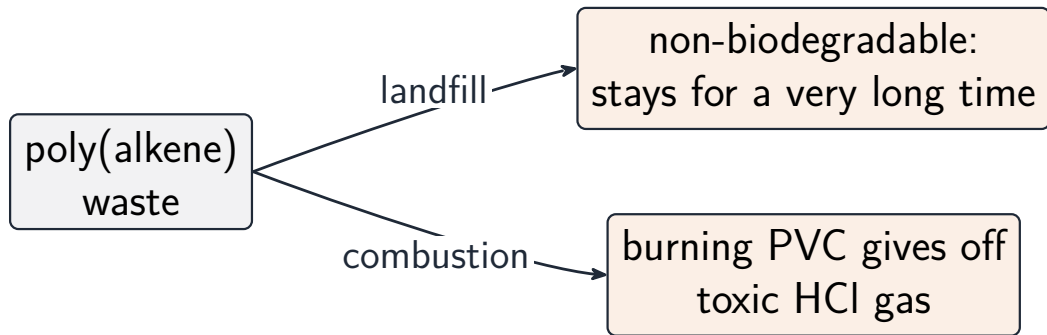
Method — Repeat unit and monomer



Chloroethene's C=C opening to give the PVC repeat unit; reverse to find the monomer

Method — Disposal

*Poly(alkene)s are **non-biodegradable** and their combustion can release harmful gases (e.g. PVC gives toxic HCl)*



Plastic waste building up because poly(alkene)s are non-biodegradable

Practice 2.1 ■ 1 mark

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

Solution 2.1

Method: Repeat unit and monomer

Worked steps

the small part that is repeated again and again along the polymer chain **B1**.

Practice 2.2 ■ 2 marks

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

Solution 2.2

Method: Disposal

Worked steps

non-biodegradable (microbes cannot break them down) **B1**; combustion releases harmful/toxic gases **B1**.

Exam-style 3.1 ■ 1 mark

Which feature must a monomer have to undergo addition polymerisation?

- A** an -OH group
- B** a $\text{C}=\text{C}$ double bond
- C** a benzene ring
- D** an ionic bond

Solution 3.1

Method: Addition polymerisation

A an -OH group

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



C a benzene ring

D an ionic bond

Worked steps

B. The monomer needs a $\text{C}=\text{C}$ double bond.

Exam-style 3.2 ■ 1 mark

Burning PVC is a particular problem because it releases:

- A** carbon dioxide only
- B** toxic hydrogen chloride
- C** water vapour
- D** nitrogen

Solution 3.2

- A** carbon dioxide only
- B** toxic hydrogen chloride
- C** water vapour
- D** nitrogen



Worked steps

- B.** Burning PVC releases toxic hydrogen chloride.

Exam-style 3.3 ■ 2 marks

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

- (a) Draw the repeat unit of poly(propene).
- (b) A section of a polymer is $-(\text{CH}_2\text{CHCl})_n-$. Draw the monomer it was made from.

Solution 3.3

Method: Repeat unit and monomer

Worked steps

(a) $-(\text{CH}_2\text{CH}(\text{CH}_3))_n-$ drawn with bonds out at each end **M1** **A1** *backbone, correct side group and brackets.*

(b) chloroethene, $\text{CH}_2=\text{CHCl}$ **B1**.

Exam-style 3.4 ■ 2 marks

Explain why addition polymers are described as non-biodegradable.

Solution 3.4

Worked steps

the C–C backbone is strong and unreactive **M1**, so microbes/enzymes cannot break it down, and it persists in the environment **A1**.