

Polymerisation

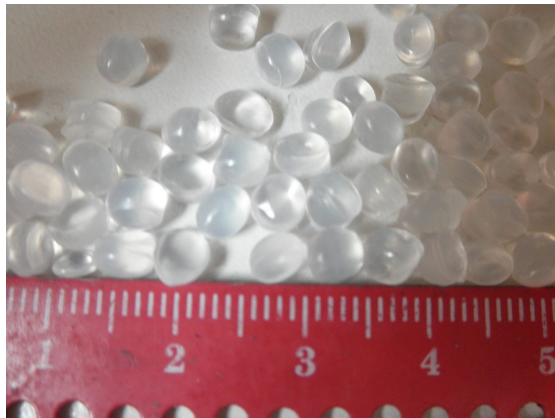
A-Level Chemistry ■ Topic 20

A-Level Chemistry



What we will cover

- 1 Addition polymerisation
- 2 Repeat units
- 3 Finding the monomer
- 4 The problem of disposal

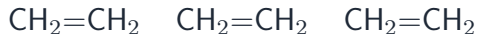


poly(ethene) pellets

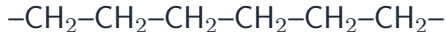


Addition polymerisation

many monomers (each has a C=C)



double bonds open and join

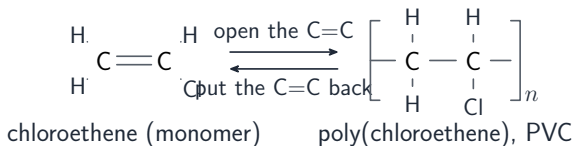


one long polymer chain (single bonds)

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.

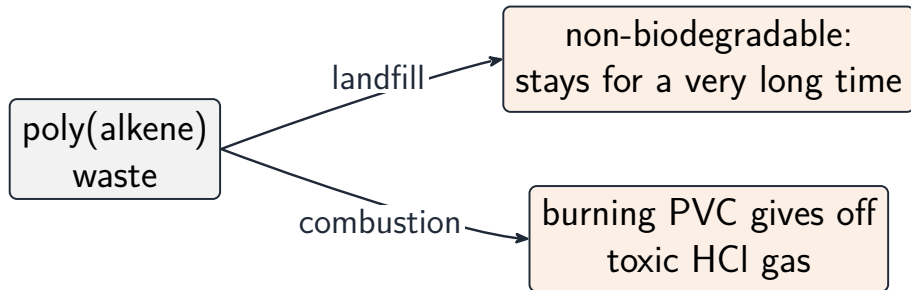
The problem of disposal



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).



Worked example – drawing a repeat unit

Draw the repeat unit of poly(propene) and explain why it is hard to dispose of.

- Propene is $\text{CH}_2=\text{CHCH}_3$. Break the π bond and join the monomers.
- Repeat unit: $-\text{CH}_2 - \text{CH}(\text{CH}_3)-$ with the bonds drawn through the brackets.
- The backbone is only strong, non-polar C–C and C–H bonds.
- Nothing in nature attacks them $\Rightarrow$ non-biodegradable. Burning PVC also gives toxic HCl.

An addition polymer has the same empirical formula as its monomer – nothing is lost. Draw it with the C=C opened and bonds through the brackets.

Topic 20 – key takeaways

1

Polymerisation

many $\text{C}=\text{C}$ monomers join, no other product

2

Repeat unit

change $\text{C}=\text{C}$ to a single bond, bonds out

3

Monomer

put the $\text{C}=\text{C}$ back into one repeat unit

4

Disposal

non-biodegradable; PVC burning gives HCl

Check yourself

- 1 What bond must a monomer have for addition polymerisation?
- 2 Which polymer is made from chloroethene?
- 3 How do you find the monomer from a repeat unit?
- 4 Why is poly(ethene) hard to dispose of?



Answers 1. a C=C double bond 2. PVC / poly(chloroethene) 3. put the C=C back
4. it is non-biodegradable