# 4.3 Synthetic polymers

Name: _____ Class: _____ Date: _____ **Total: 18 marks**

## Objective

Build the skills to answer exam questions on **synthetic polymers** : addition polymerisation, drawing repeat units and monomers, condensation polymers (polyesters), and the problems of disposing of polymers.

**You must be able to:**

- draw the repeat unit of an addition polymer from its monomer
- work out the monomer from a repeat unit
- compare addition and condensation polymerisation
- evaluate ways of disposing of polymers

## 1 Key knowledge and worked examples

### Polymers

| idea | rule |
|---|---|
| addition polymerisation | many monomers with a C=C bond join; the double bond opens; nothing else is made |
| repeat unit | the monomer with the C=C changed to C−C, two bonds sticking out, brackets and $n$ |
| naming | poly(monomer): ethene → poly(ethene); propene → poly(propene) |
| condensation polymerisation | two different monomers join; a small molecule (water) is made at each link |
| polyesters | a diol (two −OH) + a dicarboxylic acid (two −COOH) |

**Worked example 1: repeat unit.** Draw the repeat unit of poly(propene) from propene, $CH_2{=}CHCH_3$.

1. Known: the C=C is between the first two carbons.
2. Rule: open the double bond; the $CH_3$ hangs off the chain.
3. Numbers: $-CH_2-CH(CH_3)-$.



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4. Result: $[-\mathbf{CH_2} - \mathbf{CH}(\mathbf{CH_3})-]_n$.

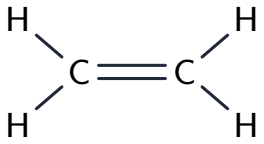
**Worked example 2: monomer.** A repeat unit is $[-CF_2 - CF_2-]_n$. Find the monomer.

1. Known: two carbons, each with two F.
2. Rule: put the C=C back and remove the brackets.
3. Numbers: $CF_2{=}CF_2$.
4. Result: **tetrafluoroethene**.

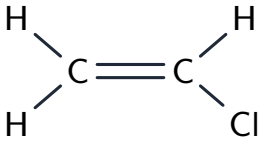
**Answer shapes:** in an evaluation, give a point for and against each option, then a conclusion.

## 2 Practice

**2.1** Name the polymer made from ethene, and give **one** use. [2]




**2.2** Draw the repeat unit of the polymer made from chloroethene. [2]

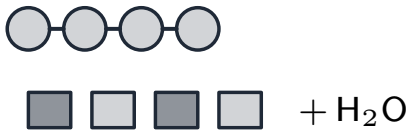





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## 3 Exam-style questions

**3.1** Explain **two** differences between addition and condensation polymerisation. [3]




**3.2** Drinks bottles are made from PET, a polyester. Ways to dispose of used bottles are shown in the table.

| method | what happens |
|---|---|
| landfill | bottles are buried in the ground |
| burning | bottles are burned; heat can make electricity |
| recycling | bottles are melted and made into new products |

(a) Name the **two** types of monomer used to make a polyester, and the small molecule given off. [2]

(b) Explain why PET bottles last a long time in landfill, and give **one** problem caused by burning them. [3]



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(c) Evaluate landfill, burning and recycling as ways to dispose of used PET bottles. [6]



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