

## 35.2 Predicting the type of polymerisation

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 9 marks

**KEY WORDS** addition polymerisation 加成聚合 • condensation polymerisation 缩合聚合 • monomer 单体  
• amino acid 氨基酸 • repeat unit 重复单元

### Objective

Build the skills to answer exam questions on **predicting the type of polymerisation**  
判断聚合类型 — telling **addition** 加成聚合 from **condensation** 缩合聚合 from the monomer and the product.

**You must be able to:**

- use the monomer's structure to predict the polymerisation type
- recognise addition ( $C=C$ , nothing lost) vs condensation (two groups, small molecule lost)

### 1 Worked examples

#### ■ Which type?

##### addition polymerisation

- monomer has a  $C=C$
  - the double bond opens and the monomers join
  - **nothing else** is lost
- e.g. ethene  $\rightarrow$  poly(ethene)

##### condensation polymerisation

- each monomer has **two** functional groups
  - a **small molecule** ( $H_2O$  or  $HCl$ ) is lost
  - ester or amide links form
- e.g. a polyester or polyamide

*Addition opens a  $C=C$  and loses nothing; condensation joins two-group monomers and loses a small molecule*

polyester (ester links)



break each link; add back  $-\text{OH}$  and  $-\text{H}$



diol



dicarboxylic acid

*Find the monomers to predict the polymerisation type*

| Clue                                                                     | Type                |
|--------------------------------------------------------------------------|---------------------|
| monomer has a $\text{C}=\text{C}$ , <b>nothing</b> else lost             | <b>addition</b>     |
| each monomer has <b>two</b> functional groups; a small molecule is lost; | <b>condensation</b> |
| chain has ester/amide links                                              |                     |

## 2 Practice

**2.1** State the type of polymerisation when ethene forms poly(ethene). [1]

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**2.2** State the type of polymerisation when a small molecule is lost at each link. [1]

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### 3 Exam-style questions

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**3.1** A monomer with **one** C=C and no other functional group will undergo: [1]

- **A** addition polymerisation
  - **B** condensation polymerisation
  - **C** neither
  - **D** hydrolysis
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**3.2** Which observation shows that a polymer formed by **condensation**? [1]

- **A** the monomer had a C=C
  - **B** no small molecule was lost
  - **C** water (or HCl) was released and the chain has ester/amide links
  - **D** the polymer is an alkene
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**3.3** For each monomer, predict the type of polymerisation and justify it: [3]

(a)  $\text{CH}_2=\text{CHCl}$  (chloroethene)

(b)  $\text{HOCH}_2\text{CH}_2\text{OH} + \text{HOOC}(\text{CH}_2)_4\text{COOH}$

(c) a single amino acid  $\text{H}_2\text{NCH}_2\text{COOH}$

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**3.4** Explain how you could tell, from the **product** alone, whether a polymer was made by addition or condensation. [2]

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## Solutions

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**2.1** addition polymerisation.

**2.2** condensation polymerisation.

**3.1 A.** One  $C=C$  and nothing lost  $\rightarrow$  addition polymerisation.

**3.2 C.** Releasing a small molecule and having ester/amide links shows condensation.

**3.3 (a)** addition — it has a  $C=C$  and nothing is lost.

(b) condensation — two two-group monomers join, losing water  $\rightarrow$  polyester.

(c) condensation — the amino acid has two groups ( $-NH_2$  and  $-COOH$ ), losing water  $\rightarrow$  polyamide.

**3.4** an addition polymer has a saturated  $C-C$  backbone with no links (the repeat unit is just the monomer); a condensation polymer has ester or amide links along the chain, which can be hydrolysed back to two monomers.