

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 • repeat unit 重复单元 • polyester 聚酯

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 → poly(ethene)

condensation polymerisation

- each monomer has **two** functional groups
- a **small molecule** (H₂O 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 –OH and –H



diol



dicarboxylic acid

Find the monomers to predict the polymerisation type

Clue	Type
monomer has a C=C, nothing else lost	addition
each monomer has two functional groups; a small molecule is lost; chain has ester/amide links	condensation

2 Practice

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

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

3 Exam-style questions

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

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
-

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 $\text{H}_2\text{NCH}_2\text{COOH}$
-
-
-

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

Solutions

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 ($-\text{NH}_2$ and $-\text{COOH}$), 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.