

Cambridge (CIE) A Level Chemistry



Your notes

Predicting the Type of Polymerisation

Contents

- * Predicting & Deducing the Type of Polymerisation



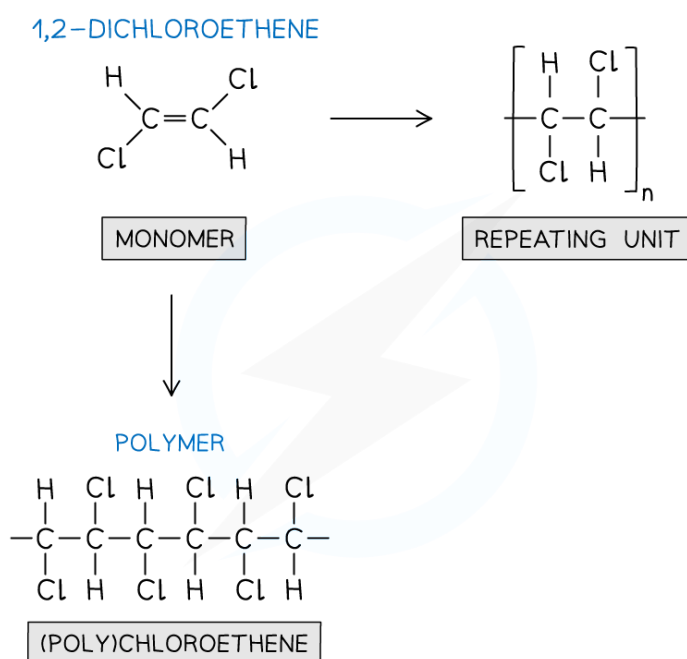
Predicting Type of Polymerisation

- When a set of monomers is given in an exam question, the type of polymerisation can be determined
- Firstly, it's important to identify the key functional groups in the monomers

Addition polymerisation

- If the monomer/s contain a C=C double bond, they will polymerise through addition polymerisation
- The double bond can open up in order to add more monomers on either side of the starting monomer
- This type of polymerisation makes (poly)alkenes

Addition polymerisation using one monomer



Copyright © Save My Exams. All Rights Reserved

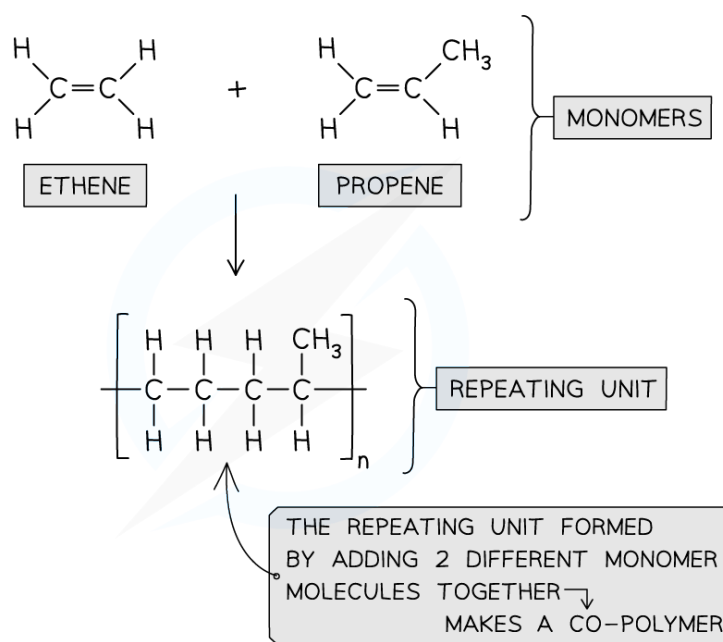
During addition polymerisation of one alkene monomer, a (poly)alkene is formed

- (Poly)alkenes can be produced if there are 2 or more alkene monomers as well
- When more than one monomer is used for addition polymerisation, the resulting product is known as a copolymer

Addition polymerisation using more than one monomer



Your notes



Copyright © Save My Exams. All Rights Reserved

Addition polymerization can also use two or more different alkene monomers forming a co-polymer

Condensation polymerisation

- Condensation polymerisation makes polyamides and polyesters
- When looking to identify this type of polymerisation, there are some key functional groups to be aware of

Monomers for condensation polymers table

Polyamide monomers	Polyester monomers	Molecule expelled as a result of condensation polymerisation
Acyl chlorides ($-\text{COCl}$) Amines ($-\text{NH}_2$)	Acyl chlorides ($-\text{COCl}$) Alcohols ($-\text{OH}$)	Hydrochloric acid (HCl)
Carboxylic acids ($-\text{COOH}$) Amines ($-\text{NH}_2$)	Carboxylic acids ($-\text{COOH}$) Alcohols ($-\text{OH}$)	Water (H_2O)
Aminocarboxylic acids ($\text{H}_2\text{N}-\text{CHR}-\text{COOH}$)	Hydroxycarboxylic acids ($\text{HO}-\text{R}-\text{COOH}$)	Water (H_2O)



Examiner Tips and Tricks



Your notes

- As well as the functional groups to be aware of, know that a small molecule is expelled when the polymer is formed
- Identify 2 functional groups that can react together to produce either a polyamide or a polyester
- There are instances where both of the functional groups are on the same monomer molecule
 - For example, amino acid molecules contain an amine group ($-\text{NH}_2$) and a carboxylic acid group ($-\text{COOH}$) which means that they can polymerise to produce a polyamide

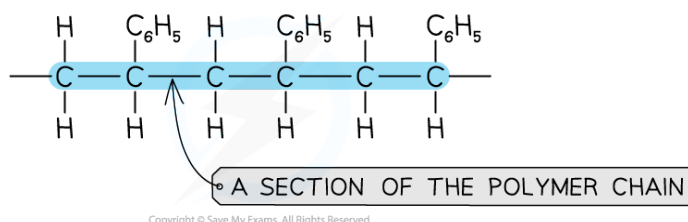
Deducing Type of Polymerisation

- The type of polymerisation can be determined by considering the structure of the polymer backbone

Identifying addition polymerisation

- The polymer backbone of an addition polymer does not contain functional groups
- The backbone of the polymer is generally a chain of carbon atoms
- There may be sidechains branching off from the backbone
- Some examples of side chains include:
 - Benzene rings
 - Nitrile groups ($-\text{CN}$)
 - Halogen atoms ($-\text{F}$ / $-\text{Cl}$ / $-\text{Br}$ / $-\text{I}$)

Identifying addition polymers

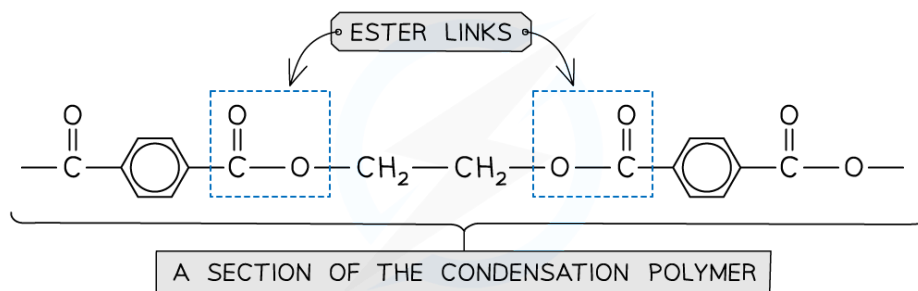


Addition polymers are identified using the plain carbon chain as the polymer backbone

Identifying condensation polymerisation

- A condensation polymer can be identified by functional groups on the polymer backbone
- The backbone of polyesters contains ester links ($-\text{COO}-$)
- The backbone of polyamides contains amide / peptide links ($-\text{CONH}-$)

Identifying condensation polymers



Copyright © Save My Exams. All Rights Reserved



Your notes

Condensation polymers are identified using functional groups that form part of the polymer backbone, e.g. ester links in polyesters and amide / peptide links in polyamides



Examiner Tips and Tricks

- Different sections of polymer chains may be formed using various types of polymerisation
- In an exam, you may be given a section of a polymer and asked to determine the type of polymerisation used to form that section
- Firstly, look at the polymer backbone
 - If there are functional groups along the backbone, that section was made using condensation polymerisation
 - If there are no functional groups along the backbone, addition polymerisation was used