# 7.1 Biomolecule structure: bonds, polarity and function

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

**KEY WORDS** peptide bond • hydrolysis

## Objective

Biomolecule structure: bonds, polarity and function. Original classroom practice for IB SL; not an official IB paper.

## 1 Key knowledge and worked examples

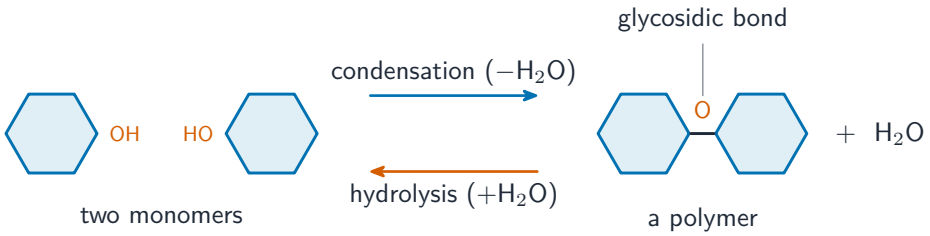
### What would explain this observation?

- Starch, a triglyceride and a protein can all contain carbon, hydrogen and oxygen, yet their structures and functions differ. An element list alone does not identify a biomolecule.

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### Build the model

- Carbohydrates include monosaccharides and polymers joined by glycosidic bonds.
- A triglyceride has glycerol joined to three fatty acids by ester bonds.
- Proteins contain amino-acid residues joined by **peptide bonds** ; side chains and folding contribute to their properties.
- These structures support storage, membrane or functional roles depending on the molecule.
- peptide bond: A covalent linkage between amino-acid residues.
- **hydrolysis** : Breaking a linkage using water.




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### Choose evidence that can test it

- Condensation forms a linkage with a small molecule such as water released in the simplified model; hydrolysis uses water to break such a linkage.
- Polymer sequence, branching, polarity and three-dimensional shape matter.
- Saturated fatty acids have no carbon-carbon double bond, while unsaturated fatty acids have at least one; this difference can influence packing under stated conditions.

**In the lab:** Use labelled molecular models and identify the actual linkage rather than memorizing shapes alone. Compare an attributed structure with the proposed function, mark polar and non-polar regions where justified, and distinguish a monomer from a residue within a polymer. Food tests provide evidence of chemical groups under specific conditions, not complete molecular structures.

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### Work from known quantities

- Known: a single unbranched peptide formed from 20 amino acids contains 19 peptide linkages.
- In a simplified condensation accounting model, forming these links releases 19 water molecules.
- A triglyceride formed from one glycerol and three fatty acids has three ester linkages and releases three waters in the corresponding model.
- These are linkage counts, not complete pathways in living cells.

**Your turn:** A single unbranched peptide contains 35 amino-acid residues. How many peptide bonds join them?

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### Check the conclusion and its limits

- Not every protein is an enzyme, and not every catalyst is a protein.
- Lipids are not all polymers of repeating monomers.
- A protein can lose function when its folding changes without every peptide bond being broken.

**Not true:** Every protein is an enzyme and every lipid is a repeating-monomer polymer. Enzymes are one functional class of protein; structural and transport proteins are not enzymes. And lipids such as triglycerides are built from unlike parts, not repeating monomers, so they are not polymers.

**Key:**

- Carbohydrates include monosaccharides and polymers joined by glycosidic bonds.
- Condensation forms a linkage with a small molecule such as water released in the simplified model; hydrolysis uses water to break such a linkage.
- Watch for: not every protein is an enzyme, and not every catalyst is a protein.

■ **Write from 21 peptide bonds**

- A single unbranched peptide contains 22 amino-acid residues.
- Find the number of peptide bonds. Not every protein is an enzyme.

## 2 Practice

**2.1** What distinguishes a triglyceride in this model? Choose one answer.

- **A** A chain consisting only of peptide bonds
- **B** Glycerol with three fatty acids joined by ester bonds
- **C** A DNA sequence with thymine [1]

**2.2** A single unbranched peptide contains 35 amino-acid residues. How many peptide bonds join them? Show the relation, substitution and units. [2]

**2.3** Decide whether this claim is true and justify: Enzymes are one functional class of protein; structural and transport proteins are not enzymes. [2]

**2.4** A covalent linkage between amino-acid residues: write the technical term. [1]

## 3 Exam-style questions

**3.1** Two separate linear peptides each contain 10 residues. How many peptide bonds exist before and after joining them end to end by one peptide linkage? State the model boundary. [4]