

2 Biological molecules – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	Write it 3 times (English)		
condensation	_____	_____	_____
hydrolysis	_____	_____	_____
triglyceride	_____	_____	_____
glycerol	_____	_____	_____
fatty acids	_____	_____	_____
ester bonds	_____	_____	_____
hydrophobic	_____	_____	_____
saturated	_____	_____	_____
unsaturated	_____	_____	_____
phospholipid	_____	_____	_____
phosphate	_____	_____	_____
hydrophilic	_____	_____	_____
bilayer	_____	_____	_____
amino acids	_____	_____	_____
peptide bond	_____	_____	_____

English	Write it 3 times (English)		
polypeptide			
primary structure			
secondary structure			
tertiary structure			
Globular proteins			
fibrous proteins			
collagen			
polar			
hydrogen bonds			
solvent			
specific heat capacity			

Recall

From Part 1 you know that big biological molecules are built from small ones by **condensation** (removing water) and broken by **hydrolysis** (adding water). The same idea returns here for fats and proteins.

- You met fats and proteins in food at IGCSE.
- Now we look at what they are actually made of, and why their shape matters.

New ideas

Read these first, then do the Practice.

■ 1 Triglycerides (fats and oils)

A **triglyceride** is the main fat or oil. It is one **glycerol** molecule joined to three **fatty acids** by **ester bonds**. It is **hydrophobic** (does not mix with water).

Fatty acids are of two kinds:

- **saturated** – no carbon–carbon double bonds; usually solid fats.
- **unsaturated** – one or more double bonds (a “kink”); usually liquid oils.



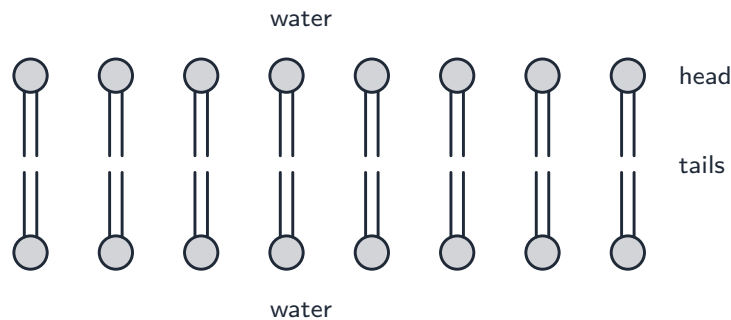
Worked example. A triglyceride releases about **twice** as much energy per gram as a carbohydrate, so it makes a good long-term energy store.

■ 2 Phospholipids and the bilayer

A **phospholipid** is like a triglyceride, but one fatty acid is swapped for a **phosphate** group. This gives it two ends:

- a **hydrophilic** (“water-loving”) head.
- two hydrophobic (“water-fearing”) tails.

In water, phospholipids line up into a **bilayer** – heads facing the water, tails hidden inside. This is the basis of every cell membrane.



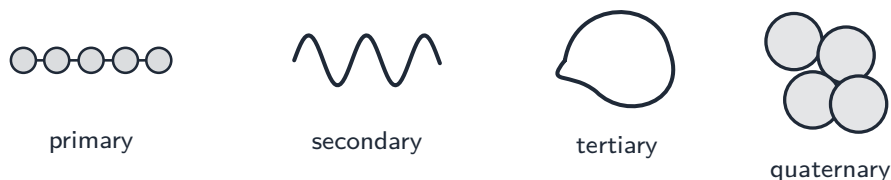
■ 3 Proteins and the peptide bond

Proteins are polymers of **amino acids**. Two amino acids join by condensation, forming a **peptide bond** and removing water. A long chain is a **polypeptide**.

A protein folds into a precise 3-D shape, described in levels:

- **primary structure** – the order of amino acids.
- **secondary structure** – local coils and folds held by hydrogen bonds.
- **tertiary structure** – the whole chain folded into one shape.

The shape decides the job. **Globular proteins** (like enzymes) are rounded and soluble; **fibrous proteins** (like collagen) are long, strong strands.



■ 4 Water – small but special

Water is a **polar** molecule: the oxygen end is slightly negative, the hydrogen ends slightly positive. So water molecules attract each other by weak **hydrogen bonds**. This explains:

- water is a good **solvent** (so substances dissolve and can be carried).
- water has a high **specific heat capacity** (so its temperature stays steady).

Watch out: a phospholipid has *both* a hydrophilic head and hydrophobic tails – that split is *why* it forms a bilayer. And a protein's *shape* (set by its amino-acid order) is what decides its job.

Practice

Try these in order.

2.1 Name the parts that join to make a triglyceride. [2]

2.2 State one difference between a saturated and an unsaturated fatty acid. [1]

2.3 A phospholipid has a hydrophilic head and hydrophobic tails. Explain how this makes phospholipids form a bilayer in water. [2]

2.4 Name the bond that joins two amino acids, and the small molecule removed when it forms. [2]

2.5 State what is meant by the *primary structure* of a protein. [1]

2.6 Water has a high specific heat capacity. Explain why this is useful to living things. [2]

2.7 Challenge. A phospholipid forms a bilayer in water, but a triglyceride does not. Explain why, using their structures. [2]
