

2 Biological molecules – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
condensation	缩合	_____
hydrolysis	水解	_____
triglyceride	甘油三酯	_____
glycerol	甘油	_____
fatty acids	脂肪酸	_____
ester bonds	酯键	_____
hydrophobic	疏水	_____
saturated	饱和	_____
unsaturated	不饱和	_____
phospholipid	磷脂	_____
phosphate	磷酸	_____
hydrophilic	亲水	_____
bilayer	双层	_____
amino acids	氨基酸	_____
peptide bond	肽键	_____

English	中文	Write it 3 times (English)
polypeptide	多肽	_____
primary structure	一级结构	_____
secondary structure	二级结构	_____
tertiary structure	三级结构	_____
Globular proteins	球状蛋白质	_____
fibrous proteins	纤维状蛋白质	_____
collagen	胶原蛋白	_____
polar	极性	_____
hydrogen bonds	氢键	_____
solvent	溶剂	_____
specific heat capacity	比热容	_____

Recall

From Part 1 you know that big biological molecules are built from small ones by **condensation** 缩合 (removing water) and broken by **hydrolysis** 水解 (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** 甘油三酯 is the main fat or oil. It is one **glycerol** 甘油 molecule joined to three **fatty acids** 脂肪酸 by **ester bonds** 酯键. It is **hydrophobic** 疏水 (does not mix with water).

Fatty acids are of two kinds:

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



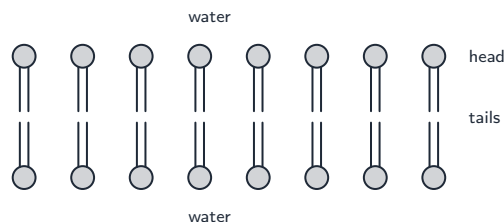
Worked example. A triglyceride releases about **twice** as much energy per gram as a carbohydrate, so it makes a good long-term energy store.

■ 2 Phospholipids and the bilayer

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

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

In water, phospholipids line up into a **bilayer** 双层 — 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** 氨基酸. Two amino acids join by condensation, forming a **peptide bond** 肽键 and removing water. A long chain is a **polypeptide** 多肽.

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

- **primary structure** 一级结构 — the order of amino acids.
- **secondary structure** 二级结构 — local coils and folds held by hydrogen bonds.
- **tertiary structure** 三级结构 — the whole chain folded into one shape.

The shape decides the job. **Globular proteins** 球状蛋白质 (like enzymes) are rounded and soluble; **fibrous proteins** 纤维状蛋白质 (like **collagen** 胶原蛋白) are long, strong strands.



■ 4 Water — small but special

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

- water is a good **solvent** 溶剂 (so substances dissolve and can be carried).
- water has a high **specific heat capacity** 比热容 (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]
