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.

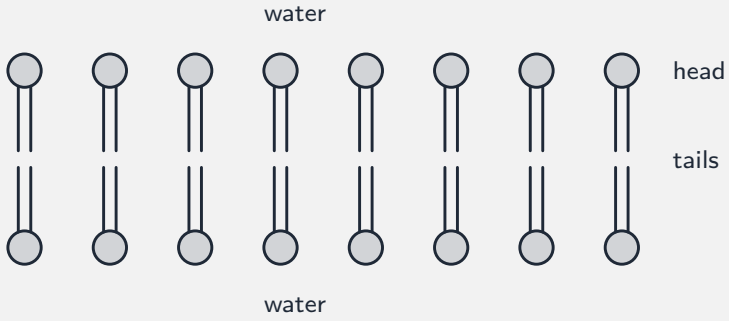
Worked example. A triglyceride releases about **twice** as much energy per gram as a carbohydrate, so it makes a good long-term energy store.

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]
