

4.1 Biological molecules

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS proteins 蛋白质 • starch 淀粉 • molecule 分子 • elements 元素
• carbohydrates 碳水化合物

Objective

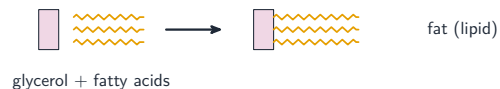
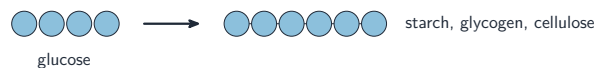
Build the skills to answer exam questions on **biological molecules** 生物分子 — the elements in food, building large molecules from small units, **food tests** 食物检验, and DNA.

You must be able to:

- give the elements in carbohydrates, fats and proteins
- state the small units that build starch, proteins and fats
- carry out the food tests and recall the DNA base pairs

1 Worked examples

■ Building blocks and food tests



Starch ← glucose; protein ← amino acids; fat ← 3 fatty acids + glycerol

Food substance (test)	start	positive result
Starch (iodine)		blue-black
Reducing sugar (Benedict's, heat)		brick-red
Protein (biuret)		purple
Fat (ethanol emulsion)		cloudy white
Vitamin C (DCPIP)		colourless

*Starch + iodine → blue-black; reducing sugar + Benedict's (heat) → brick-red;
protein + biuret → purple*

- carbohydrates/fats = C, H, O; proteins also contain N. DNA bases pair A–T, C–G.

2 Practice

2.1 Name the elements found in a protein. [1]

2.2 Name the small units that join to make a protein. [1]

3 Exam-style questions

3.1 The test for a reducing sugar uses Benedict's solution and: [1]

- A cooling
- B heat
- C iodine
- D no change

3.2 A student tests a food sample.

(a) Describe the test for starch and its positive result. [2]

(b) Describe the test for protein and its positive result. [2]

3.3 One strand of DNA has the base sequence A–C–G–T. Write the sequence of the matching strand. [2]

3.4 A student tested a food sample for three nutrients.

(a) For **starch**, **reducing sugar** and **protein**, name the reagent used, describe the method, and give the positive result. [6]

(b) The sample was positive for starch and protein but negative for reducing sugar. Name the small units that starch and protein are each built from. [2]

(c) Explain why the reducing sugar test needs heating but the starch test does not. [2]

(d) Name the three elements found in every carbohydrate, and the extra element always present in a protein. [2]

Solutions

2.1 carbon, hydrogen, oxygen and nitrogen.

2.2 amino acids.

3.1 B. Benedict's test needs heat.

3.2 (a) add iodine solution; it turns from orange-brown to blue-black.

(b) add biuret solution; it turns from blue to purple.

3.3 T–G–C–A — each base pairs A–T and C–G.

3.4 (a) **Starch** — iodine solution; add a few drops to the sample; orange-brown turns **blue-black**. **Reducing sugar** — Benedict's solution; add and heat in a water bath; blue turns green, then yellow, then **brick red**. **Protein** — biuret solution (or sodium hydroxide then copper sulfate); add and shake, no heating; blue turns **purple/lilac**.

(b) Starch is built from **glucose** molecules; protein is built from **amino acids**.

(c) The Benedict's test is a chemical reaction between the sugar and the copper(II) ions, and heat is needed to give the particles enough energy for it to happen at a useful rate. Iodine simply changes colour when it meets the starch molecule, so no reaction needs to be started.

(d) Carbon, hydrogen and oxygen; proteins also always contain **nitrogen**.