Week 5

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

IGCSE Biology Name: _____ Score: _____

1. Proteins are built from smaller units called:
   - ☐ amino acids
   - ☐ glucose
   - ☐ fatty acids
   - ☐ glycerol
2. A positive iodine test for starch gives a:
   - ☐ blue-black colour
   - ☐ brick-red colour
   - ☐ purple colour
   - ☐ cloudy white emulsion
3. Carbohydrates are made of which three elements?
   - ☐ carbon, hydrogen and oxygen
   - ☐ carbon, nitrogen and oxygen
   - ☐ hydrogen, nitrogen and sulfur
   - ☐ carbon, hydrogen and nitrogen
4. Benedict's solution, when heated with a reducing sugar, turns:
   - ☐ brick-red
   - ☐ blue-black
   - ☐ purple
   - ☐ colourless
5. Lipids (fats) are made from fatty acids and:
   - ☐ glycerol
   - ☐ glucose
   - ☐ amino acids
   - ☐ starch
6. The Benedict's test for reducing sugar must be heated.

   ☐ True ☐ False

7. Proteins contain nitrogen, but carbohydrates and lipids do not.

   ☐ True ☐ False

8. The _____ test turns purple when protein is present.

   _____

9. Many glucose units join together to make the storage carbohydrate _____ in plants.

   _____

4. Biological molecules

Answers · 答案

IGCSE Biology

1. **amino acids**

   Proteins are chains of amino acids.

2. **blue-black colour**

   Iodine turns blue-black with starch.

3. **carbon, hydrogen and oxygen**

   Carbohydrates contain C, H and O.

4. **brick-red**

   Benedict's goes blue → brick-red with reducing sugar.

5. **glycerol**

   A lipid is fatty acids joined to glycerol.

6. **True**

   Benedict's needs heating in a water bath; the others are done cold.

7. **True**

   The nitrogen in amino acids distinguishes proteins.

8. **Biuret**

   Biuret detects protein (blue → purple).

9. **starch**

   Plants store glucose as starch; animals store it as glycogen.

IGCSE BIOLOGY • EXERCISE SHEET

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

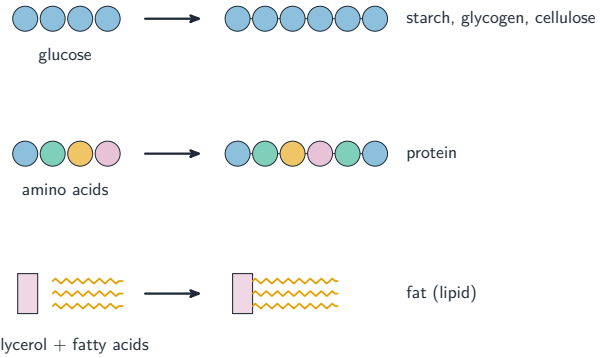
Build the skills to answer exam questions on **biological molecules** 生物分子 — the elements in food, building large molecules from small units, **food tests** 食物检验, and DNA.

You must be able to:

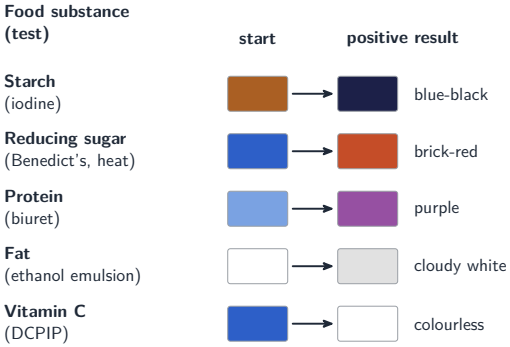
- give the elements in carbohydrates, fats and proteins
- state the small units that build starch, proteins and fats
- carry out the food tests and recall the DNA base pairs

1 Worked examples

Building blocks and food tests



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



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**.

5 The diagram shows the order of bases along part of one strand of DNA.

A—C—T—T—A—G—A—T

What is the order of bases on the complementary part of the other strand?

A A—C—T—T—A—G—A—T

B C—A—G—G—C—T—C—G

C T—A—G—A—T—T—C—A

D T—G—A—A—T—C—T—A

1 Yeast cells produce an enzyme called invertase. Invertase catalyses the breakdown of sucrose into reducing sugars. Sucrose is **not** a reducing sugar.

A student investigated the effect of two different concentrations of invertase extract on a sucrose solution.

The student used this method:

Step 1 Label three test-tubes **A**, **B** and **W**.

Step 2 Use a syringe to put 2 cm^3 of sucrose solution into all three test-tubes.

Step 3 Use a clean syringe to put 2 cm^3 of 100% invertase extract into test-tube **A**.

Step 4 Use a clean syringe to put 2 cm^3 of 10% invertase extract into test-tube **B**.

Step 5 Use a clean syringe to put 2 cm^3 of distilled water into test-tube **W**.

Step 6 Put all three test-tubes in a warm water-bath at 40 °C for 15 minutes.

Step 7 Measure the temperature of the liquid in the test-tubes.

(a) State the name of the piece of equipment that is used to measure temperature.

..... [1]

Step 8 Use a clean syringe to add 4 cm^3 of Benedict's solution to all three test-tubes.

Step 9 Place all three test-tubes into a hot water-bath for five minutes.

Step 10 After five minutes, record the colour of the liquid in each test-tube.

Fig. 1.1 shows the notes the student made about their observations in step 10.

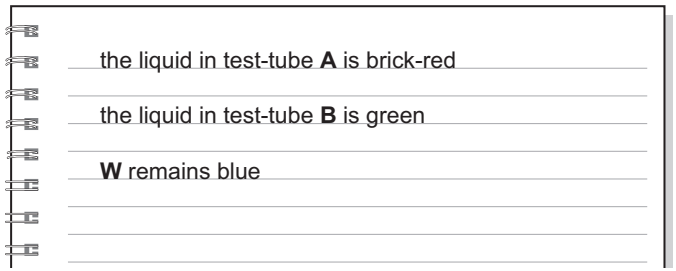


Fig. 1.1

(b) Prepare a table and record the results of this investigation using the information in Fig. 1.1.

[3]

(c) State a conclusion for the results shown in test-tube **A** and test-tube **B**.

.....

.....

..... [1]

(d) Explain the purpose of test-tube **W**.

.....

.....

.....

..... [2]

(e) State the independent variable in this investigation.

..... [1]

(f) Explain why the test-tubes were placed in the warm water-bath in step 6.

.....

.....

..... [1]

(g) Explain why a clean syringe was used in steps 3, 4 and 5.

.....

.....

..... [1]

(h) Invertase is a protein.

State the reagent used to test for the presence of protein.

..... [1]

[Total: 11]

5 A DNA molecule contains pairs of bases.

What is a correct combination of a pair of bases?

A A and G **B** C and A **C** G and T **D** T and A

6 What is the test for protein?

	name of the test	heat	colour change
A	Benedict's	yes	blue to purple
B	biuret	yes	blue to red
C	biuret	no	blue to purple
D	Benedict's	no	blue to red

21 What is the chemical formula of glucose?

A $C_6H_6O_6$ **B** C_6HO_6 **C** $C_6H_{12}O_6$ **D** $C_{12}H_{12}O_6$

2 **(a)** A student used DCPIP solution to compare the concentration of vitamin C in five solutions.

The student used this method:

- Put 1 cm^3 of 1% DCPIP solution into a test-tube.
- Use a syringe to add drops of 125 mg per dm^3 vitamin C solution to the test-tube.
- Keep adding drops of vitamin C solution until the DCPIP solution becomes colourless.
- Record the total volume of the 125 mg per dm^3 vitamin C solution added.

This method was repeated with four other concentrations of vitamin C solution.

(i) State the expected colour of the DCPIP solution **before** the vitamin C solution was added.

..... [1]

(ii) State **two** variables that were kept constant by the student in this investigation.

1 .....

2 .....

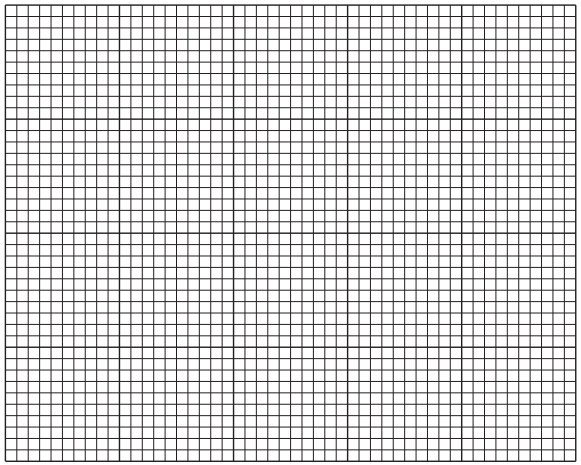
[2]

The results of the investigation are shown in Table 2.1.

Table 2.1

concentration of vitamin C / mg per dm^3	total volume of vitamin C solution added / cm^3
125	1.6
250	1.4
500	1.1
750	0.8
1000	0.5

(b) (i) Plot a line graph on the grid of the data in Table 2.1.



[4]

(ii) The student tested a sample of orange juice.

They found that 1.2 cm^3 of orange juice was needed to react with 1 cm^3 of 1% DCPIP solution.

Use your graph to estimate the vitamin C concentration of the orange juice.

Show on the graph how you obtained your estimate.

..... mg per dm^3
[2]

(c) The student wanted to investigate the effect of storage on the vitamin C concentration in apple juice.

Three samples of fresh apple juice and three samples of stored apple juice were tested.

The results are shown in Table 2.2.

Table 2.2

sample	concentration of vitamin C in fresh apple juice / mg per dm^3	concentration of vitamin C in stored apple juice / mg per dm^3
1	281	170
2	276	96
3	272	104

(i) State a conclusion for the data shown in Table 2.2.

.....

.....

..... [1]

(ii) The student decided that the result of one sample shown in Table 2.2 was anomalous.

State what is meant by an anomalous result.

.....

.....

..... [1]

(iii) Draw a circle around the anomalous result in Table 2.2. [1]

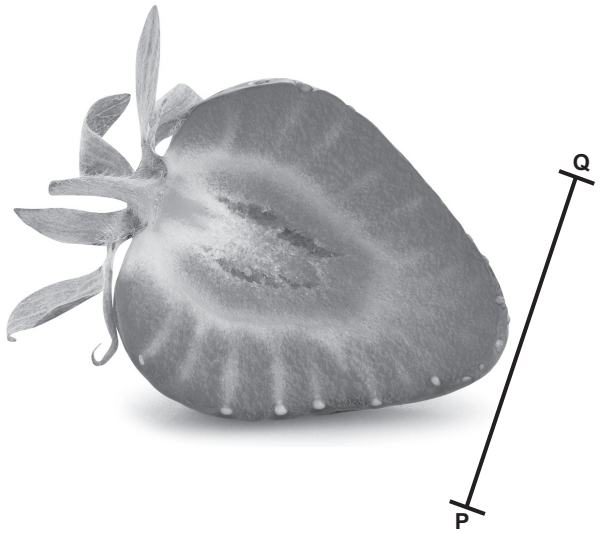
(iv) Using the data for **sample 3** in Table 2.2, calculate the percentage change in the vitamin C concentration of the apple juice when it is stored.

Give your answer to **one** decimal place.

Space for working.

.....% [3]

(d) Fig. 2.1 is a photograph of a fruit from a strawberry plant, *Fragaria ananassa*, that has been cut in half.



magnification ×1.8

Fig. 2.1

(i) Draw a large diagram of the strawberry fruit shown in Fig. 2.1.

[4]

(ii) Line **PQ** in Fig. 2.1 represents the maximum diameter of the strawberry fruit.

Measure the length of line **PQ** in Fig. 2.1.

length of **PQ** ..... mm

Calculate the actual diameter of the strawberry fruit using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line PQ in Fig. 2.1}}{\text{actual diameter of the strawberry fruit}}$$

Give your answer to **three** significant figures.

Space for working.

.....mm
[3]

(e) Describe a method the student could use to test a strawberry fruit for reducing sugars.

.....

.....

.....

.....

.....

.....

..... [2]

[Total: 24]

1 Potato cells contain the enzyme catalase. Catalase catalyses the breakdown of hydrogen peroxide into water and oxygen gas. The oxygen gas forms a foam. The height of the foam indicates how active the enzyme is.

A student investigated the effect of temperature on the activity of the enzyme catalase.

The student used this method:

Step 1 Label three test-tubes **C**, **R** and **H**.

Step 2 Use a syringe to add 4 cm^3 of hydrogen peroxide solution to each of the test-tubes labelled **C**, **R** and **H**.

Step 3 Place test-tube **C** into a cold water-bath.

Step 4 Place test-tube **R** in a test-tube rack to keep it at room temperature.

Step 5 Place test-tube **H** into a hot water-bath.

Step 6 Leave the test-tubes for five minutes.

Step 7 After five minutes, use a clean syringe to add 1 cm^3 of potato extract to test-tube **C**. Start the stop-clock.

Step 8 Repeat step 7 for test-tube **R** and test-tube **H**.

Fig. 1.1 shows the test-tubes 30 seconds after adding the potato extract.

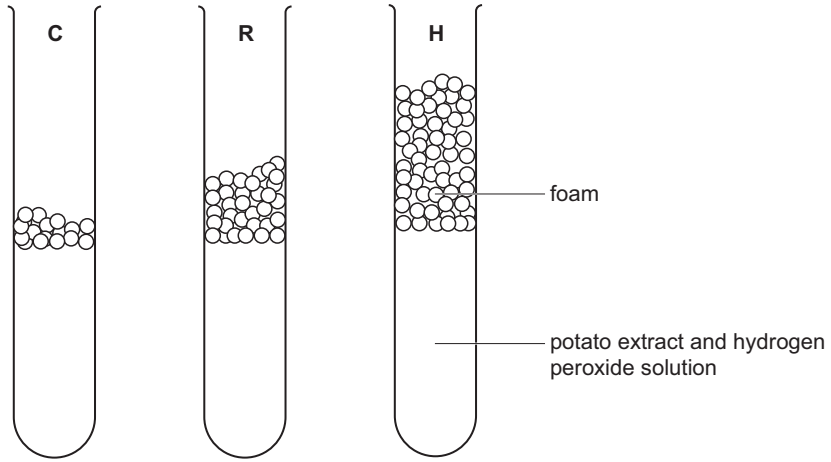


Fig. 1.1

(a) (i) Prepare a table for the results of the investigation.

Measure the maximum height of the foam, in mm, in each of test-tubes **C**, **R** and **H** shown in Fig. 1.1.

Record these measurements in your table.

[4]

(ii) State a conclusion for these results.

.....

.....

..... [1]

(iii) State the independent and dependent variables in the investigation.

independent variable .....

.....

dependent variable .....

.....

[2]

(iv) Explain why test-tube **C** and test-tube **H** were kept in the water-baths for five minutes in step 6.

.....

.....

..... [1]

(v) The student suggests repeating the investigation twice more.

Explain how this would give you more confidence in these results.

.....

.....

..... [1]

(vi) Potato extract can be prepared by cutting a potato into pieces and then grinding it with a mortar and pestle and some water.

Describe a safety precaution that would reduce the hazards in producing potato extract using this method.

.....

.....

..... [1]

(b) (i) Another student did the same experiment and measured the height of the foam in one of the test-tubes as 29 mm. The diameter of the test-tube was 25 mm.

Calculate the volume of foam produced, and give your answer in cm^3 to **one** decimal place.

Use 3.14 as the value for π.

..... cm^3 [3]

(ii) Suggest a more accurate method of measuring the volume of oxygen gas produced.

.....

.....

.... [1]

(c) Potatoes are a source of starch and vitamin C.

(i) Iodine solution was used to test a sample of potato for starch.

State the result of a positive test for starch.

..... [1]

(ii) State the name of a reagent that can be used to test for vitamin C.

..... [1]

(d) Photosynthesis also produces oxygen gas.

Plan an investigation to determine the effect of light intensity on the rate of photosynthesis in aquatic plants.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

[Total: 22]

8 Which chemical element is found in proteins but **not** in carbohydrates?

A carbon

B hydrogen

C nitrogen

D oxygen