Cambridge Assessment International Education

# Cambridge International AS & A Level

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*4841324854*

**BIOLOGY** **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 2024**

**2 hours**

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

**INSTRUCTIONS**

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

**INFORMATION**

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| Total | |

This document has **16** pages. Any blank pages are indicated.


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**1** Seeds of many plant species contain an enzyme that is used to hydrolyse sucrose into reducing sugars. This enzyme is essential to provide the reducing sugars needed for the seeds to grow.

When seeds are soaked in sucrose solution, some of this enzyme diffuses from the seeds into the surrounding solution and hydrolyses the sucrose, as shown in Fig. 1.1.

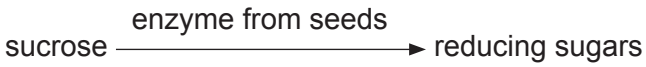



**Fig. 1.1**

You will investigate the release of this enzyme from the seeds of two different species of plant, **G** and **H**.

Seeds from the two different species of plant, **G** and **H**, were put into sucrose solutions at 20 °C for 24 hours, as shown in Fig. 1.2. All conditions, including the mass of seeds used, were the same.

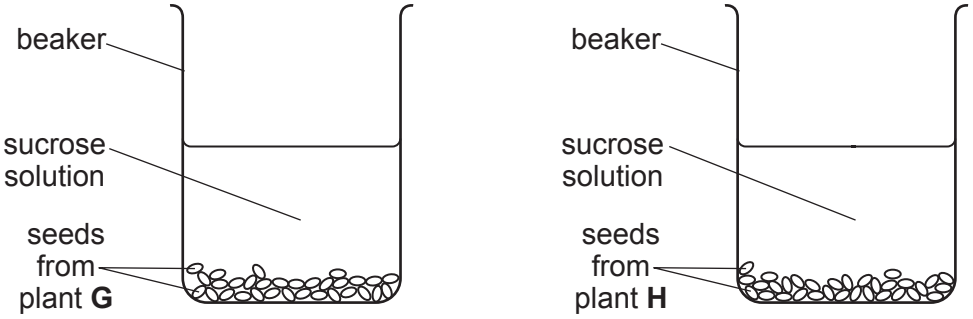



**Fig. 1.2**

After 24 hours, a sample of the sucrose solution was removed from each beaker.

You are provided with the materials shown in Table 1.1.

**Table 1.1**

| labelled | contents | hazard | volume / $cm^3$ |
|---|---|---|---|
| **R** | 1.00% reducing sugar solution | none | 50 |
| **W** | distilled water | none | 150 |
| **G1** | sample of the sucrose solution taken after 24 hours from plant **G** | none | 10 |
| **H1** | sample of the sucrose solution taken after 24 hours from plant **H** | none | 10 |
| **Benedict's** | Benedict's solution | harmful irritant | 25 |

If any solution comes into contact with your skin, wash it off immediately with cold water.

It is recommended that you wear suitable eye protection.

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You will determine the concentration of reducing sugars in **G1** and **H1** by:

- preparing different concentrations of reducing sugar solution
- carrying out a semi-quantitative Benedict's test on each of the concentrations of reducing sugar
- carrying out a semi-quantitative Benedict's test on **G1** and **H1**
- using your results to estimate the concentration of reducing sugars in **G1** and **H1**.

**(a)** You will need to carry out a **serial** dilution of the 1.00% reducing sugar solution, **R**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of reducing sugar solution in addition to the 1.00% reducing sugar solution, **R**.

After the serial dilution is completed, you will need to have 10 $cm^3$ of each concentration available to use.

**(i)** Complete Fig. 1.3 to show how you will prepare your serial dilution.

Each beaker should have:

- a labelled arrow to show the volume of reducing sugar solution transferred
- a labelled arrow to show the volume of distilled water, **W**, added
- a label under the beaker to show the concentration of the reducing sugar solution.

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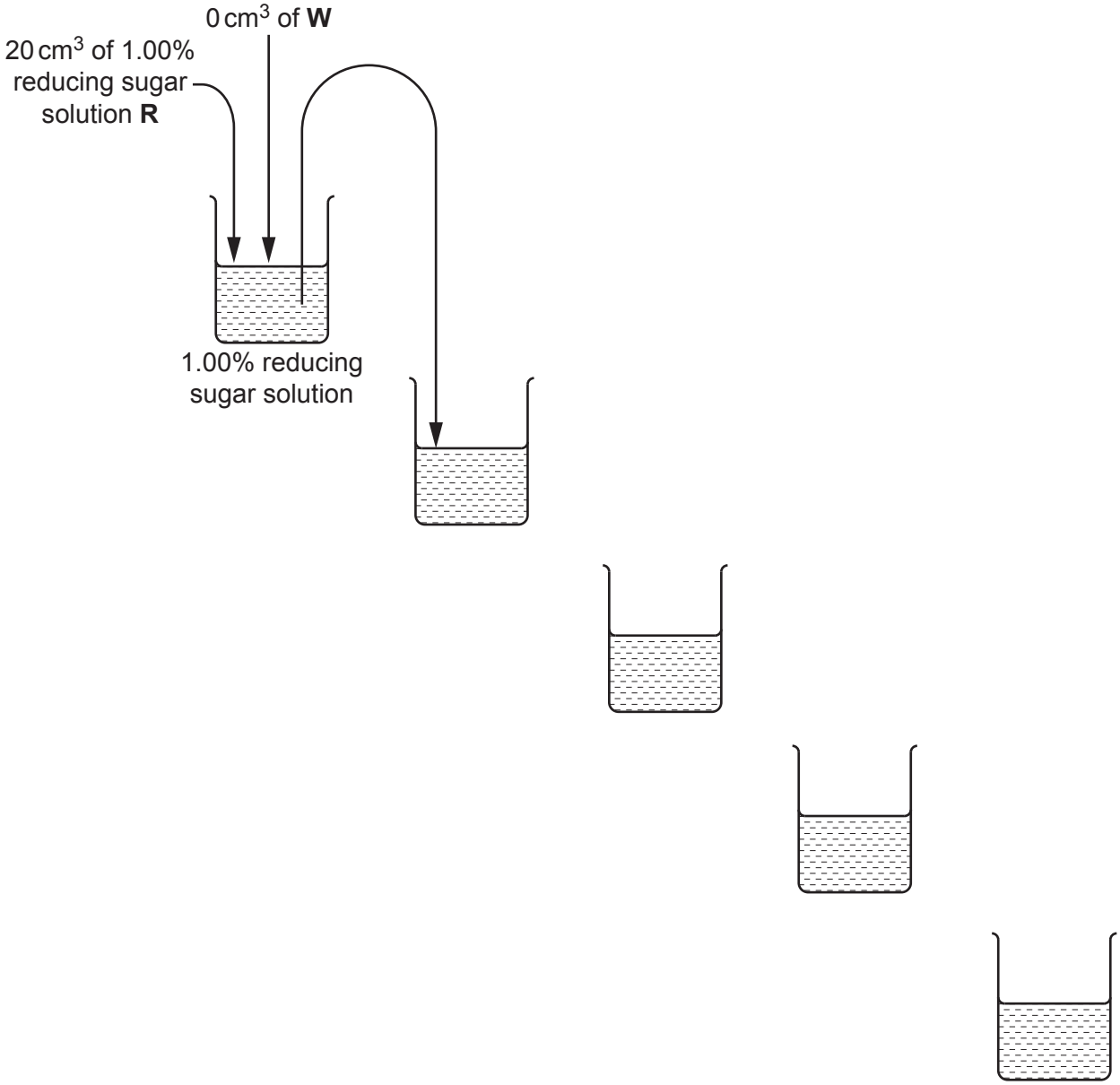

0 cm3 of W
20 cm3 of 1.00% reducing sugar solution R
1.00% reducing sugar solution

**Fig. 1.3**

[3]

Carry out step 1 to step 9.

step 1 Set up a water-bath using the beaker of water labelled **water-bath** and heat it to boiling, ready for step 6.

step 2 In the beakers provided, prepare the concentrations of reducing sugar solution as shown in Fig. 1.3.

step 3 Label five test-tubes with the concentrations you prepared in step 2.

step 4 Put 2 $cm^3$ of each reducing sugar concentration into the appropriately labelled test-tube.

step 5 Put 2 $cm^3$ of Benedict's solution into each of the test-tubes. Shake gently to mix.

step 6 Put the test-tube containing 1.00% reducing sugar solution into the boiling water-bath. Start timing.

step 7 Record, in **(a)(ii)**, the time taken to the first appearance of a colour change.

If there is no colour change after 120 seconds, stop timing and record the result as 'more than 120'.

step 8 Remove the test-tube from the boiling water-bath.

step 9 Repeat step 6 to step 8 with the remaining concentrations of reducing sugar.

You will need the boiling water-bath again in step 13.

**(ii)** Record your results in an appropriate table.

[5]

**(iii)** State the dependent variable in this investigation.

.....

..... [1]

You will now collect results to estimate the concentration of reducing sugars in samples **G1** and **H1**.

Carry out step 10 to step 16.

step 10 Label two test-tubes **G1** and **H1**.

step 11 Put 2 $cm^3$ of **G1** into the appropriately labelled test-tube.

step 12 Put 2 $cm^3$ of Benedict's solution into the test-tube. Shake gently to mix.

step 13 Put the test-tube into the boiling water-bath. Start timing.

step 14 Record, in **(a)(iv)**, the time taken to the first appearance of a colour change.

If there is no colour change after 120 seconds, stop timing and record the result as 'more than 120'.

step 15 Remove the test-tube from the boiling water-bath.

step 16 Repeat step 11 to step 15 with **H1**.

**(iv)** Record your results for **G1** and **H1**.

result for **G1** ..... s

result for **H1** ..... s
[1]

Fig. 1.4 shows a scale of reducing sugar concentrations from 1.00% to 0.00%.




**Fig. 1.4**

**(v)** Complete the scale in Fig. 1.4 so that it shows, in the correct positions, all the reducing sugar concentrations you prepared in step 2. [1]

**(vi)** Use your results in **(a)(ii)** and **(a)(iv)** to estimate the concentrations of reducing sugars in **G1** and **H1**.

Show your estimates for **G1** and **H1** on Fig. 1.4 by drawing arrows (↓) at the correct positions on the scale. Label one arrow **G1** and the other arrow **H1**. [1]

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**(vii)** Suggest modifications to this procedure that would allow you to obtain a more accurate estimate of the concentrations of reducing sugars in **G1** and **H1**.

.....

.....

.....

.....

.....

.....

..... [3]

**(viii)** A student repeated the investigation by soaking seeds from several other species of plant in sucrose solutions for 24 hours, either at a temperature of 20 °C or at a higher temperature. All other conditions were kept the same.

After soaking at 20 °C for 24 hours, the concentrations of reducing sugars were **different** for the seeds from different species of plants. However, after soaking at the higher temperature for 24 hours, the concentrations of reducing sugars were the **same** for all the seeds tested.

Suggest **and** explain why, at a higher temperature, the concentrations of reducing sugars were the same for all the seeds tested.

.....

.....

.....

.....

..... [2]

**(b)** Amylase is another enzyme released by germinating seeds. A scientist investigated the release of amylase from germinating seeds by measuring amylase activity over four days. Amylase activity was measured in arbitrary units (au).

The results are shown in Table 1.2.

**Table 1.2**

| time after germination / hours | activity of amylase / au |
|---|---|
| 0 | 1.6 |
| 24 | 7.5 |
| 48 | 5.4 |
| 72 | 2.6 |
| 96 | 1.7 |

**(i)** Plot a graph of the data in Table 1.2 on the grid in Fig. 1.5.

Use a sharp pencil.

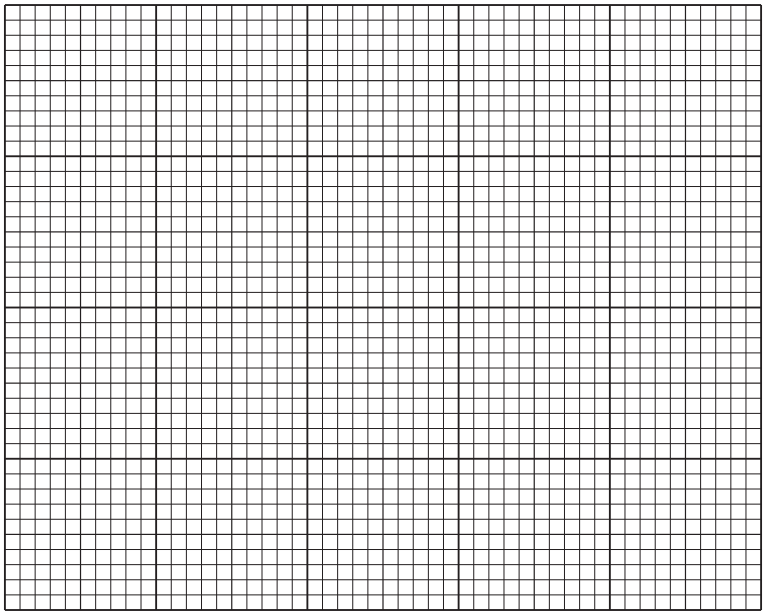


**Fig. 1.5**

[4]

**(ii)** Use your graph to estimate the activity of amylase at 60 hours after germination.

activity of amylase = ..... au [1]

[Total: 22]

**2** **P1** is a slide of a stained transverse section through a plant leaf.

**(a)** **(i)** Draw a large plan diagram of part of the leaf section on **P1** to show **all** of the different tissues.

The part of the section that you draw should show the full depth of the leaf section from the upper surface to the lower surface and must include at least **one** vascular bundle.

Use **one** ruled label line and label to identify the epidermis.

[5]

**(ii)** Observe the epidermal cells of the leaf on **P1**.

Select **four** adjacent epidermal cells that are arranged in a line.

Each cell must touch at least **one** other cell.

- Make a large drawing of this line of **four** cells.
- Use **one** ruled label line and label to identify the cell wall.

[5]

**(b)** Fig. 2.1 is a photomicrograph of a transverse section through a leaf of a different species of plant.

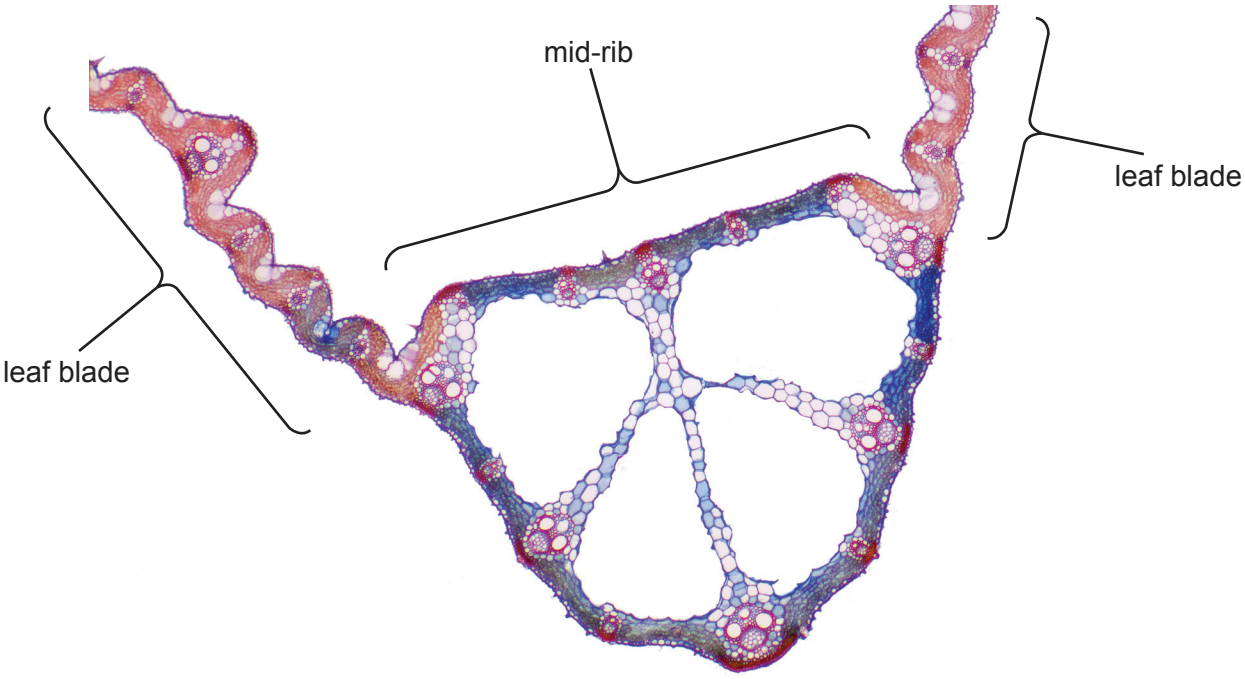



**Fig. 2.1**

**(i)** Identify **three** observable features, other than colour, that are different between the leaf in Fig. 2.1 and the leaf on **P1**.

Record the differences between these **three** observable features in Table 2.1.

**Table 2.1**

| feature | Fig. 2.1 | P1 |
|---|---|---|
| | | |

[3]

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**(ii)** The leaf section shown in Fig. 2.1 is from a plant that is adapted to live in water.

State **one** feature visible in Fig. 2.1 that adapts the plant to live in water.

Suggest the function of this feature.

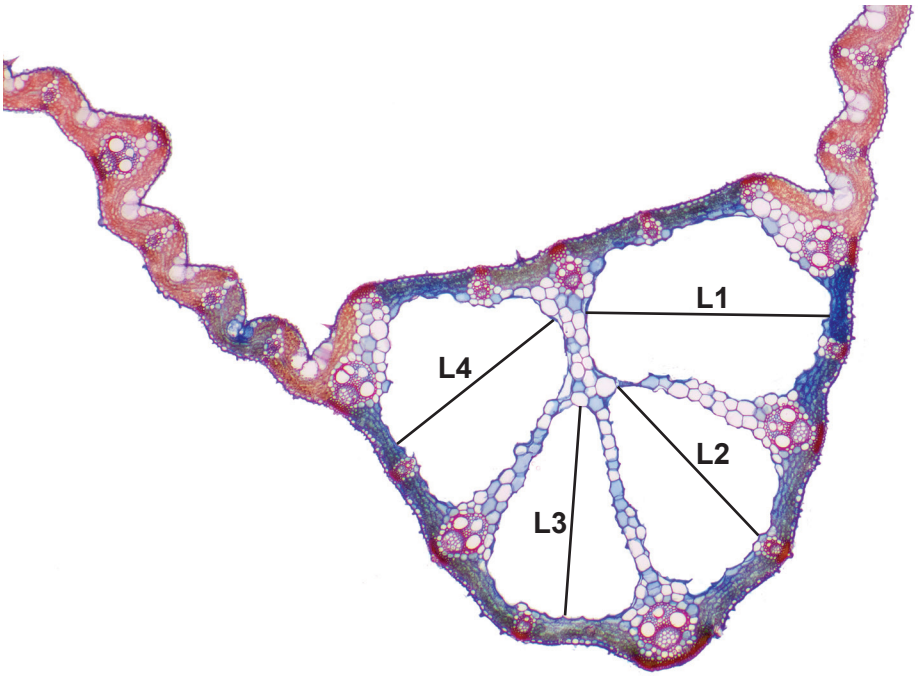
feature .....

function .....

.....

[1]

**(c)** Fig. 2.2 is the same photomicrograph of a transverse section of a leaf as is shown in Fig. 2.1.




magnification ×12

**Fig. 2.2**

**(i)** In Fig. 2.2, the lines **L1**, **L2**, **L3** and **L4** are drawn across the lengths of four air spaces.

Measure the lengths in the photomicrograph of these four air spaces, along the lines **L1**, **L2**, **L3** and **L4**.

length of **L1** = .....

length of **L2** = .....

length of **L3** = .....

length of **L4** = .....

Calculate the **mean** length in the photomicrograph of the four air spaces.

Show your working.

mean length = .....
[2]

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**(ii)** Calculate the mean **actual** length of these four air spaces in micrometres (μm), using your answer to **(c)(i)** and the magnification in Fig. 2.2.

Show your working.

Give your answer to an appropriate number of significant figures.

mean actual length = ..... μm
[2]

[Total: 18]

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