Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **5090/41**

Paper 4 Alternative to Practical **May/June 2023**

1 hour

You must answer on the question paper.

No additional materials are needed.

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 [ ].

This document has **8** pages. Any blank pages are indicated.

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1 A student investigated the uptake of water by a leafy plant stem in a laboratory using the apparatus, called a potometer, shown in Fig. 1.1.

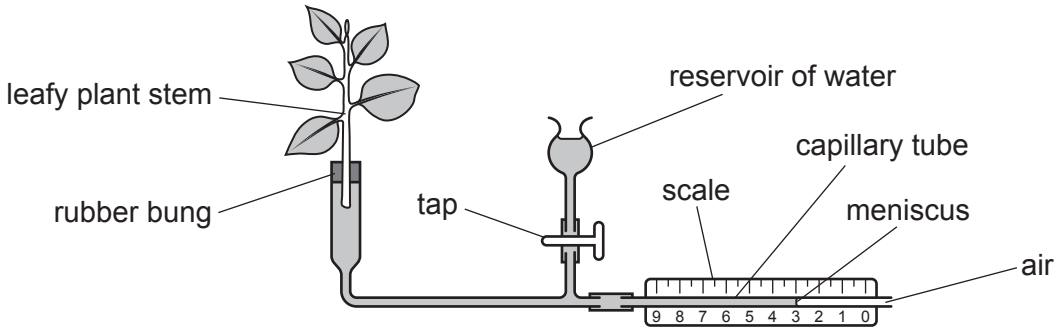


Fig. 1.1

As water is lost from the leaves by transpiration, water is taken into the cut end of the stem. The meniscus of the water in the capillary tube will then move towards the cut end of the stem.

At the beginning of the investigation, the student noted the position of the meniscus on the scale. This is its start position. The apparatus was left for 20 minutes and the position of the meniscus was noted against the scale again. This is its end position. Fig. 1.2 shows the start and end positions of the meniscus.



Fig. 1.2

(a) (i) Complete the column headings in Table 1.1. [1]

(ii) Read the start and end positions of the meniscus on the scales in Fig. 1.2 and record them in Table 1.1. [2]

Table 1.1

	start position /	**end position / .....**
position of meniscus		

(iii) Calculate the distance moved by the meniscus.

distance moved ..... [1]

(iv) Calculate the rate of movement of the meniscus.

rate ..... [2]

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(v) The student had difficulty making an accurate reading of the position of the meniscus.

Suggest what this difficulty was and a way of preventing this difficulty when setting up the apparatus.

difficulty .....

.....

prevention .....

.....

[2]

(vi) The stem was sealed in a tight-fitting rubber bung so that its cut end was in the water, as shown in Fig. 1.1.

Describe what might happen if this seal was not leak-proof and the effect that could have on the results.

description .....

.....

effect on results .....

.....

[2]

(vii) The tap on the reservoir of the potometer can be opened so that more water can flow into the capillary tube, moving the meniscus back to the start of the scale. The tap is then closed and the apparatus is ready to use again.

Explain why the student should take several readings using the same leafy plant stem.

.....

..... [1]

(viii) The apparatus in Fig. 1.1 is designed to investigate the uptake of water by a leafy stem. Sometimes this same measurement is described as the rate of water loss (transpiration) from the leafy stem.

Explain why the uptake of water and the rate of water loss may be different.

.....

..... [1]

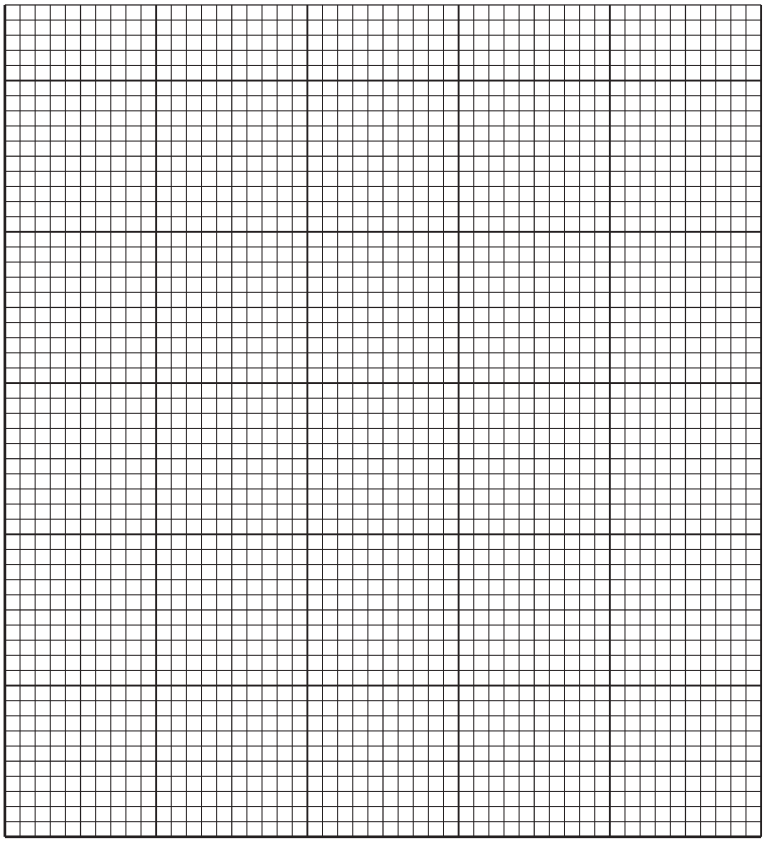
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(b) A scientist measured the rate of transpiration of a plant growing outside in a field during a morning. The results are shown in Table 1.2.

Table 1.2

time of day / hours	rate of transpiration / arbitrary units
04:00	1.1
06:00	2.4
08:00	4.5
10:00	6.8
12:00	9.9

(i) Construct a graph of the rate of transpiration against the time of day. Join your points with ruled lines. [4]



(ii) Use your graph to determine the rate of transpiration at 11:00. Show your working on the graph.

rate ..... arbitrary units [2]

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(iii) Leaves have many microscopic openings called stomata through which water evaporates and is lost from the leaf.

Stomata can be open so that more water vapour is lost, or closed so that less water vapour is lost.

Use this information, your graph and the data given to explain what is happening to the stomata between 04:00 and 12:00.

.....

.....

..... [2]

(c) A student reads that the rate of transpiration is lowest when the air around a leafy plant is still.

(i) Design an investigation using the apparatus in Fig. 1.1 to discover whether this statement is correct.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

(ii) Identify the independent variable in your investigation.

..... [1]

(d) A student wanted to discover whether some liquid collected from a vein in a green leaf contained glucose.

Describe a test for glucose that could be carried out, including how it would show that glucose was present.

.....

.....

..... [3]

[Total: 30]

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[Turn over

2 Fig. 2.1 is a photograph of a small animal that has an external shell.

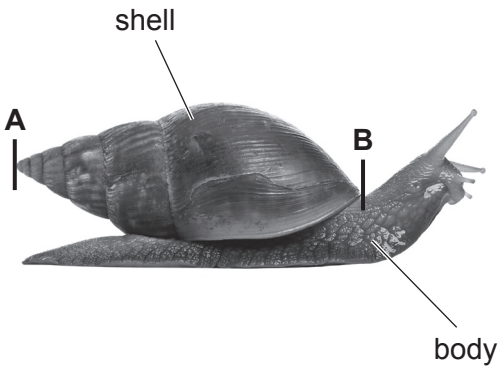


Fig. 2.1

(a) In the space below make a large drawing of the animal and its shell as shown in Fig. 2.1. Do **not** include the surface detail of the body of the animal.

[5]

(b) (i) Draw a straight line on the photograph to join lines **A** and **B**.

Measure and record the length of this line.

length of line **A–B** ..... mm [1]

(ii) On your drawing, draw a line at the same location as the line **A–B**.

Measure and record the length of this line.

length of line on drawing ..... mm [2]

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(iii) Use your measurements in **(b)(i)** and **(ii)** to calculate the magnification of your drawing compared to the photograph. Give your answer to 1 decimal place.

Space for working.

magnification × ..... [2]

[Total: 10]

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