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CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2419493412

BIOLOGY **9700/38**

Paper 3 Advanced Practical Skills 2 **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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	

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1 When potato pieces are soaked in methylene blue solution, the solution enters the potato tissue and stains it blue.

When the potato pieces are placed in water, the blue colour moves out of the tissue into the water.

You will investigate the effect of temperature on the movement of the blue colour out of the potato tissue.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
W	distilled water	none	75
T	tap water	none	400

labelled	contents	hazard	quantity
P	potato pieces stained with methylene blue	none	5 pieces

Methylene blue solution can stain clothing and skin. Use blunt forceps to handle the potato pieces and if any methylene blue comes into contact with your skin, wash it off immediately.

It is recommended that you wear suitable eye protection.

You will need to:

- put stained potato pieces in water at different temperatures
- leave the potato pieces in the water for 5 minutes
- record the intensity of colour in the water at each temperature.

The temperature range that you will use must include a minimum temperature of 25 °C **and** a maximum temperature of 65 °C.

(a) (i) State **three other** temperatures you will use in your investigation.

25 °C ..... °C ..... °C ..... °C 65 °C [1]

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Carry out step 1 to step 19.

step 1 Remove the five potato pieces from the beaker labelled **P** and cut them into lengths of 3 cm. Some methylene blue solution is released when the potato pieces are cut.

step 2 Empty the coloured water from **P** into the container labelled **For Waste**.

step 3 Put the potato pieces back into **P** and cover them with tap water from the beaker labelled **T**.

step 4 Stir the potato pieces with a glass rod.

step 5 Repeat step 2 to step 4 four more times. The water in **P** should now be pale blue or colourless.

step 6 Set up a water-bath at 25 °C. The water-bath will be needed in step 11.

step 7 Remove the potato pieces from **P** and put them on a paper towel.

step 8 Label **two** test-tubes 25 °C.

step 9 Put **one** potato piece into one of the labelled test-tubes.

step 10 Put 10 cm^3 of distilled water, **W**, into the test-tube with the potato piece.

step 11 Put this test-tube into the water-bath at 25 °C.

step 12 Start timing and leave the test-tube in the water-bath for 5 minutes.
You will need to maintain the temperature of the water-bath during this time.

step 13 After 5 minutes, remove the test-tube from the water-bath.

step 14 Stir the contents of the test-tube with a clean glass rod. Pour the water from this test-tube into the other test-tube that you labelled in step 8, leaving the potato piece in the first test-tube.

step 15 Put the test-tube containing the water into the test-tube rack to use in step 19. Put the other test-tube into the beaker labelled **D**.

step 16 Set up the water-bath at the next highest temperature stated in **1(a)(i)**.

step 17 Repeat step 8 to step 16 until all the temperatures stated in **1(a)(i)** have been tested, finishing with the maximum temperature of 65 °C.

step 18 Observe the colour intensity of the water in each of the test-tubes in the test-tube rack. Placing a piece of white paper or card behind each test-tube may help with your observations.

step 19 Using only the symbols shown in Table 1.2, decide on the colour intensity in each of the test-tubes. You may see the same colour intensity in more than one test-tube. Record your results in **1(a)(ii)**.

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Table 1.2

colour intensity	symbol
dark blue ↓ decreasing colour intensity ↓ no colour	++++++
	+++++
	++++
	+++
	++
	+

(ii) Record your results in an appropriate table.

[5]

(iii) State the independent variable in this experiment.

..... [1]

(iv) Describe the trend in your results.

.....

.....

.....

..... [1]

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(v) Use your results in **1(a)(ii)** to explain the effect of temperature on the release of methylene blue solution from the potato tissue.

.....

.....

.....

..... [2]

(vi) State why the water in step 5 needed to be pale blue or colourless.

.....

..... [1]

(vii) Explain why confidence in the results could be increased by repeating the procedure several times and finding the mean.

.....

.....

..... [1]

(viii) Two main sources of error in this investigation are shown in Table 1.3.

Complete Table 1.3 to suggest how to make an improvement to reduce each of the sources of error identified.

Table 1.3

main source of error	how to make an improvement
difficult to judge the intensity of colour	
difficult to maintain the temperature of the water-bath	

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(b) Methylene blue is used as a dye in many industries. If waste dye (methylene blue) enters a river it causes pollution. Scientists discovered that some plants can remove methylene blue from river water. The amount of dye removed by those plants depends on the pH of the river water.

Scientists investigated the effect of pH on the percentage of dye removed by the plants.

The results are shown in Table 1.4.

Table 1.4

pH	percentage of dye removed
4	96.3
5	96.2
6	95.8
8	94.5
10	94.3

(i) Plot a graph of the data shown in Table 1.4 on the grid in Figure 1.1.

Use a sharp pencil.

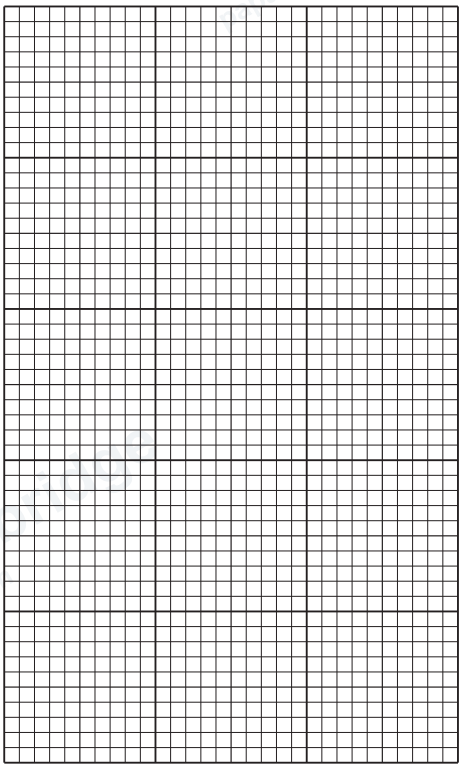


Figure 1.1

[4]

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(ii) Use your graph in Figure 1.1 to estimate the percentage of dye removed at pH 7.

percentage of dye removed = ... [1]

[Total: 19]

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2 **M1** is a slide of a stained transverse section through a stem.

(a) **(i)** Draw a large plan diagram of the whole stem on **M1**.

Use a sharp pencil.

Use **one** ruled label line to identify the xylem.

[5]

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(ii) Observe the xylem vessel elements on the section of the stem on **M1**.

Select a group of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **one** other xylem vessel element.

- Make a large drawing of this group of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of **one** xylem vessel element.

[5]

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(b) Figure 2.1 is a photomicrograph of a stained transverse section through a different species of plant.

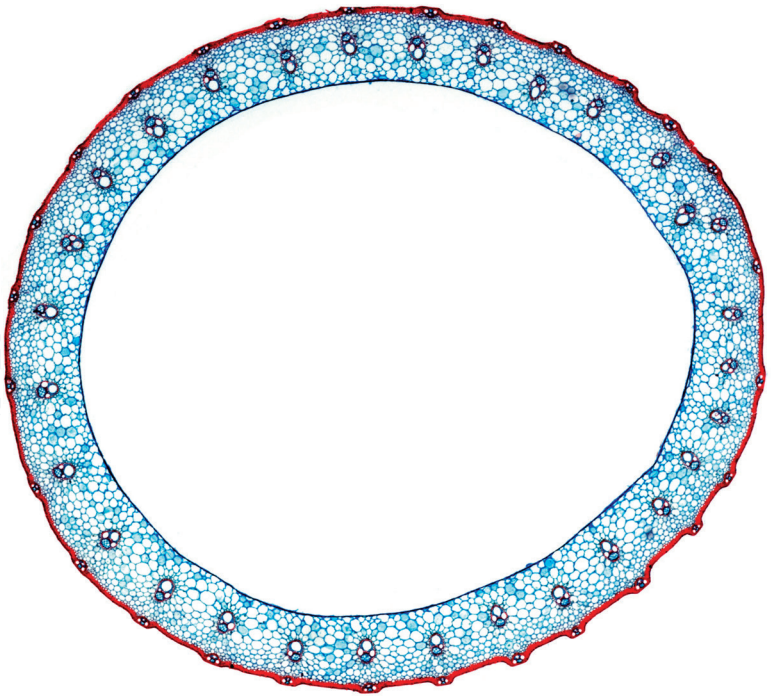


Figure 2.1

Identify **three** observable differences, other than colour, between the section on **M1** and the section in Figure 2.1.

Record these **three** observable differences in Table 2.1.

Table 2.1

feature	M1	Figure 2.1
1		
2		
3		

[4]

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(c) Figure 2.2 is the same photomicrograph as that shown in Figure 2.1.

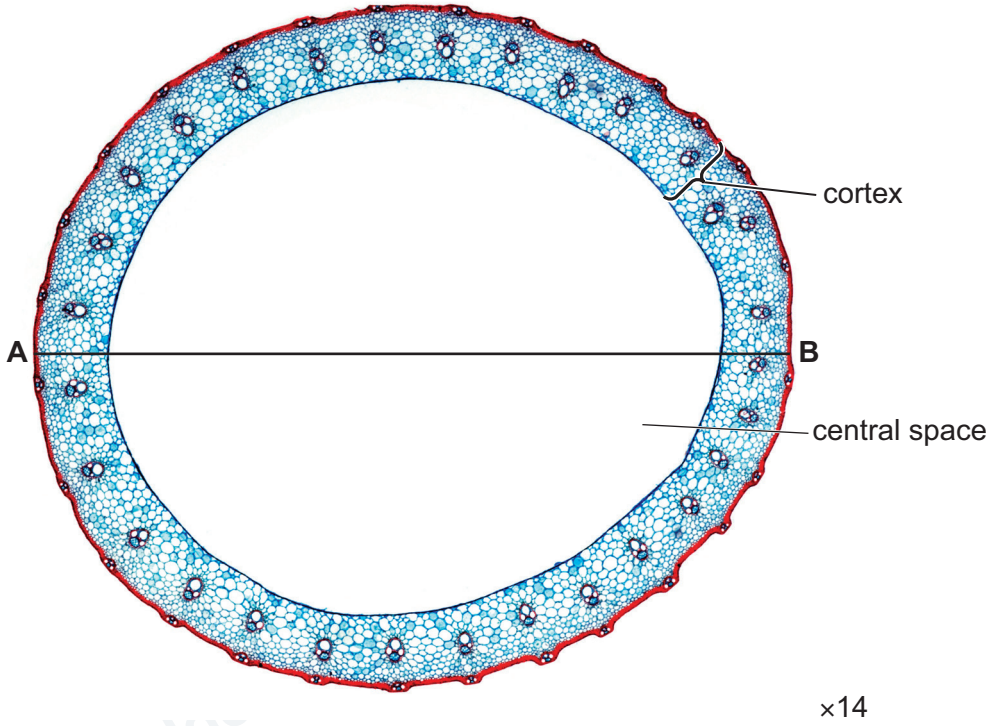


Figure 2.2

(i) On Figure 2.2, use the line **A**–**B** to measure the diameter of the stem **and** the diameter of the central space.

diameter of the stem = ...

diameter of the central space = ...

The magnification of the photomicrograph in Figure 2.2 is ×14.

Calculate the **actual** diameter of the stem and the **actual** diameter of the central space.

actual diameter of the stem = ...

actual diameter of the central space = ...

[4]

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(ii) Using the actual diameters from **2(c)(i)**, calculate the actual area of the cortex.

Show your working and give your answer to 3 significant figures.

The area of a circle = πr^2
π = 3.14
r = radius

actual area of the cortex = ... [2]

(iii) Suggest **one** advantage to the plant shown in Figure 2.2 of having a hollow stem.

.....

..... [1]

[Total: 21]

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