Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2114771965

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 2025**

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 **12** pages.

1 Agar cubes that have been stained with a blue indicator called DCPIP can be used to investigate diffusion.

When ascorbic acid diffuses into an agar cube stained blue with DCPIP, it causes the DCPIP to decolourise (the blue colour disappears). The end-point is reached when the agar cube has completely decolourised all the way through to the centre.

You will investigate the effect of temperature on the time taken to reach the end-point.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	materials	hazard	volume / cm^3
A	ascorbic acid solution in a beaker	low	100
B	agar block stained blue with DCPIP in a Petri dish	low	–

If **A** or **B** comes into contact with your skin, wash the affected area under cold water.

It is recommended that you wear suitable eye protection and disposable gloves.

You will need to:

- cut agar block **B** into cubes of equal size
- incubate the agar cubes in the ascorbic acid solution **A** at different temperatures
- record the time taken for each cube to reach the end-point.

The cubes will all be cut to a size of 5 mm × 5 mm × 5 mm, as shown in Fig. 1.1.

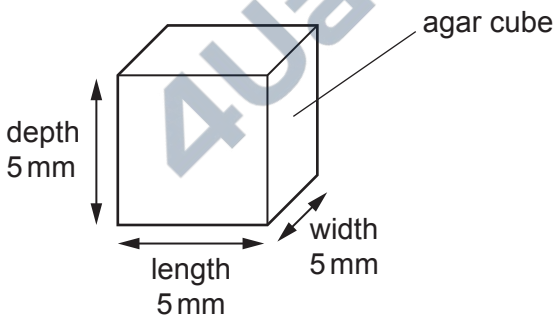


Fig. 1.1

You will use five different temperatures. The lowest temperature will be the temperature of the water in the beaker labelled **water-bath** before heating. The highest temperature will be 60 °C. You will need to decide on the three **other** temperatures that you will use.

(a) (i) Measure the temperature of the water in the beaker labelled **water-bath**.

Decide on the three **other** temperatures that you will use.

Complete Table 1.2 to show the temperature of the water in the water-bath and the three other temperatures that you have decided to use. The maximum temperature is already included.

Table 1.2

temperature / °C				
.....	.....	.....	.....	60
water-bath				maximum

[1]

Carry out step 1 to step 8.

step 1 On the tile provided, cut 5 agar cubes to the size shown in Fig. 1.1.

Put any waste pieces of agar into the container labelled **For waste**.

step 2 Put 10 cm^3 of **A** into a large test-tube.

step 3 Put the large test-tube into the water-bath and wait for 2 minutes.

(ii) Explain why the test-tube is left in the water-bath for 2 minutes in step 3.

.....

.....

..... [1]

step 4 After 2 minutes, put **one** of the agar cubes into the large test-tube and immediately start timing.

step 5 Measure the time taken for the agar cube to reach the end-point. Record this time in **(a)(iii)**.

The end-point is when the blue colour disappears from the **whole** agar cube.

If the end-point has **not** been reached after 300 seconds, stop timing and record the result as 'more than 300'.

step 6 Remove the large test-tube from the water-bath and place it in the test-tube rack.

step 7 Increase the temperature of the water-bath to the next temperature stated in Table 1.2 and maintain this temperature.

step 8 Repeat step 2 to step 7 until all of the temperatures stated in Table 1.2 have been tested.

(iii) Record your results in an appropriate table.

[5]

(iv) State the dependent variable in this investigation.

..... [1]

(v) Describe **and** explain the trend in your results.

.....

.....

.....

.....

..... [2]

(vi) Explain why confidence in the results can be increased by repeating the procedure several times.

.....

.....

..... [1]

(vii) You used the procedure described in step 1 to step 8 to investigate the effect of temperature on the diffusion of ascorbic acid into agar cubes of the same size.

Describe how you would modify the procedure to investigate the effect of changing the surface area to volume ratio of agar **cubes** on the time taken to reach the end-point.

.....

.....

.....

.....

..... [2]

(b) A scientist investigated the uptake of glucose into red blood cells. The red blood cells were put into a solution of radioactive glucose. The concentration of radioactive glucose in the red blood cells was measured over a period of 60 minutes.

The results are shown in Table 1.3.

Table 1.3

time / minutes	concentration of radioactive glucose / mmol dm^{-3}
0	0
10	48
20	71
30	83
40	94
60	102

(i) Plot a graph of the data shown in Table 1.3 on the grid in Fig. 1.2. Fig. 1.2 is on page 7.

Use a sharp pencil.

[4]

(ii) Use your graph in Fig. 1.2 to estimate the concentration of radioactive glucose in the red blood cells at 50 minutes.

Show on your graph how you estimated this value.

concentration of radioactive glucose = ... mmol dm^{-3}

[2]

(iii) Explain why the concentration of radioactive glucose in the red blood cells increases over time.

.....

.....

.....

.....

..... [2]

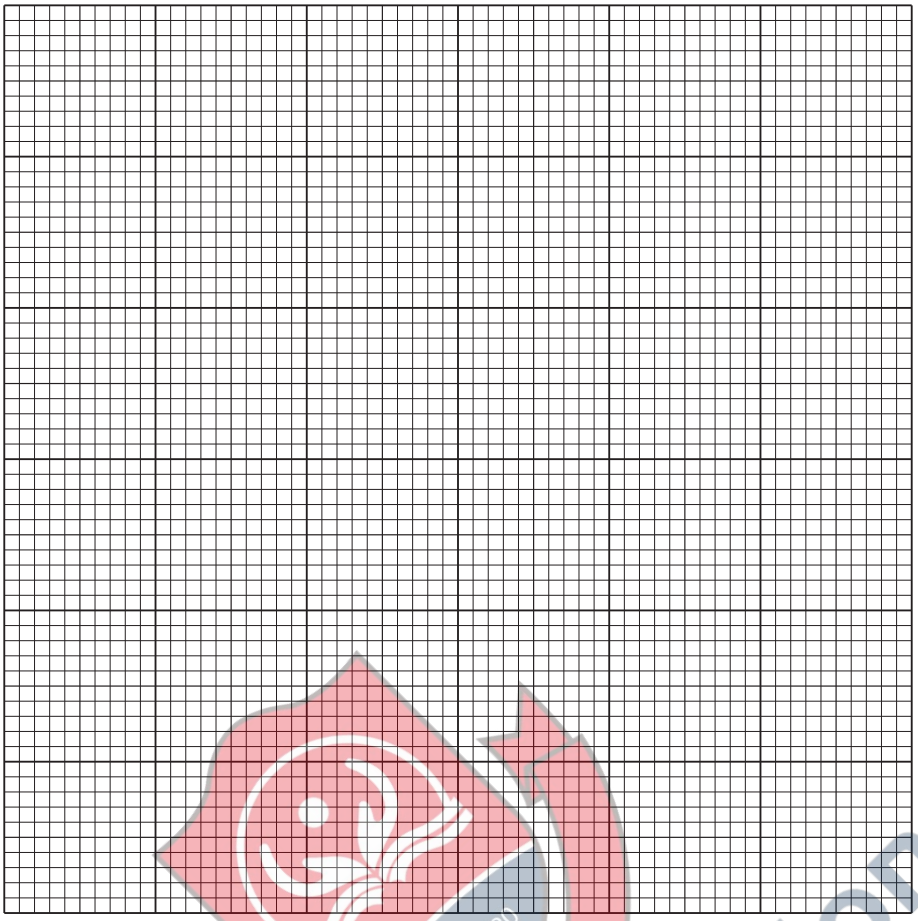


Fig. 1.2

[Total: 21]

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

(a) (i) Draw a large plan diagram of the region on **P1** indicated by the shaded area in Fig. 2.1.

Use a sharp pencil.

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

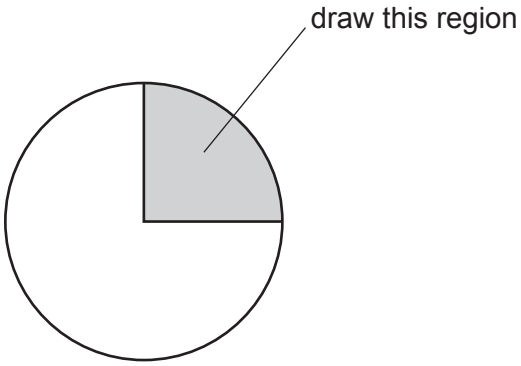


Fig. 2.1

[5]

(ii) Observe the cells in the cortex of the organ on **P1**.

The cortex is the tissue beneath the outer layer of cells (epidermis) of the organ on **P1**.

Select a group of four adjacent cells from within this tissue, making sure that each of the four selected cells is touching **at least two** of the other cells.

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

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section of the same organ shown on **P1** from a different species of plant. This species of plant has thorns. One of the thorns has been labelled on Fig. 2.2.

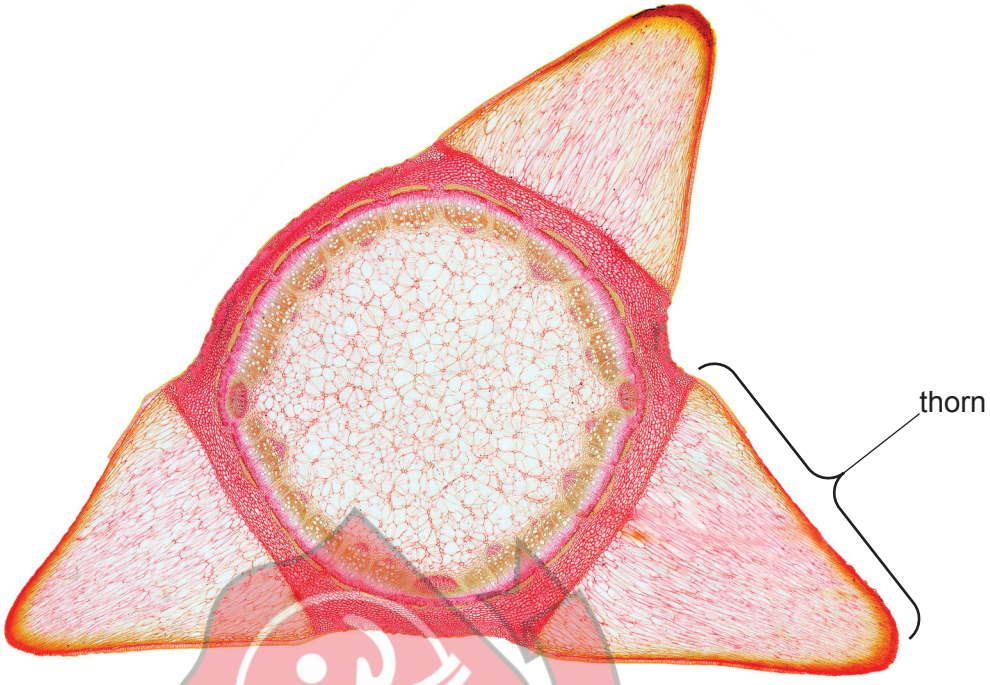


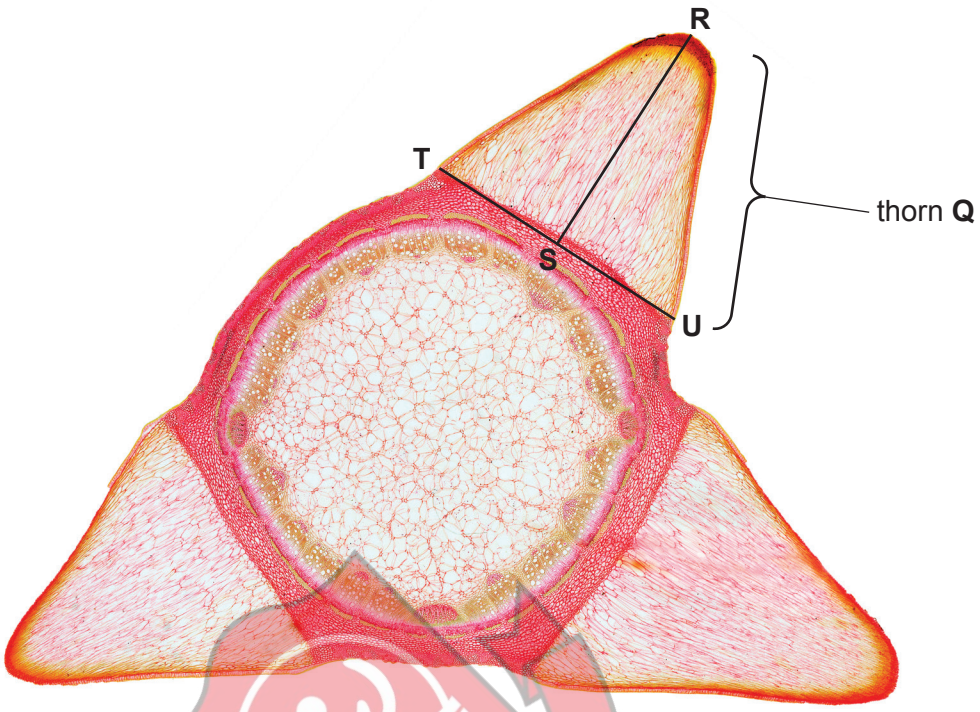
Fig. 2.2

Identify **three** observable differences, **other** than colour, size and presence or absence of thorns, between the section on **P1** and the section shown in Fig. 2.2.

Record these **three** observable differences in an appropriate table.

[4]

(c) Fig. 2.3 is the same photomicrograph as that shown in Fig. 2.2. Labels have been added to show where to measure the height and width of thorn **Q**.



magnification ×14

Fig. 2.3

(i) The section through thorn **Q** is the shape of a triangle. Line **R–S** is the height of the triangle and line **T–U** is the width of the triangle.

- Measure the lengths of line **R–S** and line **T–U** on Fig. 2.3.

length of line **R–S**: .....

length of line **T–U**: .....

- Calculate the actual height and actual width of the section through thorn **Q** using your measurements for the lengths of line **R–S** (height) and line **T–U** (width).

Show your working.

actual height = ...

actual width = ...

[3]

(ii) Calculate the actual area of the section through thorn **Q** using your answers to **(c)(i)**.

area of a triangle = 0.5 × height × width

Show your working and give your answer to **two** significant figures.

actual area of section through thorn **Q** = ...
[2]

[Total: 19]