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CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1586228697O

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **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	

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

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1 Plant cells contain the enzyme catalase, which catalyses the breakdown of hydrogen peroxide releasing oxygen.

You are going to investigate the effect of hydrogen peroxide concentration on the activity of the catalase in a plant extract.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
H	1.0% hydrogen peroxide solution	harmful irritant	40
P	plant extract	harmful irritant	55
U	unknown concentration of hydrogen peroxide solution	harmful irritant	10
W	distilled water	none	30

If any of the solutions comes into contact with your skin, wash it off immediately.

You should wear suitable eye protection.

Wear gloves to protect your hands when using **H** and **U**.

When a mixture of hydrogen peroxide solution and plant extract is put into a syringe, oxygen is produced inside the syringe. As the oxygen is produced, some of the mixture is pushed out of the syringe nozzle.

You will need to:

- prepare different concentrations of hydrogen peroxide
- mix each of the concentrations of hydrogen peroxide with plant extract in a syringe
- count the number of drops released from the syringe in 30 seconds
- use your results to estimate the concentration of hydrogen peroxide in **U**.

(a) You will need to use **proportional** dilution to make a total of **five** different concentrations of hydrogen peroxide.

You will need to prepare 10 cm^3 of each concentration, using **H** and **W**.

Table 1.2 shows two of the concentrations of hydrogen peroxide you will use and how to prepare **one** of the concentrations.

Decide which **three** other concentrations of hydrogen peroxide you will use.

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(i) Complete Table 1.2 to show how you will prepare the concentrations of hydrogen peroxide you will use.

Table 1.2

percentage concentration of hydrogen peroxide	volume of H / cm^3	volume of W / cm^3
1.0	10.0	0.0
0.2		

[2]

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Carry out step 1 to step 15.

step 1 Label beakers with the concentrations of hydrogen peroxide solution stated in Table 1.2.

step 2 Prepare the concentrations of hydrogen peroxide, as shown in Table 1.2, in the appropriately labelled beakers.

step 3 Hold the syringe so that the nozzle is just below the surface of the plant extract, **P**, as shown in Figure 1.1.

step 4 Pull the plunger out to the 4 cm^3 mark so that **P** enters the syringe, as shown in Figure 1.1.

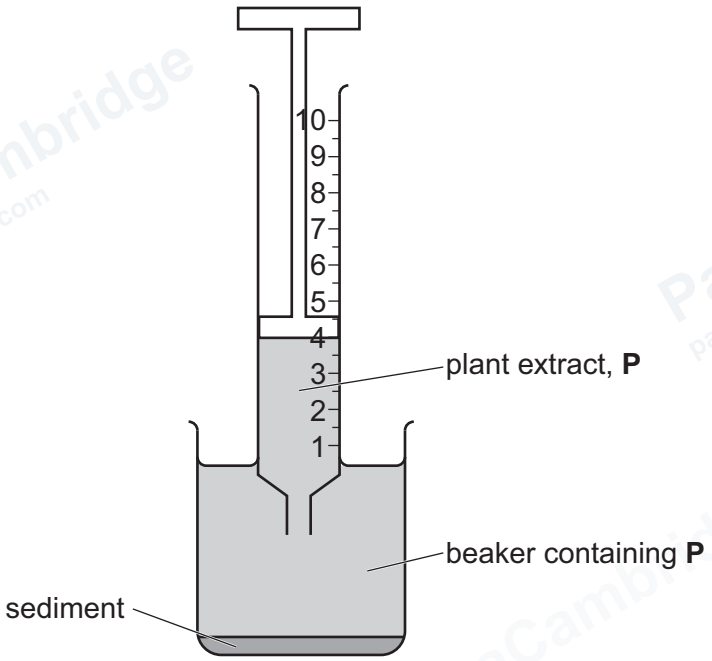


Figure 1.1

step 5 Remove the syringe from the beaker containing **P** and wipe the nozzle with a paper towel.

step 6 Put the nozzle of the same syringe into the beaker containing 1.0% hydrogen peroxide, **H**.

step 7 Pull the plunger out to the 8 cm^3 mark so that 4 cm^3 of **H** enters the syringe,as shown in Figure 1.2.

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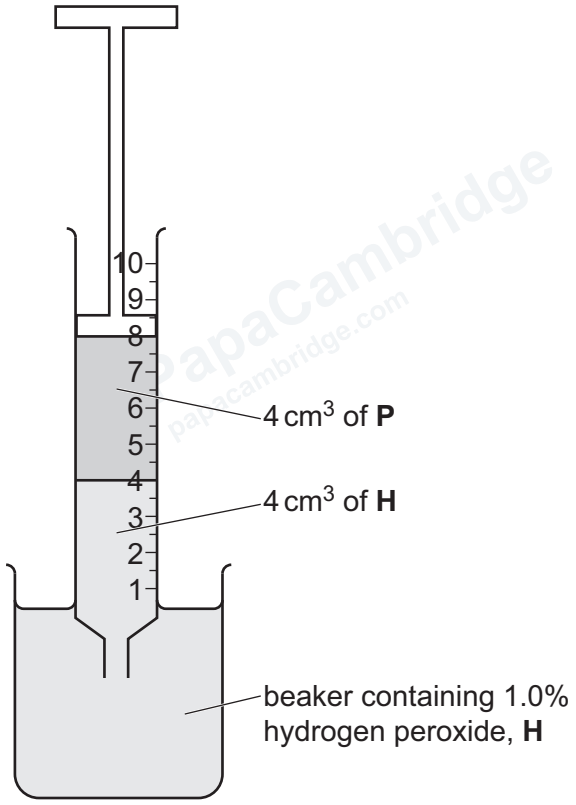


Figure 1.2

step 8 Remove the syringe from the beaker containing **H**.

step 9 Hold the syringe with the nozzle pointing downwards over the container labelled '**For waste**'.

step 10 Start the timer when a drop is released from the syringe. Count the number of drops released in 30 seconds. Record in **1(a)(ii)** the number of drops released.

step 11 Hold the syringe with the nozzle pointing downwards over the container labelled '**For waste**'. Push the plunger to empty the syringe.

step 12 Fill the syringe with water from the container labelled '**For washing'** and empty the syringe into the container labelled '**For waste**'.

step 13 Repeat step 3 to step 12 with the **same** concentration of hydrogen peroxide.

step 14 Repeat step 3 to step 13 with each of the other concentrations of hydrogen peroxide stated in Table 1.2.

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(ii) Record your results in an appropriate table.

[5]

step 15 Carry out step 3 to step 11 using **U** instead of **H**. Record in **1(a)(iii)** the number of drops released.

(iii) State the number of drops released in 30 seconds for **U**.

number of drops ..... [1]

(iv) Use your results in **1(a)(ii)** and **1(a)(iii)** to estimate the concentration of hydrogen peroxide in **U**.

percentage concentration of hydrogen peroxide in **U** = ... [1]

(v) Describe a suitable control to show that an enzyme in **P** causes the breakdown of hydrogen peroxide in this investigation.

.....

..... [1]

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(vi) Complete Table 1.3 to identify **two** main sources of error in step 7 to step 10 **and** describe how you could improve the procedure to reduce the effect of each source of error.

Table 1.3

error	improvement

[4]

(vii) A student repeated the investigation and increased the concentration of hydrogen peroxide to 2.0%.

Predict the effect of increasing the concentration of hydrogen peroxide on the number of drops released in 30 seconds.

Explain your answer.

.....

.....

..... [1]

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(b) A student estimated the concentration of hydrogen peroxide in fresh urine samples from some healthy humans.

The student mixed a standardised volume of urine with catalase and measured the oxygen released. This was used to determine the concentration of hydrogen peroxide present in the samples of urine.

The results are shown in Table 1.4 for females and males.

Table 1.4

age / years	concentration of hydrogen peroxide / μmol dm^{-3}	
	female	male
19	0.75	14.50
25	11.00	6.00
35	13.50	18.25

(i) Draw a bar chart of the data in Table 1.4 on the grid in Figure 1.3.

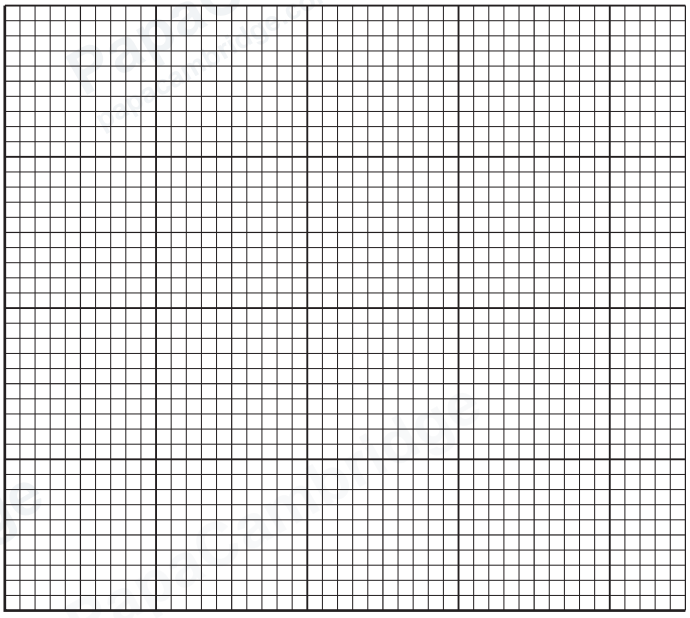


Figure 1.3

[4]

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(ii) From the data in Table 1.4, the student wrote the conclusion:

more hydrogen peroxide is present in urine as people get older.

Outline the extent to which the data in Table 1.4 supports or does not support this conclusion.

.....

.....

.....

.....

..... [2]

[Total: 21]

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2 **J1** is a slide of a stained transverse section through a plant stem.

(a) **(i)** Draw a large plan diagram of the region of the stem on **J1** indicated by the shaded area in Figure 2.1. Use a sharp pencil.

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

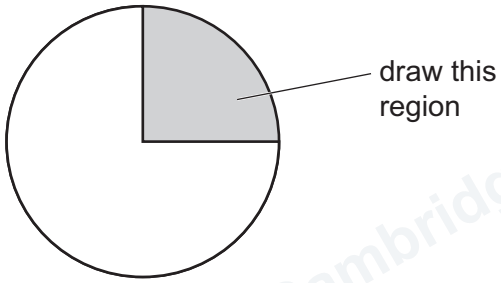


Figure 2.1

[5]

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(ii) Observe the central tissue of the section on **J1**.

Select a group of **four** adjacent cells from the central tissue.

Each cell must touch at least **two** of the other cells from the central tissue.

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

[5]

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(b) Figure 2.2 is a photomicrograph of a stained transverse section of a stem from a different plant.

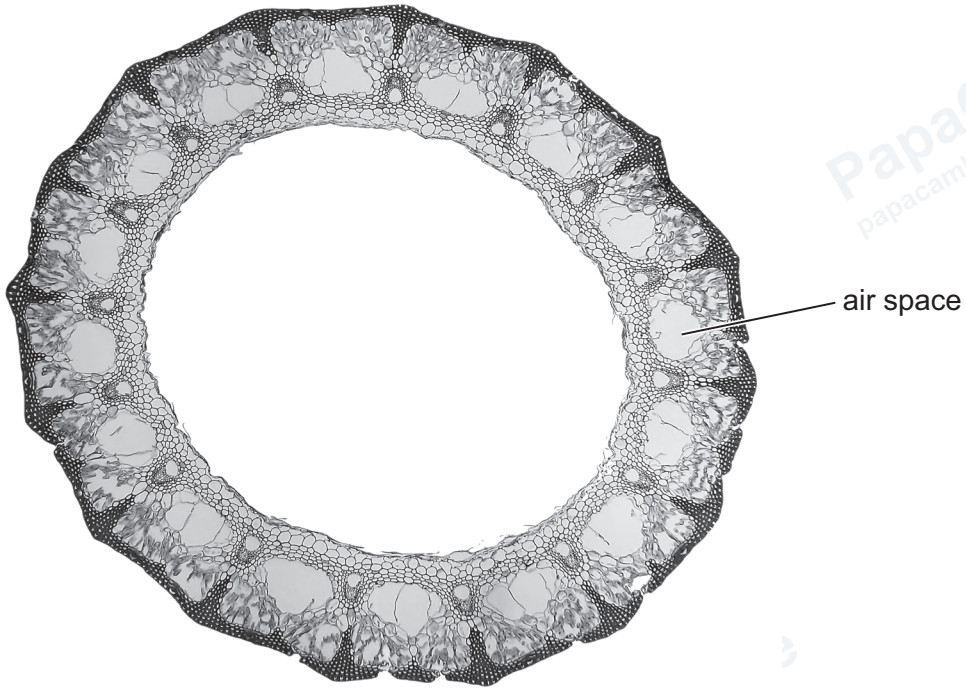


Figure 2.2

(i) Identify **three** observable differences, other than colour, between the section on **J1** and the section in Figure 2.2.

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

Table 2.1

feature	J1	Figure 2.2
1		
2		
3		

[4]

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(ii) The stem section shown in Figure 2.2 is from a plant that is adapted to live in a wetland habitat.

State **one** feature visible in Figure 2.2 that adapts the plant to live in this habitat.

Suggest a function of this feature.

feature .....

function .....

.....

[1]

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(c) Figure 2.3 is the same photomicrograph as that shown in Figure 2.2.

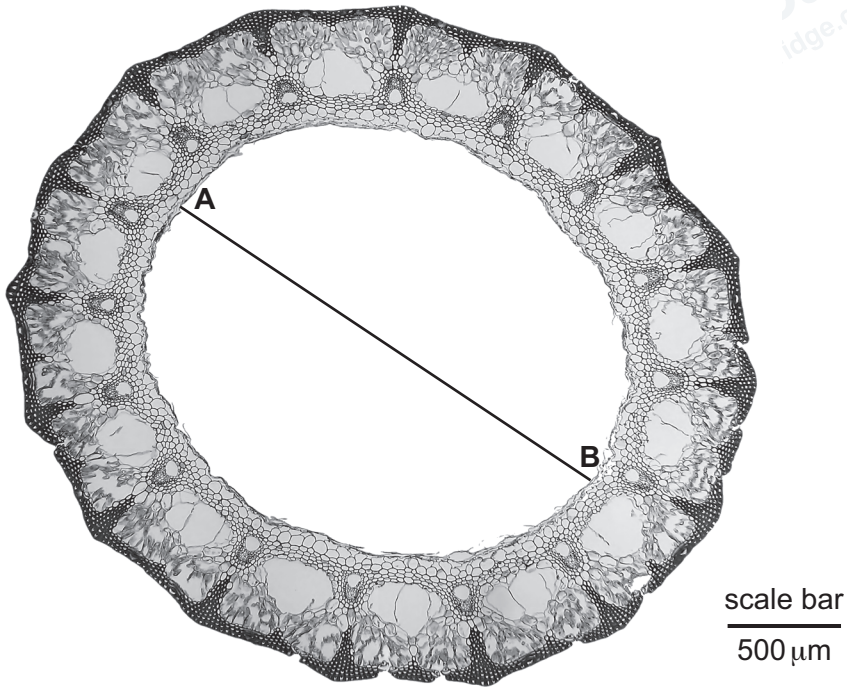


Figure 2.3

Use the scale bar on Figure 2.3 and the line **A–B** to calculate the actual diameter of the central region in Figure 2.3.

Show your working, including units.

actual diameter = ... [4]

[Total: 19]

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