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* 0000800000001 * DFD

CAMBRIDGE
International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 7 3 0 7 6 2 8 6 2 3 *

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

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.

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**[Turn over**

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

You are going to investigate the effect of hydrogen peroxide concentration on the activity of 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 | 50 |
| **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**.

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
- measure the rate at which the mixture is released from the syringe.

**(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]

Carry out step 1 to step 22.

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 Put clear plastic tubing onto the nozzle of a 10 $cm^3$ syringe, as shown in Figure 1.1.

step 4 Put two marks on the tubing so that one mark is 5 cm from the nozzle and the other mark is 15 cm from the nozzle, as shown in Figure 1.1.

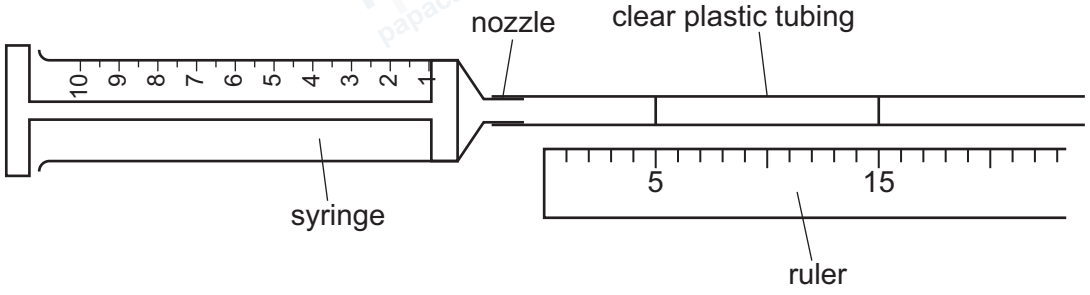



**Figure 1.1**

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step 5 Remove the tubing from the nozzle of the syringe.

step 6 Hold the syringe so that the nozzle is just below the surface of the plant extract, **P**, as shown in Figure 1.2.

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

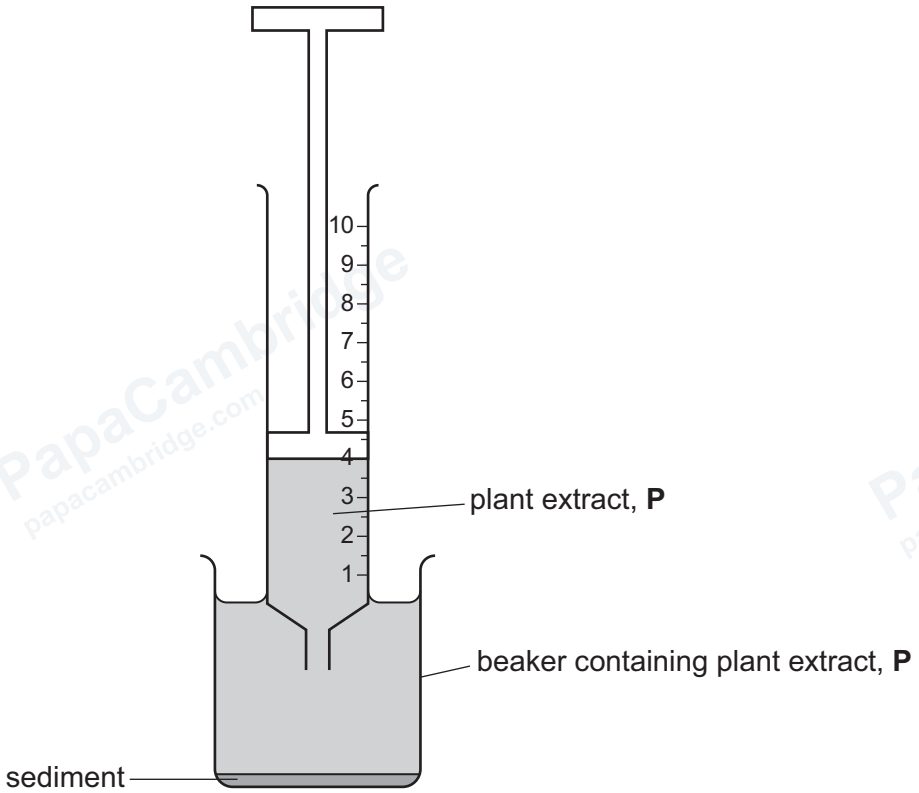



**Figure 1.2**

step 8 Remove the syringe from the beaker containing **P** and wipe the nozzle with a paper towel.

step 9 Put the nozzle of the same syringe into the beaker containing 1.0% hydrogen peroxide, **H**.

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step 10 Pull the plunger out to the 8 $cm^3$ mark so that 4 $cm^3$ of **H** enters the syringe, as shown in Figure 1.3.

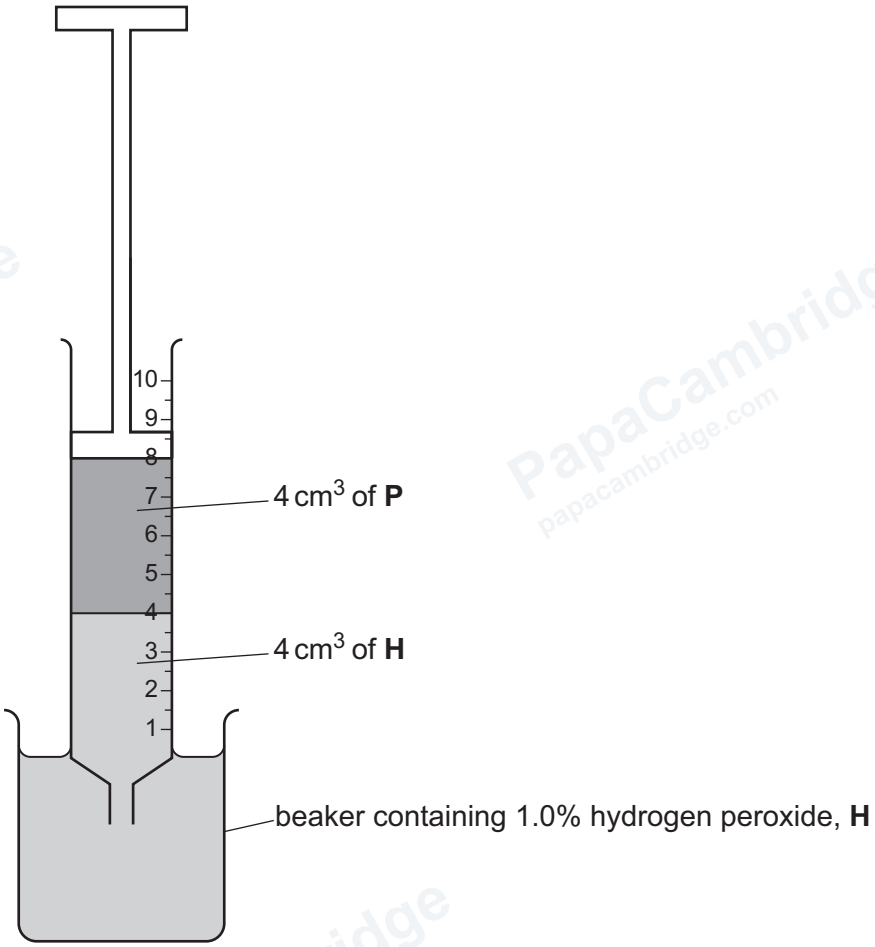



**Figure 1.3**

step 11 Remove the syringe from the beaker containing **H**.

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step 12 Put the tubing onto the nozzle, as shown in Figure 1.4.

step 13 Put the syringe and tubing on a flat surface.

step 14 Start timing when the mixture reaches the 5 cm mark.

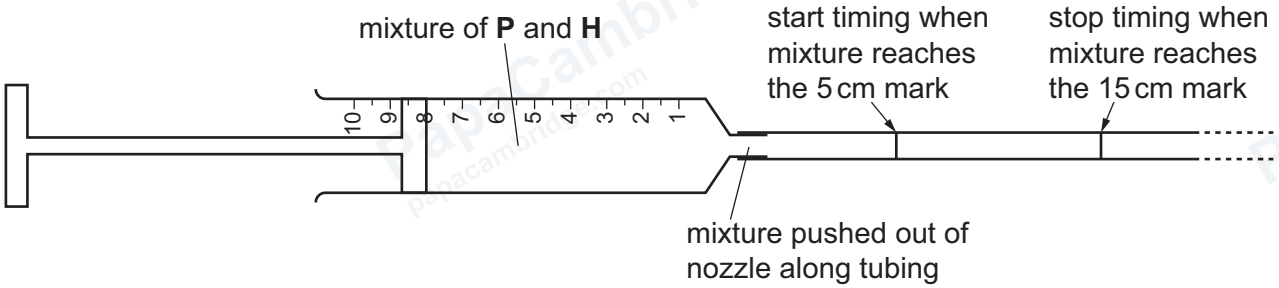



**Figure 1.4**

step 15 Stop timing when the mixture reaches the 15 cm mark. Record the time in **1(a)(ii)**.

If the mixture takes more than 4 minutes to reach the 15 cm mark, record as 'more than 240'.

step 16 Hold the syringe so that the open end of the tubing is in the container labelled '**For waste**'. Push the plunger to empty the syringe.

step 17 Remove the tubing from the syringe and put the tubing onto a paper towel.

step 18 Fill the syringe with water from the container labelled '**For washing**'. Put the tubing onto the syringe nozzle and empty the syringe into the container labelled '**For waste**'.

step 19 Remove the tubing from the syringe and pull out the plunger. Put the tubing onto the syringe nozzle and hold the tubing over the container labelled '**For waste**'. Push the plunger in completely to remove any liquid left in the tubing.

step 20 Remove the tubing from the syringe and put the tubing onto a paper towel.

step 21 Repeat step 6 to step 20 with the **same** concentration of hydrogen peroxide.

step 22 Repeat step 6 to step 21 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]

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

description .....

.....

explanation .....

.....

.....

.....

.....

.....

.....

[4]

**(iv)** State **one** main source of error in the procedure.

.....

..... [1]

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**(v)** A student suggested that measuring the volume of oxygen produced can be used to determine the rate of breakdown of hydrogen peroxide.

- Draw a labelled diagram of the assembled apparatus the student could use to measure the volume of oxygen produced.
- Outline how the student could use the apparatus to determine the rate of breakdown of hydrogen peroxide.

.....

.....

.....

..... [3]

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**(b)** Phagocytes release hydrogen peroxide to destroy pathogenic microorganisms that enter the human body. Some microorganisms can break down the hydrogen peroxide.

A scientist investigated the effect of using hydrogen peroxide to kill microorganisms.

The scientist used five different species of microorganism. Each species of microorganism was put into a solution of 3% hydrogen peroxide. The time taken to kill 90% of the microorganisms (the D-value) was recorded for each species.

The results are shown in Table 1.3.

**Table 1.3**

| species of microorganism | D-value / min |
|---|---|
| **A** | 25.50 |
| **K** | 2.00 |
| **S** | 3.25 |
| **C** | 22.25 |
| **T** | 1.00 |

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**(i)** Draw a bar chart of the data in Table 1.3 on the grid in Figure 1.5.

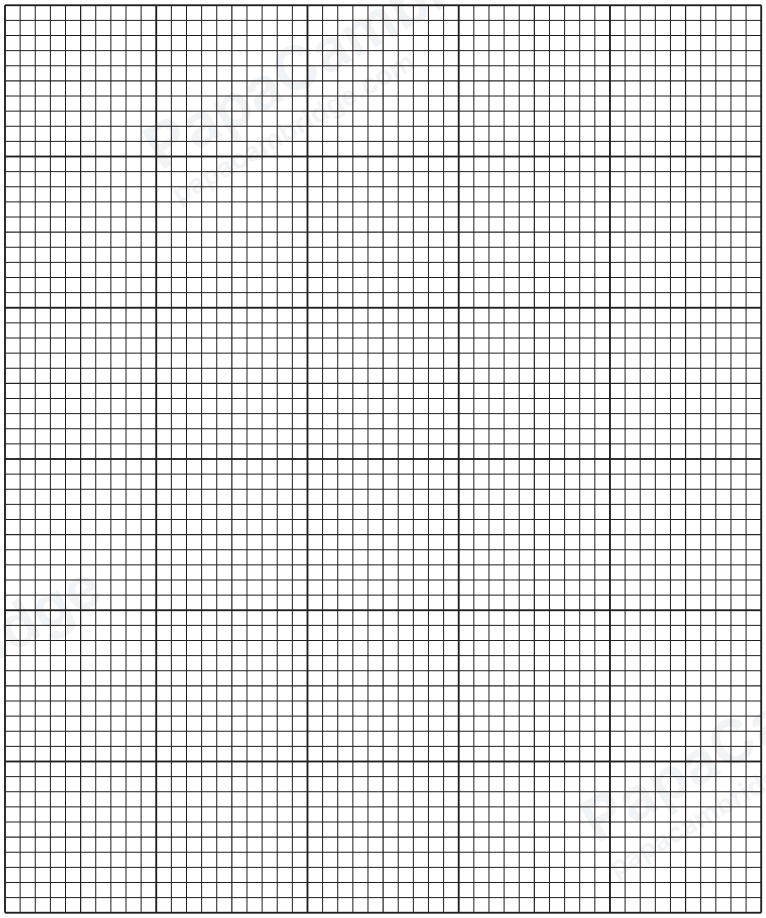


**Figure 1.5**

[4]

**(ii)** Suggest why the D-values for microorganisms **A** and **C** were higher than the D-values for **K**, **S** and **T**.

..... [1]

[Total: 20]

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**2** **L1** is a slide of a stained transverse section through a plant organ.

**(a)** **(i)** Draw a large plan diagram of the whole section on **L1**. Use a sharp pencil.

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

[5]

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**(ii)** Observe the epidermis on the section on **L1**.

Select a group of **four** adjacent epidermal cells.

Each cell must touch at least **one** of the other epidermal cells.

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

[5]

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**(b)** Figure 2.1 is a photomicrograph of a stained transverse section of a different organ from a different plant.

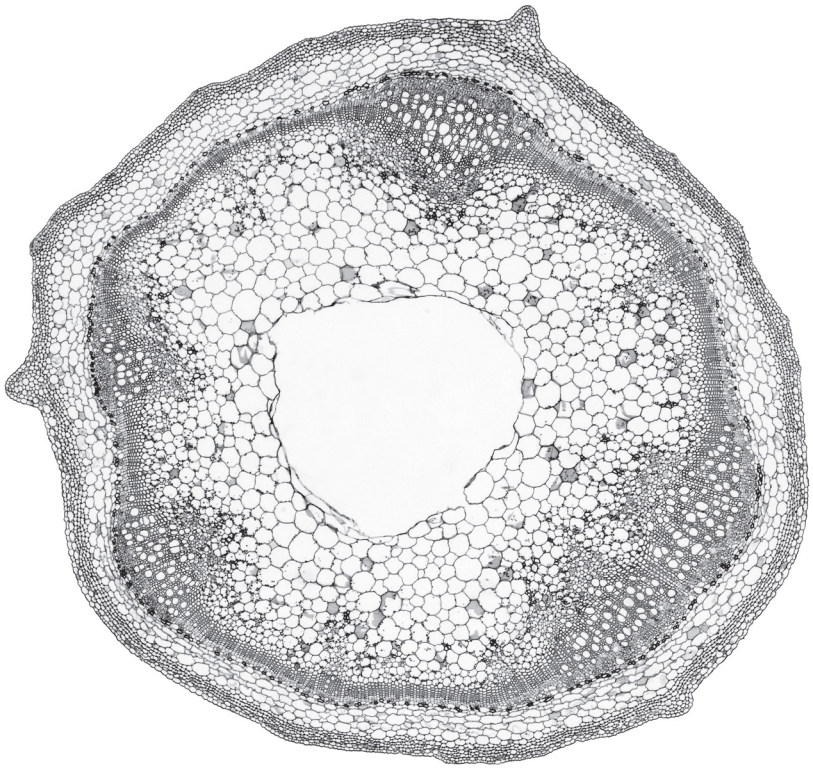


**Figure 2.1**

**(i)** Identify **three** observable differences, other than colour, between the section on **L1** and the section in Figure 2.1.

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

**Table 2.1**

| feature | L1 | Figure 2.1 |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

[4]

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**(ii)** Use your observations in **2(b)(i)** to identify the type of plant organ on **L1** and the type of plant organ in Figure 2.1.

plant organ on **L1** .....

plant organ in Figure 2.1 .....

[1]

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

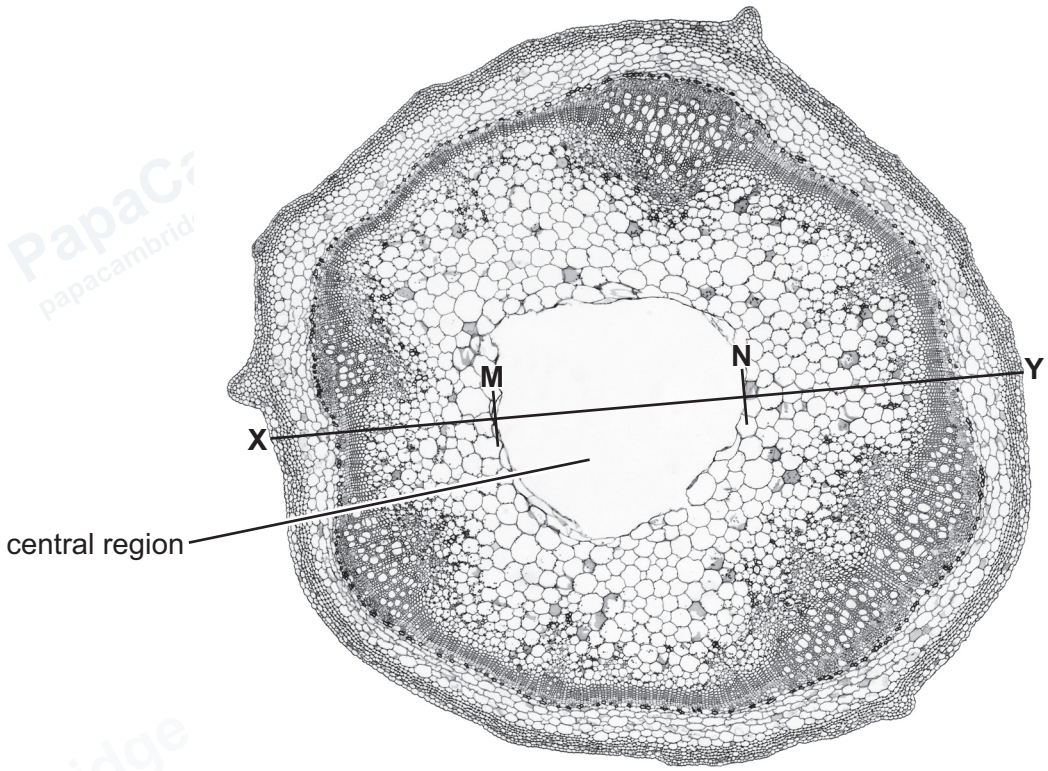



**Figure 2.2**

In Figure 2.2:

- the line **X**–**Y** represents the diameter of the whole section
- the line **M**–**N** represents the diameter of the central region.

**(i)** Using the line **X**–**Y** and the line **M**–**N**, measure the diameter of the whole section **and** the diameter of the central region.

Use appropriate units.

diameter of whole section .....

diameter of central region .....

[2]

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**(ii)** Calculate the area of the whole section and the area of the central region using the answers in **2(c)(i)** and the equation:

$$\text{area} = \pi r^2$$

where $\pi = 3.14$ and **r** = radius.

Show your working and include appropriate units.

area of whole section .....

area of central region .....

[2]

**(iii)** State the ratio of the area of the whole section to the area of the central region.

ratio ..... [1]

[Total: 20]

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