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Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7802017452

BIOLOGY **5090/42**

Paper 4 Alternative to Practical **October/November 2025**

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 **12** pages. Any blank pages are indicated.

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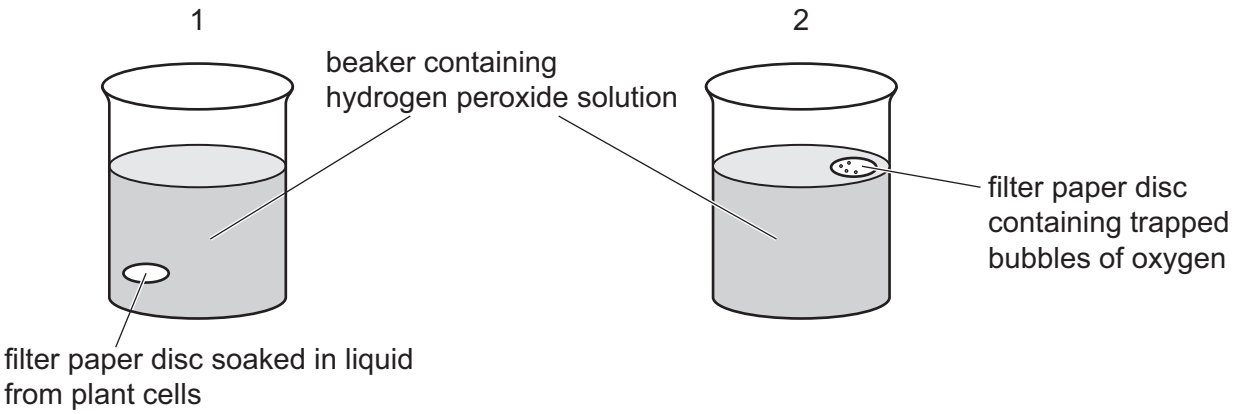
1 Hydrogen peroxide is a harmful waste product in living cells. The enzyme catalase breaks down hydrogen peroxide into water and oxygen.

Some students investigated catalase in tissues from different plants. They used small filter paper discs. The filter paper discs were placed on the cut surface of plant tissues to absorb liquid from the cells. The liquid from the cells might contain catalase.

Fig. 1.1 shows how the students were able to tell if catalase was present in tissues from different plants.



A filter paper disc soaked in liquid from plant cells was dropped into the hydrogen peroxide solution and sank to the bottom.

If catalase was present, bubbles of oxygen formed. The bubbles of oxygen were trapped in the filter paper disc making it float to the surface.

Fig. 1.1

The students were given 2 cm × 2 cm × 2 cm cubes of tissue from three different plants labelled **A**, **B** and **C**, small filter paper discs and a beaker of hydrogen peroxide solution.

The students followed this procedure.

- Cut the piece of plant tissue **A** in half.
- Use forceps to place a filter paper disc onto a cut surface of plant tissue **A**, to absorb liquid from the cells.
- After 1 minute, use forceps to pick up the filter paper disc from the cut surface of plant tissue **A**.
- Drop the filter paper disc into the beaker of hydrogen peroxide solution and immediately start timing. The filter paper disc will sink to the bottom of the beaker.
- Observe the filter paper disc until it reaches the surface of the hydrogen peroxide solution, then stop timing. If a filter paper disc does **not** float within 4 minutes (240 seconds) stop timing and record the time taken for the filter paper disc to reach the surface as >240.
- Record the time taken, to the nearest whole second, for the filter paper disc to reach the surface of the hydrogen peroxide solution.
- Use forceps to remove the filter paper disc from the beaker of hydrogen peroxide solution and place it in the waste container provided.
- Rinse and dry the forceps.
- Repeat the procedure **two** more times with filter paper discs on the same cut surface of plant tissue **A**.
- Repeat all of the procedure for filter paper discs on plant tissue **B** and then again for plant tissue **C**.

Fig. 1.2 shows a student's notebook. The student has recorded their results to the nearest whole second. The result for the third filter paper disc on plant tissue **A** is missing from their notes.

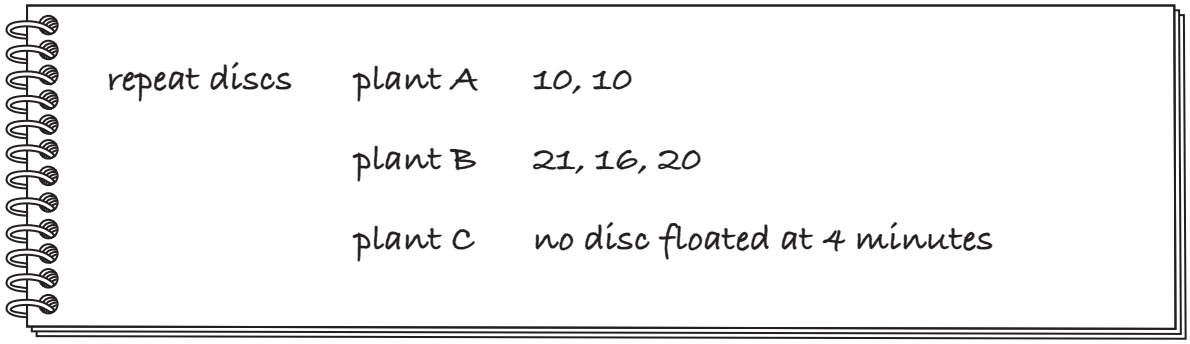


Fig. 1.2

Fig. 1.3 shows the time taken for the third filter paper disc on plant tissue **A** to reach the surface.



Fig. 1.3

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

Table 1.1

.....	.....			
	disc 1	**disc 2**	**disc 3**	**mean**
A				
B				
C				

(ii) Enter the data from Fig. 1.2 and Fig. 1.3 into Table 1.1.

Calculate the mean times for the filter paper discs, from tissues **A**, **B** and **C**, to reach the surface. Record all the values to the nearest whole second.

[4]

(iii) Using the results in Table 1.1, state what you can conclude about catalase in plant tissues **A**, **B** and **C**.

tissue **A** .....

.....

tissue **B** .....

.....

tissue **C** .....

.....

[3]

(b) (i) Suggest why the filter paper discs were left on the cut surfaces of the plant tissues for the same length of time.

.....

.....

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..... [2]

(ii) Suggest a suitable control for this investigation.

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..... [1]

[Total: 11]

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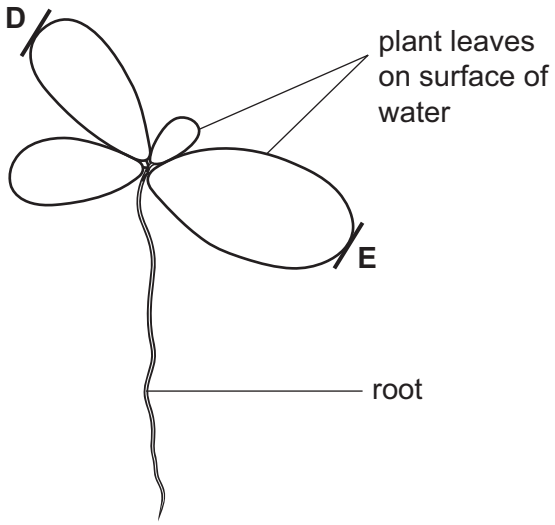
2 *Lemna* is a small green plant that floats on the surface of water in ponds and lakes. It consists of leaves which float and a root that hangs down in the water.

Fig. 2.1 shows a single plant that has four leaves. **D** and **E** indicate the maximum length of two of the plant's leaves.



magnification ×12

Fig. 2.1

(a) On Fig. 2.1, draw a straight line to join **D** and **E**. Measure the length of the line and record it.

..... mm

Calculate the **actual** maximum length of two of the plant's leaves and record it to the nearest whole number.

Space for working.

.....
[3]

(b) The population of this plant grows by each plant dividing into two smaller plants. These smaller plants then grow new leaves and divide again.

Some students decided to investigate the growth of *Lemna* plants. They placed six plants in a small beaker containing nutrients in distilled water (nutrient solution). They used a lamp to provide constant light.

(i) Suggest why the students added nutrients to the distilled water.

.....

..... [1]

The students decided to measure growth by counting the total number of leaves at the same time each day. At the start of the investigation there were 16 leaves in total on the plants.

Fig. 2.2 shows the beaker seen from above on day 4.

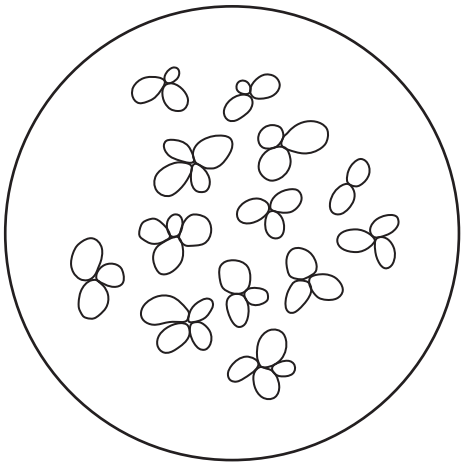


Fig. 2.2

(ii) Count the total number of leaves visible in Fig. 2.2 and enter the number in Table 2.1.

Table 2.1

time / days	total number of leaves
0	16
2	20
3	29
4	
5	55
6	83
7	91

[1]

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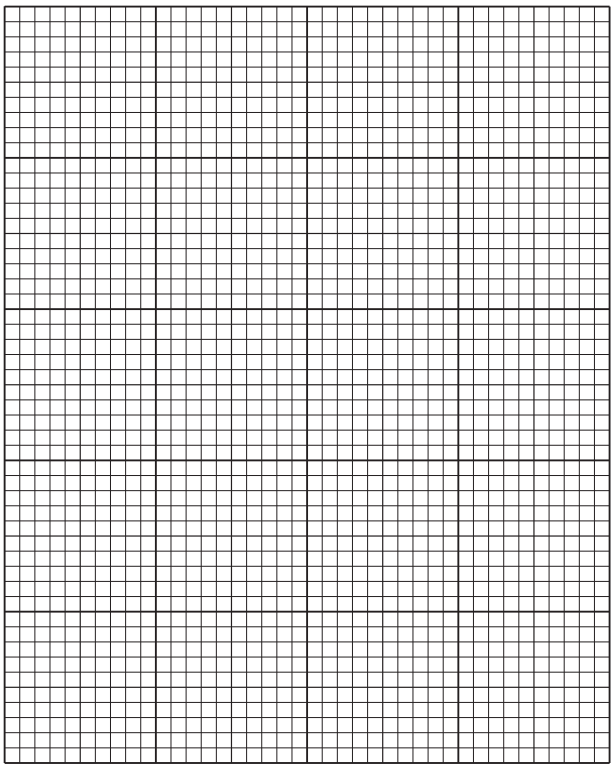
(iii) On the grid, draw a line graph of the data shown in Table 2.1.

Join the points with ruled, straight lines.



[5]

(iv) Use your graph to estimate the total number of leaves that would have been present on day 1. Show your working on your graph.

total number of leaves on day 1 .....

[2]

(v) Predict the shape of the graph after day 7 if the investigation continues for another six days. Explain your answer.

prediction .....

.....

explanation .....

.....

[2]

(vi) Suggest **one** other method that the students could use to measure the growth of *Lemna*.

.....

..... [1]

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(c) Plan an investigation to determine the effect of different concentrations of a nutrient solution on the growth of *Lemna*. Use the same method of counting the number of leaves that the students used in their investigation for measuring growth.

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..... [6]

[Total: 21]

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3 Fig. 3.1 is a photomicrograph of cells from a plant epidermis that have been treated so that some of the cells are plasmolysed.

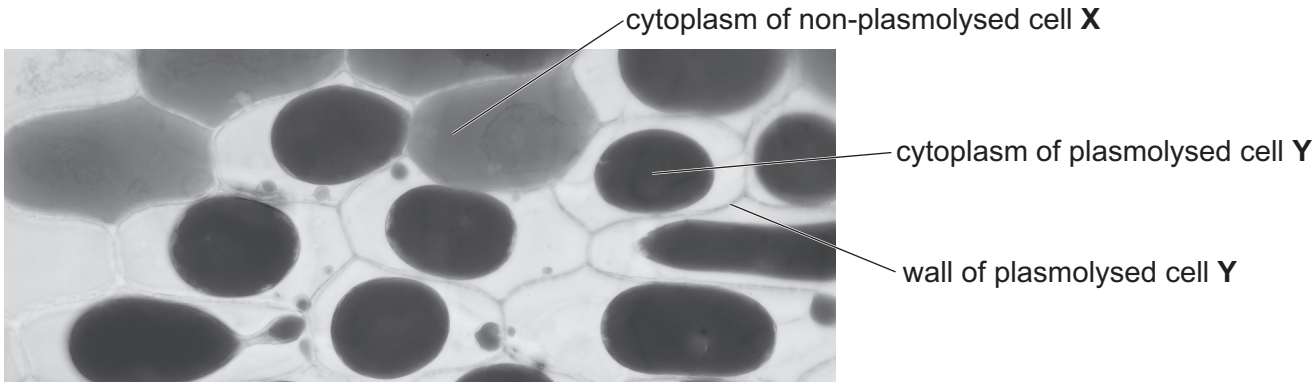

Fig. 3.1

(a) State **three** items of apparatus that you would need to use to observe the actual cells shown in the photomicrograph.

1 .....

2 .....

3 .....

[3]

(b) Make a large drawing of the **two** cells labelled **X** and **Y** as they appear in Fig. 3.1.

[3]

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(c) Describe how you would treat cells from a plant epidermis so that they become plasmolysed.

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..... [2]

[Total: 8]

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