Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

4249434382

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **October/November 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **15** printed pages and **1** blank page.

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CAMBRIDGE International Examinations

[Turn over

Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish all the work that you would like to do.

If you have enough time, think about how you can improve the confidence in your results, for example by obtaining and recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Plant cells contain enzymes which catalyse some of their metabolic reactions. Some of these enzymes catalyse the release of oxygen from hydrogen peroxide.

A cylinder of potato tissue will have these enzymes on the surface.
When hydrogen peroxide solution and a cylinder of potato tissue are mixed, oxygen bubbles are released.

You will need to investigate the effect of surface area by:

- changing the surface area
- counting the number of bubbles of oxygen released in a set time (dependent variable).

You are provided with the materials shown in Table 1.1 and Table 1.2.

Table 1.1

labelled	contents	hazard	volume / cm^3
H	hydrogen peroxide solution	moderate	40
W	water	none	100

If any of **H** comes into contact with your skin, wash off immediately under cold water.
It is recommended that you wear suitable eye protection and gloves.

Table 1.2

labelled	contents	details	quantity
P	potato cylinders	same cross-sectional area	4

(a) To investigate the effect of surface area, other variables need to be standardised.

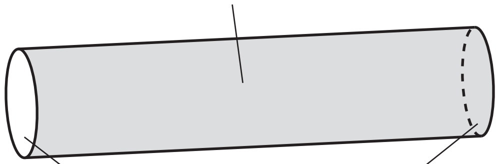
Each potato cylinder has been provided with the same diameter but with **different** lengths.

Each cylinder of potato tissue must be cut to the **same** length.

1. Cut each of the four potato cylinders in the beaker labelled **P**, to a length of 20 mm.

To investigate the effect of surface area, the surface area can be changed by cutting each of these four cylinders into a different number of pieces.

The formula for calculating the total surface area of a cylinder is shown in Fig. 1.1.



Total surface area of a cylinder = curved surface area + surface area of all the circular ends.

Fig. 1.1

The curved surface area of a cylinder can be calculated by using the formula:

$$\text{curved surface area} = 2\pi r l$$

$\pi = 3.14$
r = radius of cylinder
l = length of cylinder

All the cylinders start with the same length (20 mm) and have the same radius, so the curved surface area is standard.

The total curved surface area is the same for all four cylinders, even when a cylinder is cut into several pieces, as shown in the example on page 4.

To change the total surface area, each cylinder is cut into a different number of pieces.

The change in surface area depends on the number of the circular ends, n.

$$\text{surface area of all the ends} = \pi r^2 n$$

EXAMPLE

One cylinder has 2 circular ends as shown in Fig. 1.2.

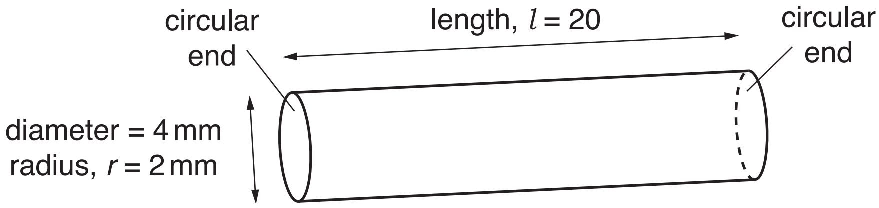


Fig. 1.2

- number of circular ends, $n = 2$
- area of one circular end = $\pi r^2 = 3.14 \times 2^2 = 12.56 = 13\,mm^2$ (to the nearest whole number)
- surface area of all the circular ends = $\pi r^2 n$
  = 13×2
  = $26\,mm^2$

Fig. 1.3 shows another cylinder with the same radius and length, which is cut into two pieces. There are then 4 circular ends.

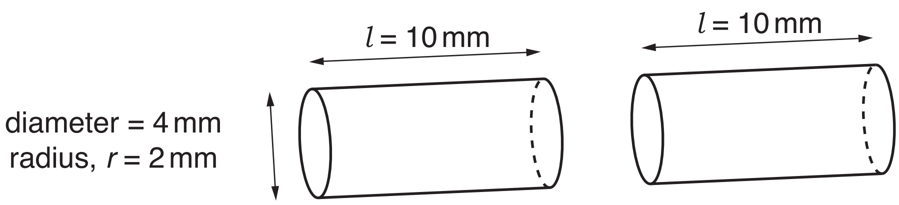


Fig. 1.3

- total number of circular ends, $n = 4$
- area of circular end = $13\,mm^2$ to the nearest whole number
- surface area of all the circular ends = $\pi r^2 n$
  = 13×4
  = $52\,mm^2$ (to the nearest whole number)

(i) Measure the diameter of **one** of the cylinders in **P** and calculate the radius, *r*.

r = ... [1]

(ii) Calculate the curved surface area, to the nearest whole number, using $2 \times 3.14 \times r \times 20$.

curved surface area = ... [2]

(iii) For the potato cylinders in **P**, use πr^2 to calculate the area of one circular end to the nearest whole number.
Use π as 3.14 and use *r* as recorded in **(a)(i)**.

area of one circular end = ... [1]

(iv) Complete Table 1.3 to calculate the total surface area when using different numbers of pieces to include:

- one whole cylinder
- one cylinder cut into two pieces
- two other cylinders cut into two different numbers of pieces.

Table 1.3

number of pieces cut from one cylinder	number of circular ends, *n*	area of one circular end from **(a)(iii)** / mm^2	surface area of all the ends / mm^2	curved surface area from **(a)(ii)** / mm^2	total surface area / mm^2
1	2				
2	4				

[2]

2. Cut each of the four cylinders into the number of pieces, as shown in Table 1.3.

3. Put the pieces into the shallow dish labelled **C**.
Cover with a damp paper towel to prevent the pieces from drying out.

You will use the apparatus as shown in Fig. 1.4.

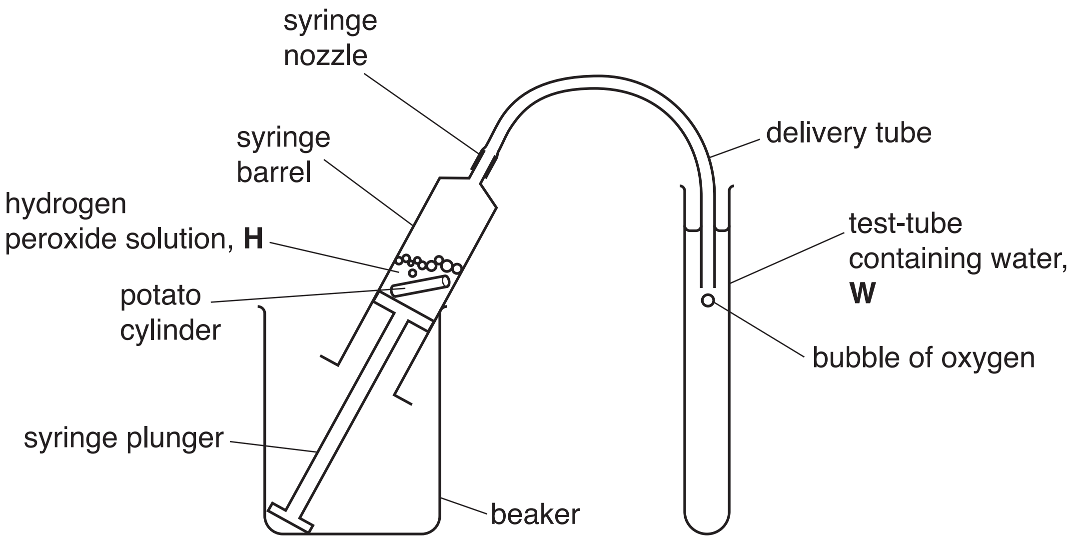


Fig. 1.4

The position of the delivery tube in the test-tube of water should be standardised to have confidence in the results.

(v) Describe how you will standardise the position of the delivery tube in the test-tube of water, as shown in Fig. 1.4.

....

....

.... [1]

4. Set up the test-tube with **W** and the delivery tube, as shown in Fig. 1.4 and described in **(a)(v)**. Do **not** attach the tubing to the syringe. You may stand the test-tube in the test-tube rack provided.

5. Remove the plunger from the $10\,cm^3$ syringe.

6. Put potato tissue into the barrel of the syringe, for example the whole cylinder in one piece.

7. Replace the plunger and push it to the $4\,cm^3$ mark, as shown in Fig. 1.5.

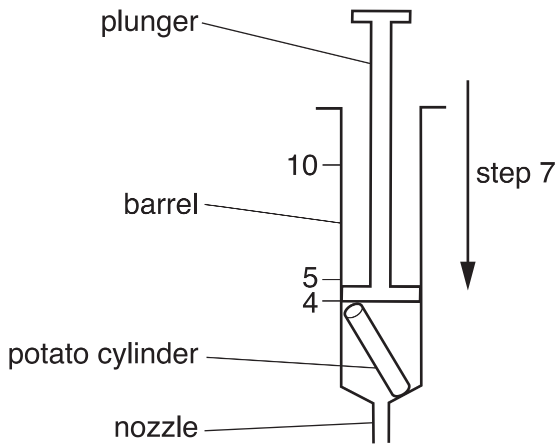


Fig. 1.5

8. Put the nozzle of the syringe into the beaker containing **H**.

9. Pull the plunger out to the 10 cm^3 mark so that **H** enters the syringe, as shown in Fig. 1.6.

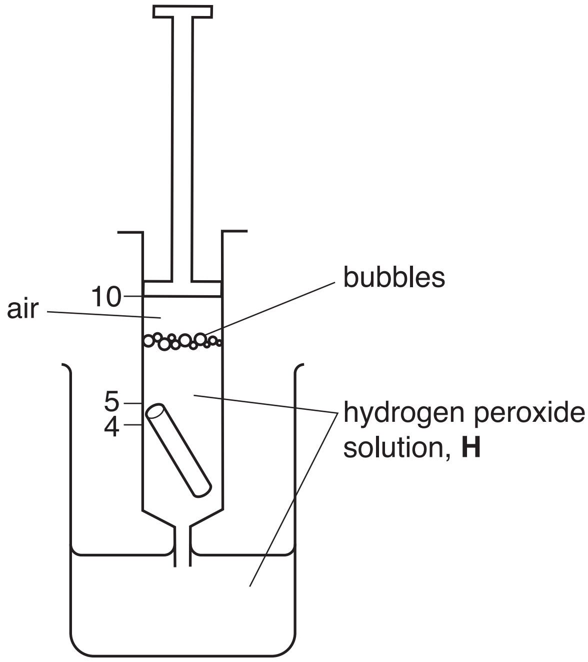


Fig. 1.6

10. Hold the syringe above the beaker containing **H** and push the plunger to adjust the level of **H** to the 5 cm^3 mark in the syringe, as shown in Fig. 1.7.

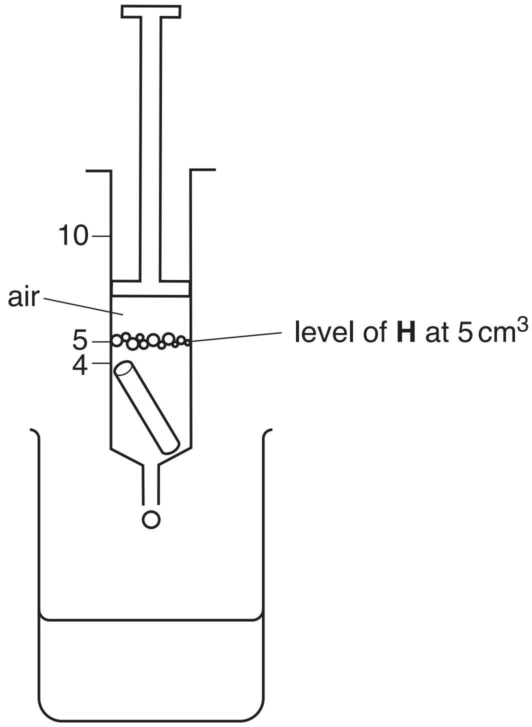


Fig. 1.7

11. Turn the syringe upside down so that the nozzle is up and there is air in the top of the syringe barrel. Carefully wipe the nozzle with a paper towel to remove excess **H**.

12. Tap the syringe barrel to make sure all the potato pieces are in **H**.

13. Attach the delivery tube to the nozzle to make an airtight fit.

14. Put the syringe into a beaker as shown in Fig. 1.4 (page 5).

15. Put the end of the delivery tube back into the test-tube as described in **(a)(v)**.

16. Start timing when the first bubble is observed in the water in the test-tube.

17. Count the bubbles at intervals of 30 seconds up to 120 seconds. Record the results in **(a)(vi)**.

18. Using a paper towel to avoid **H** coming into contact with your skin, remove the delivery tube from the syringe, keeping the syringe nozzle up.

19. Then push the plunger to empty as much as possible of **H** into the container labelled '**For waste**'.

20. Slowly pull out the plunger and put the potato tissue and remaining **H** into the container labelled '**For waste**'.

21. Repeat step 6 to step 20 with both of the pieces from the cylinder cut into two pieces.

22. Repeat step 6 to step 20 with each of the other two cylinders which have been cut into different numbers of pieces.

(vi) Record your results for the total surface area as shown in Table 1.3 **and** the number of bubbles at each 30 seconds in an appropriate table.

[5]

(vii) Using the results in **(a)(vi)**, calculate for the **largest** surface area:

- the mean number of bubbles in 30 seconds
- the rate of activity, number min^{-1}.

Show all the steps in your working and use appropriate units.

mean number of bubbles = ...

rate of activity = ...[3]

(viii) A significant source of error in this procedure is the different size of the bubbles which are released. An improvement to reduce this error would be to measure the volume of oxygen released.

Complete Table 1.4 to suggest:

- how to measure the volume of oxygen released
- **one** other significant source of error in this procedure
- how to make an improvement to reduce this other error.

Table 1.4

significant source of error	how to make an improvement
different sizes of bubbles released	
another significant source of error	

[3]

(ix) Think about how you could modify this procedure to investigate the effect of **concentration of substrate**, starting with 6% hydrogen peroxide, on the activity of the enzyme (catalase) in the potato tissue.

Describe how you could change the independent variable, **concentration of substrate**.

....

....

.... [1]

[Total: 19]

Question 2 starts on page 12

2 **K1** is a slide of a stained transverse section through a plant leaf.

You are not expected to be familiar with this specimen.

Use a sharp pencil for drawing.

(a) **(i)** Select a field of view so that you can observe the different tissues in the whole leaf.

Draw a large plan diagram to show the observable tissues in the **whole** leaf.

Use **one** ruled label line and label to identify the palisade tissue.

You are expected to draw the correct shape and proportions of the different tissues.

[5]

(ii) Observe the epidermis with trichomes (hairs) in **K1**.

Select **three** adjacent, touching epidermal cells where only one cell has a trichome attached.

Make a large drawing of these epidermal cells and the trichome.

Use **one** ruled label line and label to identify a cell wall of **one** cell.

You are expected to draw the correct shape and proportions of the different cells.

[5]

(iii) The presence of trichomes supports the conclusion that the plant grows in a dry environment.

Observe the leaf on **K1**.

Suggest **one** other observable feature in the specimen on **K1** which supports this conclusion.

Explain how this feature would prevent water loss.

feature ....

explanation ....

.... [2]

(b) Fig. 2.1 shows a photomicrograph of part of a leaf surface showing the stomata.

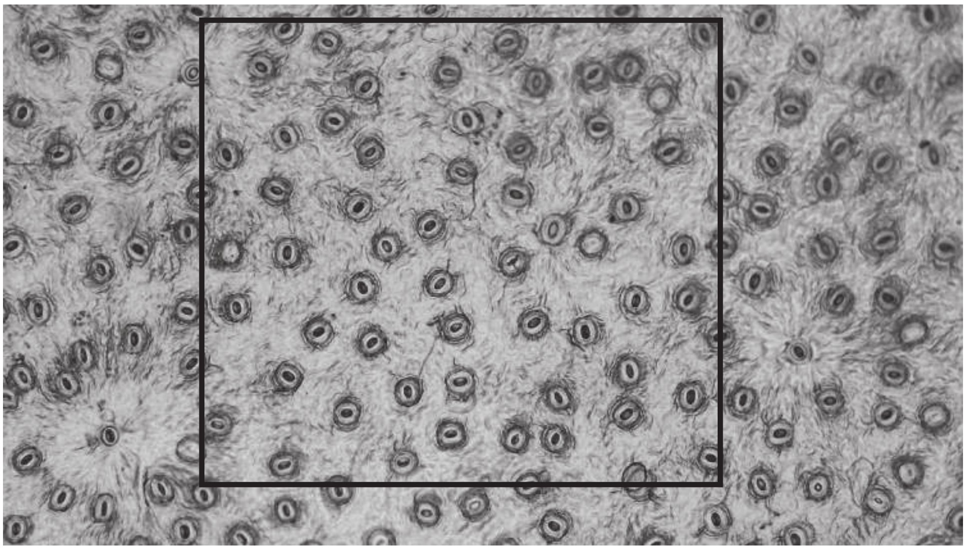


Fig. 2.1

Estimate the number of stomata inside the square shown on Fig. 2.1.
Show **on Fig. 2.1** those stomata that you counted.

If half or more of a stoma is within the square, count it as a whole stoma.
Do **not** count any stoma that is less than half within the square.

estimated number of stomata .... [3]

(c) A scientist investigated the percentage of stomata that were open between the times of 00:00 and 12:00.

Table 2.1 shows the results for this investigation.

Table 2.1

time of day	percentage of open stomata
00:00	17
02:30	9
05:00	78
09:00	79
12:00	89

(i) Plot a graph of the data shown in Table 2.1 on the grid in Fig. 2.2.

Use a sharp pencil for drawing graphs.

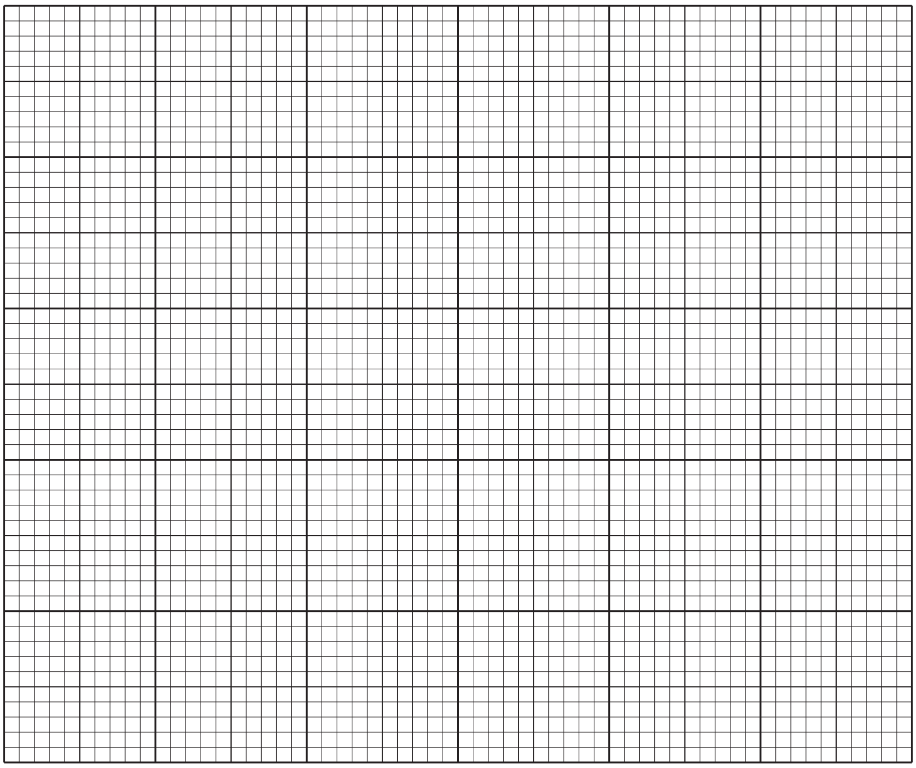


Fig. 2.2

[4]

(ii) Suggest the effect that the change in percentage of open stomata between 02:30 and 05:00 would have on the rate of transpiration.

Explain your answer.

....

....

....

....

....

.... [2]

[Total: 21]

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