Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0312057341

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 2019**

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 **13** printed pages and **3** blank pages.

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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** the whole of Question 1 and Question 2.

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

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

1 Catalase breaks down hydrogen peroxide as shown in Fig. 1.1.

Fig. 1.1

The decrease in the concentration of hydrogen peroxide can be measured to investigate the progress of this enzyme-catalysed reaction.

Catalase can be found in plant extract.

Potassium manganate(VII) solution can be used to estimate the concentration of hydrogen peroxide.

The greater the concentration of hydrogen peroxide, the higher the volume of potassium manganate(VII) solution needed to reach the end-point.

The end-point is reached when the first colour change appears and stays for at least 5 seconds.

Potassium manganate(VII) solution will be added one drop at a time using a syringe.

Carry out step 1 to step 3 to practise releasing drops from a syringe.

1. Fill a syringe with 1 cm^3 of distilled water, **W**.

2. Hold the syringe over an empty beaker as shown in Fig. 1.2. Push the plunger slowly to release one drop.

3. Repeat this until you can release one drop at a time.

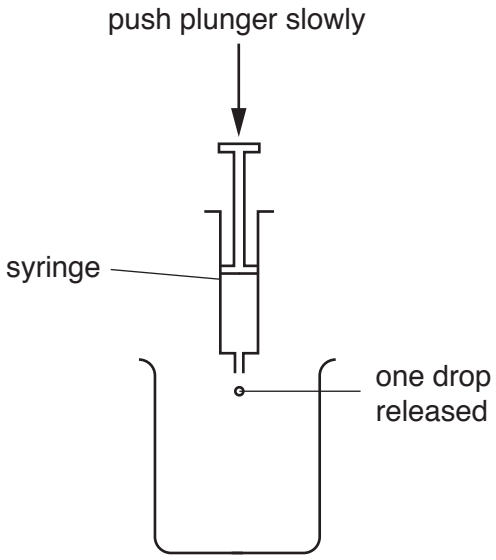

Fig. 1.2

You will need to investigate the effect of changing pH on the activity of the enzyme catalase by:

- changing the pH using different pH buffers
- measuring the volume of **P** needed to reach the end-point for each pH.

The lower the concentration of hydrogen peroxide remaining after 5 minutes, the lower the volume of **P** needed to reach the end-point.

[Turn over

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
A	dilute sulfuric acid	irritant	25
H	1% hydrogen peroxide solution	irritant	25
P	1% potassium manganate(VII) solution	oxidising harmful	50
E	plant extract solution	harmful irritant	25
B3	buffer pH3	none	10
B4	buffer pH4	none	10
B5	buffer pH5	none	10
B6	buffer pH6	none	10
B7	buffer pH7	none	10

If any solution comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

(a) (i) Think about the hazards of using the materials in Table 1.1.

State whether you think the risk of using the materials is **low**, **medium** or **high**.
Give a reason for your answer.

risk.....

reason .....

..... [1]

Carry out step 4 to step 18 to investigate the effect of pH on the activity of catalase in the plant extract **E**.

4. Label 5 beakers **pH3**, **pH4**, **pH5**, **pH6** and **pH7**.

5. Put 1 cm^3 of each buffer into the appropriately labelled beaker.

6. Put 1 cm^3 of **E** into each beaker. Stir gently to mix.

7. Leave the beakers for at least 1 minute. Stir gently to mix.

*The reaction will start as soon as **H** is added to the mixture of **E** and buffer in step 8.*

8. Put 1 cm^3 of **H** into each beaker. Stir gently to mix.

9. Leave for 5 minutes.

While you are waiting, use your time to continue with Question 1.

10. After 5 minutes, put 1 cm^3 of **A** into each beaker. Stir gently to mix.

You will now test each solution to find the volume of **P** needed to reach the end-point.

11. Put the beaker labelled **pH3** onto a white tile.

12. Fill the syringe labelled **P** with 2.0 cm^3 of **P**.

13. Wipe off any **P** from the outside of the syringe with a paper towel.

14. Put one drop of **P**, as shown in Fig. 1.2, into the beaker labelled **pH3**.

15. Stir gently to mix.

16. Repeat step 14 and step 15 until the end-point is reached.

    *You may need to refill the syringe with **P**.*

17. Record in **(a)(ii)** the volume of **P** added.

18. Repeat step 11 to step 17 with each of the beakers labelled **pH4**, **pH5**, **pH6** and **pH7**.

[Turn over

(ii) Record your results in an appropriate table.

[6]

(iii) State the independent variable in this investigation.

..... [1]

(iv) Use your results in **(a)(ii)** to suggest an optimum pH for catalase in this plant extract.

Give a reason for your answer.

optimum pH.....

reason .....

..... [1]

(v) Identify **one** source of error in this investigation.

Explain why this is a source of error.

source of error.....

explanation.....

.....

..... [1]

(vi) Suggest how you would make improvements to this investigation in order to obtain a more accurate estimate of the optimum pH for catalase in this plant.

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..... [3]

[Turn over

(b) A student carried out another investigation into the effect of temperature on the release of oxygen from hydrogen peroxide, using a plant extract containing the enzyme catalase.

Test-tubes containing plant extract and hydrogen peroxide were placed in thermostatically controlled water-baths, at five different temperatures for 180 seconds.

The volume of oxygen produced was measured. All other variables were standardised.

The results are shown in Table 1.2.

Table 1.2

temperature/ °C	volume of oxygen produced in 180 seconds/cm^3
17.5	3.7
25.0	6.4
38.5	9.8
47.5	4.3
60.0	0.3

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

Use a sharp pencil for drawing graphs.

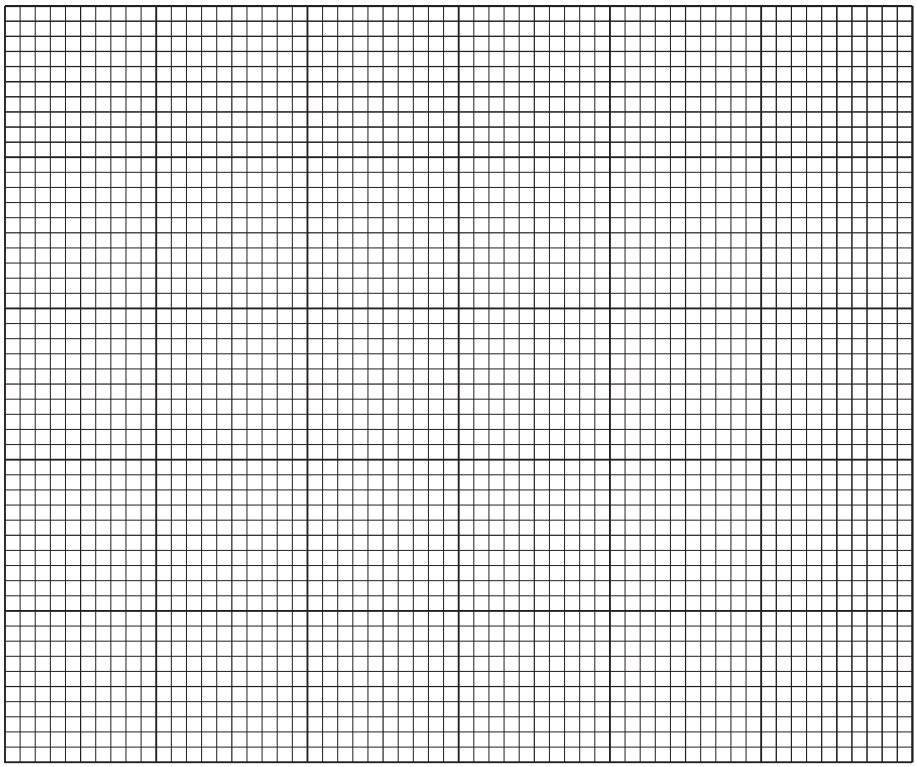

Fig. 1.3

[4]

(ii) Use your graph in Fig. 1.3 to determine the volume of oxygen produced when the temperature is 29.5 °C.

Show on your graph how you determined your answer.

volume of oxygen = ... [1]

(iii) Suggest an explanation for the results between 20.0 °C and 60.0 °C.

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..... [3]

(iv) Suggest an appropriate control the student could have used for this investigation.

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..... [1]

[Total: 22]

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

You are not expected to be familiar with this specimen.

Use a sharp pencil for drawings.

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

(a) **(i)** Draw a large plan diagram of the whole root.

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

[5]

(ii) Observe the cells in the cortex of the root on **J1**.

Select **four** adjacent, touching cells which show observable features of the cortex tissue.

Each cell must touch at least two other cells.

Make a large drawing of this group of **four** touching cells.

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

[5]

(b) Fig. 2.1 is a photomicrograph of a stained transverse section through a root of a different type of plant.

You are not expected to be familiar with this specimen.

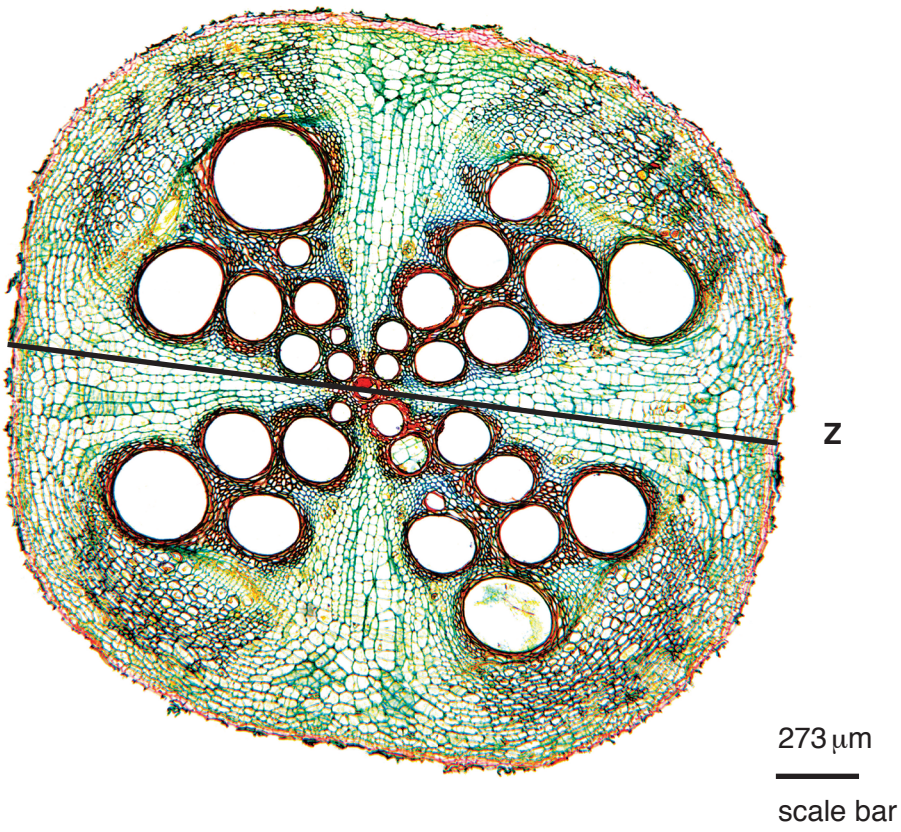

Fig. 2.1

(i) Annotate Fig. 2.1 to describe **three** observable differences between the root in Fig. 2.1 and the root on **J1**.

- Draw label lines to **three** features of the root in Fig. 2.1 that are different from the root on **J1**.
- Label one line **Q**, label one line **R** and label one line **S**.
- Next to each letter, describe how each feature of the root in Fig. 2.1 differs from the root on **J1**.

[3]

(ii) Use the scale bar and the line **Z** on Fig. 2.1 to calculate the actual width of the root.

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

actual width of the root = ... [5]

[Total: 18]

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