Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1746388050

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 2021**

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 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 [ ].

For Examiner's Use	
1	
2	
Total	

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

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.

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

When a mixture of hydrogen peroxide and yeast cells is put into a syringe, some of the mixture comes out of the syringe nozzle as the oxygen is released.

You are going to investigate the effect of pH on the activity of catalase.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
H	3% hydrogen peroxide solution	irritant	25
Y	yeast cell suspension	none	40
B3	buffer pH 3	none	10
B4	buffer pH 4	none	10
B5	buffer pH 5	none	10
B6	buffer pH 6	none	10
B7	buffer pH 7	none	10
U	unknown pH buffer	none	10

If any of the solutions come into contact with your skin, wash off immediately with cold water.

It is recommended that you wear suitable eye protection.

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

Carry out step 1 to step 22.

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

2. Put two marks on the (plastic) tubing so that one mark is at a distance of 5 cm from the nozzle and the other mark is at a distance of 15 cm from the nozzle, as shown in Fig. 1.1.

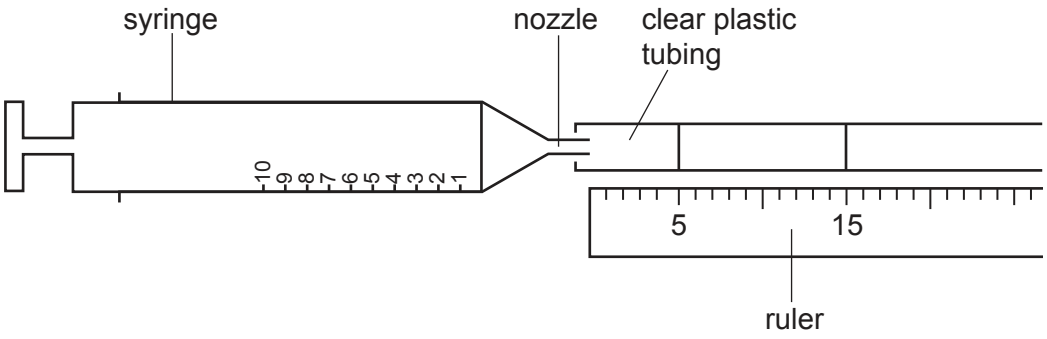

Fig. 1.1

3. Remove the tubing from the nozzle of the syringe.

4. Use the glass rod to stir the yeast cell suspension, **Y**.

5. Put the nozzle of the syringe into the beaker containing **Y**.

6. Pull the plunger out to the 3 cm^3 mark so that **Y** enters the syringe, as shown in Fig. 1.2.

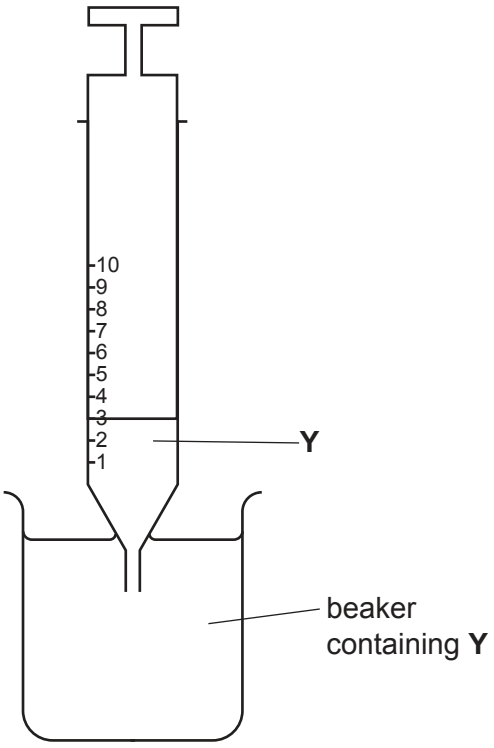

Fig. 1.2

7. Remove the syringe from the beaker containing **Y** and wipe the nozzle with a paper towel.

8. Put the nozzle of the same syringe into the beaker containing the pH 3 buffer, **B3**.

9. Pull the plunger out to the 5 cm^3 mark so that approximately 2 cm^3 of the buffer enters the syringe, as shown in Fig. 1.3.

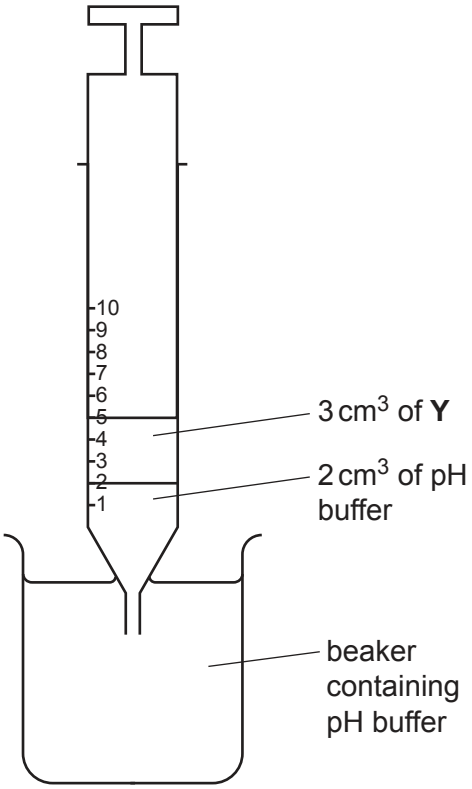

Fig. 1.3

10. Remove the syringe from the beaker containing pH buffer and wipe the nozzle with a paper towel.

11. Put the nozzle of the same syringe into the beaker containing hydrogen peroxide solution, **H**.

12. Pull the plunger out to the 6 cm^3 mark so that approximately 1 cm^3 of **H** enters the syringe, as shown in Fig. 1.4.

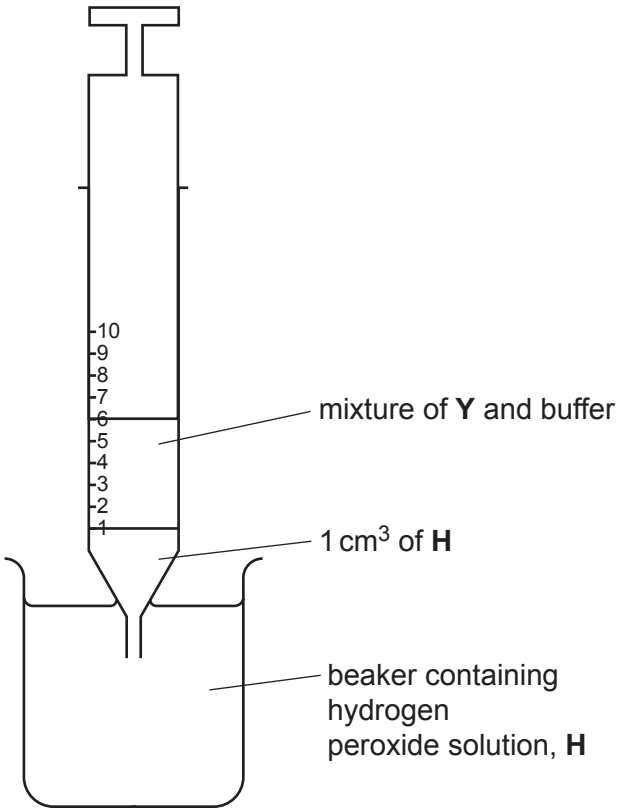

Fig. 1.4

13. Remove the syringe from the beaker containing hydrogen peroxide solution, **H**, and carefully wipe the nozzle with a paper towel to remove excess **H**.

14. Put the tubing onto the nozzle.

15. Put the syringe and tubing on a flat surface, as shown in Fig. 1.5.

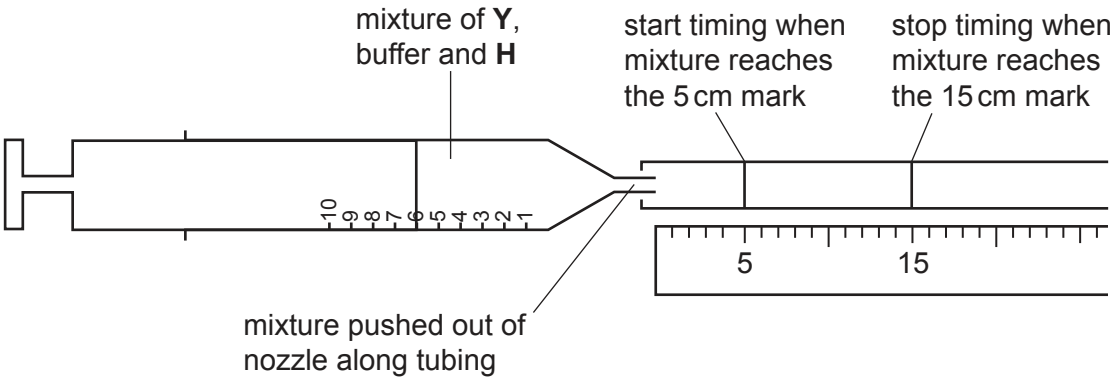

Fig. 1.5

16. Start timing when the mixture reaches the mark at 5 cm.

17. Stop timing when the mixture reaches the mark at 15 cm. Record the time in **(a)(i)**.

    If the mixture does not reach the 5 cm mark or if it takes more than 4 minutes to reach the 15 cm mark, record as 'more than 240'.

18. Hold the syringe with the nozzle up and remove the tubing from the syringe. Put the tubing onto a paper towel.

19. Hold the syringe with the nozzle pointing downwards over the container labelled '**For waste**' and empty the syringe.

20. 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**'.

21. Repeat step 3 to step 20 with each of the other pH buffers, **B4**, **B5**, **B6** and **B7**.

(a) **(i)** Record your results in an appropriate table.

[5]

(ii) State the dependent variable for this investigation.

..... [1]

(iii) Suggest an appropriate control for this investigation.

.....

.....

..... [1]

22. Repeat step 3 to step 20 with the unknown pH buffer, **U**. Record the time in **(a)(iv)**.

(iv) State the time for **U**. .....

Using your results from **(a)(i)** estimate the pH of **U**. .....

[2]

(v) Identify **one** source of error in step 4 to step 17.

Suggest an improvement to the method which will reduce the effect of this error.

error .....

.....

improvement .....

.....

.....

.....

[2]

(vi) The procedure described by step 1 to step 21 investigated the effect of pH on catalase activity, by measuring the time taken for the mixture to move a set distance.

Describe how you would modify the procedure to investigate the effect of changing the concentration of hydrogen peroxide on the time taken for the mixture to move a set distance.

.....

.....

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..... [2]

(b) A student investigated the effect of temperature on the activity of catalase, by measuring the concentration of hydrogen peroxide remaining in the mixture after a set time.

The student used potassium manganate(VII) solution to determine the concentration of hydrogen peroxide remaining in the mixture.

The greater the volume of potassium manganate(VII) used, the higher the concentration of hydrogen peroxide remaining.

The results are shown in Table 1.2.

Table 1.2

temperature / °C	**volume of potassium manganate(VII) used / cm^3**
10.0	11.0
23.0	7.0
32.0	4.5
38.5	3.2
49.0	7.4
58.5	10.8

(i) Plot a graph of the data in Table 1.2 on the grid in Fig. 1.6.

Use a sharp pencil for drawing graphs.

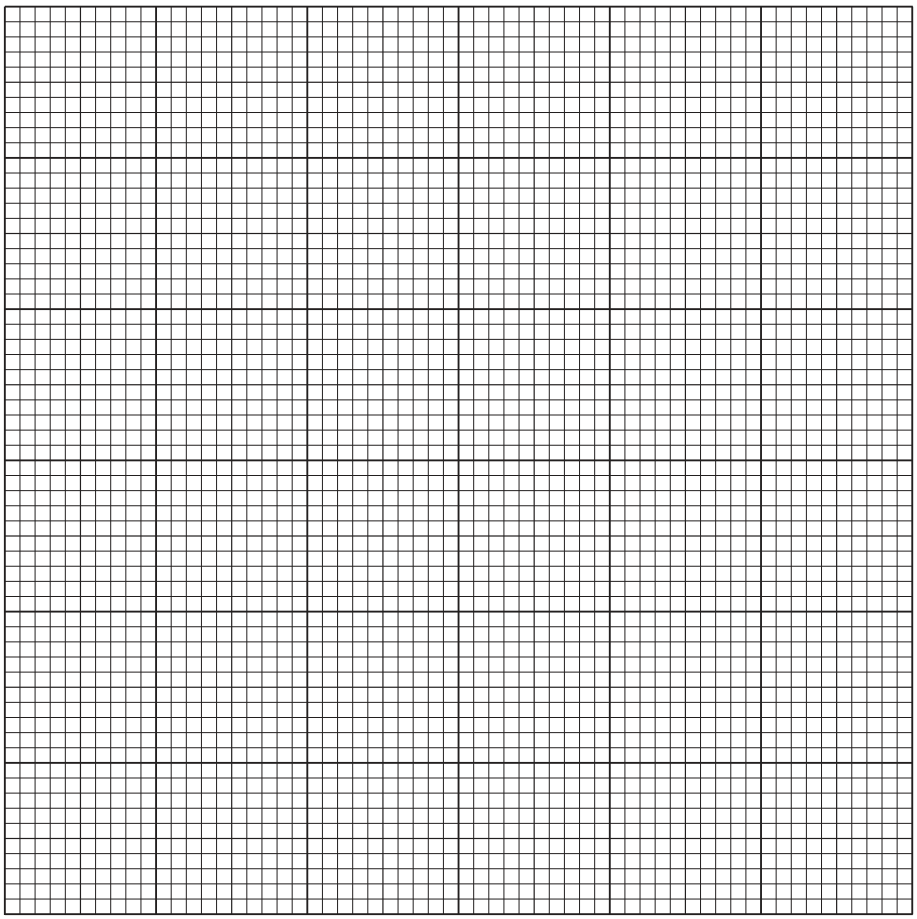

Fig. 1.6

[4]

(ii) Use your graph to find the volume of potassium manganate(VII) needed when the temperature was 45 °C.

volume of potassium manganate(VII) = ... cm^3 [1]

(iii) Suggest an explanation for the difference in concentration of hydrogen peroxide remaining at 38.5 °C and at 58.5 °C.

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.....

.....

..... [2]

[Total: 20]

2 **M1** is a slide of a stained transverse section through a plant root.

(a) Set up the microscope so that you can observe the section on **M1**.

Use a sharp pencil for drawing.

(i) Draw a large plan diagram of the whole section on **M1**. Your drawing should show the correct shapes and proportions of the different tissues.

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

[6]

(ii) Observe the xylem vessel elements in the centre of the section of the root on **M1**.

Select **one** large xylem vessel element and **three** adjacent, touching, smaller cells.

Each smaller cell that you draw must touch the larger xylem vessel element and at least **one** of the other smaller cells.

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

[5]

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

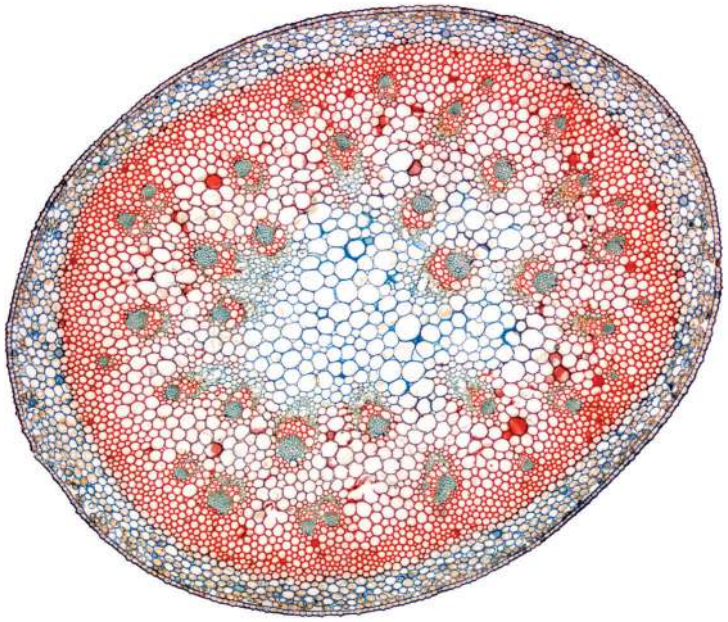

Fig. 2.1

(i) Identify **one** similarity between the section on **M1** and the section shown in Fig. 2.1.

.....

..... [1]

(ii) Identify the observable **differences** between the section on **M1** and the section shown in Fig. 2.1.

Record the observable differences in Table 2.1.

Table 2.1

feature	M1	Fig. 2.1

[3]

(c) Fig. 2.2 shows a diagram of a stage micrometer scale that is being used to calibrate an eyepiece graticule.

The length of one division on this stage micrometer is **0.8 mm**.

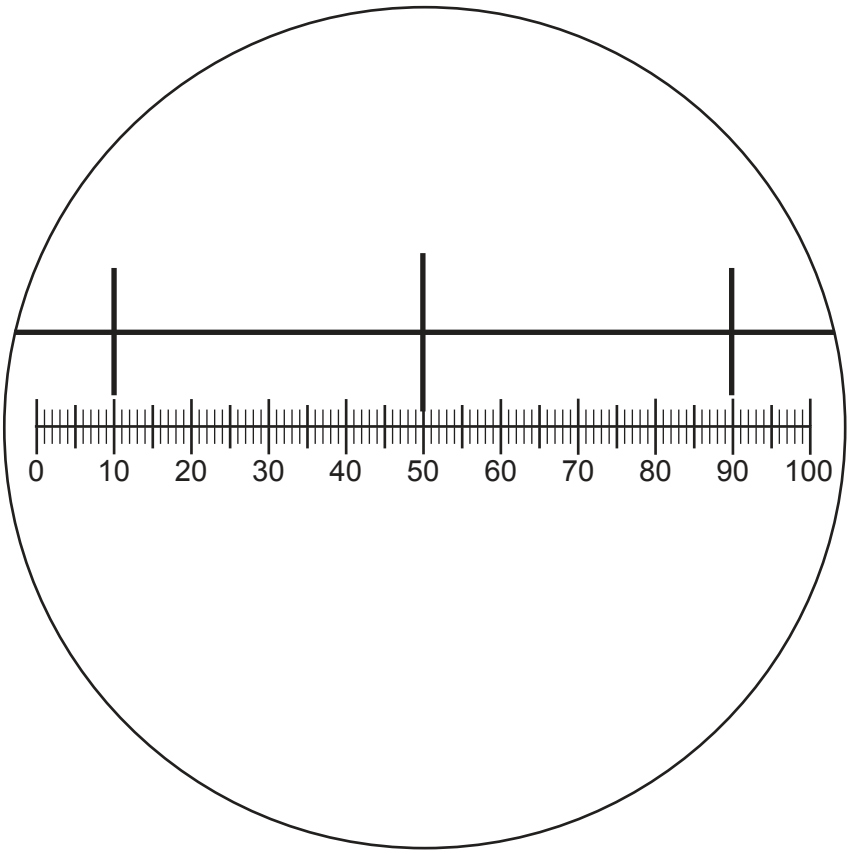

Fig. 2.2

(i) Use Fig. 2.2 to calculate the actual length of one eyepiece graticule unit.
Show your working.

[3]

Fig. 2.3 shows a photomicrograph of a section of a stem, viewed using a microscope with an eyepiece graticule.

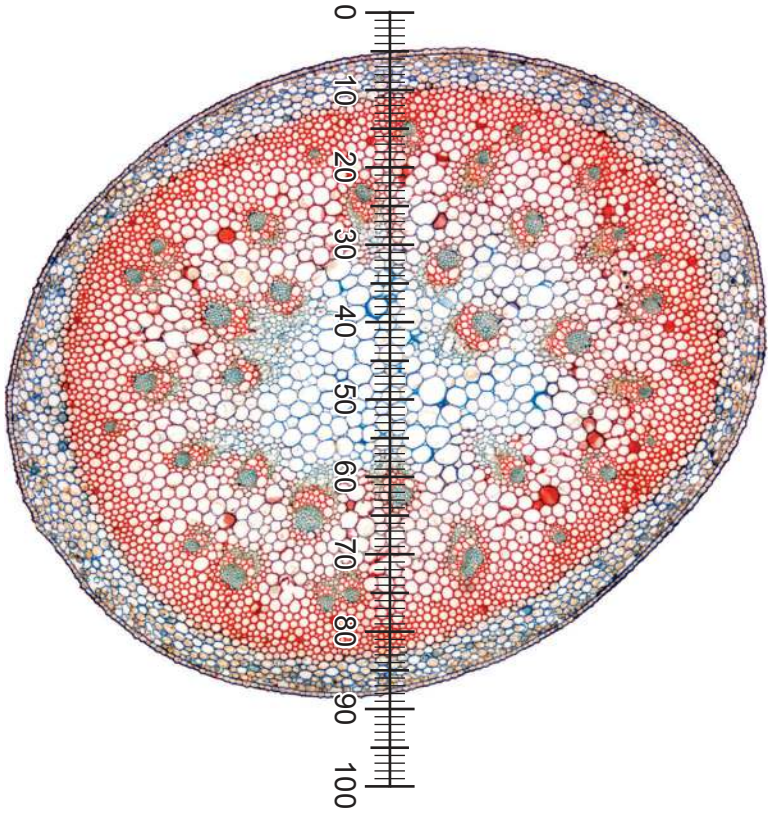

Fig. 2.3

(ii) The eyepiece graticule shown in Fig. 2.3 has been placed across the diameter of the section.

Use the calibration of the eyepiece graticule unit from **(c)(i)** to calculate the actual diameter of the section in Fig. 2.3.

Show your working.

[2]

[Total: 20]

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