Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

7515112616

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **October/November 2024**

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.

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1 Plant cells produce the enzyme catalase that catalyses the hydrolysis (breakdown) of hydrogen peroxide into water and oxygen, as shown in Fig. 1.1.

$$\text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water + oxygen}$$

Fig. 1.1

A cylinder of potato tissue will have catalase molecules on its surface.

When potato tissue is put into hydrogen peroxide solution, oxygen bubbles are released and a foam forms at the surface of the hydrogen peroxide solution.

You will investigate the effect of ethanol concentration on the activity of catalase by measuring the height of the foam.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
H	hydrogen peroxide solution	harmful irritant	40
W	water	none	200
E	100% ethanol	flammable	80
P	5 potato cylinders	none	–

If any of **H** comes into contact with your skin, wash off immediately with cold water.

It is recommended that you wear suitable eye protection.

Carry out step 1 to step 7.

step 1 Put the five potato cylinders onto a white tile or cutting surface and cut each cylinder to a length of 4 cm.

step 2 Label a beaker **0** and put 30 cm^3 of **W** into this beaker.

step 3 Put **one** potato cylinder into the beaker labelled **0**. Start timing and leave for 5 minutes.

step 4 Label **one** test-tube **0**.

step 5 After 5 minutes (step 3), remove the potato cylinder from the beaker labelled **0** and put it into the test-tube labelled **0**.

step 6 Put 5 cm^3 of hydrogen peroxide solution into this test-tube. Immediately start timing.

step 7 Measure and record the height of the foam at 1 minute **and** at 2 minutes.

height of foam at 1 minute .....

height of foam at 2 minutes .....

(a) **(i)** The length of the potato cylinders may not be precisely 4 cm.

Identify **one** other source of error in the procedure you have carried out.

.....

.....

..... [1]

You will investigate the effect of different concentrations of ethanol on catalase activity.

You will need to carry out a **serial** dilution of the 100% ethanol, **E**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **three** concentrations of ethanol in addition to the 100% ethanol, **E**.

After the serial dilution is completed, you will need to have 30 cm^3 of each concentration available to use.

(ii) Complete Fig. 1.2 to show how you will prepare your serial dilution.

Each beaker should have:

- a labelled arrow to show the volume of ethanol transferred
- a labelled arrow to show the volume of distilled water, **W**, added
- a label under the beaker to show the concentration of ethanol.

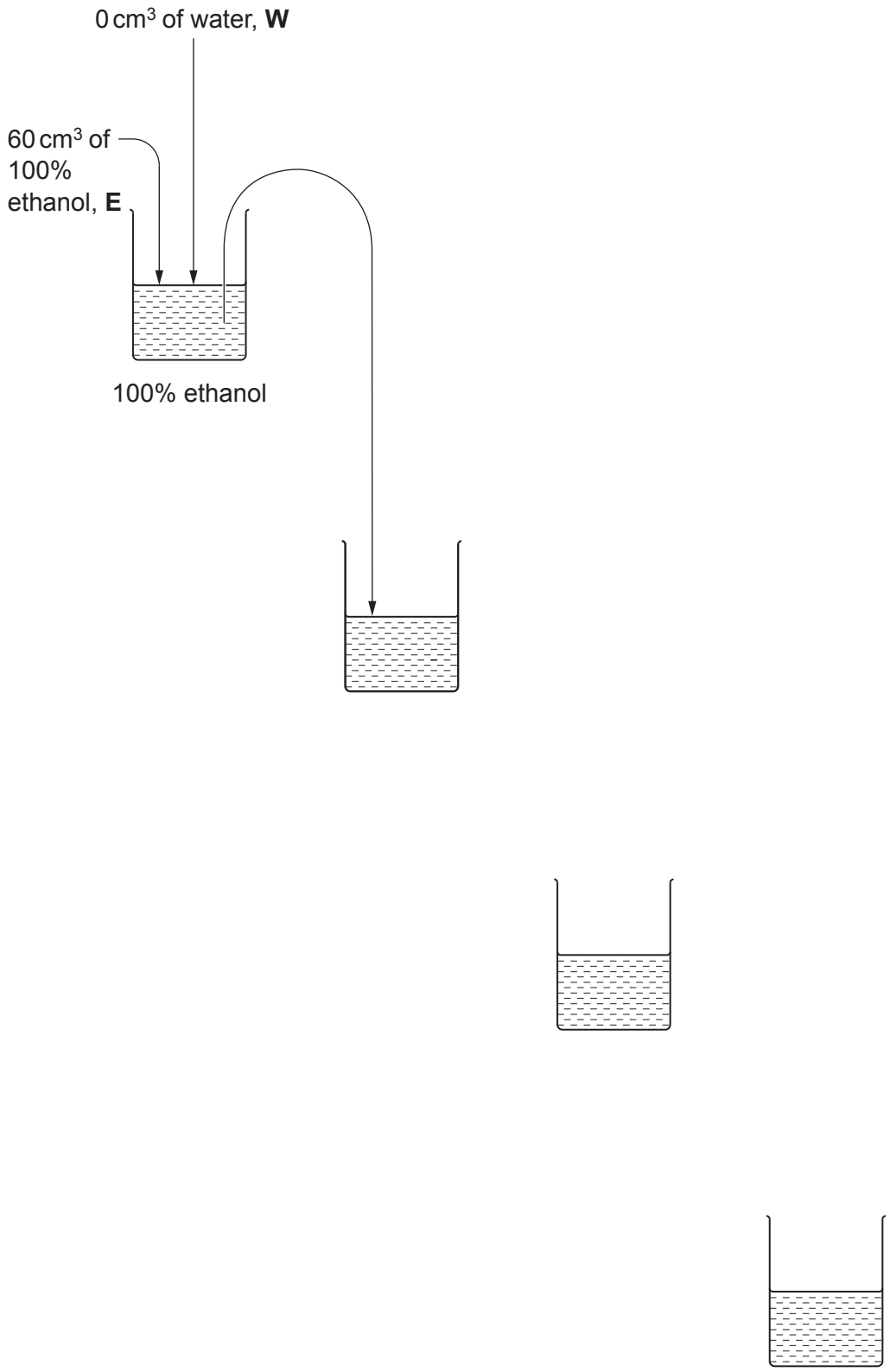

Fig. 1.2

[3]

Carry out step 8 to step 14.

step 8 Prepare the concentrations of ethanol as shown in Fig. 1.2.

step 9 Put **one** potato cylinder into each beaker. Start timing and leave for 5 minutes.

step 10 Label test-tubes with the ethanol concentrations prepared in step 8.

step 11 After 5 minutes (step 9), remove the potato cylinders from the beakers and put them into the appropriately labelled test-tubes.

step 12 Put 5 cm^3 of hydrogen peroxide solution into the test-tube labelled **100**. Immediately start timing.

step 13 Measure the height of the foam after 1 minute **and** after 2 minutes. Record the results in **(a)(iii)**.

step 14 Repeat step 12 and step 13 with the potato cylinders in each of the other test-tubes.

(iii) Record your results in an appropriate table. Include the results recorded in step 7.

[5]

(iv) Calculate the rate at which the foam was produced at 1 minute **and** at 2 minutes for **100%** ethanol, **E**.

Show your working.

Include the unit in your answer.

rate at 1 minute = ...

rate at 2 minutes = ...
[1]

(v) Use your results in **(a)(iv)** to describe how the rate changes with time.

.....

.....

..... [1]

(vi) With reference to the activity of catalase, explain why the results of **0** (step 7) were important in this investigation.

.....

.....

..... [1]

(vii) State the dependent variable in this investigation.

..... [1]

(viii) Suggest **two** improvements to the investigation you have carried out to increase the confidence in your results.

1 .....

.....

.....

2 .....

.....

.....
[2]

(b) Some fruits turn brown when they are cut into slices for eating. This browning can make the fruit less appealing to eat and difficult to sell.

The enzyme polyphenol oxidase (PPO) catalyses an oxidation reaction when fruit is cut, causing the fruit tissue to turn brown.

Scientists carried out an investigation to see how exposing wampee fruits to different concentrations of ethanol affected the activity of PPO in the fruit tissue.

A large sample of wampee fruits was divided into five equal groups. Each group of fruit was sealed in a plastic container and treated with a different concentration of ethanol.

After a short time in storage, the activity of the enzyme PPO in the wampee fruit tissue was recorded.

The results are shown in Table 1.2.

Table 1.2

concentration of ethanol / $\mu dm^3 dm^{-3}$	**PPO activity / arbitrary units**
0	2.20
100	1.40
200	0.95
400	0.70
500	0.60

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

Use a sharp pencil.

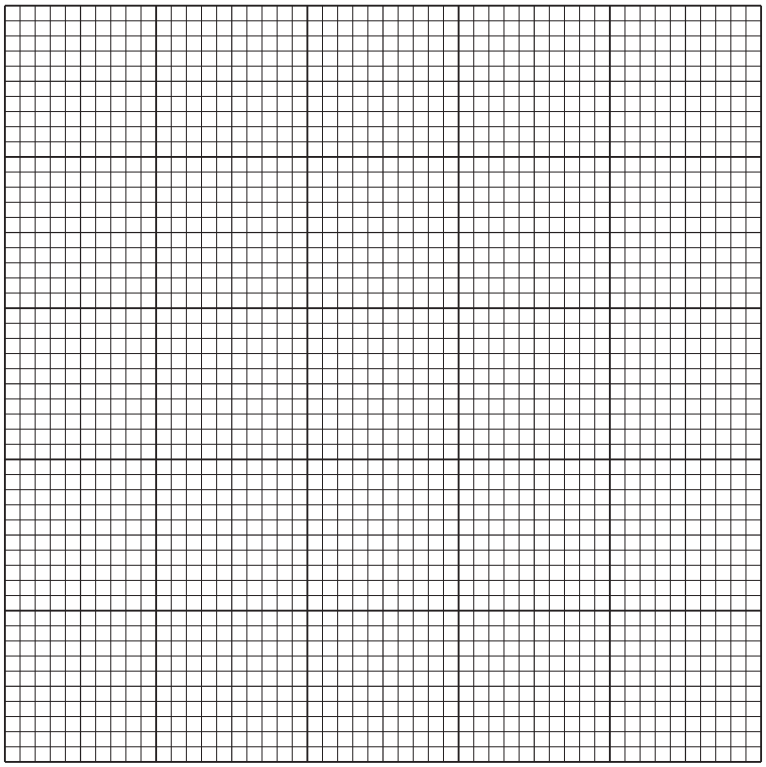

Fig. 1.3

[4]

(ii) Suggest an explanation for the pattern shown in the data.

.....

.....

.....

.....

.....

.....

.....

..... [2]

[Total: 21]

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

(a) **(i)** Draw a large plan diagram of the region of the stem on **K1** indicated by the shaded area in Fig. 2.1.

Use a sharp pencil.

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

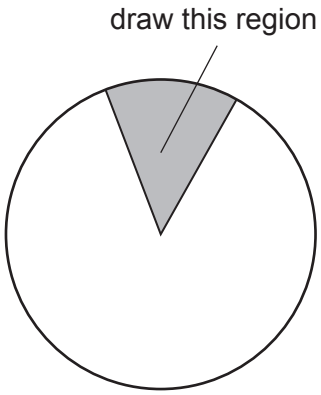

Fig. 2.1

[5]

(ii) Observe the cells in the centre of the stem on **K1**.

Select a group of four adjacent cells.

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

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

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section of a stem from a different plant.

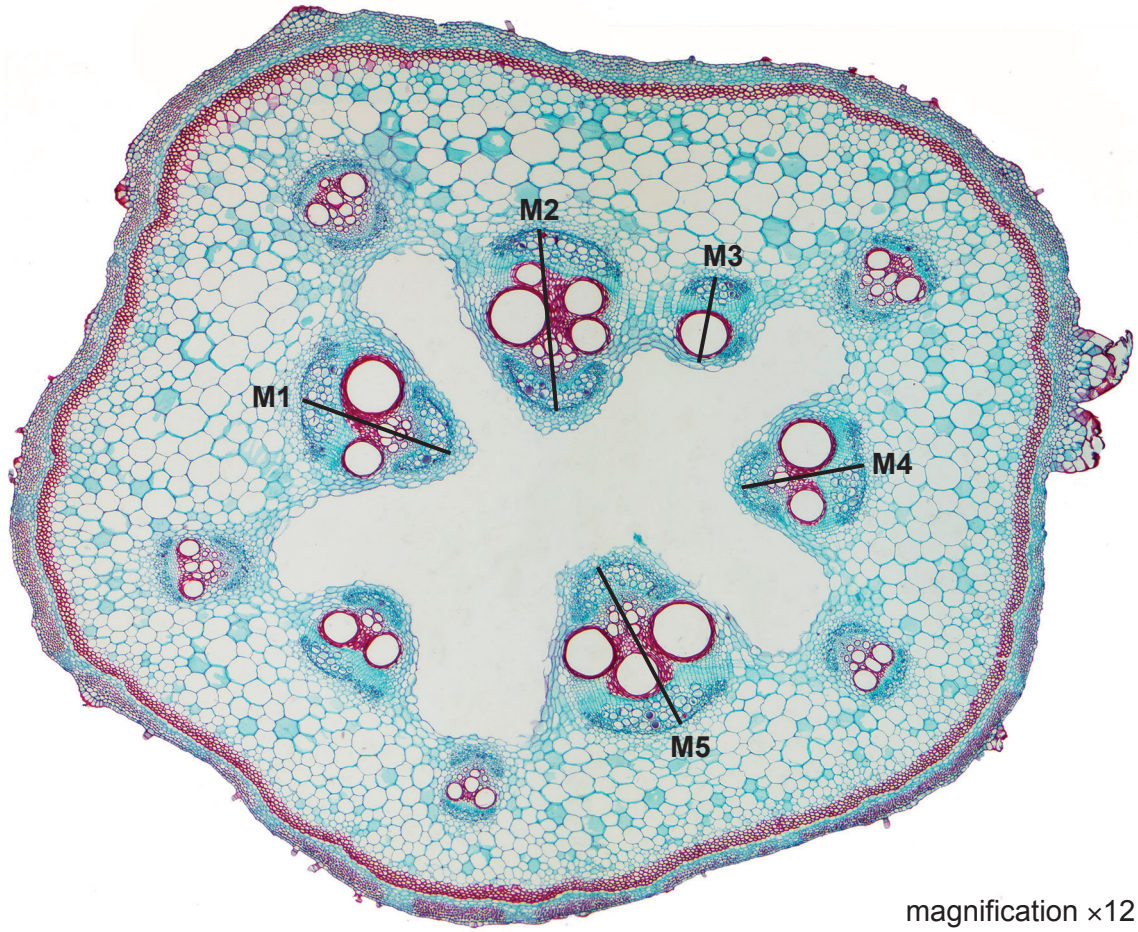

Fig. 2.2

(i) Measure the length of the vascular bundles using the lines **M1**, **M2**, **M3**, **M4** and **M5** in Fig. 2.2 **and** calculate the mean actual length of the vascular bundles.

Show your working.

M1 = **M2 =** **M3 =** **M4 =** **M5 =**

mean actual length ..... [4]

(ii) A student suggested that the mean actual length of the vascular bundles calculated in **(b)(i)** was not accurate for the whole plant.

Describe **two** modifications to the method used in **(b)(i)** that would allow a more accurate mean length of the vascular bundles for the whole plant to be calculated.

1 .....

.....

.....

2 .....

.....

.....

[1]

(c) Fig. 2.3 is the same photomicrograph as that shown in Fig. 2.2.

Fig. 2.3

Identify **three** observable differences, other than colour, between the stem section on **K1** and the stem section in Fig. 2.3.

Record these **three** observable differences in an appropriate table.

[4]

[Total: 19]

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