Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7210537736

BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2022**

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 tissues contain the enzyme catalase which catalyses the breakdown of hydrogen peroxide into oxygen gas and water.

Ascorbic acid acts as an inhibitor of catalase.

You will investigate the effect of changing ascorbic acid concentration on catalase inhibition.

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	50
W	distilled water	none	50
A	1 mol dm^{-3} ascorbic acid solution	irritant	10

If **H** or **A** comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

You are also provided with five cylinders of potato tissue, labelled **P**.

(a) You will need to carry out a serial dilution of the 1 mol dm^{-3} ascorbic acid, **A**, to reduce the concentration by a **factor of ten** between each successive dilution.

You will need to prepare four concentrations of ascorbic acid in addition to the 1 mol dm^{-3} ascorbic acid solution, **A**.

After the serial dilution is completed, you will need to have 9 cm^3 of each concentration available to use.

(i) Complete Fig. 1.1 to show how you will prepare your serial dilution.

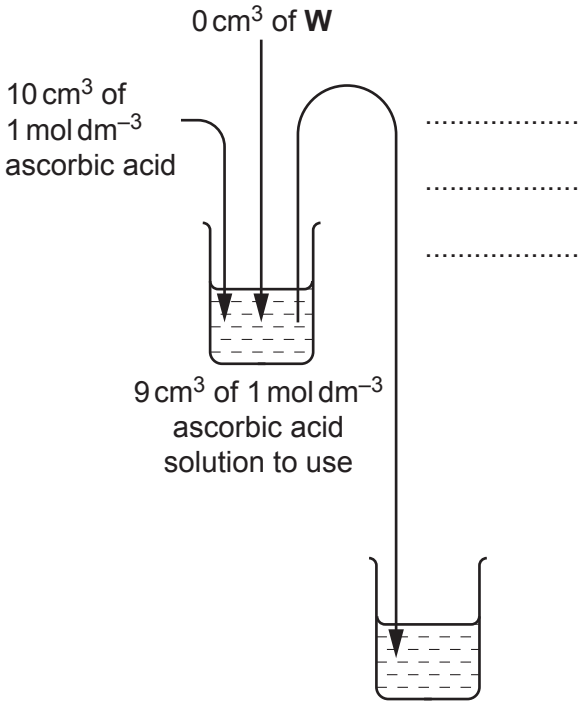
Fig. 1.1 shows the first two beakers you will use to make your serial dilution. You will need to draw **three** additional beakers.

For each beaker, add labelled arrows to show:

- the volume of ascorbic acid solution transferred
- the volume of distilled water, **W**, added.

Under each beaker, state the concentration of ascorbic acid solution.

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0 cm3 of W
10 cm3 of 1 mol dm–3 ascorbic acid
9 cm3 of 1 mol dm–3 ascorbic acid solution to use

.....

.....

.....

.....

.....

.....

.....

Fig. 1.1

[3]

Carry out step 1 to step 13.

step 1 Prepare the concentrations of ascorbic acid solution, as decided in **(a)(i)**, in the beakers provided.

step 2 Label test-tubes with the ascorbic acid concentrations prepared in step 1.

step 3 Label another test-tube **0**.

step 4 On a white tile carefully cut the cylinders of potato tissue into thin discs that are approximately 1–2 mm thick.

You will need to cut at least 70 discs.

step 5 Place 10 potato discs into each labelled test-tube.

step 6 Add 1 cm^3 distilled water, **W**, to the test-tube labelled **0**.

step 7 Add 1 cm^3 of each concentration of ascorbic acid to the appropriately labelled test-tubes.

step 8 Set up the apparatus as shown in Fig. 1.2 using the test-tube labelled **0**. The syringe barrel should be fully submerged in the beaker of water, **B**.

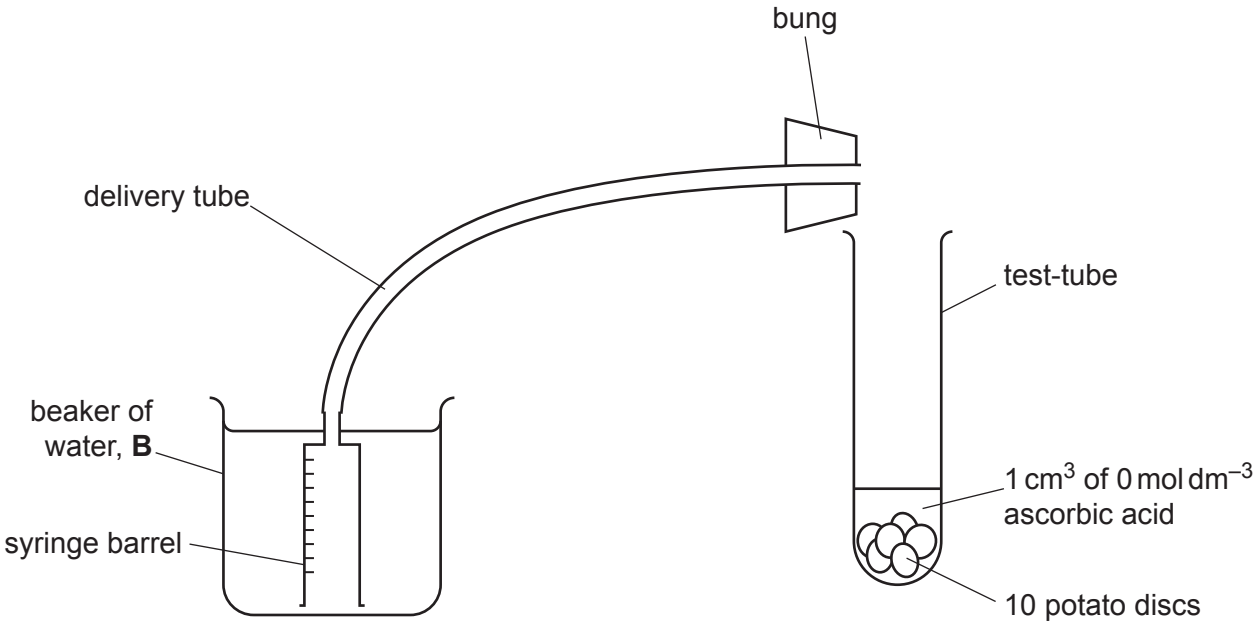


Fig. 1.2

step 9 Add 5 cm^3 of hydrogen peroxide solution **H** to the test-tube labelled **0**. Place the bung into the top of the test-tube, making sure that the syringe barrel stays fully submerged.

step 10 Record in **(a)(ii)** the **initial volume** of gas in the syringe barrel then start the stop-clock.

step 11 After 2 minutes record in **(a)(ii)** the **final volume** of gas in the syringe barrel. If the syringe barrel is full of gas, record as 10.

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step 12 Repeat step 9 to step 11 with each of the test-tubes labelled in step 2.

step 13 Calculate the **total** volume of gas produced at each concentration of ascorbic acid. Record these processed results in **(a)(ii)**.

(ii) Record your results in an appropriate table, including raw results **and** processed results.

[6]

(iii) Use your results in **(a)(ii)** to identify the **greatest** volume of gas produced in the reaction.

greatest volume of gas produced = ...

Use your answer to calculate the **rate** of gas production.
Show your working.

rate of gas production = ... $cm^3\,min^{-1}$
[2]

(iv) Describe **two** improvements to the procedure that would make the measurements more accurate.

1 .....

.....

2 .....

.....
[2]

Carry out step 14 to step 18.

step 14 Label a test-tube **T**.

step 15 Put 5 cm^3 of **H** into test-tube **T**.

step 16 Use a thermometer to measure the temperature of **H** in test-tube **T**. Record this value, to the nearest 0.5 °C, in **(b)(i)**.

step 17 Add 10 discs of potato tissue to test-tube **T** and start timing.

step 18 After 2 minutes measure the temperature of the mixture in test-tube **T**. Record this value, to the nearest 0.5 °C, in **(b)(i)**.

(b) (i) State the temperature of **H before** adding potato discs (step 16). ..... °C

State the temperature of **H** 2 minutes **after** adding potato discs (step 18).

..... °C

Calculate the **change** in temperature after 2 minutes. ..... °C
[2]

(ii) State whether temperature is a significant source of error in this investigation.

Explain your answer.

.....

..... [1]

(c) A study was carried out in which volunteers were given different daily doses of ascorbic acid (vitamin C) in addition to their normal diet. The maximum ascorbic acid concentration in the blood plasma of each volunteer was measured.

The results are shown in Table 1.2.

Table 1.2

ascorbic acid daily dose / mg	maximum ascorbic acid concentration in blood plasma / μmol dm^{-3}
0	6
50	25
200	68
500	75
1000	75

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

Use a sharp pencil.

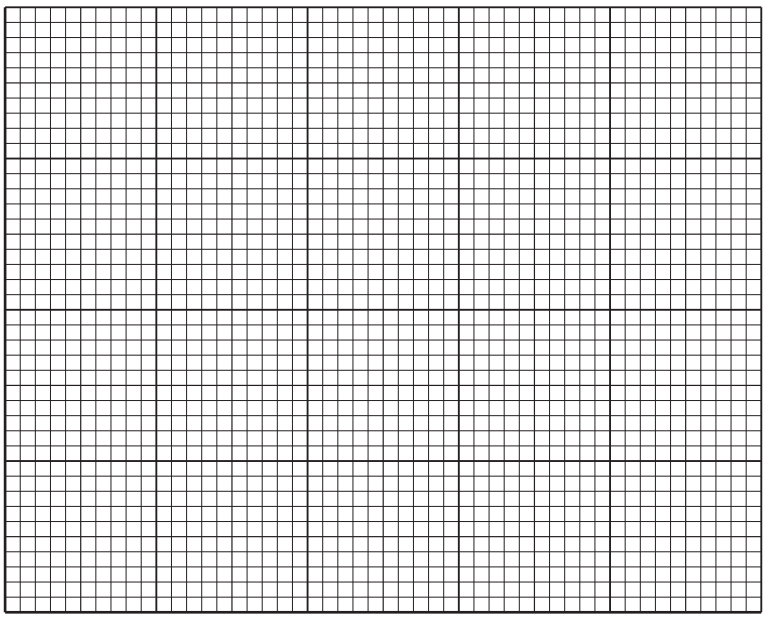


Fig. 1.3

[4]

(ii) Suggest an explanation for the results for a daily dose of 0 mg and the results for daily doses of between 500–1000 mg.

0 mg .....

.....

500–1000 mg .....

.....

[2]

[Total: 22]

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 region in Fig. 2.1. Use a sharp pencil.

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

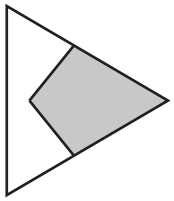


Fig. 2.1

[5]

(ii) Observe one of the larger vascular bundles of the section on **K1**.

Select a group of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **two** other xylem vessel elements.

- Make a large drawing of this group of four xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of **one** xylem vessel element.

[5]

(b) 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 1 mm.

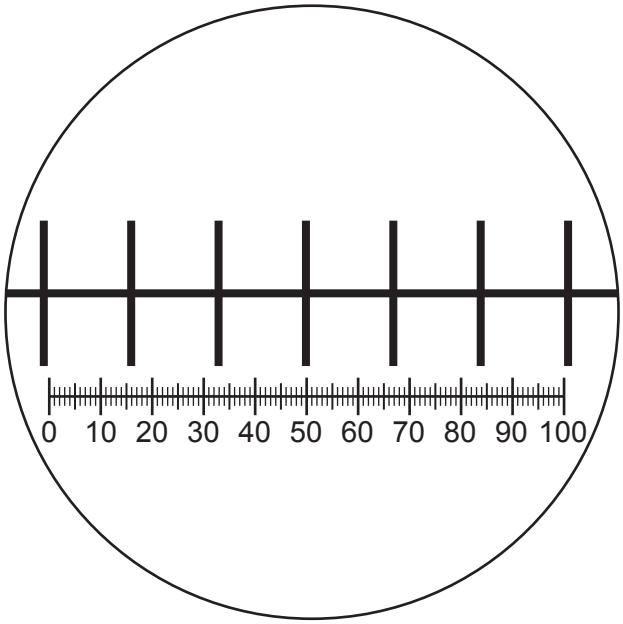


Fig. 2.2

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

Show your working.

actual length = ...
[3]

Fig. 2.3 shows a photomicrograph of a transverse section through a different stem to **K1**. This was taken with the same microscope and lenses used to take Fig. 2.2. The eyepiece graticule has been placed across the diameter of the section.

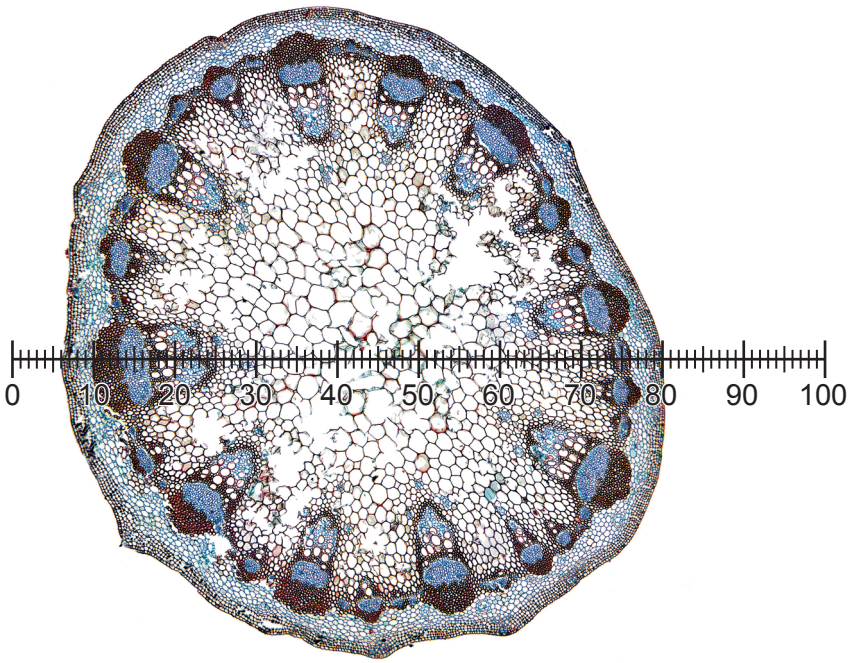


Fig. 2.3

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

Show your working.

actual diameter = ...
[2]

(iii) Identify **three** observable differences, other than size and colour, between the stem section on **K1** and the stem section on Fig. 2.3.

Record **three** observable differences in Table 2.1.

Table 2.1

feature	K1	Fig. 2.3

[3]

[Total: 18]

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