Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0686762061

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 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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[Turn over

1 Ascorbic acid is important in the diet for maintaining health. Ascorbic acid can be found in many vegetables.

You will investigate the effect of heating on the concentration of ascorbic acid in a vegetable extract. You will be carrying out a test to estimate the concentration of ascorbic acid in a vegetable extract.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
A	0.1% ascorbic acid solution	none	50
W	distilled water	none	100
iodine	iodine solution	none	20
S	starch solution	none	20
U	vegetable extract before cooking	none	20
C	vegetable extract after cooking	none	20

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

It is recommended that you wear suitable eye protection.

To estimate the concentration of ascorbic acid in the vegetable extract you will use iodine solution. The higher the concentration of ascorbic acid in the vegetable extract, the greater the volume of iodine solution needed to reach the end-point.

The end-point is when the blue colour remains for at least 10 seconds.

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(a) To find the volume of iodine solution needed to reach the end-point, iodine solution will be added to the vegetable extract, one drop at a time, using a syringe.

To practise releasing drops from a syringe, carry out step 1 to step 3.

step 1 Fill a 1.0 cm^3 syringe with distilled water, **W**.

step 2 Hold the syringe over an empty test-tube, as shown in Fig. 1.1, and push the plunger slowly to release one drop.

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

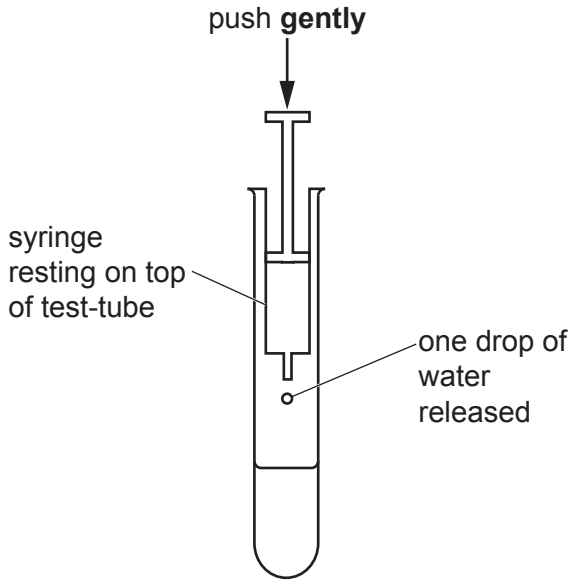


Fig. 1.1

You will need to carry out a **serial** dilution of the 0.1% solution of ascorbic acid, **A**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of ascorbic acid in addition to the 0.1% solution, **A**.

After the serial dilution is completed, you will need to have 10 cm^3 of each concentration available to use.

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

Fig. 1.2 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 **A** transferred
- The volume of distilled water, **W**, added.

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

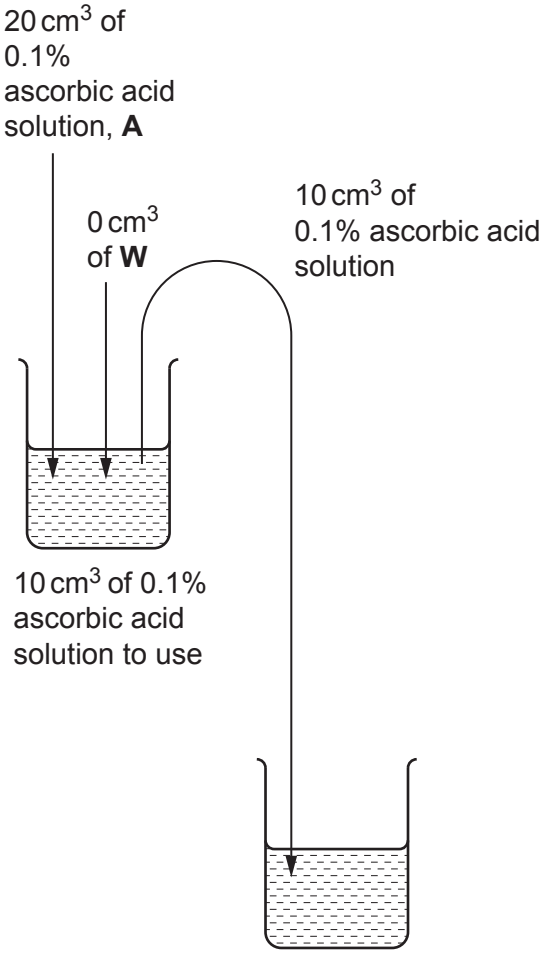

20 cm3 of 0.1% ascorbic acid solution, A
0 cm3 of W
10 cm3 of 0.1% ascorbic acid solution
10 cm3 of 0.1% ascorbic acid solution to use

Fig. 1.2

[3]

Carry out step 4 to step 17.

step 4 Prepare the concentrations of ascorbic acid solution, as decided in **(a)(i)**, in the beakers provided.

step 5 Put 1.0 cm^3 of **S** into a test-tube.

step 6 Put 5.0 cm^3 of 0.1% ascorbic acid solution, **A**, into the same test-tube.

step 7 Shake the test-tube gently to mix the contents.

step 8 Put the nozzle of a 1.0 cm^3 syringe into the beaker containing **iodine**.

step 9 Pull the plunger out so that 1.0 cm^3 of **iodine** enters the syringe.

step 10 Wipe off any excess **iodine** from the outside of the syringe with a paper towel.

In step 11 to step 15, you will be finding the volume of iodine solution needed to reach the end-point.

step 11 Put one drop of **iodine**, as shown in Fig. 1.1, into the mixture of **S** and **A** in the test-tube.

step 12 Mix gently and observe any colour change.

step 13 Repeat step 11 to step 12 until a blue colour appears. You may need to refill the 1.0 cm^3 syringe with **iodine** as in step 8 to step 10.

step 14 When the blue colour appears, shake the test-tube gently for 10 seconds and see if the end-point has been reached.

step 15 If the blue colour disappears then repeat step 11 to step 14 until the mixture stays blue for at least 10 seconds. This is the end-point.

If the colour does **not** stay blue after adding 5.0 cm^3 of iodine solution, stop adding iodine solution.

step 16 Record in **(a)(ii)** the volume of iodine solution added to reach the end-point. If the colour does **not** stay blue after adding 5.0 cm^3 of iodine solution, record as 'more than 5.0'.

step 17 Repeat step 5 to step 16 for each of the concentrations of ascorbic acid solution prepared in step 4.

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(ii) Record your results in an appropriate table.

[4]

(iii) Describe **one** significant source of error when carrying out steps 8 to 17.

.....

.....

..... [1]

You will now estimate the concentration of ascorbic acid in vegetable extracts **U** and **C**.

step 18 Repeat step 5 to step 15 with **U**, instead of **A**.

step 19 Record in **(a)(iv)** the volume of iodine solution added to reach the end-point.

step 20 Repeat step 5 to step 15 with **C**, instead of **A**.

step 21 Record in **(a)(iv)** the volume of iodine solution added to reach the end-point.

If the colour does **not** stay blue after adding 5.0 cm^3 of iodine solution, record as 'more than 5.0'.

(iv) Record the volume of iodine solution needed to reach the end-point for **U** and **C**.

volume for **U** ..... cm^3

volume for **C** ..... cm^3

[1]

(v) Complete Fig. 1.3 to show the positions of each of the percentage concentrations of ascorbic acid, recorded in **(a)(ii)**.



percentage concentration of ascorbic acid

Fig. 1.3

[1]

(vi) Use your results in **(a)(ii)** and **(a)(iv)** to estimate the concentration of ascorbic acid in **U** and **C**.

Show these estimates on Fig. 1.3 by placing the letters **U** and **C** in the correct positions along the line. [1]

(vii) Describe how you could modify this procedure to obtain a more accurate estimate of the concentration of ascorbic acid in the vegetable extract **U** and **C**.

Do **not** include the use of a colorimeter in your answer.

.....

..... [1]

(viii) **U** is a vegetable extract before heating and **C** is the same vegetable extract after heating.

Suggest an explanation for the effect of heating on the concentration of ascorbic acid in the vegetable extract.

.....

.....

..... [1]

(ix) In the investigation you have carried out, vegetable extract, **C**, was heated for 60 minutes.

Outline how you could investigate the effect of different heating times on the concentration of ascorbic acid in a vegetable extract.

.....

.....

.....

.....

.....

.....

..... [3]

(b) Some chemicals, such as ascorbic acid, have antimicrobial properties. A scientist carried out an investigation to determine the effect of ascorbic acid on the growth of a species of bacterium, *B. subtilis*.

The growth of bacteria was investigated by measuring the mass of the bacteria when grown on agar containing different concentrations of ascorbic acid.

All other variables were kept constant.

The results are shown in Table 1.2.

Table 1.2

ascorbic acid concentration / mM	mass of *B. subtilis* / mg
2.5	9.7
10.0	7.2
20.0	4.7
30.0	3.1
40.0	2.4

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(i) Plot a graph of the data shown in Table 1.2, on the grid in Fig. 1.4.

Use a sharp pencil.

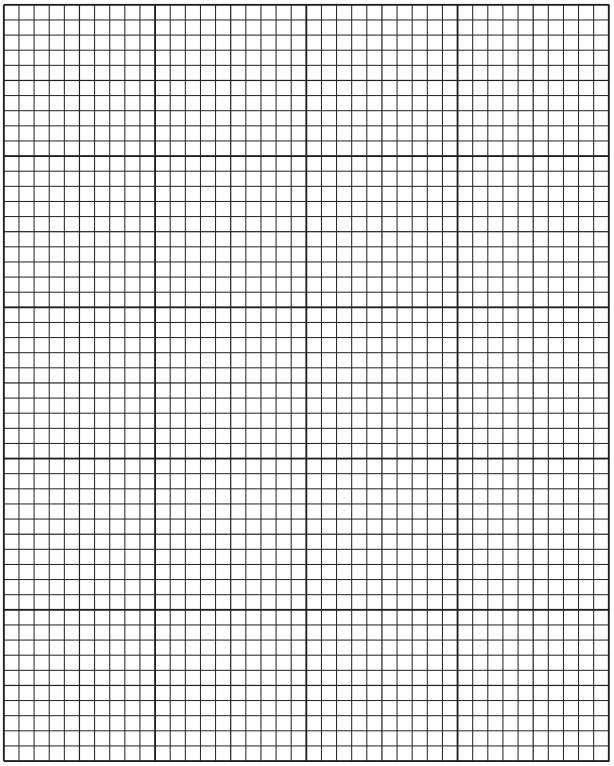


Fig. 1.4

[4]

(ii) Use your graph to calculate the percentage decrease in the mass of the bacteria between 10.0 mM and 35.0 mM ascorbic acid.

Show your working.

percentage decrease = ... [2]

[Total: 22]

2 **L1** is a slide of a stained transverse section through a plant root.

(a) **(i)** Draw a large plan diagram of the region of the root on **L1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

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

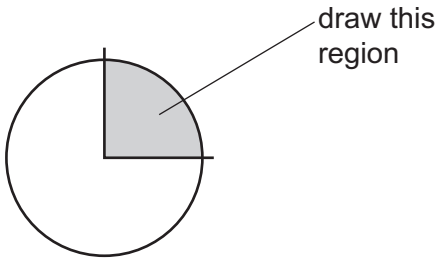


Fig. 2.1

[5]

(ii) Observe the cells in the cortex of the root on **L1**.

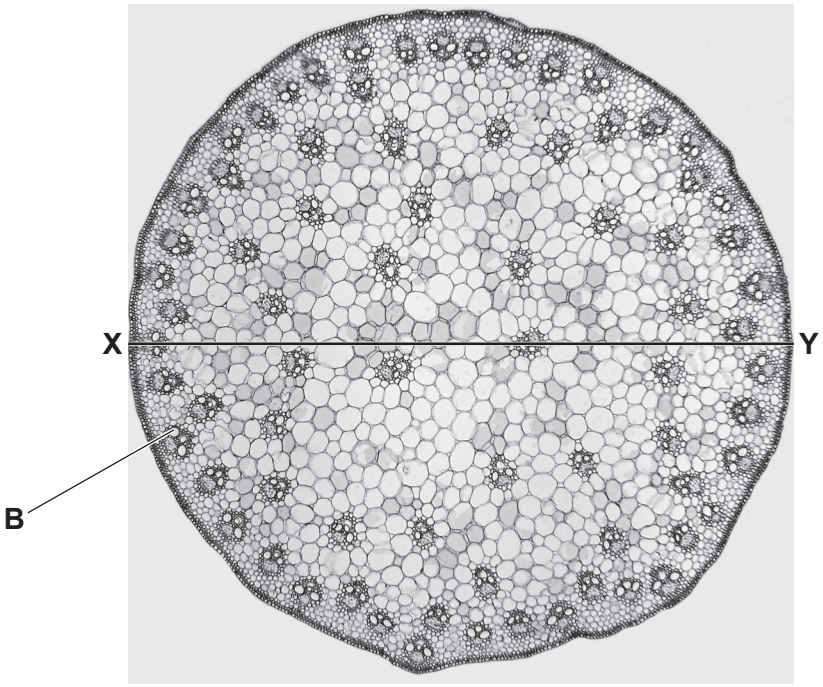
Select a group of four adjacent cells that make up this tissue.

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 the same plant species as the root on **L1**.



Magnification ×22

Fig. 2.2

(i) In Fig. 2.2 the line **X**–**Y** is drawn across the diameter of the root.

Use the magnification and the line **X**–**Y** to calculate the actual diameter of the root.

Show your working and use appropriate units.

actual diameter = ... [3]

(ii) In Fig. 2.2, the structure labelled **B** forms part of the vascular bundle.

Identify structure **B** and explain how you identified this structure.

structure **B** .....

explanation .....

.....

[1]

(iii) Identify **three** observable **differences**, other than size and colour, between the root on **L1** and the stem in Fig. 2.2.

Record these three observable differences in Table 2.1.

Table 2.1

feature	L1	Fig. 2.2

[4]

[Total: 18]

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