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Cambridge Assessment International Education

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5504405290

BIOLOGY **9700/34**

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 **20** pages. Any blank pages are indicated.

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1 In industry it is important that scientists are able to estimate the concentration of chemicals in plant extracts such as fruit juice.

Sucrose is a non-reducing sugar that can be hydrolysed to form reducing sugars.

You will prepare known concentrations of a reducing sugar by serial dilution. You will then use the known concentrations to estimate the concentration of a reducing sugar produced by hydrolysis of a sucrose solution.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
R	1.0% reducing sugar solution	none	50
B	Benedict's solution	harmful irritant	30
W	distilled water	none	100

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) You will need to carry out a **serial** dilution of the 1.0% reducing sugar solution, **R**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of solution in addition to the 1.0% reducing sugar solution, **R**.

After the serial dilution is completed, you will need to have 10 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.

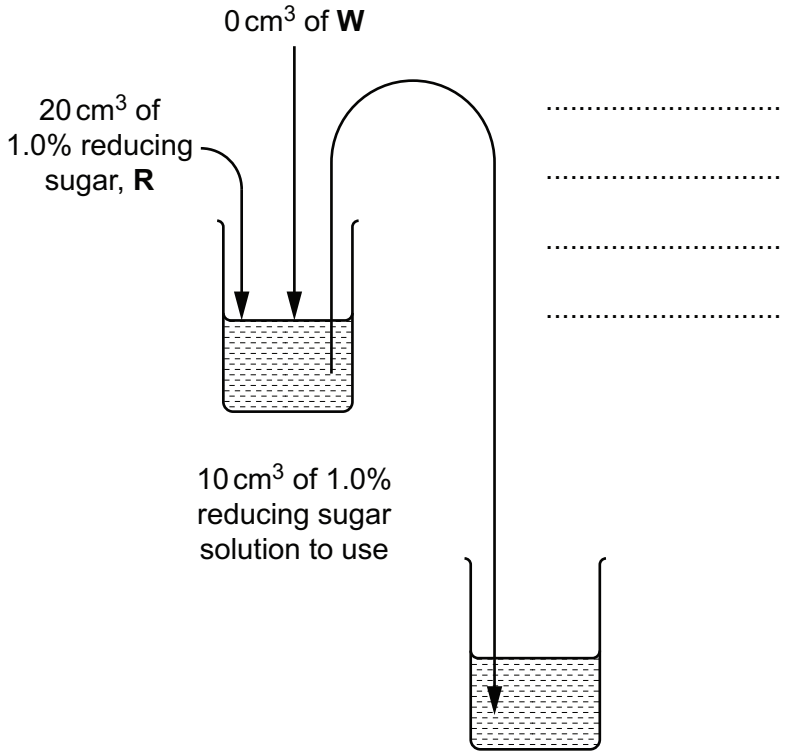
For each beaker add labelled arrows to show:

- the volume of reducing sugar solution transferred
- the volume of distilled water, **W**, added.

Under each beaker, state the concentration of reducing sugar solution.

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Fig. 1.1

[3]

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Carry out step 1 to step 11.

step 1 Set up a water-bath and heat it to boiling ready for step 6.

step 2 Prepare the concentrations of reducing sugar solution, as decided in **(a)(i)**, in the beakers provided.

step 3 Label the test-tubes with the concentrations you prepared in step 2.

step 4 Put 2 cm^3 of each reducing sugar concentration into the appropriately labelled test-tube. Put these test-tubes into a test-tube rack.

step 5 Put 2 cm^3 of Benedict's solution, **B**, into each of the test-tubes from step 3. Shake gently to mix.

step 6 Put the test-tube labelled 1.0% into the boiling water-bath. Start timing.

step 7 Measure the time taken to the first appearance of a colour change in the test-tube. If there is no colour change after 120 seconds, stop timing and record as 'more than 120'.

step 8 Record the result from step 7 in **(a)(ii)**.

step 9 Remove the test-tube from the water-bath. Put the test-tube in the test-tube rack.

step 10 Repeat step 6 to step 9 with the remaining concentrations of reducing sugar.

step 11 Turn off the water-bath. You will need this again in step 16 and in step 23.

(ii) Record your results in an appropriate table.

[5]

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(iii) State **one** significant source of error when measuring the dependent variable in this investigation.

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..... [1]

(iv) Suggest how you could improve the procedure to reduce the error you stated in **(a)(iii)**.

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..... [1]

Question 1 continues on page 6.

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You will:

- carry out the test for non-reducing sugar on the unknown concentration of sucrose, **U**
- estimate the concentration of the reducing sugar fructose in **U**.

You are provided with the materials shown in Table 1.2. You will also need to use the Benedict's solution, **B**, shown in Table 1.1.

Table 1.2

labelled	contents	hazard	volume / cm^3
U	unknown concentration of sucrose solution	none	20
H	dilute hydrochloric acid	irritant	10
A	10 g sodium hydrogencarbonate powder	none	–

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

It is recommended that you wear suitable eye protection.

Carry out step 12 to step 27.

step 12 Heat the water-bath to boiling ready for step 16 and step 23.

step 13 Label a clean test-tube **U**.

step 14 Put 2 cm^3 of **U** into the test-tube labelled **U**.

step 15 Put 2 cm^3 of **H** into this test-tube. Shake gently to mix.

step 16 Put test-tube **U** into the boiling water-bath. Leave the test-tube for 2 minutes.

step 17 After 2 minutes, remove the test-tube from the water-bath and put it into the beaker labelled **For cooling**.

step 18 Leave the test-tube in the beaker for 3 minutes.

step 19 After 3 minutes, use a spatula to put a small amount of **A** into test-tube **U**. The mixture will fizz and rise up the test-tube.

step 20 Repeat step 19 until there is no more fizzing and there is a small amount of **A** in the bottom of the test-tube.

step 21 Put 4 cm^3 of **B** into test-tube **U**.

step 22 Shake the test-tube gently to mix.

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step 23 Put test-tube **U** into the boiling water-bath. Start timing.

step 24 Measure the time taken to the first appearance of a colour change in the test-tube. If there is no colour change after 120 seconds, stop timing and record as 'more than 120'.

step 25 Record the result in **(a)(v)**.

step 26 Remove the test-tube from the water-bath. Put the test-tube in the test-tube rack.

step 27 Turn off the water-bath.

(v) State the result for **U**.

result for **U** ..... [1]

(vi) Using results from **(a)(ii)** and **(a)(v)**, estimate the concentration of reducing sugars in **U**.

concentration of reducing sugars in **U** ..... %

Calculate the concentration of fructose in **U**. Explain how you determined this concentration.

concentration of fructose in **U** ..... %

explanation .....

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[2]

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(b) A student investigated the effect of different concentrations of sucrose solution on the mass of pieces of potato tissue.

The mass of each piece of potato tissue was measured before and after soaking in different concentrations of sucrose for 1 hour and the change in mass calculated.

Table 1.3 shows the results of this investigation.

Table 1.3

concentration of sucrose solution / mol dm^{-3}	change in mass / g
0	+0.60
0.2	+0.31
0.4	0.00
0.6	–0.29
0.8	–0.45
1.0	–0.66

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

Use a sharp pencil.

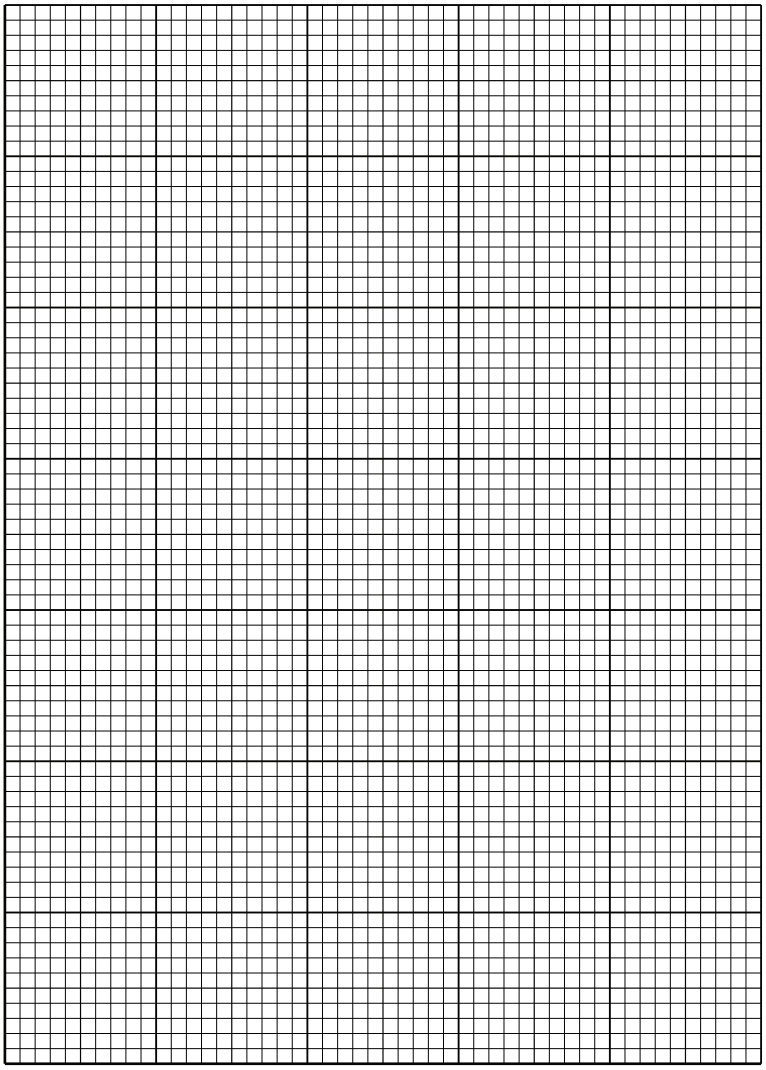


Fig. 1.2

[4]

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(ii) Using your knowledge of water potential, explain the difference in the change of mass between the potato piece in the 0.4 mol dm^{-3} sucrose solution and the potato piece in the 1.0 mol dm^{-3} sucrose solution.

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..... [3]

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

(a) **(i)** Draw a large plan diagram of the whole section on **M1**. Use a sharp pencil.

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

[4]

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(ii) Observe the epidermis and the layer of cells beneath it on the section of the root on **M1**.

Select a group of four adjacent cells: **two** cells from the epidermis and **two** cells from the layer below the epidermis.

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 a cell wall of **one** cell.

[5]

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

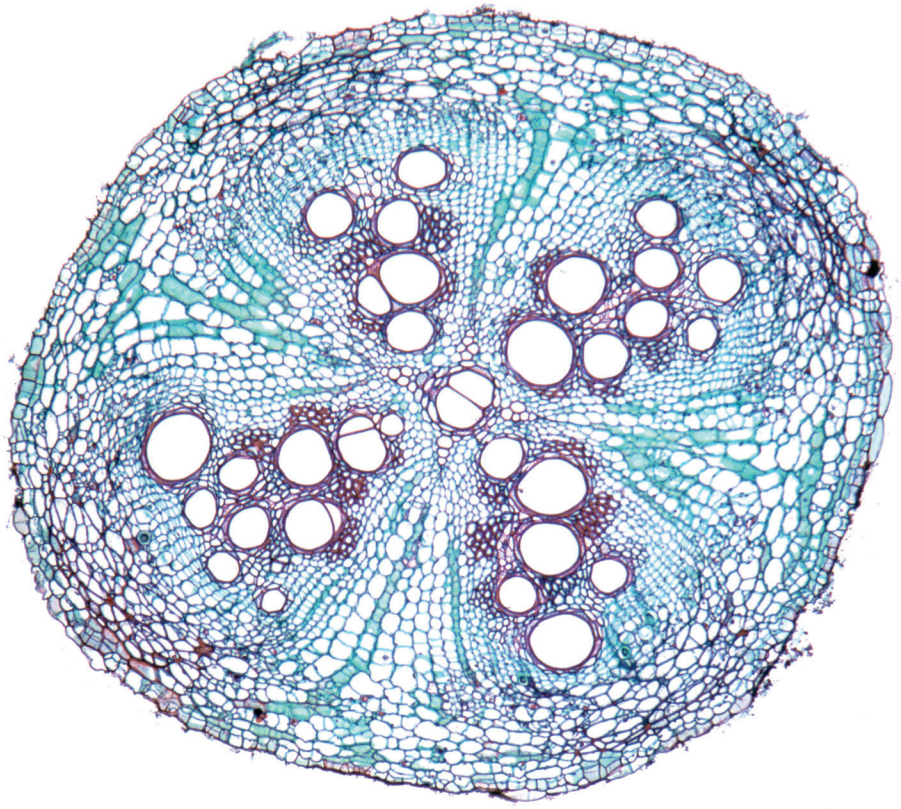


Fig. 2.1

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Identify **three** observable differences, other than size and colour, between the root section on **M1** and the root section shown in Fig. 2.1.

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

Table 2.1

feature	M1	Fig. 2.1

[4]

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(c) Fig. 2.2 is the same photomicrograph as that in Fig. 2.1, with the line **X–Y** drawn across its width.

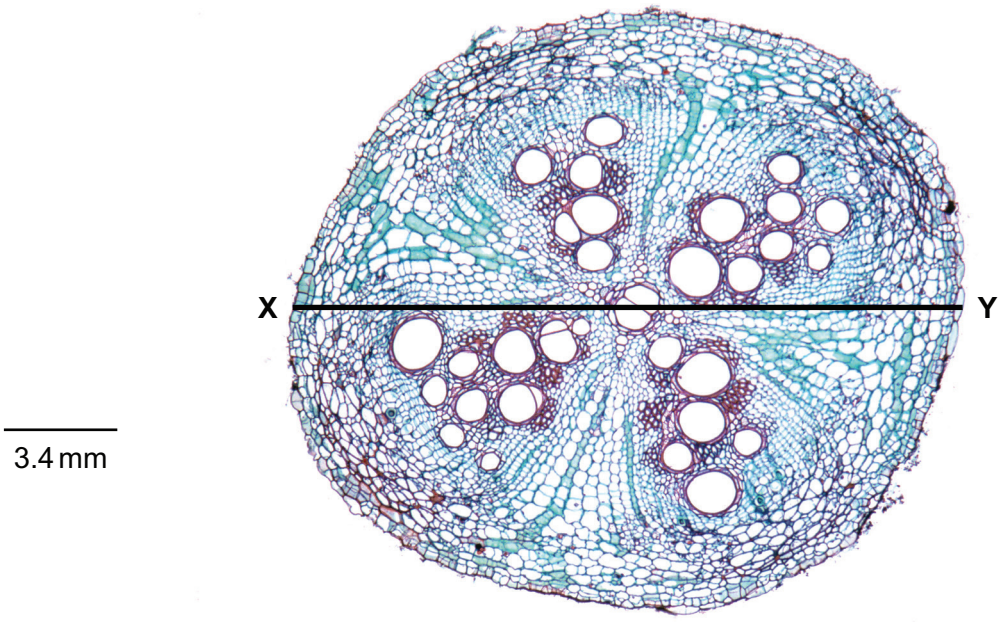


Fig. 2.2

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

Use the line **X–Y** and the scale bar to calculate the actual diameter of the root section.

Show your working and use appropriate units.

actual diameter of the root section = ... [3]

(ii) Calculate the area of the root section in Fig. 2.2, using the actual diameter from **(c)(i)** and the equation:

$$\text{area} = \pi r^2$$

Show your working and use appropriate units.

area of root section = ... [2]

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(iii) Suggest why the answer to **(c)(ii)** is an estimate of the area of the root section shown in Fig. 2.2 rather than the actual area.

.....

..... [1]

(iv) Suggest how a more accurate estimate of the area of the root section shown in Fig. 2.2 could be made.

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