Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8611816848

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 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.

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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 Visking tubing is a selectively permeable membrane, similar to a cell membrane. Some biological molecules are able to diffuse through the Visking tubing membrane.

You will investigate the effect of temperature on the diffusion of reducing sugar through the Visking tubing membrane into the surrounding water.

You will need to:

- prepare a serial dilution of 10.0% reducing sugar, **R**
- estimate the concentration of reducing sugar in the water at two different temperatures.

You are provided with the materials shown in Table 1.1 and Table 1.2.

Table 1.1

labelled	contents	hazard	volume / cm^3
R	10.0% reducing sugar solution	none	30
G	20.0% reducing sugar solution	none	30
B	Benedict's solution	harmful irritant	30
W	distilled water	none	100

Table 1.2

labelled	details
V	2 lengths (15 cm) of Visking tubing in a beaker of water
P	beaker containing water at **room temperature**
Q	beaker containing **hot** water

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

It is recommended that you wear suitable eye protection.

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(a) You will set up the apparatus as shown in Fig. 1.1 using step 1 to step 6.

1. Tie a knot in one piece of the Visking tubing as close as possible to one end, so that the end is sealed.

2. To open the other end, wet the Visking tubing and rub the tubing gently between your fingers and thumb.

3. Put 10 cm^3 of **G** into the Visking tubing.

4. Rinse the outside of the Visking tubing by dipping it into the water in the beaker labelled **V**.

5. Put the Visking tubing into the **large** test-tube labelled **P1**. Put this test-tube into a test-tube rack.

6. Fold the open end of the Visking tubing over the top of the large test-tube. Use a paper clip to hold the Visking tubing in place as shown in Fig. 1.1.

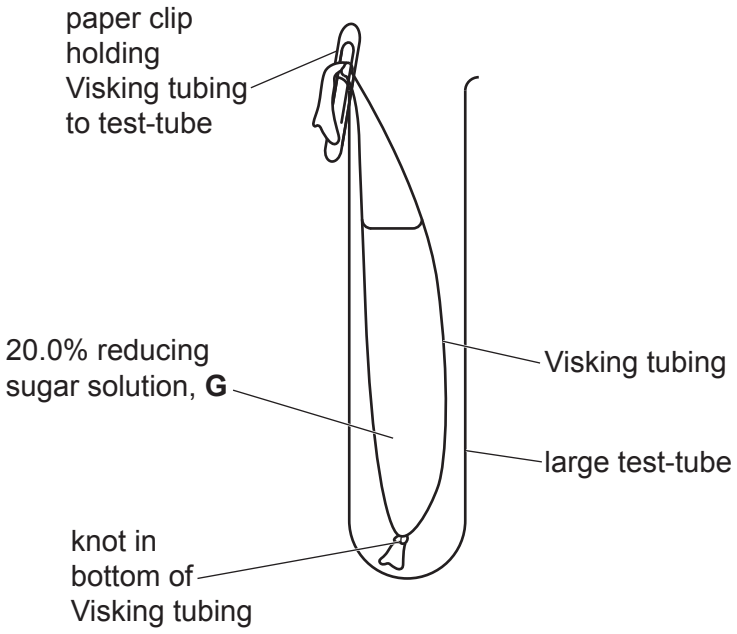


Fig. 1.1

Carry out step 7 to step 15.

7. Repeat step 1 to step 6 with the other piece of Visking tubing and the large test-tube labelled **Q1**.

8. Record the temperature of the water in beaker **P**. ..... °C

9. Prepare a water-bath at 60 °C using beaker **Q**. The water may need to be heated.

10. Use a syringe to transfer distilled water, **W**, into each of the large test-tubes containing the Visking tubing.

    The level of water in each large test-tube must be just above the level of **G** in the Visking tubing, as shown in Fig. 1.2.

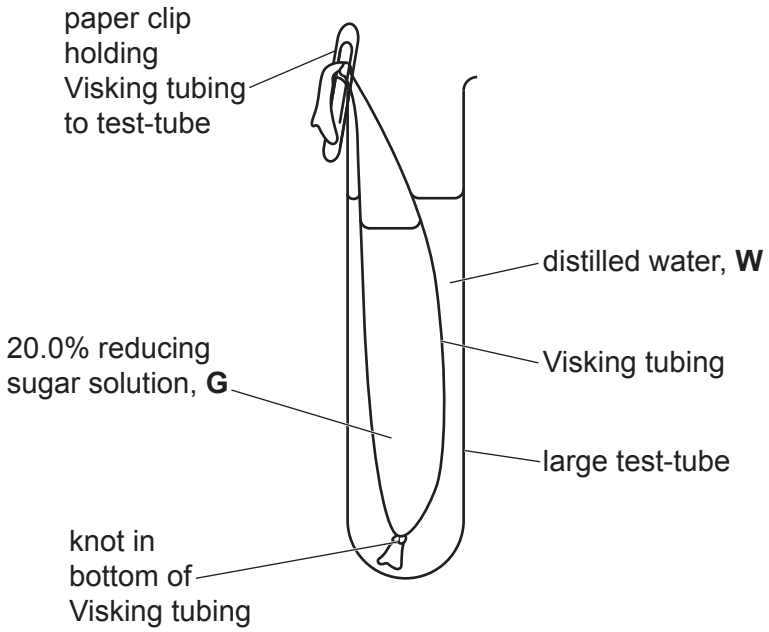


Fig. 1.2

11. Put the test-tube **P1** containing Visking tubing into beaker **P**.

12. Put the test-tube **Q1** containing Visking tubing into beaker **Q**.

13. Start timing and leave for **at least** 10 minutes. During this 10 minutes continue with step 14 to step 18.

14. Put 2 cm^3 of distilled water, **W**, into each of the small test-tubes **P2** and **Q2**. Draw a line on each test-tube at the level of the water.

15. Pour this water into the container labelled **For waste**. Put test-tubes **P2** and **Q2** into a test-tube rack ready for step 21 and step 22.

You will now need to carry out a **serial** dilution of the **10.0%** reducing sugar solution, **R**, to reduce the concentration by **a factor of 10** between each successive dilution.

You will need to prepare **four** concentrations of reducing sugar solution in addition to the 10.0% reducing sugar solution, **R**.

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

(i) Complete Fig. 1.3 to show how you will prepare your serial dilution.

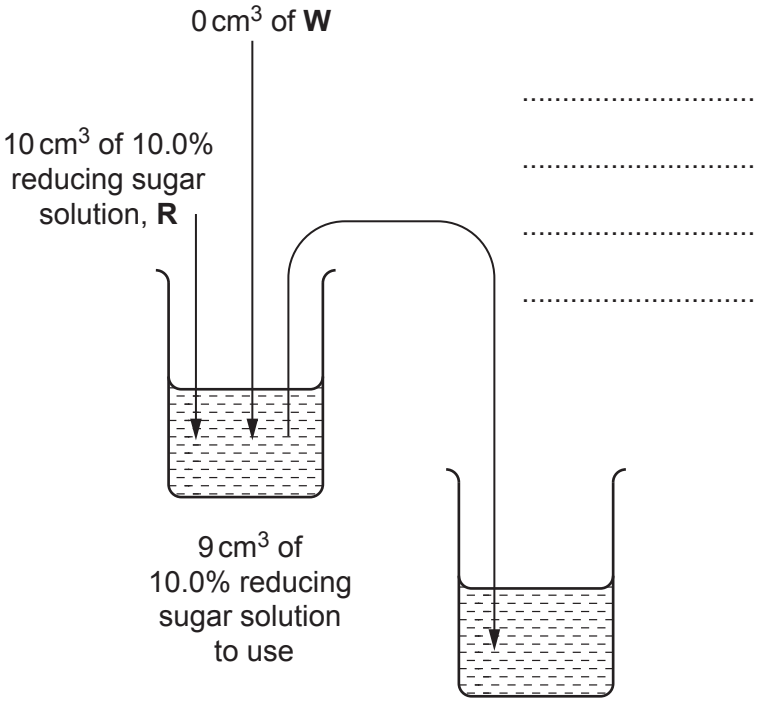
Fig. 1.3 shows the first two beakers you will use to make your serial dilution. You will need to draw **three** additional beakers.

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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0 cm3 of W
10 cm3 of 10.0% reducing sugar solution, R
9 cm3 of 10.0% reducing sugar solution to use

.....

.....

.....

.....

.....

.....

.....

.....

Fig. 1.3

[3]

Carry out step 16 to step 29.

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

17. Label five **small** test-tubes with the concentrations you prepared in step 16.

18. Put 2 cm^3 of each concentration of reducing sugar solution into the appropriately labelled test-tube. Put these five test-tubes into a test-tube rack ready for step 24.

19. After at least 10 minutes (step 13), remove test-tubes **P1** and **Q1** from the beakers and put them in a test-tube rack.

20. Remove the Visking tubing from test-tubes **P1** and **Q1** and put these into the container labelled **For waste**. Do **not** throw away the solution remaining in the test-tubes.

21. Use a pipette to transfer solution from the large test-tube **P1** into the small test-tube **P2**, up to the line you drew in step 14.

22. Use a pipette to transfer solution from the large test-tube **Q1** into the small test-tube **Q2**, up to the line you drew in step 14.

23. Carefully remove some water from beaker **Q** so there is approximately 250 cm^3 of water in the beaker. Use this as a water-bath and heat to boiling ready for step 25.

24. Put 2 cm^3 of Benedict's solution, **B**, into each of the five small test-tubes from step 18. Shake gently to mix.

25. Put the test-tube labelled 10.0% into the boiling water-bath. Start timing.

26. 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'.

27. Record the result from step 26 in **(a)(ii)**.

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

29. Repeat step 25 to step 28 with the remaining concentrations of reducing sugar solution.

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(ii) Record your results in an appropriate table.

[5]

30. Put 2 cm^3 of Benedict's solution, **B**, into test-tube **P2**. Shake gently to mix.

31. Put this test-tube into the boiling water-bath. Start timing.

32. 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'.

33. Record the result from step 32 in **(a)(iii)**.

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

35. Repeat step 30 to step 34 with test-tube **Q2**.

(iii) Result for **P2** .....

Result for **Q2** .....

[2]

(iv) Using your results from **(a)(ii)** and **(a)(iii)** estimate the concentration of reducing sugar in **P2** and **Q2**.

concentration of reducing sugar in **P2** .....

concentration of reducing sugar in **Q2** .....
[2]

(v) Explain the difference between your results for **P2** and **Q2**.

.....

.....

..... [1]

(vi) State the dependent variable in the investigation you have just carried out.

..... [1]

(vii) Identify **one** source of error in step 24 to step 29.

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

error .....

.....

improvement .....

.....

.....
[2]

(viii) Suggest how you could modify this procedure to obtain a more accurate estimate of reducing sugar concentration in **P2** and **Q2**.

.....

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.....

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.....

..... [2]

(b) A student investigated the effect of the concentration of acid on the distance it diffused through agar blocks containing universal indicator over a period of two minutes.

The results are shown in Table 1.3.

Table 1.3

concentration of hydrochloric acid / mol dm^{-3}	distance acid diffused in 2 minutes / mm
1.00	9.0
0.89	8.5
0.75	4.5
0.45	4.0
0.27	3.8

Plot a graph of the data in Table 1.3 on the grid in Fig. 1.4.

Use a sharp pencil for drawing graphs.

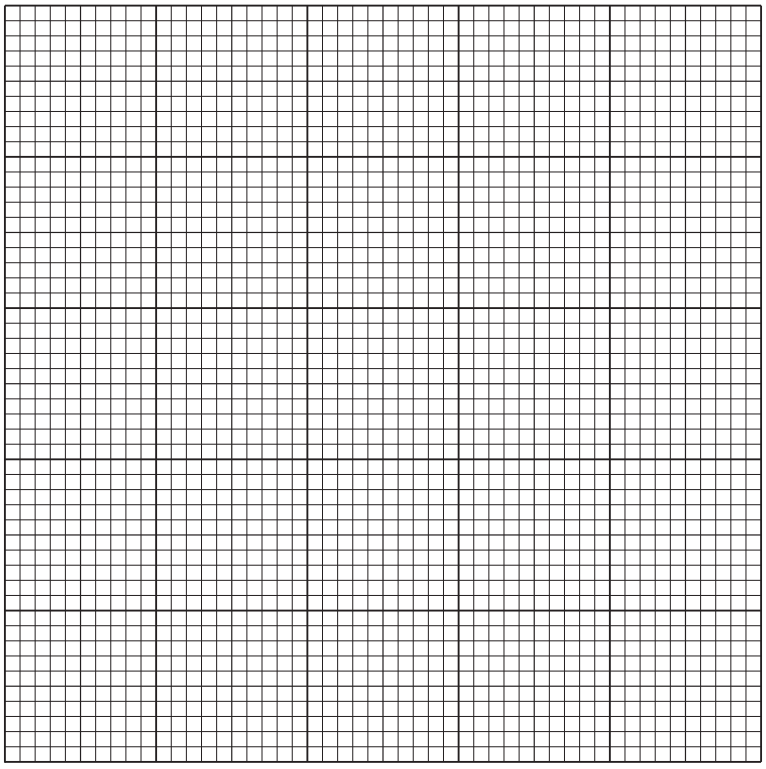


Fig. 1.4

[4]

[Total: 22]

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

(a) Set up the microscope so that you can observe the section on **L1**.

Use a sharp pencil for drawing.

(i) Draw a large plan diagram of the whole section of the plant organ on **L1**. Your drawing should show the correct shapes and proportions of the different tissues.

Use **one** ruled label line and label to identify the layer containing xylem.

[4]

(ii) Identify the plant organ on **L1**.

.....

Give a reason for your answer.

.....

.....

.....

..... [2]

(iii) Observe the epidermis and the layer of cells beneath it on the section of the plant organ on **L1**.

Select **two** epidermal cells and **two** adjacent, touching cells from the layer under 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.

[4]

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

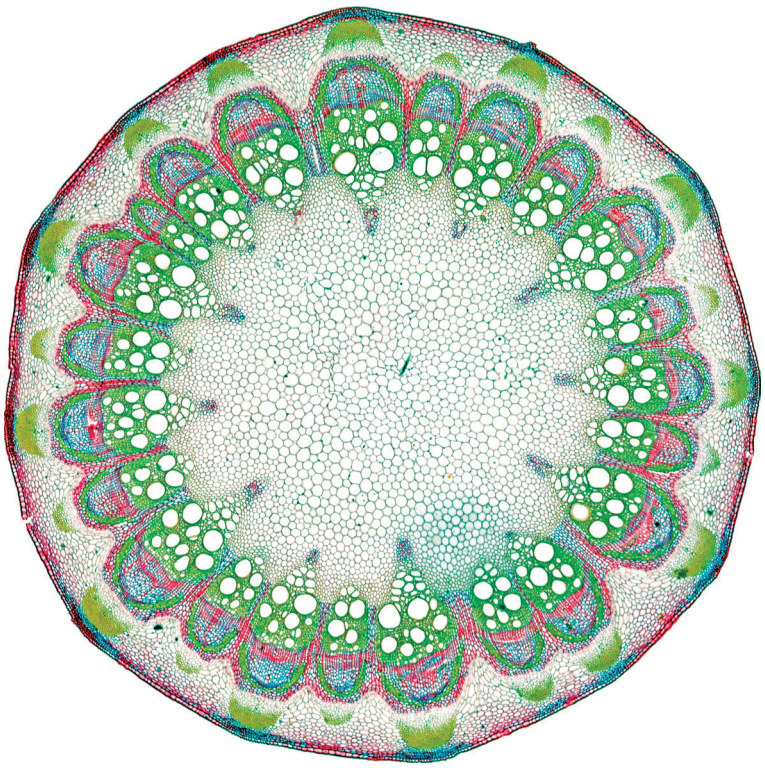


Fig. 2.1

Identify the observable differences between the section on **L1** and the section in Fig. 2.1.

Record the observable differences in Table 2.1.

Table 2.1

feature	L1	Fig. 2.1

[3]

(c) Fig. 2.2 is a photomicrograph of the same section that is in Fig. 2.1.

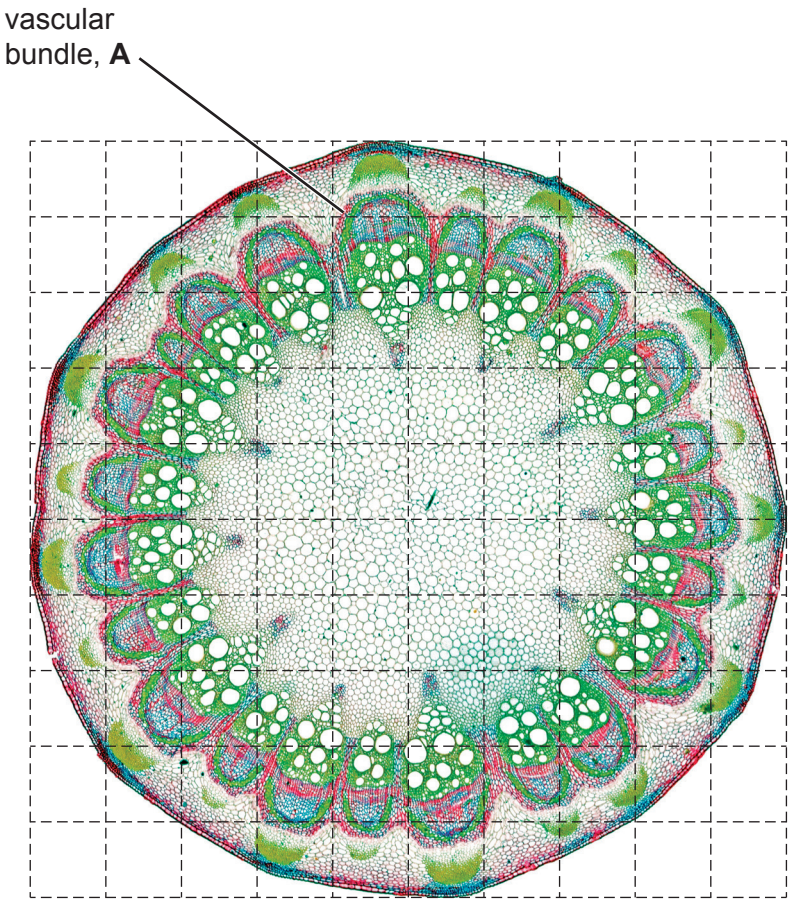


Fig. 2.2

You will need to use the grid to find the area of the vascular bundle labelled **A and** the total area of the plant organ section in Fig. 2.2.

Each square of the grid is 1 cm^2.

Some squares are not completely filled by the section.

(i) Describe the method you will use to decide which of these squares to include.

.....

.....

..... [1]

(ii) Use the grid to estimate the area of the vascular bundle labelled **A** and the total area of the plant organ section in Fig. 2.2.

area of vascular bundle **A** = ... cm^2

total area of the section = ... cm^2

[2]

(iii) Calculate the area of the vascular bundle, **A**, as a percentage of the total area of the plant organ section.

Show your working.

answer = ... %
[2]

[Total: 18]

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