Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7080401240

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do **not** use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **16** printed pages.

Cambridge Assessment International Education

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.

If you have enough time, think about how you can improve the confidence in your results, for example by recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Plants transport sucrose through vascular bundles in stems and roots.

You are required to investigate the movement of sucrose solution.

The apparatus will be set up as shown in Fig. 1.1, using a large test-tube and a 5 cm^3 syringe.

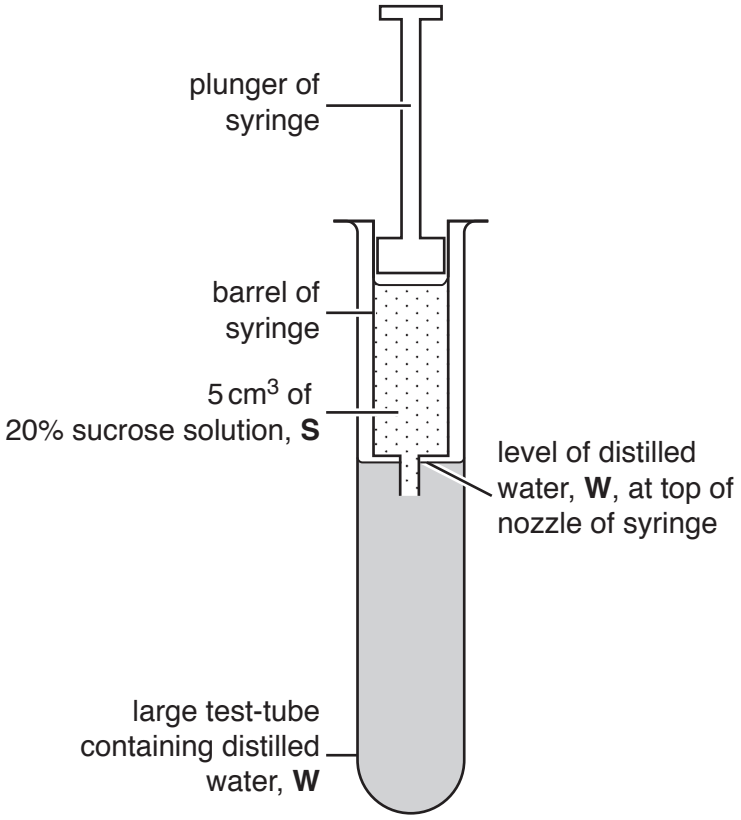


Fig. 1.1

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
S	20% sucrose solution	none	40
W	distilled water	none	300

Carry out step 1 to step 5 to investigate the movement of sucrose solution from the syringe.

1. Set up the apparatus as shown in Fig. 1.1 but **without** any distilled water, **W**, in the large test-tube.

2. Observe and record in **(a)(i)** your observations of any movement of the sucrose solution.

3. Put **W** into the large test-tube. The level of **W** must be to the top of the nozzle of the syringe, as shown in Fig. 1.1.

4. Observe and record in **(a)(i)** your observations.

5. Empty the syringe and the large test-tube into the container labelled **For waste**.

(a) (i) Complete Table 1.2.

Table 1.2

contents of large test-tube	observations
without distilled water	
with distilled water	

[1]

(ii) State a tissue in a plant vascular bundle in which the same type of movement occurs as that observed in **(a)(i)** when the large test-tube contains distilled water.

Give a reason for your answer.

tissue .....

reason .....

.....

[1]

(b) You will need to investigate the movement of the sucrose solution out of the syringe by:

- setting up the apparatus, as shown in Fig. 1.2
- collecting the sucrose solution released from the syringe during each of the first four two-minute periods after setting up the apparatus, as shown in Fig. 1.2
- testing the mixtures of sucrose solution and water collected during each of the four two-minute periods, using the non-reducing sugar test
- recording the time taken for the first colour change to occur when heating each mixture with Benedict's solution during the non-reducing sugar test.

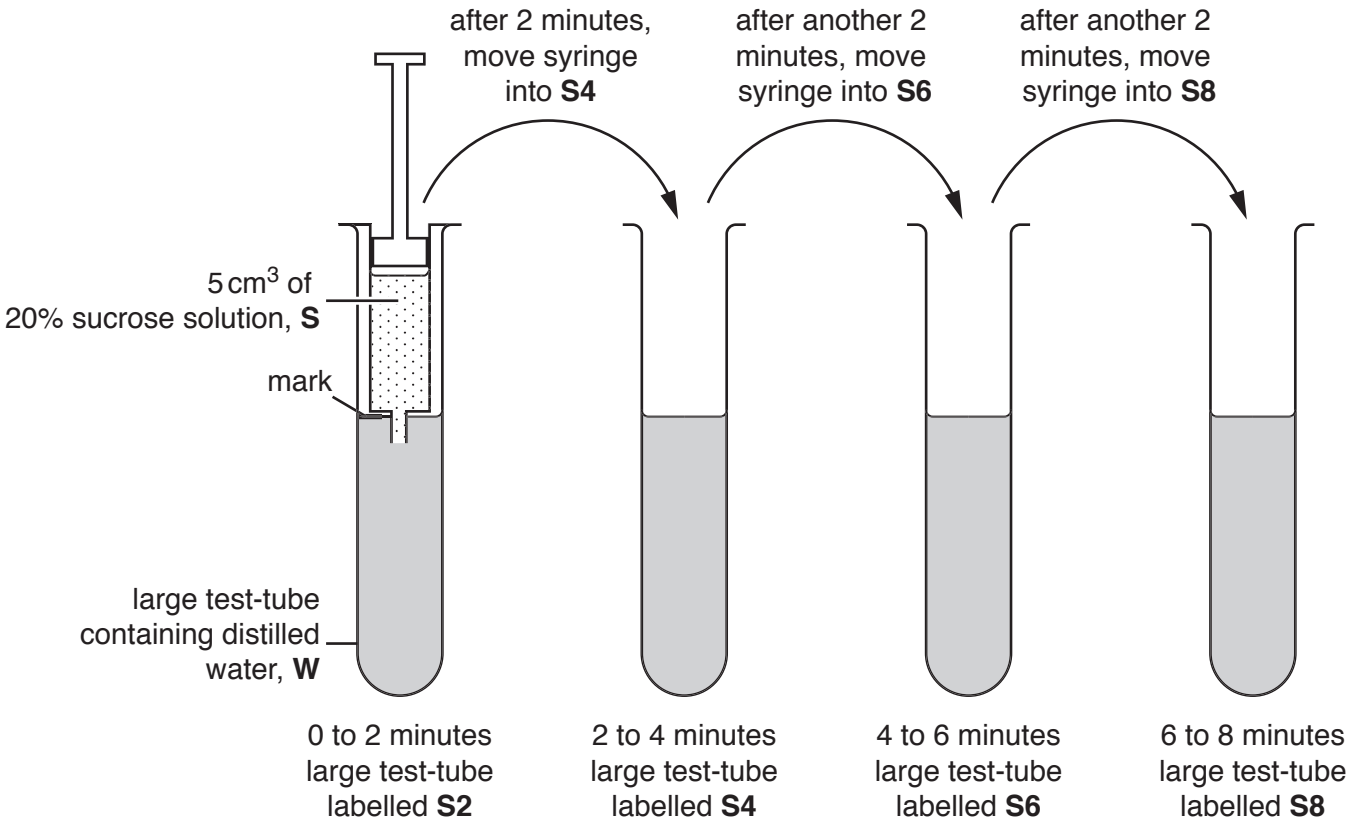


Fig. 1.2

6. Set up a water-bath and heat the warm water to boiling. This will be used in step 20 and step 27 during the tests for non-reducing sugar.

7. Label the four large test-tubes **S2**, **S4**, **S6** and **S8**.

The apparatus needs to be set up as shown in Fig. 1.2 so that at the start there is a standard volume of distilled water in each of the large test-tubes **S2**, **S4**, **S6** and **S8**.

8. Put the empty 5 cm^3 syringe from step 5 into the large test-tube labelled **S2**.

9. Put a mark on the large test-tube labelled **S2**, as shown in Fig. 1.2, so that the mark is level with the top of the nozzle of the syringe.

(i) Describe how you will use the apparatus provided to find the volume of distilled water, **W**, needed to fill the large test-tube to the mark, **when the syringe is in place**.

.....

.....

.....

.....[2]

(ii) Find the volume of distilled water, **W**, needed to fill the large test-tube to the mark, using the method you described in **(b)(i)**.

volume .....[1]

10. Put the volume of distilled water, **W**, stated in **(b)(ii)** into each of the four large test-tubes, **S2**, **S4**, **S6** and **S8**.

11. Fill a 5 cm^3 syringe with more than 5 cm^3 of sucrose solution, **S**. Push the plunger in to the 5 cm^3 mark to make sure that there are no air bubbles in the nozzle.

12. Put the syringe into the first large test-tube, **S2**, as shown in Fig. 1.2. The nozzle of the syringe must be below the surface of the distilled water, **W**. Start the timer.

13. Leave the syringe in the large test-tube **S2** for 2 minutes, then remove the syringe and put it immediately into the next large test-tube, **S4**. The nozzle of the syringe must be below the surface of the distilled water, **W**. Leave for a further 2 minutes. Do **not** stop the timer.

14. Repeat this process with each of the two remaining large test-tubes, **S6** and **S8**, removing the syringe from the last large test-tube, **S8**, at 8 minutes. Each time, the nozzle of the syringe must be below the surface of the distilled water, **W**.

To estimate the rate of movement of the sucrose solution into distilled water, **W**, the solution collected in each large test-tube will be tested for non-reducing sugar. After hydrolysing any non-reducing sugar present, the measurement used will be the time taken for the first colour change to occur when the solution is heated with Benedict's solution. This measurement allows the test to be semi-quantitative.

(iii) A student suggested the hypothesis that:

the rate of movement of the sucrose solution from the syringe into the water in the large test-tube will decrease with time.

If the student's hypothesis is correct, describe the expected trend in the time taken for the first colour change to occur when each solution collected in the large test-tubes **S2**, **S4**, **S6** and **S8** is heated with Benedict's solution.

.....

.....

.....[1]

You will test the samples of the solution collected during each two-minute period for non-reducing sugar, using step 15 to step 31.

You are provided with the materials shown in Table 1.3.

Table 1.3

labelled	contents	hazard	volume/cm^3
H	dilute hydrochloric acid	irritant	50
A	10 g sodium hydrogencarbonate powder	none	–
Benedict's	Benedict's solution	harmful	50

It is recommended that you wear suitable eye protection. If any of these materials come into contact with your skin, wash them off immediately under cold water.

15. Put a bung into one of the large test-tubes, **S2**, **S4**, **S6** or **S8**, and, with a finger on the top of the bung, shake the solution to mix well.

16. Remove the bung and pour the solution from this large test-tube into a labelled beaker.

17. Put 2 cm^3 of the solution in the beaker into a labelled **small** test-tube.

18. Put 2 cm^3 of dilute hydrochloric acid, **H**, into the same small test-tube. Shake this test-tube gently to mix.

19. Repeat step 15 to step 18 for **each** of the solutions in the remaining large test-tubes.

20. Put all the small test-tubes into the boiling water-bath (set up in step 6). Leave the test-tubes for 2 minutes.

21. After 2 minutes, remove the small test-tubes from the water-bath and put them into the beaker of water labelled **For cooling**.

You will need the boiling water-bath again for step 27.

22. Leave the small test-tubes in the beaker to cool for 3 minutes. After 3 minutes, continue to step 23.

23. Put a small amount of sodium hydrogencarbonate, **A**, into each small test-tube. The mixture will fizz and rise up inside each small test-tube.

24. Repeat step 23 until there is no more fizzing and a small amount of sodium hydrogencarbonate, **A**, is left in the bottom of each test-tube.

25. Put 3 cm^3 of Benedict's solution into the small test-tube containing **S2**.

26. Shake the small test-tube gently to mix.

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

28. Measure the time taken to the first appearance of a colour change in the small test-tube.

If there is no colour change after 180 seconds, **stop timing** and record the result in **(b)(iv)** as 'more than 180'.

29. Record in **(b)(iv)** the result from step 28.

30. Remove the small test-tube from the boiling water-bath. Put the small test-tube in the test-tube rack.

31. Repeat step 25 to step 30 with each of the other solutions instead of **S2**.

(iv) Record your results in an appropriate table.

[5]

(v) The student's hypothesis stated that:

the rate of movement of the sucrose solution from the syringe into the water in the large test-tube will decrease with time.

State whether your results provide evidence to **support** or **reject** this hypothesis.

Explain how your results provide evidence for this decision.

support or reject .....

explanation .....

.....

[1]

(c) A student modified the procedure by:

- using a 10% sucrose solution in the syringe
- collecting sucrose solution from the syringe in four-minute periods over a total time of 20 minutes
- collecting any precipitate (solid particles) formed during the Benedict's test when testing each solution for non-reducing sugar
- drying and weighing the precipitate from each test to determine the mass of sucrose that had been present.

After carrying out the procedure, the student processed and analysed the results to calculate the rate of movement of the sucrose solution at specific times after placing the syringe in the large test-tube of water for the first time.

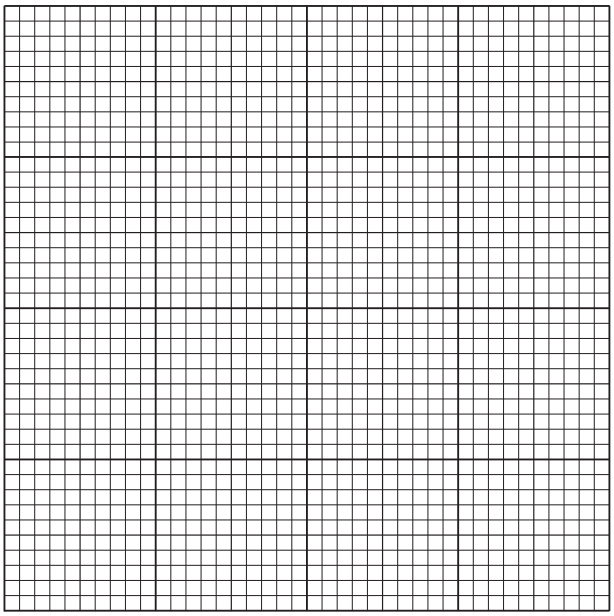
The calculated rates are shown in Table 1.4.

Table 1.4

time /minutes	rate of movement of sucrose solution /arbitrary units (au)
4	0.18
8	0.09
12	0.04
16	0.02
20	0.01

(i) Plot a graph of the data in Table 1.4 on the grid provided.

Use a sharp pencil for drawing graphs.



[4]

(ii) Use your graph to find the rate of movement of sucrose solution at 5 minutes.

Show **on the graph** how you determined your answer.

rate of movement ..... au
[2]

(iii) The procedure investigated how the rate of movement of sucrose solution from the syringe changed with time.

The procedure can be modified to investigate the effect of sucrose concentration, instead of time, on the rate of movement of sucrose solution. In the modified procedure, the sucrose solution from the syringe only needs to be collected once. The time period over which the sucrose solution is collected in the procedure needs to be standardised.

Use the graph to suggest a suitable time period for collecting the sucrose solution from the syringe.

Give a reason for your answer.

time period .....

reason .....

.....
[1]

(iv) Think about how else you could modify this procedure to investigate the effect of using different concentrations of sucrose on the rate of movement of the sucrose solution.

State the concentrations of sucrose solution you would use.

.....

Describe how the concentrations of sucrose solution would be prepared.

.....

.....

.....

.....

.....

[2]

[Total: 21]

Question 2 starts on page 12

2 **P1** is a slide of a stained transverse section through a plant stem.

You are not expected to be familiar with this specimen.

(a) Observe all the different tissues in the stem on **P1** and select a field of view so that you can observe:

- the epidermis
- at least two vascular bundles.

Use a sharp pencil for drawings.

(i) Draw a large plan diagram of the area you have selected on **P1**, to include:

- part of the epidermis
- only **two** vascular bundles
- any other observable tissues.

You are expected to draw the correct shapes and proportions of the different tissues.

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

[5]

(ii) Observe the vascular bundles in the stem on **P1**.

Select **one** large xylem vessel element **and** three cells that touch this xylem vessel element.

Make a large drawing of this group of **four** cells.

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

Use **one** ruled label line and label to identify the lumen in **one** of the cells.

[6]

(b) Fig. 2.1 is a photomicrograph of part of a stained transverse section through a stem of a different species of plant.

You are not expected to be familiar with this specimen.

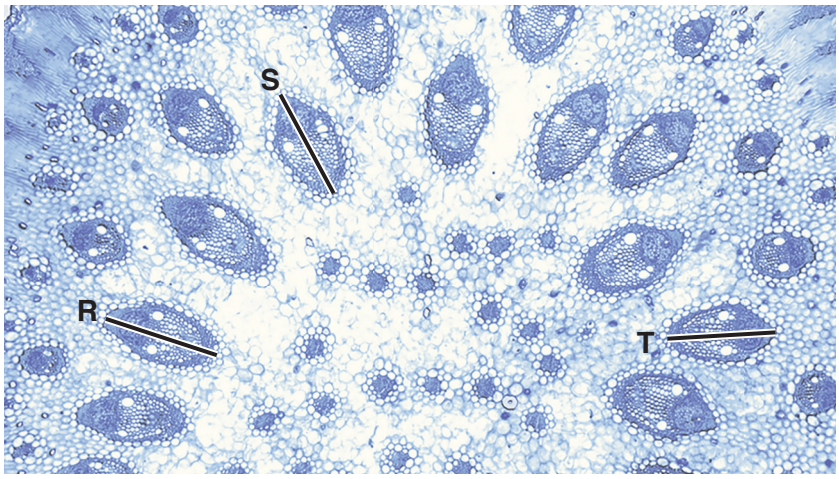


Fig. 2.1

(i) In Fig. 2.1, the lines **R**, **S** and **T** are drawn across the length of three vascular bundles.

Measure the length in the photomicrograph of these three vascular bundles, along the lines **R**, **S** and **T**.

length of **R** .....

length of **S** .....

length of **T** .....

[2]

(ii) Using the lengths measured in **(b)(i)**, calculate the **mean** length in the photomicrograph of these three vascular bundles.

Show all the steps in your working.

working:

mean length .....

[2]

(iii) The magnification of the photomicrograph in Fig. 2.1 is ×66.

Use your answer to **(b)(ii)** and the magnification of the photomicrograph in Fig. 2.1 to calculate the mean **actual** length of these three vascular bundles, in μm.

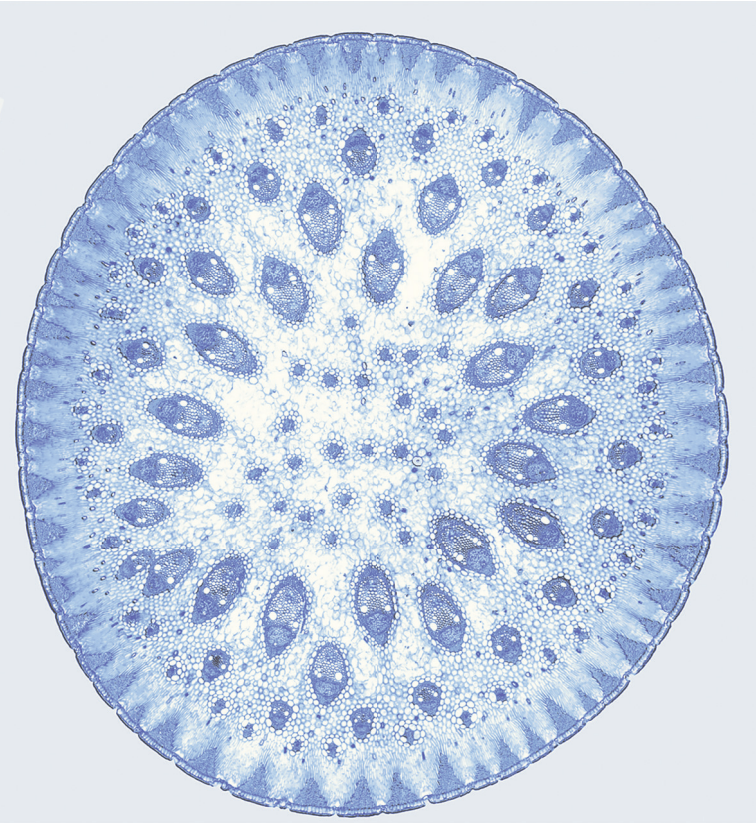
Show all the steps in your working.

working:

mean actual length .....μm
[2]

Question 2 continues on page 16

Fig. 2.2 is a photomicrograph of the same transverse section of a stem as is shown in Fig. 2.1, but it is at a lower magnification.



magnification ×44

Fig. 2.2

(iv) You are required to annotate Fig. 2.2 to describe **two** observable differences between the stem in Fig. 2.2 and the stem in **P1**. Ignore any differences in colour and size.

- Draw lines to label **two** features of the stem in Fig. 2.2 that are different from the corresponding features of the stem in **P1**.
- Label one line **J** and the other line **K**.
- Next to each letter, describe how the labelled feature is different from the corresponding feature of the stem in **P1**.

[2]

[Total: 19]