Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

5837901037

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 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 **11** printed pages and **1** blank page.

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.

1 When plant tissue is soaked in methylene blue solution, the solution enters the tissue and stains it blue. When the stained plant tissue is placed into solutions of different pH, methylene blue is released from the plant cells.

A student investigated the effect of pH on the release of methylene blue from the cells of potato tissue.

The student suggested the following hypothesis:

The lower the pH of the solution surrounding the potato tissue, the more methylene blue will be released into the solution.

You will investigate this hypothesis by comparing the release of methylene blue from potato tissue at different pH values.

- The pH values will be changed using buffers, **P2**, **P3**, **P4**, **P5** and **P6**.
- Buffer **PU** has an unknown pH.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
P2	buffer solution pH 2	none	25
P3	buffer solution pH 3	none	25
P4	buffer solution pH 4	none	25
P5	buffer solution pH 5	none	25
P6	buffer solution pH 6	none	25
PU	buffer solution of unknown pH	none	25
W	distilled water	none	200
B	3 potato cylinders stained with methylene blue, in distilled water	none	–

Use the forceps to handle the potato cylinders.

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

It is recommended that you should wear suitable eye protection.

Methylene blue can stain skin and clothing.

Carry out step 1 to step 17. Use forceps when handling potato cylinders.

1. Pour the water surrounding the potato cylinders in **B** into the container labelled **For waste**.

2. Pour distilled water from the beaker labelled **W** into **B** so that the potato cylinders are covered. Stir gently with the glass rod.

3. Put the potato cylinders onto the white tile using the forceps.

(a) (i) Measure the length of each potato cylinder in mm.

Record your measurements in Table 1.2.

Table 1.2

potato cylinder	length / mm
1	
2	
3	

[1]

(ii) The potato cylinders all have the same diameter.

Describe how you will standardise the surface area of each potato cylinder.

.....

..... [1]

4. Cut one potato cylinder into two pieces and then cut each piece into four smaller pieces, as shown in Fig. 1.1. Repeat for the other two potato cylinders.

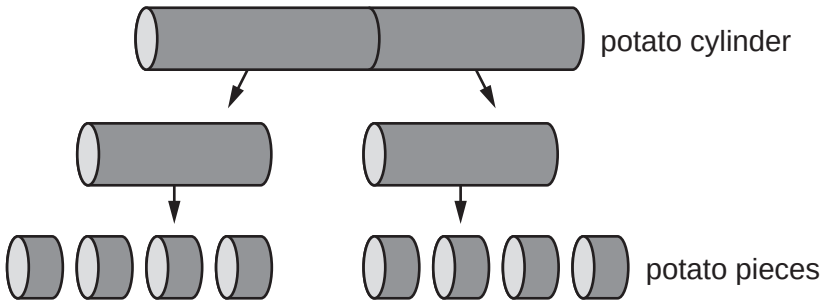


Fig. 1.1

5. Put the potato pieces into beaker **B**. Repeat step 2.

6. Put four potato pieces into each of six test-tubes.

7. Label the six test-tubes using the labels **P2**, **P3**, **P4**, **P5**, **P6** and **PU**.

Buffer solution will be added to the pieces of potato in each test-tube.

The volume of buffer solution surrounding the plant tissue in the test-tube is a variable that must be standardised.

(iii) Think about how you will standardise the volume of buffer solution.

State the volume of buffer solution that you will use in each test-tube.

volume = ...cm^3 [1]

8. Put the volume of buffer solution **P2** stated in **(a)(iii)** into the appropriately labelled test-tube.

9. Repeat step 8 for each of the other buffer solutions **P3**, **P4**, **P5**, **P6** and **PU**.

10. Put a bung into the test-tube labelled **P2** and mix the contents.

11. Remove the bung from the test-tube and rinse the bung with water in the beaker labelled **For washing**.

12. Repeat step 10 and step 11 with the remaining test-tubes.

13. Leave the test-tubes in the test-tube rack for 10 minutes.

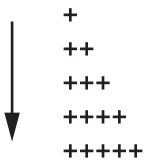
While you are waiting, use your time to continue with Question 1.

14. After 10 minutes, shake each test-tube and pour the liquid into six clean test-tubes.

Fig. 1.2 shows the key you need to use to record your results.

Key:

very pale colour: lowest intensity



deep colour: highest intensity

Fig. 1.2

15. Observe the liquid in each test-tube.

It may help to observe the liquid with a piece of white card behind the test-tube.

You may observe the same intensity in more than one test-tube.

16. Record your results for **P2**, **P3**, **P4**, **P5** and **P6** in **(a)(iv)** using the symbols shown in the key in Fig. 1.2.

17. Record your result for **PU** in **(a)(v)** using one of the symbols shown in the key in Fig. 1.2.

(iv) Record your results in an appropriate table for **P2**, **P3**, **P4**, **P5** and **P6**.

[5]

(v) Record your result for **PU**.

result for **PU** ..... [1]

(vi) Using your results from **(a)(iv)** and **(a)(v)**, estimate the pH of **PU**.

pH of **PU** = ... [1]

(vii) Suggest **one** improvement to this investigation so that a more accurate estimate of the pH of **PU** can be made.

.....

..... [1]

(viii) Think about how you would modify this procedure to investigate the effect of temperature on the release of methylene blue from the cells of potato tissue.

Describe **how** the independent variable (temperature) will be changed to investigate the release of methylene blue from the cells of potato tissue.

.....

.....

.....

.....

.....

..... [2]

(b) A student investigated the effect of soil pH on grass growth.

Grass was grown in pots containing soil of different pH values for 90 days. The grass was then collected, dried and weighed. All other variables were kept constant.

The results are shown in Table 1.3.

Table 1.3

soil pH	mean mass of grass / g
4.5	7.5
5.0	9.5
5.5	11.1
6.0	12.5
6.5	13.4

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

Use a sharp pencil for drawing graphs.

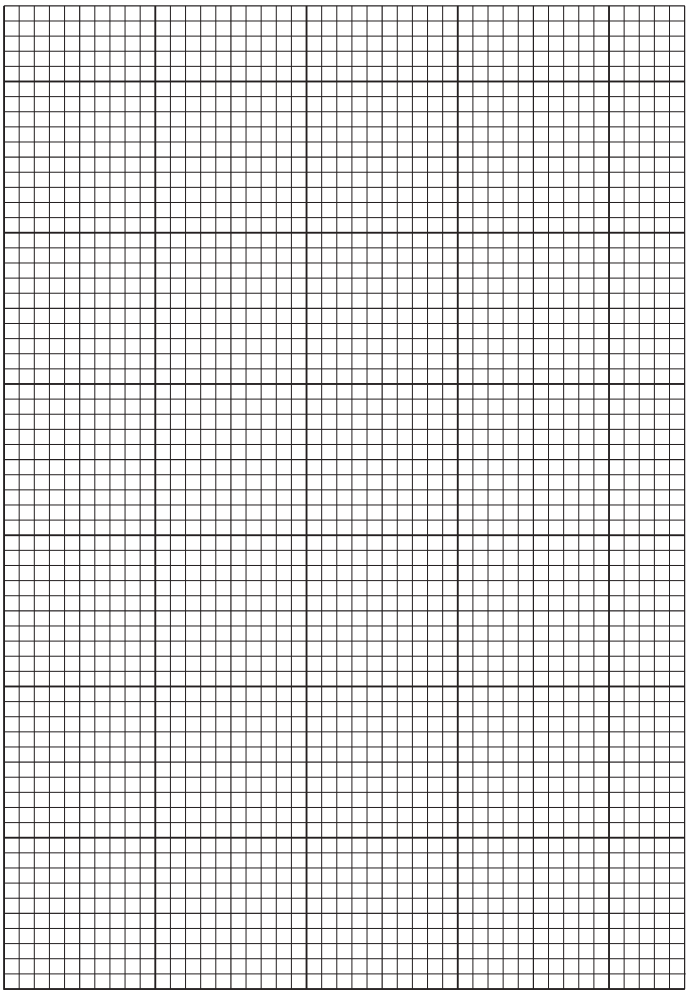


Fig. 1.3

[4]

(ii) Use Table 1.3 and the graph in **(b)(i)** to describe the trend in the data.

.....

.....

.....

.....[2]

(iii) Minerals from the soil enter a plant with the help of membrane-bound protein molecules. Suggest how a low pH could affect the growth of grass.

.....

.....

.....

.....[2]

[Total: 21]

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

You are not expected to be familiar with this specimen.

(a) Select a field of view so that you can observe the different tissues shown by the shaded area in Fig. 2.1.

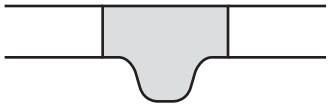


Fig. 2.1

Use a sharp pencil for drawing.

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

(i) Draw a large plan diagram of the part of the leaf on **M1** shown by the shaded area in Fig. 2.1.

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

[5]

(ii) Observe the vascular bundle of the leaf on **M1**.

Select one group of **four** cells from the xylem tissue.

Each cell in the group should touch at least one 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) State **one** feature that identifies the cells you have drawn in **(a)(ii)** as xylem.

.....

..... [1]

(c) A student investigated the structure of a different leaf to that on **M1**.

The student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual width of the leaf could be found.

The calibration was: one eyepiece graticule division equal to 15 μm.

Fig. 2.2 shows the field of view and eyepiece graticule using the same microscope with the same lenses as those used by the student.

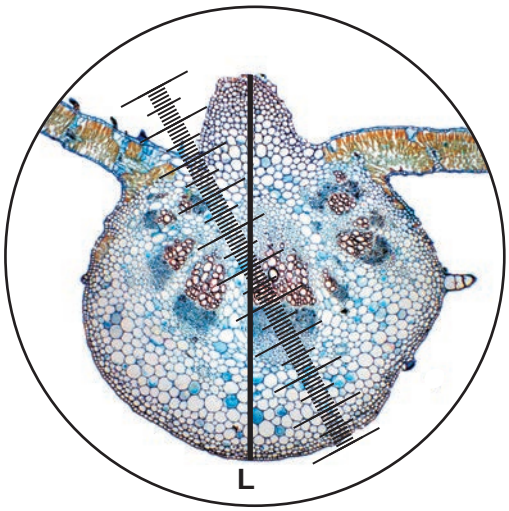


Fig. 2.2

(i) Use the calibration of the eyepiece graticule scale and line **L** on Fig. 2.2 to calculate the actual depth of the leaf.

Show all the steps in your working and use appropriate units.

actual depth of the leaf = ... [4]

Fig. 2.3 is a photomicrograph of the same leaf section that is in Fig. 2.2.

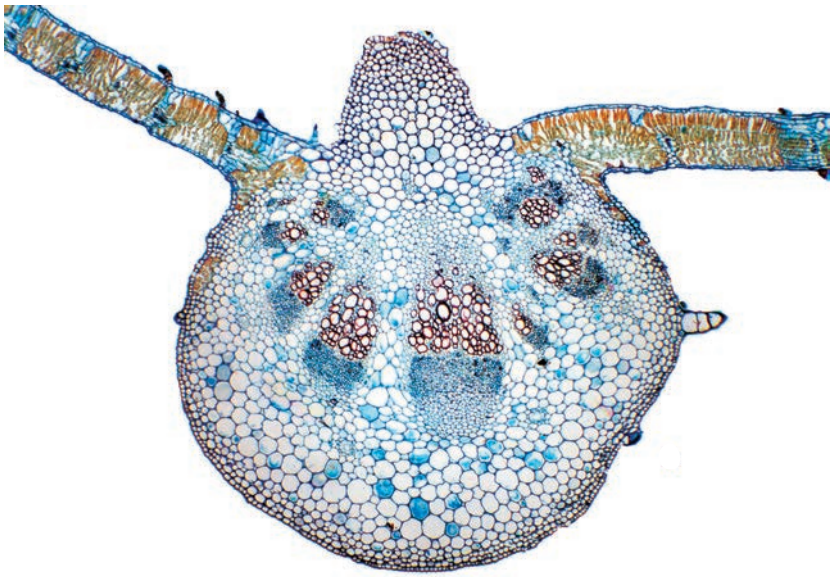


Fig. 2.3

(ii) Use your answer to **(c)(i)** to calculate the magnification of the leaf shown in Fig. 2.3.

Show all the steps in your working.

Space for working

magnification of leaf in Fig. 2.3 ..... [1]

(iii) Annotate Fig. 2.3 to describe **three** observable differences between the leaf in Fig. 2.3 and on **M1**.

- Draw label lines to **three** different features on the leaf in Fig. 2.3 **and** use only the labels **R**, **S** and **T**.
- Next to each letter, describe how each feature on the leaf differs from the leaf on **M1**.

[3]

[Total: 19]

BLANK PAGE