Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6673773999

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 2015**

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 **14** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

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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 all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

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

1 When onion cells are placed into a solution, water will move depending on the water potential inside the cells and the water potential of the surrounding solution.

You are required to:

- investigate the effect of sodium chloride solution on onion epidermis cells
- observe the effect of adding iodine solution to the onion epidermis cells
- observe the effect on the onion epidermis cells of replacing the sodium chloride solution with water
- calculate the percentage plasmolysis of the cells in the onion epidermis.

You are provided with:

labelled	contents	hazard	volume / cm^3
W	distilled water	none	50
I	iodine solution	irritant	10

You are also provided with:

- onion tissue in sodium chloride solution, in a container labelled **S1**.

You are required to observe and draw cells from:

- onion tissue from **S1**
- onion tissue from **S1** after staining with solution **I**.

Proceed as follows:

1. Label one **clean and dry** microscope slide as **S1** and put the slide on a paper towel.
2. Put a few drops of sodium chloride solution from **S1** onto the slide.

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3. Remove a piece of the onion tissue from **S1** and, using forceps or fingers, peel off the inner epidermis as shown in Fig. 1.1.

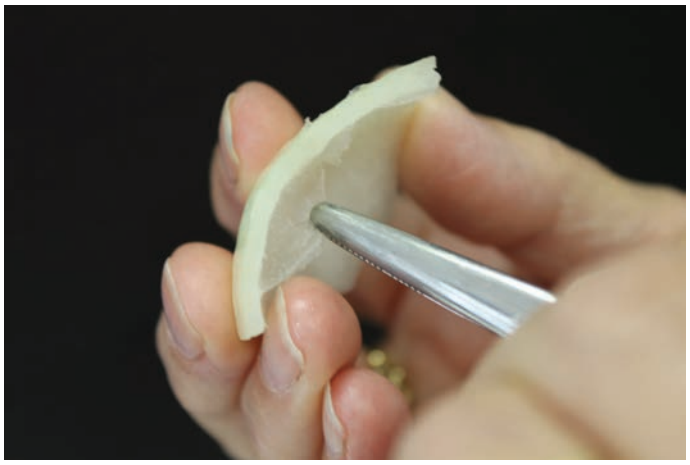


Fig. 1.1

4. Cut one piece of the epidermis that will fit under a coverslip. Replace the remaining epidermis into **S1**.

5. Place the epidermis on the slide as shown in Fig. 1.2. If the epidermis is folded, you may need to add more drops from **S1** so that it floats and uncurls.

6. To prevent the epidermis from drying out add more drops from **S1** if needed.

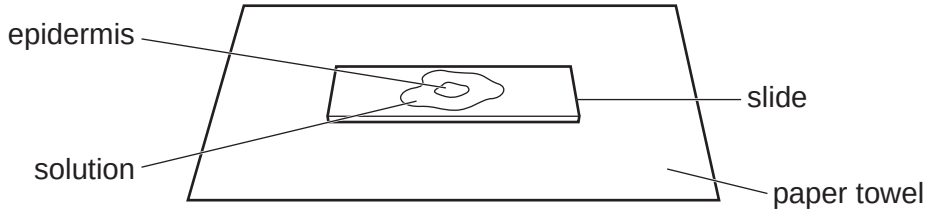


Fig. 1.2

7. Cover the epidermis with a coverslip so that one edge of the epidermis is close to the edge of the coverslip. Use a paper towel to remove any excess liquid that is outside the coverslip.

8. View the slide using the microscope.

   You may need to reduce the amount of light entering the microscope to observe the cells clearly.

You are required to use a sharp pencil for drawings.

(a) (i) Select **two** cells from the epidermis which show the effect of sodium chloride solution from **S1**.

Make a large drawing of these two cells.

On your drawing use a ruled label line and label to identify the cell wall of one cell.

[3]

You will now add solution **I** to the solution from **S1** without removing the coverslip.

9. Remove the slide from the microscope and place on a paper towel.

10. Put a few drops of solution **I** onto the slide in contact with one **edge** of the coverslip nearest to the edge of the epidermis as shown in Fig. 1.3.

Wait a few seconds while solution **I** moves under the coverslip.

Use a paper towel to remove any excess liquid from the top of the coverslip.

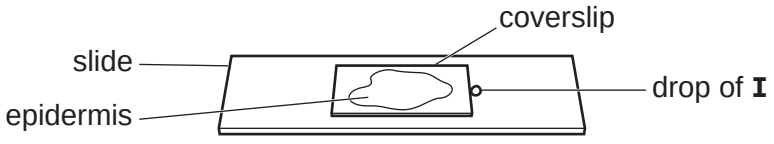


Fig. 1.3

11. View the slide using the microscope.

Select one cell which has been affected by solution **I**.

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(ii) Make a large drawing of the cell that you have selected.

Annotate your drawing to describe **one** feature that is different between this cell and the cells drawn in **(a)(i)**.

[3]

You are now required to:

- investigate the effect of replacing the solution from **S1** with water
- calculate the percentage of the cells that are plasmolysed in the onion tissue.

12. Label one **clean and dry** microscope slide as **W** and put the slide on a paper towel.

13. Repeat steps 3 and 4 (page 3).

14. Put the piece of the cut epidermis into the container labelled **W** (which contains distilled water) and leave for two minutes.

15. After two minutes, put a few drops of distilled water from **W** onto slide **W** and then put the epidermis on the slide as shown in Fig. 1.2 on page 3.

16. Cover the epidermis with a coverslip and use a paper towel to remove any excess liquid that is outside the coverslip.

17. View the slide using the microscope.

(b) Look at an area of cells using the ×10 and ×40 objective lenses.

Select the objective lens which allows you to count a suitable number of cells in a field of view so that you can calculate the percentage of cells showing plasmolysis.

(i) State the magnification of the objective lens you will use.

magnification × .....

[1]

You will need to decide the total number of cells to count as your sample.

(ii) State the total number of cells you decided to count.

total number of cells .....

[1]

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[Turn over

The onion cells may show degrees of plasmolysis, from no plasmolysis to complete plasmolysis as shown in Fig. 1.4.

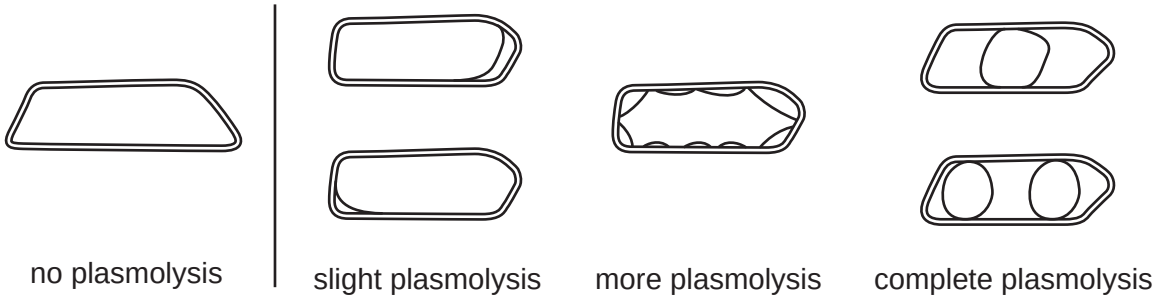


Fig. 1.4

18. Select one field of view which includes cells showing **any** degree of plasmolysis and cells showing no plasmolysis.

19. Observe and record on page 7 each of the cells in your sample, recording:

    - '✓' for each cell that shows any degree of plasmolysis (see Fig. 1.4)
    - '✗' for each cell that shows no plasmolysis.

Consider how you will obtain results which are as accurate as possible.

(iii) Using your results calculate the percentage of cells that are plasmolysed.

You may lose marks if you do not show your working.

[1]

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(iv) Prepare the space below and record the number of cells showing any degree of plasmolysis and the number of cells showing no plasmolysis (raw results) **and** record processed results for the percentage of cells that are plasmolysed in the onion tissue.

[5]

(v) Identify **one** significant source of error in measuring the dependent variable.

.....

..... [1]

(vi) Explain, in terms of the movement of water and water potential, the effect of water replacing the sodium chloride solution on the cells of the epidermis.

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..... [3]

(vii) Suggest how you would modify this investigation to find the sodium chloride concentration of an unknown solution.

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..... [3]

[Total: 21]

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[Turn over

2 Plants lose water through a process called transpiration. This involves the flow of water from the roots to the leaves, where water evaporates from the surfaces of the cells in the leaf.

Some plants have features to reduce water loss. For example their leaves may be rolled or their stomata are located mainly on the underside of their leaves.

These features reduce transpiration and such plants are called xerophytes.

Fig. 2.1 shows diagrams of a transverse section and surface view of the same leaf in humid conditions and in dry conditions.

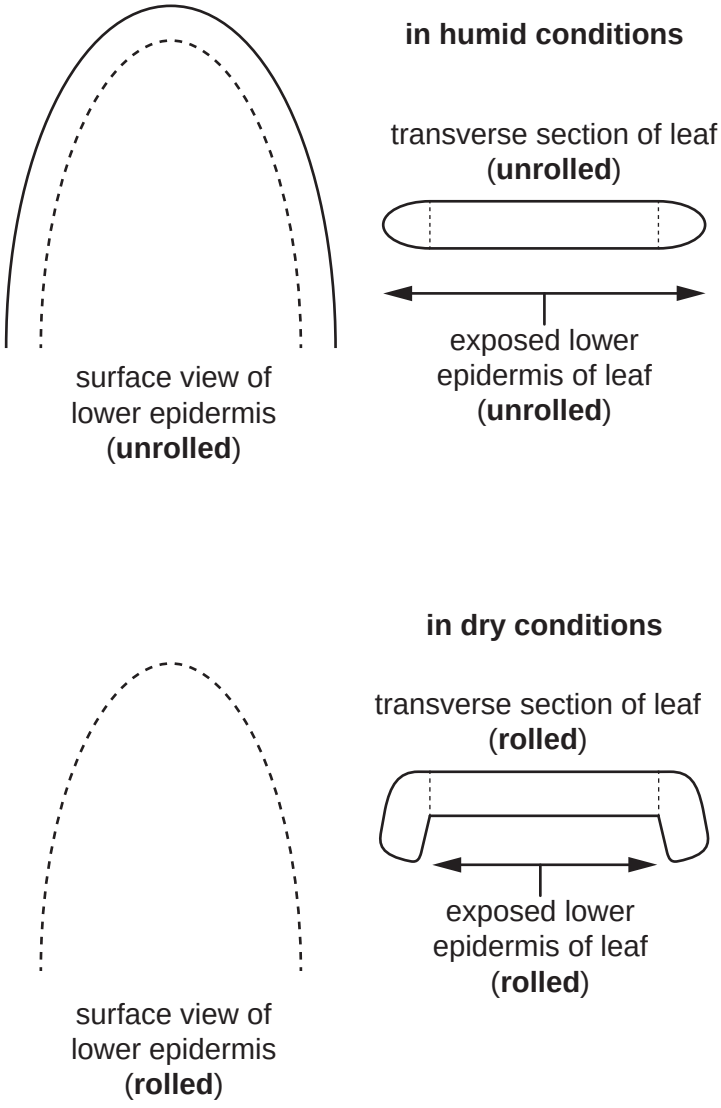


Fig. 2.1

You are required to investigate the effect of rolled leaves in a plant by calculating the surface area of the exposed lower epidermis in the **rolled** leaf.

You are provided with the diagram of the exposed lower epidermis of the **rolled** leaf on **page 15**.

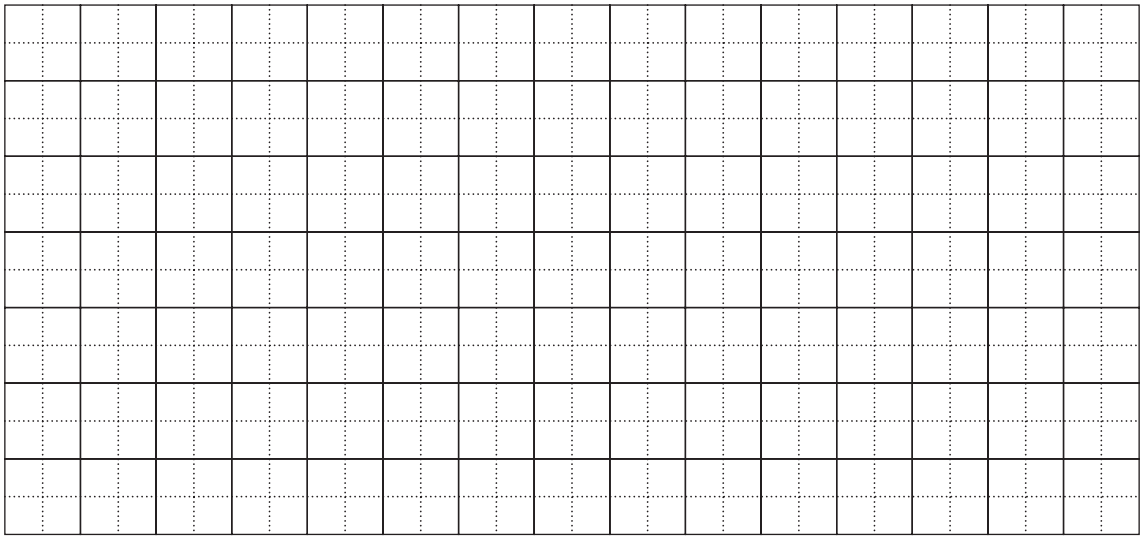
Proceed as follows:

1. Cut round the diagram of the outline of the exposed lower epidermis of the **rolled** leaf on **page 15**.

2. Put this on Grid 2.1 on page 9 and, use a sharp pencil to trace around the shape.

(a) (i) Calculate the total surface area of the exposed lower epidermis in the rolled leaf using the shape you have cut out:

- Count the number of 1 cm × 1 cm squares within the outline.
- Count any 'half square' or 'more than half square' as **one square**.
- Do **not** count any square that is less than half a square.
- Indicate **on your grid** all of the 1 cm × 1 cm squares that you have included in your surface area.



Grid 2.1

total surface area of the exposed lower epidermis in the rolled leaf .....[4]

(ii) A student determined the ratio of the length of the unrolled leaf compared to the width of the unrolled leaf as shown below.

length of the unrolled leaf = 15 cm width of the unrolled leaf = 6 cm Ratio is the length of the unrolled leaf compared to the width of the unrolled leaf. Ratio is 15:6

However, a ratio may be simplified to the smallest possible whole number on each side.

In this example, both sides of the ratio 15:6 are divisible by 3, so the simplest ratio is 5:2.

The surface area of the exposed lower epidermis of the **unrolled** leaf was found to be 60 cm^2.

Determine the simplest ratio of the surface area of the **unrolled** leaf to the surface area of the **rolled** leaf (from page 15) using your answer from **(a)(i)**.

You will lose marks if you do not show your working.

ratio .....

[1]

(b) A scientist investigated the effect of the number of leaves on a tomato plant on the rate of transpiration.

A tomato plant had 14 leaves at the start of the investigation. The transpiration rate of this tomato plant was recorded.
At regular intervals leaves were removed and the transpiration rate recorded.
All other variables were standardised.

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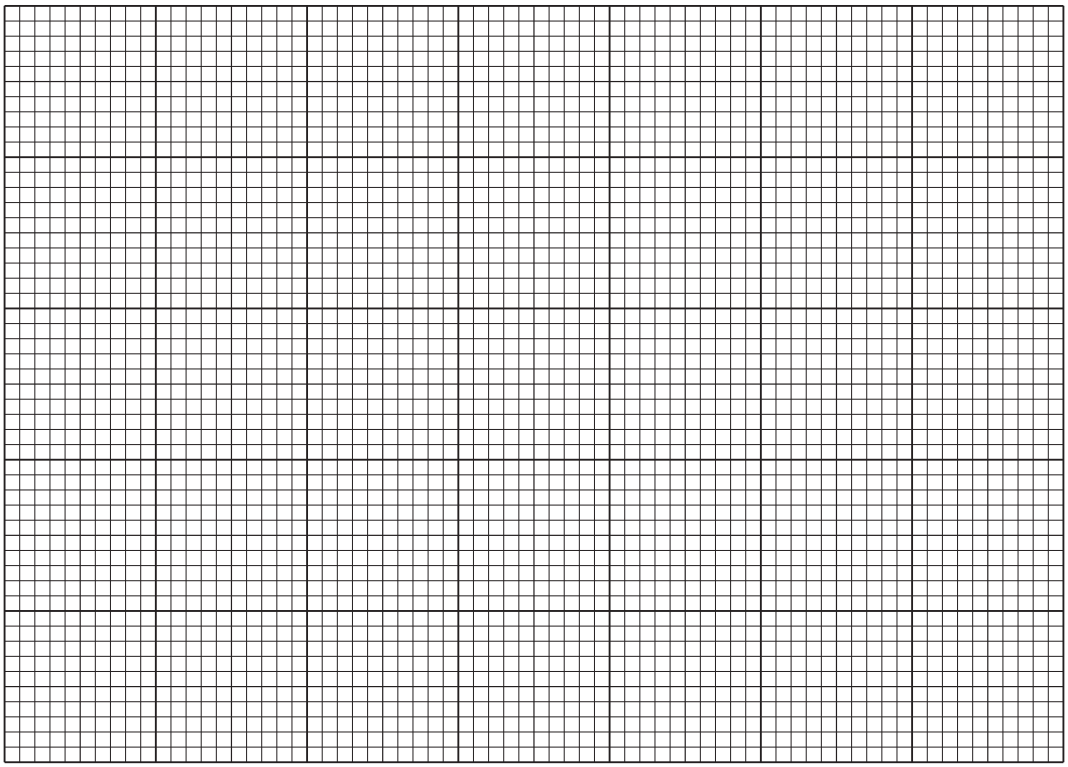
The results of the investigation are shown in Table 2.1.

Table 2.1

number of leaves	transpiration rate / $\mu l\,min^{-1}$
14	9.5
10	4.3
8	3.9
5	3.5
2	1.8

You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 2.1.



[4]

(ii) Estimate the transpiration rate of the plant with 12 leaves.

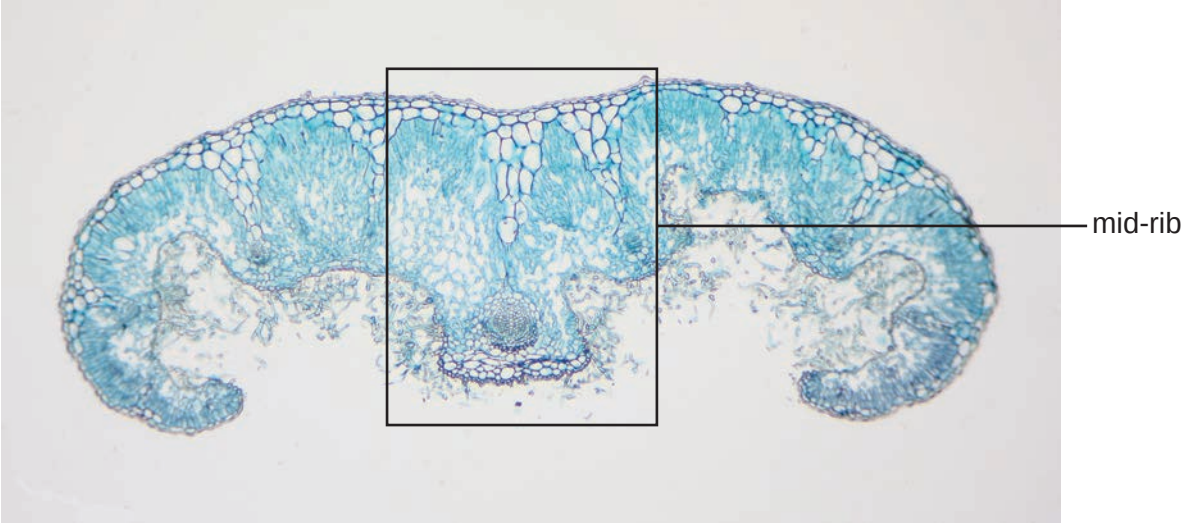
Show on the graph how you estimated the transpiration rate.

transpiration rate ..... [2]

You are required to use a sharp pencil for drawing.

(c) Fig. 2.2 is a photomicrograph showing a stained transverse section through a leaf.

You are not expected to be familiar with this specimen.



magnification ×200

Fig. 2.2

Draw a large plan diagram of the mid-rib as shown in Fig. 2.2.

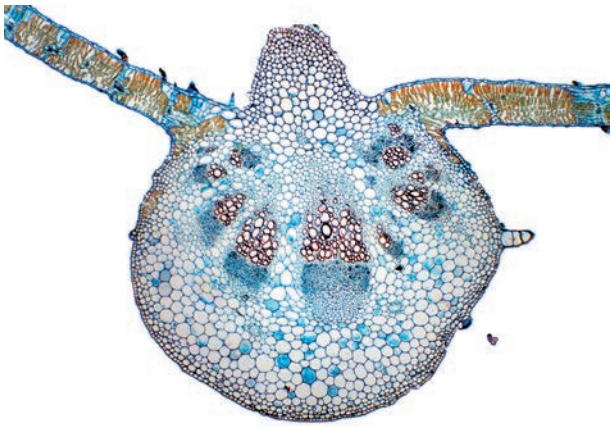
Use **one** ruled label line and label to identify the xylem.

[5]

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(d) Fig. 2.3 is a photomicrograph showing a stained transverse section of a mid-rib of a different plant species.

You are not expected to be familiar with this specimen.



magnification ×100

Fig. 2.3

Prepare the space below so that it is suitable for you to record observable differences between the mid-rib of Fig. 2.2 and the mid-rib of Fig. 2.3.

Record your observations in the space you have prepared.

[3]

[Total: 19]

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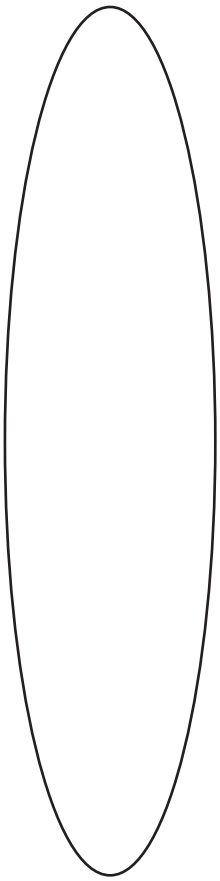
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Diagram for Question 2 (a)(i)

Outline of exposed lower epidermis of the **rolled** leaf



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