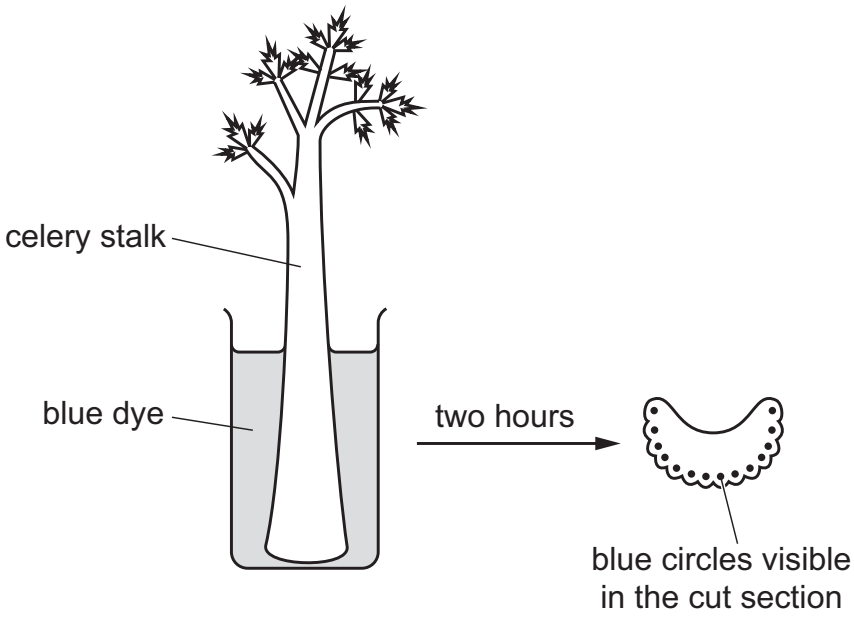
10 A student cut one stalk of celery from a celery plant.

They put the celery stalk into a beaker of blue dye.

The celery stalk was removed from the blue dye after two hours and was cut into sections.



What is shown by the blue circles in the cut sections of celery stalk?

A position of the cortex cells

B position of the palisade cells

C position of the phloem cells

D position of the xylem vessels

3 **(a)** Describe the pathway a water molecule takes from the soil to reach the xylem.

.....

.....

.....

.....

..... [2]

(b) A student investigated the effect of temperature on transpiration.

The student collected four small plants and placed them in beakers filled with water.

Fig. 3.1 shows the apparatus used.

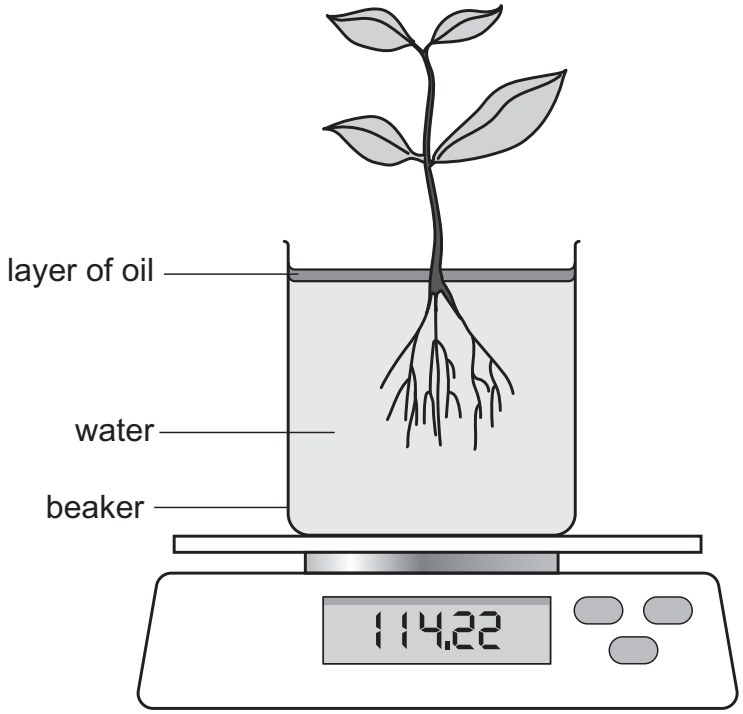


Fig. 3.1

For each plant, the student measured the initial masses of the equipment, water and plant.

Each plant was placed in a different temperature-controlled room for three hours.

After three hours, the student measured the final masses of the equipment, water and plants.

The results are shown in Table 3.1.

Table 3.1

temperature / °C	initial mass / g	final mass / g	transpiration rate / g per hour
15	138.2	135.5	0.9
20	136.1	132.5	1.2
25	137.8	128.5	3.1
30	135.7	118.3	

(i) Using the information in Table 3.1, calculate the transpiration rate in the plant kept at 30 °C.

..... g per hour [1]

(ii) Describe **and** explain the difference in the results for the plants kept at 15 °C and 25 °C.

.....

.....

.....

.....

.....

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.....

.....

..... [4]

(iii) The investigation was repeated with a plant kept at 25 °C in a lower humidity environment.

Predict the effect of these conditions on the transpiration rate.

Explain your prediction.

.....

.....

.....

.....

..... [2]

(iv) Complete the sentences about water movement through the xylem.

The xylem transports water and ..... .

Xylem cells form a long continuous ..... with thick walls

containing cellulose and ..... .

Water moves upwards in the xylem because of transpiration ..... .

This draws up a ..... of water molecules, held together by

..... between water molecules.

[6]

(c) (i) Explain why wilting occurs.

.....

.....

.....

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..... [3]

(ii) Marram grass, *Ammophila arenaria*, is a xerophyte.

Fig. 3.2 is a photomicrograph of a cross-section of a marram grass leaf.

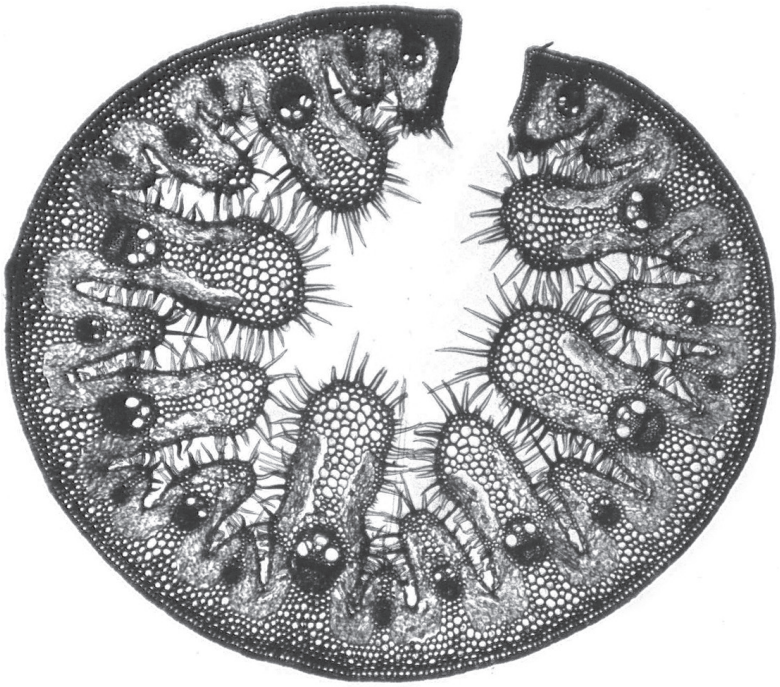


Fig. 3.2

Explain **one** way that the marram grass leaf shown in Fig. 3.2 is adapted to reduce transpiration.

.....

.....

.....

.....

..... [2]

[Total: 20]

1 A student investigated the effect of temperature on the movement of water in celery stalks. The water contained a blue dye.

In plant stems such as a celery stalk, water moves in the xylem tissue within the vascular bundles.

The student used this method:

Step 1 Take two stalks of celery and cut them so that they are both 10 cm long.

Step 2 Prepare an ice-cold water-bath **C** and a warm water-bath **W**.

Place a beaker of blue dye into each water-bath, as shown in Fig. 1.1.

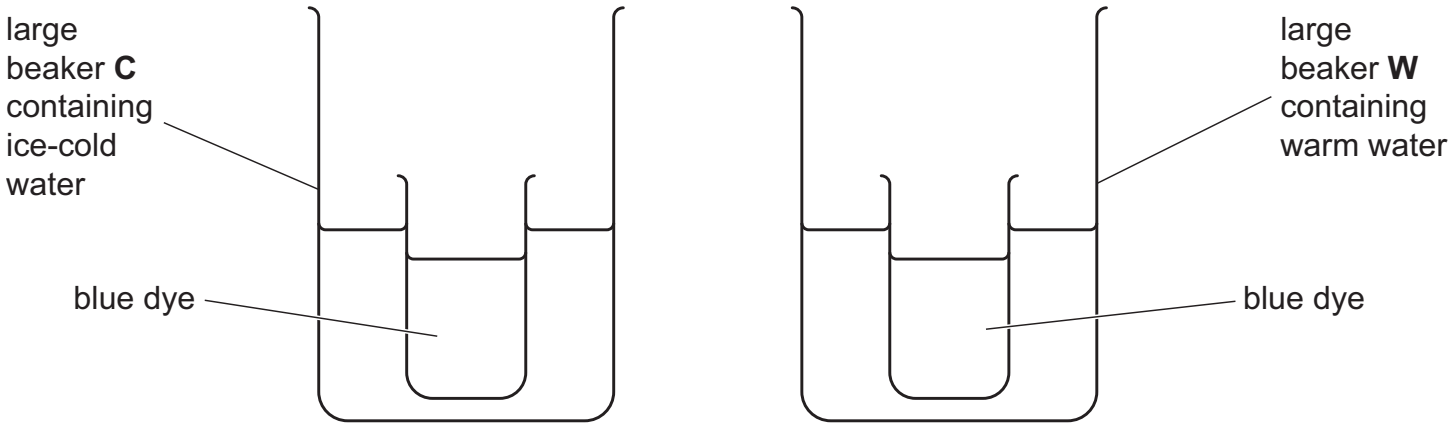


Fig. 1.1

Step 3 Measure the temperatures of the water in water-bath **C** and water-bath **W**.

Step 4 Let the blue dye equilibrate in the water-baths for three minutes.

Step 5 After three minutes, place one celery stalk into each beaker of blue dye, as shown in Fig. 1.2.

Keep the celery stalks in the blue dye for ten minutes.

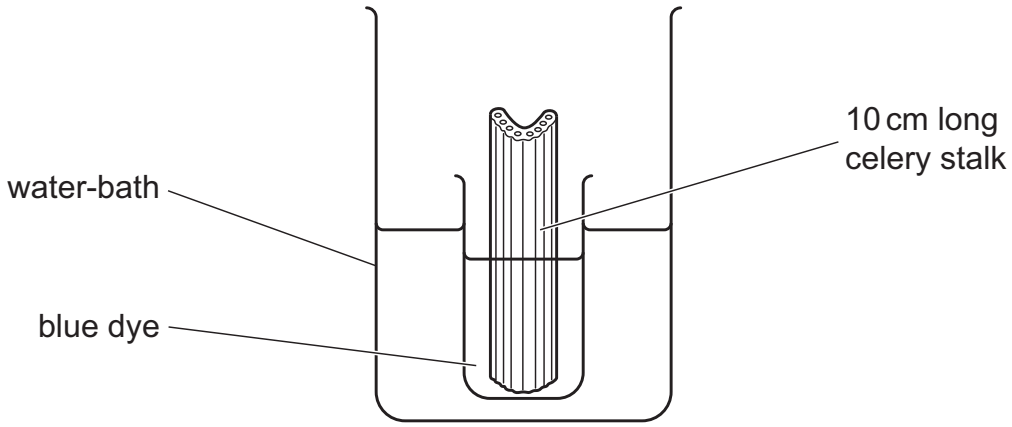


Fig. 1.2

Step 6 After ten minutes, measure the final temperatures of the water in water-bath **C** and water-bath **W**.

(a) (i) Complete Table 1.1 by calculating the change in the water temperature for each water-bath.

Table 1.1

water-bath	water temperature in step 3 / °C	water temperature in step 6 / °C	change in water temperature / °C
C	4	15	.....
W	40	28	.....

[1]

Step 7 Remove the celery stalk from the blue dye in water-bath **C** and put it on a white tile.

Step 8 Cut a section across the celery stalk 5 mm from the end that was in the blue dye, as shown in Fig. 1.3.

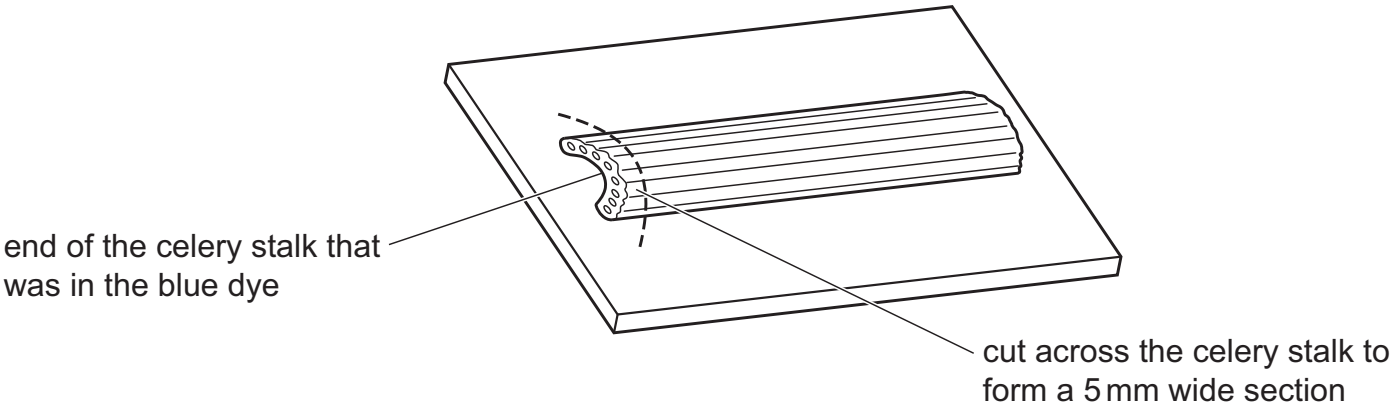


Fig. 1.3

Step 9 Examine the xylem tissue of the cut section of celery stalk to see if the blue dye is visible.

Fig. 1.4 shows the position of the xylem tissue in a cut section of a celery stalk.

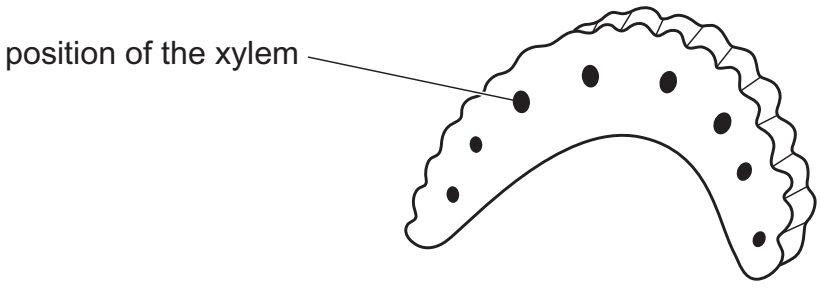


Fig. 1.4

Step 10 If the blue dye is still visible in the celery stalk, cut another 5 mm wide section from the dyed end of the remaining part of the celery stalk.

Continue cutting 5 mm wide sections from the celery stalk until the blue dye is no longer visible in the cut section.

Step 11 Count the number of sections you have cut from the celery stalk that contain the blue dye.

Step 12 Repeat steps 7 to 11 with the celery stalk from water-bath **W**.

The student's results are shown in Fig. 1.5.

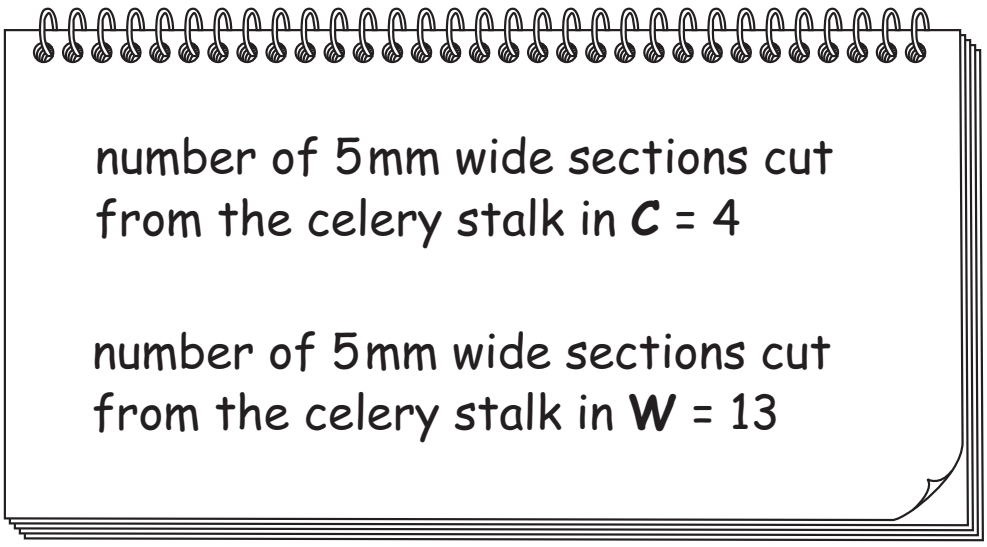


Fig. 1.5

(ii) Prepare a table and record the results shown in Fig. 1.5.

Include the number of sections cut and the total distance moved by the blue dye in each celery stalk.

[4]

(iii) Calculate the rate of movement of the blue dye in the celery stalk in beaker **W**.

Include the unit.

..... [2]

(iv) State a conclusion for this investigation.

.....

.....

..... [1]

(v) This investigation was only done once.

Explain why it is better to repeat an investigation.

.....

.....

..... [1]

(b) Identify **two** variables that were kept constant in this investigation.

1 .....

2 .....

[2]

(c) **(i)** The data you have recorded in Table 1.1 may indicate that there is a source of error with the method used in this investigation.

Identify the possible error, and describe an improvement to the method to reduce the effect of this error.

error .....

.....

improvement .....

.....

.....

[2]

(ii) In step 9, it is difficult to determine precisely the final position of the blue dye in the xylem.

Suggest an improvement to the method that would reduce this source of error.

.....

.....

..... [1]

(d) Xylem forms cylinder-like structures in a celery stalk.

Calculate the volume of a cylinder which is 100 mm long and has a diameter of 0.06 mm.

Use this formula: $v = \pi r^2 h$

Use a value for π of 3.14.

Give your answer to **two** decimal places.

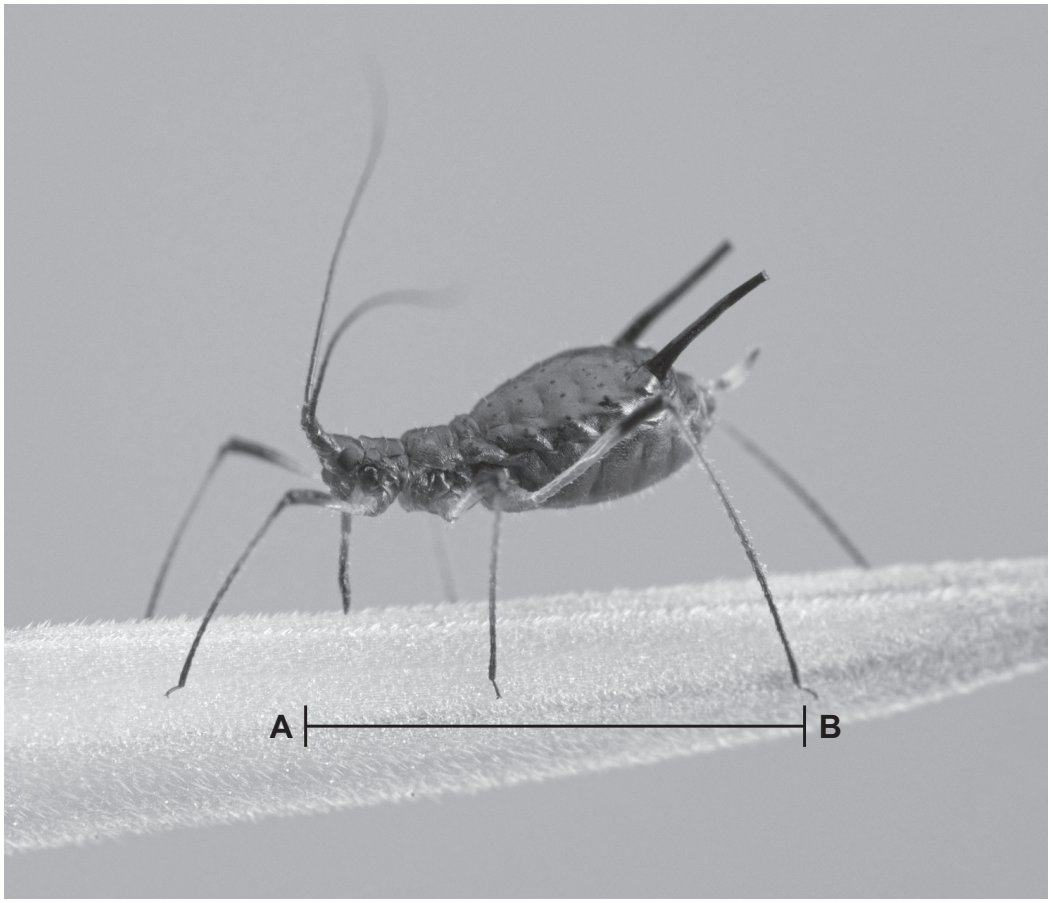
Space for working.

..... mm^3 [2]

(e) Celery plants can be damaged by insect pests feeding on them. This can reduce the growth of the celery plants.

A black aphid and the larvae of a leaf miner fly are both insect pests that damage celery plants.

Fig. 1.6 is a photograph of a black aphid.



magnification ×35

Fig. 1.6

Fig. 1.7 is a photograph of a leaf miner fly.

magnification ×11

Fig. 1.7

(i) Line **AB** represents the body length of the black aphid.

Measure the length of line **AB** in Fig. 1.6.

length of line **AB** ..... mm

Calculate the actual body length of the black aphid using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line } \mathbf{AB} \text{ in Fig. 1.6}}{\text{actual body length of the black aphid}}$$

Give your answer to **one** significant figure.

Space for working.

..... mm
[3]

(ii) State **three** ways that the leaf miner fly shown in Fig. 1.7 differs from the black aphid shown in Fig. 1.6.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

(f) Fig. 1.8 is a photograph of a celery leaf.

Fig. 1.8

Draw a large diagram of the celery leaf shown in Fig. 1.8.

[4]