

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.

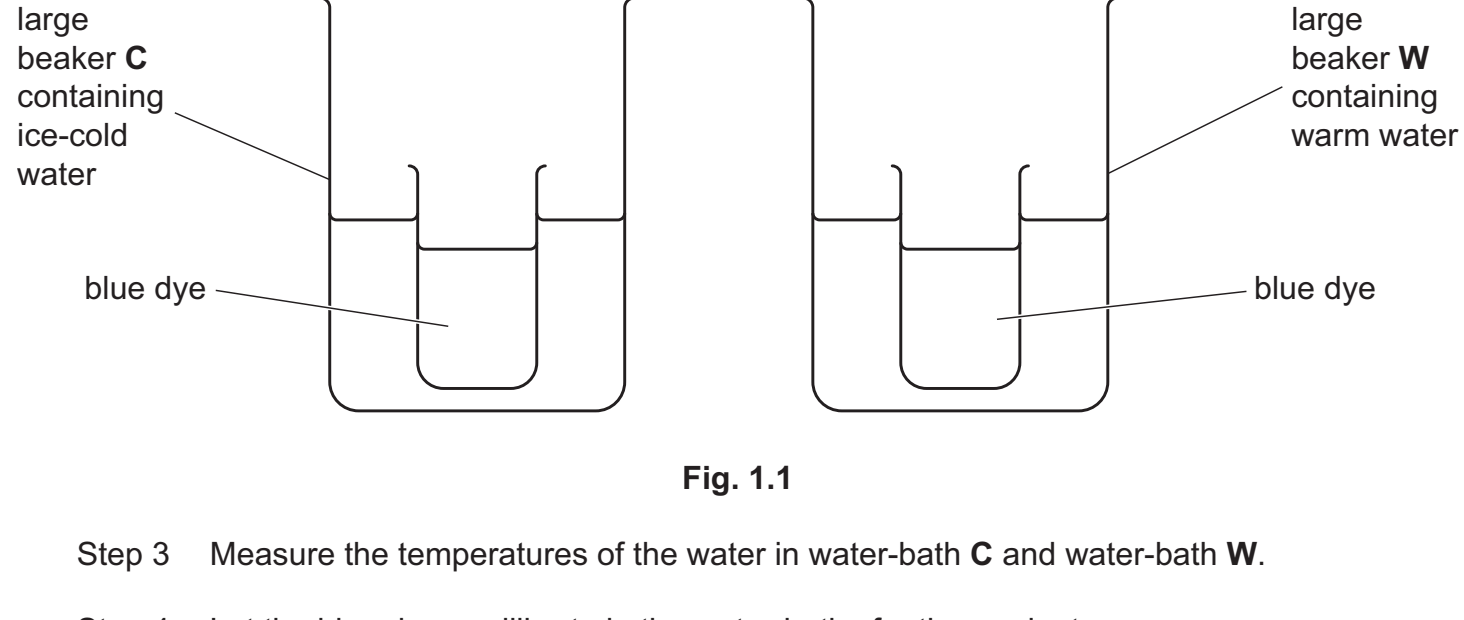


Fig. 1.1

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.

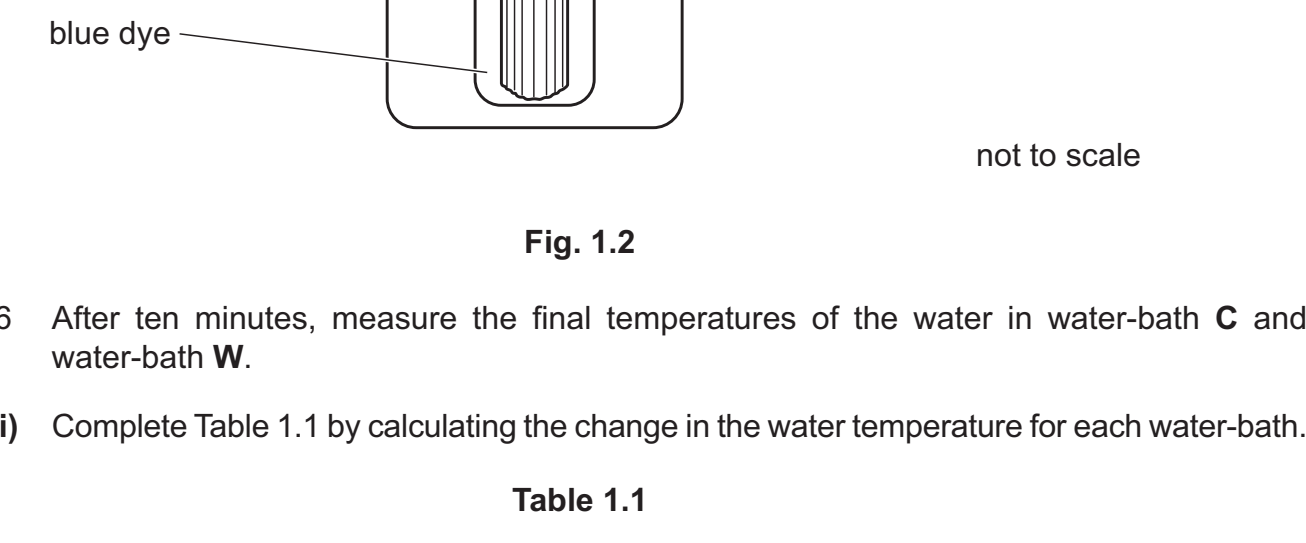


Fig. 1.2

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.

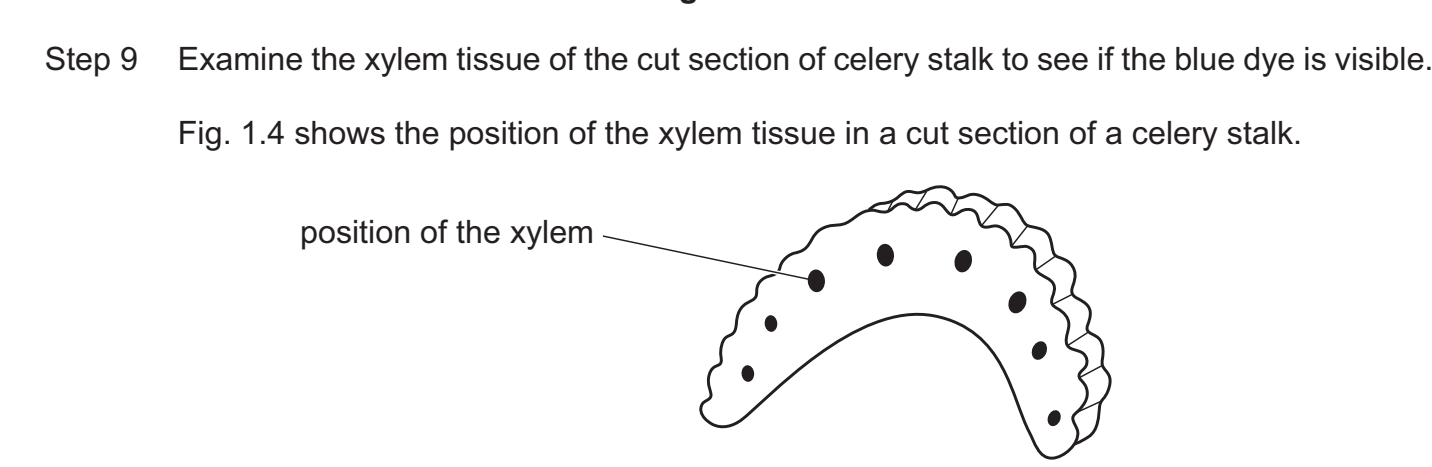


Fig. 1.3

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.

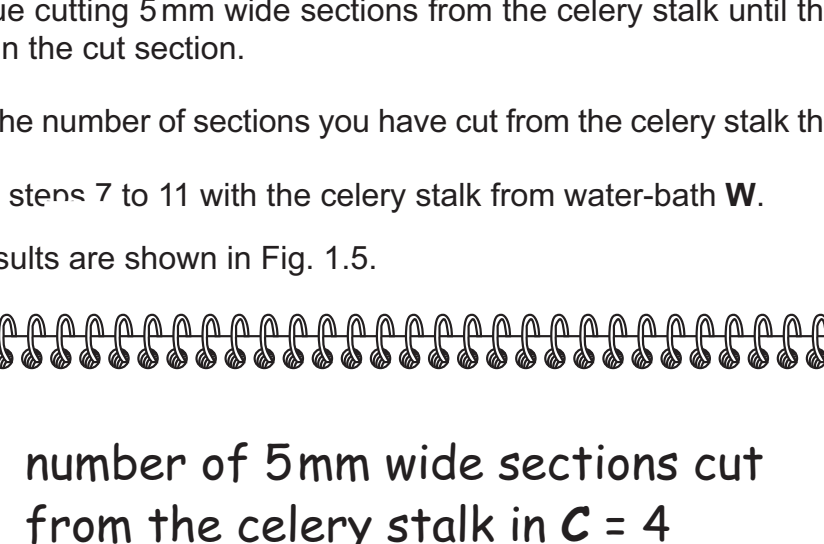


Fig. 1.4

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

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