Answers to Workbook exercises Chapter 8

Exercise 8.1 A transpiration experiment

a The results chart could look like this:

Condition	Still air						Moving air				
time / min	0	2	4	6	8	10	12	14	16	18	20
distance / cm	0	2.8	6.1	10.0	12.9	16.2	21.8	27.9	31.1	39.5	44.9

b Look for 'time' on the *x*-axis and 'distance' on the *y*-axis, both with units and sensible scales; points plotted accurately either as crosses or encircled dots; ruled straight best-fit lines drawn, with change in gradient sharp and clear at time 10 mins.

c Still air: meniscus moved 16.2 – 0 = 16.2 cm in 10 minutes. So, mean rate was 1.62 cm per minute.

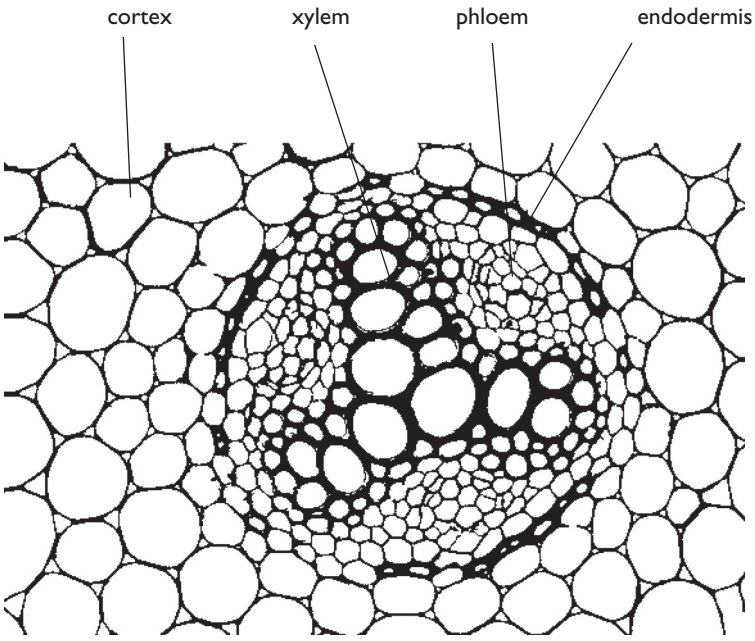
Moving air: meniscus moved 44.9 – 16.2 = 28.7 cm in 10 mins. So, mean rate was 2.87 cm per minute.

d Yes. The mean rate per minute of movement of the meniscus is much higher in moving air than still air. This means that the shoot was taking up water faster in the moving air. The rate at which it takes up water is determined by the rate at which transpiration is taking place within the leaves.

e It is likely that the temperature was not controlled – it could have been warmer or colder in the moving air than in the still air. It is possible that light intensity was not controlled. The student was actually measuring the rate at which water was taken up, rather than the rate at which it was lost – but we can assume that they are very similar to each other, if not identical.

Exercise 8.2 Tissues in a root

a



b Diameter in diagram = 10 mm
allow any measurement between 10 and 12

So real diameter = 10 ÷ 200 = 0.05 mm

c Transporting water; transporting mineral ions; support.

d They are hollow and empty so water containing dissolved mineral ions can easily flow through them. They have no end walls, so they can fit end to end to form continuous tubes. Their walls contain lignin, which is very strong, to provide support.

e Water enters the root hairs by osmosis, down a water potential gradient from the soil to the cytoplasm, through the partially permeable cell membrane. It moves across the cortex by osmosis, and finally into the xylem vessels.

S Exercise 8.3 Sources and sinks

a sucrose

b starch

c i There is plenty of light in summer, but not enough in winter. It is warmer in summer than in winter. Liquid water may be in short supply in winter if the ground is frozen.

ii Leaves will be sources in summer. They photosynthesise, producing sugars that can be converted to sucrose and transported to other parts of the plant.

iii Leaves will be sinks in winter. They cannot photosynthesise, so they need to obtain sugars from other parts of the plant, such as storage organs.

d i The concentration of starch in the leaves increases slightly, by 0.6% of their dry mass, between spring and summer, reaching a peak of 15.6% of dry mass. It then falls to only 4.9% of dry mass in the autumn.

ii The concentration of starch in the roots increases from 2.6% to 3.1% of dry mass between spring and summer, and then continues to increase to reach 4.1% of dry mass by autumn.

iii In spring and summer, leaves make more glucose than they need by photosynthesis, and store some of this as starch. In autumn, they are photosynthesising much less and may be using up their starch stores. Also, some of the sugars will have been transported to other parts of the plant – such as the roots – for storage. This can explain the increase in starch content of the roots in the autumn.

e Removing the buds had no effect on the amount of starch in the leaves. This is because removing the buds did not affect the rate at which the leaves could photosynthesise. Removing the leaves reduced the amount of starch in the roots, from 7.1% to 6.5% of dry mass. This could be because there was less sugar being made now that the leaves had been removed, so there was less sucrose to transport to the roots to turn into starch.