Transport in plants

Question Paper 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Exchange and transport
Topic	Transport in plants
Booklet	Question Paper 2

Time allowed: **69 minutes**

Score: **/51**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Fig. 25.1 shows a potometer.

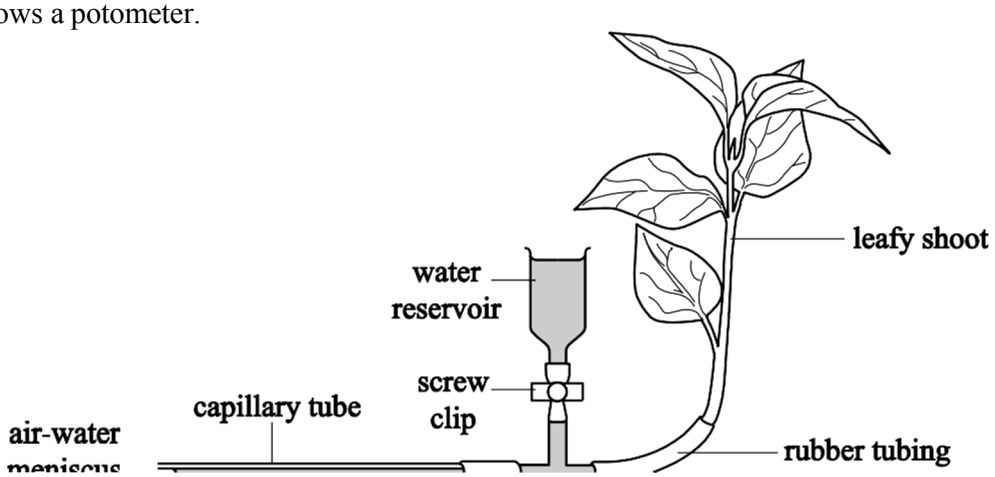

Fig. 25.1

(a) A student used this apparatus to investigate the role of stomata in transpiration. The student noted the position of the air–water meniscus each minute for five minutes.

The student then covered the underside of one of the leaves in petroleum jelly before repeating the measurements. This was continued until the undersides of all the leaves had been covered.
Table 25.1 shows the results.

Number of leaves with undersides covered in petroleum jelly	Position of meniscus (mm) at					
	0 min	1 min	2 min	3 min	4 min	5 min
0	0	23	44	65	84	102
1	0	20	40	58	77	95
2	0	16	31	47	61	76
3	0	11	23	37	50	62
4	0	9	17	24	32	40
5	0	6	11	16	22	28

Table 25.1

The student presented these results as a graph. **Fig. 25.2** shows the graph.

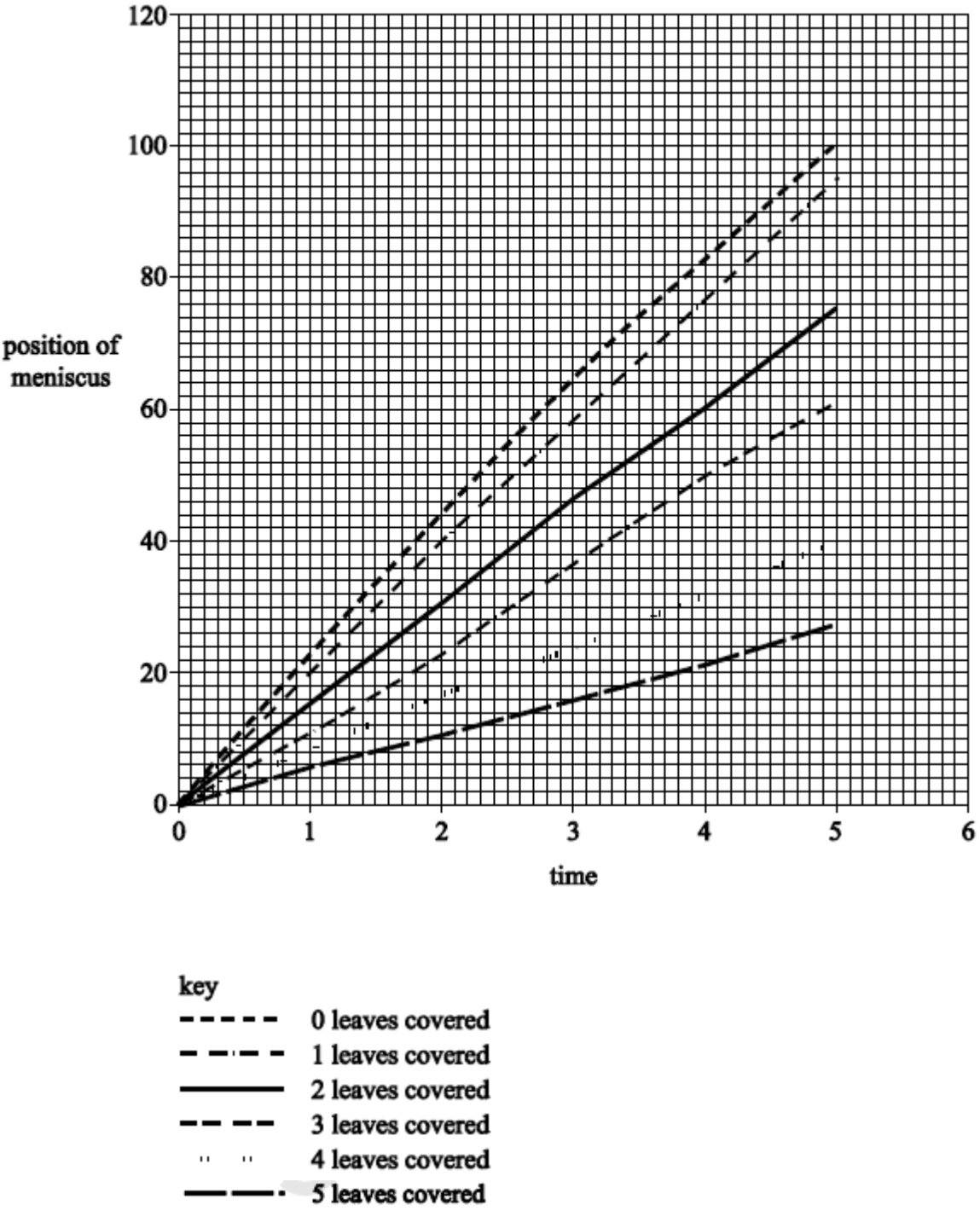

Fig. 25.2

(i) State two different types of information the student has missed from the graph. **[2]**

(ii) Use the graph to calculate the minimum rate of transpiration. **[2]**

(b) Suggest how water is being lost from the cut stem when all the leaves have been treated with petroleum jelly. **[2]**

(c) Suggest **two** possible sources of error in this investigation. **[2]**

[Total: 8]

(a) Following their formation, assimilates are transported throughout the plant by translocation in phloem.

Phloem sap mainly consists of carbohydrate in the form of sucrose, but also contains other solutes.

(i) Suggest why it is beneficial to the plant for the carbohydrate to be transferred throughout the plant in the form of sucrose rather than as an alternative carbohydrate.

[2]

(ii) How is transport in the phloem similar to and different from transport in the xylem? **[2]**

Similar

Different

(b) Assimilates are loaded into the phloem at the 'source' and then transported to the 'sink'.

(i) Explain, with a suitable example, how some parts of the plant can act as both a 'source' and a 'sink'.

[2]

(ii)* **Fig. 19.1** is a diagram that represents the loading of sucrose into the phloem at the 'source'.

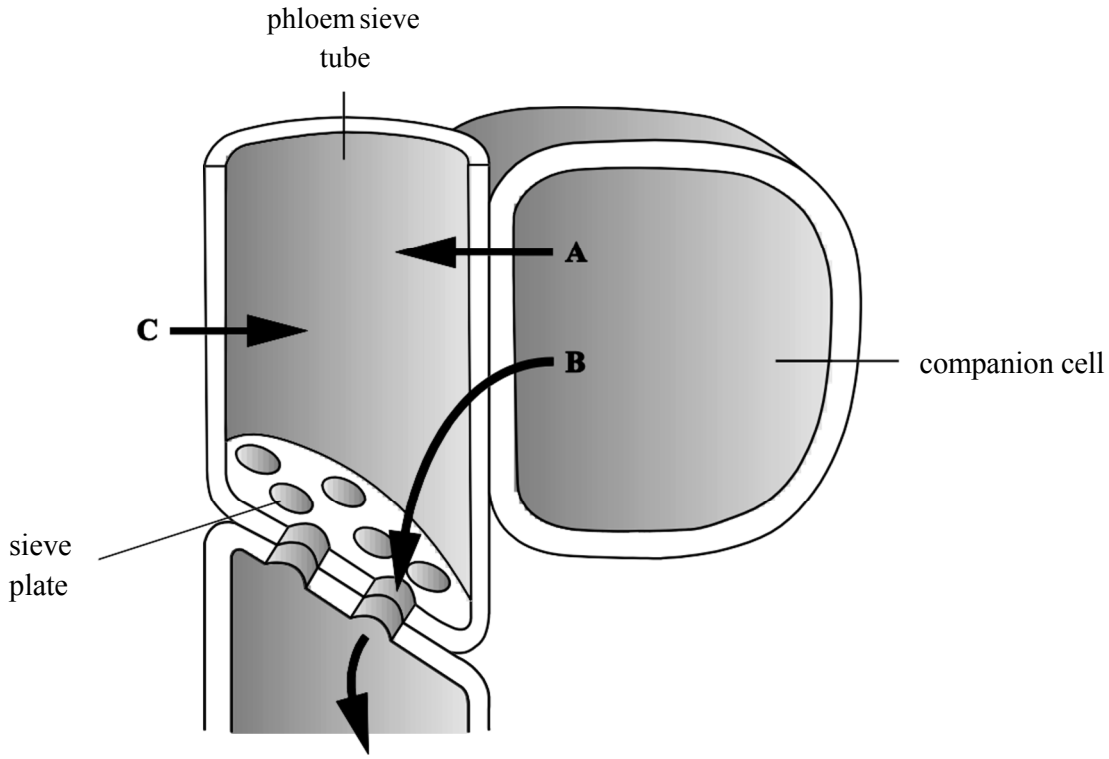

Fig. 19.1

With reference to **Fig. 19.1**, explain the process of the loading of sucrose into the phloem and its movement in the phloem.

[6]

(c) **Fig. 19.2** is a diagram of a potato plant. Potatoes are tubers which are underground storage organs.

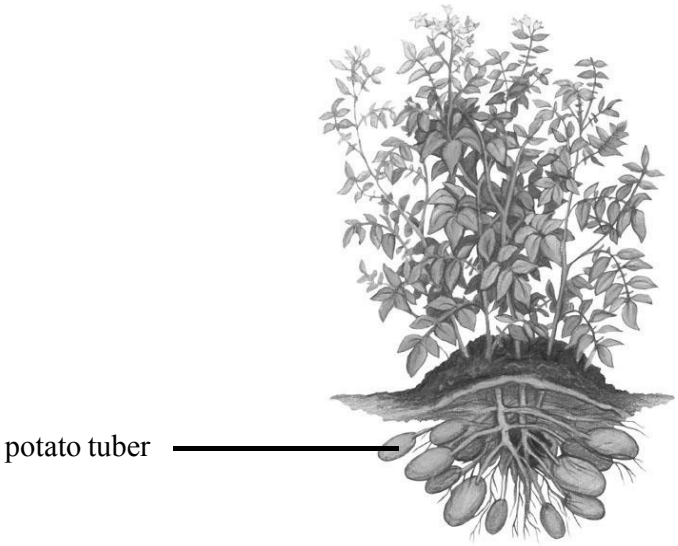

Fig. 19.2

Actively growing tissues have a high demand for carbohydrates. This means that a lot of phloem sap is directed to these tissues and requires sucrose to be unloaded in large amounts.

In an investigation, potato plants were modified by having a gene for invertase inserted into their DNA so that the gene for invertase would be expressed in the tubers. Invertase is responsible for catalysing the hydrolysis of the disaccharide sucrose.

A trial experiment was carried out to compare the properties of the modified plants with those that had not been modified. After harvesting, the tubers of three of each type of plant were compared. The results are shown in **Table 19.1**.

	Modified	**Not modified**
Mean number of tubers per plant	2.2	5.3
Mean mass per tuber (g)	49.7	16.8
Mean sucrose concentration (mg g^{-1} tuber mass)	1.4	13.7
Mean glucose concentration (mg g^{-1} tuber mass)	36.3 ± 3.5	1.9 ± 0.3
Invertase activity (arbitrary units)	62.1	1

Table 19.1

(i) Name the bond that is hydrolysed by invertase. **[1]**

(ii) The potato tubers contain monosaccharides.

Compare the concentration of monosaccharides in the modified tubers with those that were not modified.

[2]

(i(iii) In the modified plants, the unloading of sucrose is increased in the tubers compared with those that were not modified.

The transport of sucrose to the tubers was also increased in the modified plants.

Using the data and the information given, deduce a possible mechanism to account for the increased unloading and transport of sucrose in the modified plants.

[4]

((iv) The trial experiment compared the properties of modified potato plants with those that were not modified.

Analyse the data and draw conclusions about the yield of the tubers of modified plants compared with those tubers from plants which had not been modified.

[3]

[Total: 22]

Mosses are small plants with no true roots. Each plant is anchored by simple root-like structures which do not contain vascular tissue.

The leaves of moss plants are usually one cell thick and are attached to a thin stem. Neither the leaves nor stem contain vascular tissue.

Fig. 5.1 shows a leaf from a typical moss plant.

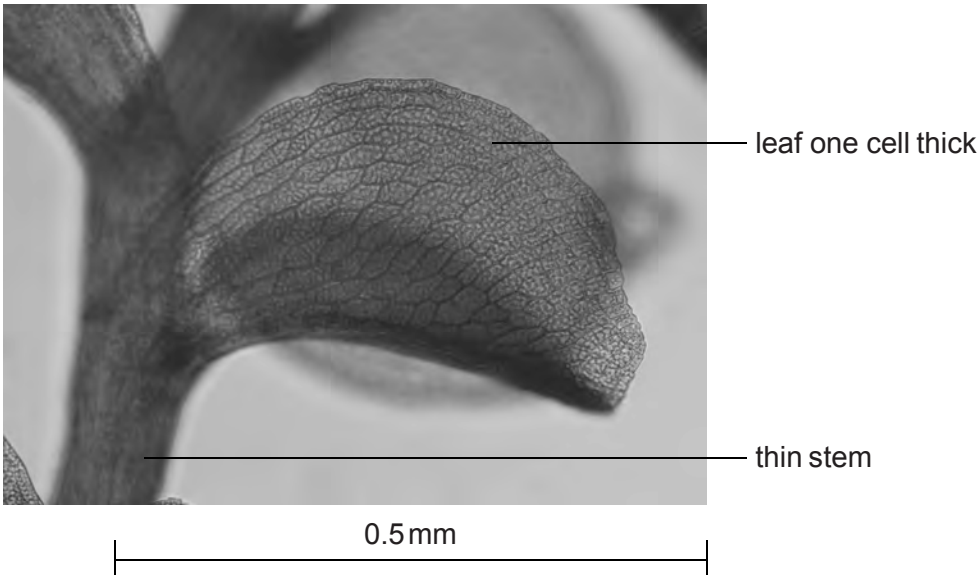

Fig. 5.1

(a) Suggest **and** explain how the absence of vascular tissue might affect the size to which moss plants can grow.

[2]

(b) Although a moss plant has no vascular tissue, water still moves through the plant from the root-like structures to the leaves.

Use your knowledge of the mechanisms of water transport to explain the movement of water through the moss plant.

In your answer you should use appropriate technical terms, spelled correctly.

[4]

(c) (i) What is meant by the term *tissue*? **[2]**

(ii) Leaves of dicotyledonous plants contain types of cells that are not found in the leaves of mosses, such as that shown in Fig. 5.1.

Other than the cells found in vascular tissues, name **two** types of cell found in the leaves of dicotyledonous plants that are not found in the leaves of mosses.

[2]

[Total: 10]

(a) Transpiration is the loss of water vapour from the aerial parts of a plant.

(i) Name the pores through which most water vapour is lost from a leaf. **[1]**

(ii) Describe how the guard cells surrounding the leaf pores are adapted to their role.

[2]

(iii) Name **one** other part of the leaf from which water may be lost. **[1]**

(b) Water lost from the leaf must be replaced with water from the xylem.

Complete the following passage about movement of water from the xylem to the cells of the leaf using the most appropriate terms.

When water is lost from the cells of the leaf it reduces the .....

in those cells. As a result, water enters the cells by ..... .

This process occurs across the plasma membrane which is ..... .

If all the water lost from the leaf cells is not replaced, they lose .....

and the leaf may wilt. **[4]**

(c) The cohesion-tension theory is often used to explain the mechanism by which water moves up the xylem from the roots to the leaves.

Use this theory to explain how water moves from the roots to the leaves. **[3]**

[Total: 11]