Structure of transport tissues

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in plants
Sub Topic	Structure of transport tissues
Booklet	Theory
Paper Type	Question Paper 2

Time Allowed : **58 minutes**

Score : **/ 48**

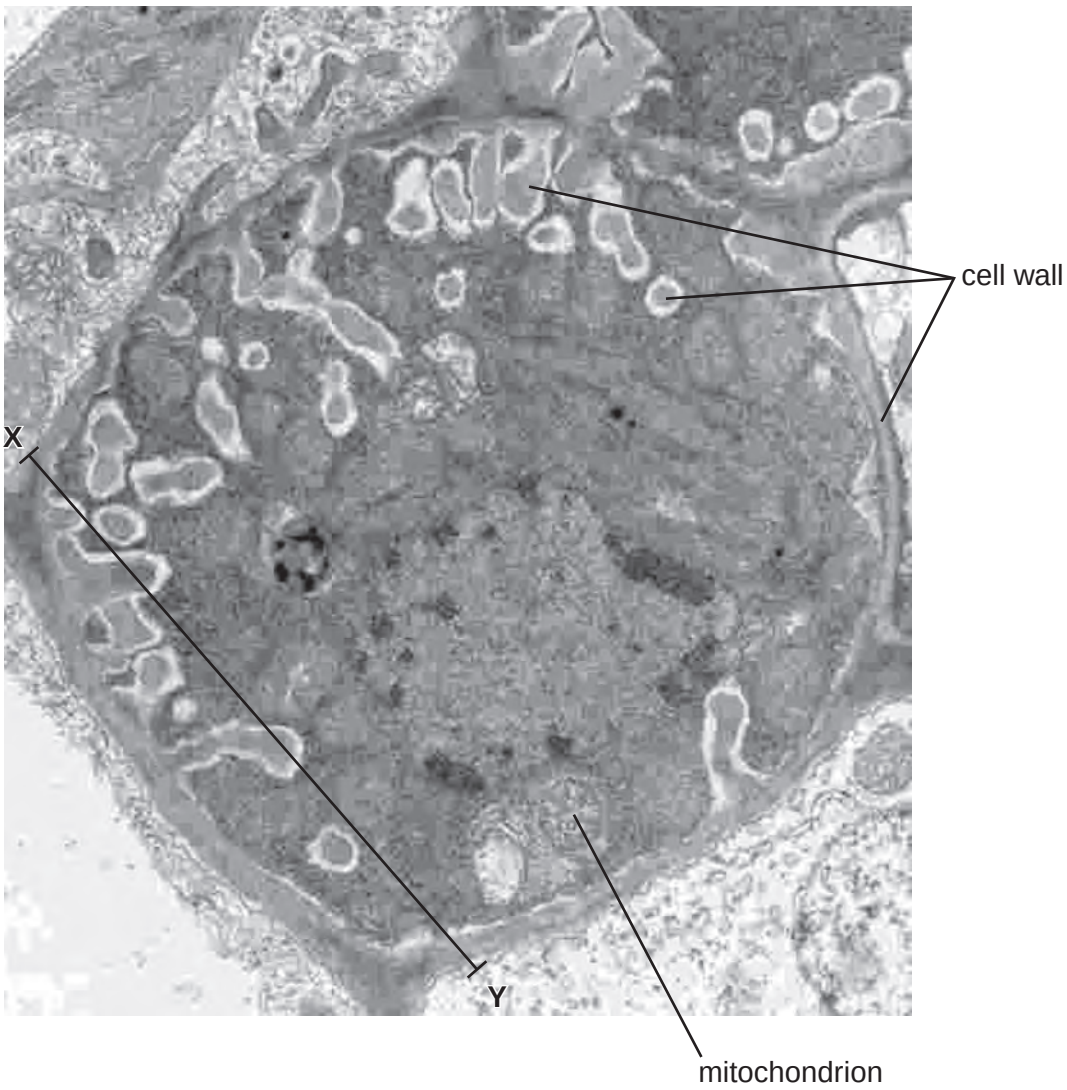
Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Phloem transfer cells are modified companion cells that move sucrose and other assimilates from mesophyll tissue into phloem sieve tube elements.

Fig. 5.1 is an electron micrograph of a phloem transfer cell.



magnification = ×10 000

Fig. 5.1

(a) Calculate the actual distance across the transfer cell from **X** to **Y**.

Show your working and express your answer to the nearest micrometre.

answer ..... µm [2]

(b) With reference to Fig. 5.1, explain how phloem transfer cells help in the movement of sucrose from the mesophyll of a leaf into a phloem sieve tube element.

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(c) Explain how sucrose in the phloem sap is moved from sieve tube elements in leaves to cells in a sink, such as a root.

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[Total: 11]

2 Fig. 6.1 shows a phloem sieve tube element, its companion cell and a mesophyll cell in the leaf of a photosynthesising plant.

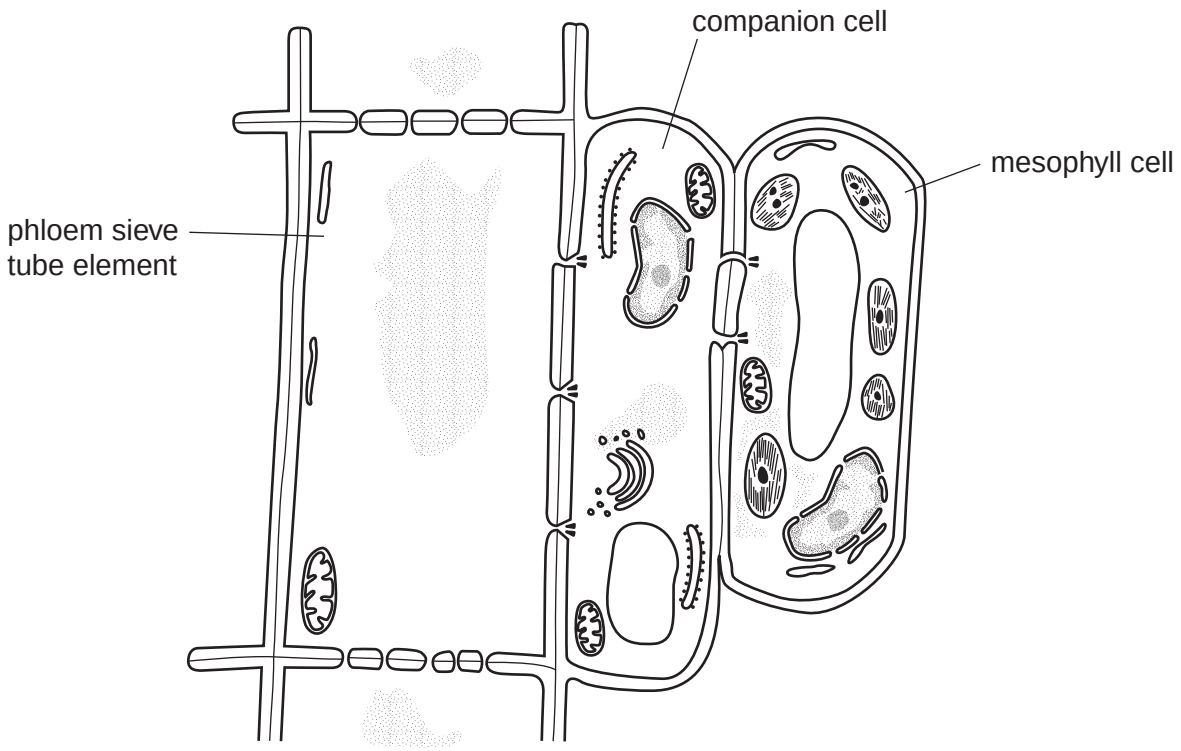

Fig. 6.1

(a) Use label lines and the letters **C** to **E** to identify the following on Fig. 6.1.

C – a structure involved in ribosome synthesis

D – an organelle that is involved in the modification and packaging of proteins

E – an organelle that is involved in aerobic respiration [3]

(b) The concentration of sucrose in the sap of the phloem sieve tube element is much higher than in the cytoplasm of the photosynthesising cell.

Describe **and** explain how sucrose is transported from the photosynthesising cell to the phloem sieve tube element.

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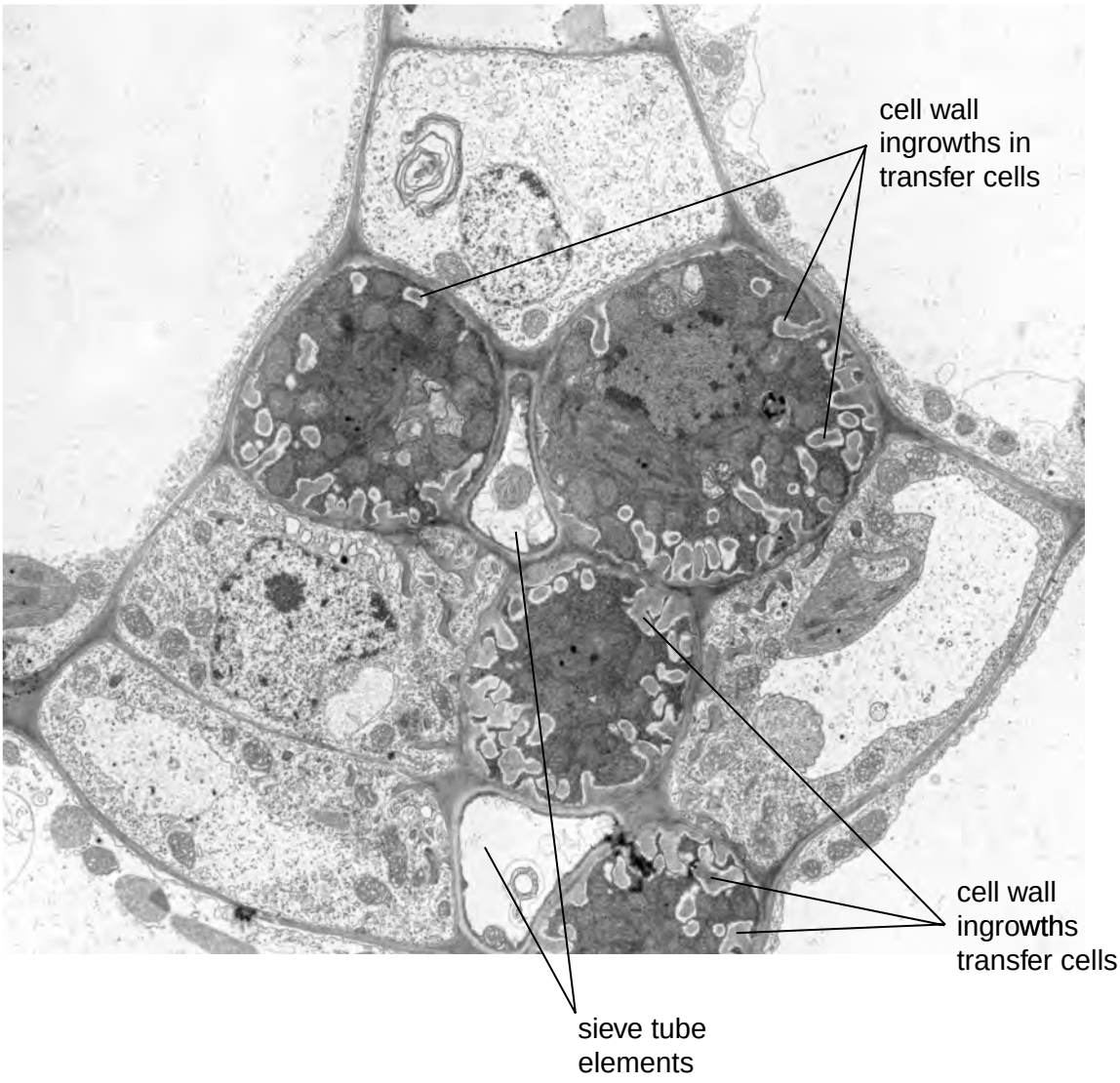
[Total: 7]

3 Phloem transfer cells are specialised companion cells that load sucrose into sieve tube elements.

Fig. 4.1 is an electron micrograph of a transverse section showing phloem tissue from a leaf of *Senecio vulgaris*. The section shows two sieve tube elements and four phloem transfer cells. The sieve tube elements are small in this section because it is taken at the end of a vein in the leaf.

It is thought that the many ingrowths of the cell walls visible in Fig. 4.1 are related to the movement of large quantities of sucrose.



magnification = ×10,000

Fig. 4.1

(a) Describe how companion cells load sucrose into phloem sieve tubes.

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(b) Transfer cells move large quantities of sucrose into phloem sieve tubes.

Suggest why these cells have cell wall ingrowths as shown in Fig. 4.1.

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(c) **(i)** Explain the advantage of studying cells, such as transfer cells, with the electron microscope rather than the light microscope.

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(ii) Describe the appearance of the phloem sieve tubes when viewed in longitudinal section.

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[Total: 10]

4 Fig. 2.1 shows a transverse section of a root nodule of a legume. Fig. 2.2 is a drawing of a cell from the centre of the nodule made from an electron micrograph.

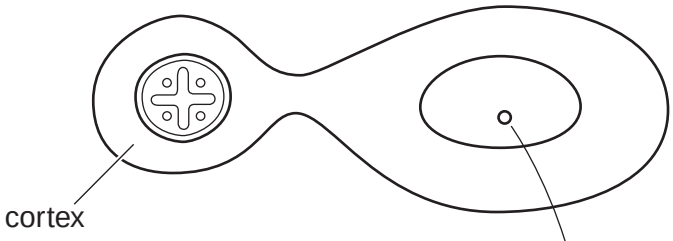

Fig. 2.1

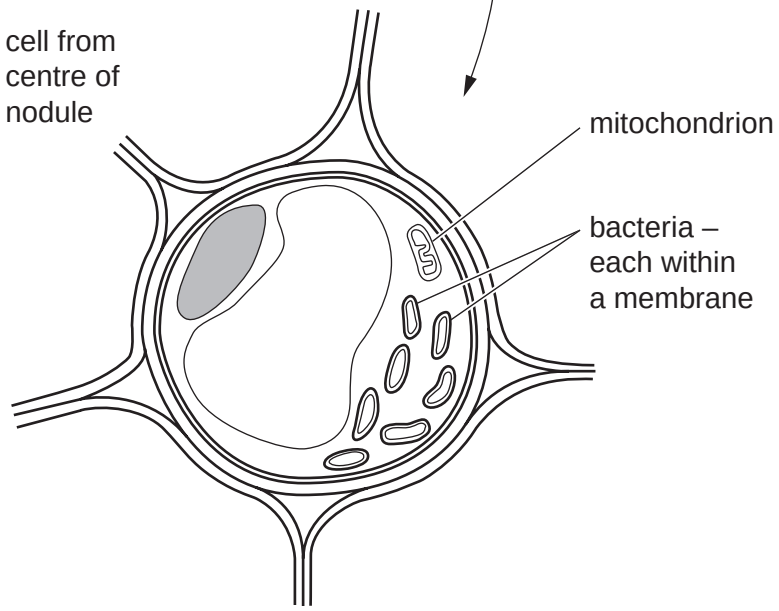

Fig. 2.2

(a) Name three structures that are present in cells in the cortex of the root that are not present in bacterial cells.

1 .....

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3 .....[3]

(b) Explain the advantages of studying cell structure with an electron microscope rather than with a light microscope.

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(c) Describe the role of *Rhizobium* in the root nodule.

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(d) Cells in the centre of the root nodule have a high concentration of the pigment, leghaemoglobin. This combines with oxygen in much the same way as haemoglobin in mammals. Leghaemoglobin is responsible for maintaining anaerobic conditions around the bacteria in the nodules. Leghaemoglobin is not found in the roots of other plants.

The base sequence in the gene that codes for the β polypeptide of mammalian haemoglobin is similar to that for leghaemoglobin.

Suggest why this is so.

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[Total: 10]

5 Fig. 1.1 is a drawing made from an electron micrograph. It shows a longitudinal section through a sieve tube element and a companion cell in the phloem of a flowering plant.

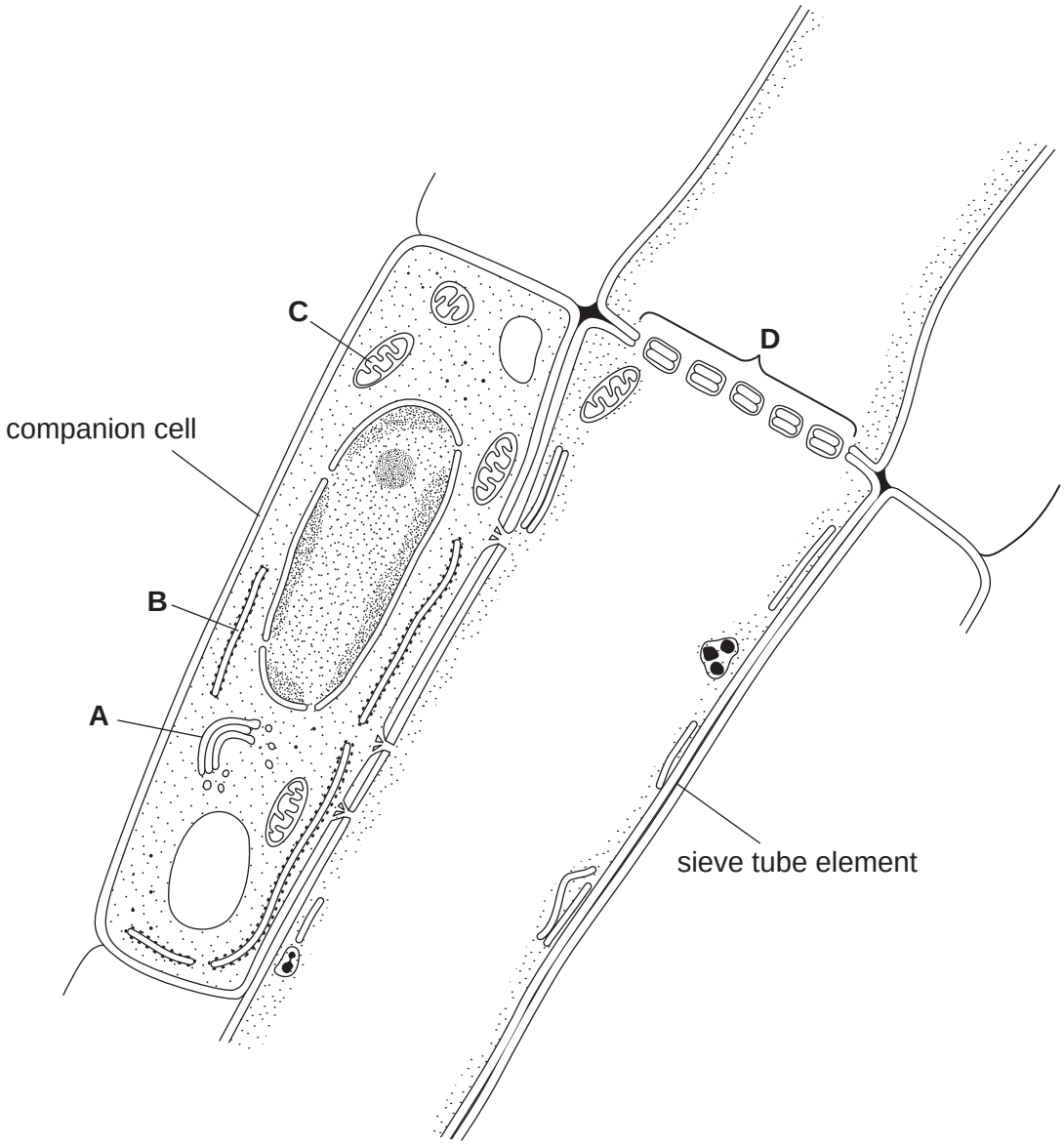

Fig. 1.1

(a) Refer to Fig. 1.1.

(i) Name structures **A** to **C**.

A .....

B .....

C .....[3]

(ii) State the name given to the region labelled **D** that separates the two sieve tube elements.

.....[1]

(iii) Name **one assimilate** that is transported in the phloem.

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(b) Explain how the structure of sieve tube elements helps the translocation of substances in the phloem.

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(c) Describe the role of companion cells in translocation in the phloem.

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[Total : 10]