

GCSE Biology B (Twenty First Century Science)
J257/04 Depth in biology (Higher Tier)

Question Set 16

1

Mistletoe is a very unusual plant. Instead of growing in the ground, mistletoe grows on another plant such as a tree, as shown in Fig. 4.1.



Fig. 4.1

(a) Mistletoe does not have roots in the soil.

Mistletoe takes all the water it needs from a tissue in the tree. This tissue transports water from the tree's roots to the tree's leaves.

(i) What is the name of the tissue in the tree that the mistletoe takes water from?

xylem

[1]

(ii) Explain why water moves through this tissue from the roots to the leaves in a normal tree.

More water is present in soil than in root hair cell so water diffuse in down the concentration gradient.

through a plant to the leaves where some of it diffuses out into the air. Water molecules move up the xylem vessels to leaves where some evaporates out of the stomata due to transpiration.

(iii) Suggest one **other** substance that the mistletoe could take from this tissue in the tree.

SUCROSE

[1]

(b) Very little photosynthesis takes place in the mistletoe.

It takes most of the sugar it needs from phloem tissue in the tree. Phloem transports sugars around the tree.

A diagram of the phloem tissue is shown in Fig. 4.2.

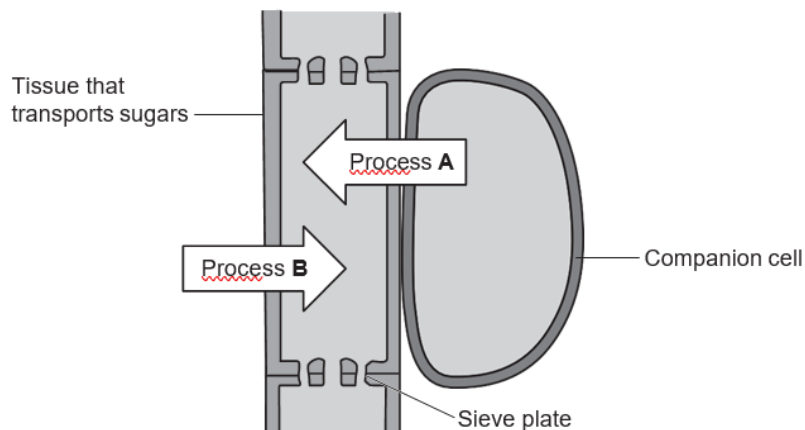


Fig. 4.2

- (i) Process **A** and process **B** move substances into the phloem tube.

Describe process **A** and process **B**.

In your answer you should include:

- the names of the processes
- what is moved by each process.

- Process A is loading sucrose via active transport (energy is used) into phloem tube from source cell/leaf.
- Process B is osmosis where water is taken up by / diffuse to the phloem tube due to reduced water potential

[4]

- (ii) Explain how sugars are moved along a phloem tube

Via pressure flow due to high pressure which is created by water diffusing in from xylem near source and low pressure near sink. Also sieve plate has holes which sugar can flow through & along the tube to the sink.

- (iii) The phloem tube is made of living cells, but these cells do not have any mitochondria.

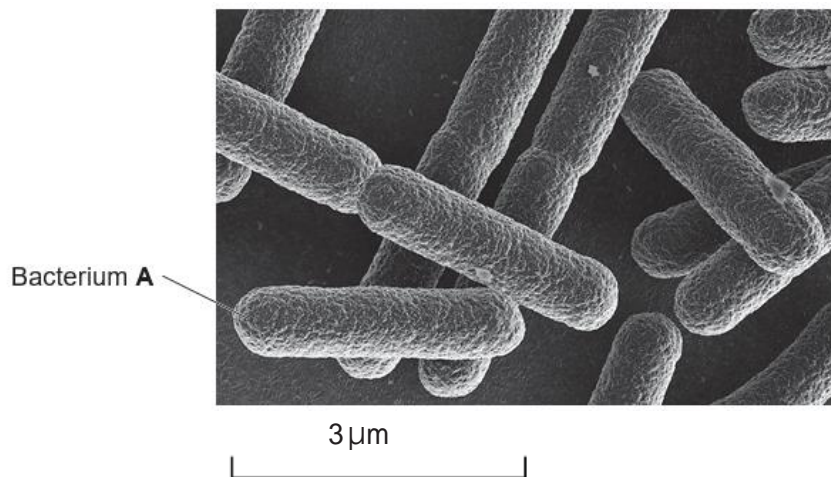
Explain why they depend on the companion cells, which do have mitochondria.

As they provide ATP to allow active transport of sucrose into the sink or out of the source.

- (c) Mistletoe can catch diseases from the tree it is growing on.

A scientist thinks some bacteria have spread from a tree to some mistletoe that is growing on it. They collect a sample of the bacteria from the mistletoe.

Fig. 4.3 shows an image of some of the bacteria from the mistletoe.



- (i) The actual length of bacterium A is $3\mu\text{m}$.

In the image in Fig. 4.3 it appears to be 4.5 cm long. $1\mu\text{m} = 0.0001\text{ cm}$

Calculate the magnification of the image.

Use the equation: magnification = measured size \div actual size

$$m = \frac{4.5}{0.0003} \quad \text{Magnification} = \times \dots\dots 15\,000 \dots\dots [2]$$

- (ii) Each bacterium from the tree is $3 \times 10^{-4}\text{ cm}$ long.

Is it possible that the bacteria from the tree are the same bacteria as bacterium A from the mistletoe?

Yes

$$1 \times 10^{-4}\text{ cm} = 1\mu\text{m}$$

No

$$3 \times 10^{-4}\text{ cm} = 3\mu\text{m}$$

Explain your answer. *Because it has the same length as the one found from the mistletoe.* [2]

- (d) The scientist has made some monoclonal antibodies that recognise the bacteria from the tree.

- (i) Describe how scientists make monoclonal antibodies that recognise the bacteria from the tree.

- Bacterial antigen is injected into the mouse [4]
- Mouse would naturally produce lymphocytes which produce antibodies specific to that antigen.

- Spleen cells are removed from the mouse and fused with human cancerous white blood cells to form hybridoma cells. [3]

- These cells divide indefinitely and produce many monoclonal antibodies that recognise specific bacteria.

- (ii) The monoclonal antibodies are designed to recognise the bacteria from the tree. The scientist wants to test whether they also recognise the bacteria from the mistletoe.

Describe how the scientist could do this in a diagnostic test **and** what the scientist would see if the result was positive.

Use the same monoclonal antibodies that are designed for bacteria on tree on the mistletoe. Apply a fluorescent.

label on the antibodies. If the antibodies bind to the bacteria from mistletoe, they would emit fluorescent light give positive result.

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