

**Q1.** Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

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.....

.....

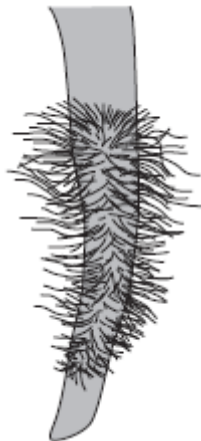
.....

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.....

**(3)**

(b) The image below shows part of a plant root.



The plant root is adapted for absorbing water from the soil.

Use information from the diagram to explain how this plant root is adapted for absorbing water.

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(3)  
(Total 6 marks)

**Q2.**The leaves of most plants have stomata.

(a) (i) Name the cells which control the size of the stomata.

.....

(1)

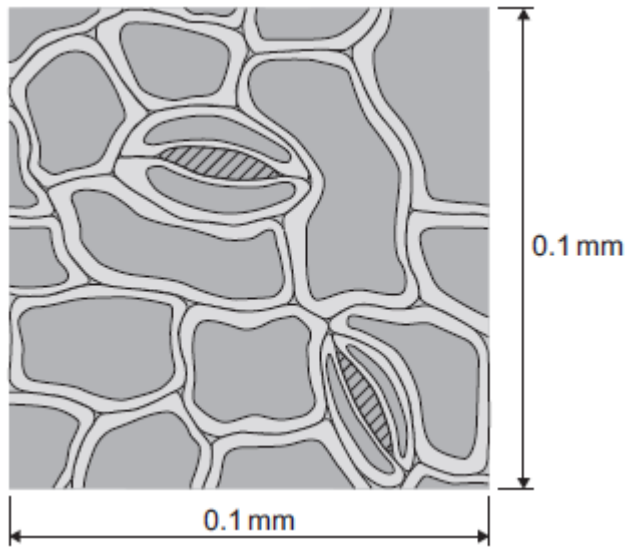
(ii) Give **one** function of stomata.

.....

.....

(1)

(b) The image below shows part of the surface of a leaf.



The length and width of this piece of leaf surface are both 0.1 mm.

(i) Calculate the number of stomata per  $\text{mm}^2$  of this leaf surface.

.....

.....

..... per mm<sup>2</sup>

(2)

- (ii) A different plant species has 400 stomata per mm<sup>2</sup> of leaf surface.

Having a large number of stomata per mm<sup>2</sup> of leaf surface can be a disadvantage to a plant.

Give **one** disadvantage.

.....  
 .....

(1)

- (c) A student investigated the loss of water from plant leaves.

The student did the following:

- Step 1: took ten leaves from a plant
- Step 2: weighed all ten leaves
- Step 3: hung the leaves up in a classroom for 4 days
- Step 4: weighed all ten leaves again
- Step 5: calculated the mass of water lost by the leaves
- Step 6: repeated steps 1 to 5 with grease spread on the upper surfaces of the leaves
- Step 7: repeated steps 1 to 5 with grease spread on both the upper and lower surfaces of the leaves.

All the leaves were taken from the same type of plant.

The table below shows the student's results.

Treatment of leaves	Mass of water the leaves lost in g
No grease was used on the leaves	0.98
Grease on upper surfaces of the leaves	0.86
Grease on upper and lower surfaces of the leaves	0.01

- (i) What mass of water was lost in 4 days through the upper surfaces of the leaves?

.....  
.....

Mass = ..... g

(1)

- (ii) Very little water was lost when the lower surfaces of the leaves were covered in grease.

Explain why.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

(3)

(Total 9 marks)

**M1.(a)** any **three** from:

- (water through a) partially permeable  
*accept 'semi permeable' / selectively permeable*
- membrane
- from dilute to (more) concentrated solution  
*allow 'from a high concentration of water to a lower concentration (of water)'*  
*allow 'from high water potential to low water potential'*  
*allow 'down a concentration gradient of water'*  
*do **not** accept 'along a concentration gradient of water'*
- (it's a) passive (process)  
*allow requires no energy*

3

(b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

*ignore absorption*

1

**[6]**

**M2.(a)** (i) guard (cells)

*allow phonetic spelling*

1

(ii) any **one** from:

*ignore reference to cells*

- allow carbon dioxide to enter  
*allow control loss / evaporation of water **or** control transpiration rate*
- allow oxygen to leave.  
*allow 'gaseous exchange'*

1

- (b) (i) 200  
*correct answer gains 2 marks with or without working*  
*allow 1 mark for  $0.1 \times 0.1 = 0.01$  (mm<sup>2</sup>)* 2
- (ii) more / a lot of / increased water loss  
*allow plant more likely to wilt (in hot / dry conditions)* 1
- (c) (i) 0.12 1
- (ii) the lower surface has most stomata 1
- stomata are now covered / blocked (by grease) 1
- so water cannot escape / evaporate from the stomata  
*ignore waterproof*  
*to gain credit stomata must be mentioned at least once* 1
- [9]**

- E1.(a)** Most students gained 2 marks for correctly identifying the partially permeable membrane, and approximately a quarter of all students went on to gain the third mark for correctly identifying the direction of travel of water. If students stated a movement of water from high to low concentration, this was only awarded if the student made it clear that they are referring to the concentration of water, i.e. from dilute to concentrated solutions. A significant number of students simply referred to movement of water from a high to a low concentration, which was not creditworthy. Movement along or up the gradient were seen quite often with a correct description for mark point 3, and unfortunately, this cancelled the mark for these students. Gases and mineral ions moving by osmosis were seen occasionally. A small number of students gained one mark for correctly identifying that osmosis is a passive process.
- (b) Just over half of all students gained two or three marks in this question, with most students correctly identifying the large surface area of the structures. However, there was confusion between root, root hair and root hair cell. A significant number of students started their explanations with 'it' or 'they' and were not awarded the first mark point. Some students referred to fibres or the root itself for no credit, and similarly long root hairs was insufficient. Students often failed to gain the third mark as they simply restated the stem by stating 'therefore more water can be absorbed', and did not clearly identify that more osmosis would occur. Erroneous responses about movement of mineral ions or water moving by active transport were seen.
- E2.(a)**
- (i) The vast majority of students gained credit in this question.
- (ii) Many students did well in this question and understood aspects of gaseous exchange. For those who took this approach a minority lost the mark for having CO<sub>2</sub> or O<sub>2</sub> moving in the 'wrong direction' as they hadn't specified that this occurred at night.
- Those who took the water approach did less well as the 'control' aspect was missing from their response.
- (b) (i) Only a third of all students gained credit for calculating the number of stomata per mm<sup>2</sup>, and around half did not gain any marks. There was evidence that many students are not good at multiplying decimals and put the decimal point in the incorrect place, giving 2 or 20 as the number of stomata.
- (ii) Approximately two thirds of all students could correctly identify a disadvantage of having a large number of stomata. Where students did not gain credit, it was often for giving an answer that was not comparative, e.g. plant will lose water as opposed to the plant will lose more water.
- (c) (i) Just over half of all students correctly worked out the amount of water lost.
- (ii) Approximately two thirds of students gained two or three marks on this question. Those students who recognised the role of stomata in water loss

could gain at least 1 mark, usually for stating that the stomata were blocked by the grease. Many did not point out that the majority of the stomata are on the lower surface of the leaf, merely stating that there were 'many' stomata on the lower surface and so failed to gain that mark. Those students who failed to mention stomata and rephrased the given data, gained no credit.