PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 4: EXCHANGE AND TRANSPORT

TRANSPORT IN PLANTS

SCORE	PERCENTAGE
/64	%

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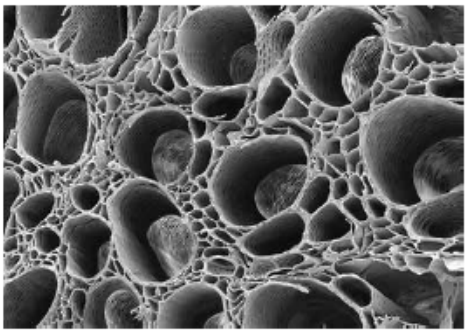
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Q1.

The photograph below shows an electronmicrograph of xylem tissue.



© B705/0112 Xylem tissue, SEM Steve Gschmeissner/Science Photo Library

Give **three** ways in which xylem tissue is adapted for its functions.

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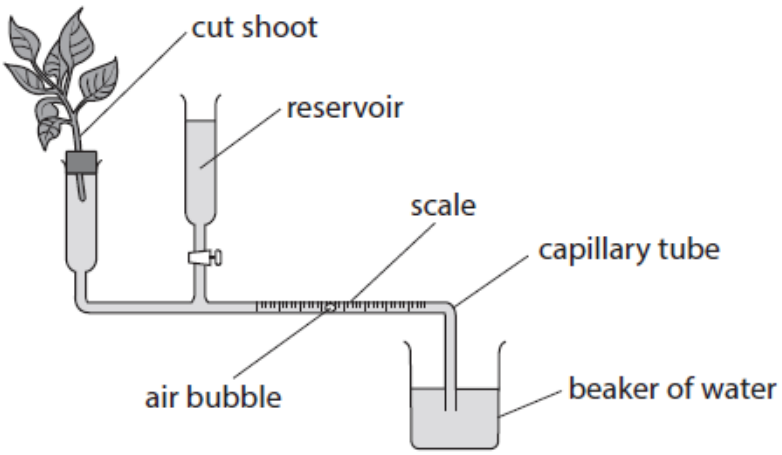
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(Total for question = 3 marks)

Q2.

Water moves through xylem vessels in a plant during transpiration.

A student used the potometer shown in the diagram to investigate the rate of water uptake in a leafy shoot.



The student investigated the effect of a combination of environmental conditions on the rate of water uptake.

The table shows the results of this investigation.

Conditions	Distance moved by the bubble in 5 minutes / cm					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Mean
Still air, in light	2.4	2.2	2.2	2.2	2.1	2.2
Moving air, in light	6.5	6.7	6.4	6.2	6.3	6.4
Still air, in dark	0.9	0.4	0.0	0.0	0.0	0.3
Moving air, in dark	1.7	0.8	0.0	0.0	0.0	0.5

(i) The internal diameter of the capillary tubing is 0.3 mm.

The volume of a cylinder is calculated using the formula

$$\pi r^2 h$$

Calculate the mean rate of water uptake for the shoot in moving air, in the light.

Give your answer in $mm^3\ min^{-1}$ to two significant figures.

(3)

Answer ..... $mm^3\ min^{-1}$

(ii) Analyse the data to explain the results of this investigation.

(3)

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(iii) Describe how this investigation could be modified to make a valid comparison of water loss from the upper and lower surfaces of the leaves.

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(Total for question = 10 marks)

Q3.

The photograph shows a wombat, an animal that lives in dry parts of Australia.



Source: © Blue Gum Pictures/Alamy Stock Photo

Wombats are herbivores, feeding on grasses, leaves and bark. Wombats also dig in the soil for roots.

They have behavioural and physiological adaptations to survive periods of severe drought.

The effect of drought on the health of wild wombats was investigated.

Changes in body mass, body condition and the chemical constituents of stomach contents and faeces were recorded.

These changes were related to the changes in the quality and quantity of the food of wombats.

Explain why drought affects the quality and quantity of the food of wombats.

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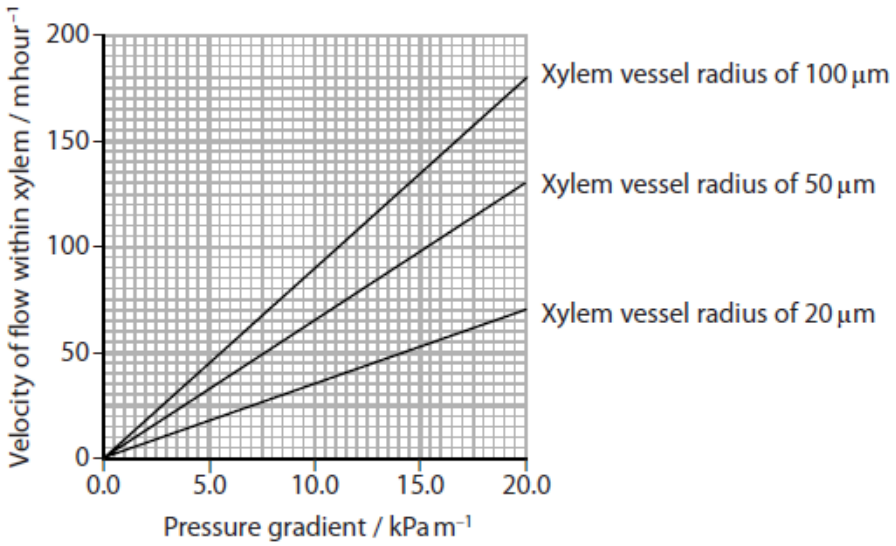
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(Total for question = 5 marks)

Q4.

Xylem and phloem are involved in transport in plants.

The graph shows the effect of pressure gradient on the velocity of flow within three xylem vessels.



(i) Describe the effect of pressure gradient and radius on the velocity of flow within the xylem vessels.

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(ii) Calculate the percentage increase in the velocity of water flowing through a xylem vessel of radius 20 µm and a xylem vessel of radius 100 µm, at a pressure gradient of 17.5 kPa m^{-1}.

(2)

Answer .....

(Total for question = 4 marks)

Q5.

Plants and animals are adapted for gas exchange.

(i) Which row of the table describes gas exchange in the root of a plant?

(1)

		Net movement of carbon dioxide	Net movement of oxygen
☒	**A**	in only	out only
☒	**B**	out only	in only
☒	**C**	in and out	in and out
☒	**D**	neither in nor out	neither in nor out

(ii) Which is the gas exchange surface in the stem of a woody plant?

(1)

☒ **A** lenticel

☒ **B** pit

☒ **C** plasmodesmata

☒ **D** stomata

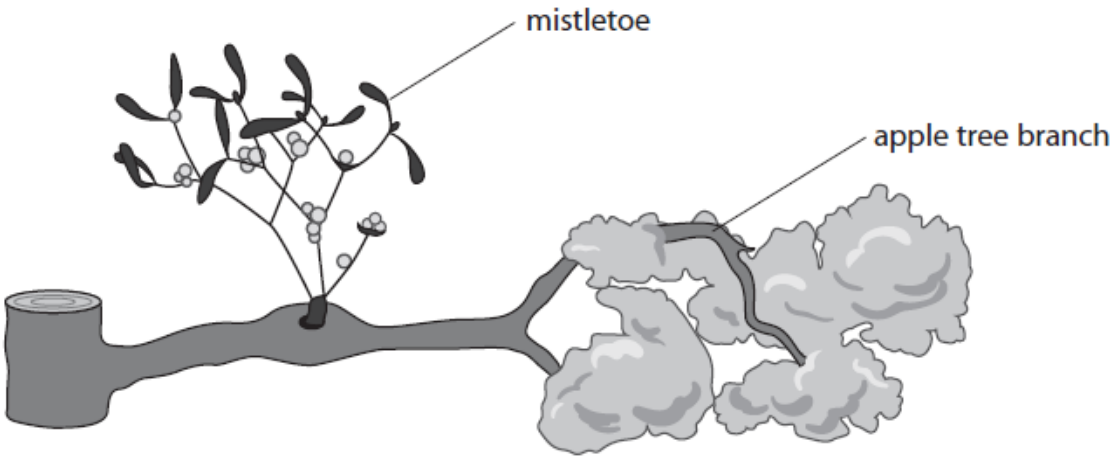
(Total for question = 2 marks)

Q6.

*Mistletoe is a plant that is a parasite on trees.

Mistletoe has green leaves. Mistletoe also has a modified root that grows into the xylem of a tree.

The diagram shows mistletoe growing on an apple tree branch.



The effect of mistletoe on the growth of apple trees was investigated.

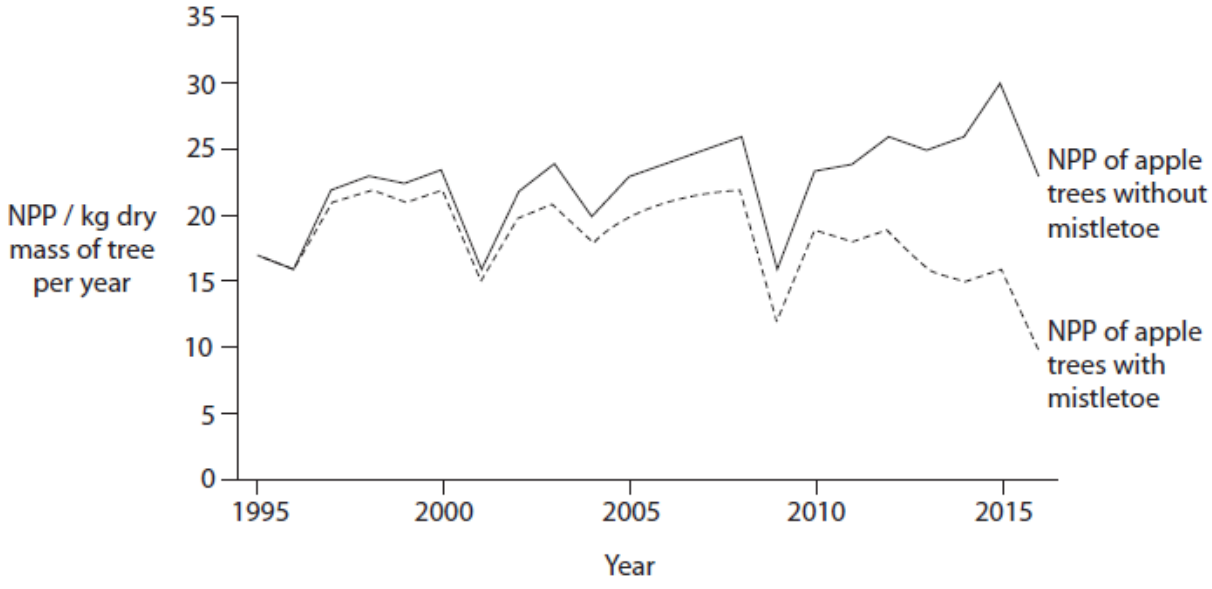
Every year for 20 years, scientists selected apple trees infected with mistletoe and measured the:

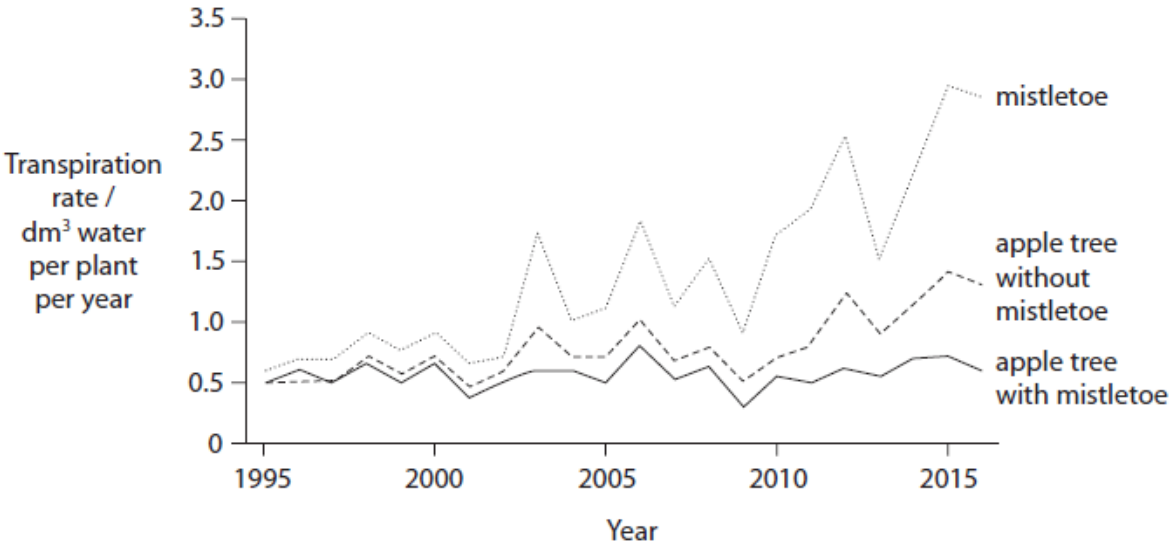
- mean net primary productivity (NPP) of the apple trees
- transpiration rate of the apple trees
- transpiration rate of the mistletoe branches on the apple trees

They also determined the mineral content of the apple tree leaves after 20 years.

A control group of apple trees not infected with mistletoe was included in this investigation.

The graphs and table show the results of the investigation.





Apple tree leaves from	Nitrogen content / mg per g of leaf	Calcium content / mg per g of leaf
trees infected with mistletoe	8.50	6.45
trees not infected with mistletoe	10.60	8.90

Analyse the data to explain the effect of mistletoe on the NPP of apple trees.

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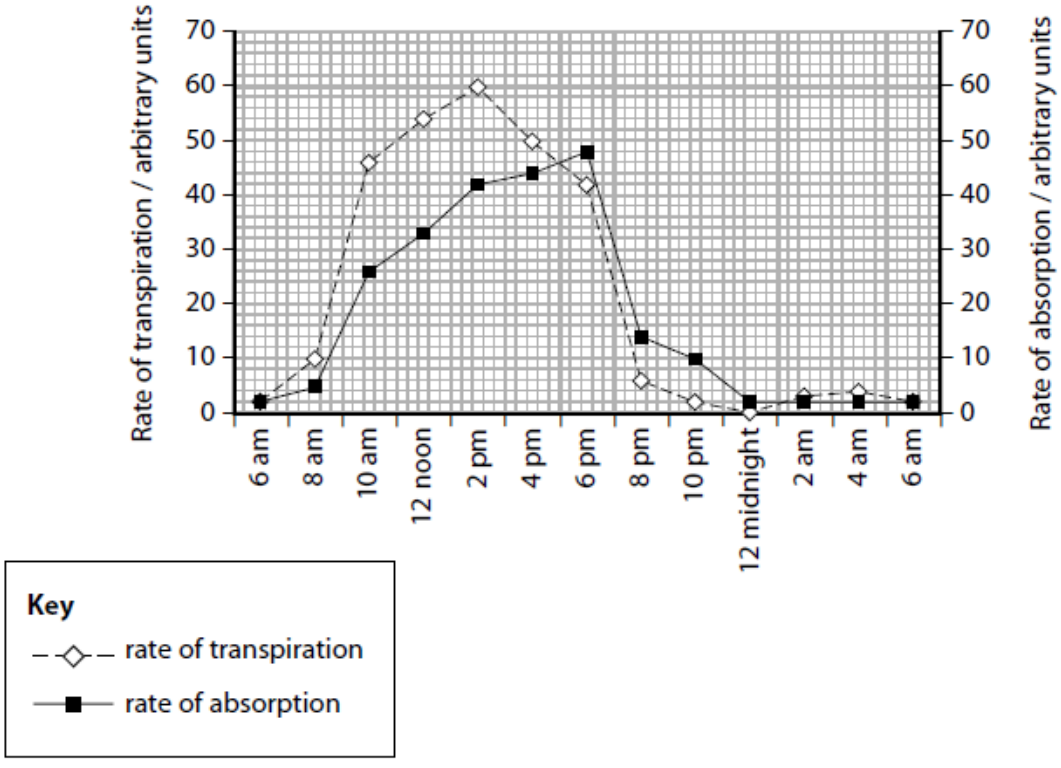
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(Total for question = 6 marks)

Q7.

The graph below shows the rates of transpiration and water absorption by a Jerusalem pine tree (*Pinus halepensis*), during a 24-hour period.



Analyse the data to explain the relationship between these two rates during this 24-hour period.

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(Total for question = 4 marks)

Q8.

The primary productivity of plants depends on their ability to synthesise carbohydrates and transport solutes to cells.

Explain how the mass-flow hypothesis accounts for the movement of sugars from leaves to roots.

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(Total for question = 4 marks)

Q9.

Which statements describe some properties of water that are useful to plants?

1 Hydrogen bonding makes water a polar solvent.

2 Cohesive forces between water molecules allow the water to move in an unbroken stream.

3 Weak hydrogen bonds between water molecules attract the molecules to each other and allow water molecules to move easily in relation to one another.

(1)

☒ **A** 1 and 2 only

☒ **B** 2 and 3 only

☒ **C** 1 and 3 only

☒ **D** 1, 2 and 3

(Total for question = 1 mark)

Q10.

Biodiversity is monitored by conservationists.

The photograph shows a hedge.



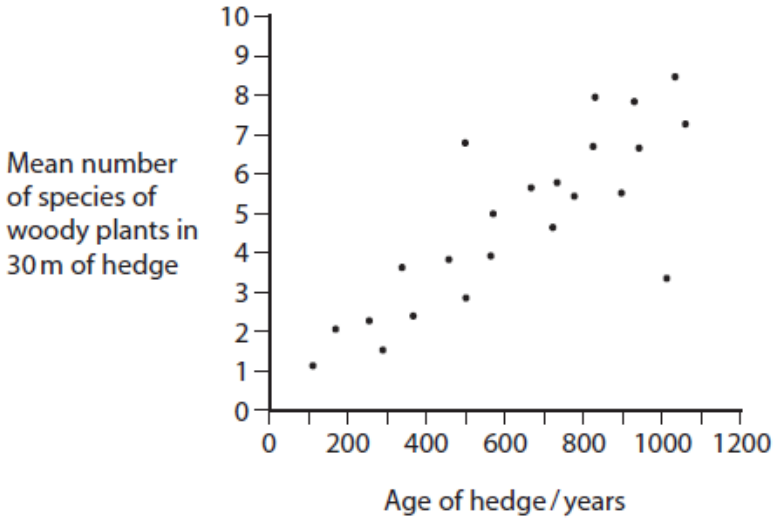
(Source: © 1000 Words/Shutterstock)

Many fields in the UK are separated by hedges.

Conservationists investigated biodiversity in hedges of different ages.

Hedges of different ages were sampled at random and the number of species of woody plants was counted.

The graph shows the results of this investigation.



The conservationists observed that the plants in older hedges contained more wood than the plants in younger hedges.

Wood consists of xylem tissue.

(i) Give an advantage for older plants of containing more wood.

(1)

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(ii) Describe a method to show that the stem of an older plant contains more wood.

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(Total for question = 4 marks)

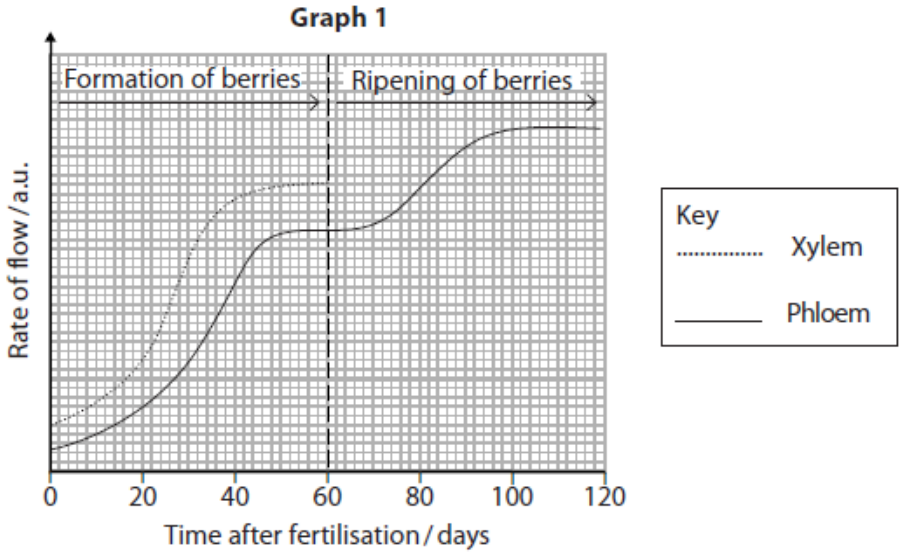
Q11.

Xylem and phloem are involved in transport in plants.

* Double fertilisation in some plants leads to the development of fruits, such as berries.

In an investigation, the rate of flow in xylem during the formation of berries was measured. The rate of flow in the phloem during the formation and ripening of the berries was also measured.

The results are shown in graph 1.



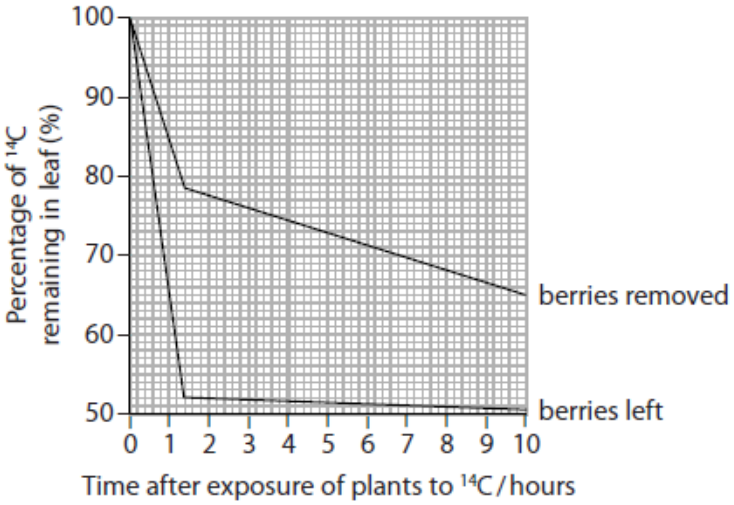
In a second investigation, two plants with berries were exposed to radioactive carbon dioxide (^{14}C).

After exposure to ^{14}C, the berries were removed from one plant and left on the second plant.

The percentage of ^{14}C remaining in the leaves of each plant was determined during the next 10 hours.

The results are shown in graph 2.

Graph 2



Analyse the data to explain the role of double fertilisation, xylem and phloem in the development of the berries.

(6)

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(Total for question = 6 marks)

Q12.

Xylem and phloem are involved in transport in plants.

(i) Which row of the table shows some of the substances transported in xylem and phloem?

(1)

	Xylem	Phloem
☒ **A**	water only	sucrose only
☒ **B**	water only	water and sucrose
☒ **C**	water and mineral ions	sucrose only
☒ **D**	water and mineral ions	water and sucrose

(ii) Describe the differences between the structure of xylem and that of phloem.

(3)

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(Total for question = 4 marks)

Q13.

Water moves through xylem vessels in a plant during transpiration.

Phloem tissue is responsible for transport of organic materials such as sucrose.

Compare and contrast the structure of xylem tissue and phloem tissue.

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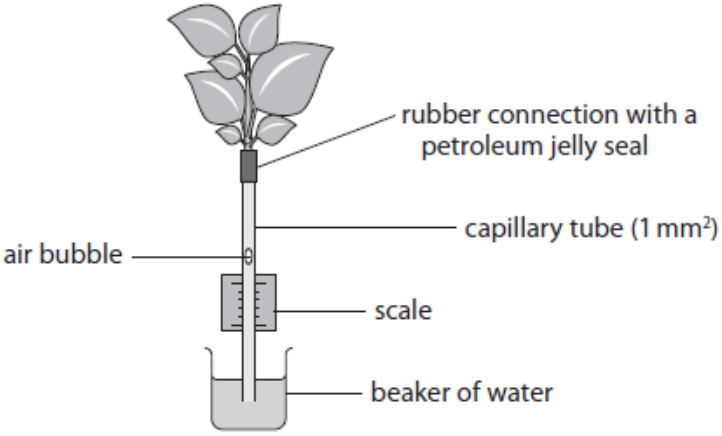
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(Total for question = 3 marks)

Q14.

A student investigated the effect of moving air on transpiration in a leafy shoot.

The diagram shows the potometer used by the student.



The student measured the distance in millimetres that the air bubble moved during a five-minute period in moving air and in still air.

(i) Explain how the student could convert these readings into a transpiration rate using the units mm^3 cm^{-2} min–1.

(3)

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(ii) The table shows the mean results and standard deviations of this investigation.

Mean rate of transpiration / mm^3 cm^{-2} min^{-1}	
In moving air	**In still air**
3.2 ± 0.3	0.8 ± 0.2

Explain the results of this investigation.

(2)

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(Total for question = 5 marks)

Q15.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Transpiration moves water and mineral ions from the roots to the leaves of plants.

Water enters the root hair cells and moves through the root tissues by the apoplastic and symplastic pathways.

(i) Root hairs have a large surface area that increases the rate of uptake of water.

The surface area of a root hair is rounded up to 3.14×10^5 μm^2.

Which is the actual surface area of this root hair?

(1)

☒ **A** 31 460 μm^2

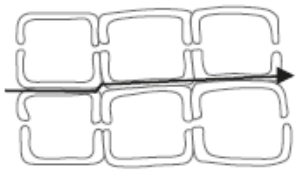
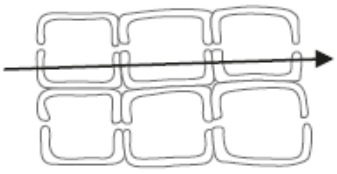
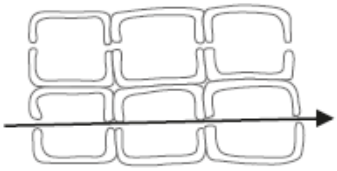
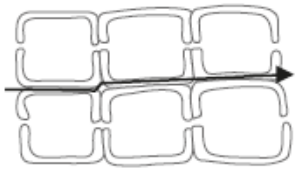
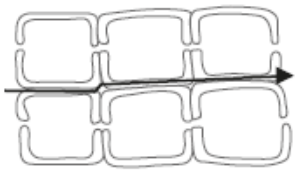
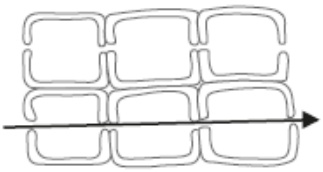
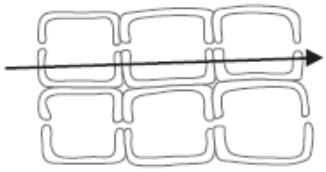
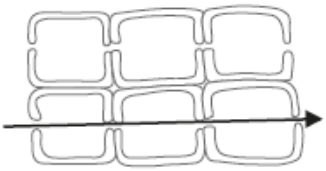
☒ **B** 314 600 μm^2

☒ **C** 313 900 μm^2

☒ **D** 3 139 000 μm^2

(ii) Which row of the table shows the movement of water through the apoplastic and symplastic pathways?

(1)

	Apoplastic pathway	Symplastic pathway
☒ A		
☒ B		
☒ C		
☒ D		

(iii) Water moves through the root tissue due to a difference in water potential between one cell and the next cell.

Which row of the table describes this movement?

(1)

	Direction of water movement with respect to water potential	Direction of water movement with respect to concentration of solutions
☒ A	higher to lower	concentrated to dilute
☒ B	higher to lower	dilute to concentrated
☒ C	lower to higher	concentrated to dilute
☒ D	lower to higher	dilute to concentrated

(Total for question = 3 marks)