OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



EXAM QUESTION PACK

B3.2 HOW DO PRODUCERS GET THE SUBSTANCES THEY NEED? (HIGHER)

SCORE	PERCENTAGE
/80	%

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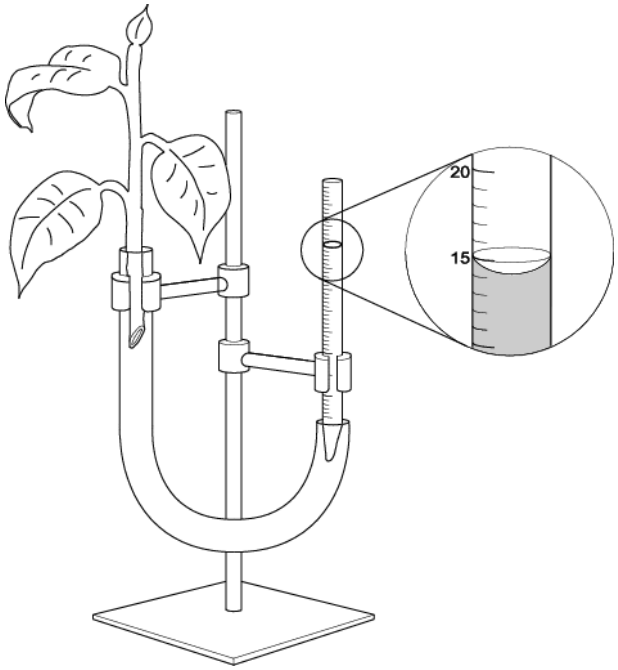
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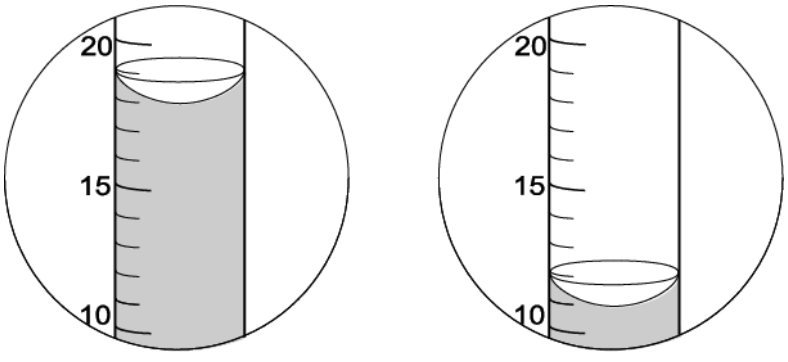
1(a). A student investigates the effect of temperature on the rate of water uptake by a plant.

She places a plant in the apparatus shown below. The temperature of the room is 35°C.



(i) The student measured the distance moved by the water level over a period of 30 minutes.

The diagrams show her results.



Calculate the rate of water uptake.

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Show your working.

Give your answer to two significant figures.

Rate of water uptake = _____ cm^3/min **[2]**

(ii) How could the student use this apparatus to investigate the rate of water uptake in windy conditions?

Other apparatus is available, too.

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[1]

(iii) The volume of water taken up may not be an accurate measurement of the water lost in transpiration.

Suggest why.

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[2]

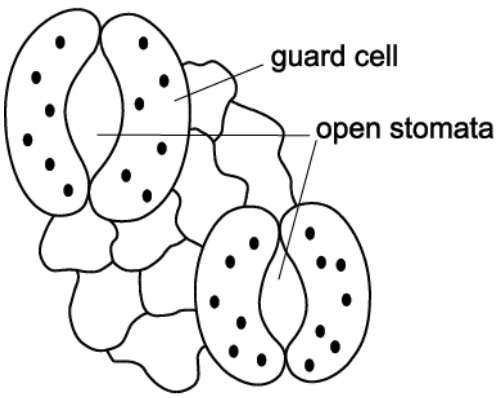
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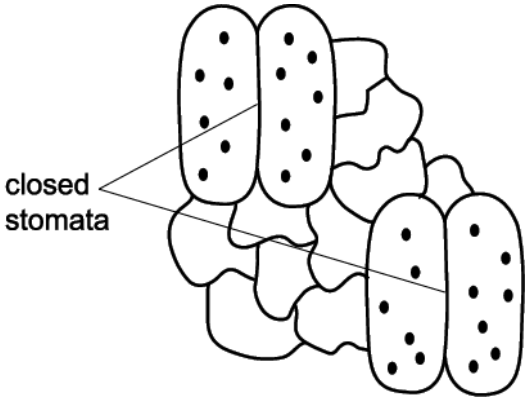
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(b). Stomata are small holes found mostly on the underside of leaves.

They can open and close. The opening and closing of the stomata is controlled by guard cells.

The diagram below shows the stomata and the guard cells.





Potassium ions from neighbouring cells enter the guard cells. This causes the stomata to open.

Explain how this mechanism works.

---

[2]

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2(a). A student does an experiment to find out more about how the process of osmosis works.

The student was provided with ten pieces of potato, each about 5 cm long.

She was also given five dishes each containing a different **unknown** concentration of sugar solution.

The student put two pieces of potato in each dish and left them for 30 minutes. She then removed the potato pieces and re-measured their length.

The student recorded the results in this table.

Dishes of sugar solution	Length of potato (cm)				Change in mean length (cm)	Percentage change
	Original	After 30 minutes in sugar solution				
		Piece 1	Piece 2	Mean		
1	4.9	5.0	5.4	5.2	+0.3	
2	5.1	4.3	4.1	4.2	–0.9	–18.4
3	5.0	4.8	4.4	4.6	–0.4	–8.0
4	5.2	5.7	5.9	5.8	+0.6	+11.5
5	4.9	4.8	4.8	4.8	–0.1	–2.0

(i) The student has not finished working out the results.

Calculate the missing value and write it in the table.

[2]

(ii) The table below shows the concentration of sugar solution in each of the five dishes.

Use the results from the students' experiment to show which solution was in each dish.

Write down the correct dish number in the column headed **"Dish"**.

Sugar solution concentration (mol dm^{-3})	Dish
0.2	
0.4	
0.6	
0.8	

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1.0	

[1]

(iii) The student measured the length of the pieces of potato as a quick way to obtain results.

Why does this method not measure the total change to the pieces of potato?

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[1]

(iv) How could the student modify the experiment to show the rate of water movement by osmosis in pieces of potato?

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[2]

(b). Another student did a similar experiment.

These are his results.

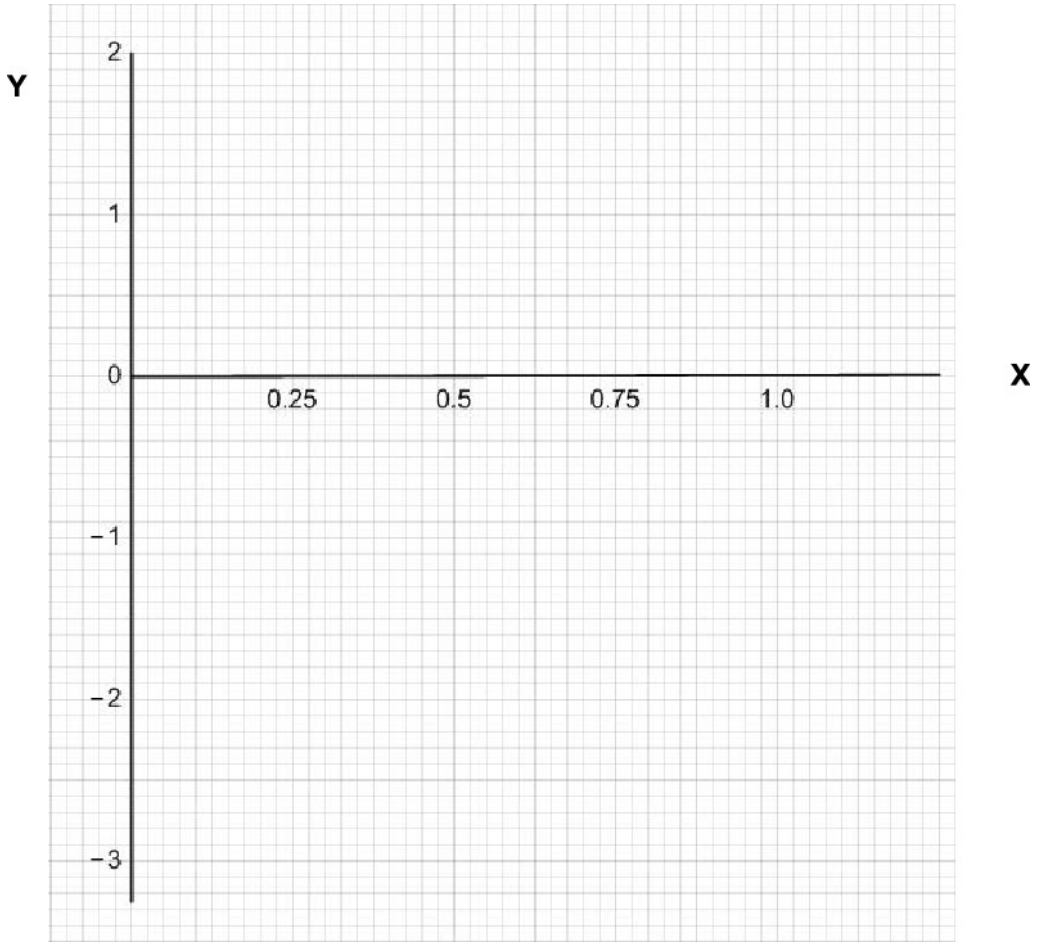
Sugar solution concentration (mol dm^{-3})	Change in mean length (mm)
1.00	–1.9
0.75	–1.2
0.50	–0.5
0.25	+0.3
0.00	+1.0

(i) Use the information in the table to label the X and Y axis on the grid below.

[1]

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(ii) Plot the student's results on the grid.

[2]

(iii) Draw a line of best fit.

[1]

(iv) Use your graph to find the concentration of the sugar solution where the potato pieces do not change in length.

sugar solution concentration _____ mol / dm^{-3} **[1]**

(v) What can you conclude, in terms of osmosis, at this concentration?

---

[1]

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3(a). Victoria investigates the effect of different salt concentrations on cells.

Victoria weighs five pieces of potato.

She places one piece of potato into each of five different concentrations of salt solution.

After 20 minutes, she removes the pieces of potato and weighs each of them again.

Her results are shown in the table.

Concentration of the salt solution (mol)	Starting mass (g)	Final mass (g)	Difference in mass (g)	Percentage change in mass (%)
0.1	2.2	2.5	+0.3	
0.2	2.4	2.5	+0.1	+4.17
0.3	3.0	3.1	+0.1	+3.33
0.4	2.1	1.9	−0.1	−4.76
0.5	2.4	2.2	−0.2	−8.33

(i) Calculate the percentage change for the piece of potato placed in the 0.1 mol salt solution.

Show your working.

Give your answer to two decimal places.

percentage change = _____ % **[2]**

(ii) It is better to calculate the percentage change in mass rather than just using the difference in mass.

Explain why.

_____

_____

_____ **[2]**

(iii) What conclusion can Victoria make?

Put a tick (✓) in the box next to the correct answer.

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Potato pieces in concentrations …

… greater than 0.4 mol lose mass. ☐

… lower than 0.3 mol do not change mass. ☐

… lower than 0.2 mol lose mass. ☐

… greater than 0.1 mol do not change mass. ☐

[1]

(iv) The data in the table can be used to work out the concentration of the cells in the potato pieces.

Use the data to give the range of concentration of the cells.

Range = _____ (mol) to _____ (mol) **[2]**

(b). Victoria wants to improve the quality of her data and to improve her confidence in the conclusions.

Suggest **three** improvements she could make to her procedure.

1

2

3

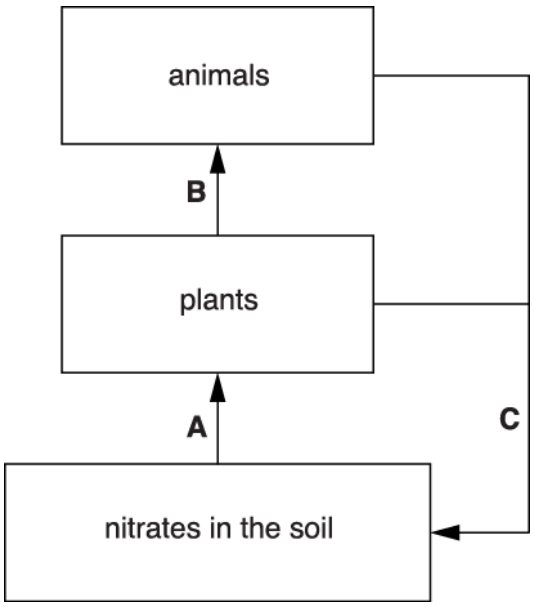
---**[3]**

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4. Sewage contains chemicals that can be broken down into nitrates.

Nitrates are found in the soil.

The diagram shows part of the nitrogen cycle.



Use the diagram to explain what is happening at arrows **A**, **B** and **C**.

The quality of written communication will be assessed in your answer.

[6]

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5(a). Photosynthesis takes place in plants.

Pondweed cells contain structures that have different roles in photosynthesis.

Write the correct name for each **cell structure** alongside its role in **photosynthesis**.

One has been done for you.

role in photosynthesis	cell structure
contains the genetic code for making the enzymes needed	nucleus
allows oxygen to pass out of the cell	.....
contains chlorophyll and enzymes	.....

[1]

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(b). In addition to the substrates needed for photosynthesis, plants need a source of nitrogen to grow.
Plants use **active transport** to absorb nitrogen in the form of nitrates from the soil.

(i) Complete the sentence about active transport.

Active transport is the overall movement of chemicals across a _____ requiring energy from the process of _____.

[1]

(ii) Some plants cannot grow very well in water-logged soils.

Such soils often **lack oxygen**.

A team of plant scientists conclude that

"Plants growing in water-logged soils have an increased chance of showing signs of nitrogen-deficiency."

Use your knowledge of active transport to explain this conclusion.

_____

_____

_____

_____ [2]

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6(a). Plants need chemicals to survive.

Water enters and leaves plant tissues by osmosis.

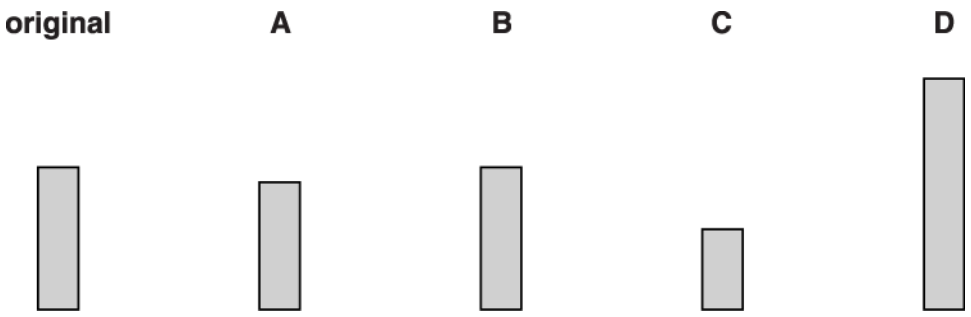
Kaye is investigating how plant tissue takes up water.

She uses four potato chips, **A**, **B**, **C** and **D**.

The chips are all cut to the **same length**.

Kaye puts the four chips into four different concentrations of sugar solution.

The diagram shows the original length of the chips and the length of each chip **after** soaking for 60 minutes in the sugar solutions.



(i) Write letters **A**, **B**, **C** and **D** in the table to show which chip was in each solution.

Concentration of solution in arbitrary units	Potato chip
0.0	
0.3	
0.6	
0.9	

[2]

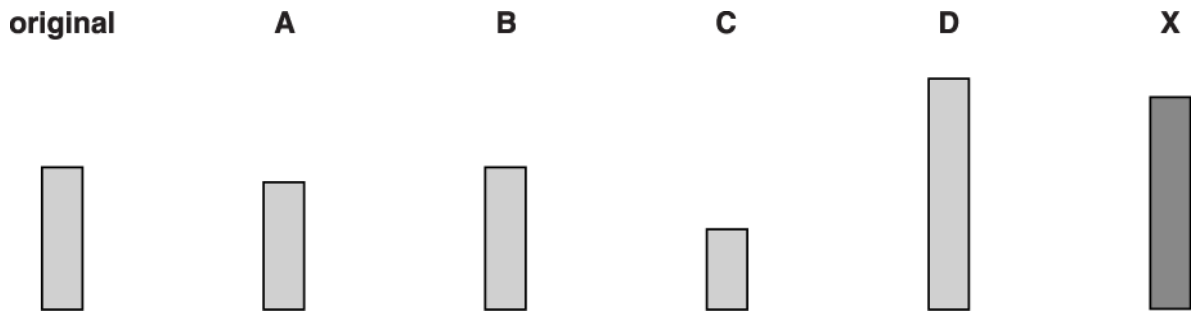
(ii) Kaye has another potato chip, **X**, which has been in a different concentration of sugar solution.

Potato chip **X** was originally cut to the same length as the other chips.

The diagram shows potato chip **X after** soaking for 60 minutes in the sugar solution.

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The label on the test tube containing chip **X** has rubbed off.

Use the results of Kaye's experiment to estimate the concentration of sugar solution (in arbitrary units) in the test tube containing chip **X**.

---

[2]

(b). Active transport is used in the absorption of nitrates by plant roots.

What is **active transport**?

Complete the sentences.

Active transport is the movement of chemicals from low concentration to high concentration

across a _____.

This requires _____ from the process of respiration.

[1]

(c). Suggest why plants growing in water-logged soil may not take up enough nitrates.

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[2]

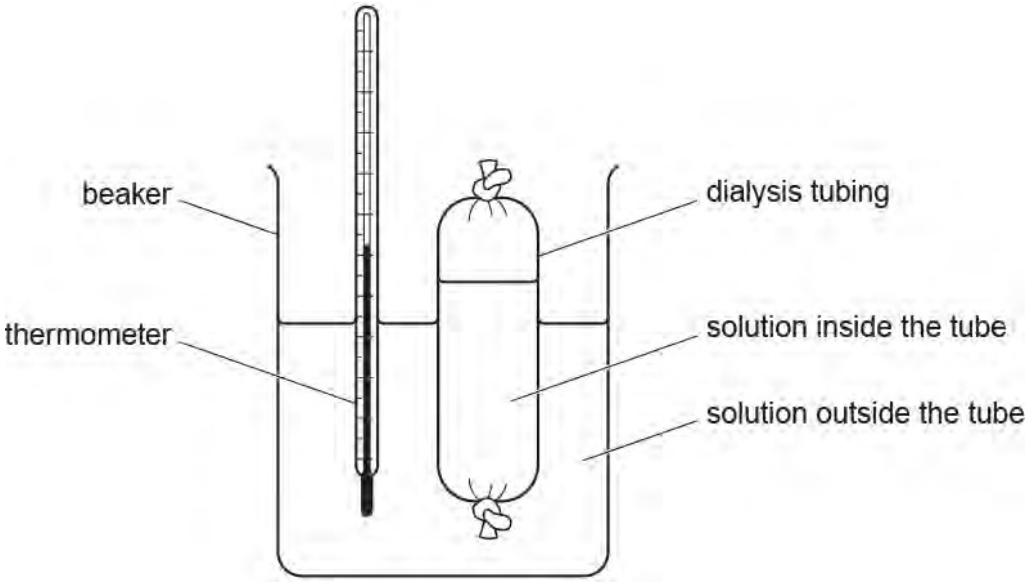
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7(a). Eve sets up three experiments using dialysis tubing.

Dialysis tubing is a partially-permeable membrane.

Each experiment is set up as shown in the diagram:



What is the purpose of the thermometer?

Tick (✓) **one** box.

To control the temperature. ☐

To record the temperature. ☐

To measure the temperature. ☐

To stir the solution. ☐

[1]

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(b). Eve wants to do each of her three experiments at exactly 30 °C.

Describe how Eve could ensure the temperatures of the solutions in each experiment are kept at exactly 30 °C.

---

[1]

(c). Eve sets up the solutions as shown in **Table 2.1**.

Amylase is an enzyme.

Experiment	Solution inside the tube	Solution outside the tube
1	starch + tap water	tap water
2	glucose + tap water	tap water
3	starch + amylase + tap water	tap water

Table 2.1

After 3 minutes she removes a small sample of each solution.

Describe how she could test each sample for the presence of glucose.

---

[2]

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(d). She also uses iodine solution to test each sample for the presence of starch.

Her results are shown in **Table 2.2**.

Experiment	Sample from inside the tube		Sample from outside the tube	
	Test for starch	Test for glucose	Test for starch	Test for glucose
1	positive	negative	negative	negative
2	negative	positive	negative	positive
3	positive	positive	negative	positive

Table 2.2

(i) What conclusions can you make from Eve's results?

---

[4]

(ii) Eve repeats experiment 3, but this time she boils the amylase before using it.

Write a testable prediction for this repeat of experiment 3.

Explain the science behind your prediction.

Prediction ---

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Explanation

[3]

(e). Eve sets up one more experiment as shown in **Table 2.3**.

Experiment	Solution inside the tube	Solution outside the tube
4	starch + tap water	tap water + iodine solution

Table 2.3

The molecules of iodine in the iodine solution are smaller than molecules of glucose.

Eve watches this experiment for 5 minutes.

Describe and explain the changes she is likely to observe during the 5 minutes.

[4]

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8. State the function of stomata in plants.

[1]

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9(a). Nina is learning about substances absorbed by plants. She finds out that plants absorb nitrate ions from the soil.

Explain why nitrate ions are essential for plant growth and survival.

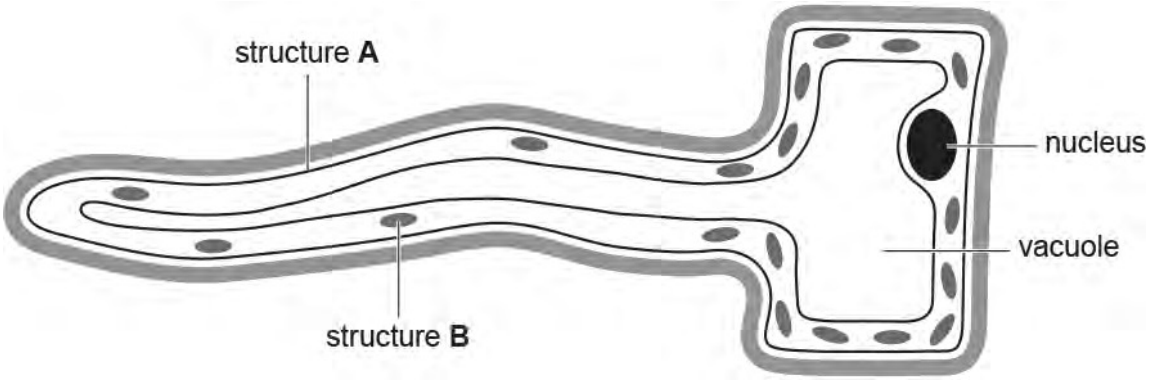
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[2]

(b).

Nitrate ions are absorbed into a plant root through root hair cells.

Nina finds this diagram of a root hair cell.



(i) State the names of structures **A** and **B**.

A ---

B ---

[2]

(ii) Explain the roles of **A** and **B** in transporting nitrate ions into the root hair cell.

A ---

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B

[2]

(iii) The shape of the root hair cell is an adaptation.

Explain how this adaptation helps the root hair cell to absorb nitrate ions more effectively.

[2]

(c). The root hair cells also absorb water from the soil.

Complete the sentences below to describe how water is transported through a plant.

Choose the correct words from the list.

Each word may be used once, more than once or not at all.

diffusion **flowers** **meristem** **osmosis**

phloem **stomata** **xylem**

Water is transported from the soil into the root cells by .....

Water is pulled from roots to leaves through the ..... tissue in the plant stem.

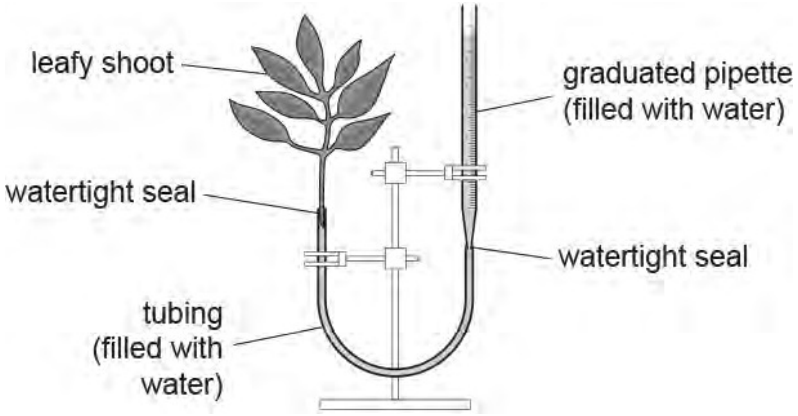
Water molecules are lost from the leaves into the atmosphere because of ..... through open ..... .

[4]

(d). * Nina wants to investigate how changing the light intensity affects the rate of water uptake by a leafy shoot. She sets up a leafy shoot in a simple potometer as shown in the diagram.

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Nina has access to other apparatus including:

fan	glass tank filled with water	lamp	metre ruler
	small heater	stopwatch	thermometer

She does **not** have to use all the apparatus.

Describe the experimental procedure Nina should follow and how she should process her results.

[6]

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END OF QUESTION PAPER

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