AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.2.3 PLANT TISSUES, ORGANS AND SYSTEMS (PACK 1)

SCORE	PERCENTAGE
/279	%

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Q1.

Plants are made up of cells, tissues and organs.

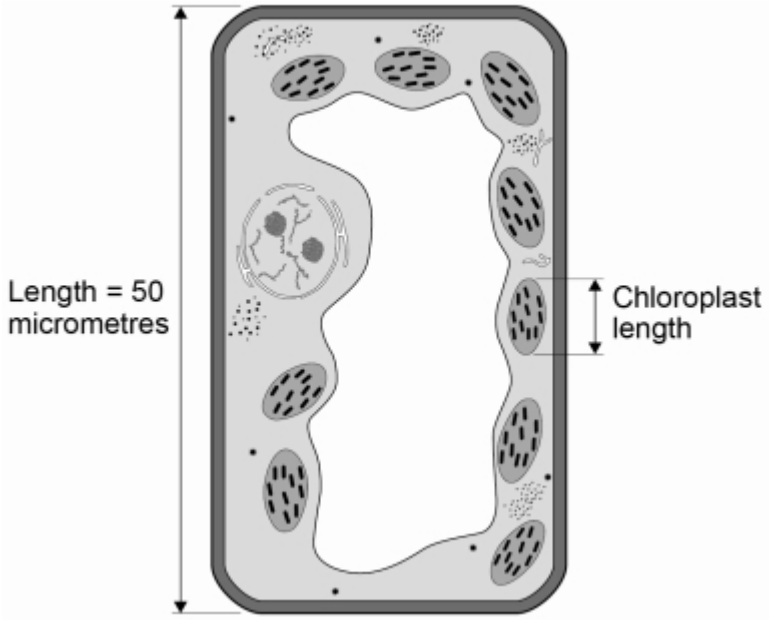
(a) Draw **one** line from each level of organisation to the correct plant part.

Level of organisation	Plant part
	Leaf
Organ	Root hair
	Spongy mesophyll
Tissue	Vacuole
	Xylem

(2)

Figure 1 shows a plant cell drawn to scale.

Figure 1



(b) Where in a plant would the cell in **Figure 1** be found?

Tick **one** box.

Epidermis ☐

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Palisade mesophyll ☐

Phloem ☐

Xylem ☐

(1)

(c) Calculate the length of the chloroplast labelled in **Figure 1**.

_____

_____

_____

_____

Length = _____ micrometres

(2)

(d) Cells in plant roots do **not** photosynthesise.

Give **one** reason why.

_____

_____

(1)

(e) As a plant grows, new root hair cells are formed from unspecialised cells.

How does an unspecialised cell become a new root hair cell?

Tick **one** box.

Differentiation ☐

Metabolism ☐

Transpiration ☐

Transport ☐

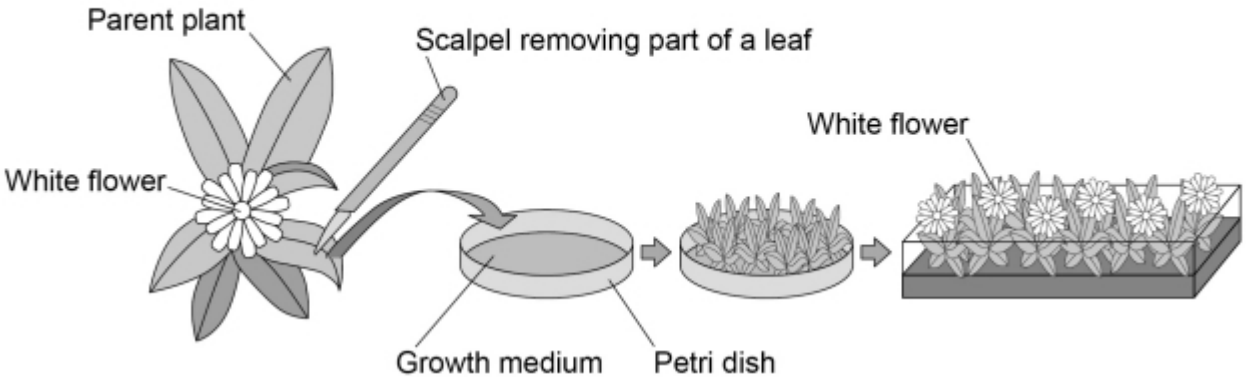
(1)

Scientists can clone plants using tissue culture.

Figure 2 shows the process of tissue culture.

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Figure 2



(f) Why might scientists want to clone plants?

Tick **one** box.

To create new species of plants. ☐

To introduce variation into plants. ☐

To protect endangered plants from extinction. ☐

To reduce disease resistance in plants. ☐

(1)

(g) What is the advantage of cloning plants using tissue culture?

Tick **one** box.

No special equipment is needed. ☐

Plants can be produced quickly. ☐

The flowers are all different colours. ☐

The offspring are all genetically different. ☐

(1)

(h) The growth medium in **Figure 2** helps the plants to grow.

Name **one** substance in the growth medium.

_____

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(1)

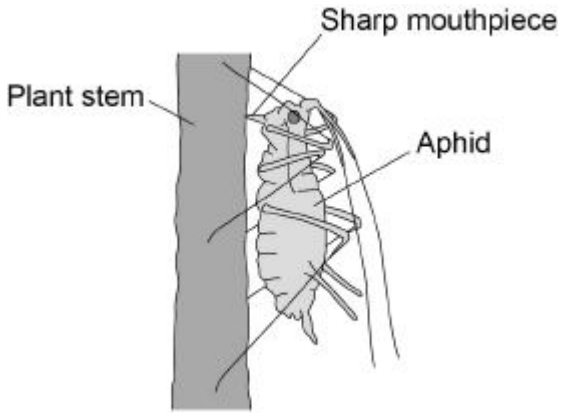
(Total 10 marks)

Q2.

Aphids are small insects that carry pathogens.

Figure 1 shows an aphid feeding from a plant stem.

Figure 1



(a) An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

After feeding, the mouthpiece of an aphid contains a high concentration of dissolved sugars.

Which part of the plant was the aphid feeding from?

Tick **one** box.

Palisade layer ☐

Phloem ☐

Stomata ☐

Xylem ☐

(1)

(b) What is the process that transports dissolved sugars around a plant?

Tick **one** box.

Filtration ☐

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Respiration ☐

Translocation ☐

Transpiration ☐

(1)

(c) Plants infected with aphids have stunted growth.

Explain **one** way the removal of dissolved sugars from the stem of the plant causes stunted growth.

_____

_____

_____

_____

_____

(2)

(d) Most aphids do not have wings when they hatch. After several generations, some aphids hatch which have wings and can fly.

Explain the advantage to the aphid of being able to fly.

_____

_____

_____

_____

_____

(2)

(e) The leaves of some plants release oils onto their surface.

Suggest how the production of oil on the surface of a leaf may protect the plant from aphids.

_____

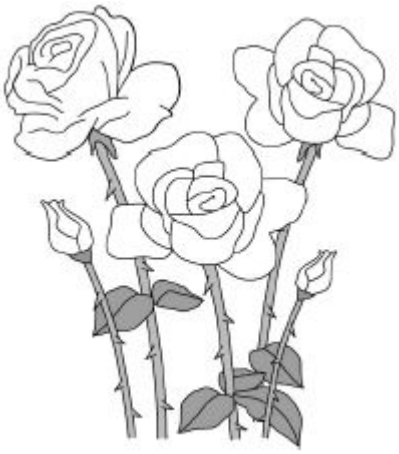
_____

(1)

Figure 2 shows part of a rose plant.

Figure 2

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(f) Give **one** adaptation shown in **Figure 2** that helps the rose plant defend itself.

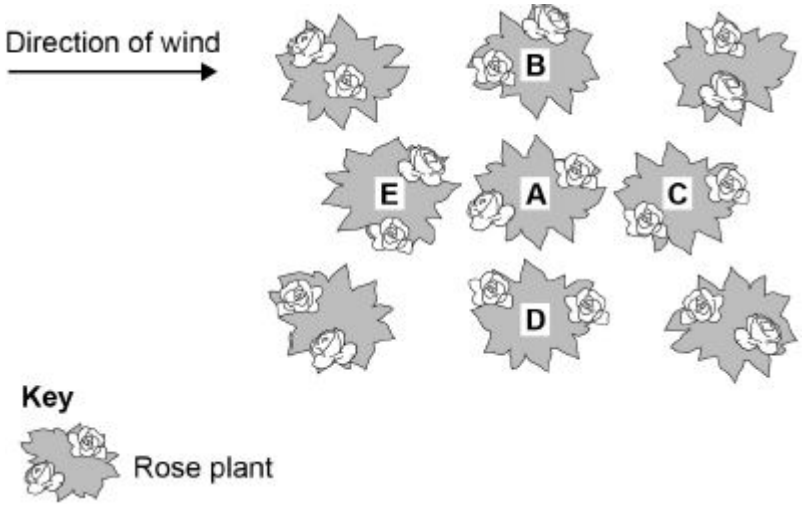
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_____

(1)

Figure 3 shows a plan of a garden containing rose plants.

Figure 3



(g) Plant **A** has the fungal disease rose black spot.

Which plant in **Figure 3** is the fungus likely to spread to first?

Give a reason for your answer.

Plant _____

Reason _____

_____

_____

_____

(2)

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(h) Suggest **one** way the gardener could reduce the spread of rose black spot to the other plants in the garden.

_____

_____

(1)

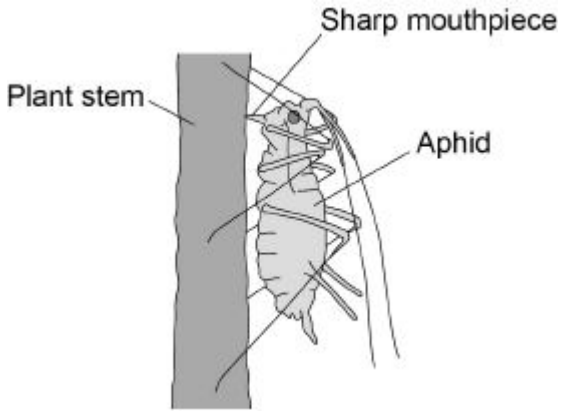
(Total 11 marks)

Q3.

Plants can be infected by fungi, viruses and insects.

Aphids are small insects that carry pathogens.

The diagram below shows an aphid feeding from a plant stem.



(a) An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

Give the reason why the mouthpiece of an aphid contains a high concentration of dissolved sugars after feeding.

_____

_____

(1)

(b) Plants infected with aphids may show symptoms of magnesium deficiency.

Magnesium deficiency symptoms include:

- yellow leaves
- stunted growth.

Explain how a deficiency of magnesium could cause these symptoms.

_____

_____

_____

_____

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_____

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(5)

(c) A farmer thinks a potato crop is infected with potato virus Y (PVY).

The farmer obtains a monoclonal antibody test kit for PVY.

To make the monoclonal antibodies a scientist first isolates the PVY protein from the virus.

Describe how the scientist would use the protein to produce the PVY monoclonal antibody.

_____

_____

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(4)

(Total 10 marks)

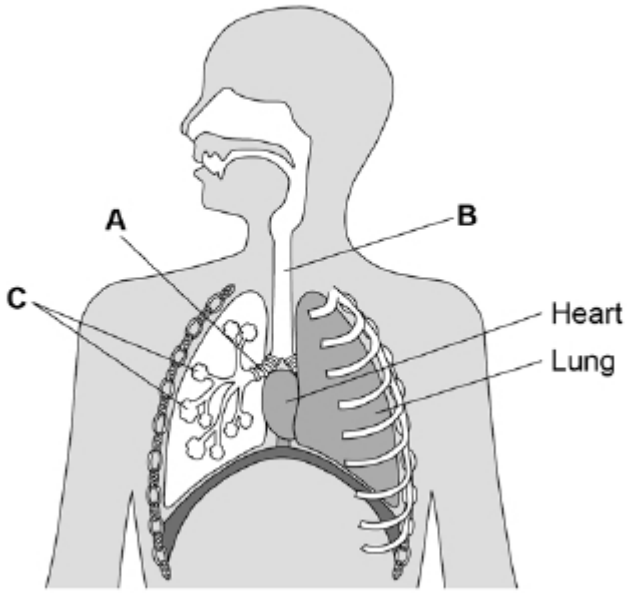
Q4.

Animals and plants contain organs and tissues.

Figure 1 shows some organs in the human thorax.

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Figure 1



(a) Name parts **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b) Which organ system is the heart part of?

Tick **one** box.

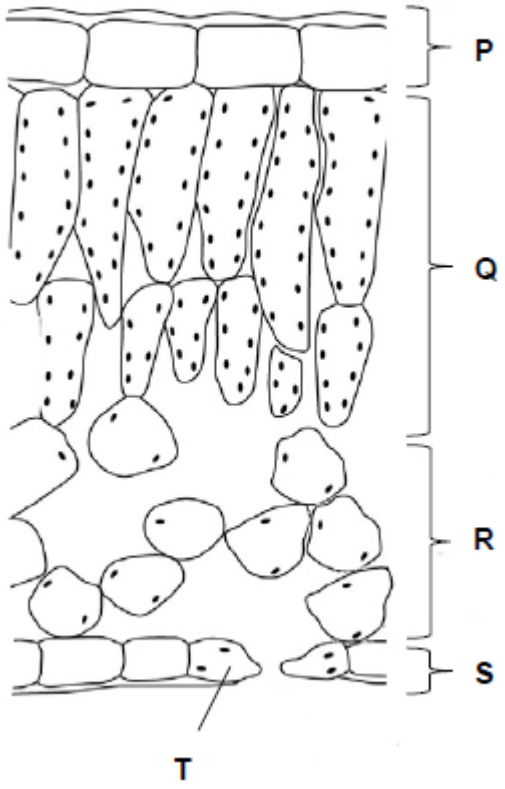
- Breathing system ☐
- Circulatory system ☐
- Digestive system ☐
- Excretory system ☐

(1)

Figure 2 shows a cross section of a leaf.

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Figure 2



(c) In which part of the leaf does most photosynthesis take place?

Tick **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

(1)

(d) What is part **T**?

Tick **one** box.

Guard cell ☐

Phloem ☐

Stoma ☐

Xylem ☐

(1)

(e) A leaf is an organ made of tissues.

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What is a tissue?

_____

_____

(1)

(f) Draw **one** line from each tissue to its function.

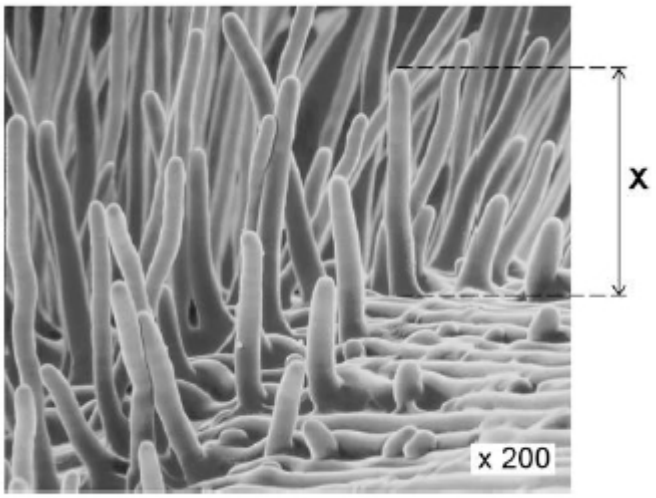
Tissue	Function
	Allows diffusion of gases through the leaf
Epidermis	Allows light through to the photosynthesising parts of the leaf
Phloem	Allows water into the leaf
Spongy mesophyll	Transport sugars around the plant
	Transports water around the plant

(3)

(Total 10 marks)

Q5.

The image below shows part of a root from a cress plant.



(a) What type of microscope was used to create the image above?

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_____

(1)

(b) The magnification of the cress root in the image above is × 200.
There are 1000 micrometres (μm) in a millimetre (mm).

Calculate the real length of the root hair, **X**.
Give your answer in micrometres (μm).

_____

_____

_____

_____

Real length **X** = _____ μm

(2)

(c) Root hair cells take up water from the soil.

Explain **one** way in which the root hair cell is adapted to this function.

_____

_____

_____

_____

(2)

The table shows the water uptake by a plant's roots on two different days.

	Mean water uptake in cm^3 per hour
Cold day	1.8
Hot day	3.4

(d) Explain why the mean rate of water uptake is higher on a hot day than on a cold day.

_____

_____

_____

_____

_____

_____

(3)

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(e) The concentration of mineral ions in the soil is lower than in root hair cells.
Root hair cells take up mineral ions from the soil.
Root hair cells contain mitochondria.

Explain why root hair cells contain mitochondria.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 12 marks)

Q6.

A student carried out an investigation using leaf epidermis.

This is the method used.

1. Peel the lower epidermis from the underside of a leaf.
2. Cut the epidermis into six equal sized pieces.
3. Place each piece of lower epidermis into a different Petri dish.
4. Add 5 cm^3 of salt solution to the six Petri dishes. Each Petri dish should have a different concentration of salt solution.
5. After 1 hour, view each piece of epidermis under a microscope at ×400 magnification.
6. Count and record the total number of stomata present and the number of open stomata that can be seen in one field of view.

The student's results are shown in the table.

Concentration of salt solution in mol / dm^3	**Number of stomata in field of view**	**Number of open stomata in field of view**	**Percentage (%) of open stomata in field of view**
0.0	7	7	100
0.1	8	8	100
0.2	7	6	**X**
0.3	9	6	67

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0.4	10	4	40
0.5	9	2	22

(a) Calculate value **X** in the table above.

_____

_____

X = _____ %

(1)

(b) Give **one** conclusion from the results in the table above.

_____

_____

(1)

(c) How could the student find out what concentration of salt solution would result in half of the stomata being open?

_____

_____

(1)

(d) The student measured the real diameter of the field of view to be 0.375 mm.

Calculate the number of open stomata per mm^2 of leaf for the epidermis placed in 0.4 mol / dm^3 salt solution.

Use information from the table above.

Take π to be 3.14

_____

_____

_____

_____

_____

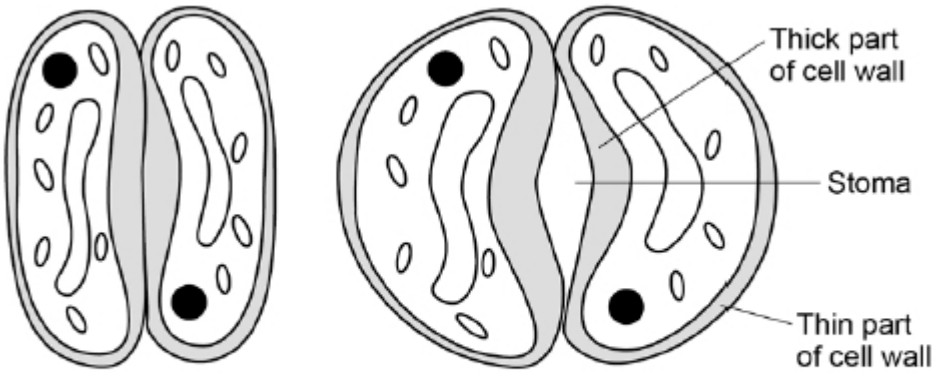
_____

Number of open stomata = _____ per mm^2

(3)

(e) The diagram below shows two guard cells surrounding a closed stoma and two guard cells surrounding an open stoma.

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When light intensity is high potassium ions are moved into the guard cells.

Describe how the movement of potassium ions into the guard cells causes the stoma to open.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

Q7.

Plants transport water and mineral ions from the roots to the leaves.

(a) Plants move mineral ions:

- from a low concentration in the soil
- to a high concentration in the root cells.

What process do plants use to move these minerals ions into root cells?

Tick **one** box.

Active transport ☐

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Diffusion ☐

Evaporation ☐

Osmosis ☐

(1)

(b) Describe how water moves from roots to the leaves.

_____

_____

_____

_____

(2)

(c) Plants lose water through the stomata in the leaves.

The epidermis can be peeled from a leaf.

The stomata can be seen using a light microscope.

The table below shows the data a student collected from five areas on one leaf.

Leaf area	**Number of stomata**	
	Upper surface	**Lower surface**
1	3	44
2	0	41
3	1	40
4	5	42
5	1	39
Mean	**2**	**X**

Describe how the student might have collected the data.

_____

_____

_____

_____

_____

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_____

_____

_____

(3)

(d) What is the median number of stomata on the upper surface of the leaf?

_____

(1)

(e) Calculate the value of **X** in the table.

Give your answer to 2 significant figures.

_____

_____

Mean number of stomata on lower surface of leaf = _____

(2)

(f) The plant used in this investigation has very few stomata on the upper surface of the leaf.

Explain why this is an **advantage** to the plant.

_____

_____

_____

_____

(2)

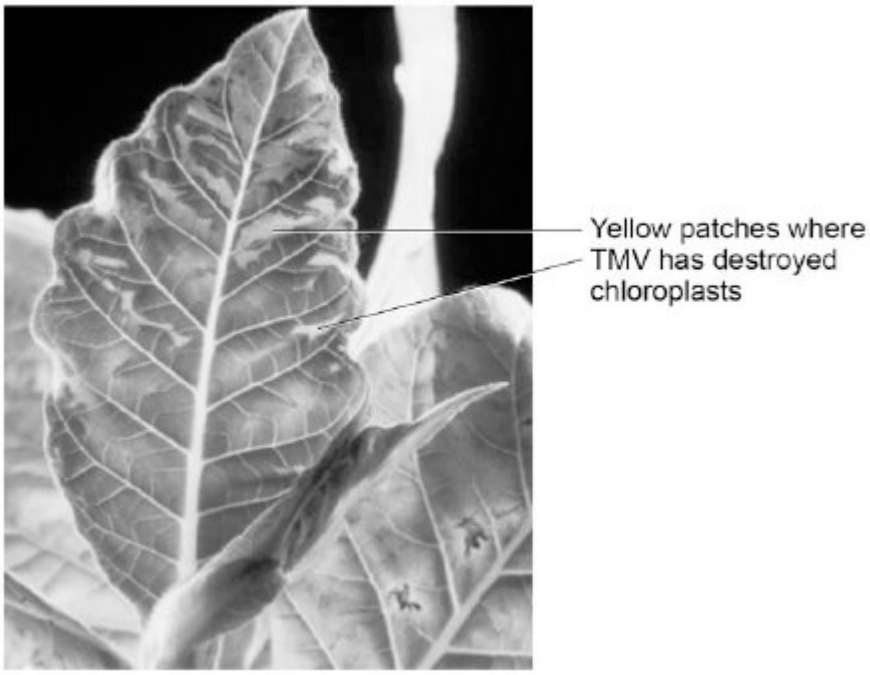
(Total 11 marks)

Q8.

Tobacco mosaic virus (TMV) is a disease affecting plants.

The diagram below shows a leaf infected with TMV.

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© Nigel Cattlin/Visuals Unlimited/Getty Images

(a) All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

_____

_____

(1)

(b) Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

_____

_____

(1)

(c) Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

_____

_____

_____

_____

(2)

(d) TMV can cause plants to produce less chlorophyll.

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This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

_____

_____

_____

_____

_____

_____

_____

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_____

(4)

(Total 8 marks)

Q9.

Carbon dioxide enters a plant through stomata on the leaves.

(a) Name the cells that control the size of the stomata.

_____

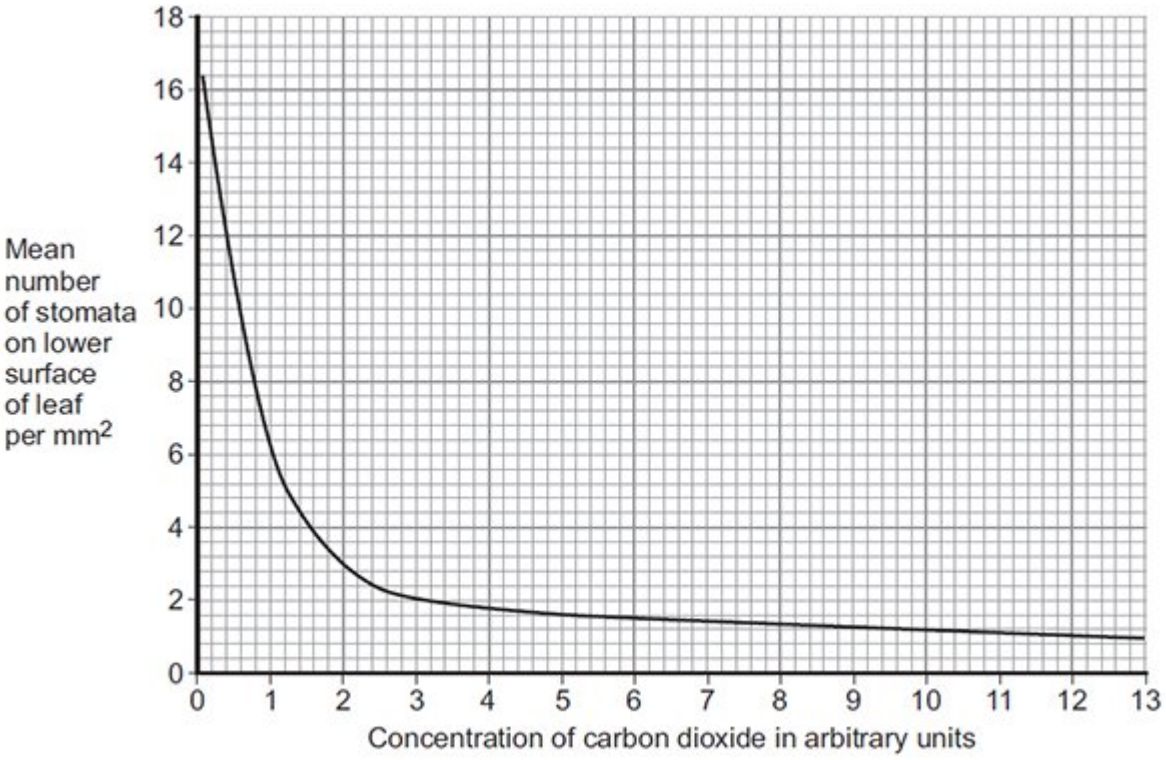
(1)

(b) Scientists grew tomato plants in air containing different concentrations of carbon dioxide.

The scientists recorded the number of stomata found on the lower surface of the leaves of plants grown at each carbon dioxide concentration.

The graph below shows the results.

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(i) Describe the relationship between the mean number of stomata per mm^2 and carbon dioxide concentration.

_____

_____

_____

_____

(2)

(ii) Suggest a reason for the relationship you described in part **(b)(i)**.

_____

_____

(1)

(c) (i) Suggest **one** disadvantage to a plant of having a large number of stomata per mm^2 on each leaf.

_____

_____

(1)

(ii) Suggest **one** environmental condition where a large number of stomata per mm^2 on each leaf would be a disadvantage.

_____

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_____

(1)

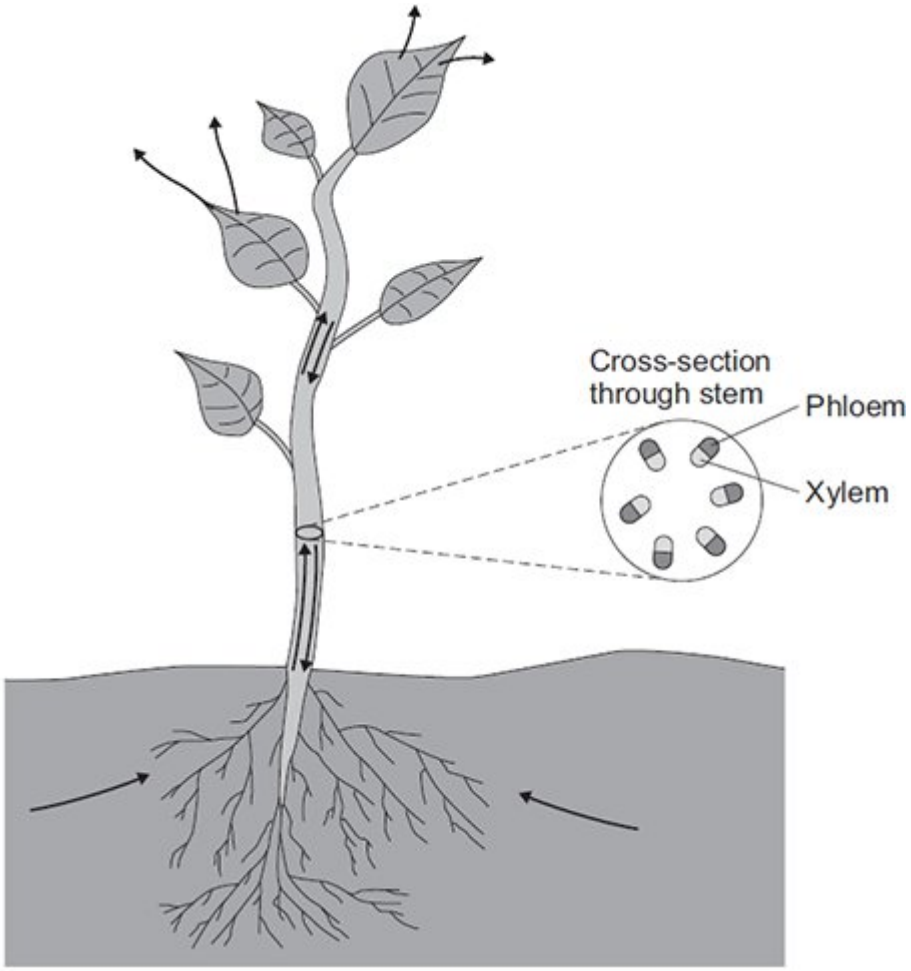
(Total 6 marks)

Q10.

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Plants transport many substances between their leaves and roots.

The diagram below shows the direction of movement of substances through a plant.



Describe how **ions**, **water** and **sugar** are obtained and transported through plants.

In your answer you should refer to materials moving upwards in a plant and to materials moving downwards in a plant.

_____

_____

_____

_____

_____

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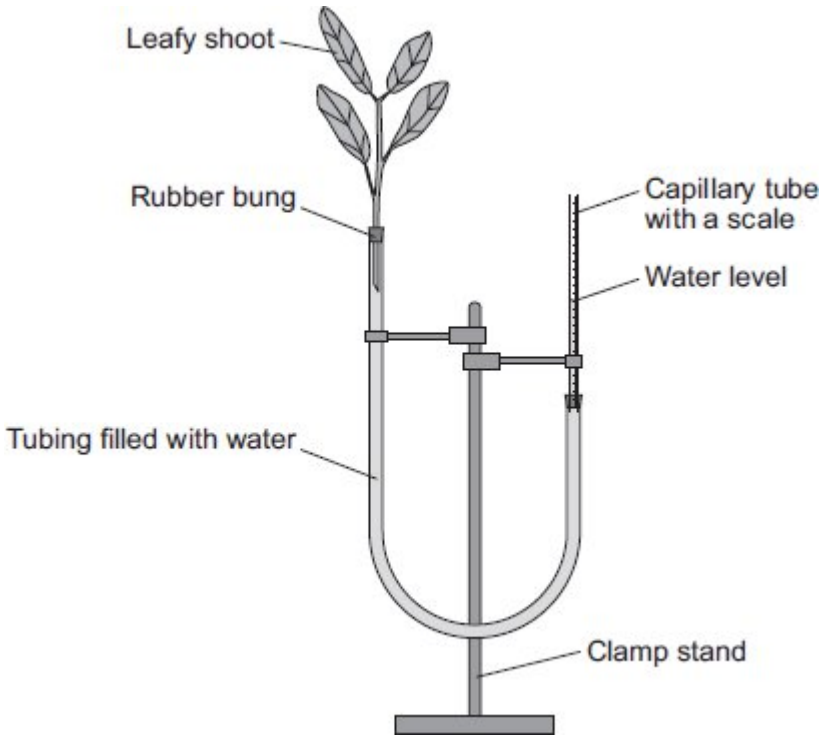
(Total 6 marks)

Q11.

A potometer is a piece of apparatus that can be used to measure water uptake by a leafy shoot.

Figure 1 shows a potometer.

Figure 1



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Some students used a potometer like the one shown in **Figure 1.**

- They measured the water taken up by a shoot in normal conditions in a classroom.
- As the water was taken up by the shoot, the level of water in the capillary tube went down.
- The students recorded the level of the water in the capillary tube at 2-minute intervals for 10 minutes.

Table 1 shows the students' results.

Table 1

Time in minutes	0	2	4	6	8	10
Level of water (on scale) in capillary tube in mm	2.5	3.6	4.4	5.4	6.5	7.5

The area of the cross section of the capillary tube was 0.8 mm^2.

(a) (i) Complete the following calculation to find the volume of water taken up by the shoot in mm^3 per minute.

Distance water moved along the scale in 10 minutes = _____ mm

Volume of water taken up by the shoot in 10 minutes = _____ mm^3

Therefore, volume of water taken up by the shoot in 1 minute = _____ mm^3

(3)

(ii) The students repeated the investigation but this time placed the potometer next to a fan blowing air over the leafy shoot.

Suggest how the results would be different. Give a reason for your answer.

_____

_____

_____

_____

(2)

(b) The students repeated the investigation at different temperatures.

The results are shown in **Table 2.**

Table 2

Temperature in °C	**Rate of water uptake in mm^3 per minute**
10	0

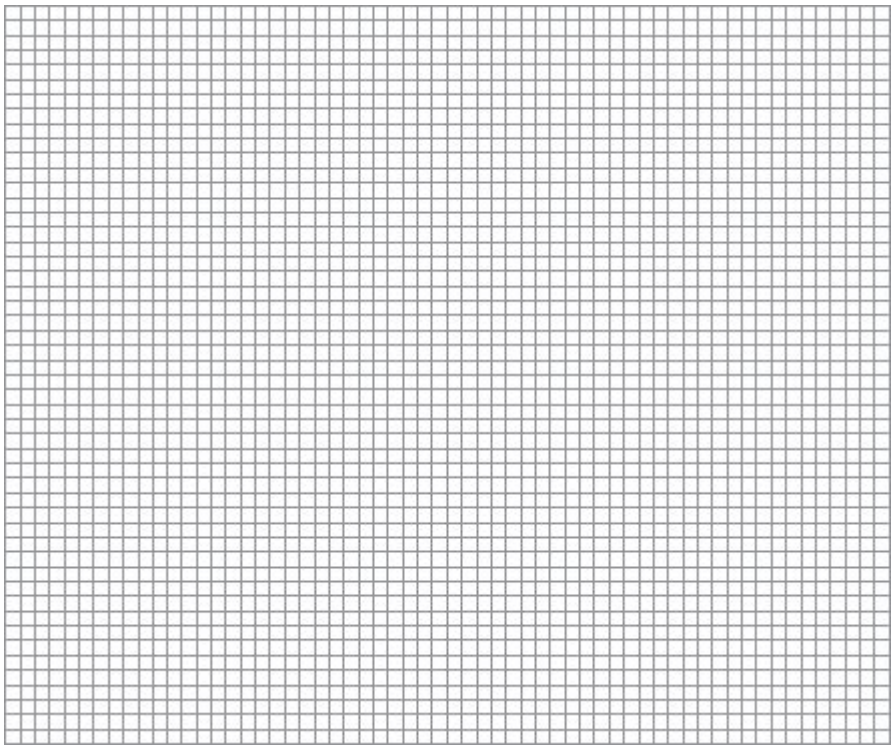
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15	0.4
20	1.0
25	2.1
30	3.2
35	4.0
40	4.4

Plot the data from **Table 2** on the graph paper in **Figure 2**.

Choose suitable scales, label both axes and draw a line of best fit.

Figure 2



(5)

(c) What would happen to the leaves if the potometer was left for a longer time at 40 °C?

Explain your answer.

_____

_____

_____

_____

_____

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_____

(3)

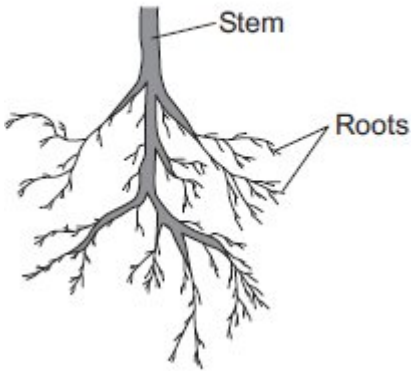
(Total 13 marks)

Q12.

Plants need different substances to survive.

Figure 1 shows the roots of a plant.

Figure 1



(a) (i) Mineral ions are absorbed through the roots.

Name **one** other substance absorbed through the roots.

_____

(1)

(ii) The plant in **Figure 1** has a higher concentration of mineral ions in the cells of its roots than the concentration of mineral ions in the soil.

Which **two** statements correctly describe the absorption of mineral ions into the plant's roots?

Tick (✓) **two** boxes.

The mineral ions are absorbed by active transport. ☐

The mineral ions are absorbed by diffusion. ☐

The mineral ions are absorbed down the concentration gradient. ☐

The absorption of mineral ions needs energy. ☐

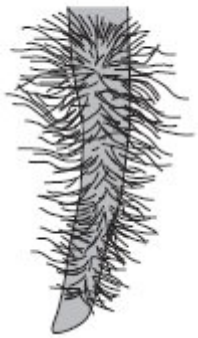
(2)

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(iii) The plant in **Figure 1** has roots adapted for absorption.

Figure 2 shows a magnified part of a root from **Figure 1.**

Figure 2



Describe how the root in **Figure 2** is adapted for absorption.

_____

_____

_____

_____

(2)

(b) The leaves of plants have stomata.

What is the function of the stomata?

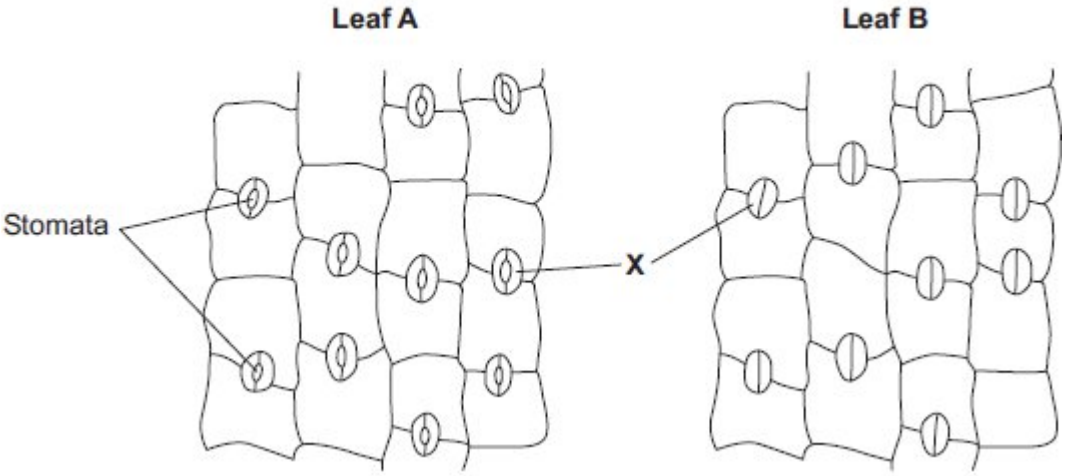
_____

_____

(1)

(c) **Figure 3** shows the underside of two leaves, **A** and **B**, taken from a plant in a man's house.

Figure 3



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(i) In **Figure 3**, the cells labelled **X** control the size of the stomata.

What is the name of the cells labelled **X**?

Tick (✓) **one** box.

Guard cells ☐

Phloem cells ☐

Xylem cells ☐

(1)

(ii) Describe how the appearance of the stomata in leaf **B** is different from the appearance of the stomata in leaf **A**.

_____

_____

(1)

(iii) The man forgets to water the plant.

What might happen to the plant in the next few days if the stomata stay the same as shown in leaf **A** in **Figure 3**?

_____

_____

(1)

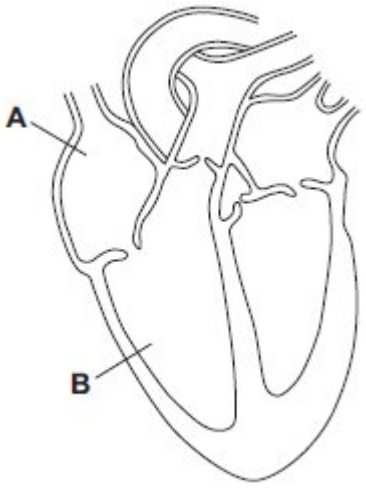
(Total 9 marks)

Q13.

Diagram 1 shows a section through the heart.

Diagram 1

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(a) Use words from the box to name the structures labelled **A** and **B** on **Diagram 1**.

aorta	**atrium**	**pulmonary artery**	**ventricle**

A _____

B _____

(2)

(b) The tissue in the wall of the heart contracts.

(i) What type of tissue is this?

Tick (✓) **one** box.

muscular ☐

glandular ☐

epithelial ☐

(1)

(ii) What does the heart do when this tissue contracts?

_____

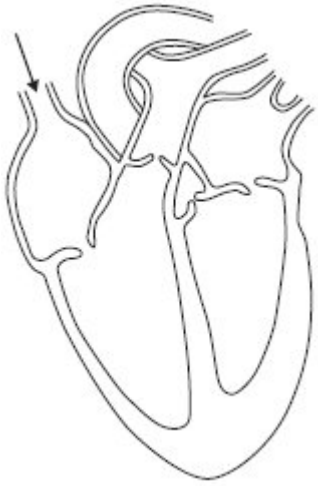
_____

(1)

(c) Draw arrows on **Diagram 2** to complete the route taken by deoxygenated blood through the heart.

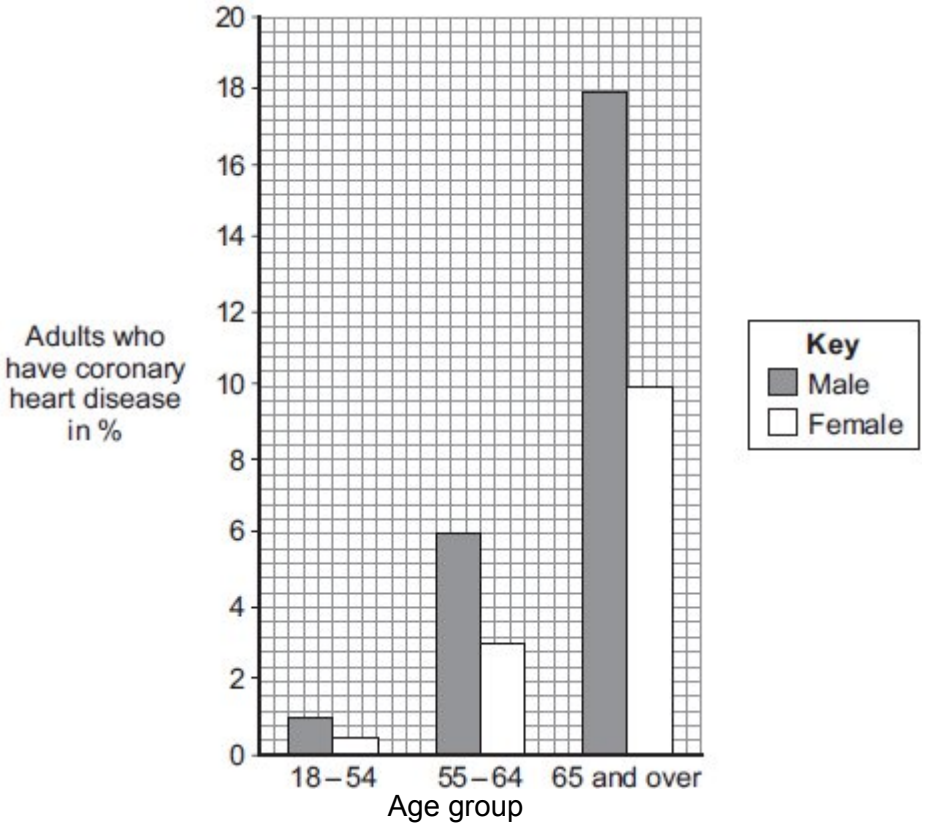
Diagram 2

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(2)

(d) The graph shows the percentage (%) of adults in the UK who have coronary heart disease.



(i) Look at the graph.

Which group of people is **most** at risk of having coronary heart disease in the UK?

_____

(2)

(ii) Explain what happens to the heart in coronary heart disease.

_____

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_____

_____

_____

_____

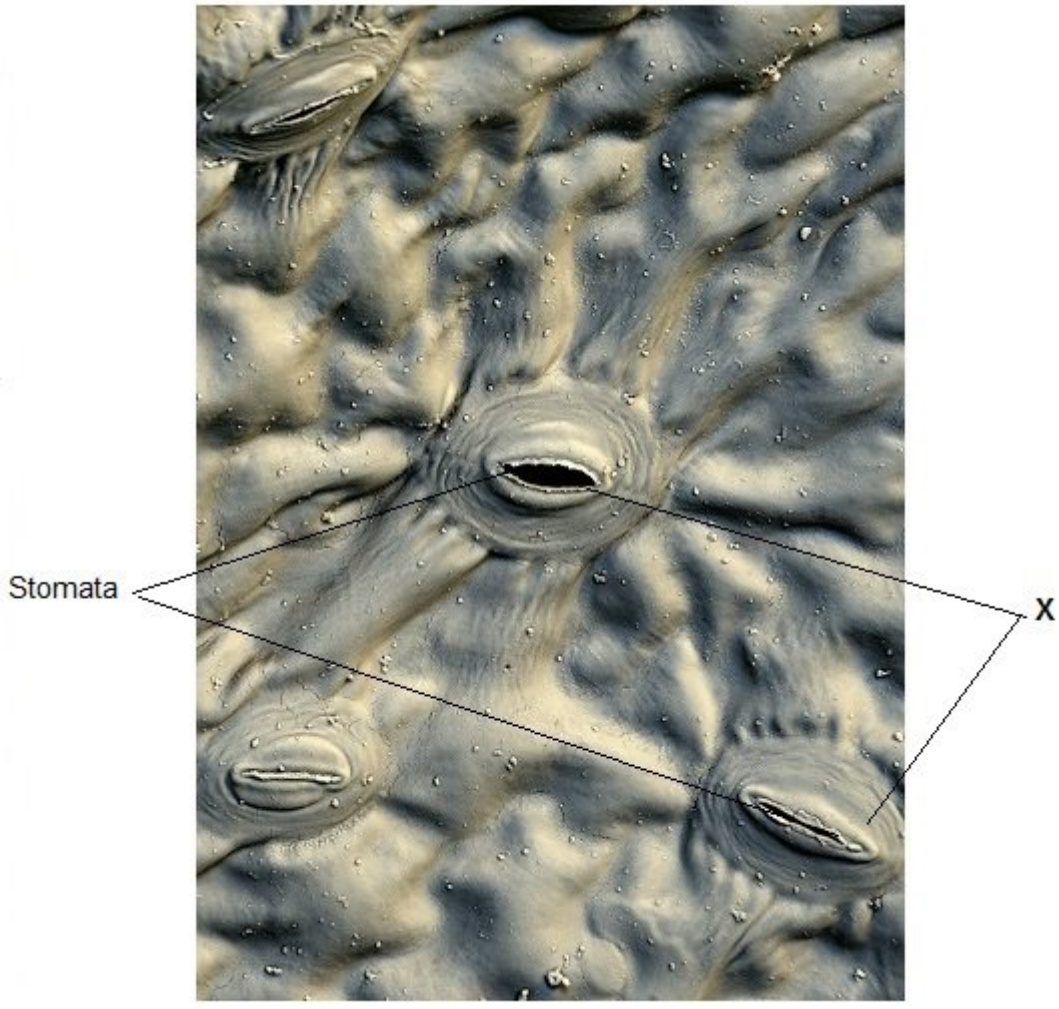
_____

(3)

(Total 11 marks)

Q14.

The image below shows some cells on the lower surface of a leaf.



© Stefan Diller/Science Photo Library

(a) What are the cells labelled **X** called?

Draw a ring around the correct answer.

guard cells **palisade cells** **mesophyll cells**

(1)

(b) Water loss by evaporation from leaves is called **transpiration**.

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A student set up an experiment to investigate water loss from leaves.

The student:

- took two leaves, **A** and **B**, from a plant
- put Vaseline (grease) on both sides of **Leaf B**; did nothing to **Leaf A**
- wrote down the mass of each leaf
- attached the leaves onto a string as shown in the diagram below.



Leaf A
(no treatment)

Leaf B
(both surfaces covered in Vaseline)

- left the leaves for 48 hours
- wrote down the mass of each leaf again
- calculated the percentage (%) change in mass for each leaf.

(i) Give **one** variable that the student controlled in this investigation.

_____

_____

(1)

(ii) The mass of **Leaf A** was 1.60 g at the start of the investigation. After 48 hours it was 1.28 g.

Calculate the % decrease in mass over 48 hours.

_____

_____

% decrease = _____

(2)

(c) Vaseline blocks the stomata.

The % change in mass of **Leaf B** was less than **Leaf A** after 48 hours.
Explain why.

_____

_____

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_____

(1)

(d) Give **three** environmental conditions that would increase transpiration.

1. _____

2. _____

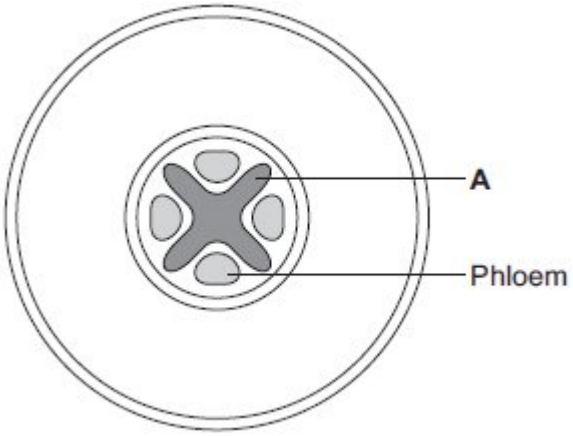
3 _____

(3)

(Total 8 marks)

Q15.

The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



(a) (i) What is tissue **A**?

Draw a ring around the correct answer.

cuticle **epidermis** **xylem**

(1)

(ii) Name **two** substances transported by tissue **A**.

1. _____

2. _____

(2)

(b) Phloem is involved in a process called translocation.

(i) What is translocation?

_____

_____

_____

(1)

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(ii) Explain why translocation is important to plants.

_____

_____

_____

_____

(2)

(c) Plants must use active transport to move some substances from the soil into root hair cells.

(i) Active transport needs energy.

Which part of the cell releases most of this energy?

Tick (✓) **one** box.

mitochondria ☐

nucleus ☐

ribosome ☐

(1)

(ii) Explain why active transport is necessary in root hair cells.

_____

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

Q16.

(a) Dodder is an unusual flowering plant. It is a parasite.

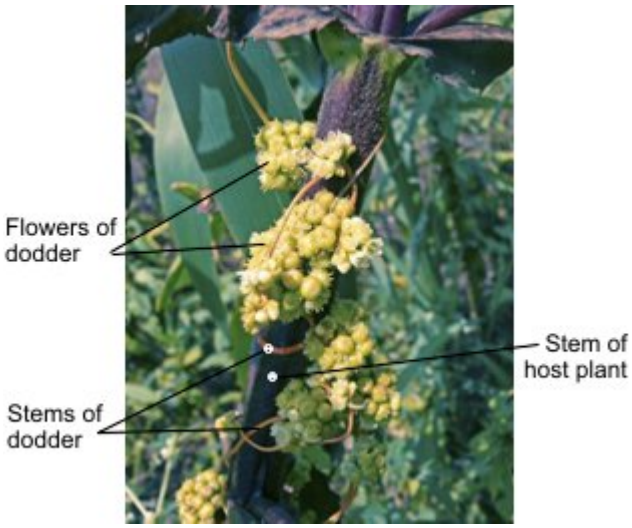
The dodder plant:

- has no chlorophyll
- has no roots

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- has no leaves
- grows attached to the stem of a host plant.

The image below shows dodder attached to its host plant.



© yogesh_more/iStock/Thinkstock

(i) Dodder has no chlorophyll. Most plants have leaves containing chlorophyll.

What is the function of chlorophyll in most plants?

_____

_____

_____

_____

(2)

(ii) Parts of the dodder stem grow into the host stem and attach to the host's phloem tissue.

Suggest why it is helpful to the dodder plant to be attached to the host's phloem tissue.

_____

_____

(1)

(iii) Suggest why the dodder will have a harmful effect on the host plant.

_____

_____

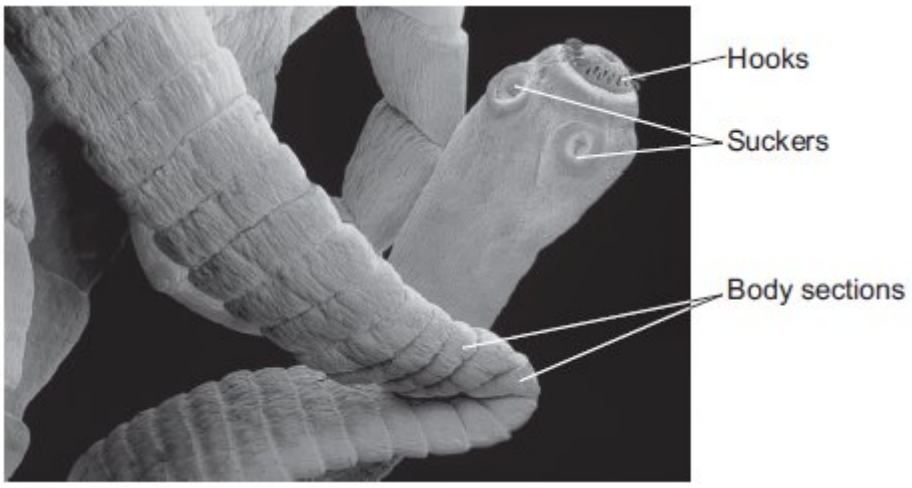
(1)

(b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

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The tapeworm is another parasite.

The image below shows part of a tapeworm.



© Science Photo Library

The tapeworm lives inside the small intestine of a mammal.

Describe and explain how the tapeworm is adapted for living inside the small intestine of its host.

Extra space

_____

_____

(6)

(Total 10 marks)

Q17.

Substances are transported through plants.

(a) Use the correct answer from the box to complete each sentence.

capillary	**guard cells**	**phloem**
stomata	**transpiration**	**xylem**

(i) Water is transported from the roots to the stem of a plant

in the _____ .

(1)

(ii) Dissolved sugars are transported through the plant

in the _____ .

(1)

(iii) Movement of water through the plant is called the

_____ stream.

(1)

(iv) Water vapour moves out of the plant through pores

called _____ .

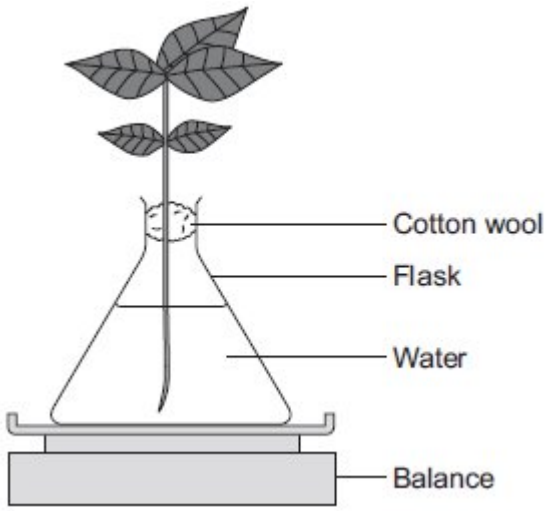
(1)

(b) Students investigated the effect of different conditions on water loss from leaves.

The apparatus is shown in **Figure 1**.

Figure 1

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The students set up four flasks, **A**, **B**, **C** and **D**.

The students:

- used the same size plant shoot in each flask
- recorded the mass of the flask and plant shoot at the start of each experiment
- left each flask and plant shoot in different conditions
- recorded the mass of each flask and plant shoot after 2 hours.

Table 1 shows the conditions that flasks **A**, **B**, **C** and **D** were left in for 2 hours.

Table 1

Flask	Temperature in °C	Fan or no fan
A	20	No Fan
B	20	Fan
C	35	No Fan
D	35	Fan

(i) Suggest why the students used cotton wool in each flask.

_____

_____

(1)

(ii) The use of the same size of plant shoot made the investigation a fair test.

Explain why.

_____

_____

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_____

_____

_____

(2)

(iii) **Table 2** shows the students' results.

Table 2

Flask	Conditions		Mass at the start in grams	Mass after 2 hours in grams	Mass of water lost in 2 hours in grams
	Temperature in °C	Fan or no fan			
A	20	No Fan	150.0	148.1	1.9
B	20	Fan	152.0	148.5	3.5
C	35	No Fan	149.0	145.9	3.1
D	35	Fan	150.0	145.5	

What mass of water was lost by the plant shoot in flask **D**?

_____

_____

_____ grams

(1)

(iv) Suggest what conclusion can be made about the effect of temperature on water loss from the plant shoot.

_____

_____

_____

(1)

(v) Suggest what conclusion can be made about the effect of the fan on water loss from the plant shoot.

_____

_____

_____

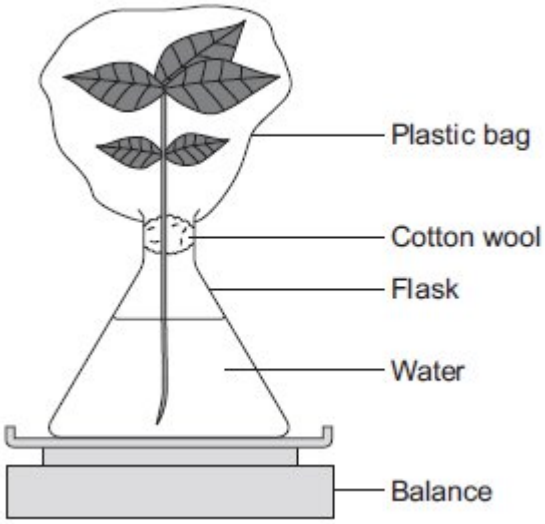
(1)

(c) The students carried out another experiment at 20 °C, with no fan.

The students used the apparatus in **Figure 2**.

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Figure 2



In this experiment, the students:

- recorded the mass of the flask and plant shoot before tying the plastic bag around the plant shoot
- removed the bag after 2 hours and recorded the mass again.

(i) What mass of water would be lost from the plant shoot in 2 hours?

Draw a ring around the correct answer.

0.3 g **1.9 g** **3.9 g**

(1)

(ii) Give a reason for your answer to part **(c)(i)**.

_____

_____

_____

(1)

(Total 12 marks)

Q18.

Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

_____

_____

_____

_____

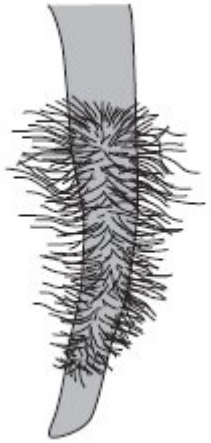
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_____

_____

(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.

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Q19.

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.

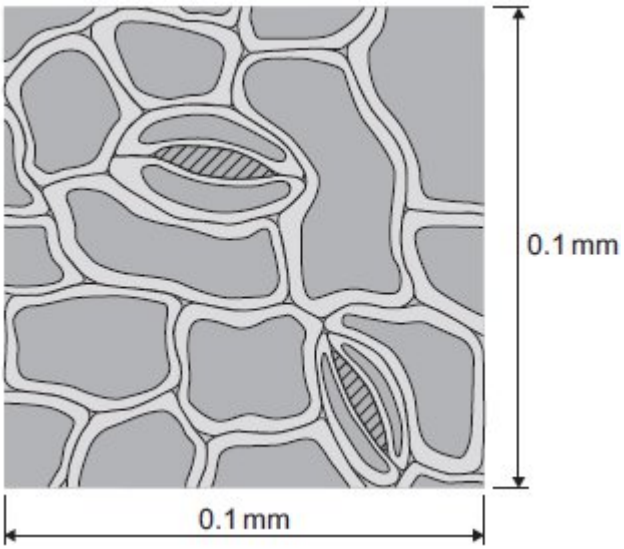
_____

_____

(1)

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(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 mm^2 of this leaf surface.

_____

_____

_____ per mm^2

(2)

(ii) A different plant species has 400 stomata per mm^2 of leaf surface.

Having a large number of stomata per mm^2 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

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- 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)

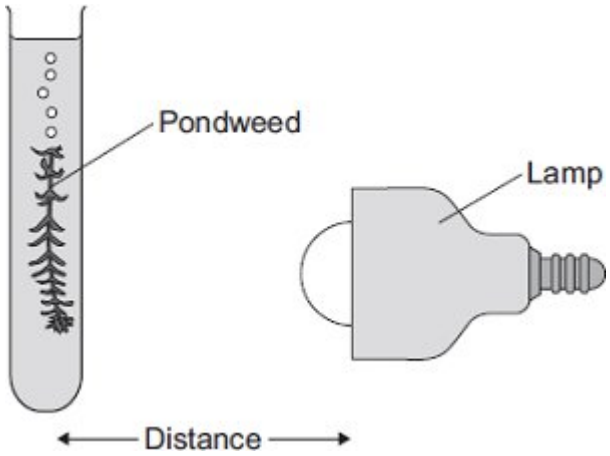
Q20.

Some students investigated the effect of light intensity on the rate of photosynthesis.

They used the apparatus shown in **Diagram 1**.

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Diagram 1



The students:

- placed the lamp 10 cm from the pondweed
- counted the number of bubbles of gas released from the pondweed in 1 minute
- repeated this for different distances between the lamp and the pondweed.

(a) The lamp gives out heat as well as light.

What could the students do to make sure that heat from the lamp did **not** affect the rate of photosynthesis?

_____

_____

(1)

(b) The table shows the students' results.

Distance in cm	Number of bubbles per minute
10	84
15	84
20	76
40	52
50	26

(i) At distances between 15 cm and 50 cm, light was a limiting factor for photosynthesis.

What evidence is there for this in the table?

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_____

_____

(1)

(ii) Give **one** factor that could have limited the rate of photosynthesis when the distance was between 10 cm and 15 cm.

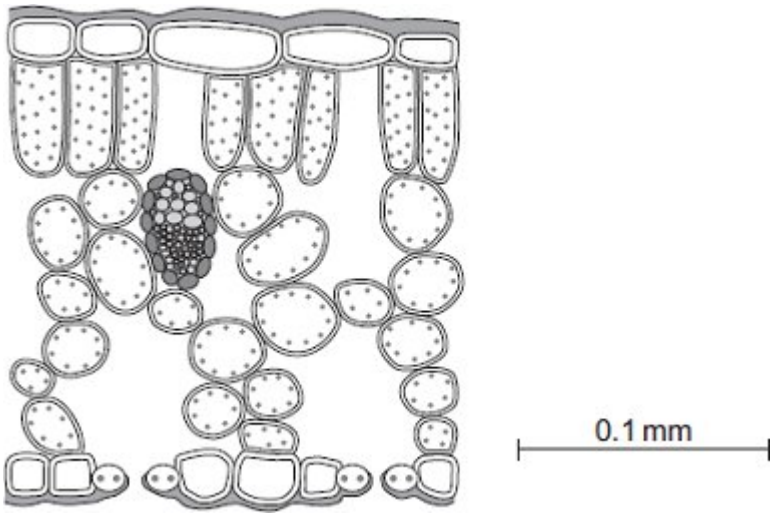
_____

(1)

(c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Diagram 2 shows a section through a plant leaf.

Diagram 2



Describe the structure of the leaf and the functions of the tissues in the leaf.

You should use the names of the tissues in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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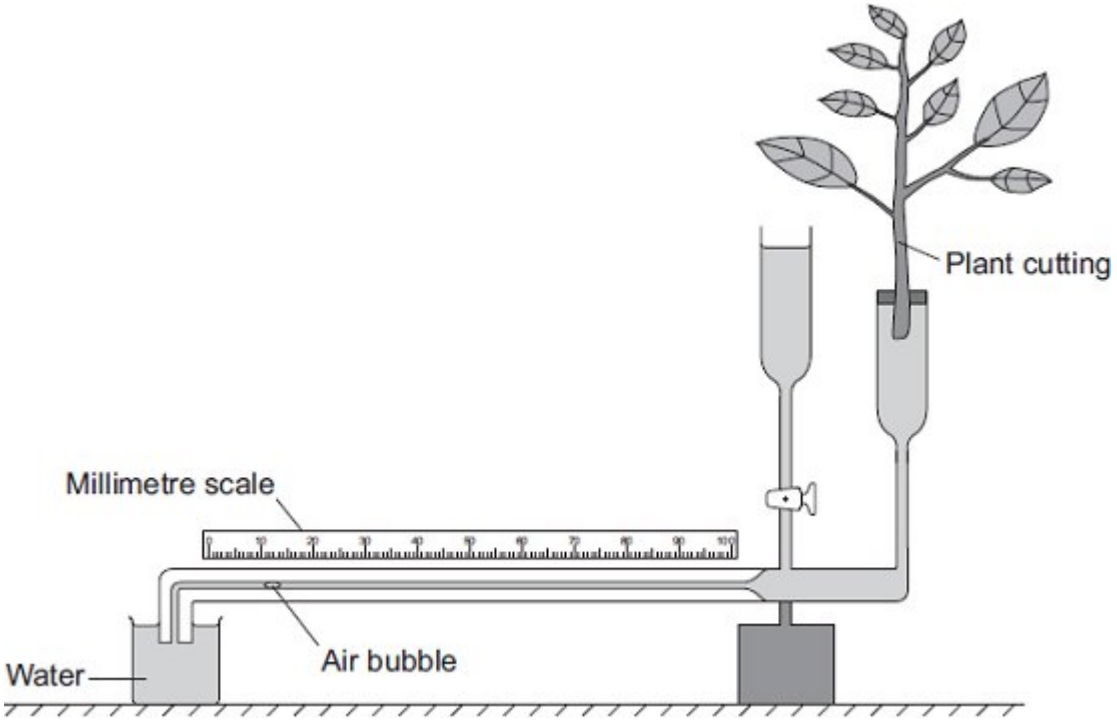
_____

(6)

(Total 9 marks)

Q21.

Some students used the apparatus shown in the diagram to measure the rate of water uptake by a plant cutting.



The students set up the apparatus in three different conditions:

- no wind at 15°C
- no wind at 25°C
- wind at 25°C

For each experiment, the students recorded the movement of the air bubble along the scale.

(a) (i) Name the **two** variables the students chose to change in these experiments.

1. _____

2. _____

(2)

(ii) It was important to use the same plant cutting each time to make these experiments fair.

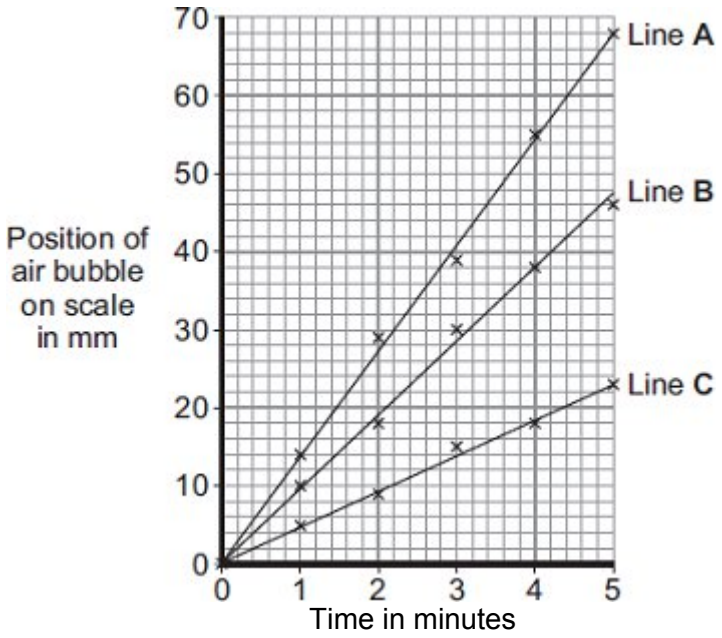
Explain why.

_____

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(1)

(b) The graph shows the students' results.



Which line on the graph, **A**, **B** or **C**, shows the results for each of the three different experiments?

Write each of the letters, **A**, **B** and **C**, in the correct boxes in the table.

Conditions	Letter
No wind at 15°C	
No wind at 25°C	
Wind at 25°C	

(2)

(c) Water is lost from the leaves of the plant cutting.

Name this process.

Draw a ring around **one** answer.

distillation **respiration** **transpiration**

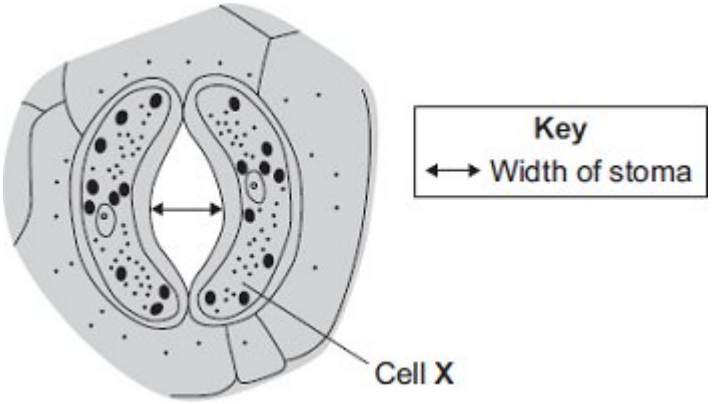
(1)

(Total 6 marks)

Q22.

Plant leaves have many stomata.
The diagram shows a stoma.

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(a) Name cell **X** _____

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	**Mean width of stomata as a percentage of their maximum width**	
		Species A	**Species B**
Dark	0	95	5
	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
Dark	20	86	6
	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

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_____

_____

_____

_____

_____

_____

_____

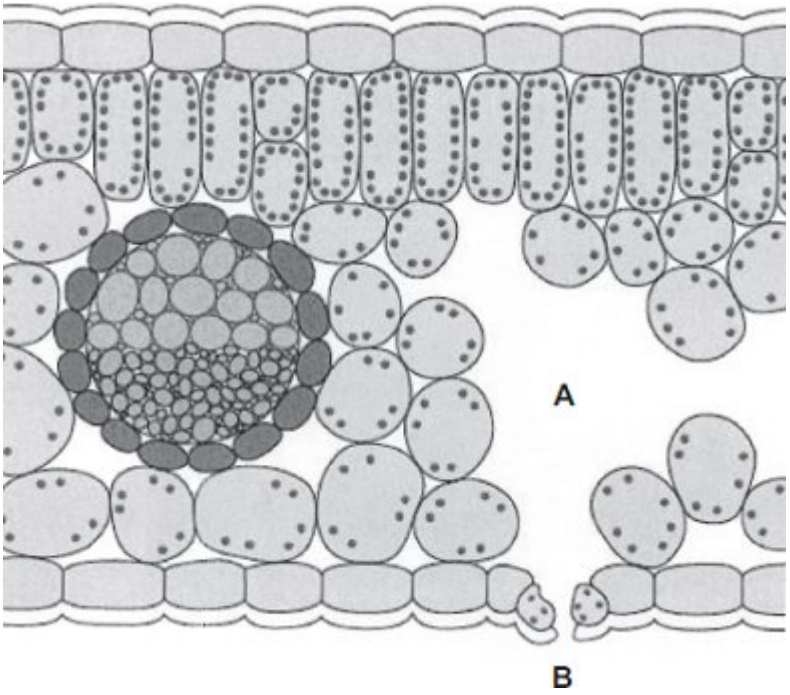
_____

(4)

(Total 5 marks)

Q23.

The diagram shows a section through a plant leaf.



(a) Use words from the box to name **two** tissues in the leaf that transport substances around the plant.

epidermis	**mesophyll**	**phloem**	**xylem**

_____ and _____

(1)

(b) Gases *diffuse* between the leaf and the surrounding air.

(i) What is *diffusion*?

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_____

_____

_____

_____

(2)

(ii) Name **one** gas that will diffuse from point **A** to point **B** on the diagram on a sunny day.

_____

(1)

(Total 4 marks)

Q24.

Plants exchange substances with the environment.

(a) Use words from the box to complete each sentence.

alveoli	**phloem**	**root hairs**	**stomata**
storage organs		**villi**	**xylem**

(i) Most water enters a plant through _____

(1)

(ii) The water is transported up the stem to the leaves in the _____

(1)

(iii) Carbon dioxide enters leaves through _____

(1)

(iv) A leaf uses the carbon dioxide to produce sugars.

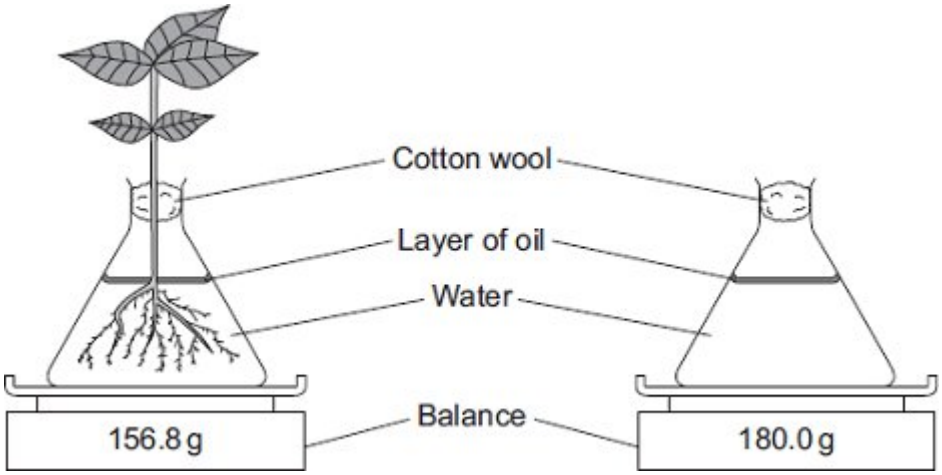
Sugars are transported to _____ through the _____ .

(2)

(b) A student set up the apparatus shown in the diagram.

At the start of the experiment both balances showed a mass of 180.0 g.

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The diagram shows the reading on each balance 24 hours later.

(i) Look at the mass shown on each balance.

Calculate the difference between the two masses.

_____

_____

Difference in mass = _____ g

(1)

(ii) Suggest an explanation for the difference between the two masses.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q25.

Plants exchange substances with the environment.

(a) Plant roots absorb water mainly by osmosis.
Plant roots absorb ions mainly by active transport.

Explain why roots need to use the two different methods to absorb water and ions.

_____

_____

_____

_____

_____

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_____

_____

_____

(4)

(b) What is meant by the *transpiration stream*?

_____

_____

_____

_____

_____

_____

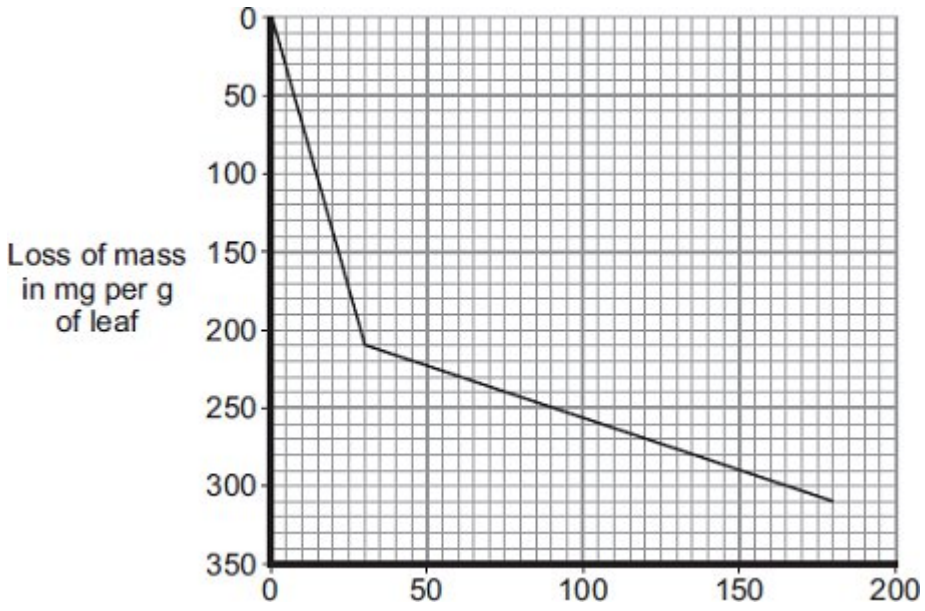
(3)

(c) Students investigated the loss of water vapour from leaves.

The students:

- cut some leaves off a plant
- measured the mass of these leaves every 30 minutes for 180 minutes.

The graph shows the students' results.



(i) The rate of mass loss in the first 30 minutes was 7 milligrams per gram of leaf per minute.

Calculate the rate of mass loss between 30 minutes and 180 minutes.

_____

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_____

Rate of mass loss = _____ milligrams per gram of leaf per minute

(2)

(ii) The rate of mass loss between 0 and 30 minutes was very different from the rate of mass loss between 30 and 180 minutes.

Suggest an explanation for the difference between the two rates.

_____

_____

_____

_____

(2)

(Total 11 marks)

Q26.

Plants lose water vapour from their leaves. Most of this water vapour is lost through the stomata.

(a) Draw a ring around the correct answer to complete the sentence.

Plants lose water vapour by

distillation.
filtration.
transpiration.

(1)

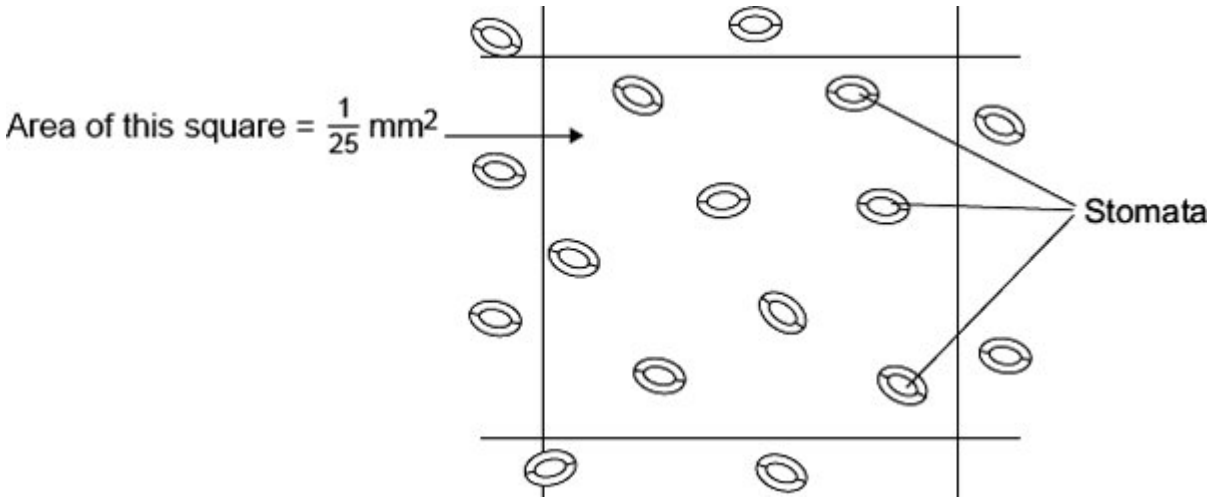
(b) A class of students investigated the number of stomata per mm^2 on the upper surface and on the lower surface of the leaves of three species of plant, **P**, **Q** and **R**.

The students placed samples of the surface cells onto a grid on a microscope.

Student **X** counted the stomata on the lower surface of a leaf from one of the plant species.

The diagram shows part of the grid that student **X** saw under the microscope.

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(i) Complete the calculation to estimate the number of stomata per mm^2 on the lower surface of this leaf.

Number of stomata in $\frac{1}{25}$ mm^2 = _____

Number of stomata in 1 mm^2 = _____

(2)

The table shows the mean results for the class.

Plant species	Mean number of stomata per mm^2 of leaf	
	Upper surface of leaf	Lower surface of leaf
P	40	304
Q	0	11
R	85	195

(ii) Student **X** had counted the stomata on the lower surface of a leaf from one of the plant species.

Use your answer to part **(b)(i)**, and information in the table, to help you to answer this question.

From which plant species, **P**, **Q** or **R**, was student **X**'s leaf most likely to have been taken? ☐

(1)

(iii) Species **Q** is normally found growing in hot, dry conditions.

Explain **one** way in which species **Q** is adapted for living in hot, dry conditions.

Use information from the table.

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_____

_____

_____

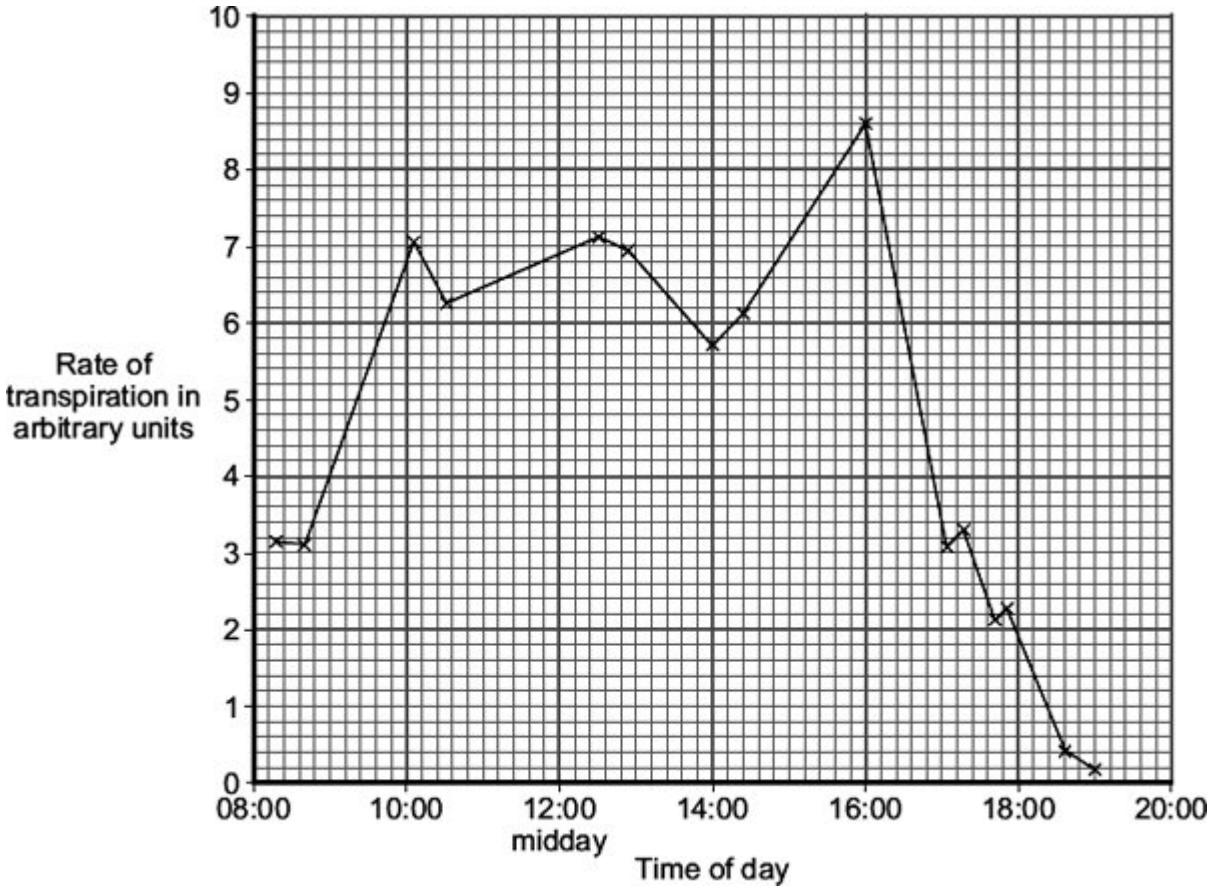
_____

(2)

(Total 6 marks)

Q27.

The graph shows the rate of transpiration from a plant at different times of the day.



Transpiration occurs mainly in the leaves of a plant.

(a) (i) What is *transpiration*?

_____

_____

_____

_____

(2)

(ii) Through which part of a leaf does most transpiration occur?

_____

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(1)

(b) In this investigation, the rate of transpiration decreases between 16:00 hours and 19:00 hours.

(i) Calculate the average rate of decrease per hour in the rate of transpiration over this time.

Show clearly how you work out your answer.

_____

_____

_____

_____

Rate = _____ arbitrary units per hour

(2)

(ii) Suggest **one** explanation for the decrease in the rate of transpiration between 16:00 hours and 19:00 hours.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q28.

(a) Draw a ring around the correct answer to complete the sentence.

A plant loses water from its leaves by a process called

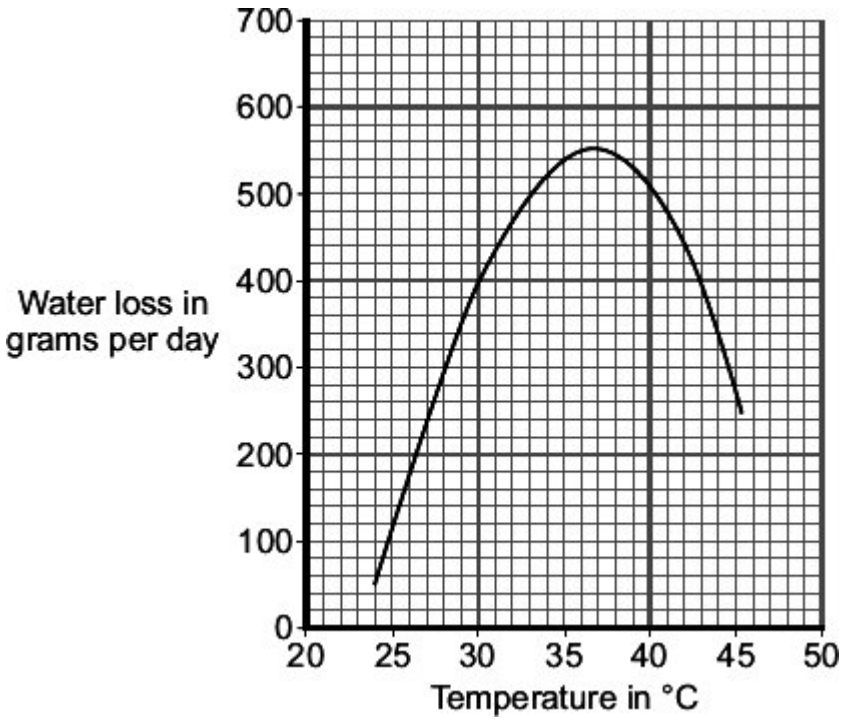
distillation.
respiration.
transpiration.

(1)

(b) Some scientists investigated the effect of temperature on water loss from a plant.

The graph shows the results.

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Describe the effect of increasing the temperature on water loss from the plant.

_____

_____

_____

_____

(2)

(c) Under different conditions, plants open or close their stomata.

(i) How does closing its stomata help a plant?

_____

_____

(1)

(ii) In the investigation described in part (b), which temperature range would cause most of the stomata to close?

Draw a ring around **one** answer.

25 - 30 °C **30 - 35 °C** **40 - 45 °C**

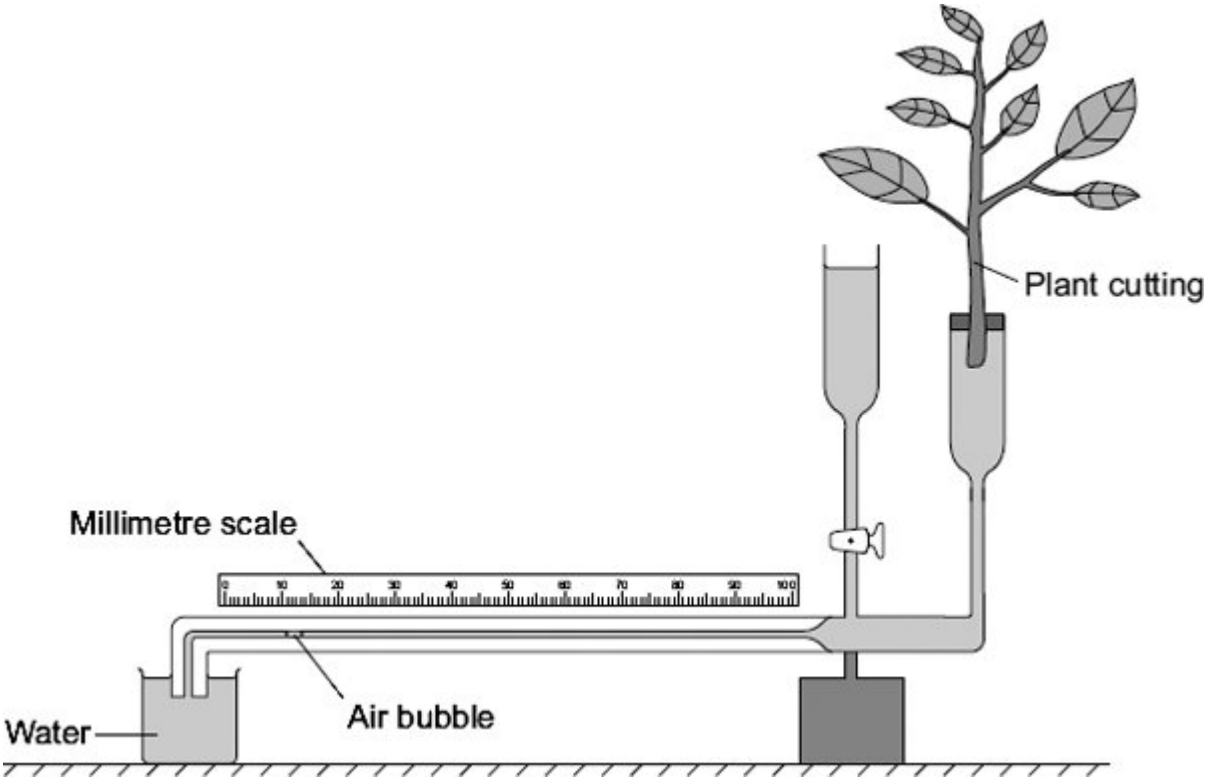
(1)

(Total 5 marks)

Q29.

Some students used the apparatus shown in the diagram to measure the rate of water uptake by a plant cutting.

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The students set up the apparatus in three different conditions:

- no wind at 15 °C
- no wind at 25 °C
- wind at 25 °C

For each experiment, the students recorded the movement of the air bubble along the scale.

(a) (i) Name the **two** variables that the students chose to change in these experiments.

1. _____

2. _____

(2)

(ii) It was important to use the same plant cutting each time to make these experiments fair.

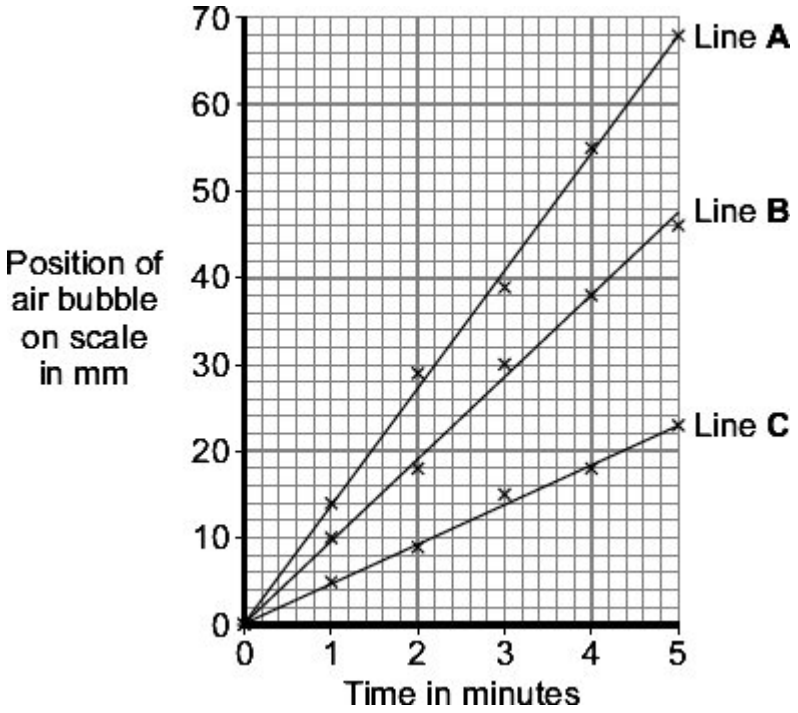
Explain why.

_____

(1)

(b) The graph shows the students' results.

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Which line on the graph, **A**, **B** or **C**, shows the results for each of the three different experiments?

Write each of the letters **A**, **B** or **C** in the correct boxes in the table.

Condition	Letter
No wind at 15 °C	
No wind at 25 °C	
Wind at 25 °C	

(2)

(c) Water is lost from the leaves of the plant cutting.

Name this process.

Draw a ring around **one** answer.

distillation **respiration** **transpiration**

(1)

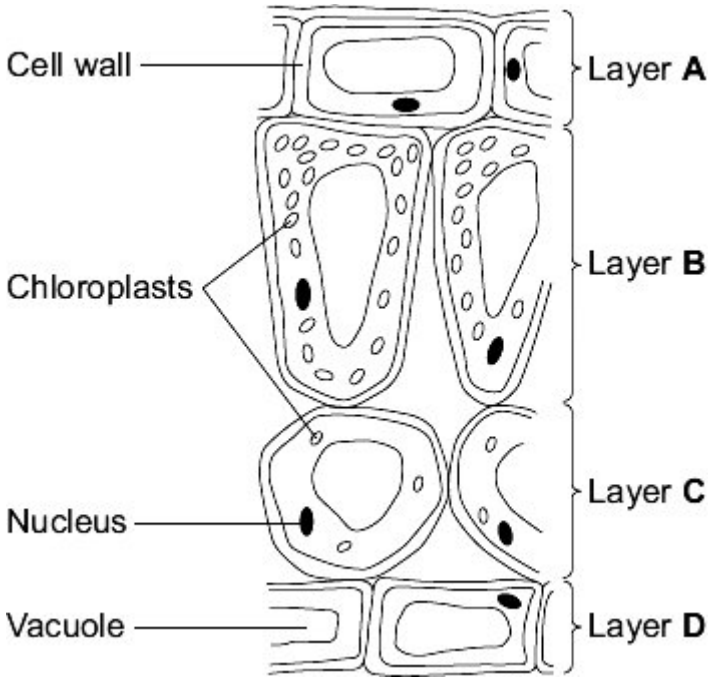
(Total 6 marks)

Q30.

Leaves are made from layers of cells.

The diagram shows a section through part of a leaf.

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(a) (i) Which word in the table describes layer **A**?

Tick (✓) **one** box.

Layer A	Tick (✓)
Tissue	
Organ	
Cell	

(1)

(ii) Which word describes a whole leaf?

Draw a ring around **one** answer.

organ **tissue** **organism**

(1)

(b) (i) Which **two** layers of cells, **A**, **B**, **C** and **D**, can photosynthesise?

Use information from the diagram to help you.

Tick (✓) **two** boxes.

Layer **A** ☐

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Layer **B** ☐

Layer **C** ☐

Layer **D** ☐

(2)

(ii) Give **one** reason for your answer.

_____

_____

(1)

(c) List **X** gives the names of two parts of a cell.
List **Y** gives information about parts of a cell.

Draw **one** line between each part of the cell in list **X** and information about it in list **Y**.

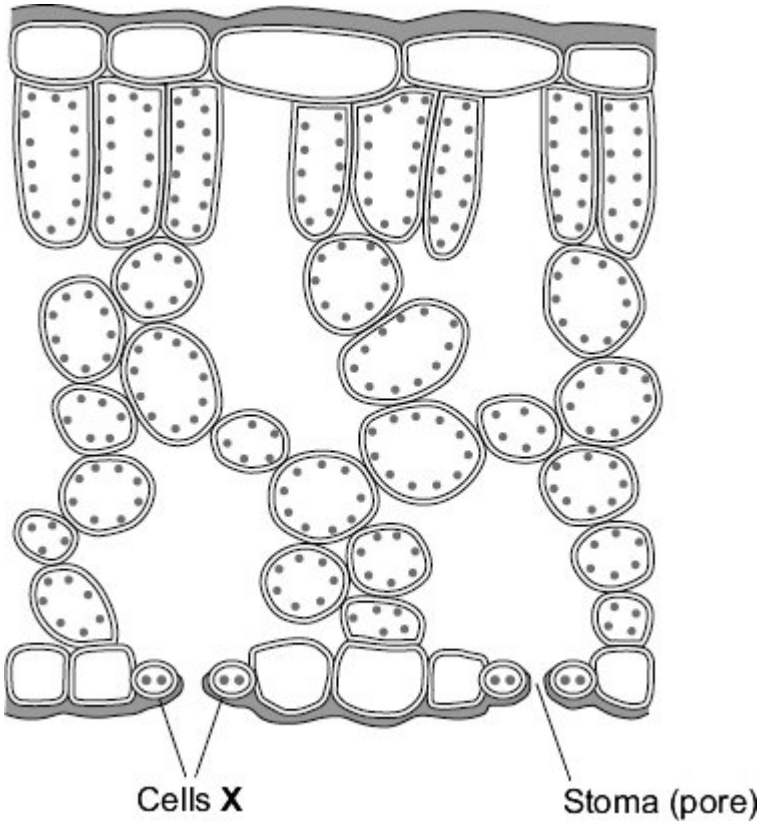
List X **Part of a cell**	**List Y** **Information**
	Controls the passage of substances into the cell
Vacuole	
	Contains the cell sap
Nucleus	
	Controls the activities of the whole cell

(2)
(Total 7 marks)

Q31.

The diagram shows a section through a plant leaf.

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(a) The cells labelled **X** surround a stoma (pore).

Draw a ring around the correct answer to complete the sentence.

Cells **X** are called

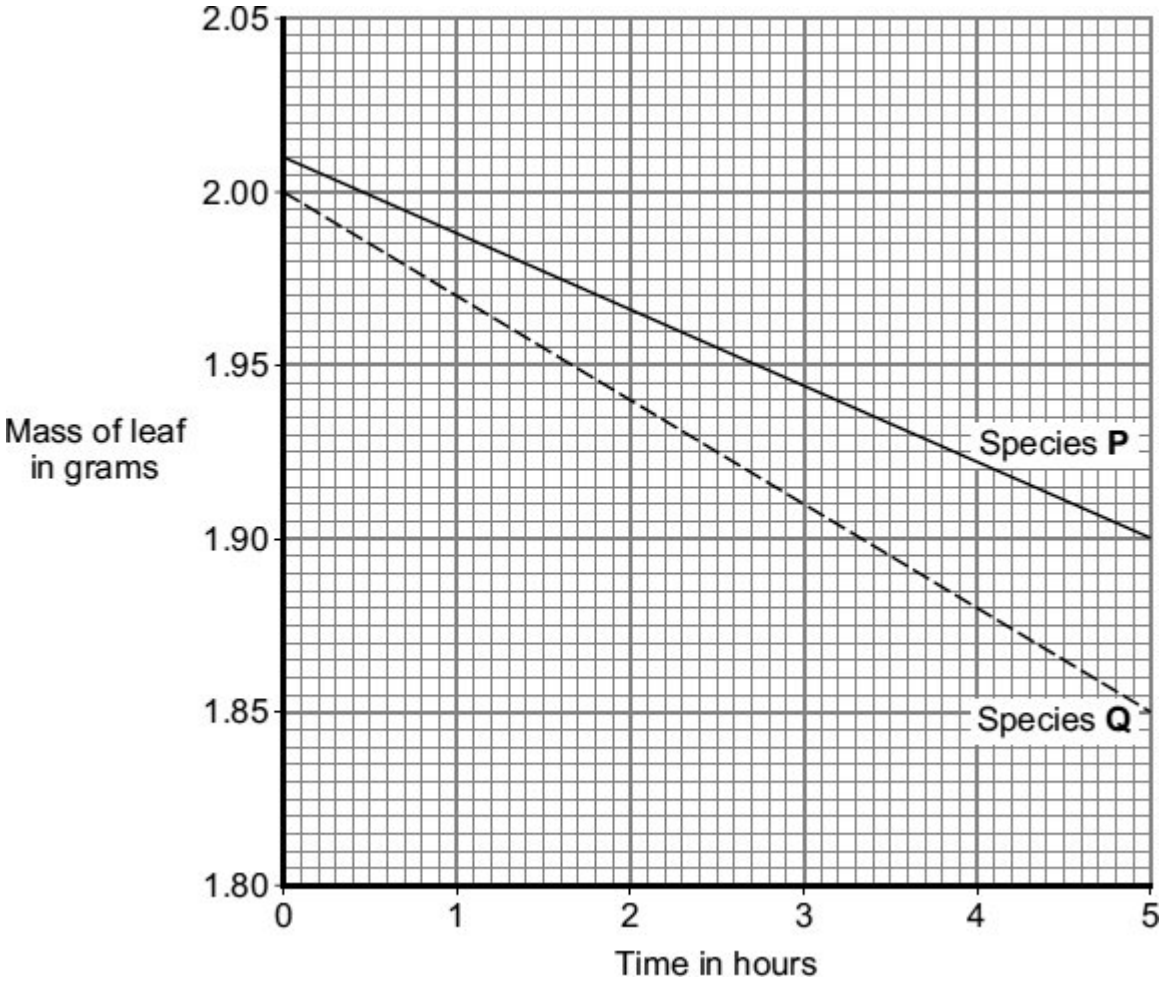
- alveoli.
- guard cells.
- villi.

(1)

(b) Water vapour is lost from leaves. Water loss causes a leaf to lose mass.

The graph shows how the masses of leaves from two plant species, **P** and **Q**, changed over several hours. Both leaves were kept in the same conditions.

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(i) What was the mass of the leaf of species **Q** at 0 hours?

_____ grams

(1)

(ii) What was the difference between the mass of the leaf of species **P** and the mass of the leaf of species **Q** after 5 hours?

_____ grams

(1)

(iii) The leaf of species **Q** lost water at a faster rate than the leaf of species **P**.

Suggest **one** reason why.

_____

_____

(1)

(iv) Which weather conditions would cause the greatest rate of loss of mass for both species **P** and species **Q**?

Tick (✓) **one** box in the table.

Weather conditions	**Tick (✓)**

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Still air or wind	Temperature in °C	
Wind	30	
Still air	30	
Wind	20	

(1)

(c) Draw a ring around the correct answer to complete the sentence.

In very hot, dry conditions, the stomata close.

This is to prevent

- anaerobic respiration.
- breathing.
- wilting.

(1)

(Total 6 marks)

Q32.

A student removed three similar leaves from a plant. The student spread petroleum jelly (a waterproofing substance) on some of the leaves, as follows:

Leaf A: on the lower surface

Leaf B: on the upper surface

Leaf C: none.

The student placed each leaf in a separate beaker. He weighed each beaker at intervals. The results are shown in the table.

Time in hours	Mass of leaf + beaker in grams		
	Leaf A	Leaf B	Leaf C
0	50.00	55.01	51.99
0	49.99	54.95	51.90
3	49.97	54.90	51.85
5	49.95	54.86	51.80

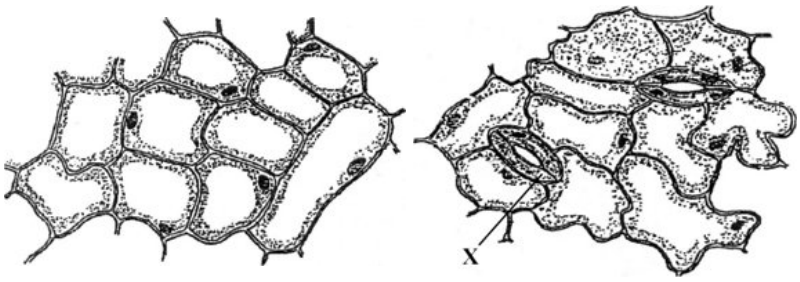
(a) Which leaf, **A**, **B** or **C**, lost most water? ☐

(1)

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(b) The diagram shows the appearance of the upper and lower surfaces of one of the leaves under a microscope.

Upper surface of leaf **Lower surface of leaf**



(i) Name cell **X**. _____

(1)

(ii) The petroleum jelly had a greater effect when it was spread on the lower surface
than when it was spread on the upper surface.

Use information from the diagram to explain why.

_____

_____

_____

_____

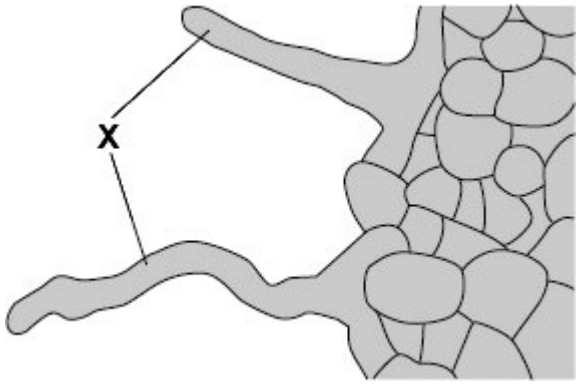
_____

(2)

(Total 4 marks)

Q33.

The diagram shows part of a plant root. A large number of structures like the ones labelled **X** grow out of the surface of the root.



(a) (i) What is the name of structure **X**?

Draw a ring around **one** answer.

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root hair **stoma** **villus**

(1)

(ii) Name **two** substances which structure **X** absorbs from the soil.

1. _____

2. _____

(2)

(b) The substances in (a)(ii) are transported from the roots to the leaves. Carbon dioxide also enters the leaves.

Draw a ring round the correct answer to complete each sentence.

(i) Carbon dioxide enters leaves through

- alveoli.
- stomata.
- villi.

(1)

(ii) Carbon dioxide enters leaf cells by

- active transport.
- diffusion.
- reabsorption.

(1)

(Total 5 marks)

Q34.

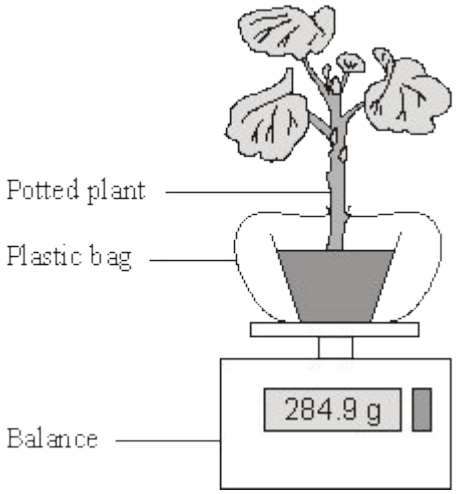
(a) Name the process by which water is lost from plant leaves.

_____

(1)

(b) Some students set up the apparatus shown in the diagram to measure the water loss from a potted plant.

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The apparatus was placed in different environmental conditions:

A in still air at 20 °C.
B in still air at 25 °C.
C in a wind at 20 °C.
D in a wind at 25 °C.

Readings from the balance were recorded by a datalogger at 10-minute intervals.

The results are given in the table.

Time in minutes	Balance reading in grams			
	A	**B**	**C**	**D**
0	285.6	284.6	282.9	280.9
10	285.3	284.2	282.4	280.2
20	284.9	283.8	281.9	279.4
30	284.7	283.4	281.4	278.8

(i) Under which conditions, **A**, **B**, **C** or **D**, was water lost most rapidly? ☐

(1)

(ii) Explain, as fully as you can, why water was lost most rapidly under these conditions.

_____

_____

_____

_____

_____

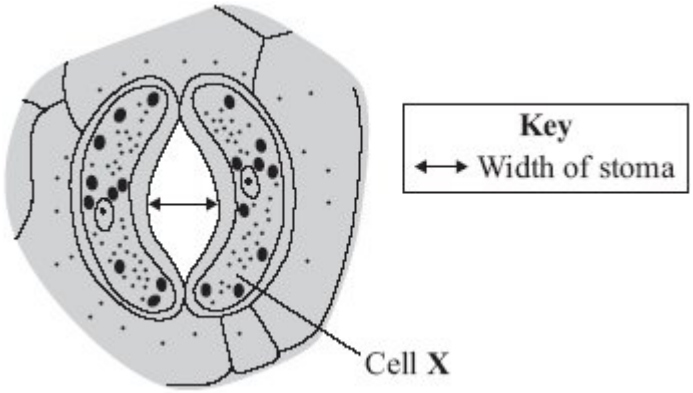
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(2)
(Total 4 marks)

Q35.

Plant leaves have many stomata.

The diagram shows a stoma.



(a) Name cell **X** _____

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** normally grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	Mean width of stomata as a percentage of their maximum width	
		Species A	Species B
	0	95	5
Dark	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
	20	86	6

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Dark	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 5 marks)

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