Plant Tissues, Organs, and Systems

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

Topic: Plant Tissues, Organs, and Systems

Q1.

Plants are made up of cells, tissues and organs.

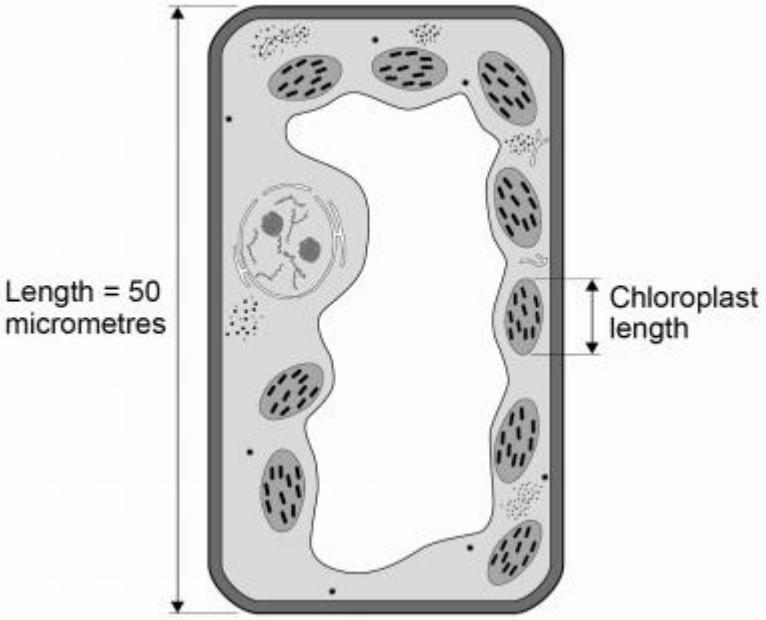
(a) Draw **one** line from each level of organisation to the correct plant part.

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 ☐

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 ☐

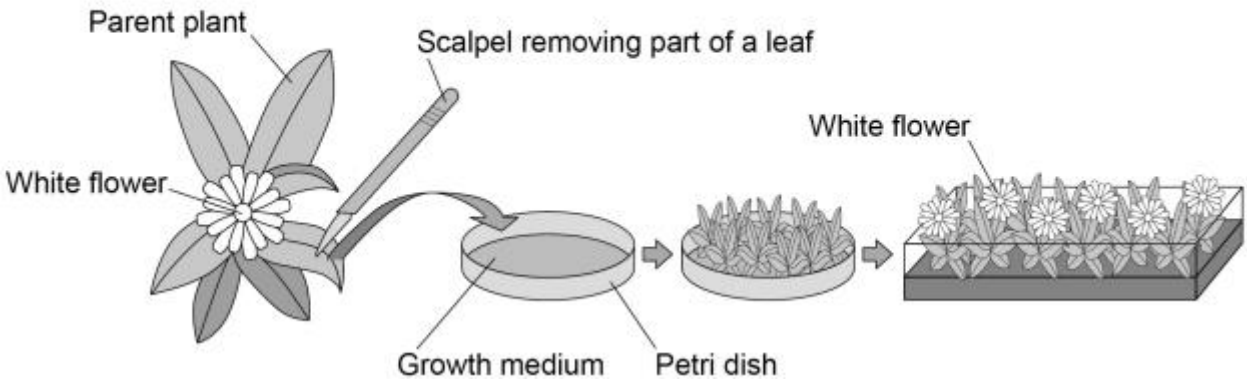
Transport ☐

(1)

Scientists can clone plants using tissue culture.

Figure 2 shows the process of tissue culture.

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.

_____

_____

(1)

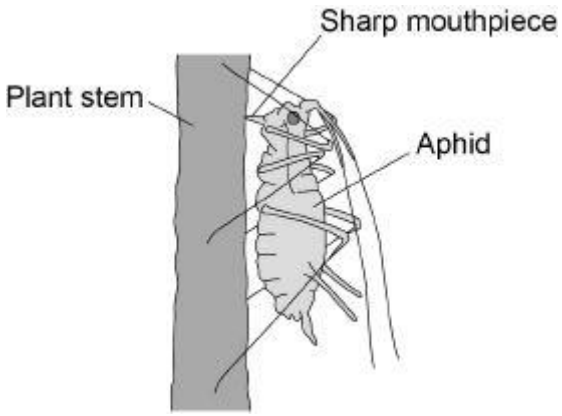
(Total 10 marks)

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 ☐

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)

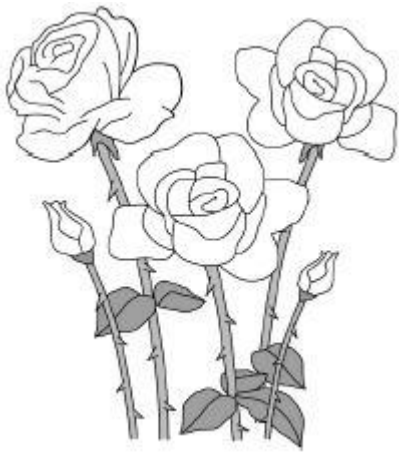
(e) The leaves of some plants release oils onto their surface.

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



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

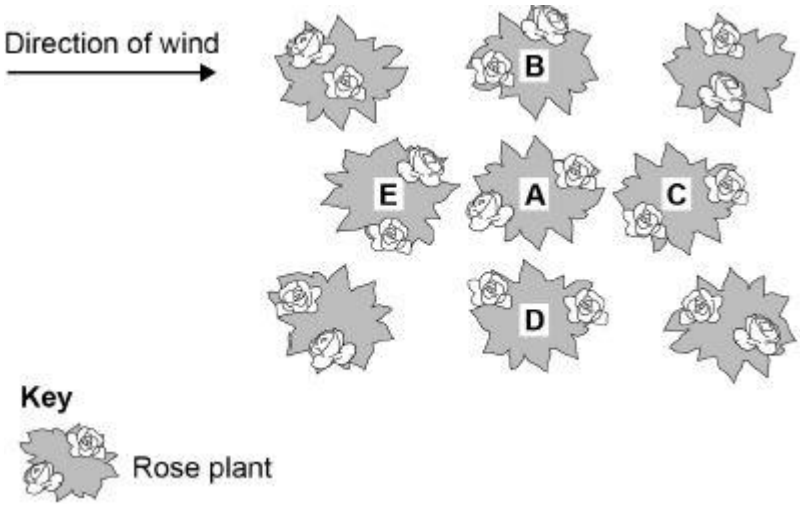
_____

_____

(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)

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

_____

_____

_____

_____

(1)

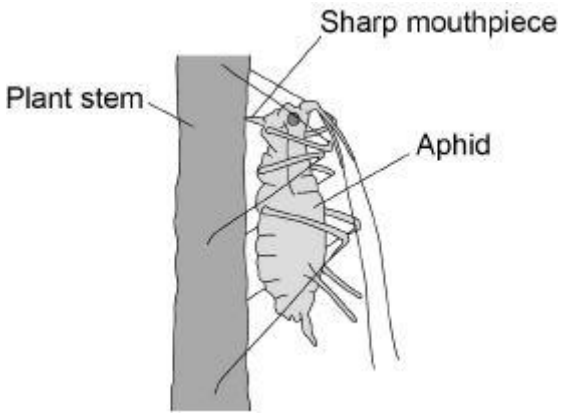
(Total 11 marks)

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.

(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.

(4)

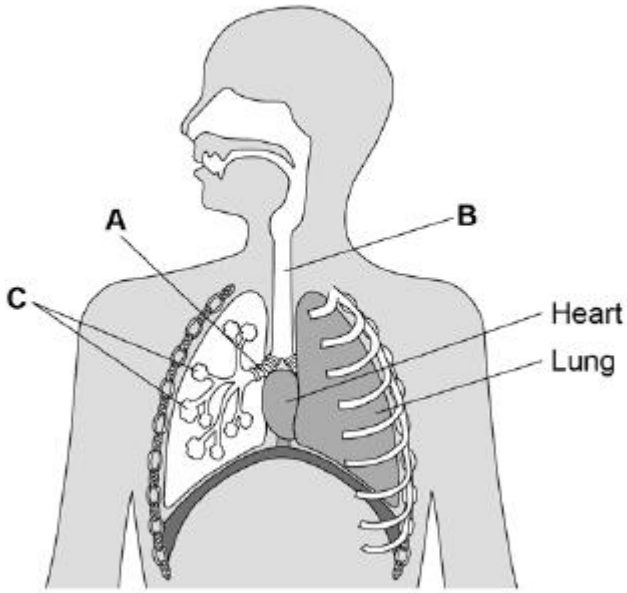
(Total 10 marks)

Q4.

Animals and plants contain organs and tissues.

Figure 1 shows some organs in the human thorax.

Figure 1



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

A _____

B _____

C _____

(3)

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

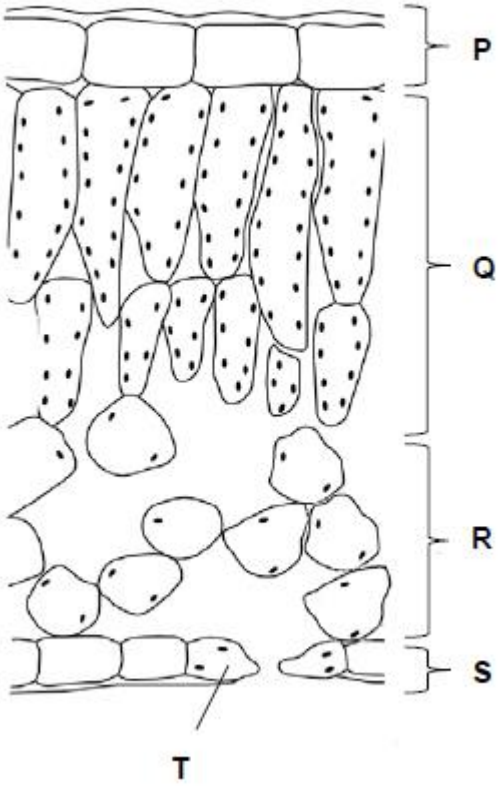
Tick **one** box.

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

(1)

Figure 2 shows a cross section of a leaf.

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.

What is a tissue?

_____

_____

_____

_____

(1)

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

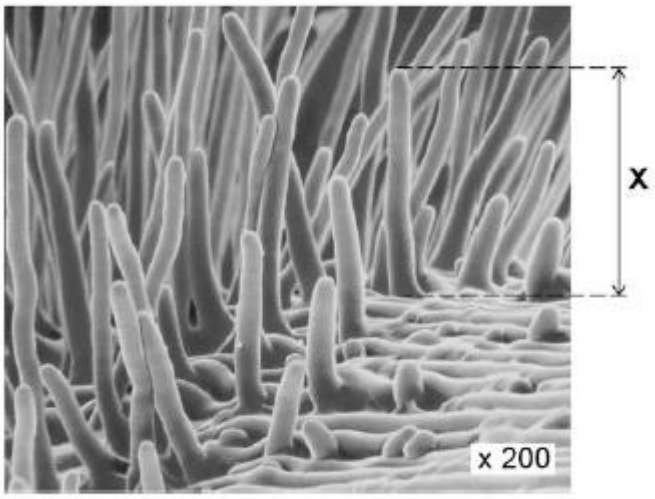
Tissue	Function
	Allows diffusion of gases through the leaf
Epidermis	Allows light through to the photosynthesising parts of the leaf
Phloem	Allows water into the leaf
Spongy mesophyll	Transport sugars around the plant
	Transports water around the plant

(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?

_____

(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)

(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
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.

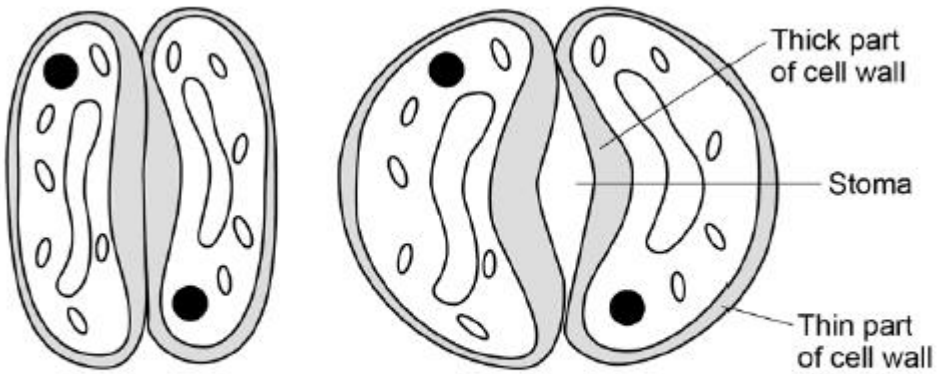
Use information from the table above.

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.



Closed stoma **Open stoma**

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	☐
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.

_____

_____

_____

_____

_____

_____

(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.

_____

_____

_____

_____

_____

_____

_____

_____

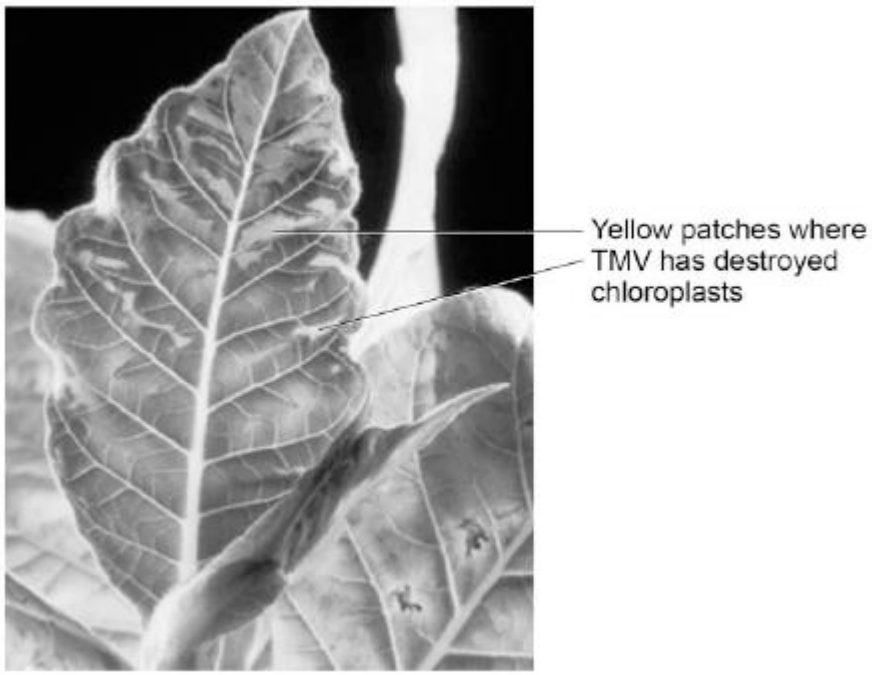
(2)

(Total 11 marks)

Q8.

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

The diagram below shows a leaf infected with TMV.



(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.

This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

(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.

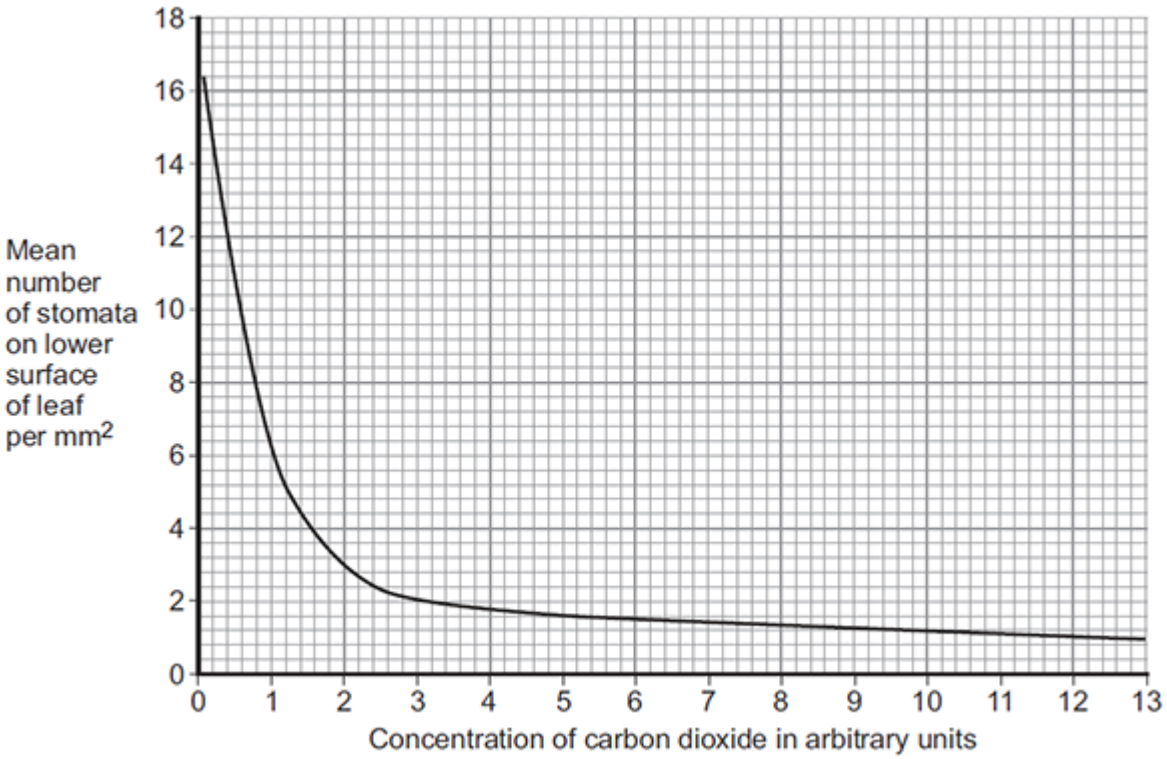
_____

(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.



(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.

_____

_____

_____

_____

(1)

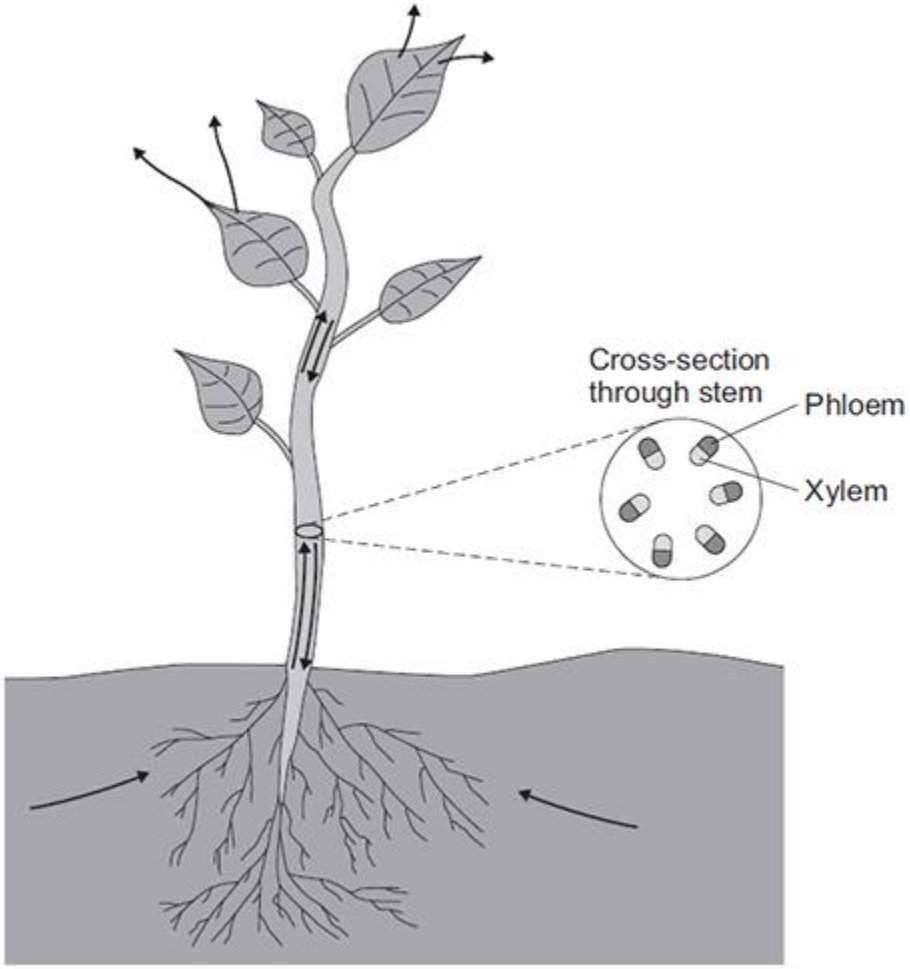
(Total 6 marks)

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.

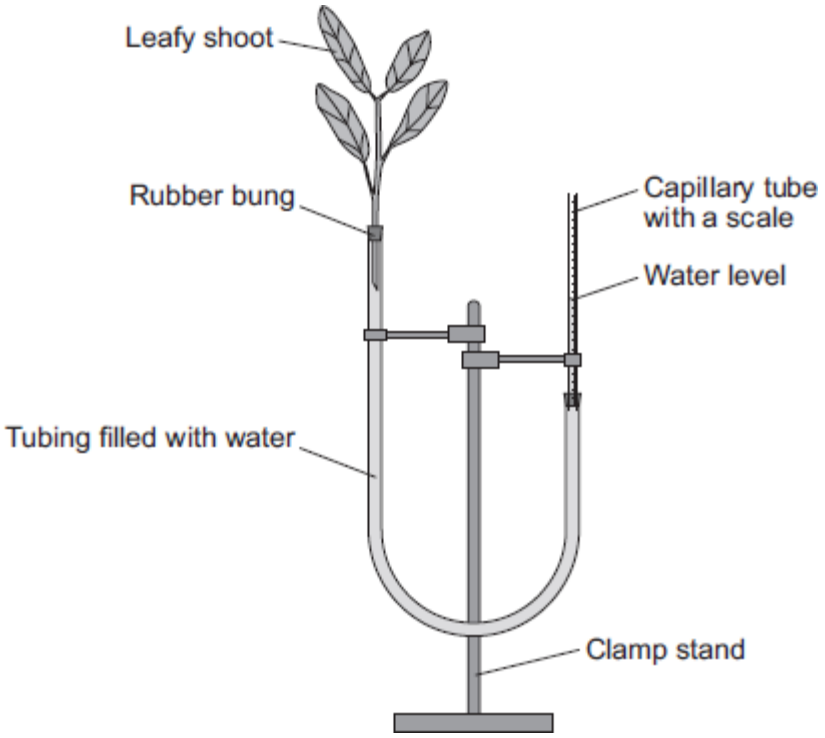
(Total 6 marks)

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



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.**

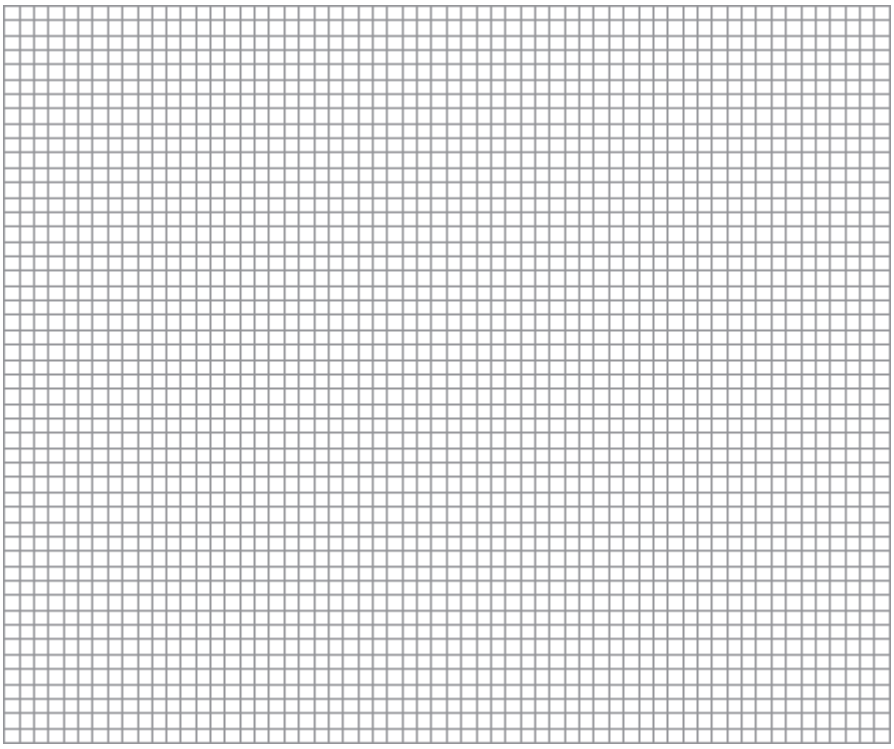
Table 2

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

_____

_____

_____

_____

_____

_____

(3)

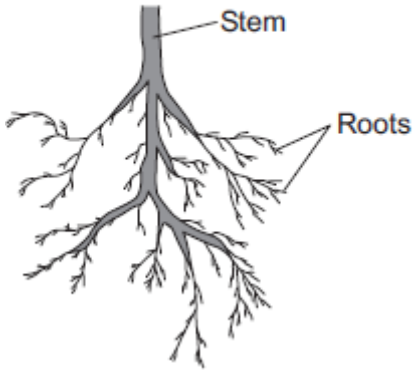
(Total 13 marks)

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. ☐

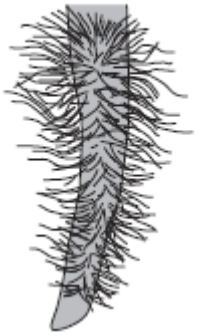
The absorption of mineral ions needs energy. ☐

(2)

(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?

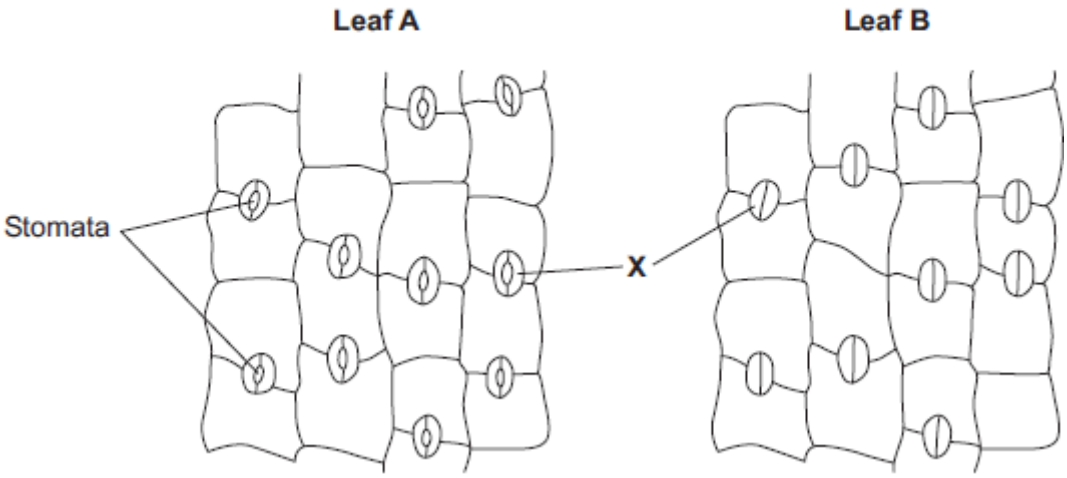
_____

_____

(1)

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

Figure 3



(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**?

_____

_____

_____

_____

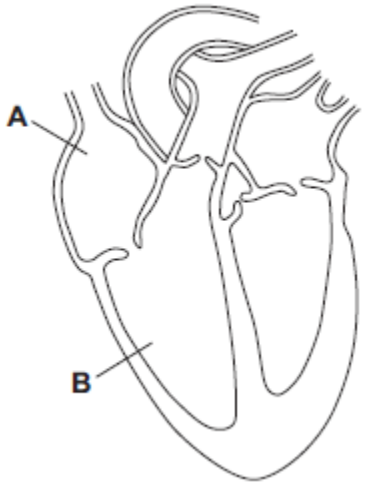
(1)

(Total 9 marks)

Q13.

Diagram 1 shows a section through the heart.

Diagram 1



(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?

_____

_____

_____

_____

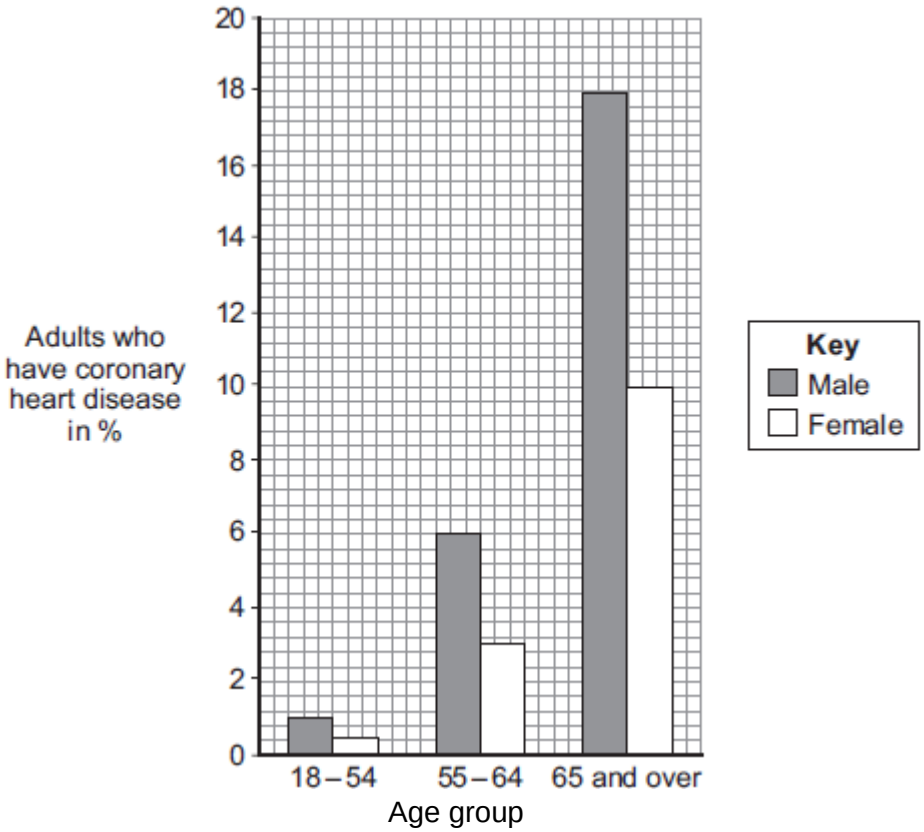
(1)

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

Diagram 2

(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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

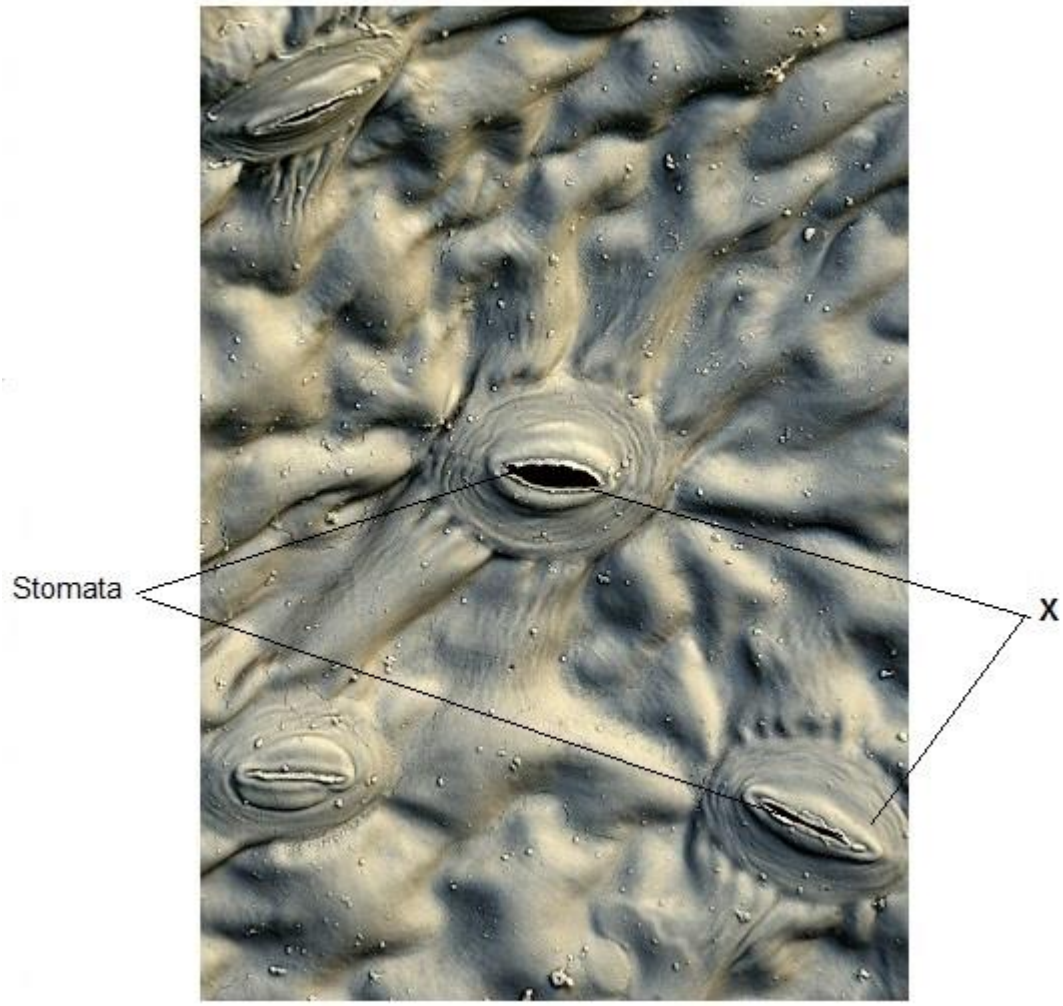
_____

(3)

(Total 11 marks)

Q14.

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



(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**.

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.

_____

_____

_____

_____

_____

_____

(1)

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

1. _____

2. _____

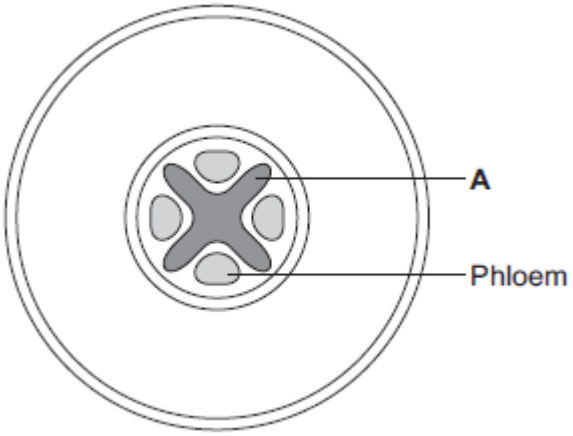
3 _____

(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)

(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)

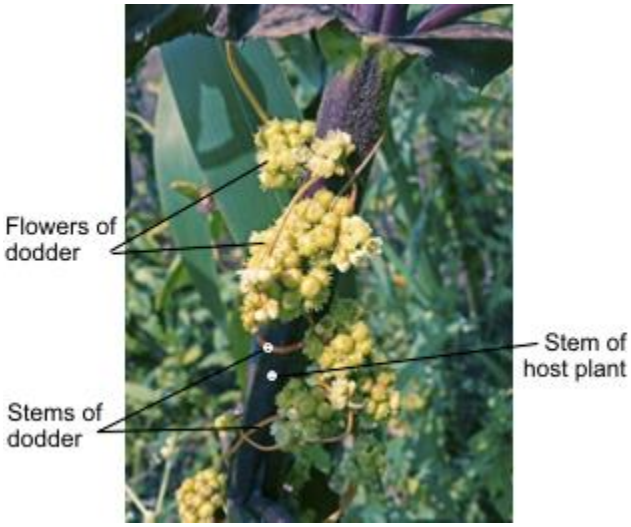
Q16.

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

The dodder plant:

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

The image below shows dodder attached to its host plant.



(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.

_____

_____

_____

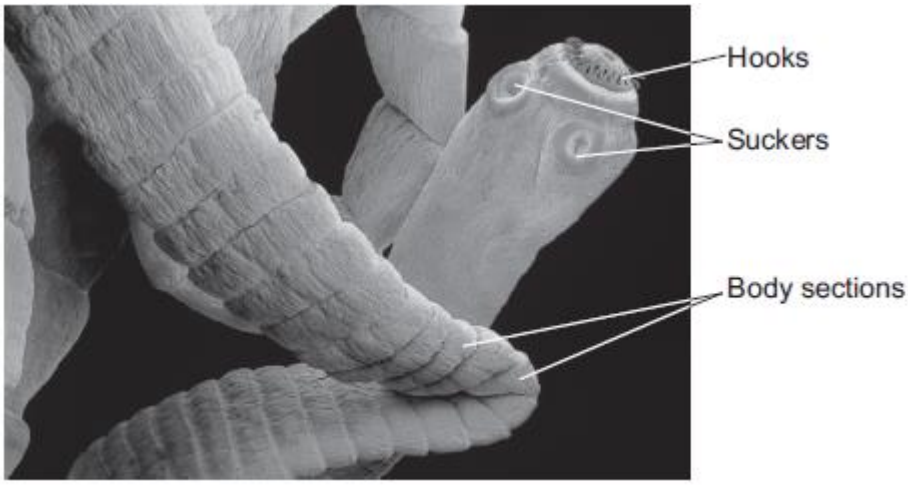
_____

(1)

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

The tapeworm is another parasite.

The image below shows part of a tapeworm.



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

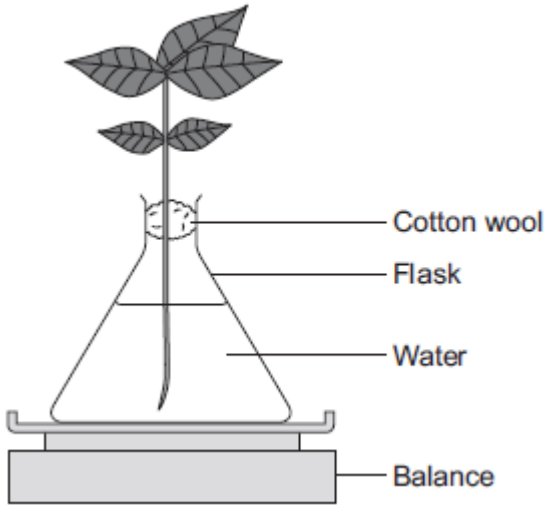
called _____ .

(1)

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

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

Figure 1



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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(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.

_____

_____

_____

_____

_____

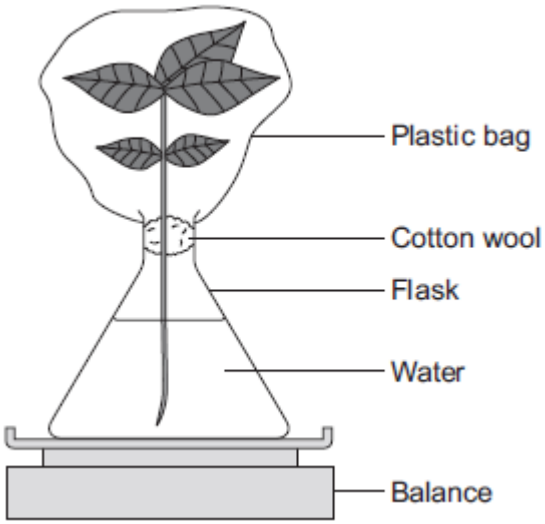
_____

(1)

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

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

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?

_____

_____

_____

_____

_____

_____

_____

_____

_____

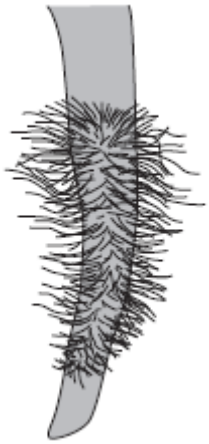
_____

_____

_____

(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.

_____

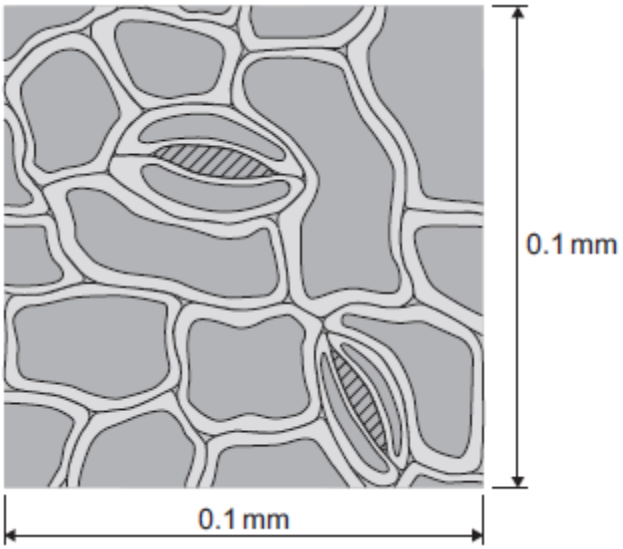
_____

_____

_____

(1)

(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
- 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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

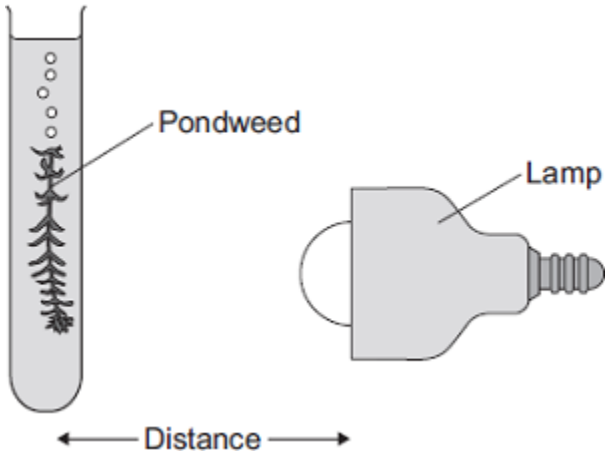
(3)
(Total 9 marks)

Q20.

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

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

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?

_____

_____

(1)

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

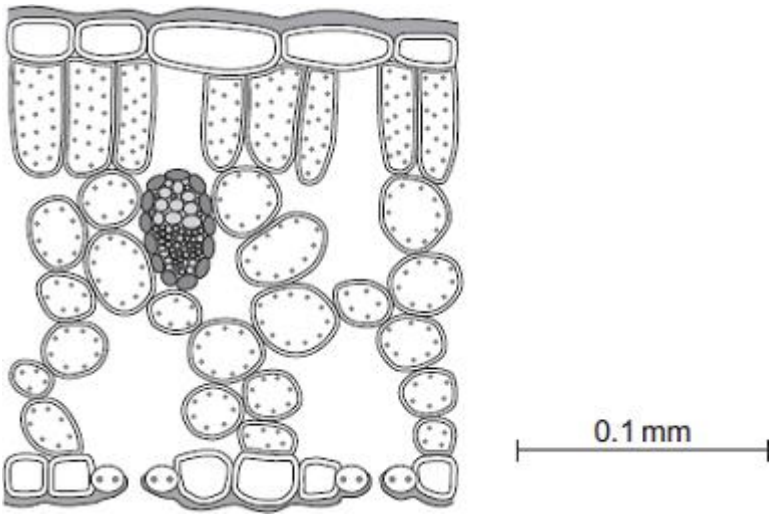
_____

(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.

_____

_____

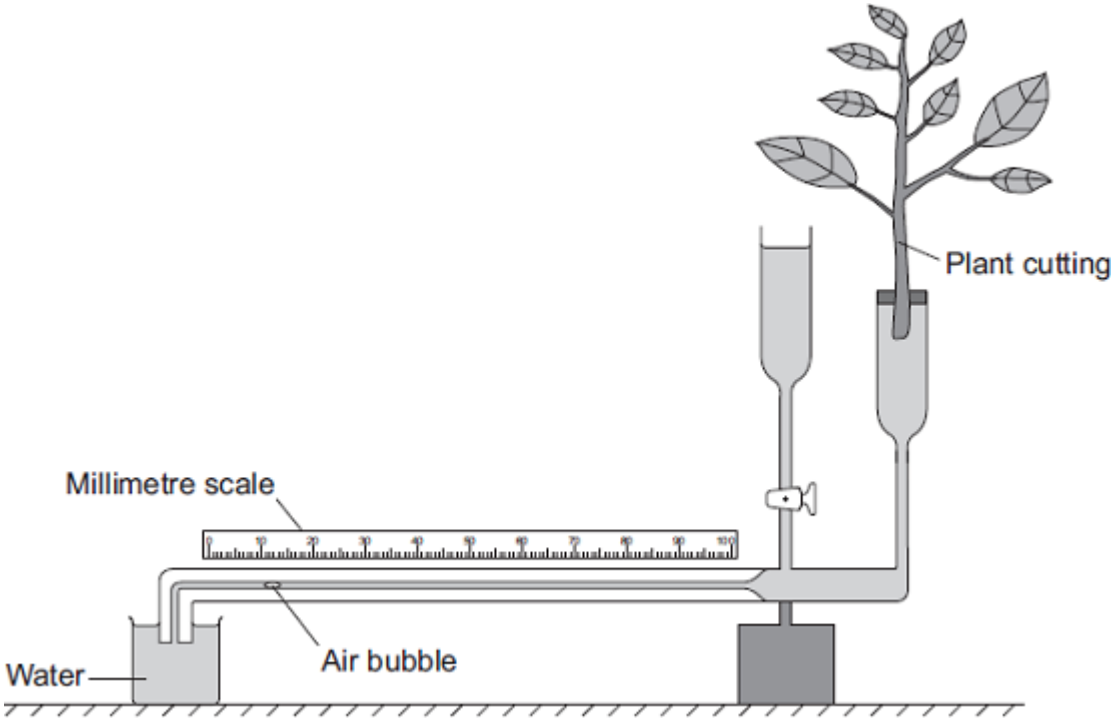
_____

(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.

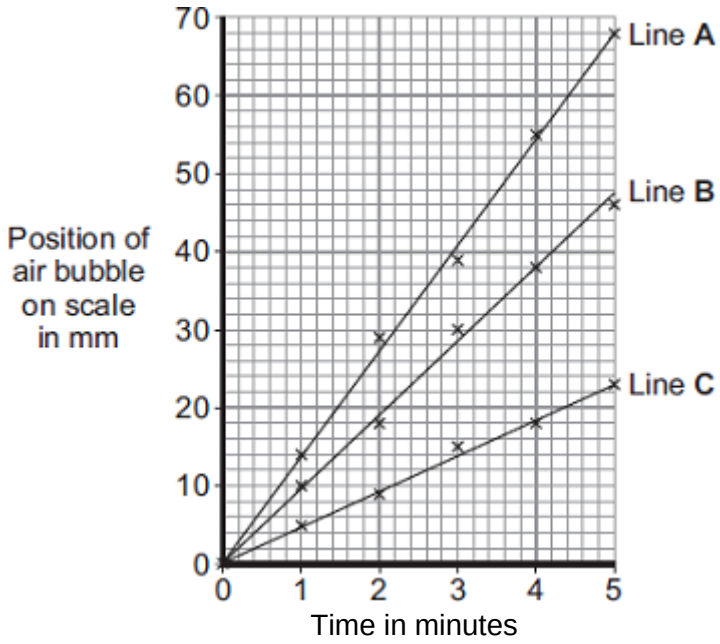
(2)

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

Explain why.

(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.

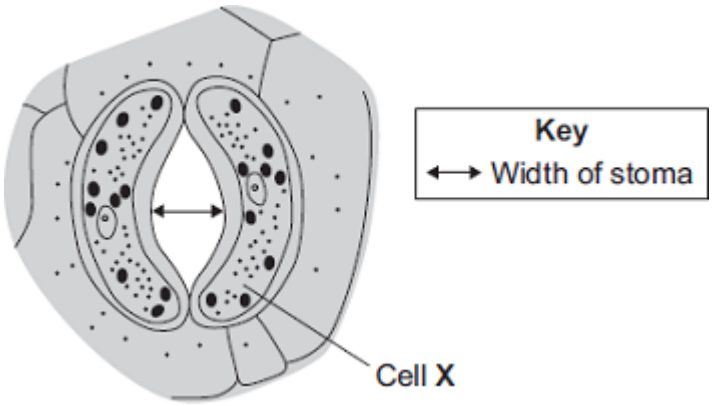
distillation **respiration** **transpiration**

(1)

(Total 6 marks)

Q22.

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



(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.

_____

_____

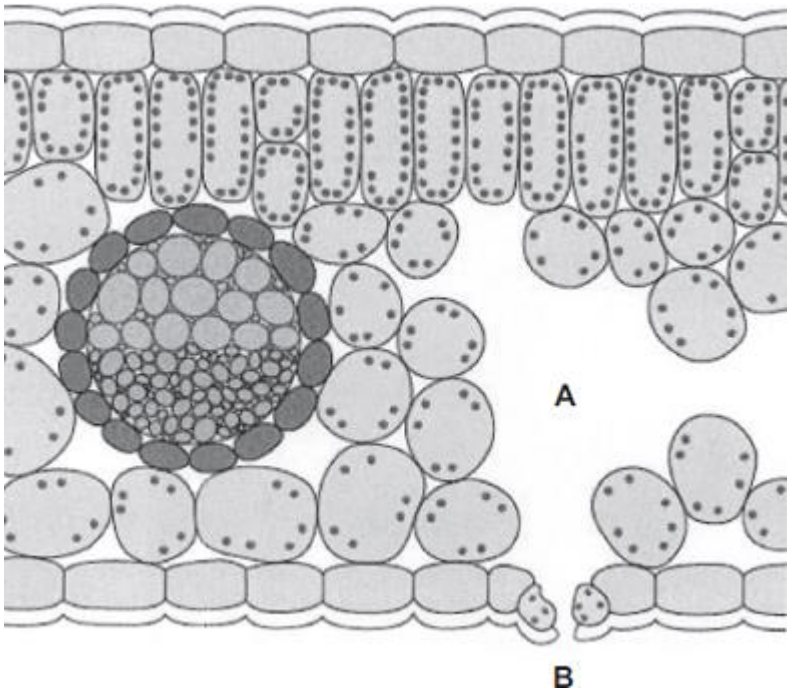
_____

(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*?

_____

_____

_____

_____

_____

(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.

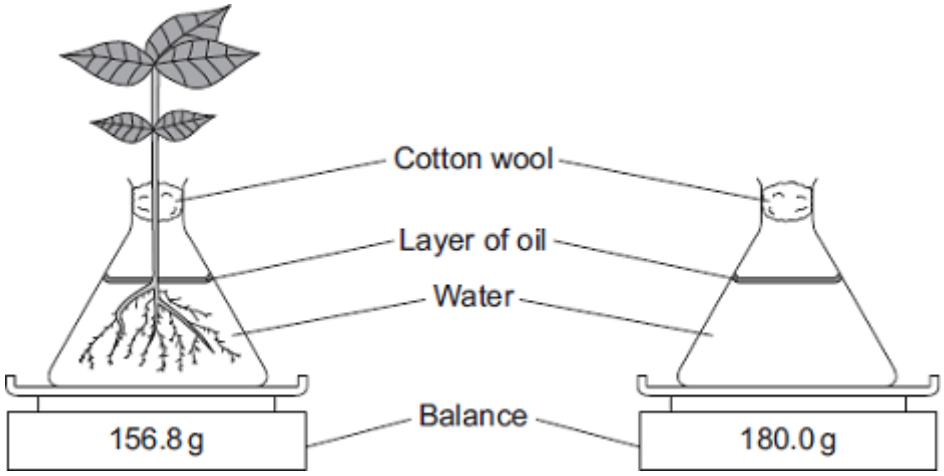
Sugars are transported to _____ through

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.



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.

(4)

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

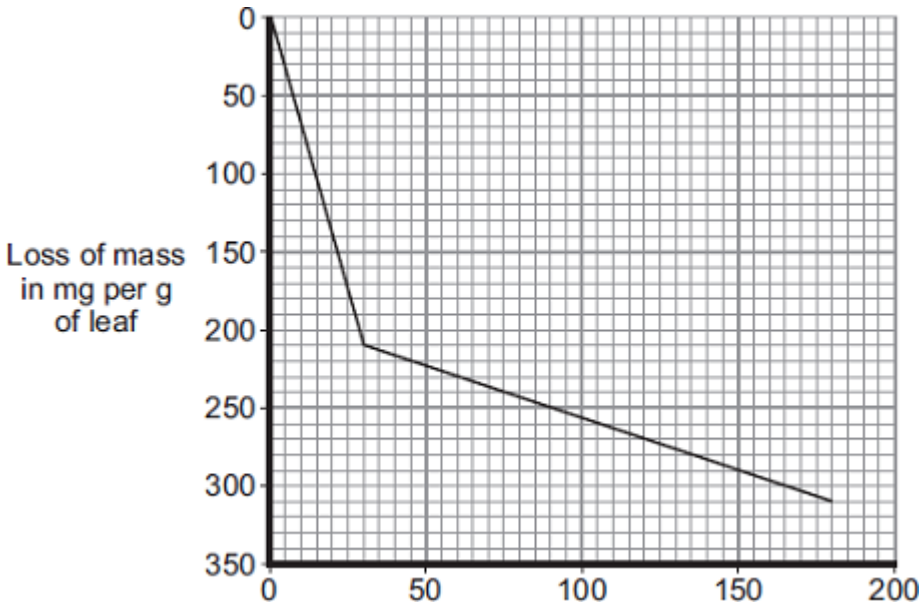
(3)

(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.

_____

_____

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.

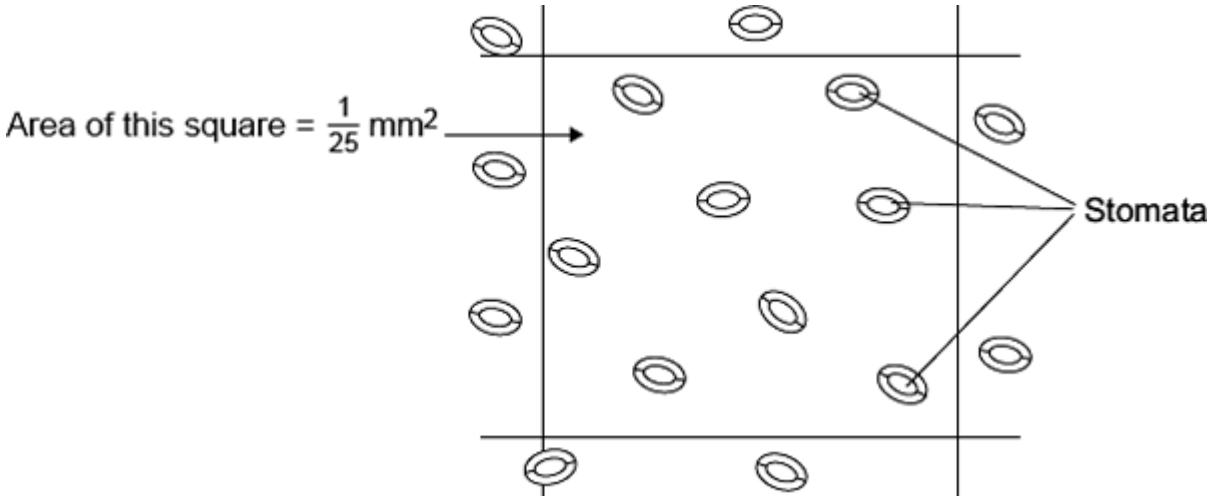
(1)

(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.



(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.

_____

_____

_____

_____

_____

_____

_____

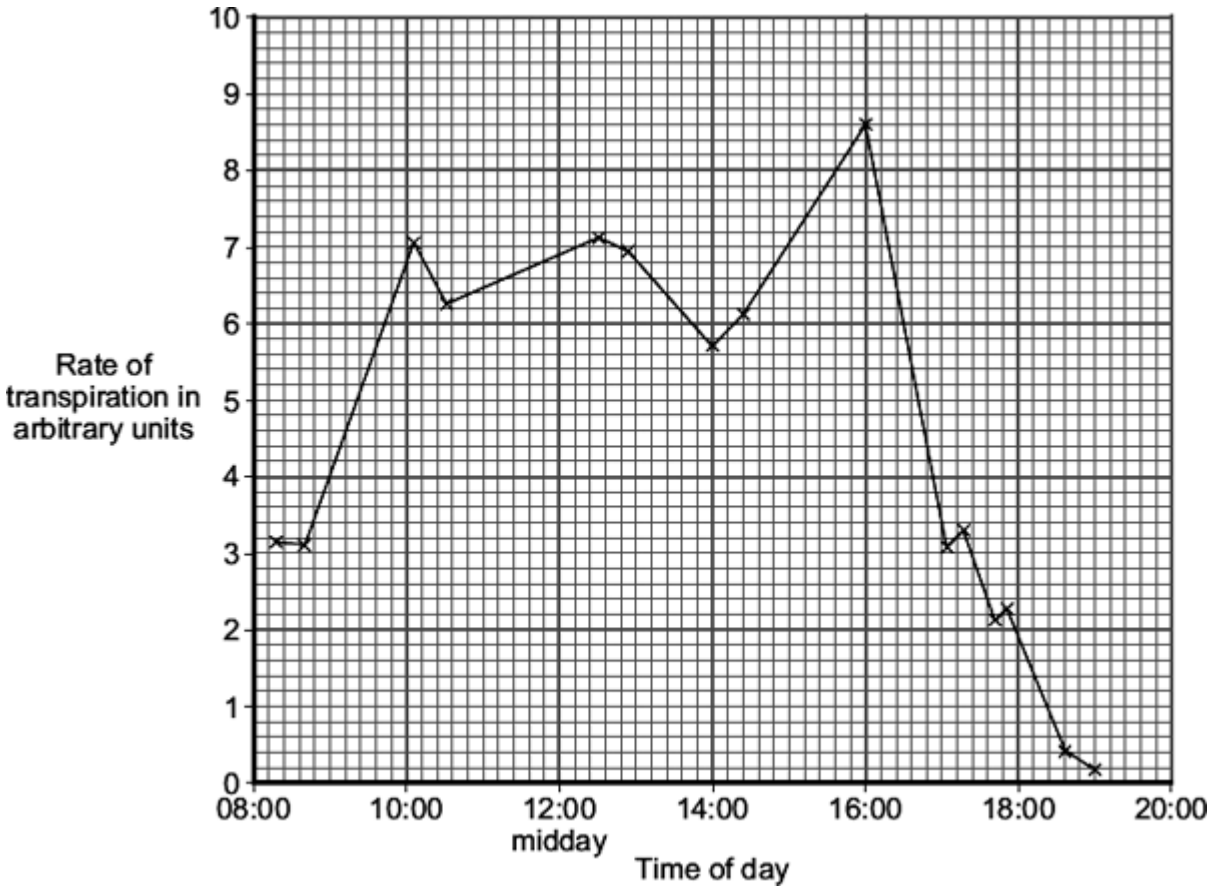
_____

(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?

_____

_____

(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.

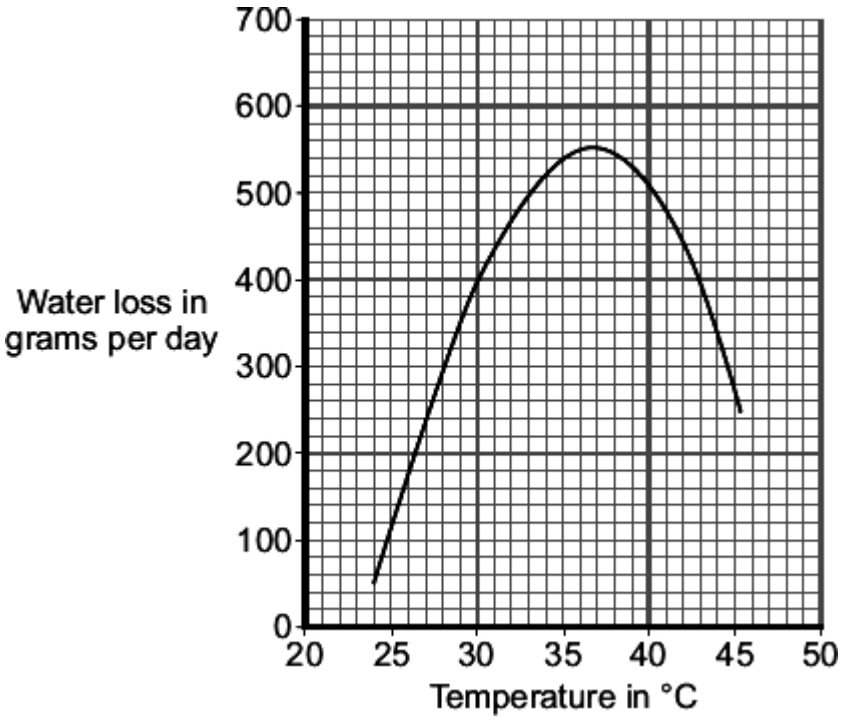
A plant loses water from its leaves by a process called

distillation.
respiration.
transpiration.

(1)

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

The graph shows the results.



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.

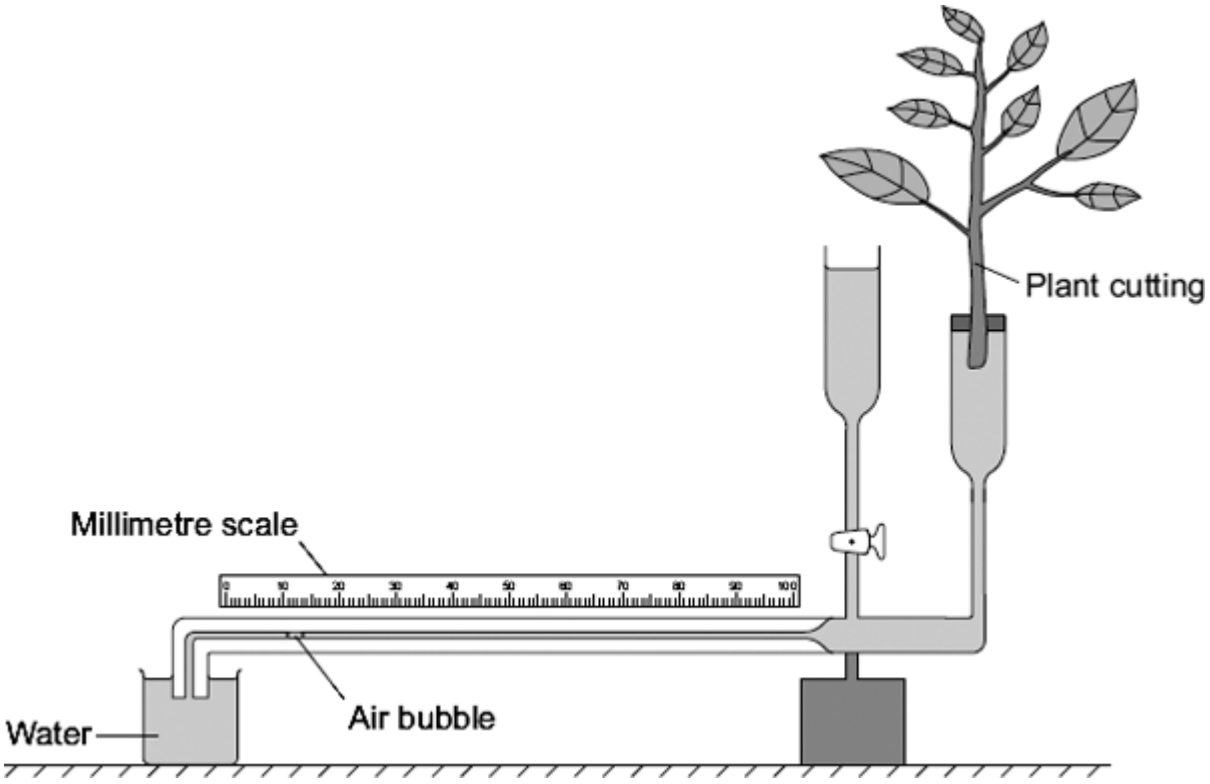
25 - 30 °C **30 - 35 °C** **40 - 45 °C**

(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.



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)

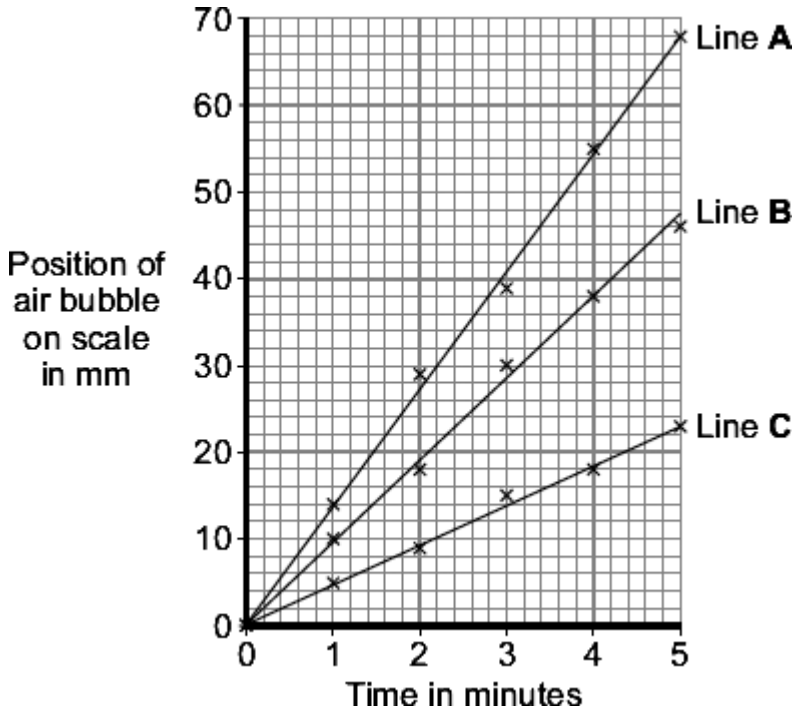
(ii) It was important to use the same plant cutting each time to make these experiments fair.

Explain why.

_____

(1)

(b) The graph shows the students' results.



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**

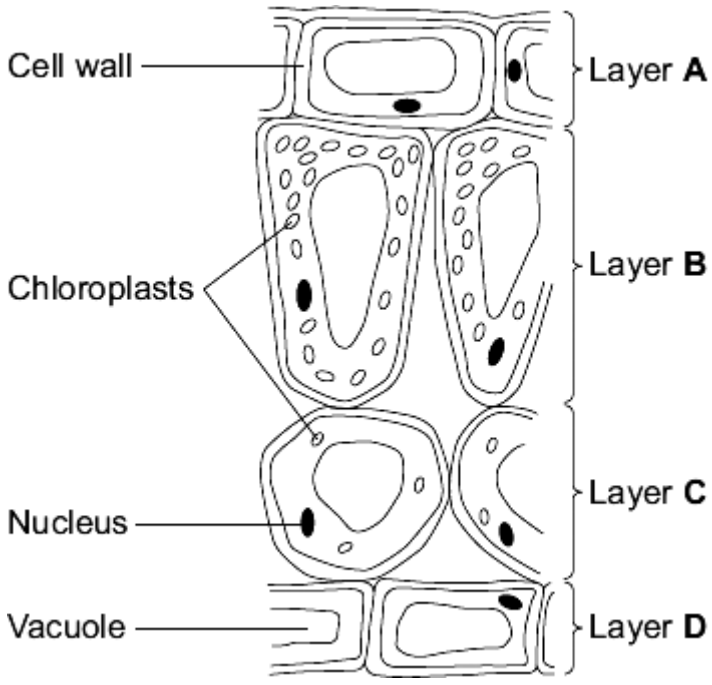
(1)

(Total 6 marks)

Q30.

Leaves are made from layers of cells.

The diagram shows a section through part of a leaf.



(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** ☐

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**.

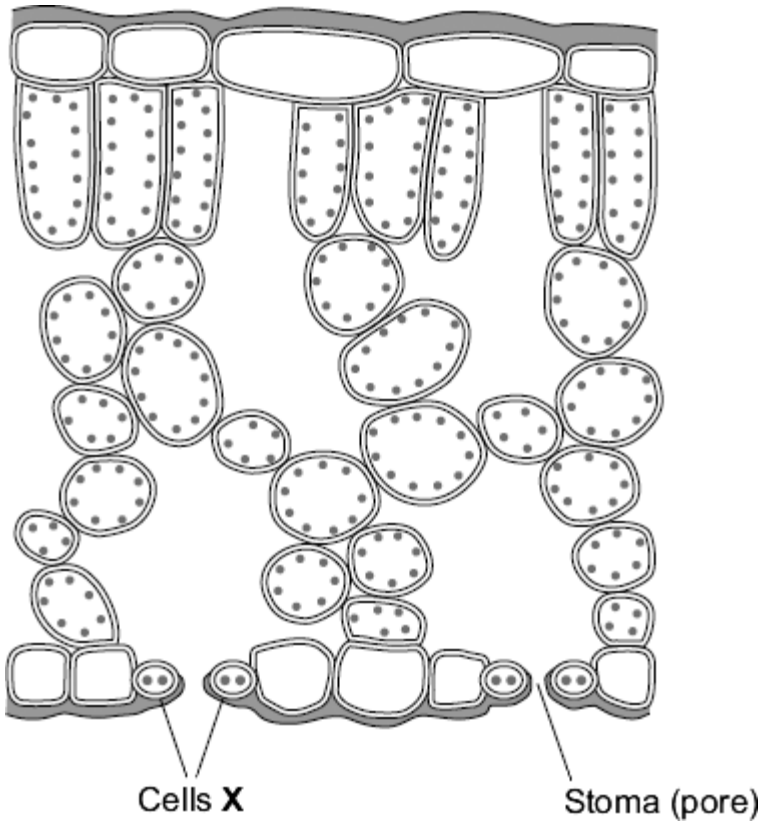
List X **Part of a cell**	**List Y** **Information**
	Controls the passage of substances into the cell
Vacuole	
	Contains the cell sap
Nucleus	
	Controls the activities of the whole cell

(2)

(Total 7 marks)

Q31.

The diagram shows a section through a plant leaf.



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

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

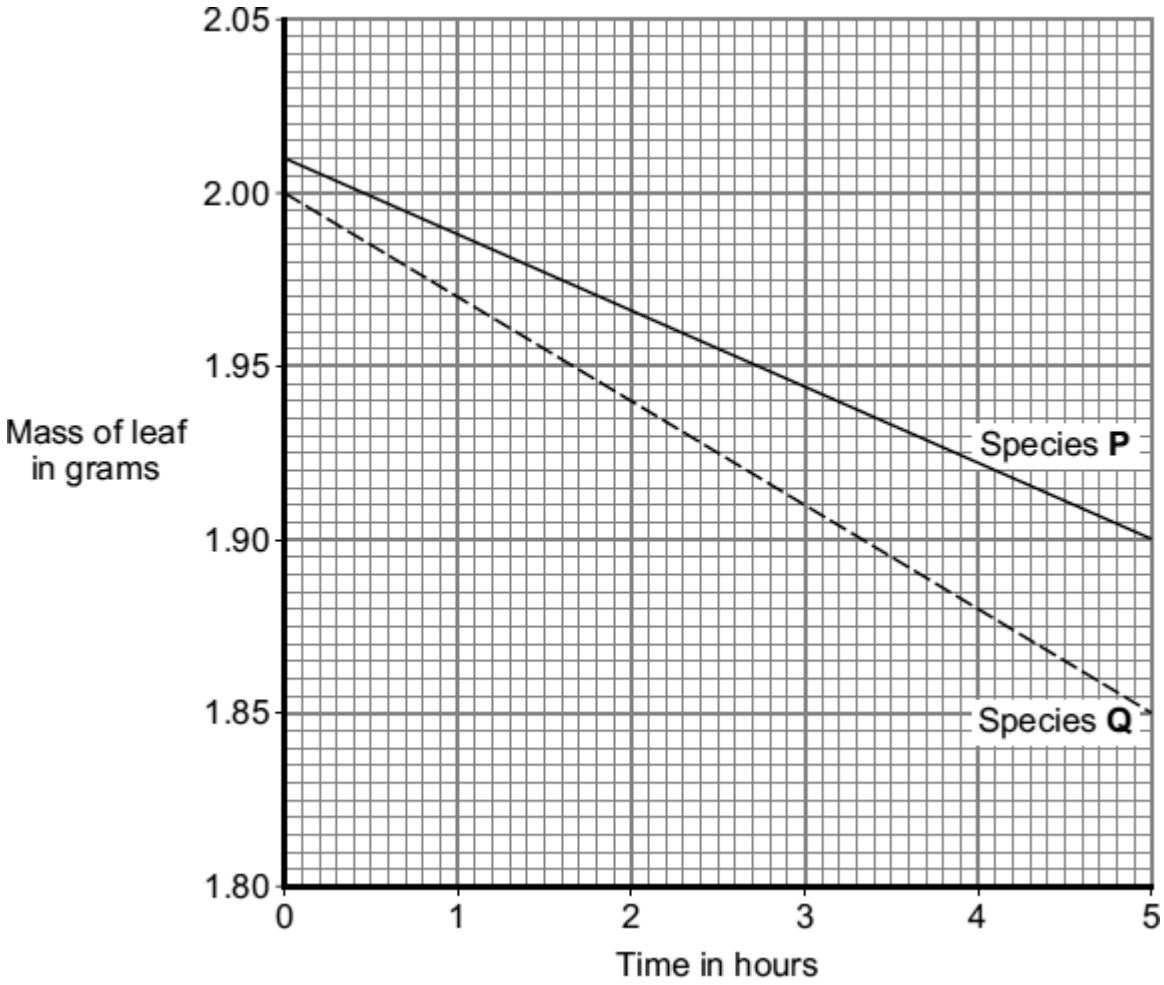
Cells **X** are called

- 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.



(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 (✓)**
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	**Mass of leaf + beaker in grams**

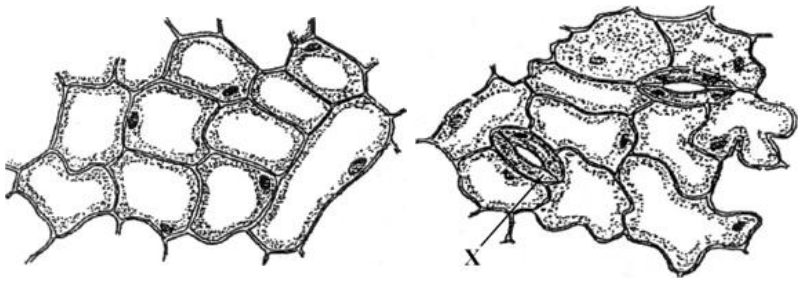
in hours	Leaf A	Leaf B	Leaf C
0	50.00	55.01	51.99
0	49.99	54.95	51.90
3	49.97	54.90	51.85
5	49.95	54.86	51.80

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

(1)

(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.

_____

_____

_____

_____

_____

_____

_____

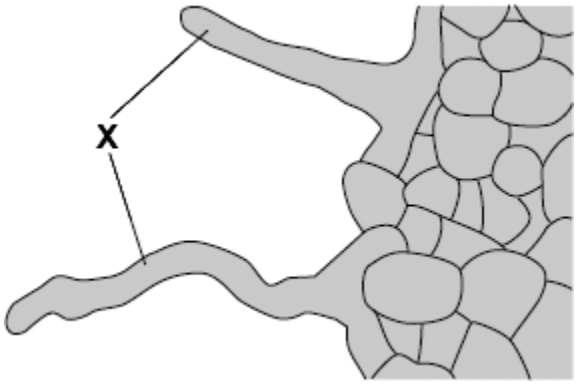
_____

(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.

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.

alveoli.

(i) Carbon dioxide enters leaves through

stomata.
villi.

(1)

(ii) Carbon dioxide enters leaf cells by

active transport.
diffusion.
reabsorption.

(1)

(Total 5 marks)

Q34.

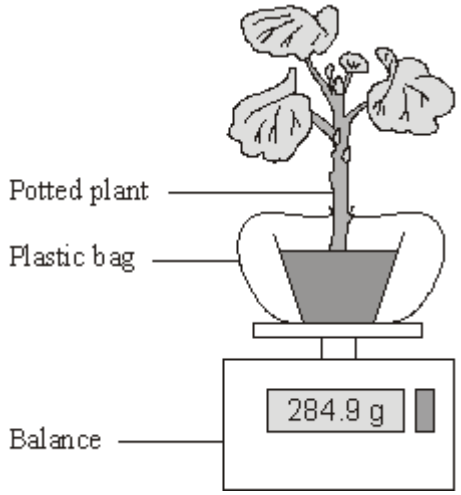
(a) Name the process by which water is lost from plant leaves.

_____

_____

(1)

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



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.

_____

_____

_____

_____

_____

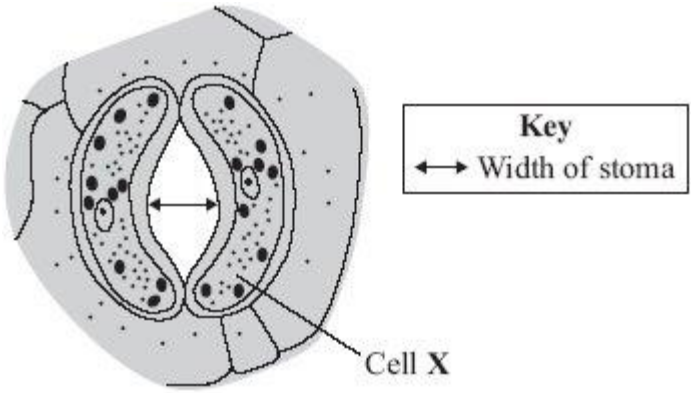
(2)

(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
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.

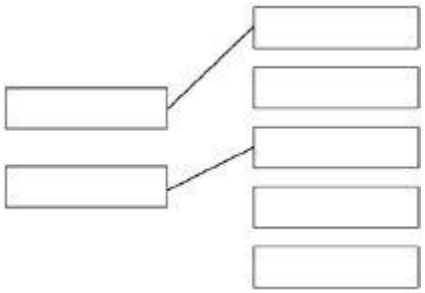
(4)

(Total 5 marks)

Mark schemes

Q1.

(a)



additional line from a level of organisation negates the mark for that level of organisation

2

(b) palisade mesophyll

1

(c) $\frac{50}{8}$

1

6 / 6.25 / 6.3 (micrometres)

1

*an answer of 6 / 6.25 / 6.3 scores **2** marks*

(d) they have no chloroplasts / chlorophyll

allow they are underground
allow they don't get (access to) light
allow (because) photosynthesis needs light
allow they can't absorb light
ignore 'sun'
ignore 'it is dark'

1

(e) differentiation

1

(f) to protect endangered plants from extinction

1

(g) plants can be produced quickly

1

(h) any **one** from:

- glucose / sugars / starch
- amino acids / protein
- hormones

  allow named hormones e.g. auxin
- ions / minerals

  allow magnesium / nitrate
- vitamins

allow named vitamins e.g. vitamin B

- water

  allow H_2O / H2O

  ignore oxygen / carbon dioxide / agar / nutrients / fertiliser

1

[10]

Q2.

(a) phloem

1

(b) translocation

1

(c) either:

less (sugars for) respiration

1

(so) less energy released

1

or

less amino acids made (1)

(so) less protein produced **or** less protein synthesis (1)

or

less cellulose made (1)

(so) weaker cell walls (1)

(d) (aphids) can fly to another plant **or** part of the plant

ignore to fly unqualified

1

to get (more) food

allow to find a mate
allow idea of less competition for food
allow to escape predators
*do **not** accept escape prey*

1

(e) (oil) prevents aphids from attaching to leaf **or** causes aphids to slide off leaf

ignore 'the leaf is slippery'

or
idea that oil may harm / kill the aphid

allow oil may be unpleasant to the aphid

1

(f) (plant / stem has) thorns

allow spines / spikes / prickles
ignore stings
*do **not** accept thorns protect (the plant) from predators*

1

(g) C

if any other letter given then no marks for the question

1

(fungi / spores) blown by / in direction of the wind

allow black spot / disease is blown by / in direction of the wind

or
it's the closest plant (to A)

*do **not** accept reference to bacteria / viruses / pollen being blown*

1

(h) any **one** from:

- spread rose bushes out more

allow isolate the infected plant
allow idea of barrier around infected plant
ignore separate unless qualified

- remove any infected parts of the plant

allow remove infected plant / A

- use a fungicide

ignore pesticide
*do **not** accept insecticides / herbicide*

1

[11]

Q3.

(a) (mouthpiece) has pierced / entered the phloem
or
(the aphid) has been feeding from the phloem

1

(b) yellow leaves due to lack of chlorophyll

ignore 'chloroplasts'
ignore magnesium is needed to make chlorophyll

1

(therefore) less / no light absorbed (by chlorophyll)

1

(therefore) lower rate of / no photosynthesis

*do **not** allow 'energy is produced by photosynthesis'*

1

(therefore) plant makes less / no sugar / glucose

1

(therefore) plant converts less / no sugar / glucose into protein (for growth, so growth is stunted)

allow less glucose / sugar converted into cellulose (cell wall)
allow less energy for protein synthesis

1

(c) inject the protein / it into a mouse

1

combine lymphocytes with tumour / cancer cells to make hybridoma (cells)

ignore white blood cells
allow T or B lymphocytes
ignore tumour unqualified

1

find a hybridoma which makes a monoclonal antibody specific to PVY

1

(the scientist) clones (the hybridoma) to produce many cells (to make the antibody)

*do **not** allow cloning of original stem cells*
allow many rounds of cloning / mitosis

1

[10]

Q4.

(a) (**A**) bronchus

allow bronchi
allow bronchiole

1

(**B**) trachea

allow windpipe

1

(**C**) alveolus

allow alveoli
ignore air sac

1

(b) circulatory system

1

(c) **Q**

1

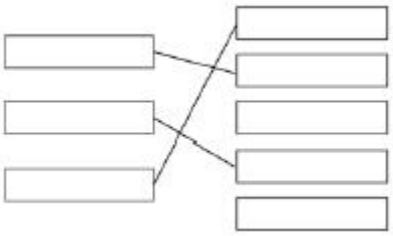
(d) guard cell

1

(e) a group of cells with a similar structure / function

1

(f)



1 *mark for each correct line*

extra line from a tissue negates the mark for that tissue

3

[10]

Q5.

(a) electron (microscope)

1

(b) $\frac{30000}{200}$

*an answer of 150 (μm) scores **2** marks*

1

150 (μm)

*if answer is incorrect allow for **1** mark sight of 0.015 / 0.15 / 1.5 / 15*

*allow ecf for incorrect measurement of line **X** for max **1** mark*

1

(c) **either**

large surface area

allow (vacuole contains) cell sap that is more concentrated than soil water (1)

1

for more / faster osmosis

create / maintain concentration / water potential gradient (1)

or

allow thin (cell) walls

for short(er) diffusion distance

1

(d) (on hot day) more water lost

allow converse for a cold day if clearly indicated

1

more transpiration

or

more evaporation

1

so more water taken up (by roots) to replace (water) loss (from leaves)

1

(e) (aerobic) respiration occurs in mitochondria

*do **not** accept anaerobic respiration*

1

(mitochondria / respiration) release energy

*do **not** accept energy produced / made / created*

1

(energy used for) active transport

1

to transport ions, against the concentration gradient
or
from a low concentration to a high concentration

1

[12]

Q6.

(a) 86

allow this answer only
*do **not** accept 85.7*
if no answer given, check for answer in the table

1

(b) as salt concentration increases, percentage of open stomata (in field of view) decreases (above 0.1 mol / dm^3)
or
allow percentage of open stomata stays the same between 0.0 and 0.1 (mol / dm^3 then decreases as salt concentration increases)

ignore references to number of open stomata
allow converse
allow idea that mean concentration (of salt) in guard cells is between 0.3 and 0.4 mol per dm^3

1

(c) use concentrations between 0.3 (mol / dm^3) and 0.4 (mol / dm^3)
or
draw a graph of the data and read off the value at 50% (open stomata)

allow a list of appropriate concentrations i.e. 0.32 mol / dm^3), 0.34 (mol / dm^3), 0.36 (mol / dm^3) etc.

1

(d) ($\pi \times 0.1875^2$) = 0.11 (mm^2)

*an answer of 36 scores **3** marks*

1

$$\frac{4}{0.11}$$

1

36 (per mm^2)

allow 36.22 / 36.23 ***or*** *36.2*

if answer is incorrect allow for ***2*** *marks for sight of number of open stomata = 9 per mm² (diameter used instead of radius)*

if no other marks awarded allow for ***1*** *mark any* ***one*** *from:*

- *sight of area = 0.44(mm²) (diameter used instead of radius)*
- *sight of number of open stomata = 9.1 / 9.05 / 9.06 per mm² (diameter used instead of radius and no rounding)*

1

(e) (potassium) ions increase the concentration of the solution (inside guard cells)
or
(potassium) ions make cell more concentrated / less dilute

allow (potassium) ions decrease concentration of water / water potential (of guard cells)

1

water moves into the (guard) cell by osmosis

1

cell swells unevenly (so stoma opens)

1

as inner wall is less flexible than outer wall **or** thick part of the wall is less flexible than the thin part (of the wall)

1

[10]

Q7.

(a) active transport

1

(b) by transpiration stream / pull

1

in xylem

1

(c) any **three** in the correct order from:

- mount epidermis on a slide
- count stomata in one area
- repeat in four more areas
- repeat method on other surface of leaf
- calculate mean

allow nail varnish film

3

(d) 1

allow numbers written out in a line with middle number circled

1

(e) (44 + 41 + 40 + 42 + 39) / 5 = 41.2

1

41

*allow 41 with no working shown for **2** marks*

1

*allow 41.2 for **1** mark*

(f) less water lost

1

so it does not wilt

1

[11]

Q8.

(a) to kill virus
or
to prevent virus spreading

1

(b) take (stem) cells from meristem
or
tissue culture

allow take cuttings

1

(c) use Benedict's solution

1

glucoses turns solution blue to orange

1

(d) **Level 2 (3–4 marks):**
A detailed and coherent explanation is provided. The student makes logical links between clearly identified, relevant points that explain why plants with TMV have stunted growth.

Level 1 (1–2 marks):
Simple statements are made, but not precisely. The logic is unclear.

0 marks:
No relevant content.

Indicative content

- less photosynthesis because of lack of chlorophyll
- therefore less glucose made
  so
- less energy released for growth
- because glucose is needed for respiration
  and / or
- therefore less amino acids / proteins / cellulose for growth
- because glucose is needed for making amino acids / proteins / cellulose

4

[8]

Q9.

(a) guard (cells)

allow phonetic spelling

1

(b) (i) as carbon dioxide (concentration) increases, the (mean) number of stomata decreases

allow there is a negative correlation

1

(there is a) rapid drop initially

allow use of any number between 1.5 and 3.0 to indicate "initially"

1

(ii) (there is) more carbon dioxide so plant doesn't need as many stomata (to obtain the amount needed)

or

(there is) less carbon dioxide so the plant needs more stomata (to obtain enough)

1

(c) (i) may lose too much water

allow plant may wilt

ignore references to oxygen / carbon dioxide

plants lose a lot of water is insufficient

ignore flaccid

1

(ii) any **one** from:

- hot
- dry
- windy

ignore environments unqualified eg desert

1

[6]

Q10.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

Level 3 (5–6 marks):
Processes used for obtaining specified materials are given.
and
correctly linked to the vessels that the materials are transported in
or
correctly linked to a description of the direction of movement of the materials.
For full credit, in addition to the above descriptors at least **one** of the processes must be linked to the vessel that the material is transported in **and** the direction of the movement of the material.

Level 2 (3–4 marks):
At least **one** process for obtaining a specified material is given

and
is correctly linked to the vessel that the material is transported in
or
correctly linked to a description of the direction of movement of the material

Level 1 (1–2 marks):
At least **one** process (P) for obtaining a material is given
or
at least **one** vessel (V) and the material it carries is given
or
there is a description of the direction of movement (M) for at least **one** material

0 marks:
No relevant points are made

examples of points made in the response Ions:
(P) taken up by diffusion or active transport
- from an area of high to low concentration (diffusion) **or** an area of low to high concentration (active transport)
  (V) travels in the xylem
  (M) to the leaves **or** from the roots / soil

Water:
(P) taken up by osmosis
- from an area of low to high concentration

  allow high concentration of water to low concentration of water

  allow from high water potential to low water potential

  ignore along a concentration gradient

  (V) travels in the xylem
  (M) to the leaves **or** from the roots / soil
  (P) transpiration stream
- movement replaces water as it evaporates from leaves
  (V) in the xylem

Sugar:
(P) made during photosynthesis
(V) travels in the phloem
(M) to other parts of the plant **or** to storage organs **or** travels up and down

[6]

Q11.

(a) (i) 5.0

1

(5 × 0.8) **or** 4

allow ecf from distance

1

0.4

allow ecf from 10-min volume

1

(ii) increased (rate of uptake)

1

more transpiration / evaporation

1

(b) correct scales

allow reversed axes

1

correctly labelled axes with units

1

correct points

*one plot error = max **1** mark*

2

curved line of best fit

allow correct straight line

1

(c) leaves <u>wilt</u>

1

because plants lose too much water (by evaporation)

1

through the <u>stomata</u>
or
because cells become <u>plamolysed</u>
or
<u>stomata</u> close
controlled by <u>guard cells</u>
to prevent <u>wilting</u>

1

[13]

Q12.

(a) (i) water / H_2O

accept oxygen

allow H_2O

*do **not** allow H^2O or H2O*

1

(ii) the mineral ions are absorbed by active transport

1

the absorption of mineral ions needs energy

1

(iii) have (many root) <u>hairs</u>

1

(which) give a large surface area (for absorption)

1

(b) carbon dioxide in

or
oxygen out
or

control water loss
accept gas exchange
ignore gases in and out
ignore gain / lose water

1

(c) (i) guard cells

1

(ii) (stomata are) closed
allow there is no gap / space

1

(iii) plant will wilt / droop
ignore die

1

[9]

Q13.

(a) A - atrium
ignore references to right / left

1

B - ventricle

1

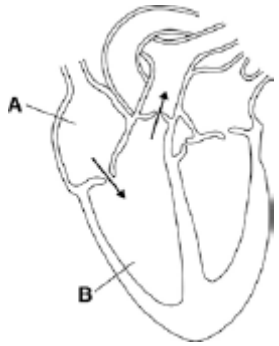
(b) (i) muscular

1

(ii) push blood
accept pump / force

1

(c)



arrows approx as indicated

1

arrow(s) showing flow from A to B
from B out / up / to artery

1

(d) (i) male

1

65 and over

1

(ii) fatty deposits / material in (coronary) arteries

allow correct points made about heart attacks

1

narrows / blocks / reduces flow

1

decreases oxygen supply (to heart muscle)

1

[11]

Q14.

(a) guard cells

1

(b) (i) any **one** from:

- species / plant
- length of time

ignore temperature and size of leaves

1

(ii) 20

*correct answer = **2** marks*

accept $\frac{1.6 - 1.28}{1.6} \times 100$

or $\frac{0.32}{1.6} \times 100$

*for **1** mark*

2

(c) less water loss / transpiration / evaporation

1

(d) hot

1

ignore bright / sunny conditions

dry / low humidity

1

wind(y)

1

[8]

Q15.

(a) (i) xylem

1

(ii) water

1

minerals / ions / named example(s)

ignore nutrients

1

(b) (i) movement of (dissolved) sugar

allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)

allow nutrients / substances / food molecules if sufficiently qualified

ignore food alone

1

(ii) sugars are made in the leaves

1

so they need to be moved to other parts of the plant for respiration / growth / storage

1

(c) (i) mitochondria

1

(ii) for movement of minerals / ions

Do not accept 'water'

1

against their concentration gradient

1

[9]

Q16.

(a) (i) traps light (energy)

allow uses light / converts light energy to chemical energy

1

for photosynthesis / for making sugar / starch / carbohydrates

ignore food

allow organic molecules

1

(ii) dodder takes sugar / glucose / sucrose from phloem / dodder cannot make its own glucose / carbohydrate

or

phloem has sugar / glucose / sucrose

accept amino acids / fatty acids / other small organic molecule

ignore takes food / minerals / water / nutrients

1

(iii) any **one** from:

- not enough sugar / nutrients to grow / respire
  accept not enough food to grow / respire
- might strangle / restrict growth by squeezing stem tightly
- may damage stem tissues by growing into it
- may smother leaves / block light **so** less photosynthesis / less growth

1

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
Description and explanation of an adaptation which only involves hooks **and / or** suckers.

Level 2 (3 – 4 marks)
Description and explanation of adaptations including hooks **and / or** suckers with any other adaptation **or** explanation.

Level 3 (5 – 6 marks)
Description of most correct adaptations **and** explanations.

Examples of biology points made in the response:

- hooks – for holding on / not being detached
- suckers – for holding on / not being detached
- flattened / large surface area – absorption of (large amounts of) food
- no gut – not needed as host digests food
- thick cuticle – protection from host's enzymes / so not digested
- large number of eggs – increased chance of infecting new host

  allow hermaphrodite and self-fertilising – likely to be just one worm per host

  internal fertilisation – gametes not digested

6

[10]

Q17.

(a) (i) xylem

1

(ii) phloem

1

(iii) transpiration

1

(iv) stomata

1

(b) (i) any **one** from:

- reduce / prevent evaporation of water from flask
- holds plant shoot in place
- prevent damage to the plant

1

(ii) same surface area **or** number of leaves

*(because if they used larger / smaller size shoots) there would be a larger / smaller surface area **or** a larger/ smaller number of leaves*

allow same number of stomata

1

from which (the same amount of) water evaporates

(and therefore) more / less water would escape

allow from which water escapes

1

(iii) 4.5

look for answer written in table

1

(iv) increasing temperature / heat increases (rate of) water loss / evaporation

1

(v) having moving air / a fan increases (rate of) water loss / evaporation

1

(c) (i) 0.3 g

1

(ii) plastic bag reduces air flow across leaves
or
air is humid around the leaves

allow plastic bag stops water (vapour) leaving
allow air (in plastic bag) becomes saturated (with water)

1

[12]

Q18.

(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]

Q19.

(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 × 0.1 = 0.01 (mm^2)

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]

Q20.

(a) any **one** from:

ignore 'check temperature'

- add a water bath
- heat screen
- use LED
- low energy bulb / described

1

(b) (i) rate / number of bubbles decreases

*accept converse with reference to increasing light **or** shorter distance*

or

less oxygen / gas released

ignore reference to rate of photosynthesis

1

(ii) temperature / CO_2 (concentration)

*accept 'it was too cool' **or** not enough CO_2*

accept number of chloroplasts / amount of chlorophyll

allow heat

allow CO2

*do **not** allow CO^2*

1

(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a brief description of at least 1 tissue **or** at least 1 function of an indicated part of the leaf.

The account lacks clarity or detail.

Level 2 (3-4 marks)
There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.

Level 3 (5-6 marks)
There is a detailed description of most of the structures and their functions.

Examples of responses:

- epidermis

- cover the plant
- mesophyll / palisade
- photosynthesises
- phloem
- xylem
- transport.

The following points are all acceptable but beyond the scope of the specification:

- (waxy) cuticle – reduce water loss
- epidermis – no chloroplasts so allows light to penetrate
- stomata / guard cells – allow CO_2 in (and O_2 out) **or** controls water loss
- palisade (mesophyll) – <u>many</u> chloroplasts to trap light

  – near top of leaf for receiving more light
- spongy (mesophyll) – air spaces for rapid movement of gases

6

[9]

Q21.

(a) (i) wind

answers in either order

1

temperature

ignore weather

1

(ii) different plants have different sizes

ignore reference to validity

/ different numbers of leaves
/ different sizes of leaves
/ different plants take up different amounts of water
/ different number of stomata
/ different surface area

allow different plants need different amounts of water

1

(b) in table, in sequence:

C
B

A

*all 3 correct = **2** marks*
*2 correct = **1** mark*
*0 or 1 correct = **0** marks*

max 2

(c) transpiration

1

[6]

Q22.

(a) guard cell

ignore stoma / stomata

1

(b) Species A :

allow converse points for species B

stomata open in dark / at night **or** close in light / in day

1

stomata closed during warm(est) period **or** open when cool(er)

1

heat (energy) /warmth increases evaporation / transpiration

must give explicit link between heat and transpiration

1

reduces water loss / evaporation / transpiration

ignore photosynthesis

1

[5]

Q23.

(a) xylem **and** phloem

either order
allow words ringed in box
allow mis-spelling if unambiguous

1

(b) (i) movement / spreading out of particles / molecules / ions / atoms

ignore names of substances / 'gases'

1

from high to low concentration

accept down concentration gradient
ignore 'along' / 'across' gradient
ignore 'with' gradient

1

(ii) oxygen / water (vapour)

allow O_2 / O2

ignore O^2/ O
allow H_2O / H2O
ignore H^2O

1

[4]

Q24.

(a) (i) root hairs
if clear which word then allow

1

(ii) xylem
if clear which word then allow

1

(iii) stomata
if clear which word then allow

1

(iv) storage organs
in this order

1

phloem

1

(b) (i) 23.2

1

(ii) loss of water (from flask with plant) from leaves / plant

1

via transpiration / via evaporation
if no other marks allow used in photosynthesis for one mark

1

[8]

Q25.

(a) solution in soil is more dilute (than in root cells)
concentration of water higher in the soil (than in root cells)

1

so water moves from the dilute to the more concentrated region
*so water moves <u>down</u> (its) concentration gradient **or** water moves from a high concentration <u>of water</u> to a lower concentration*

1

concentration of ions in soil less (than that in root cells)

1

so energy needed to move ions

or

ions are moved against concentration gradient

the direction of the concentration gradient must be expressed clearly

accept correct reference to water potential or to concentrations of water

1

(b) any **three** from:

- movement of water from roots / root hairs (up stem)
- via xylem
- to the leaves
- (water) evaporates
- via stomata

3

(c) (i) 0.67/0.7

accept 0.66, 0.6666666... or ⅔ or 0.6

*correct answer gains **2** marks with or without working*

$\frac{100}{150}$

if answer incorrect allow evidence of $\frac{100}{150}$ *for **1** mark*

*do **not** accept 0.6 or 0.70*

2

(ii) <u>during the first 30 minutes</u>

any **one** from:

- it was warmer
- it was windier
- it was less humid
- there was more water (vapour) in the leaves

1

so there was more evaporation

ignore 'water loss'

or

stomata open during first 30 minutes **or** closed after 30 minutes (1)

so faster (rate of) evaporation in first 30 min **or** reducing (rate of) evaporation after 30 min (1)

1

[11]

Q26.

(a) transpiration

1

(b) (i) 200

correct answer with or without working

if answer incorrect:

*allow **1** mark for 8 × 25 **or***

*allow **1** mark for answer from candidate's count × 25*

2

(ii) **R**

*allow **P** or **Q** if candidate's answer to (b)(i) nearer to value for one of those*

*do **not** allow **R** if the answer to (b)(i) would give an answer of **P** or **Q***

allow R if (b)(i) is blank

1

(iii) few stomat

allow no stomata on upper surface / all stomata on lower surface

1

little / less transpiration **or** little / less water (vapour) loss / enable water to be retained

allow no water loss from upper surface

1

[6]

Q27.

(a) (i) water <u>loss</u>

extra substance(s) cancel

*if transpiration stream described max **1** mark*

1

as a vapour / by evaporation

ignore stomata

1

(ii) stomata / stoma / guard cells

ignore epidermis

1

(b) (i) 2.8

*correct answer with or without working gains **2** marks*

if answer incorrect:

*allow **1** mark for (8.6 - 0.2) ÷ 3 **or** 8.4 ÷ 3*

2

(ii) warmer at 16:00 / gets cooler

***or** reverse argument for 19.00*

1

faster diffusion / evaporation

accept sun setting as equivalent to heat or light marking points

or

lighter at 16:00 / gets darker (1)

if no environmental factor still allow reason mark

stomata open / more open (1)

eg 'stomata close later in the day'

or

(more) windy at 16:00 / gets less windy (1)

removal of (more) water vapour / steeper gradient (1)

or

air is less humid at 16.00 (1)

allow rain at 19.00

faster diffusion or steeper gradient (1)

1

[7]

Q28.

(a) transpiration

1

(b) increase then decrease

1

maximum rate at 36 - 38 (°C) / 540 - 560 (grams per day)

any figure in these ranges

1

(c) (i) reduce water loss / prevent wilting

allow stops water loss

1

(ii) 40 - 45 °C

1

[5]

Q29.

(a) (i) wind

1

temperature

answers in either order

ignore weather

1

(ii) different plants have different sizes / different numbers of leaves / different sizes of leaves / different plants take up different amounts of water

ignore reference to validity

allow different plants need different amounts of water

1

(b) in table, in sequence:

C

*all 3 correct = **2** marks*

B

A

*all 3 correct = **2** marks*

*2 correct = **1** mark*

*0 **or** 1 correct = **0** mark*

2

(c) transpiration

1

[6]

Q30.

(a) (i) tissue

extra box ticked cancels the mark

1

(ii) organ

extra ring drawn cancels the mark

1

(b) (i) Layer B

*each extra box ticked cancels **1** mark*

1

Layer C

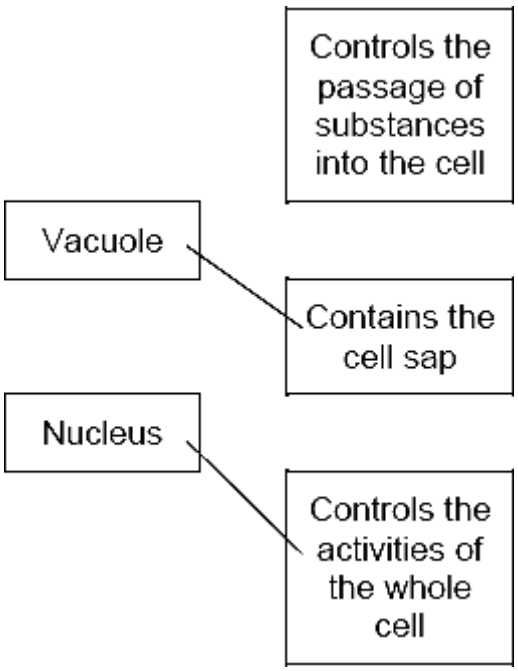
1

(ii) (contain) chloroplasts / chlorophyll

other parts disqualify

1

(c)



*two correct = **2** marks*
*one correct = **1** mark*
extra line from a part of a cell cancels the mark

2

[7]

Q31.

(a) guard cells

1

(b) (i) 2.00 / 2.0 / 2

1

(ii) 0.05 or 1/20

1

(iii) (Q has)
it = Q

large(r) surface area / more stomata / thinner cuticle / larger leaves
accept other sensible answers

1

(iv) wind 30
extra box ticked cancels the mark

1

(c) wilting
extra ring drawn cancels the mark

1

[6]

Q32.

(a) C

1

(b) (i) guard (cell)

1

(ii) temperature water movement / transpiration through stomata / pores / holes /(region) X

or

petroleum jelly blocks / covers stomata / pores / holes / X

1

stomata / pores / holes / X found on lower surface

1

[4]

Q33.

(a) (i) root hair

1

(ii) any **two** from:

ignore food

- water
- ions / minerals / nutrients / salts / correct named eg nitrates
  ignore N,P,K
- oxygen

2

(b) (i) stomata

1

(ii) diffusion

1

[5]

Q34.

(a) transpiration / evaporation / diffusion

ignore osmosis

1

(b) (i) D

1

(ii) any **two** from:

- <u>more / faster</u> diffusion **or** evaporation **or** transpiration
- molecules move faster
- maintains concentration gradient

or keeps water concentration low in the air
or brings in more dry air
or removes damp air / water

2

[4]

Q35.

(a) guard (cell)

ignore stoma / stomata

1

(b) Species A:

- stomata open in dark / at night **or** close in light / in day

1

- stomata closed during warm(est) period **or** open when cool(er)

1

- heat (energy) / warmth increases evaporation / transpiration

must give explicit link between heat and transpiration

1

- reduces water loss / evaporation / transpiration

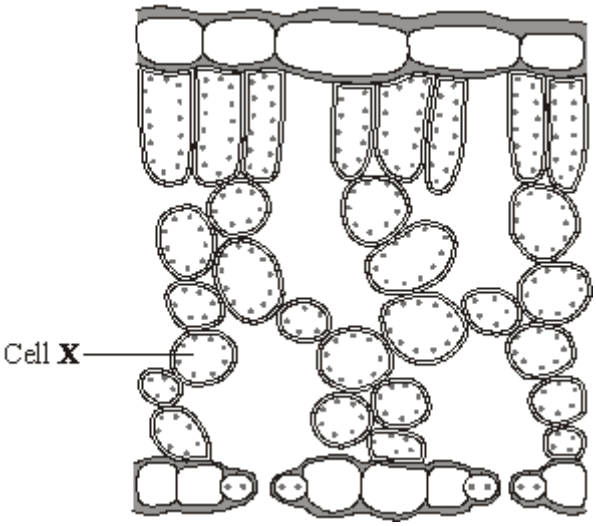
ignore photosynthesis
allow converse points for species B

1

[5]

Q1.

(a) The diagram shows a section through a plant leaf.
Water evaporates from cell **X**.



(i) **On the diagram**, draw an arrow to show how water vapour from cell **X** gets out of the leaf.

(1)

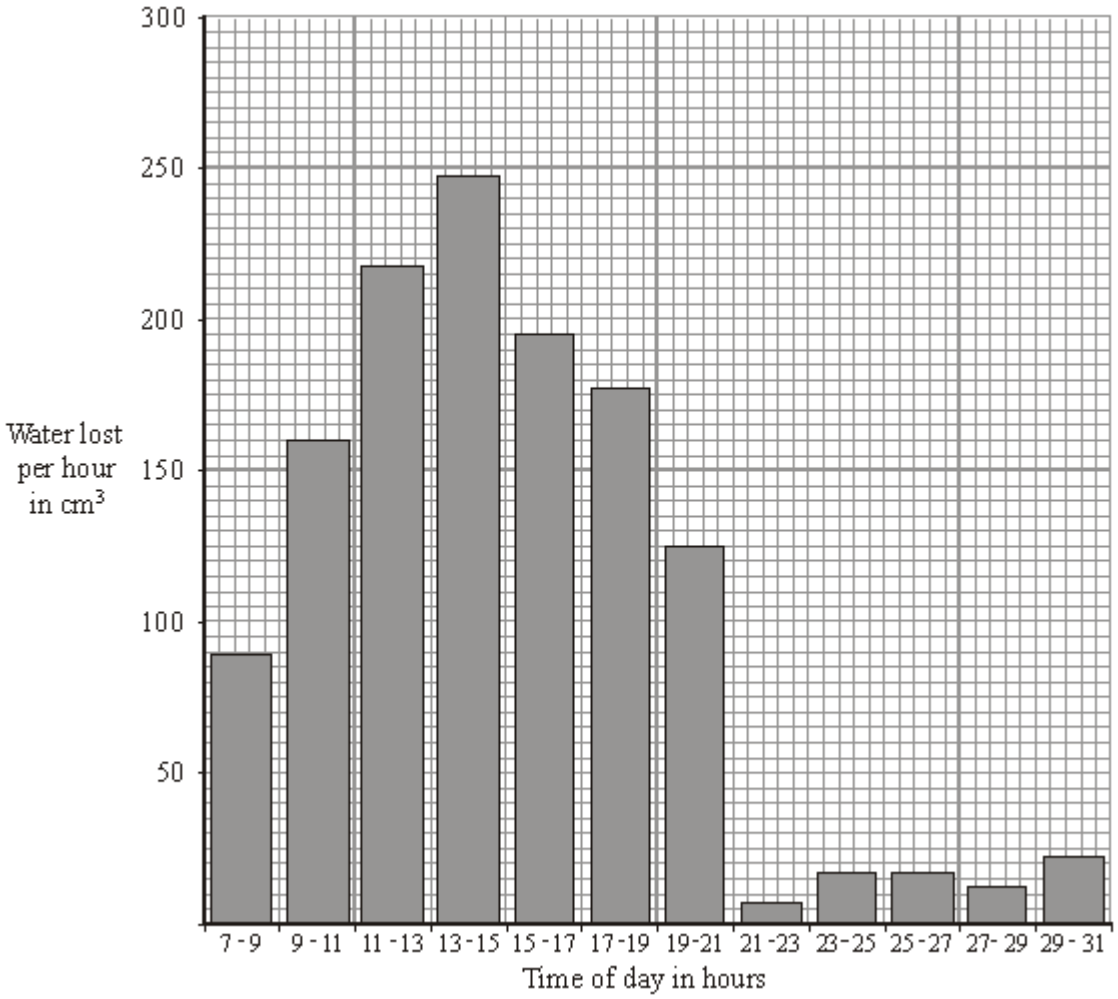
(ii) Name the process by which water vapour is lost from a leaf.

Draw a circle around **one** answer.

osmosis **transpiration** **wilting**

(1)

(b) The graph shows how much water was lost from a plant at different times of the day.



(i) During which 2-hour period was water lost most quickly?

_____

(1)

(ii) Give **one** possible explanation why water was lost most quickly at this time.

_____

_____

_____

_____

(2)

(Total 5 marks)

Q2.

A group of students looked at stomata on four different species of plants, **A, B, C** and **D**. They estimated the number of stomata per cm^2 on the upper and lower surfaces of the leaves of the four species.

Their results are shown in the table.

Plant species	Estimated number of stomata per cm^2 of leaf surface	
	Upper surface of leaf	**Lower surface of leaf**
A	4000	28 000
B	0	800
C	8500	15 000
D	8000	26 000

(a) Which plant species probably lives in a dry region? ☐

Explain the reason for your answer.

(3)

(b) All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this could help the plants to survive better.

(2)

(Total 5 marks)

Q3.

Four leaves were removed from the same plant. Petroleum jelly (a waterproofing agent) was spread onto some of the leaves, as follows:

Leaf **A**: on both surfaces
Leaf **B**: on the lower surface only
Leaf **C**: on the upper surface only
Leaf **D**: none applied

Each leaf was then placed in a separate beaker, as shown in diagram **1**.

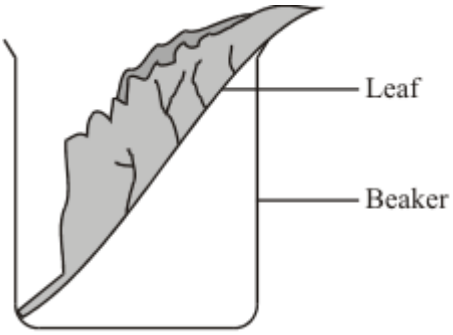
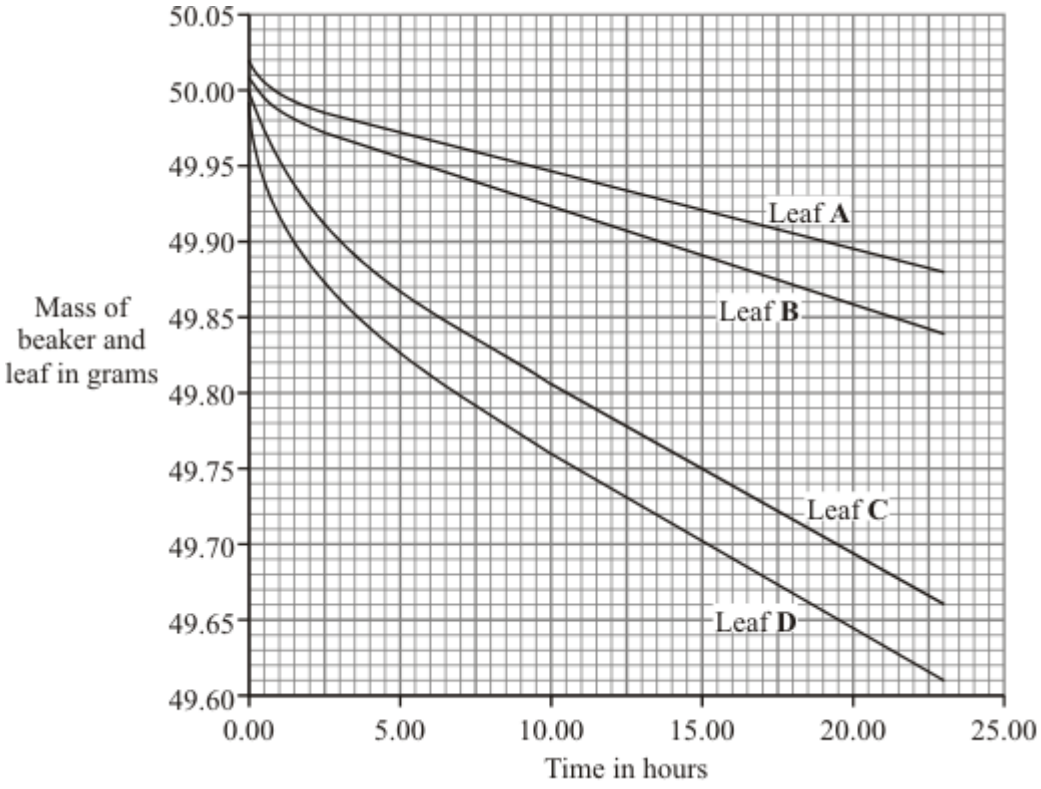


Diagram 1

Each beaker was weighed at intervals. The results are shown in the graph.



(a) Give evidence from the graph in answering the following questions.

(i) Which surface (upper or lower) loses water most rapidly? _____

Evidence _____

_____

(1)

(ii) Is water lost from both surfaces of the leaf? _____

Evidence _____

_____

(1)

(b) Diagram **2** shows the appearance of each surface of the leaf as seen through a microscope.

Upper Surface of Leaf **Lower Surface of Leaf**

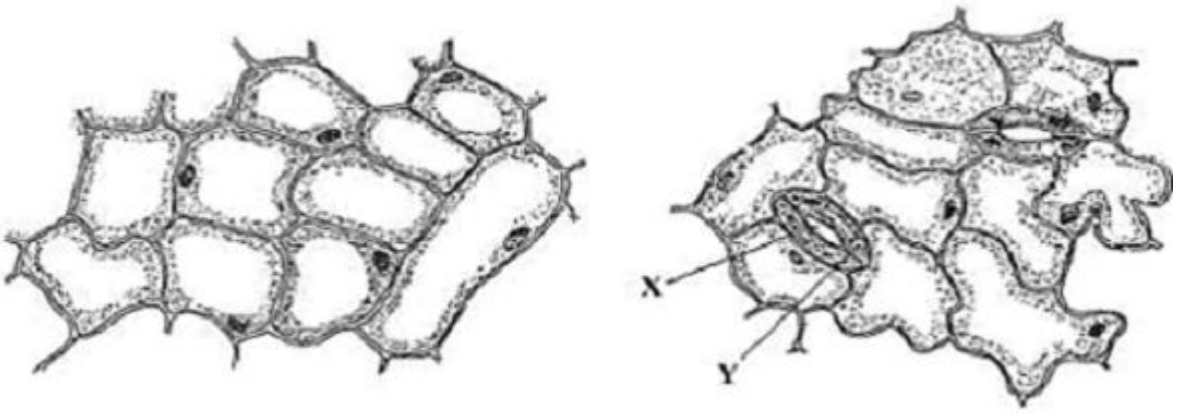


Diagram 2

(i) Name space **X** and cell **Y**.

X _____

Y _____

(2)

(ii) Use information in diagram **2** to explain why the results are different for leaves **B** and **C**.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q4.

The table gives information about a geranium plant and a cactus plant.

The geranium grows in gardens in the UK. The cactus grows in hot deserts.

Feature	Geranium	Cactus
Thickness of waxy cuticle in micrometres	5	15
Total leaf surface area in cm^2	1800	150
Percentage of water storage tissue in stem	50	85
Number of stomata per mm^2	59	13
Time of day when stomata open	daylight	at night
Horizontal spread of roots in metres	0.2	5

Using only information in the table, explain how the cactus is better adapted for living in hot, dry conditions.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 5 marks)

Q5.

(a) Complete the following sentences.

Green plants produce their own food by a process called photosynthesis. In this process the raw materials are _____ and carbon dioxide. Glucose and _____ are produced. _____ energy is absorbed by the green substance

called _____ .

(4)

(b) Name **two** things that can happen in the plant to the glucose produced in photosynthesis.

1. _____

2. _____

(2)

(c) Plants need mineral salts.

(i) Through which part do mineral salts get into the plant?

_____

(1)

(ii) Explain why water is important in this process.

_____

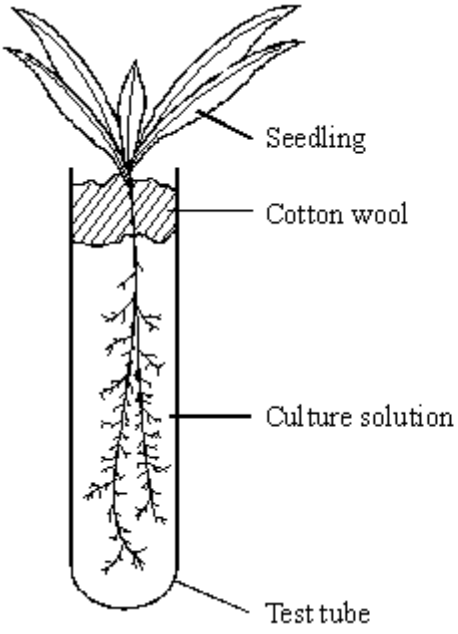
_____

_____

_____

(2)

Some students set up water cultures to find out how plants use nitrates.
They had two sets of nutrient solutions.
A full solution provided the plant with all the required nutrients.
The results table shows the average mass of the seedlings after 28 days of growth.



Culture solution	Average mass of seedling in g
distilled water	0.14
full solution with no nitrates	0.29
full solution	0.43

(d) (i) Give a conclusion you could make from these results.

_____

_____

(1)

(ii) Calculate the difference in average mass caused by the addition of nitrates to the culture solution.

_____

(1)

(iii) What are nitrates used for in the seedling?

_____

(1)

(iv) Some factors need to be controlled to keep this test fair. Name **two** of them.

1. _____

2. _____

(2)

(v) Suggest **one** way you could improve the experiment.

_____

(1)

(Total 15 marks)

Q6.

(a) What type of blood vessels join arteries to veins?

_____

(1)

(b) How are oxygen and carbon dioxide carried in the blood?

_____

_____

_____

_____

(2)

(c) List **three** things that are carried around the body in the blood plasma.

1. _____

2. _____

3. _____

(3)

(Total 6 marks)

Q7.

(a) Photosynthesis is a process that takes place in green plants.

(i) What type of energy is needed for this process?

_____

(1)

(ii) What substance in the plant absorbs this energy?

_____

(1)

(iii) In which part of the plant cell does photosynthesis take place?

_____

(1)

(iv) Write a balanced chemical equation for photosynthesis.

_____ → _____

(3)

(b) Describe **two** ways you could speed up photosynthesis.

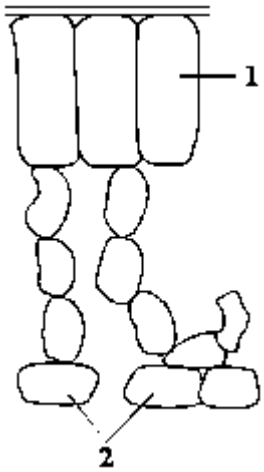
_____

_____

_____

(2)

(c) The diagram shows the outline of a cross-section of a leaf. Name cells **1** and **2** and describe how they are involved in photosynthesis.



_____

_____

_____

_____

_____

_____

_____

_____

(4)

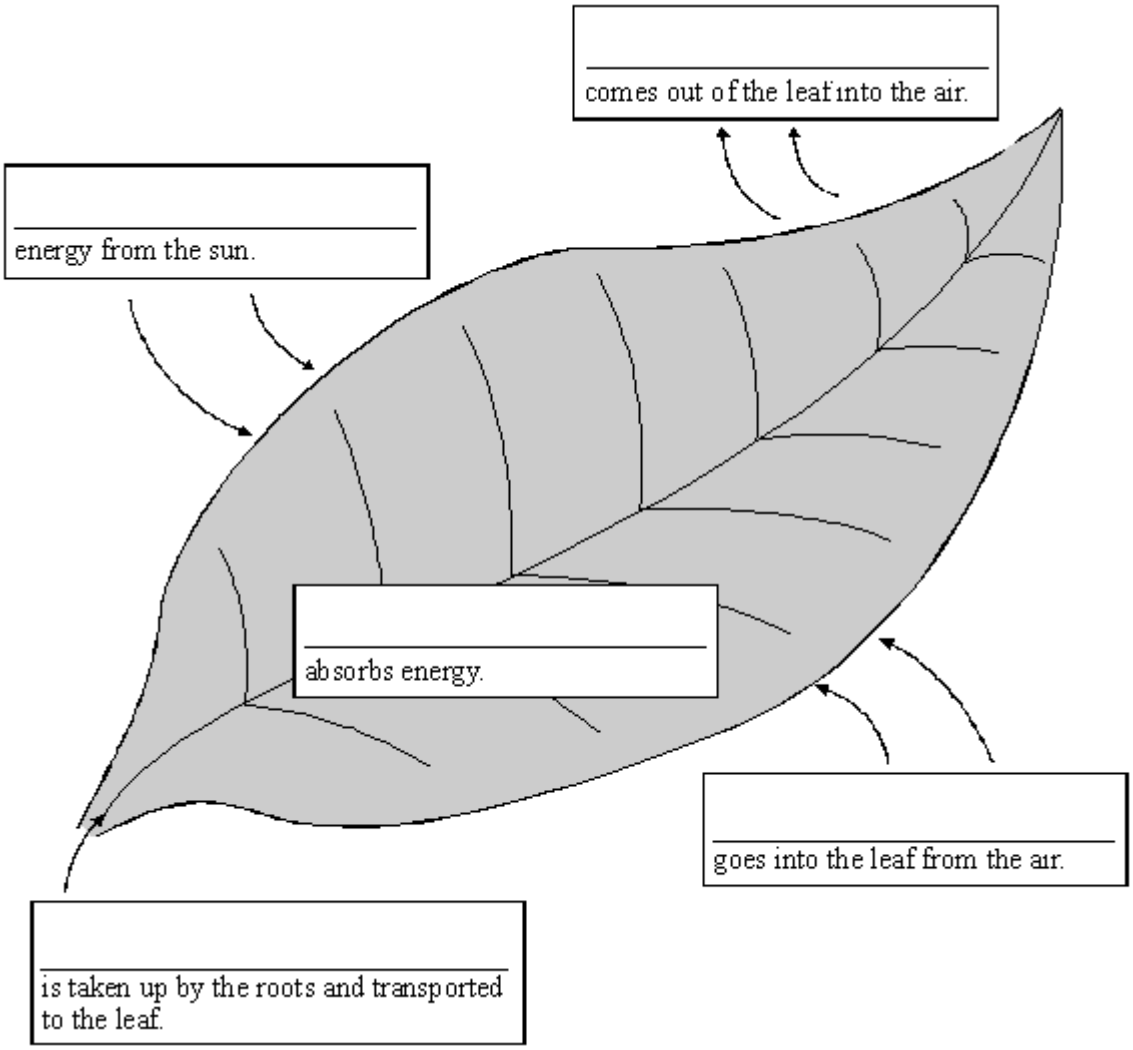
(Total 12 marks)

Q8.

The diagram shows how a leaf of a green plant makes glucose.

(a) Use words from the box to complete the labels on the diagram. You may use each word once or not at all.

carbon dioxide	chlorophyll	glucose	heat
light	oxygen	water	



(5)

(b) (i) Compete the following sentence.

Glucose in food is a type of _____ . When we eat it, it gives us energy.

(1)

(ii) The plant turns some of the glucose into starch. Why is starch useful to the plant?

_____

_____

(1)

(iii) What does the plant do with the rest of the glucose?

_____

(1)

(c) (i) What is the name of the process outlined in the diagram?

_____

(1)

(ii) Give **one** way that leaves are adapted to do this process.

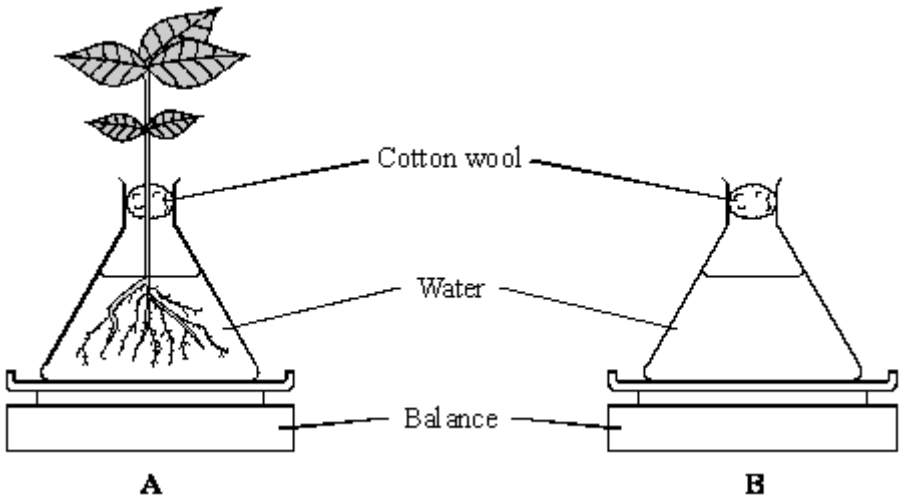
_____

(1)

(Total 10 marks)

Q9.

Some students set up the following apparatus.



The balances show the same mass at the start of the investigation.

After 24 hours the mass of flask **B** was the same but the mass of flask **A** had changed.

(i) Describe and explain the change to the mass of flask **A**.

_____

_____

_____

_____

_____

(3)

(ii) Why did the students need to set up flask **B**?

_____

_____

(1)

(Total 4 marks)

Q10.

(a) Put a tick (✓) in the correct boxes in the table below to show which of the parts given are present in the cells and organisms listed.

	CYTOPLASM	NUCLEUS	CELL WALL	GENES
Leaf mesophyll cell				
Sperm				

(2)

(b) (i) What is the main job of a leaf mesophyll cell?

_____

_____

(1)

(ii) Explain **one** way in which the structure of the leaf mesophyll cell helps it to carry out its job.

_____

_____

_____

_____

(2)

(Total 5 marks)

Q11.

A market gardener produces large numbers of attractive, large flowered geranium plants.

(a) Give two advantages to the gardener of producing geraniums from cuttings rather than from seeds.

1. _____

_____

2. _____

_____

(2)

(b) Gardeners often cover trays of cuttings with large polythene bags.

Suggest **one** advantage of this.

_____

_____

(1)

(Total 3 marks)

Q12.

Busy lizzie plants produce flowers with many different colours.

A gardener wants to produce busy lizzie plants to fill a flower bed in her garden.
She decides to grow them from cuttings rather than seeds.

(a) Give **one** condition that she should supply to the new cuttings so that they grow well.

_____

(1)

Busy Lizzie plants can produce flowers which are white, pink or red.
A gardener wants to grow a display containing all three colours of flowers.

(b) Give **one** advantage and **one** disadvantage to the gardener of growing Busy Lizzie plants from cuttings rather than seeds.

Advantage _____

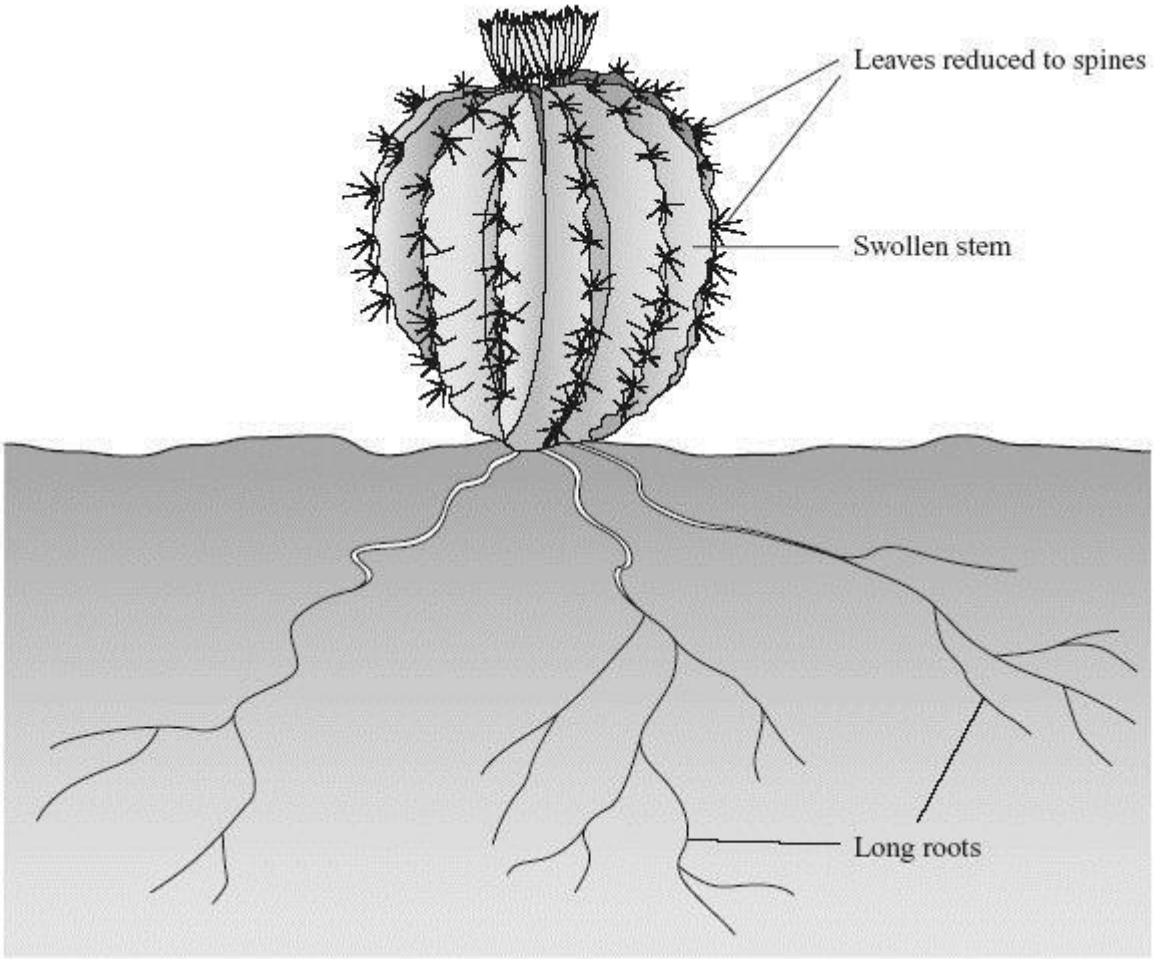
Disadvantage _____

(2)

(Total 3 marks)

Q13.

The drawing shows a plant that is adapted to life in a hot, dry desert.



(a) Which labelled part of the plant helps it to get the water it needs?

_____

_____

(1)

(b) The stem of the plant is covered by wax.
How does this help the plant to survive?

_____

_____

(1)

(Total 2 marks)

Q14.

(a) Balance the following equation for photosynthesis.

_____ CO_2 + _____ H_2O → $C_6H_{12}O_6$ + _____ O_2

(1)

(b) Give **two** conditions necessary for photosynthesis apart from a suitable temperature range and the availability of water and carbon dioxide.

1. _____

2. _____

(2)

(a) Plants have leaves which contain guard cells and palisade cells. Explain how **each** of these kinds of cell assists photosynthesis.

Guard cells _____

_____

_____

_____

(2)

Palisade cells _____

_____

_____

_____

(2)

(d) Glucose is a product of photosynthesis. Give **three** uses which green plants make of glucose.

1. _____

2. _____

3. _____

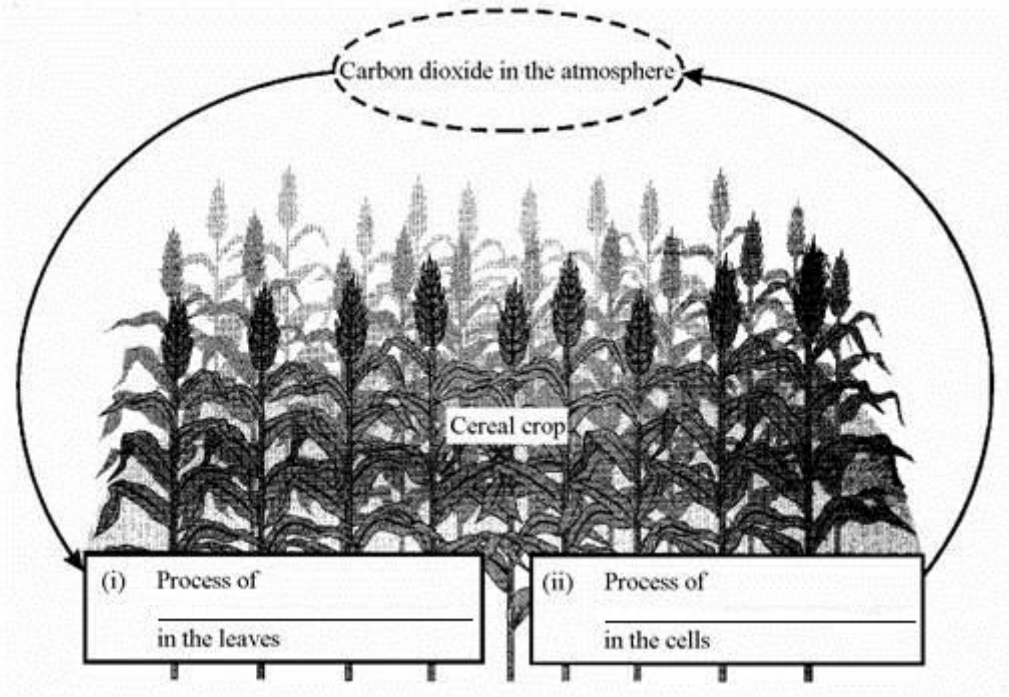
(3)

(Total 10 marks)

Q15.

(a) The diagram shows a cereal crop.

Complete spaces (i) and (ii).



(2)

(iii) What sort of weather may cause the cereal crop to wilt?

_____

(1)

(b) Describe the process of transpiration in plants.

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Mark schemes

Q1.

(a) (i) <u>on diagram</u>:

arrow drawn from cell **X**, through air space and out through stoma above stoma

1

(ii) transpiration

1

(b) (i) 13 – 15

ignore units

1

(ii) any **two** from:

- warmest / hottest / brightest time of day
  *accept warmer / hotter **or** sun higher in sky*
- water evaporates fastest
- stomata open / more open

2

[5]

Q2.

(a) **B**

1

(**B** has) low(est) number of stomata
or no stomata on upper surface
or <u>only</u> 800 (on lower surface)

1

less transpiration / evaporation / water loss owtte
or water (vapour) is lost via stomata

only allow zero water loss if linked to no stomata on upper surface / linked to leaf B upper surface

ignore references to leaf surface area

1

(b) reduce loss / amount of water (vapour)

accept converse

or
reduced transpiration (from upper surface)

*do **not** allow <u>no</u> water is lost*

1

warmer above leaf

accept converse

or wilted leaf folds over lower surface

or lower leaf in shade

ignore reference to dust

or less light / heat / sun on lower side

1

[5]

Q3.

(a) (i) lower – **B** loses less (water / mass) than **C**
or
described in terms of petroleum jelly

*accept converse re Leaf **C***

1

(ii) yes - **B** and **C** lose less than **D or**
B and **C** lose more than **A or**
D loses the most **or**
A loses the least

*do **not** accept just 'all leaves lose some weight'*

1

(b) (i) **X** = stoma

accept stomata / stomatal pore
*do **not** accept air space*

1

Y = guard cell

1

(ii) petroleum jelly blocks stomata / pores
or petroleum jelly prevents water loss
or petroleum jelly waterproofs

*allow pores are blocked in **B***

1

water (mainly) lost via stomata / pores / **X**
or stomata on lower surface only

1

[6]

Q4.

Quality of written communication

for ideas given in a sensible order;
comparison made for geranium and cactus for each feature
(ie not just list for geranium followed by list for cactus)
+ linking of feature & explanation

1

any **four** features + explanations from:

cactus has:

accept converse points for geranium plant

Feature	Explanation
thicker cuticle	waterproof / keeps water in
smaller surface area	less water loss / less heat absorbed
fewer stomata	less water loss
stomata open at night / closed in day	(closed when warmest) – so less water loss
more widespread roots	quickly absorbs water (after rain) / access to bigger area for absorbing water / absorb more water
more water storage tissue	little water available in environment / can survive drought / avoids dehydration

4

[5]

Q5.

(a) water [1]

oxygen [1]

(sun) light or solar [1]

*do **not** accept sun's*

chlorophyll [1]

*do **not** accept chloroplasts*

4

(b) any **two** from:

stored as fructose
stored as sucrose
stored as starch
stored as oil **or** lipid
moved or transported away in the phloem

*do **not** accept "stored" by itself*

respired or burnt up for energy or
fuel changed to protein
changed to cellulose
changed to fructose
changed to starch
changed to oil or lipid

*do **not** accept "food for plant"*
*do **not** accept "used up" by itself*

2

(c) (i) roots or root hair (cells)

1

(ii) the mineral salts are (dissolved) in water [1]

water transports salts throughout the plant
or water enables osmosis or diffusion to take place [1]

2

(d) (i) plants grow better with some nutrients than none
or
plants grow better with nitrates than without

comparison is needed
accept "faster" as equivalent to "better"
accept don't grow well with only water

1

(ii) 0.14(g)

*units **not** needed*

1

(iii) making protein **or** amino acids

*do **not** accept help them grow*
*accept named protein **or** DNA **or** chlorophyll*

1

any **two** from:

(iv) type **or** variety **or** starting weight **or**

2

(iii) size of seedlings

keep the environment the same
*only if light **or** temperature **or** day length not already credited*

light
temperature not heat
time of growth

*do **not** accept the same equipment*
*do **not** accept help them grow*

1

day length
amount of culture solution **or/**size of

accept named protein, DNA chlorophyll

boiling tube
number of seedlings per tube
pH
CO_2
humidity

[15]

Q6.

(a) capillaries

1

(b) (oxygen) in red blood cells **or**
haemoglobin

*the candidate **must** make clear which substance is which for **2** marks*

1

(carbon dioxide dissolved in) the plasma

accept in haemoglobin in regions of high carbon dioxide concentration

*accept for **1** mark oxygen + CO_2 is transported by red blood cells **or** haemoglobin*

*do **not** credit red + white blood cells **or** combinations of right + wrong answers*

1

(c) **one** mark for each up to a maximum of **three**

red blood cells

*award **1** mark for blood cells if no red or white*

white blood cells (or named white blood cell up to **2**)

platelets

urea

accept nitrogenous waste

*do **not** credit waste substances **or** products*

minerals (**or** one named mineral)

*accept ions **or** salts*

vitamins

water

hormones (named hormone up to 3)

protein (named blood proteins up to 2)

glucose

accept other named soluble sugar
*do **not** credit sugar(s) **or** blood sugar **or** sucrose*

fatty acids **or** glycerol

amino acids

digested food **or** nutrients (if individual foods not credited)
*do **not** credit starch **or** carbohydrates*
*do **not** credit nutrition **or** food*
*do **not** credit oxygen*
*do **not** credit haemoglobin*

carbon dioxide
accept nitrogen

antibodies

antitoxins

drugs **or** toxins (named up to 2)

bacteria **or** viruses

cholesterol

3

[6]

Q7.

(a) (i) light **or** solar
*do **not** credit sun's energy*
*do **not** credit radiant*

1

(ii) chlorophyll

1

(iii) chloroplast

1

(iv) CO_2 **+** H_2O
reactants identified (accept words)

1

$C_6H_{12}O_6 + O_2$
products identified (accept words)

1

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
balanced equation

1

(b) any **two** from:

increased CO_2 concentration

increased water supply

increased temperature (up to a point)
increased light intensity

*do **not** accept heat or warmth*

altered light quality by less green **or** increasing other colours

2

(c) any **four** points

- palisade (mesophyll)
- lots of chloroplasts **or** chlorophyll **or** main site for photosynthesis **or** absorb maximum amount of light
- guard cells
- CO_2 in **or** O_2 out **or** water vapour out
- controls size of stoma **or** pores in leaf

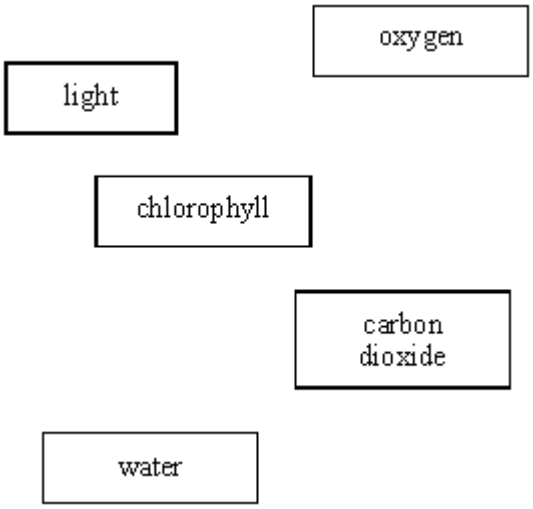
***allow** stomata*

4

[12]

Q8.

(a)



5

(b) (i) sugar **or** carbohydrate

1

(ii) it can be stored **or** it is insoluble

accept it has no osmotic effect

1

(iii) any **one** from:
respires it **or** releases **or** transfers energy
turns it **or** stores it as fructose **or** sucrose **or** lipid **or** protein **or** cellulose

1

(c) (i) photosynthesis

1

(ii) any **one** from:
flat surface
stomata
thin
chloroplasts
veins
large surface area
air spaces

*do **not** accept chlorophyll*

1

[10]

Q9.

(i) the mass got less

accept it got lighter

*award **1** mark for water was lost from the plant*

1

water was taken into the plant **or** roots
absorbed water

*do **not** accept soaked into plant*

1

and lost through transpiration **or** the leaves **or** evaporated from the leaves **or** stomata

1

(ii) to check the effect of the plant **or** to act as a control **or** to show that it was not due to evaporation from water

*do **not** accept to keep it fair **or** to check that it was fair*

*do **not** accept fair test*

1

[4]

Q10.

(a) mesophyll / / / / (all correct) sperm / / x / (all correct)

for 1 mark each

2

(b) (i) absorbs light/to produce food/photosynthesis
(allow references to gaseous exchange)
for 1 mark

1

(ii) has chlorophyll/chloroplasts to absorb light/produce food
for 1 mark each
(if linked to gas exchange allow – moist surface/ dissolve gases)

2

[5]

Q11.

(a) quick
cheap / many can be produced from one plant
cuttings produce plants identical (to parents) / outcome known
any two for 1 mark each

2

(b) *idea that* provides damp atmosphere / less likely to wilt
reduces or stops transpiration or water loss / keeps it warmer
(*reject prevents animals eating it*)
for 1 mark

1

[3]

Q12.

(a) water / damp / wet
or
suitable temperature / warm / heat / hot
or
light / sun
(*accept* rooting powder / soil qualified e.g. fine / nutrients / fertiliser / minerals)
(*do NOT allow* oxygen / carbon dioxide / food)
for 1 mark

1

(b) *advantage*
quick / cheap / several from one plant / known outcome / same as <u>parent</u>
(*reject* all the same)
disadvantage
<u>all</u> the same / all get same disease
for 1 mark each

2

[3]

Q13.

(a) (long) roots

1

(b) prevents water from evaporating

accept to reduce/stop water loss

1

[2]

Q14.

(a) 6 6 6

all required

accept a '6n 6 n n 6n' version of the balanced equation provided it is correct in every detail

1

(b) any **two** of

- (presence of) chlorophyll **or** (amount of) chloroplasts

  accept green leaves (or other green parts)

- (sufficient) light (intensity)

- (light) of **a** suitable wavelength

  any light other than green light

  do not credit Sun's energy or sunshine or Sun

2

(c) **guard cells**

any **two** of

* control by osmosis
* the movement of gases

*accept movement of carbon dioxide **or** oxygen **or** water vapour beware movement of CO_2 out*

accept a diagram or description

* through the stoma

2

palisade cells

any **two** of

* near the upper surface
* contain (a great) many **or** more chloroplasts
* (so) contain the most chlorophyll

2

(d) any three of

* for respiration
* conversion to (insoluble) starch

or to food store **or** to (other)carbohydrates
* (conversion to) sucrose **or** to food store **or** to (other) carbohydrates

or polysaccharides

*do not credit just to grow **or** live*

***or** survive*

accept conversion to food store

***or** to (other) carbohydrates once only*

* (conversion to) lipids **or** fats **or** oils
* (conversion to) amino acids **or** (plant) proteins **or** auxins **or** (plant) hormones **or** enzymes

3

[10]

Q15.

(a) (i) photosynthesis

1

(ii) respiration

do not credit combustion

do not credit decay

1

(iii) dry

*accept hot **or** windy **or** drought*

1

(b) any **three** from

* evaporation (of water)

***or** loss of water vapour*

* (mostly) from the leaf / leaves

do not credit incorrect reference to leaves

* through the stomata

accept through each stoma

accept through the stomas(sic)

* causing a pull

***or** causing an increase in osmotic potential (at the top of the plant)*
***or** causing an increase in water potential (at the top of the plant) **or** causing a decrease in osmotic pressure (at the top of the plant)*

* (so that) water moves up (through the plant)

do not credit water vapour moves up through the plant

* as the transpiration stream

* water enters through roots (and goes up plants)

3

[6]