Questions are for both separate science and combined science students unless indicated in the question

Q1.

A cactus is a plant that lives in a dry environment.

The image below shows part of a cactus plant.

(a) Give **one** adaptation shown in the image above that helps to prevent the cactus from being eaten by animals. **(separate only)**

_____

(1)

(b) A plant may produce poisons that make animals unwell.

What is this type of defence mechanism?

Tick (✓) **one** box. **(separate only)**

Chemical ☐

Mechanical ☐

Physical ☐

(1)

(c) Some desert plants only grow leaves after it has rained.

As soon as the soil dries out, the leaves fall off.

How could the leaves falling off the plant be an advantage to a plant that lives in a dry environment?

Tick (✓) **one** box.

The plant is less likely to reproduce. ☐

The plant will not lose as much water. ☐

The plant will photosynthesise faster. ☐

(1)

The stem of a cactus is green.

(d) What causes the green colour in the stem?

_____

(1)

(e) What is the advantage to the cactus of having a green stem?

_____

_____

(1)

The stem of a cactus contains many different tissues.

(f) What name is given to a group of tissues working together?

Tick (✓) **one** box.

Organ ☐

Organism ☐

Organ system ☐

(1)

(g) Name **one** substance transported through the xylem in the stem of the cactus.

_____

(1)

(h) Name the tissue that transports dissolved sugars through the stem of the cactus.

_____

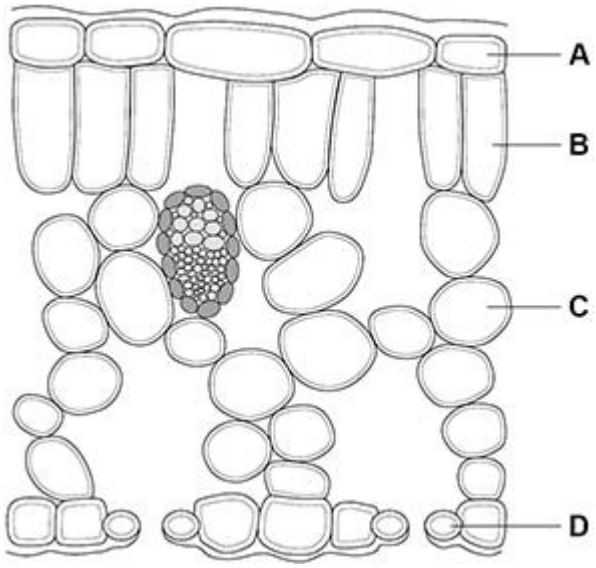
(1)

(Total 8 marks)

Q2.

Figure 1 shows a cross section of a leaf.

Figure 1



(a) Which cell is most transparent?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) Which cell structure in a leaf mesophyll cell is **not** found in a root hair cell?

_____

(1)

Plants lose water through their leaves.

(c) Name the cells in a leaf that control the rate of water loss.

_____

(1)

(d) Water is taken in by the roots, transported up the plant and lost from the leaves.

Which scientific term describes this movement of water?

_____

(1)

(e) Which change would decrease the rate of water loss from a plant's leaves?

Tick (✓) **one** box.

Increased humidity ☐

Increased light intensity ☐

Increased density of stomata ☐

Increased temperature ☐

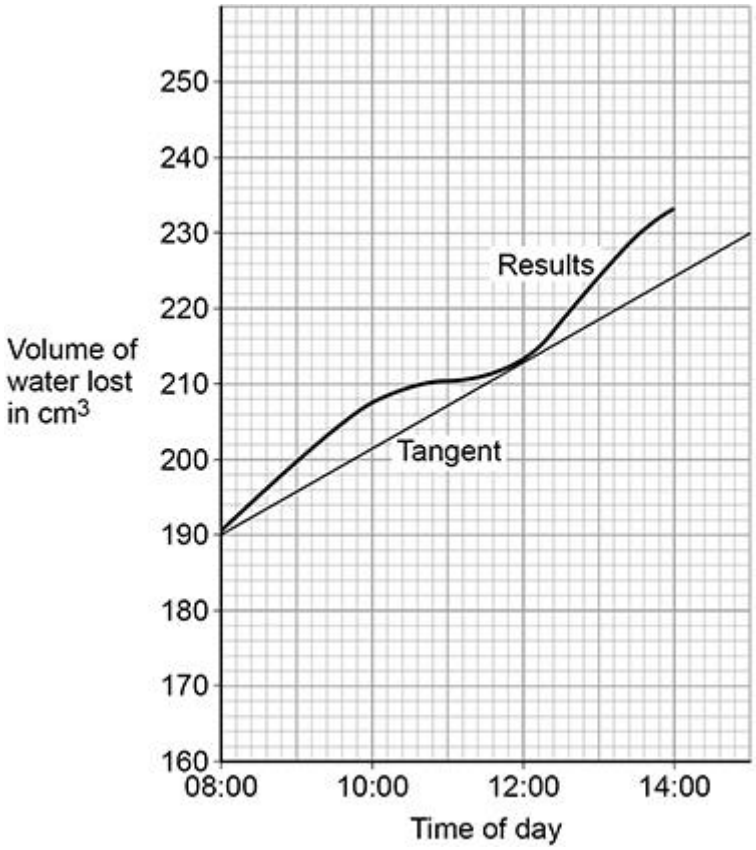
(1)

(f) Compare the structure and function of xylem tissue and phloem tissue.

(6)

Figure 2 shows the total volume of water lost from a plant over 6 hours.

Figure 2



(g) Determine the rate of water loss at 12:00

Use the tangent on the graph above.

Give your answer:

- in cm^3 per minute
- in standard form.

Rate of water loss = _____ cm^3 per minute

(4)

(h) The rate of water loss at midnight was much lower than at 12:00

Explain why.

_____

_____

_____

_____

(2)

(Total 17 marks)

Q3.

Diffusion is an important process in animals and plants.

(a) What is meant by the term diffusion?

_____

_____

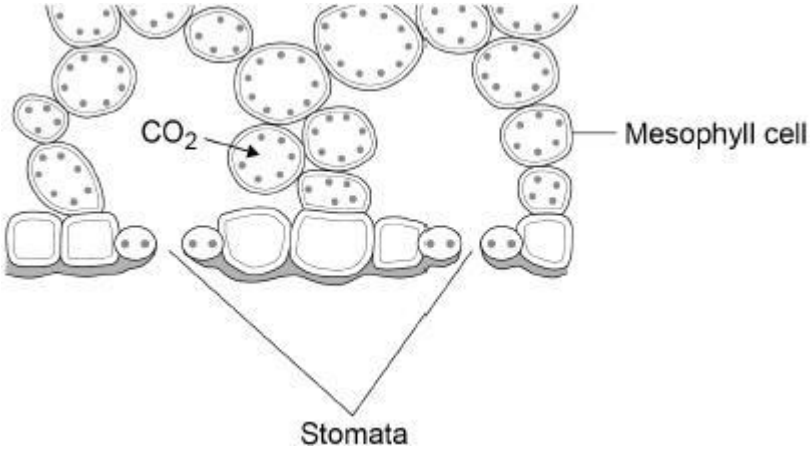
_____

_____

(2)

(b) **Figure 1** shows part of a leaf.

Figure 1



Molecules of carbon dioxide diffuse from the air into the mesophyll cells.

Which **two** changes will increase the rate at which carbon dioxide diffuses into the mesophyll cells?

Tick (✓) **two** boxes.

Decreased number of chloroplasts in the cells ☐

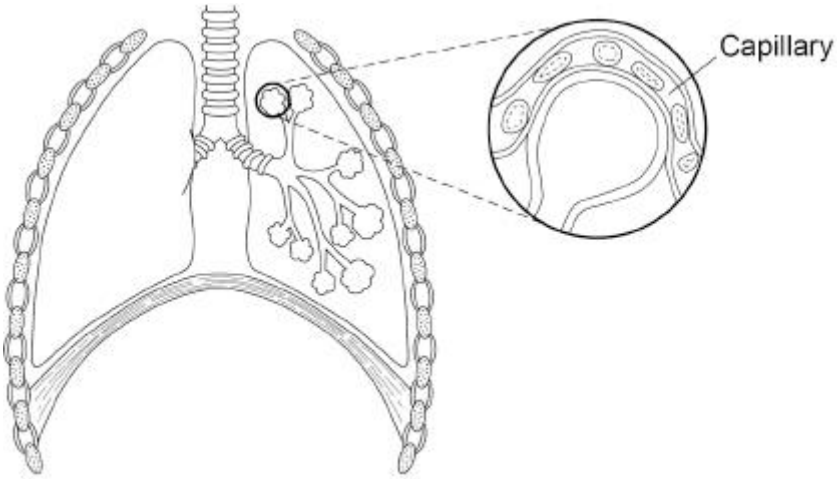
Decreased surface area of cells in contact with the air	☐
Increased carbon dioxide concentration in the air	☐
Increased number of stomata that are open	☐
Increased oxygen concentration in the air	☐

(2)

(c) Diffusion also happens in the human lungs.

Figure 2 shows the human breathing system.

Figure 2



Explain how the human lungs are adapted for efficient exchange of gases by diffusion.

_____

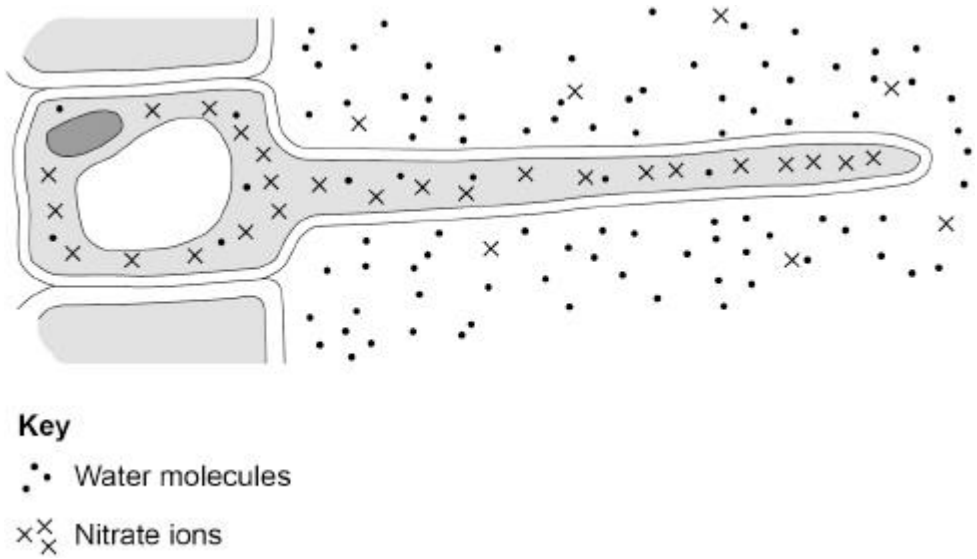
_____

_____

(6)

Figure 3 shows a root hair cell.

Figure 3



(d) Name the process by which water molecules enter the root hair cell.

_____

(1)

(e) Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in **Figure 3** are transported into the root hair cell.

Use information from **Figure 3** in your answer.

Name of process

_____

Explanation

_____

_____

_____

_____

_____

(3)

(Total 14 marks)

Q4.

This question is about leaves.

(a) Complete the sentences.

Choose answers from the box.

epidermis	**phloem**	**palisade mesophyll**	
	waxy cuticle	**xylem**	

The layer of cells lining the upper surface and lower surface of a leaf is the _____.

The part of the leaf where most photosynthesis occurs is the _____.

Water is transported to the leaf in the _____.

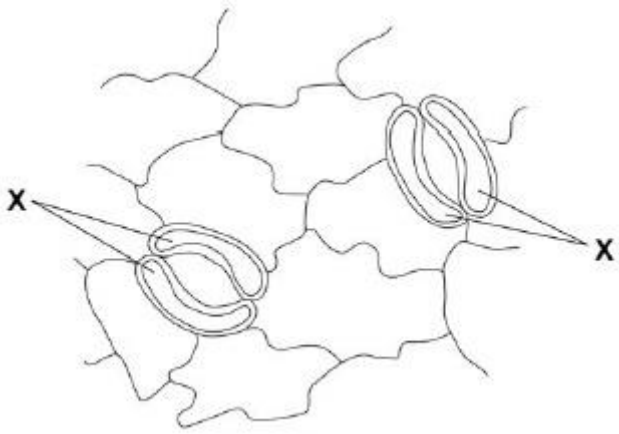
(3)

Water is lost through small openings on the lower surface of plant leaves.

These small openings are called stomata.

Figure 1 shows two stomata on the lower surface of a leaf.

Figure 1



(b) The cells labelled **X** control the width of the stomata.

What are the cells labelled **X**?

Tick (✓) **one** box.

Guard cells ☐

Mesophyll cells ☐

Root hair cells ☐

Stem cells ☐

(1)

(c) What is the function of the stomata?

Tick (✓) **one** box.

To allow light into the leaf ☐

To let carbon dioxide into the leaf ☐

To let sugars out of the leaf ☐

To protect the leaf from pathogens ☐

(1)

(d) How is water lost from a leaf?

Tick (✓) **one** box.

By evaporation ☐

By respiration ☐

By translocation ☐

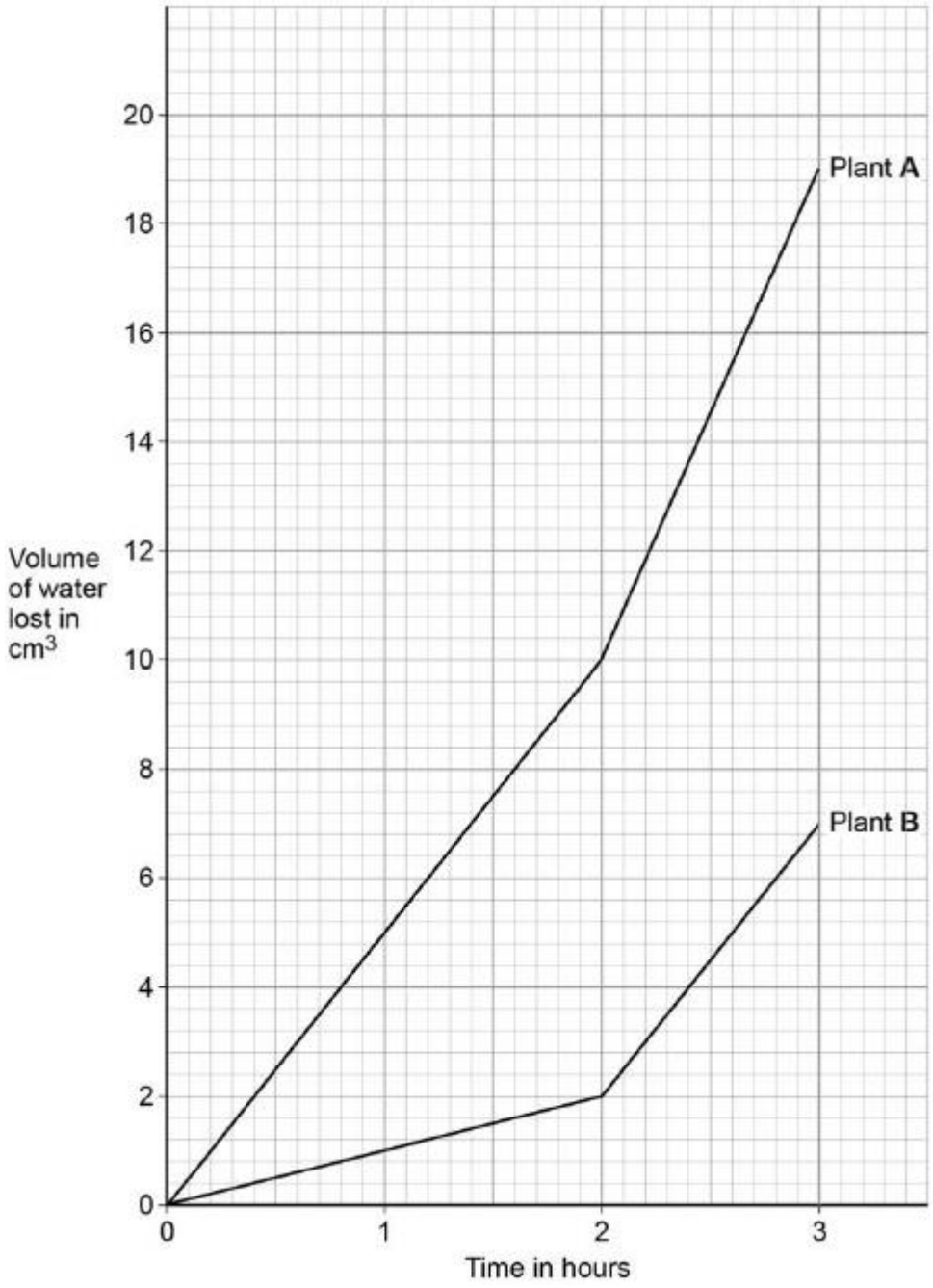
(1)

A student investigated the volume of water lost from two plants.

The plants were different species.

Figure 2 shows the student's results.

Figure 2



(e) Calculate the difference in the volume of water lost by plant **A** compared to plant **B** in the first hour.

_____

_____

Difference in volume = _____ cm^3

(2)

(f) What could cause plant **A** to lose water at a faster rate than plant **B**?

Tick (✓) **one** box.

Plant **A** has fewer stomata per leaf. ☐

Plant **A** is smaller. ☐

Plant **A** has more leaves. ☐

Plant **A** has smaller leaves. ☐

(1)

(g) After the first 2 hours, both plants were moved to a new room.

Suggest **one** reason why both plants lost water at a faster rate in the new room.

_____

_____

(1)

(h) Some plants have adaptations to stop them from being eaten by animals.

Figure 3 shows part of a holly plant.

Figure 3

Describe **one** way the holly plant is adapted to stop it being eaten by animals. **(separate only)**

_____

_____

(1)

(Total 11 marks)

Q5.

Water moves from a plant to the atmosphere through the leaves.

(a) How is the volume of water lost from the leaves controlled?

_____

_____

(1)

(b) Describe the transport of water through a plant from the roots to the atmosphere.

_____

_____

_____

_____

_____

_____

_____

_____

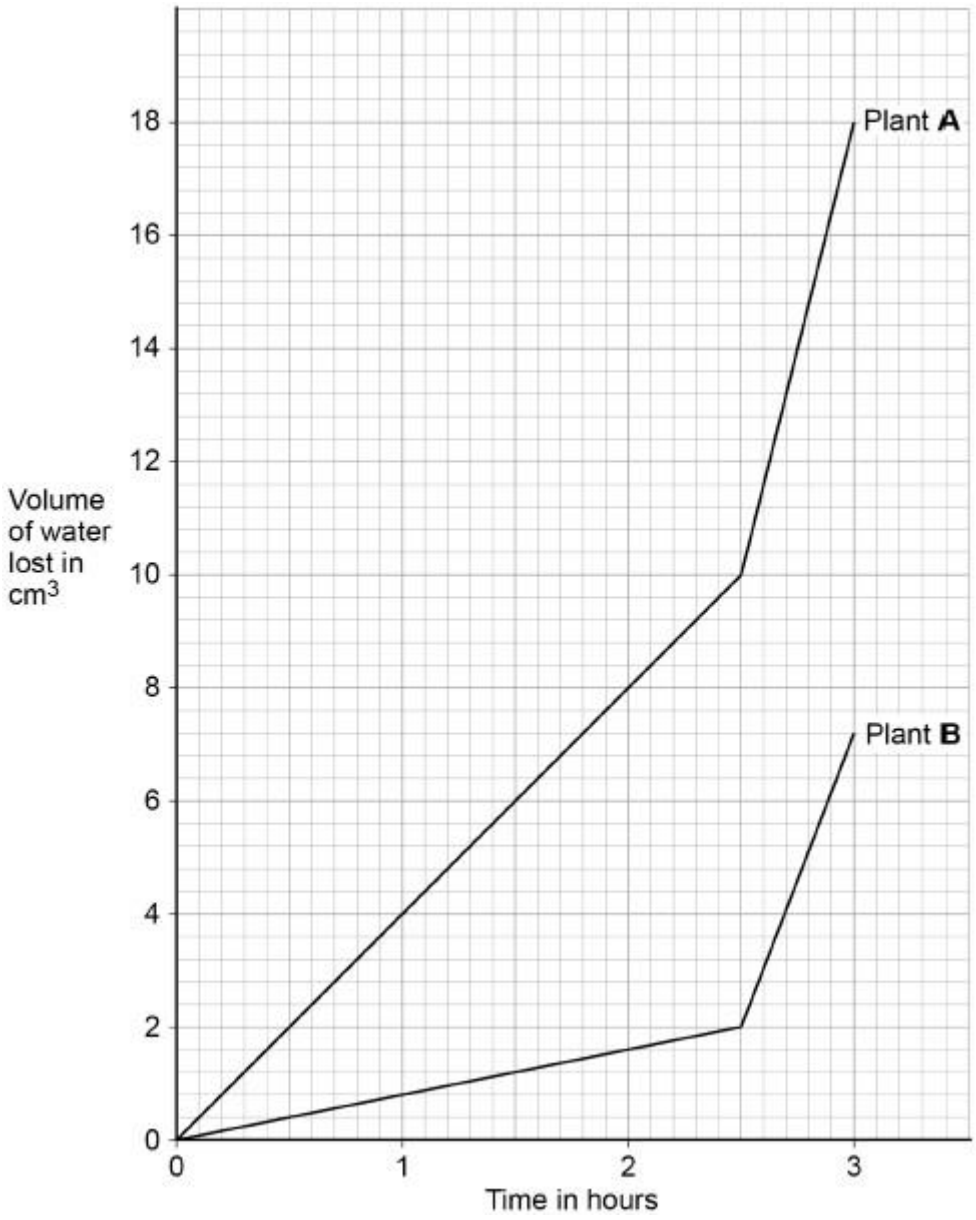
(3)

A student investigated the volume of water lost from two plants of different species.

Both plants were kept together.

Figure 1 shows the student's results.

Figure 1



(c) Suggest **one** reason for the difference in the rate of water loss from the two plants in the first 2.5 hours.

_____

_____

(1)

Both plants were moved to a different place at 2.5 hours.

(d) Calculate the rate of water loss per hour in plant **B** from 2.5 hours to 3 hours.

Give your answer to **2** significant figures.

_____

_____

_____

_____

_____

_____

Rate of water loss = _____ cm^3/hour

(3)

(e) Suggest **two** reasons why the rate of water loss in both plants changed after 2.5 hours.

_____

_____

_____

_____

(2)

(Total 10 marks)

Q6.

Plants are made up of cells, tissues and organs.

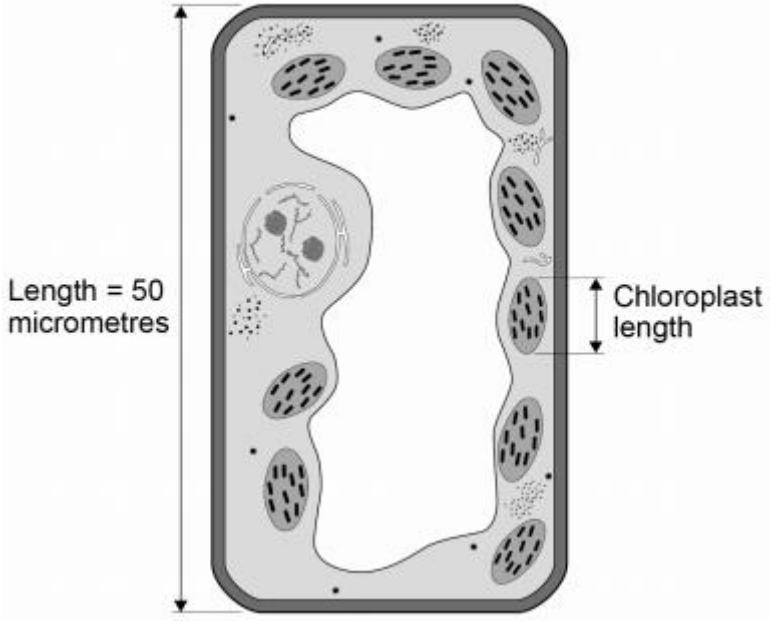
(a) Draw **one** line from each level of organisation to the correct plant part.

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

(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 ☐

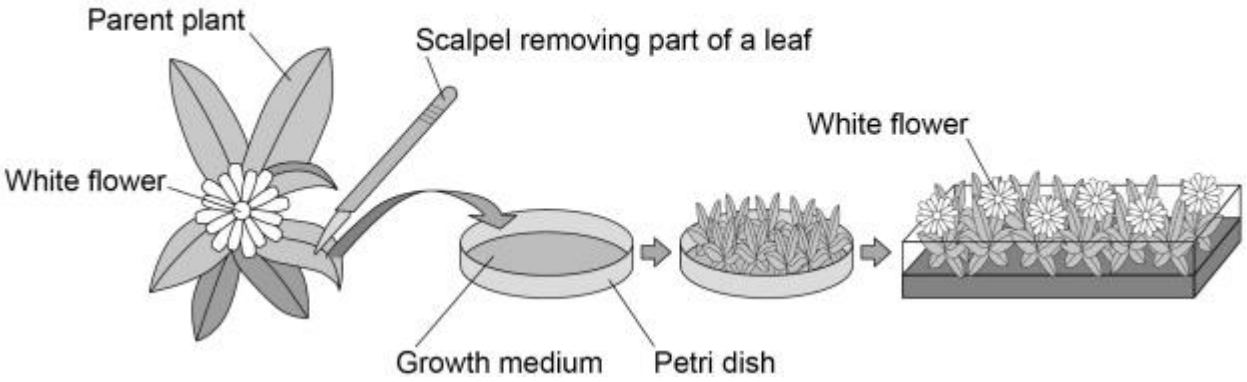
Transport ☐

(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. **(separate only)**

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. **(separate only)**

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. **(separate only)**

_____

_____

(1)

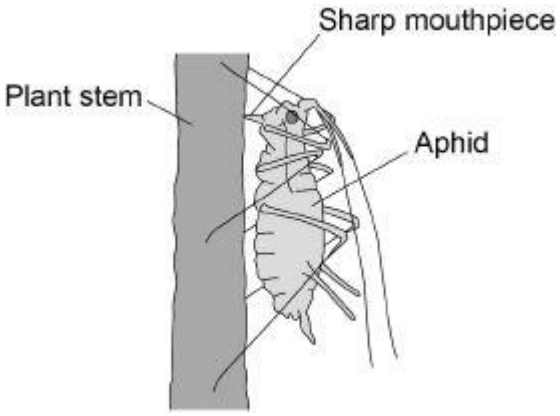
(Total 10 marks)

Q7.

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.

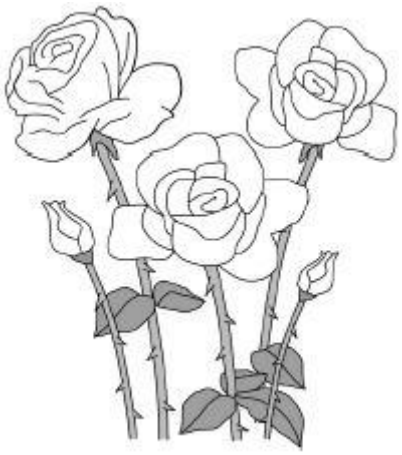
_____

_____

(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. **(separate only)**

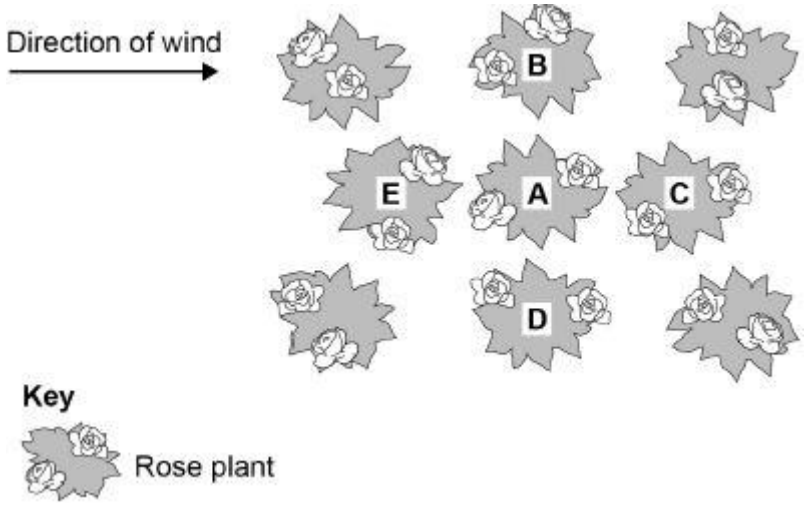
_____

_____

(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. **(separate only)**

Plant _____

Reason _____

_____

_____

_____

(2)

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

_____

_____

(1)

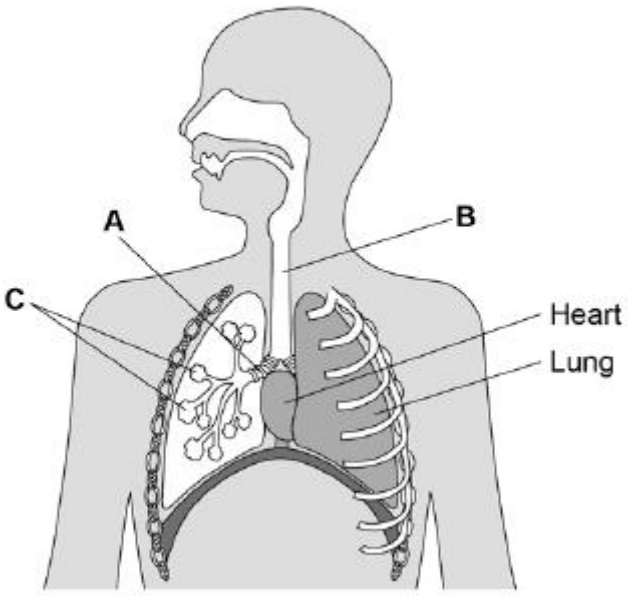
(Total 11 marks)

Q8.

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 ☐

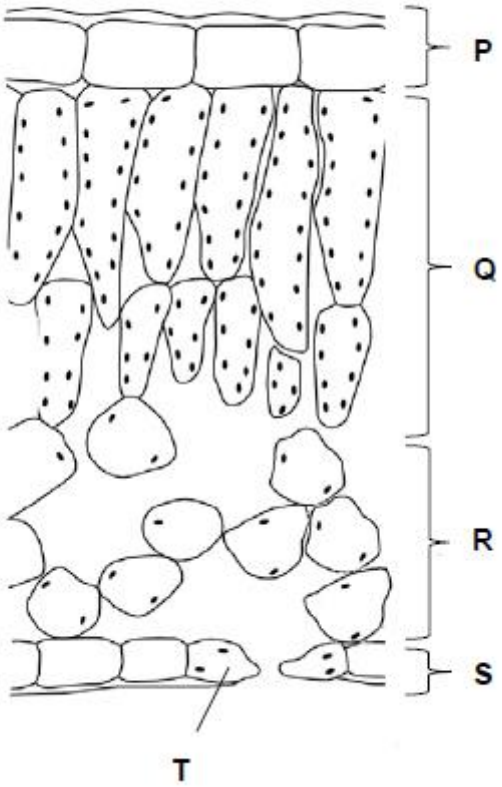
Digestive system ☐

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)

Q9.

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

_____

_____

_____

_____

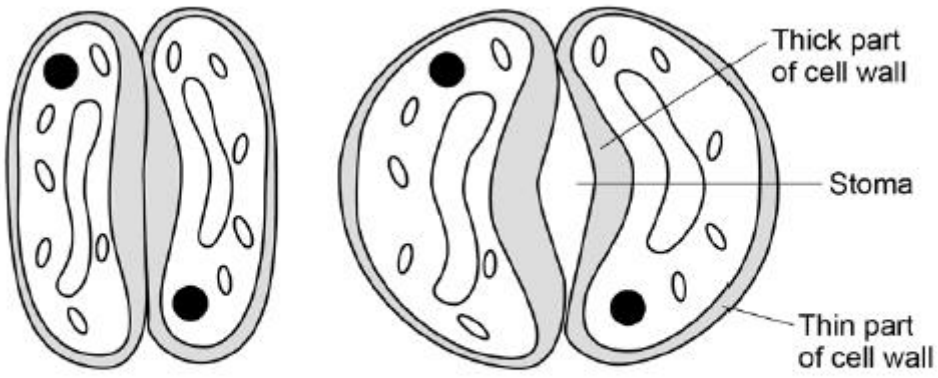
_____

_____

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.



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.

_____

_____

_____

_____

_____

_____

_____

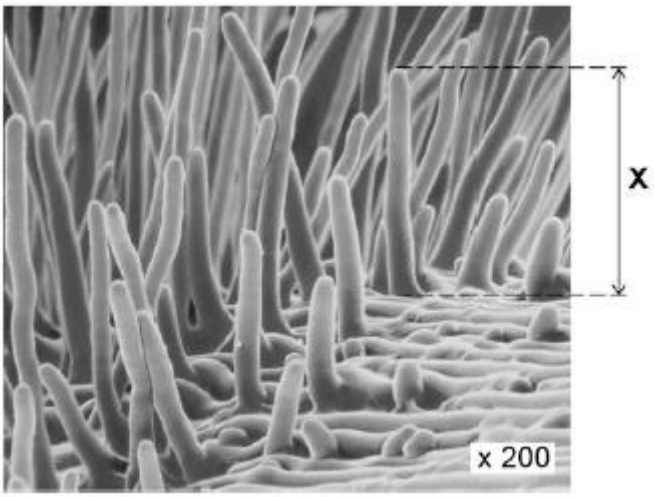
_____

(4)

(Total 10 marks)

Q10.

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)

Q11.

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)

Q12.

Carbon dioxide enters a plant through stomata on the leaves.

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

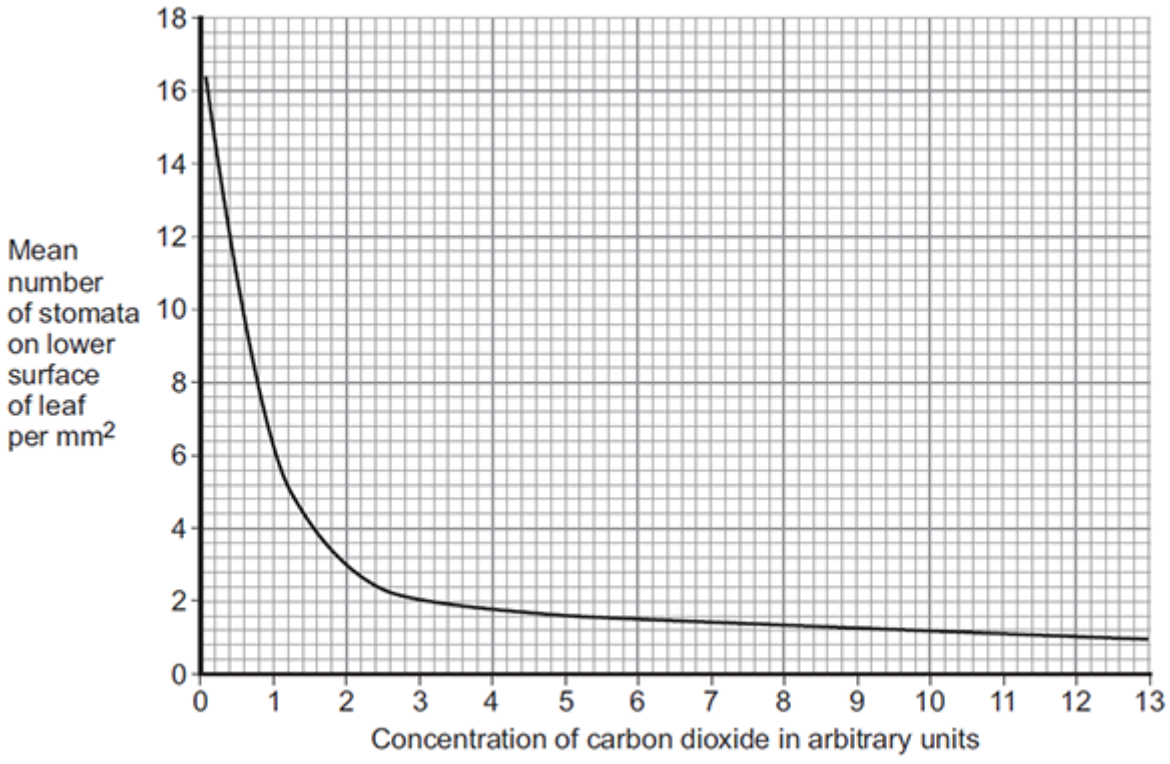
_____

(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)

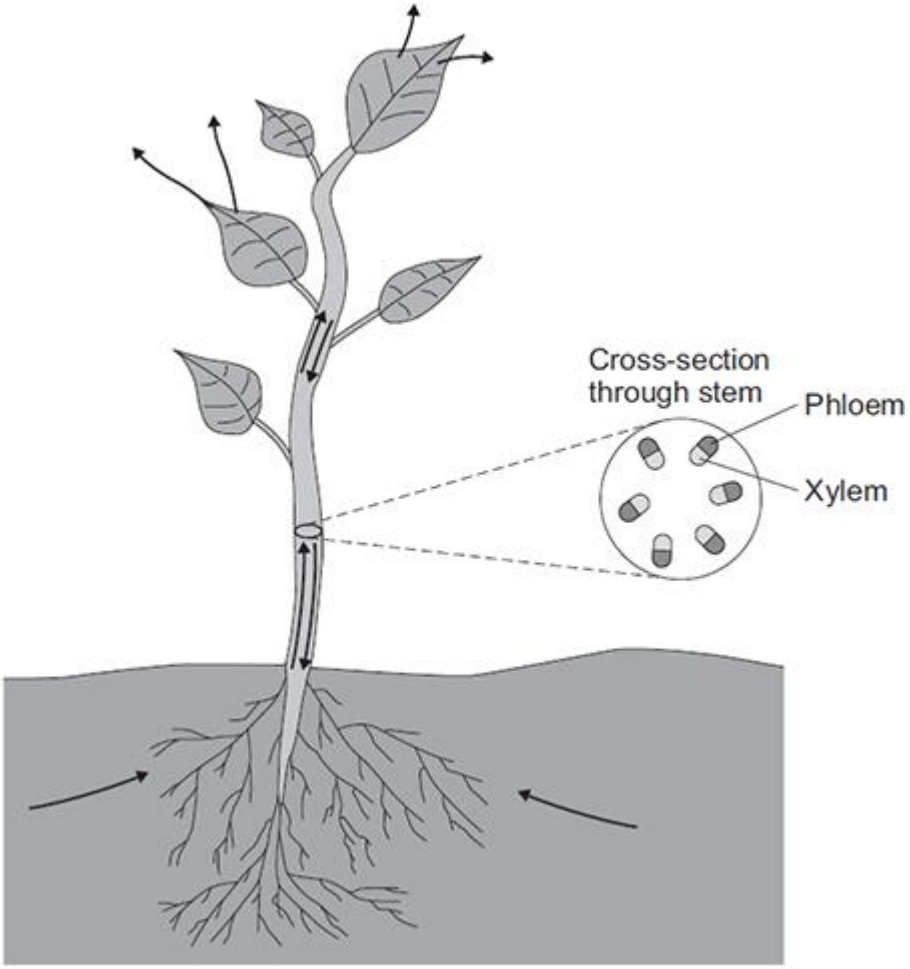
(Total 6 marks)

Q13.

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

Plants transport many substances between their leaves and roots.

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



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

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

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(Total 6 marks)