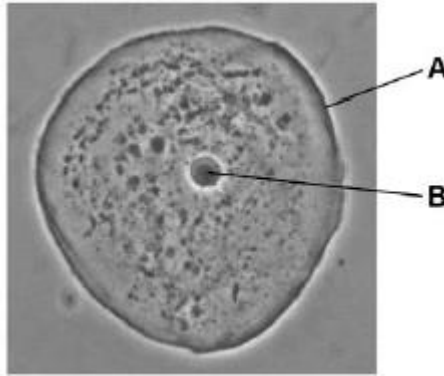


TRANSPORT IN CELLS / QUESTIONS

Figure 1 shows an animal cell.

Figure 1



© alex-mit/iStock/Thinkstock

(a) What is structure **A**?

Tick **one** box.

- | | |
|---------------|--------------------------|
| Cell membrane | <input type="checkbox"/> |
| Cell wall | <input type="checkbox"/> |
| Chromosome | <input type="checkbox"/> |
| Cytoplasm | <input type="checkbox"/> |

(b) What is structure **B**?

Tick **one** box.

- | | |
|--------------|--------------------------|
| Chloroplast | <input type="checkbox"/> |
| Mitochondria | <input type="checkbox"/> |
| Nucleus | <input type="checkbox"/> |
| Vacuole | <input type="checkbox"/> |

(1)

(1)

(c) **Figure 2** shows a sperm cell.

Figure 2



Describe how a sperm cell is adapted to carry out its function.

(1)

(d) Substances can move into and out of cells by three processes.

The diagrams show the concentration of different substances inside and outside a root hair cell.

How would each substance move into the root hair cell?

Draw **one** line from each root hair cell to the correct process.

Root hair cell	Process
<p>Water molecule</p>	<input type="checkbox"/> Active transport
<p>Nitrate ion</p>	<input type="checkbox"/> Diffusion
<p>Magnesium ion</p>	<input type="checkbox"/> Osmosis

(2)

(Total 5 marks)

Estimated population of dandelions = _____

(2)

- (c) In one area of the field there is a lot of grass growing in the same area as dandelions.

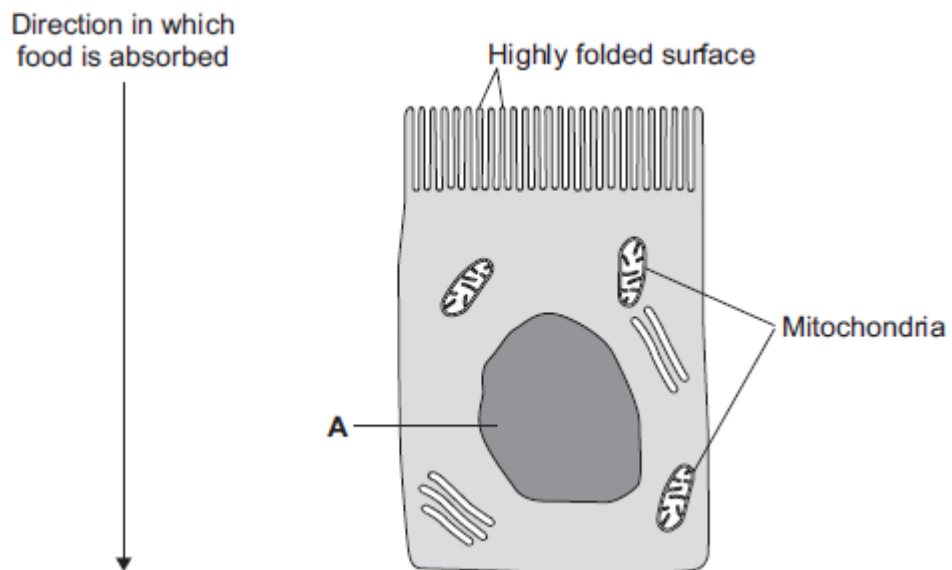
Suggest why the dandelions may **not** grow well in this area.

(4)

(Total 10 marks)

Q4.

The image below shows an epithelial cell from the lining of the small intestine.



- (a) (i) In the image above, the part of the cell labelled **A** contains chromosomes.

What is the name of part **A**?

(1)

- (ii) How are most soluble food molecules absorbed into the epithelial cells of the small intestine?

Draw a ring around the correct answer.

diffusion osmosis respiration

(1)

- (b) Suggest how the highly folded cell surface helps the epithelial cell to absorb soluble food.

(1)

- (c) Epithelial cells also carry out active transport.

- (i) Name **one** food molecule absorbed into epithelial cells by active transport.

(1)

- (ii) Why is it necessary to absorb some food molecules by active transport?

(1)

- (ii) Suggest why epithelial cells have many mitochondria.

(2)

- (d) Some plants also carry out active transport.

Give **one** substance that plants absorb by active transport.

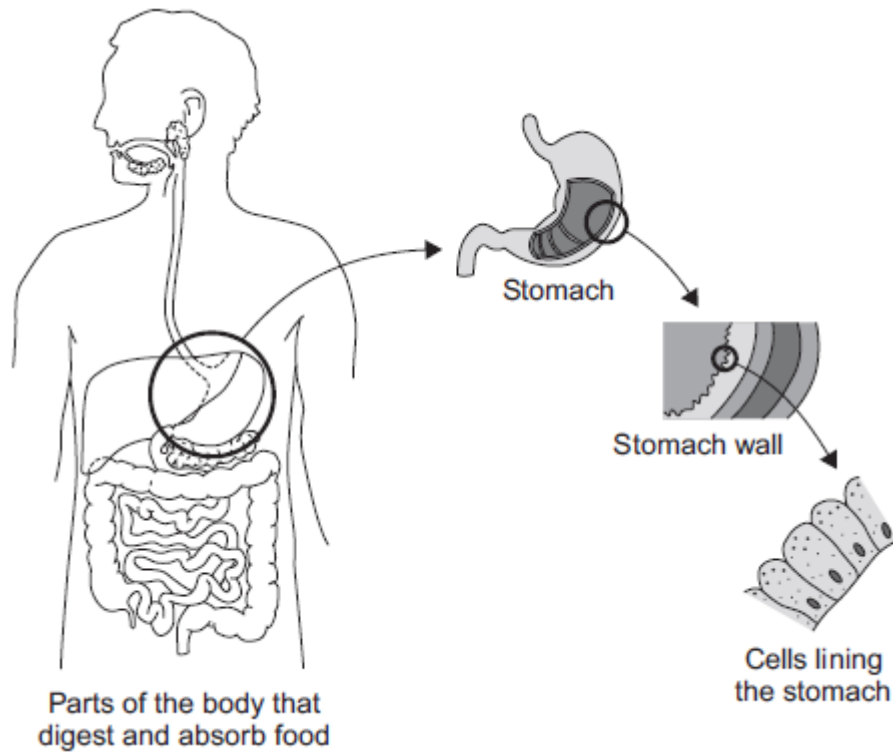
(1)

(Total 8 marks)

Q5.

The diagram below shows the parts of the body that digest and absorb food.

It also shows some details about the structure of the stomach.



- (a) Complete the table to show whether each structure is an organ, an organ system or a tissue.

For each structure, tick (✓) **one** box.

Structure	Organ	Organ system	Tissue
Stomach			
Cells lining the stomach			
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine			

(2)

- (b) (i) The blood going to the stomach has a high concentration of oxygen. The cells lining the stomach have a low concentration of oxygen.

Complete the following sentence.

Oxygen moves from the blood to the cells lining the stomach by the process of _____ .

(1)

- (ii) What other substance must move from the blood to the cells lining the stomach so that respiration can take place?

Draw a ring around the correct answer.

glucose **protein** **starch**

(1)

(iii) In which part of a cell does aerobic respiration take place?

Draw a ring around the correct answer.

cell membrane

mitochondria

nucleus

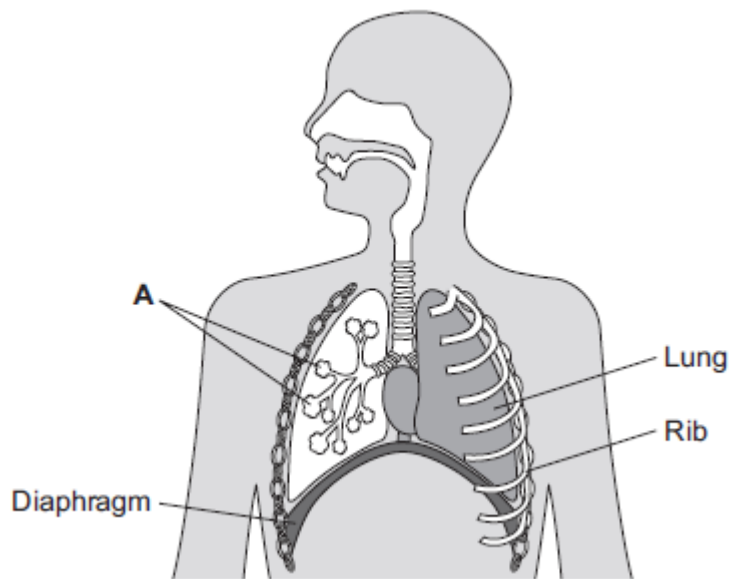
(1)

(Total 5 marks)

Q6.

Our lungs help us to breathe.

The image below shows the human breathing system.



(a) (i) Name part **A**.

(1)

(ii) Give **one** function of the ribs.

(1)

(b) (i) Use the correct answer from the box to complete the sentence.

active transport	diffusion	osmosis
------------------	-----------	---------

Oxygen moves from the air inside the lungs into the blood by the process of _____.

(1)

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

arteries	capillaries	veins
----------	-------------	-------

Oxygen moves from the lungs into the blood through the walls of the _____ .

(1)

(iii) Inside the lungs, oxygen is absorbed from the air into the blood.

Give **two** adaptations of the lungs that help the rapid absorption of oxygen into the blood.

1. _____

2. _____

(2)

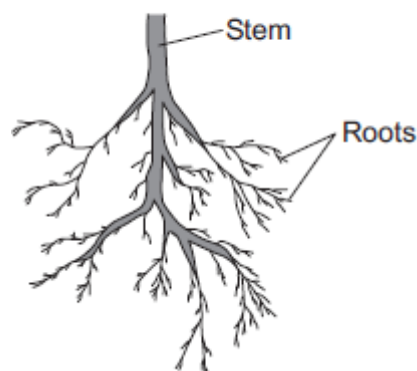
(Total 6 marks)

Q7.

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.

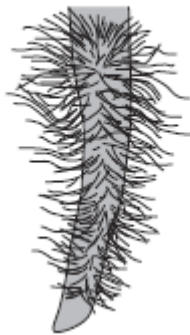
The absorption of mineral ions needs energy.

(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)

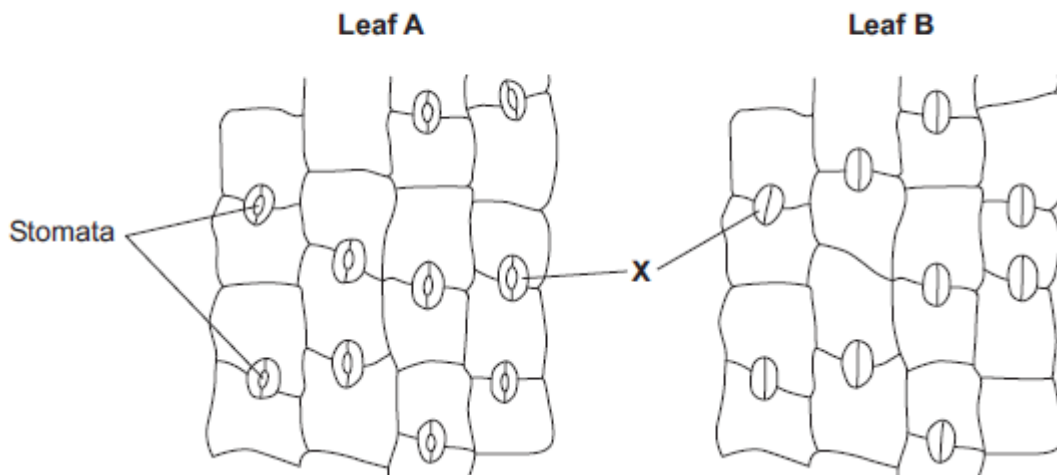
(b) The leaves of plants have stomata.

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)

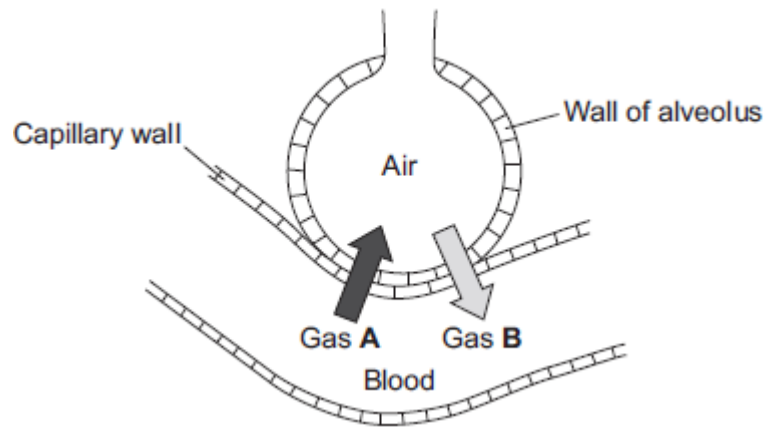
(Total 9 marks)

Q8.

Gas exchange takes place in the lungs.

The diagram shows an alveolus next to a blood capillary in a lung.

The arrows show the movement of two gases, **A** and **B**.



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

Gases **A** and **B** move by

diffusion.
osmosis.
respiration.

(1)

- (ii) Gas **A** moves from the blood to the air in the lungs.

Gas **A** is then breathed out.

Name Gas **A**.

(1)

- (iii) Which cells in the blood carry Gas **B**?

Draw a ring around the correct answer.

platelets

red blood cells

white blood cells

(1)

- (b) The average number of alveoli in each human lung is 280 million.

The average surface area of 1 million alveoli is 0.25 m^2 .

Calculate the total surface area of a human lung.

Answer _____ m^2

(2)

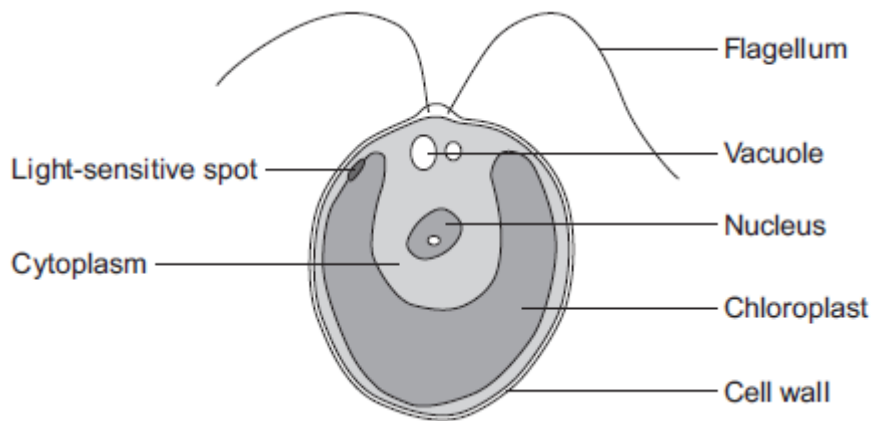
- (c) An athlete trains to run a marathon. The surface area of each of the athlete's lungs has increased to 80 m^2 .

Give **one** way in which this increase will help the athlete.

(1)
(Total 6 marks)

Q9.

The diagram below shows a single-celled alga which lives in fresh water.



(a) Which part of the cell labelled above:

(i) traps light for photosynthesis

_____ (1)

(ii) is made of cellulose?

_____ (1)

(b) In the freshwater environment water enters the algal cell.

(i) What is the name of the process by which water moves into cells?

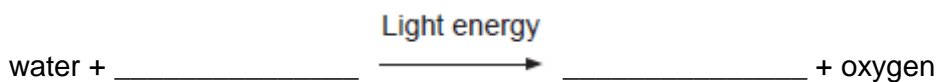
_____ (1)

(ii) Give the reason why the algal cell does not burst.

_____ (1)

(c) (i) The alga can photosynthesise.

Complete the **word** equation for photosynthesis.



(2)

(ii) The flagellum helps the cell to move through water. Scientists think that the

flagellum and the light-sensitive spot work together to increase photosynthesis.

Suggest how this might happen.

(2)

- (d) Multicellular organisms often have complex structures, such as lungs, for gas exchange.

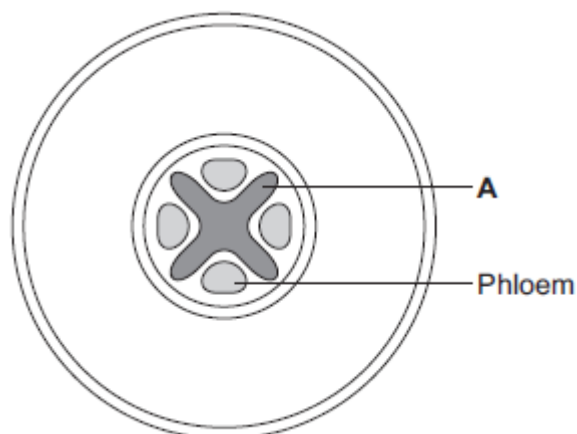
Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

(3)

(Total 11 marks)

Q10.

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)

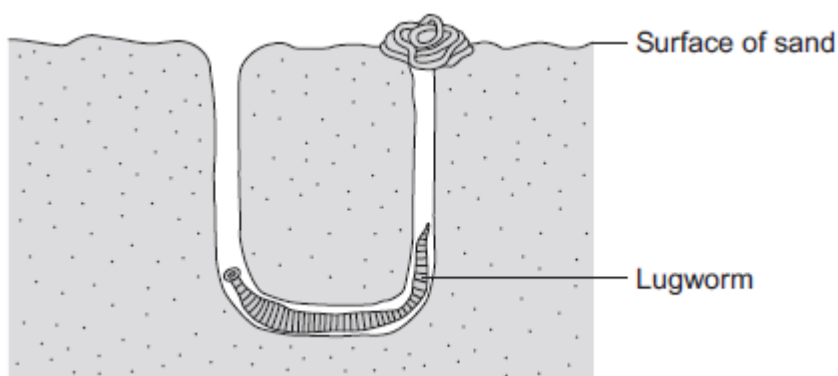
(ii) Explain why active transport is necessary in root hair cells.

(2)
(Total 9 marks)

Q11.

The lugworm lives in a U-shaped burrow in the sand on the seashore.

The diagram below shows a lugworm in its burrow.



(a) Some scientists investigated the effect of different salt concentrations on lugworms.

The scientists:

- collected 50 lugworms from the seashore
- separated them into five groups of 10 lugworms
- weighed each group of 10 lugworms
- placed each group into a different concentration of salt solution and left them for 8 hours
- took each lugworm out of the solution and placed it on blotting paper for 30 seconds
- re-weighed each group of 10 lugworms.

(i) Why did the scientists use groups of 10 lugworms and not just 1 lugworm at each concentration?

(1)

(ii) Suggest why the scientists placed each lugworm on blotting paper for 30 seconds before they reweighed the groups of lugworms.

(1)

(iii) How might the method of blotting have caused errors in the results?

(1)

(iv) Suggest **one** improvement the scientists could make to their investigation.

(1)

(b) The table below shows the scientists' results.

Concentration of salt in arbitrary units	Mass of 10 lugworms at start in grams	Mass of 10 lugworms after 8 hours in grams	Change in mass in grams	Percentage (%) change in mass
1.0	41.2	61.8	+20.6	+50
2.0	37.5	45.0	+7.5	
3.0	55.0	56.1	+1.1	+2
4.0	46.2	22.2	-24.0	-52
5.0	45.3	22.6	-22.7	-50

(i) The scientists calculated the **percentage** change in mass at each salt concentration.

Why is the **percentage** change in mass more useful than just the change in mass in grams?

Use information from the table in your answer.

(2)

(ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

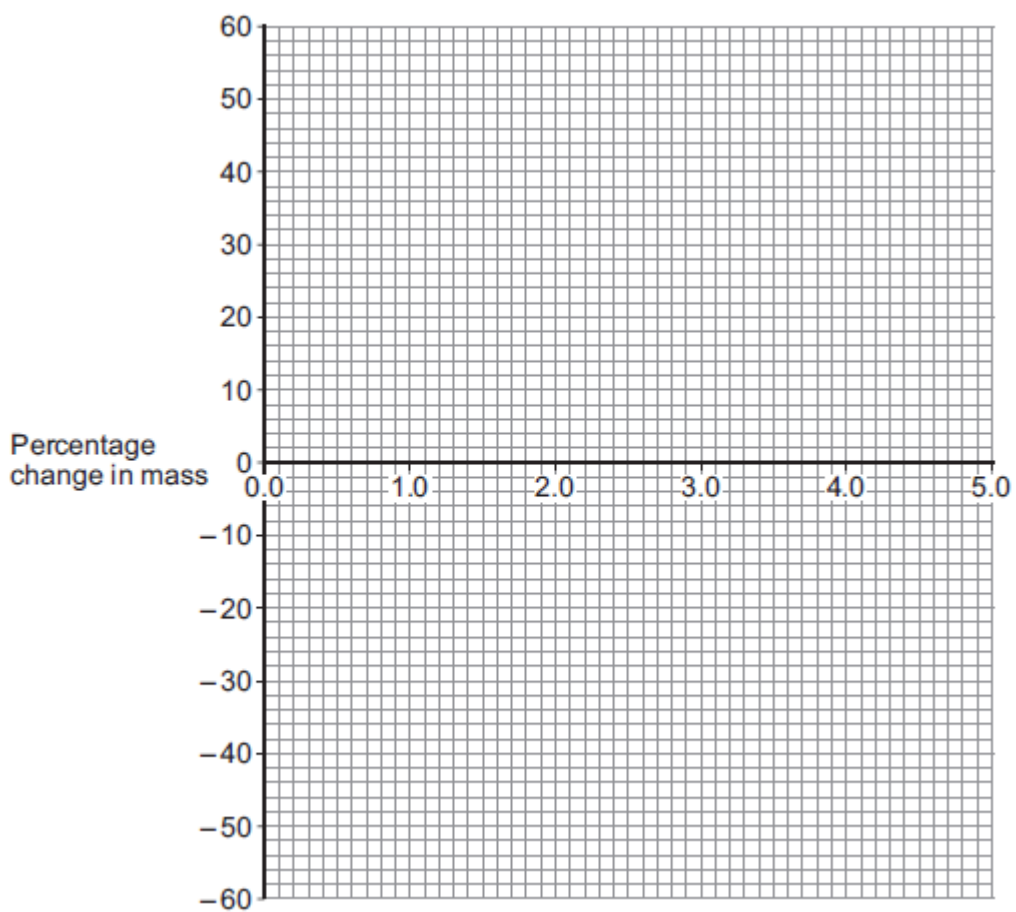
Percentage change in mass = _____ %

(2)

(c) (i) On the graph paper below, draw a graph to show the scientists' results:

- plot the **percentage** change in mass

- label the horizontal axis
- draw a line of best fit.



(4)

(ii) The scientists thought one of their results was anomalous.

Draw a ring around the anomalous result on your graph.

(1)

(iii) Suggest what might have happened to cause this anomalous result.

(1)

(d) (i) What do you think is the concentration of salts in the lugworm's natural environment?

Use information from your graph to give the reason for your answer.

Concentration = _____ %

Reason _____

(2)

- (ii) The mass of the lugworms decreased in the salt solution with a concentration of 5.0 arbitrary units.

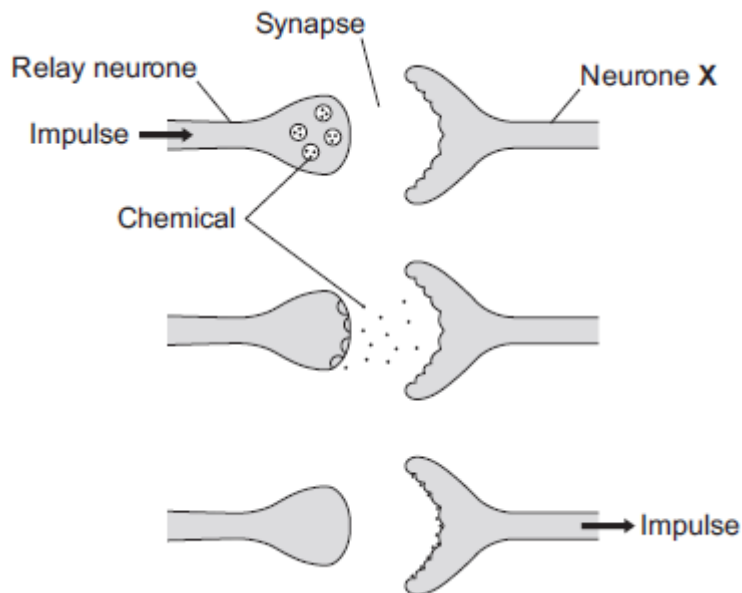
Explain what caused this.

(3)

(Total 19 marks)

Q12.

The diagram below shows how a nerve impulse passing along a relay neurone causes an impulse to be sent along another type of neurone, neurone X.



- (a) What type of neurone is neurone X?

(1)

- (b) Describe how information passes from the relay neurone to neurone X. Use the diagram to help you.

(3)

(c) Scientists investigated the effect of two toxins on the way in which information passes across synapses. The table below shows the results.

Toxin	Effect at the synapse
Curare	Decreases the effect of the chemical on neurone X
Strychnine	Increases the amount of the chemical made in the relay neurone

Describe the effect of each of the toxins on the response by muscles.

Curare _____

Strychnine _____

(2)

(Total 6 marks)

Q13.

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

Diffusion is an important process in animals and plants.

The movement of many substances into and out of cells occurs by diffusion.

Describe why diffusion is important to animals and plants.

In your answer you should refer to:

- animals
- plants
- examples of the diffusion of named substances.

Extra space _____

(Total 6 marks)

Q14.

Substances can move into cells and out of cells.

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

Water moves into cells and out of cells by

- | |
|-------------------|
| active transport. |
| osmosis. |
| reabsorption. |

The water moves through a

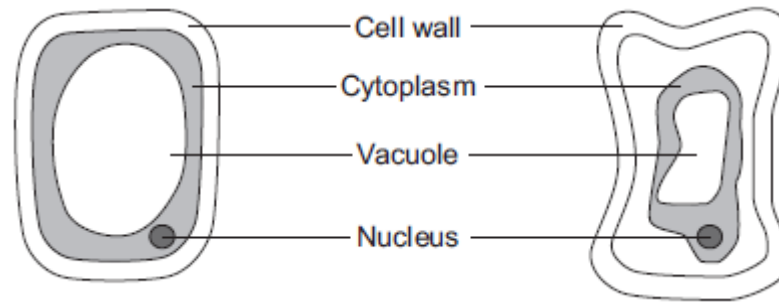
- | |
|---------------------|
| freely permeable |
| non-permeable |
| partially permeable |

membrane.

(2)

- (b) Students put plant cells into two different strengths of sugar solutions, **A** and **B**.

The diagram below shows what the cells looked like after 1 hour.



Cell in
sugar solution **A**
(after 1 hour)

Cell in
sugar solution **B**
(after 1 hour)

- (i) Describe **two** ways in which the cell in sugar solution **B** is different from the cell in sugar solution **A**.

1. _____

2. _____

(2)

- (ii) A student put red blood cells into water.

Suggest what would happen to the cells.

(1)

- (c) In the human body, glucose is absorbed into the blood from the small intestine.

The small intestine contains many villi.

Which **two** of the following help the absorption of glucose in the small intestine?

Tick (✓) **two** boxes.

Villi have a cell wall.

Villi are covered in thick mucus.

Villi give the small intestine a large surface area.

Villi have many blood capillaries.

(2)

(Total 7 marks)

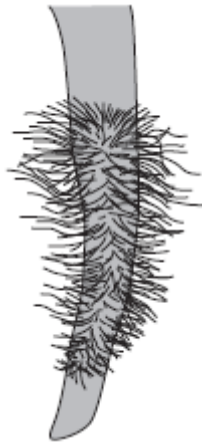
Q15.

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.

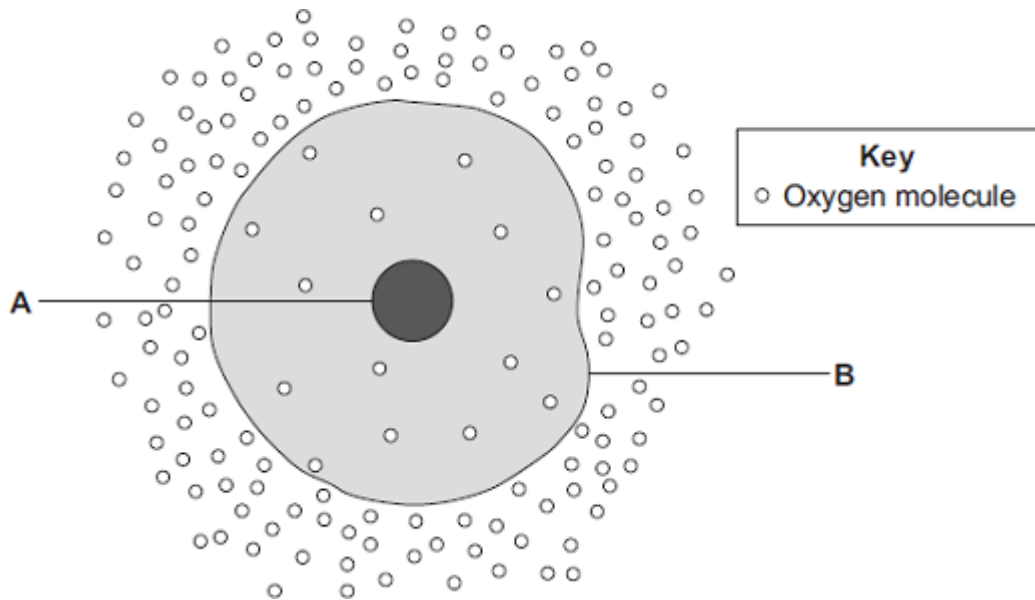
Use information from the diagram to explain how this plant root is adapted for absorbing water.

(3)

(Total 6 marks)

Q16.

The diagram shows a cell.



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

cell membrane	chloroplast	cytoplasm	nucleus
---------------	-------------	-----------	---------

A _____

B _____

(2)

(ii) The cell in the diagram is an animal cell.

How can you tell it is an animal cell and **not** a plant cell?

Give **two** reasons.

1. _____

2. _____

(2)

(b) Oxygen will diffuse into the cell in the diagram.

Why?

Use information from the diagram.

(1)

(c) The cell shown in the diagram is usually found with similar cells.

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

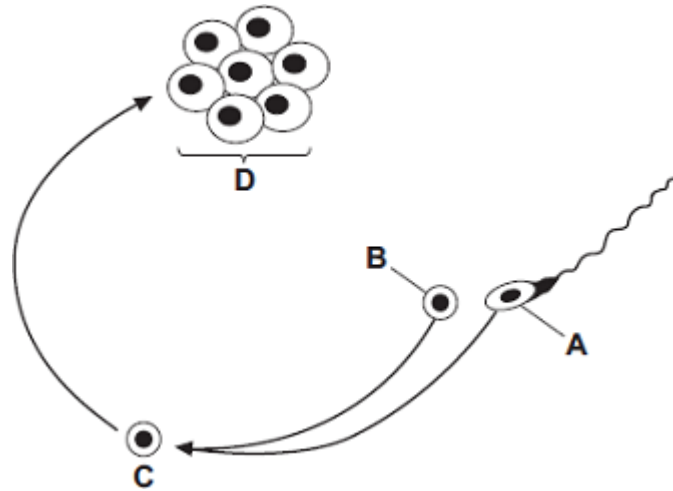
Scientists call a group of similar cells

- an organ.
- a system.
- a tissue.

(1)
(Total 6 marks)

Q17.

The diagram shows some of the stages in IVF (in vitro fertilisation).



(a) Use words from the box to name structures **A**, **B**, **C** and **D**.

egg	embryo	fertilised egg	ovary	sperm
-----	--------	----------------	-------	-------

Structure **A** _____

Structure **B** _____

Structure **C** _____

Structure **D** _____

(4)

(b) What do doctors do next with structure **D**?

(2)

(c) The table gives statistics for an IVF clinic.

	Age of women treated			
	Below 35 years	35 – 37 years	38 – 39 years	40 – 42 years
Number of women treated	414	207	106	53
Number of women who produced one baby	90	43	17	1
Number of women who produced twins	24	8	4	1
Number of women who produced triplets	1	0	0	0

- (i) About what proportion of the treated women aged 35 – 37 years produced one or more babies?

Draw a ring around your answer.

one quarter one third half

(1)

- (ii) This clinic does **not** give IVF treatment to women over 42 years of age.

Use data from the table to explain why.

(2)

- (iii) The committee which regulates IVF treatment now advises that only one embryo is used in each treatment.

Suggest **one** reason for this.

(1)

(Total 10 marks)

Q18.

Substances can move into and out of cells.

- (a) (i) How does oxygen move into and out of cells?

Draw a ring around **one** answer.

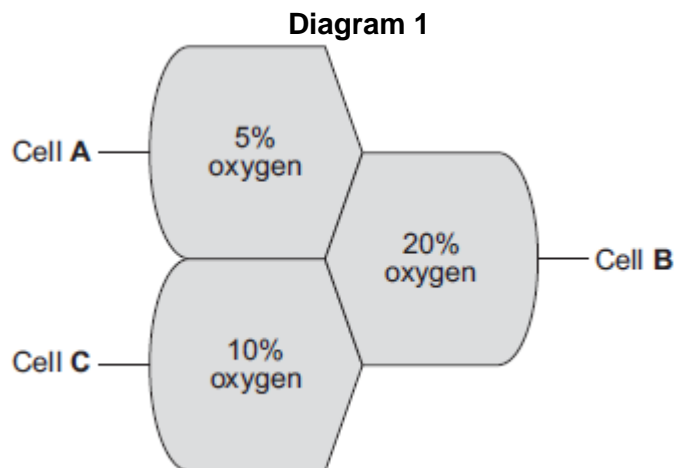
diffusion

digestion

photosynthesis

(1)

- (ii) **Diagram 1** shows the percentage concentration of oxygen in three cells, **A**, **B** and **C**.



Oxygen can move from cell to cell.

Into which cell, **A**, **B** or **C**, will oxygen move the fastest?

(1)

- (b) (i) How does water move into and out of cells?

Draw a ring around **one** answer.

breathing

osmosis

respiration

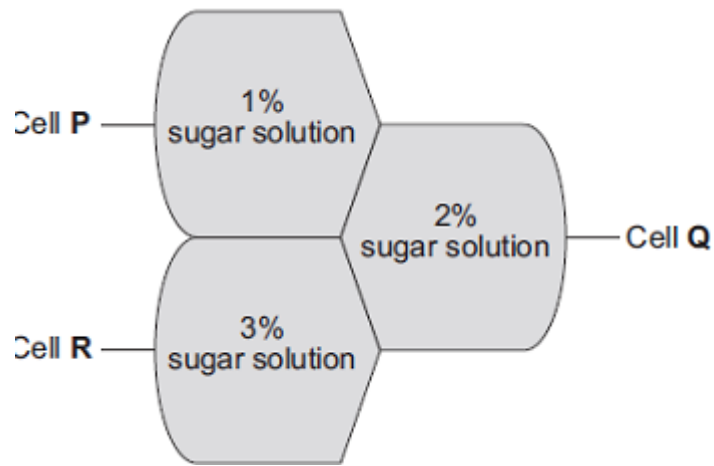
(1)

- (ii) Differences in the concentration of sugars in cells cause water to move into or out of cells at different rates.

Diagram 2 shows three different cells, **P**, **Q** and **R**.

The information shows the percentage concentration of sugar solution in cells **P**, **Q** and **R**.

Diagram 2



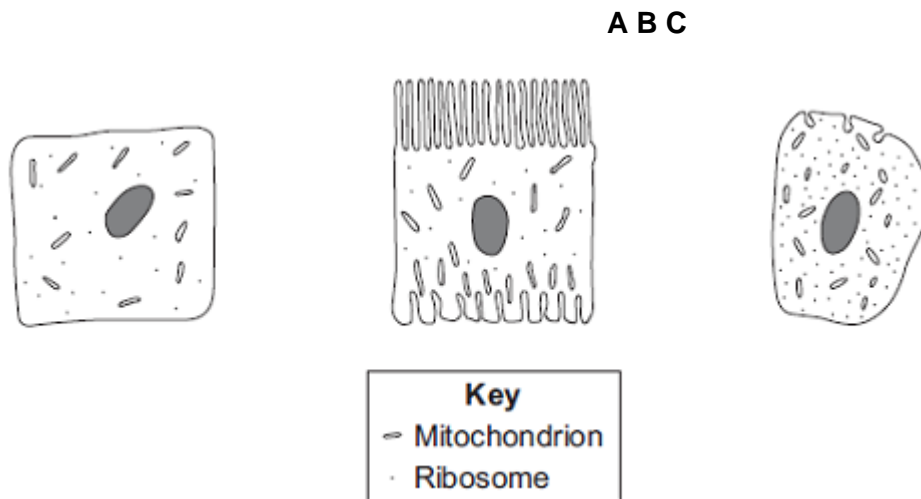
Water can move from cell to cell.

Into which cell, **P**, **Q** or **R**, will water move the fastest?

(1)
(Total 4 marks)

Q19.

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(a) Which cell, **A**, **B** or **C**, appears to be best adapted to increase diffusion into or out of the cell?

Give **one** reason for your choice.

(1)

(b) (i) Cell **C** is found in the salivary glands.

Name the enzyme produced by the salivary glands.

(1)

- (ii) Use information from the diagram to explain how cell **C** is adapted for producing this enzyme.

(2)

(Total 4 marks)

Q20.

- (a) Mr and Mrs Smith both have a history of cystic fibrosis in their families. Neither of them has cystic fibrosis. Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

(3)

- (b) Mr and Mrs Smith decided to visit a genetic counsellor who discussed embryo screening.

Read the information which they received from the genetic counsellor.

- Five eggs will be removed from Mrs Smith's ovary while she is under an anaesthetic.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs Smith's uterus and she may

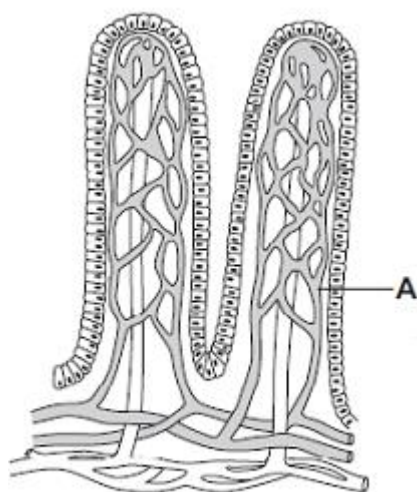
(3)
(Total 11 marks)

Q21.

Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



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

(i) Structure **A** is a

muscle.
nerve.
capillary.

(1)

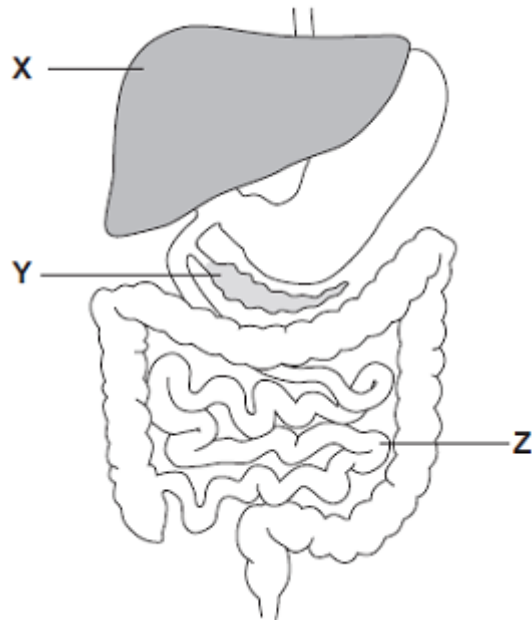
(ii) The villi absorb the products of digestion by

dialysis.
diffusion.
osmosis.

(1)

(b) **Diagram 2** shows the digestive system.

Diagram 2



(i) In which part of the digestive system, X, Y or Z, are most villi found?

(1)

(ii) There are about 2000 villi in each cm^2 of this part of the digestive system.

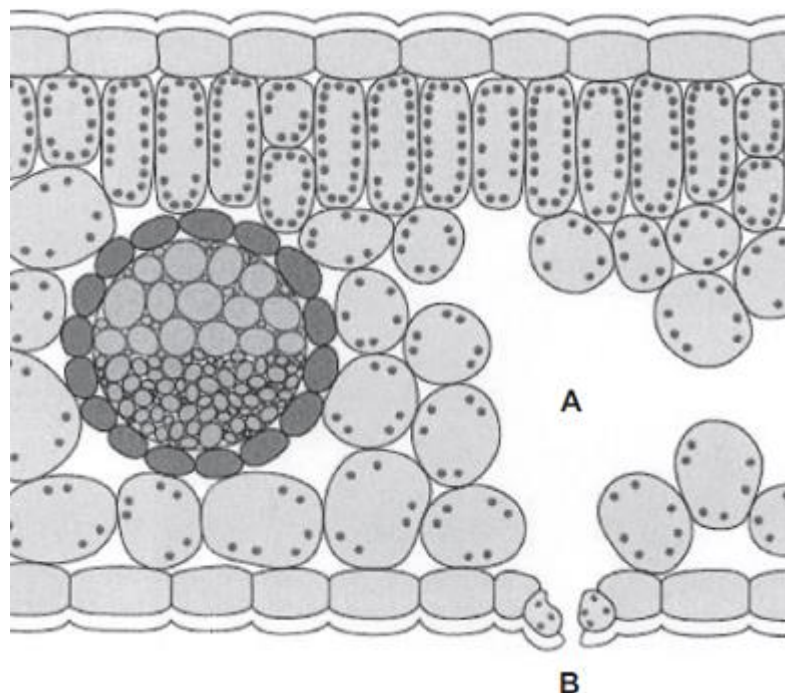
Why is it helpful to have lots of villi?

(1)

(Total 4 marks)

Q22.

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)

Q23.

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*?

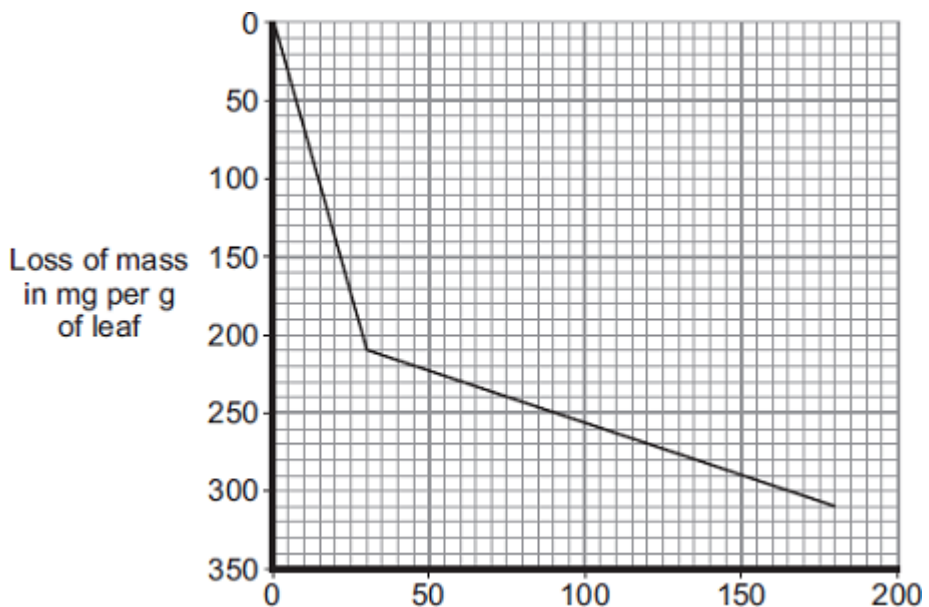
(3)

(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.

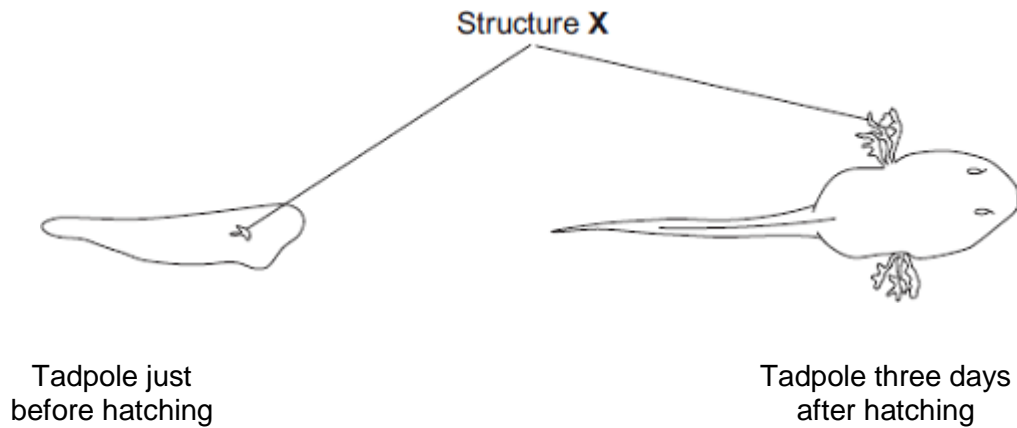
(2)
(Total 11 marks)

Q24.

The young stages of frogs are called tadpoles. The tadpoles live in fresh water.

The drawings show a tadpole just before hatching and three days after hatching.

Structure **X** helps in the exchange of substances between the tadpole and the water.



Tadpole just before hatching

Tadpole three days after hatching

- (a) Name **one** substance, other than food, that the tadpole needs to exchange with the water in order to grow.

(1)

- (b) Suggest how the changes in the tadpole shown in the drawings help it to survive as it grows larger.

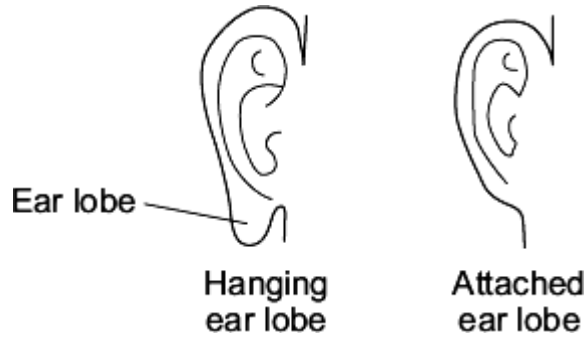
You should **not** refer to movement in your answer.
To gain full marks you should refer to structure **X**.

(4)
(Total 5 marks)

Q25.

People have different shaped ear lobes, either 'hanging' or 'attached'.

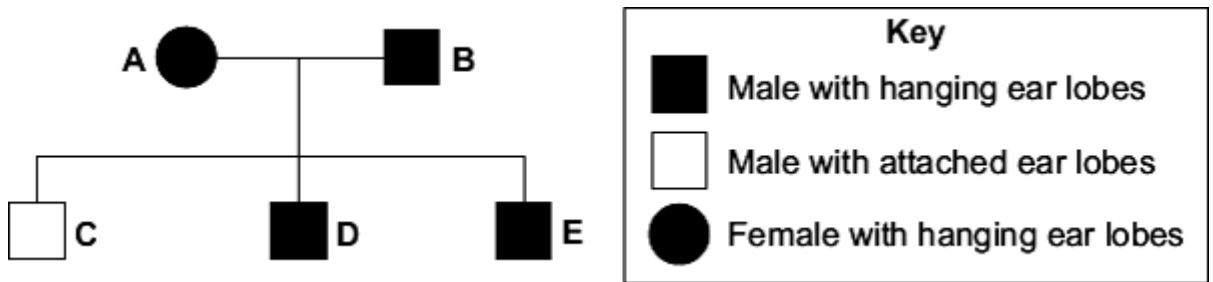
The diagrams show the two shapes of ear lobe.



A gene controls the shape of a person's ear lobes.

The diagram shows a family tree.

Parents **A** and **B** both have hanging ear lobes.



- (a) The key does **not** show the symbol for a female with attached ear lobes.

Draw the symbol for the key to show a female with attached ear lobes.

Use information in the family tree and the key.

Symbol = _____

(1)

- (b) Look at the family tree.

What does the information in the family tree tell you about the allele for hanging ear lobes?

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

The allele for hanging ear lobes is

dominant.
weak.
recessive.

(1)

- (c) (i) Parents **A** and **B** have three children, **C**, **D** and **E**.
All three children are boys.

What are the chances that the next child of parents **A** and **B** will be a girl?

Draw a ring around **one** answer.

no chance (0 %) **a half (50 %)** **certain (100 %)**

(1)

(ii) Which statement explains your answer to part (c)(i)?

Tick (✓) **one** box.

Some of **B**'s sperm cells have an X chromosome.

Some of **A**'s egg cells have a Y chromosome

All of **B**'s sperm cells have an X chromosome.

(1)

(Total 4 marks)

Q26.

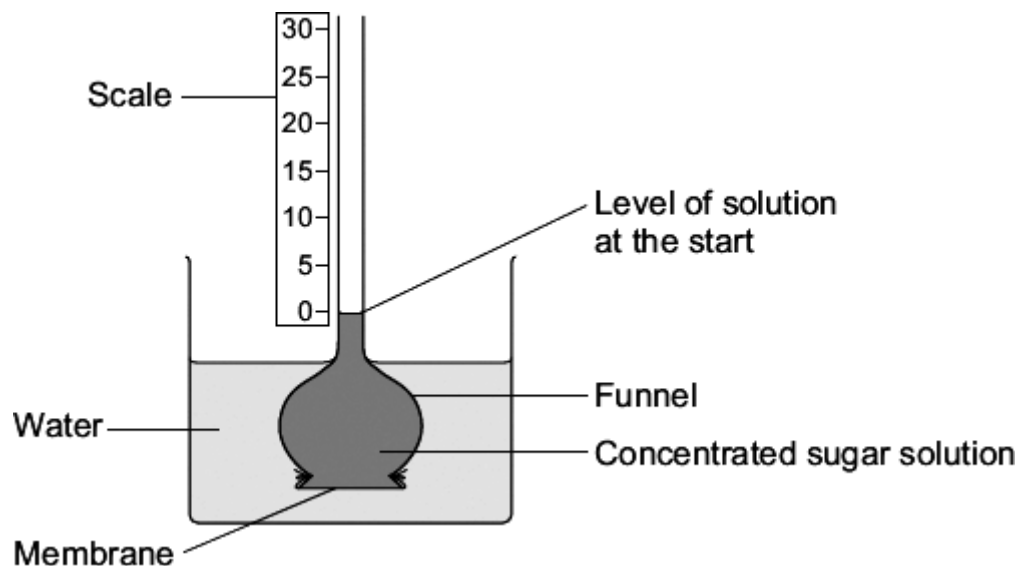
Some substances move through membranes.

A student set up an investigation.

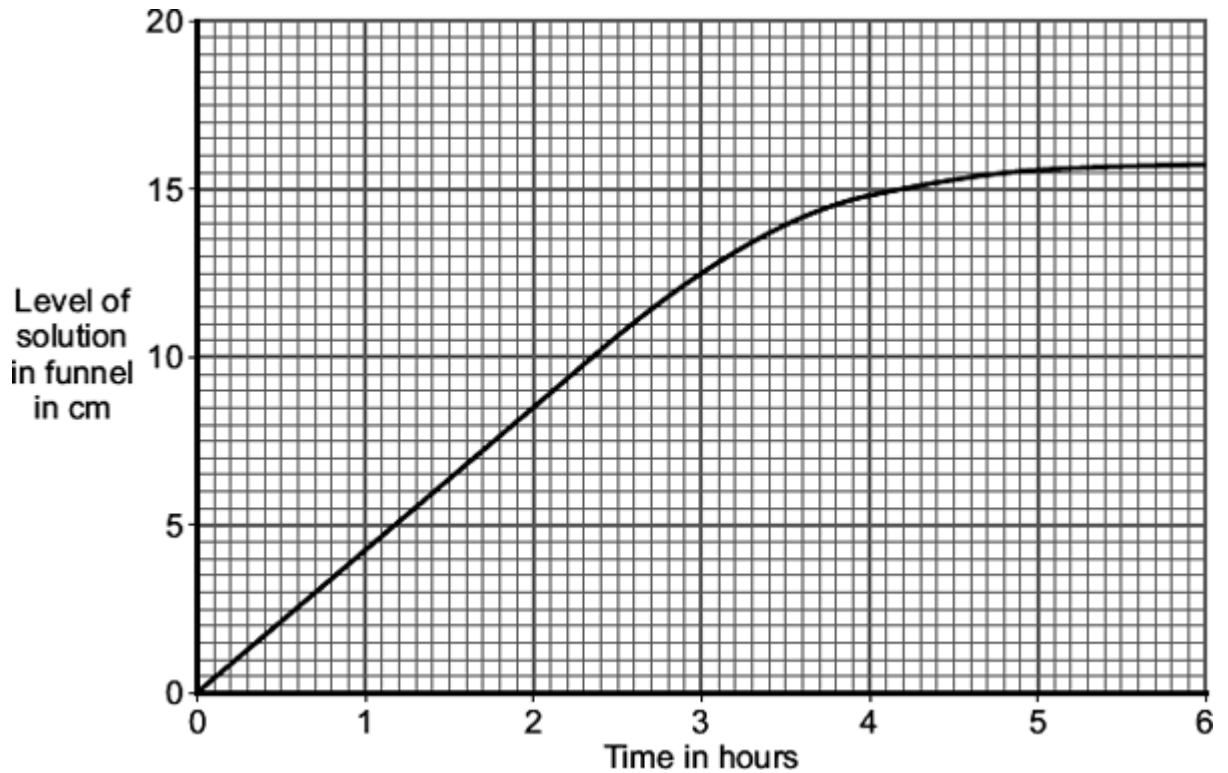
The student:

- tied a thin membrane across the end of a funnel
- put concentrated sugar solution in the funnel
- put the funnel in a beaker of water
- measured the level of the solution in the funnel every 30 minutes.

The diagram shows the apparatus.



The graph shows the results.



- (a) After 3 hours, the level of the solution in the funnel is different from the level at the start.

Explain why, as fully as you can.

(3)

- (b) The student repeated the investigation using dilute sugar solution instead of concentrated sugar solution.

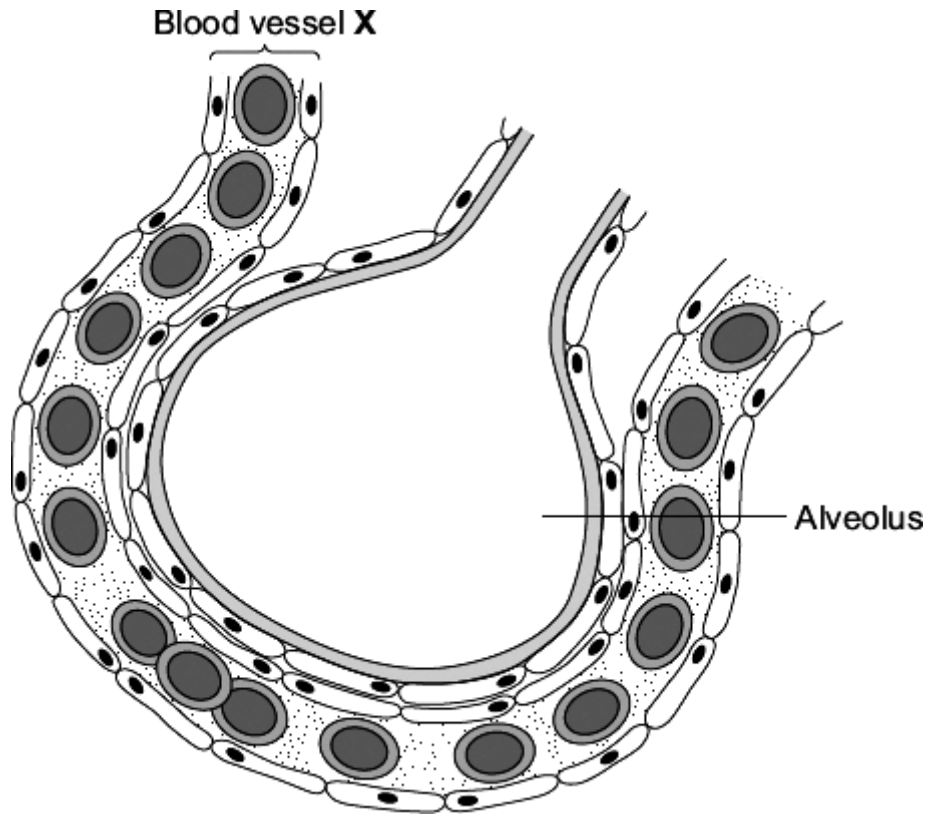
In what way would you expect the results using dilute sugar solution to be different from the results using concentrated sugar solution?

Give the reason for your answer.

(2)

Q27.

The diagram shows an alveolus and a blood vessel in the lung.



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

(i) Blood vessel X is

an artery.
a capillary.
a vein.

(1)

(ii) Gases pass across the wall of the alveolus by

diffusion.
evaporation.
fermentation.

(1)

(iii) The table compares the concentrations of some gases in inhaled air and exhaled air.

Complete the table.

Write 'lower' or 'higher' in each box.

One line has been completed for you as an example.

Gas	Concentration

	Inhaled air	Exhaled air
Water vapour	lower	higher
Carbon dioxide		
Oxygen		

(2)

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

(i) Oxygen is carried in the blood mainly in

blood plasma.
red blood cells.
white blood cells.

(1)

(ii) In the blood, the oxygen combines with

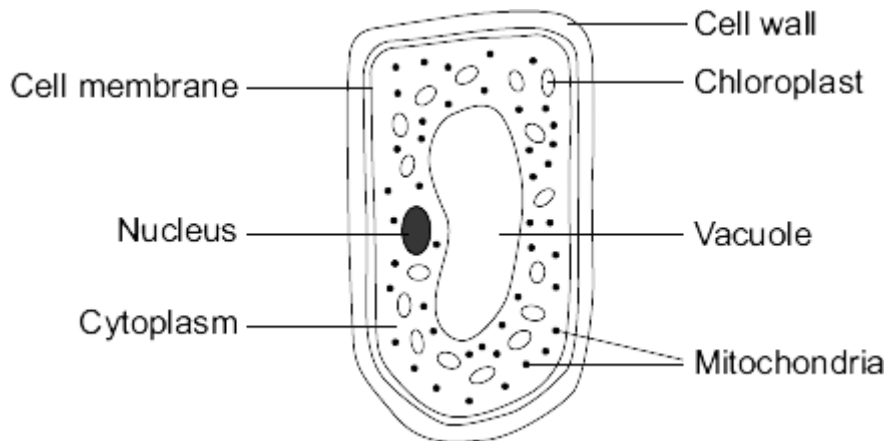
carbon dioxide.
haemoglobin.
urea.

(1)

(Total 6 marks)

Q28.

The diagram shows a cell from a plant leaf.



(a) Name the part of this cell that:

(i) controls the passage of substances in and out of the cell

(1)

(ii) is filled with cell sap.

(1)

- (b) Give the names of **two** parts of the leaf cell that would **not** be found in a human liver cell.

_____ and _____

(2)

- (c) The chloroplasts produce oxygen.

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

The oxygen produced by the chloroplasts passes out of the cell by

diffusion.

digestion.

respiration.

(1)

(Total 5 marks)

Q29.

- (a) **List A** gives four structures in the human body.

List B gives the functions of some structures in the body.

Draw a straight line from each structure in **List A** to the correct function in **List B**.

List A – Structure

List B – Function

Alveoli

Surround and protect the lungs

Veins

Filter the blood

Villi

Carry blood towards the heart

Ribs

Absorb digested food

Allow oxygen to enter the blood

(4)

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

diffusion.

In the lungs, oxygen enters the blood from the air by

filtration.
respiration.

(1)
(Total 5 marks)

Q30.

The table shows the concentrations of three mineral ions in the roots of a plant and in the water in the surrounding soil.

Mineral ion	Concentration in millimoles per kilogram	
	Plant root	Soil
Calcium	120	2.0
Magnesium	80	3.1
Potassium	250	1.2

(a) (i) The plant roots could **not** have absorbed these mineral ions by diffusion.

Explain why.

(2)

(ii) Name the process by which the plant roots absorb mineral ions.

(1)

(b) How do the following features of plant roots help the plant to absorb mineral ions from the soil?

(i) A plant root has thousands of root hairs.

(1)

(ii) A root hair cell contains many mitochondria.

(2)

(iii) Many of the cells in the root store starch.

(1)

(Total 7 marks)

Q31.

Substances can move into and out of cells.

(a) (i) How does oxygen move into and out of cells?

Draw a ring around **one** answer.

diffusion

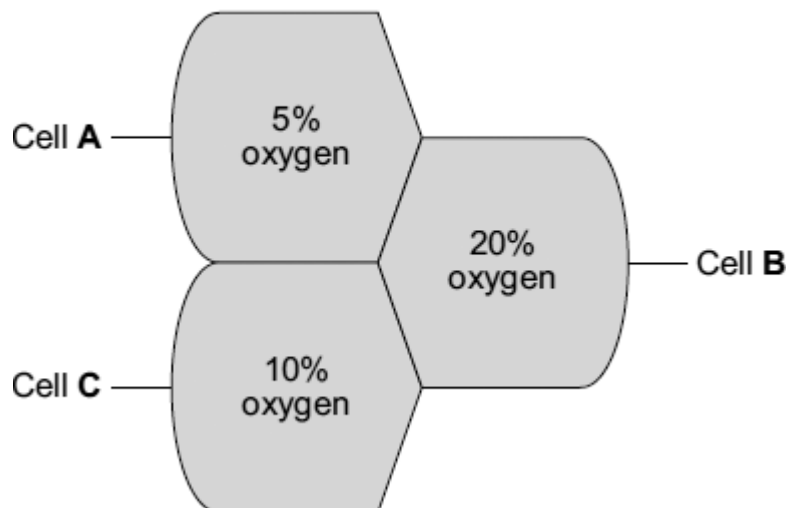
digestion

photosynthesis

(1)

(ii) **Diagram 1** shows the percentage concentration of oxygen in three cells, **A**, **B** and **C**.

Diagram 1



Oxygen can move from cell to cell.

Into which cell, **A**, **B** or **C**, will oxygen move the fastest?

(1)

(b) (i) How does water move into and out of cells?

Draw a ring around **one** answer.

breathing

osmosis

respiration

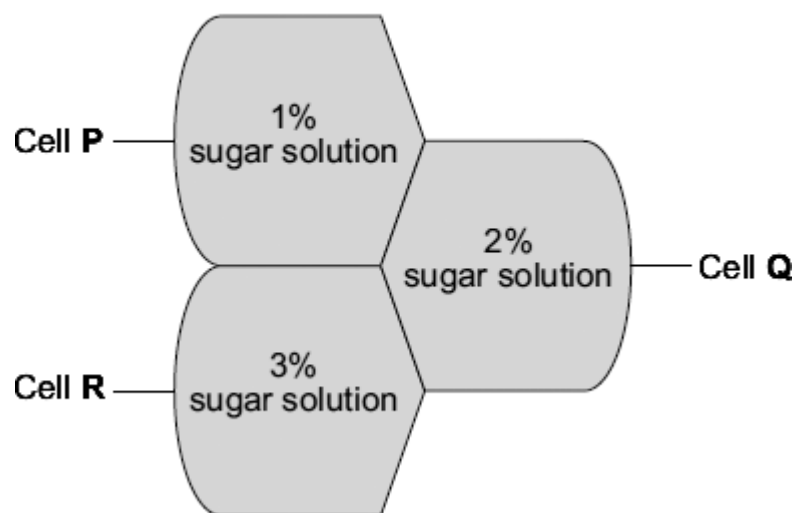
(1)

- (ii) Differences in the concentration of sugars in cells cause water to move into or out of cells at different rates.

Diagram 2 shows three different cells, **P**, **Q** and **R**.

The information shows the percentage concentration of sugar solution in cells **P**, **Q** and **R**.

Diagram 2



Water can move from cell to cell.

Into which cell, **P**, **Q** or **R**, will water move the fastest?

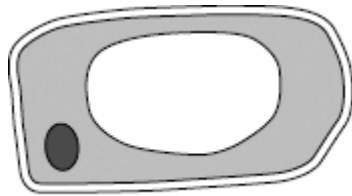
(1)

(Total 4 marks)

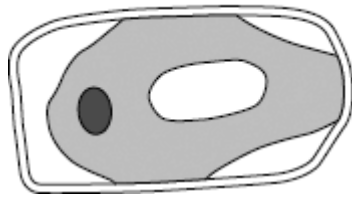
Q32.

The diagram shows the same plant cell:

- after 1 hour in distilled water
- after 1 hour in strong sugar solution.



After 1 hour in distilled water



After 1 hour in strong sugar solution

- (a) Describe **two** ways in which the cell in the strong sugar solution is different from the cell in distilled water.

1. _____

2. _____

(2)

- (b) Explain how the differences between the cell in the strong sugar solution and the cell in distilled water were caused.

(2)

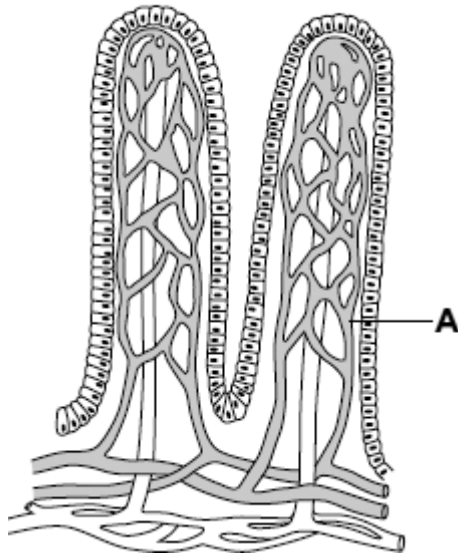
(Total 4 marks)

Q33.

Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



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

(i) Structure **A** is a

- muscle.
- nerve.
- capillary.

(1)

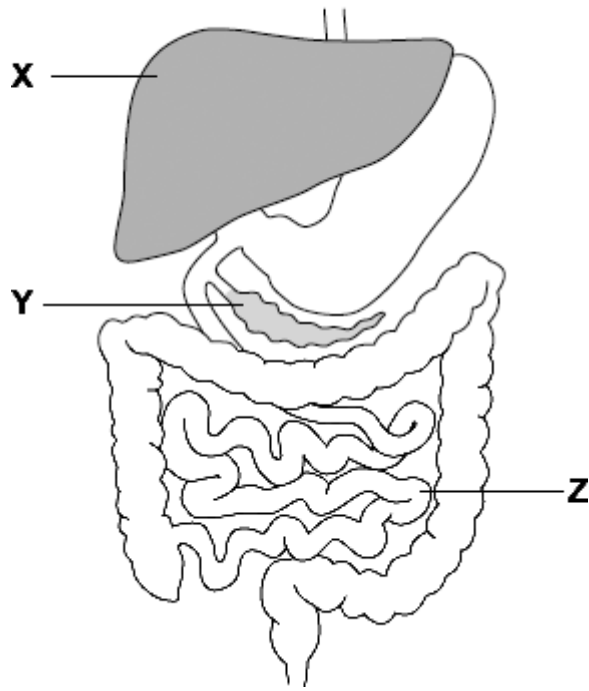
(ii) The villi absorb the products of digestion by

- dialysis.
- diffusion.
- osmosis.

(1)

(b) **Diagram 2** shows the digestive system.

Diagram 2



(i) In which part of the digestive system, **X**, **Y** or **Z**, are most villi found?

(1)

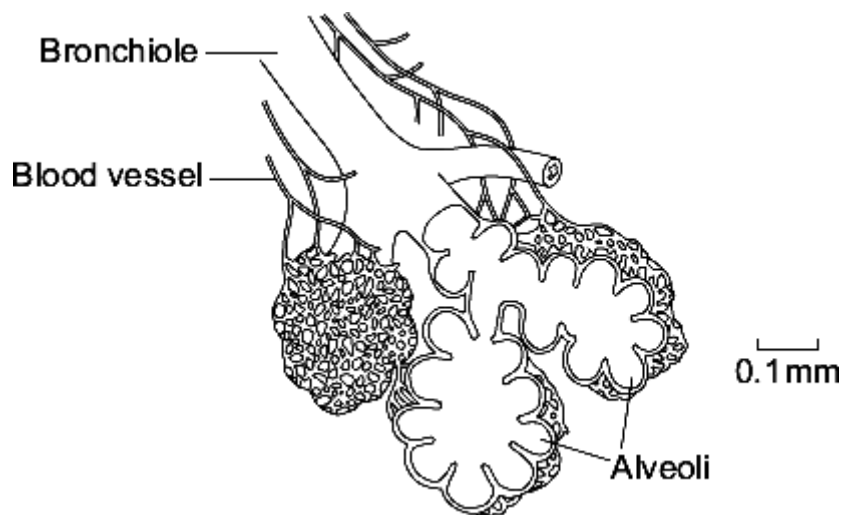
(ii) There are about 2000 villi in each cm^2 of this part of the digestive system. Why is it helpful to have lots of villi?

(1)

(Total 4 marks)

Q34.

The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



(a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1. _____

2. _____

3. _____

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

(2)

(Total 6 marks)

Q35.

Read the following information about how the small intestine absorbs sugars.

- The blood absorbs glucose and some other sugars, like xylose, from the small intestine.
- Glucose molecules are the same size as xylose molecules, but glucose is absorbed more quickly than xylose.
- Experiments with pieces of intestine show that the uptake of oxygen by the intestine is 50 % higher in the presence of glucose than in the absence of glucose. Xylose does not have this effect on the uptake of oxygen.
- The cells lining the small intestine have many mitochondria.

Explain how this information provides evidence that glucose is absorbed by the small intestine using *active transport*.

(Total 4 marks)

Q36.

Cells contain a solution of salts and sugars.

A student is investigating how cells change when they are put into water.

(a) The student:

- looks at a plant cell using a microscope
- adds water to the cell.

The plant cell swells up.

Explain why, as fully as you can.

(3)

(b) When **animal** cells are put in water, they swell up, and then burst.
When **plant** cells are put in water, they swell up, but do **not** burst.

How does the structure of plant cells prevent them from bursting?

(1)

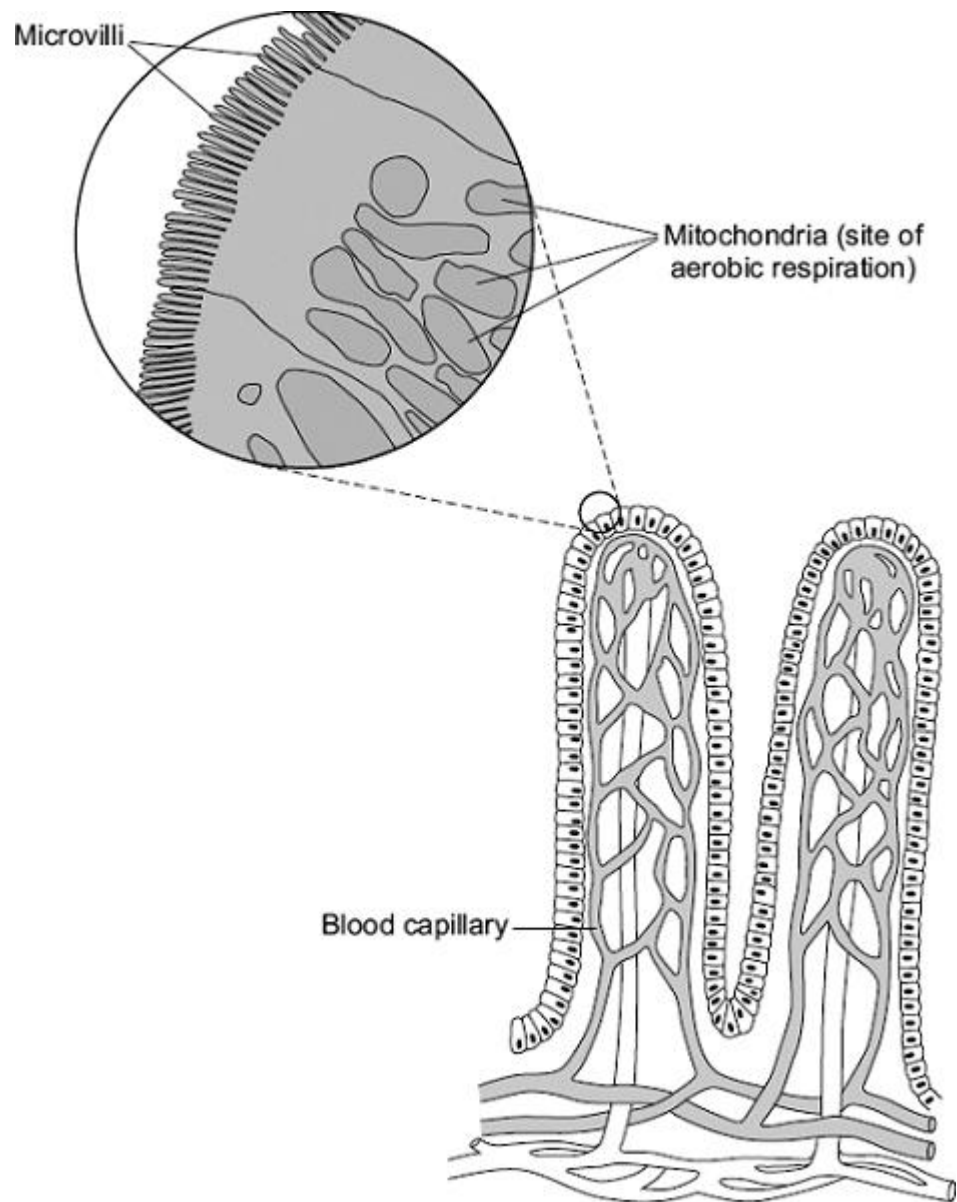
(Total 4 marks)

Q37.

The villi of the small intestine absorb the products of digestion.

The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as

seen with an electron microscope.

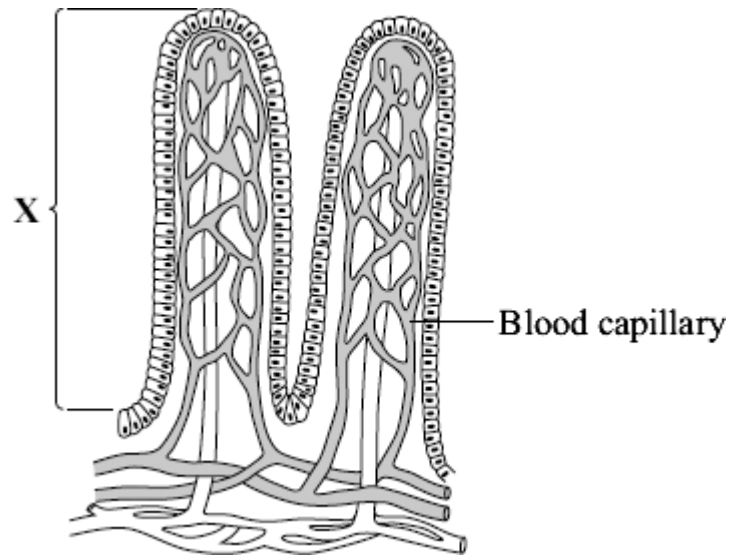


Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

(Total 5 marks)

Q38.

The diagram shows part of the lining of the small intestine.



- (a) (i) Name structure **X**.

Draw a ring around **one** answer.

alveolus

thorax

villus

(1)

- (ii) Choose **three** ways in which structure **X** is adapted to help the absorption of soluble food.

Tick (✓) **three** boxes.

It is ventilated.

Its outer surface is one cell thick.

It has a large surface area.

It contains a layer of muscle.

It has a good blood supply.

Its cells contain haemoglobin.



(3)

(b) Name the process by which soluble food enters the blood.

Draw a ring around **one** answer.

diffusion

fermentation

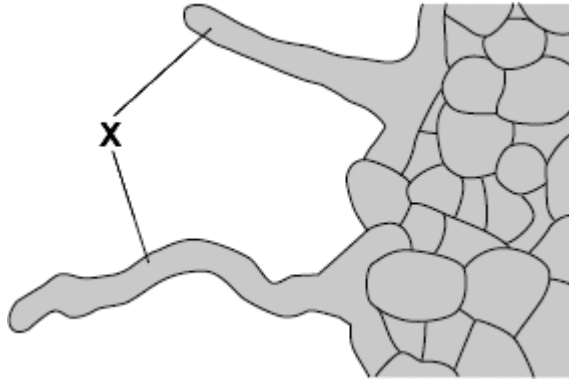
transpiration

(1)

(Total 5 marks)

Q39.

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. _____

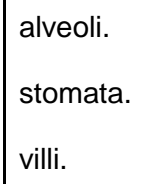
2. _____

(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.

(i) Carbon dioxide enters leaves through



(1)

active transport.
diffusion.
reabsorption.

(ii) Carbon dioxide enters leaf cells by

(1)
(Total 5 marks)

Q40.

(a) Some scientists investigated the rates of absorption of different sugars by the small intestine.

In one experiment they used a piece of normal intestine.

In a second experiment they used a piece of intestine poisoned by cyanide. Cyanide is poisonous because it prevents respiration.

The results are shown in the table.

Sugar	Relative rates of absorption	
	Normal intestine	Intestine poisoned by cyanide
Glucose	1.00	0.33
Galactose	1.10	0.53
Xylose	0.30	0.31
Arabinose	0.29	0.29

(i) Name **two** sugars from the table which can be absorbed by active transport.

- 1. _____
- 2. _____

(1)

(ii) Use evidence from the table to explain why you chose these sugars.

(3)

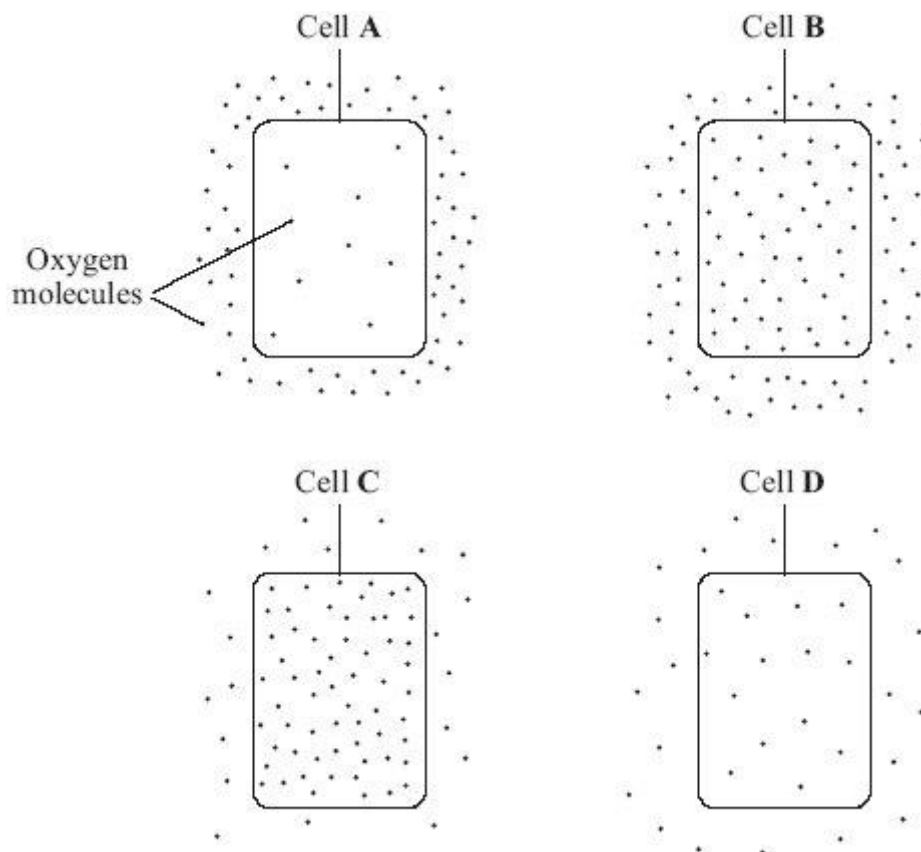
(b) All of the sugars named in the table can be absorbed by diffusion.

Explain how information from the table provides evidence for this.

(2)
(Total 6 marks)

Q41.

(a) The diagrams show cells containing and surrounded by oxygen molecules. Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest?

Write your answer, **A**, **B**, **C** or **D**, in the box.

(1)

(b) Draw a ring around the correct word to complete each sentence.

- (i) Oxygen is taken into cells by the process of

diffusion
osmosis
respiration

 . (1)
- (ii) Cells need oxygen for

breathing
photosynthesis
respiration

 . (1)
- (iii) The parts of cells that use up the most oxygen are the

membranes
mitochondria
nuclei

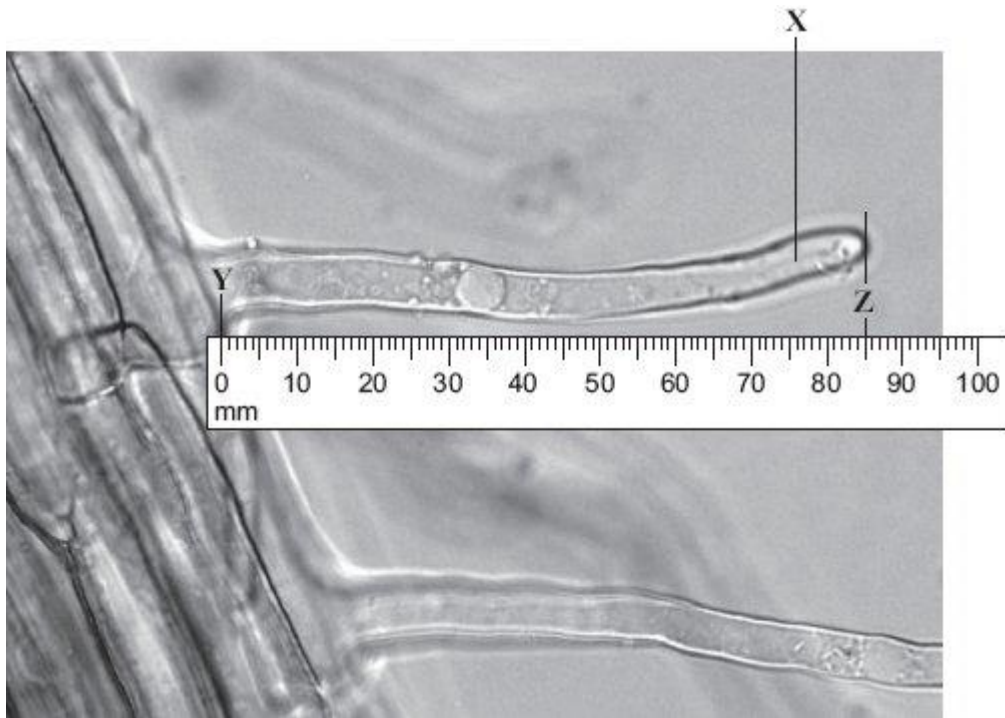
 . (1)
- (iv) Some cells produce oxygen in the process of

diffusion
photosynthesis
respiration

 . (1)
- (Total 5 marks)

Q42.

The photograph shows part of the surface of a plant root. This part of the root is covered with hundreds of structures like the one labelled **X**.



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

Draw a ring around **one** answer.

root hair

stoma

villus

(1)

(b) (i) Use the scale to measure the length **Y–Z** on the photograph.

On the photograph, length **Y–Z** = _____ mm.

(1)

(ii) The photograph shows the root magnified 100 times.

Calculate the actual length **Y–Z**.

Actual length **Y–Z** = _____ mm.

(2)

(iii) Structure **X** is very small. There are thousands of structures like **X** on a plant root.

How does this help the plant?

Q43.

- (a) The concentration of sulfate ions was measured in the roots of barley plants and in the water in the surrounding soil.

The table shows the results.

	Concentration of sulfate ions in mmol per dm ³
Roots of barley plants	1.4
Soil	0.15

Is it possible for the barley roots to take up sulfate ions from the soil by diffusion?

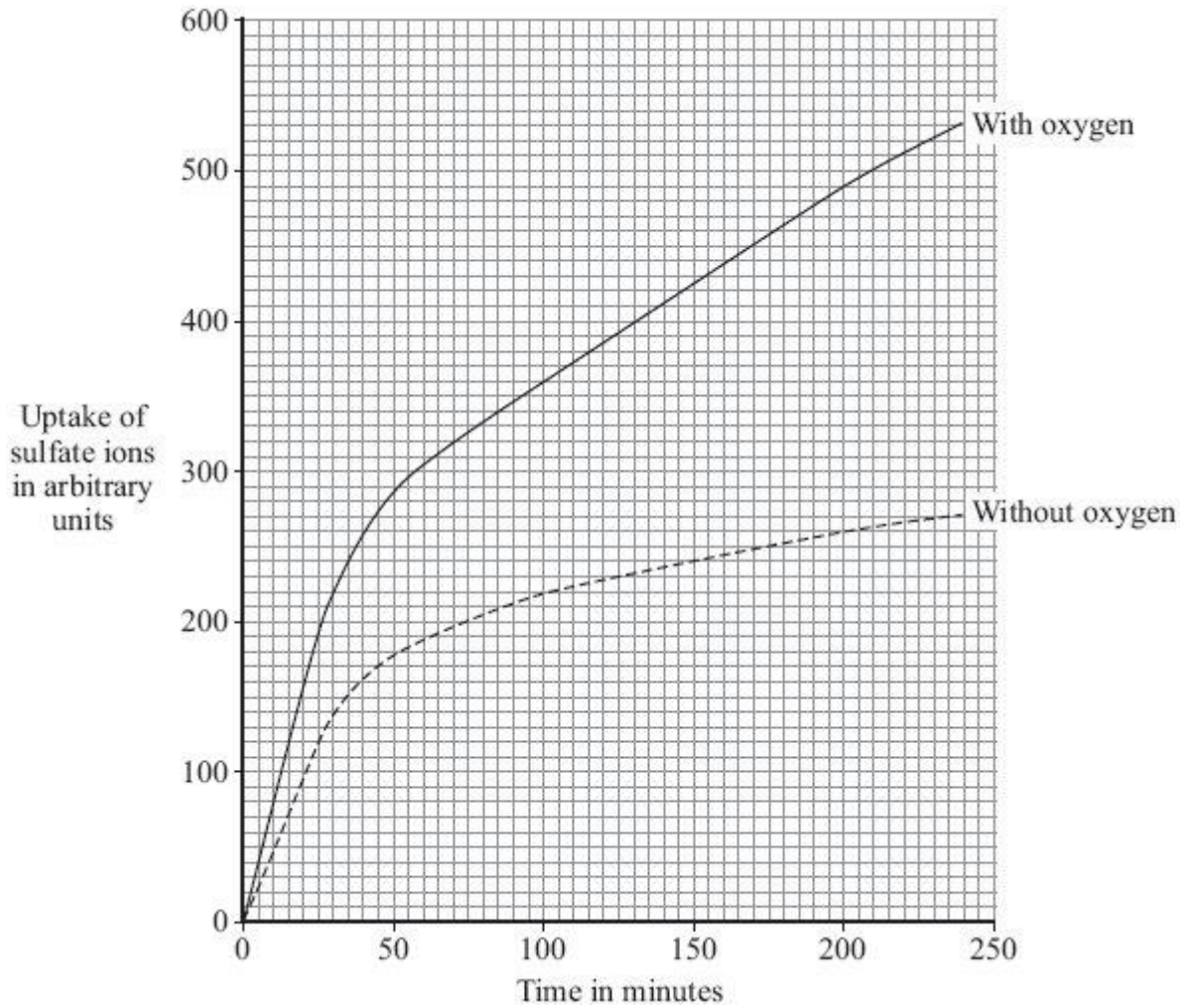
Draw a ring around your answer. **Yes / No**

Explain your answer.

(2)

- (b) Some scientists investigated the amounts of sulfate ions taken up by barley roots in the presence of oxygen and when no oxygen was present.

The graph below shows the results.



- (i) The graph shows that the rate of sulfate ion uptake between 100 and 200 minutes, **without** oxygen, was 0.4 arbitrary units per minute.

The rate of sulfate ion uptake between 100 and 200 minutes, **with** oxygen, was greater.

How much greater was it? Show clearly how you work out your answer.

Answer _____ arbitrary units

(2)

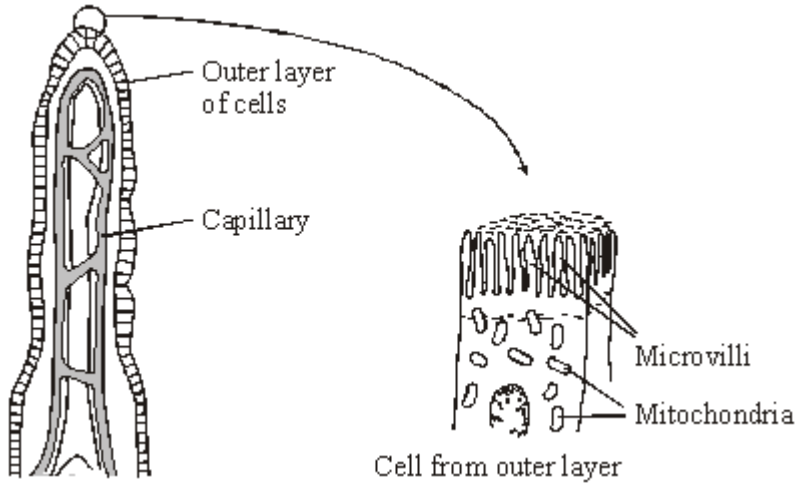
- (ii) The barley roots were able to take up more sulfate ions with oxygen than without oxygen.

Explain how.

(3)
(Total 7 marks)

Q44.

The small intestine is lined with millions of villi.
The diagram shows the structure of a villus.



In the small intestine, some of the products of digestion are absorbed into the blood by *active transport*.

(a) Explain what is meant by *active transport*.

(2)

(b) How do microvilli and mitochondria help in the active transport of the products of digestion from the small intestine into the blood?

Microvilli _____

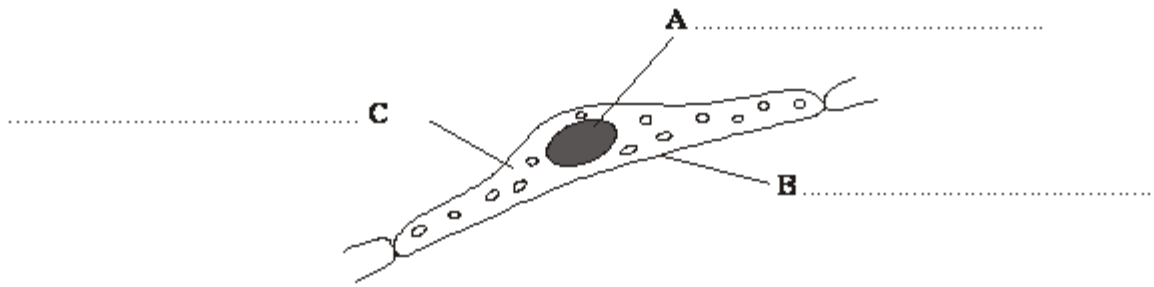
Mitochondria _____

(2)
(Total 4 marks)

Q45.

The diagram shows a cell from the lining of the lung. This cell is specialised to allow gases

to pass through quickly.



- (a) Use words from the box to label structures **A**, **B** and **C**.

cell membrane	chloroplast	cytoplasm	mitochondria	nucleus
------------------	-------------	-----------	--------------	---------

(3)

- (b) (i) Which feature of this cell allows oxygen to pass through quickly?

Put a tick (✓) in the box next to your choice.

It is thin.

It has a large nucleus.

It has many mitochondria.

(1)

- (ii) Complete the sentence by drawing a ring around the correct answer in the box.

Oxygen passes through this cell by

diffusion
osmosis
respiration

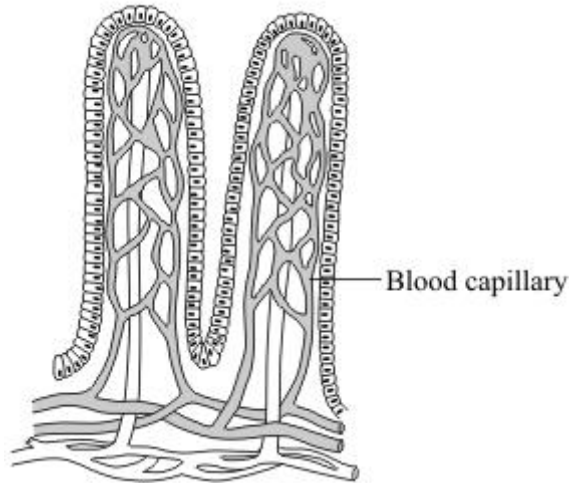
(1)

(Total 5 marks)

Q46.

Diagram 1 shows two villi in the small intestine of a healthy person.

Diagram 1



(a) Describe **two** features of the villi which help the small intestine to function.

1. _____

2. _____

(2)

(b) **Diagram 2** shows two villi in the small intestine of a person with coeliac disease.

Diagram 2



(i) How do the villi of the person with coeliac disease differ from those of a healthy person?

- _____
- _____

(1)

(ii) Suggest how this difference might affect how well the small intestine functions.

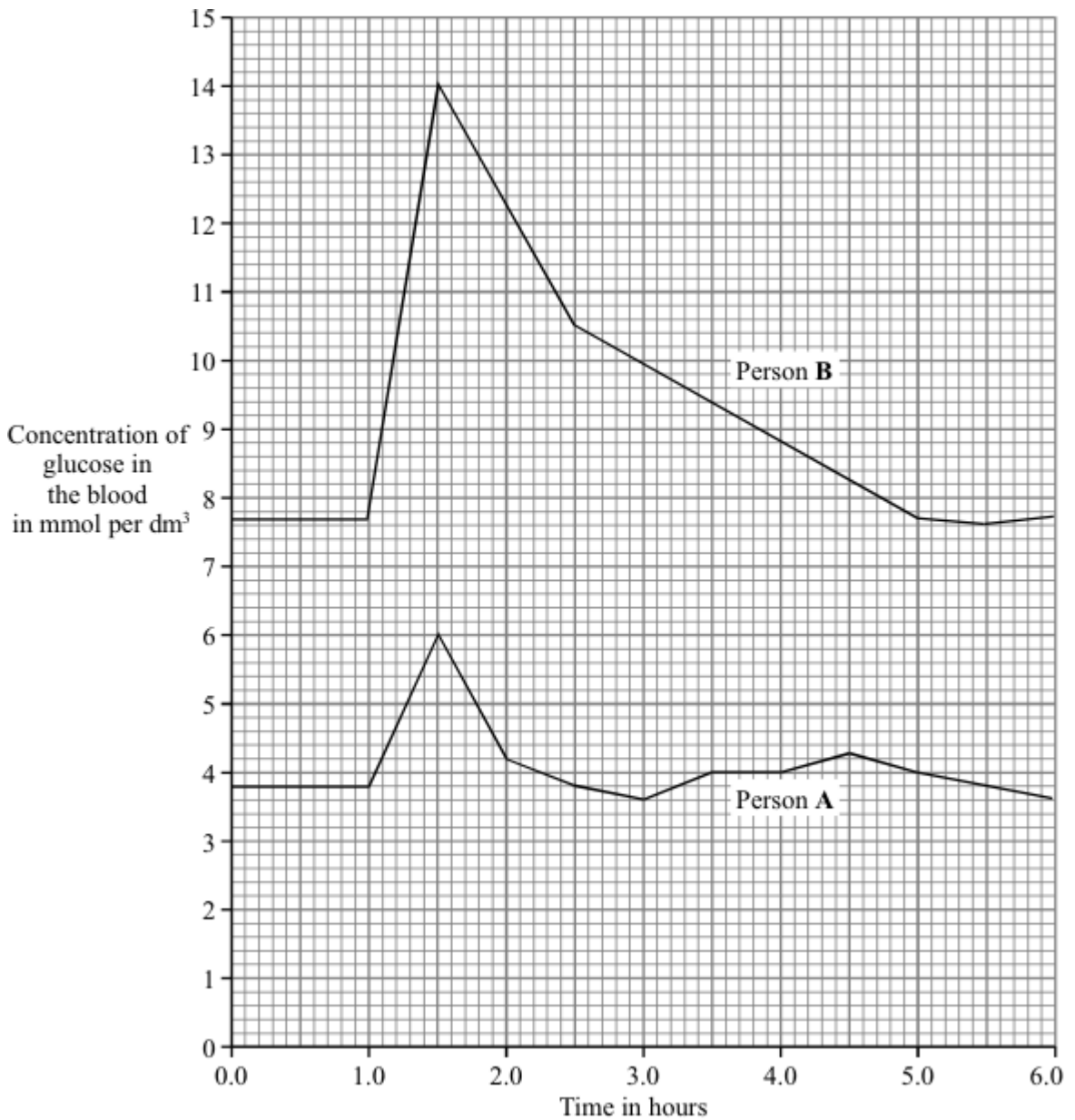
- _____
- _____

(1)

(Total 4 marks)

Q47.

The graph shows the concentration of glucose in the blood of two people. Person **A** is a non-diabetic. Person **B** has diabetes. Each person ate 75 grams of glucose at 1.0 hours.



- (a) (i) What was the maximum concentration of glucose in the blood of Person **A**?
_____ mmol per dm³ (1)
- (ii) After eating the glucose, how long did it take for the concentration of glucose in the blood of Person **B** to return to normal?
_____ hours (1)
- (b) A diabetic person does not produce enough insulin.
- (i) Which organ produces insulin?
_____ (1)

(ii) Write the letter **X** on the graph to show one time when the blood of Person **A** would contain large amounts of insulin.

(1)

(c) A high concentration of glucose in the blood can harm body cells as a result of osmosis.
Explain why.

(4)

(Total 8 marks)

Q48.

The table shows the concentrations of some mineral ions in the cells of a pond plant and in the surrounding pond water.

	Concentration in mmol per dm ³		
	Potassium	Calcium	Sulphate
Plant cells	49.0	7.0	7.0
Pond water	0.5	0.7	0.4

(i) The plant cells would not have been able to absorb these mineral ions from the pond water by diffusion. Explain why not.

(2)

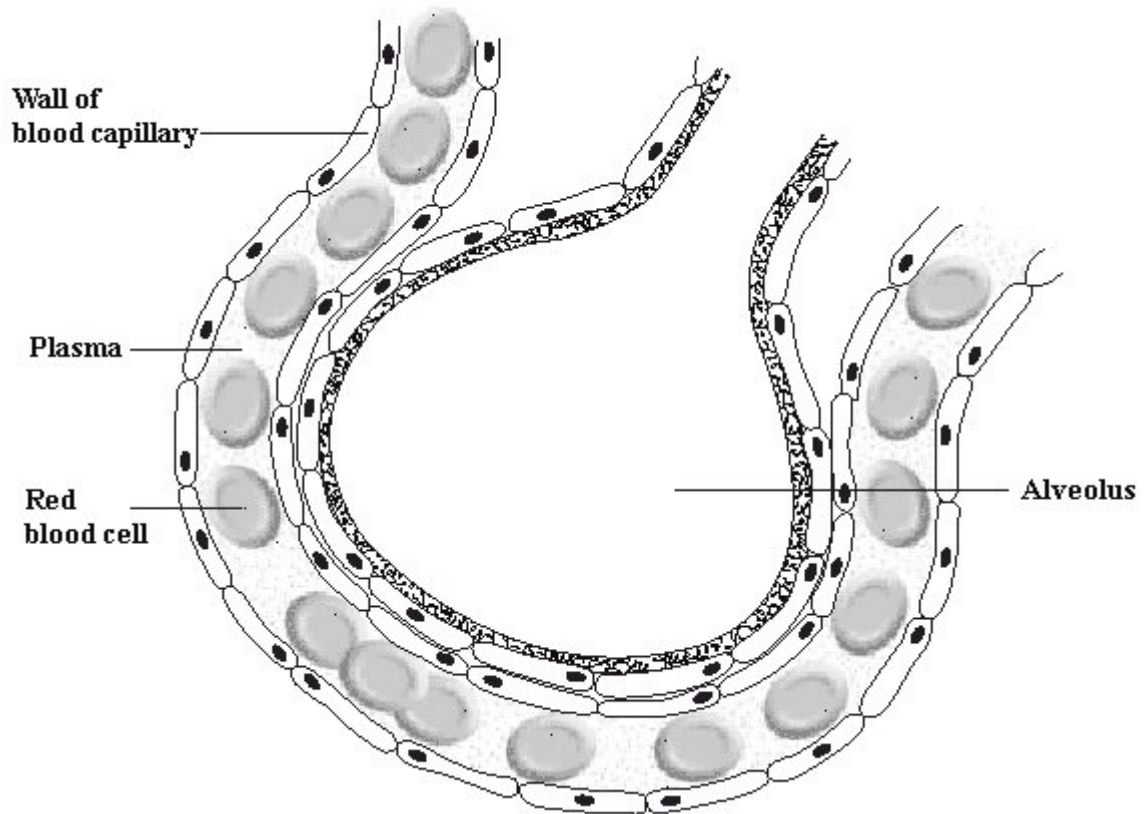
(ii) Suggest a process which would allow these ions to be absorbed from the pond water by the plant cells.

(1)

(Total 3 marks)

Q49.

The diagram shows an alveolus and a blood capillary in the lung.



- (i) During gaseous exchange, oxygen and carbon dioxide are exchanged across the wall of the alveolus. **On the diagram**, carefully draw **two** arrows to show the paths taken by oxygen and by carbon dioxide during this process. **Label each arrow.**

(3)

- (ii) Name the process by which oxygen moves across the wall of the alveolus.

(1)

- (iii) Each lung contains about 350 million alveoli. How does this help gaseous exchange?

(1)

(Total 5 marks)

Q50.

Complete the table by writing the correct process next to its description.

Choose your answers from the list in the box

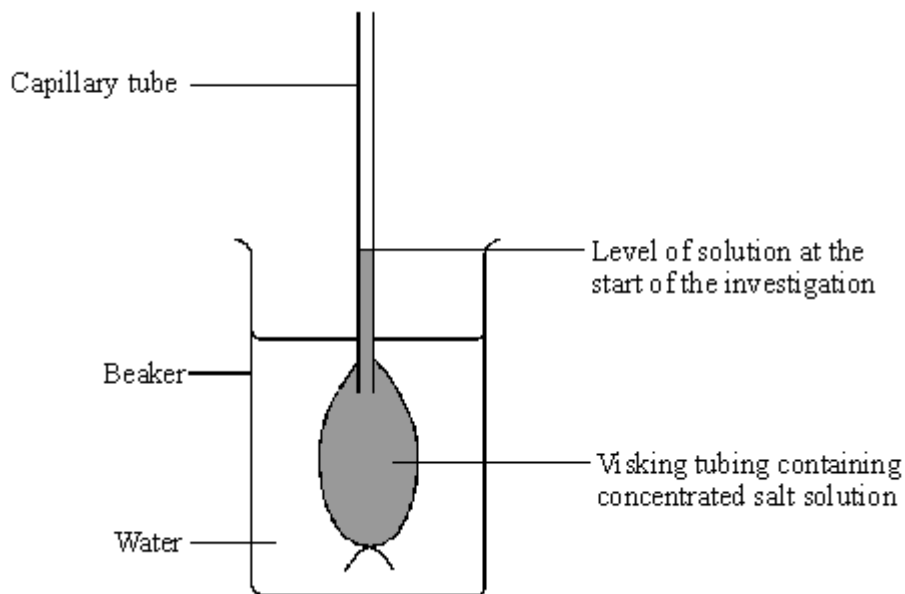
breathing	diffusion	digestion	osmosis	respiration
-----------	-----------	-----------	---------	-------------

Description	Process
Moving air in and out of the lungs	
The movement of particles of a substance from high to low concentration	
The release of energy from glucose	

(Total 3 marks)

Q51.

Some students set up the equipment below to investigate osmosis.



(a) What is osmosis?

(3)

(b) (i) What will happen to the water level in the capillary tube during the investigation because of osmosis?

(1)

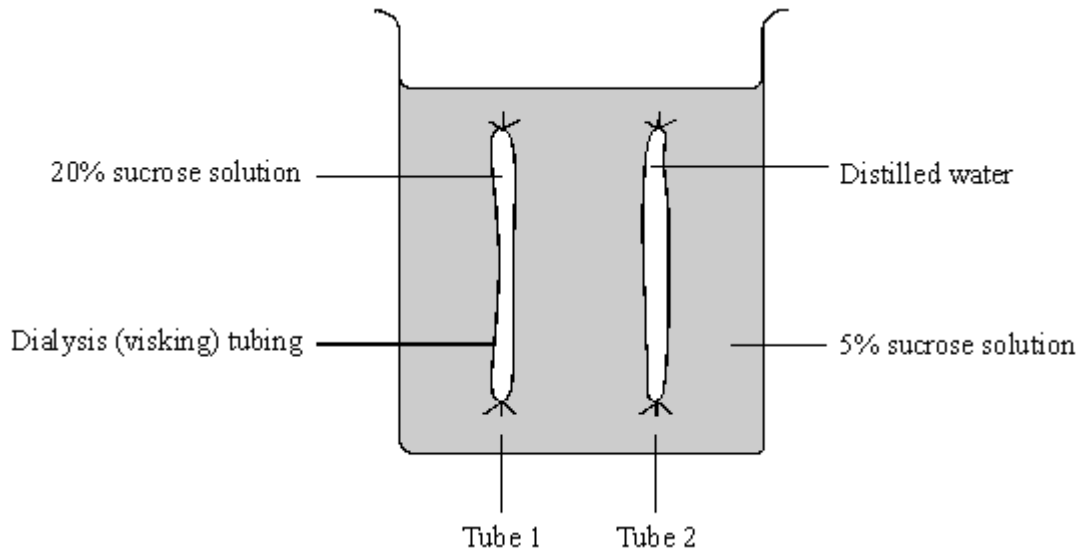
(ii) Use your knowledge of osmosis to explain why this happens.

(2)

(Total 6 marks)

Q52.

Some students set up this experiment to investigate osmosis. They filled two pieces of dialysis [visking] tubing with different liquids and left them both in a beaker of 5% sucrose solution for an hour.



(a) Describe and explain the likely results after one hour.

(6)

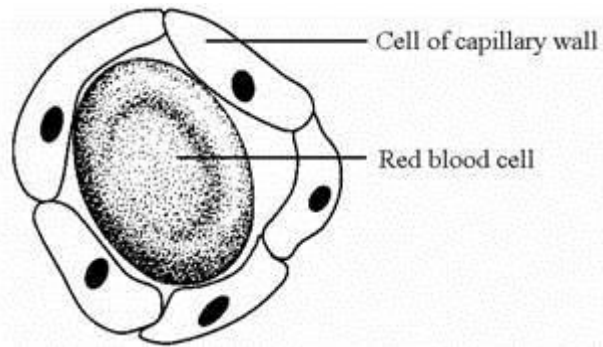
(b) Describe **two** examples where osmosis is used in living things.

(2)

(Total 8 marks)

Q53.

Capillaries are blood vessels in the body which join the arteries to the veins. They have walls which are one cell thick and so are able to exchange substances with the body cells.



(i) Name **two** substances that travel from the muscle cells to the blood in the capillaries.

1. _____

2. _____

(2)

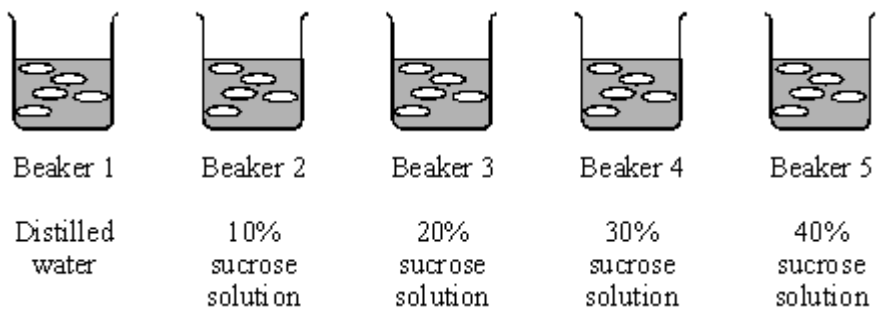
(ii) Glucose is one substance that travels from the blood in the capillaries to the body cells. Explain how this happens.

(2)

(Total 4 marks)

Q54.

Some students set up an experiment using osmosis to find the concentration of sucrose solution in potato cell sap. They used discs of potato cut to the same size and weighing approximately 10 gms. The discs were put into each of five beakers.



(a) (i) After two hours they reweighed the discs after carefully blotting them first. Why did the students blot the potato before weighing it?

(1)

(ii) Their results are shown in the table below.

	Beaker 1	Beaker 2	Beaker 3	Beaker 4	Beaker 5
--	-----------------	-----------------	-----------------	-----------------	-----------------

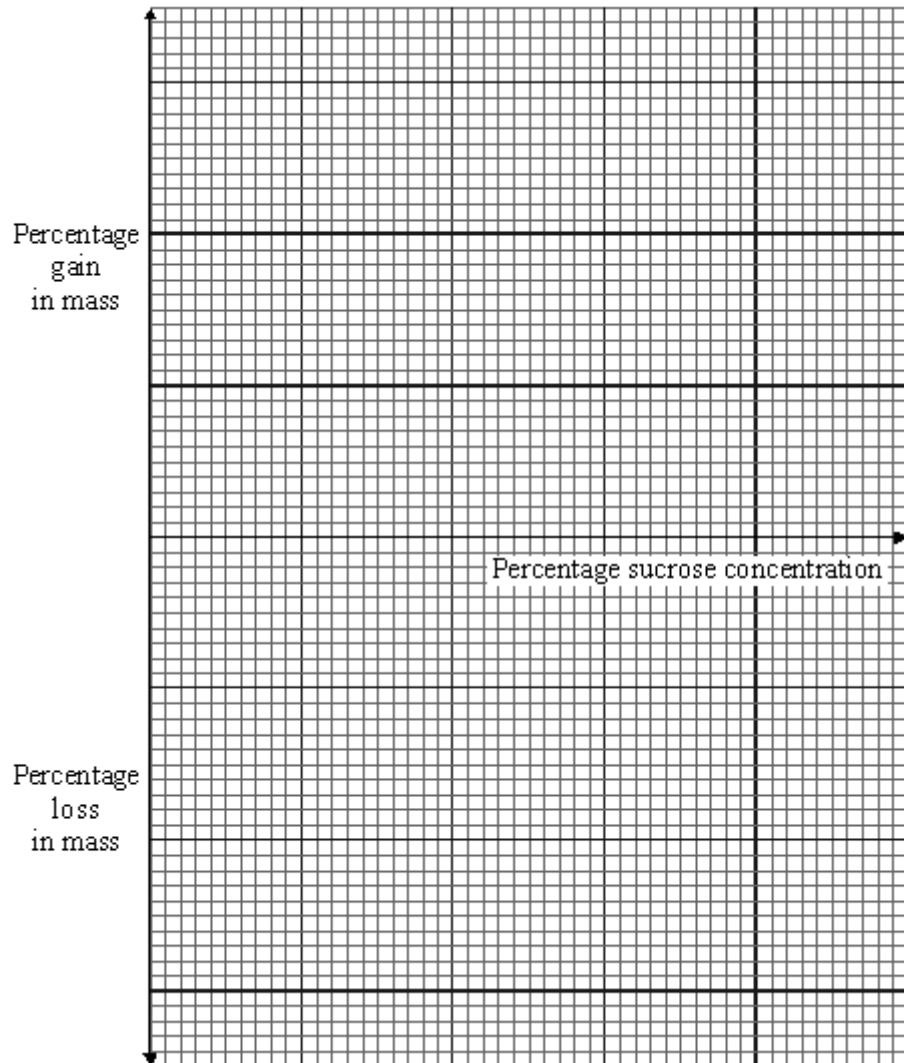
Final mass in g	13.0	12.2	9.0	7.9	7.3
Initial mass in g	10.0	10.6	10.0	10.1	10.4

The students calculated the % gain or loss in mass of potato. Complete this table of results for Beakers 2, 4 and 5.

Beaker 1	Beaker 2	Beaker 3	Beaker 4	Beaker 5
$13 - 10.0 = 3.0$ $\frac{3.0}{10.0} \times 100\% = 30\%$		$9.0 - 10.0 =$ -1.0 $\frac{-1.0}{10.0} \times 100\%$ $= -10\%$		
Gain in mass = 30%		Loss in mass = 10%		

(3)

- (b) (i) Draw a graph of % Gain or Loss in mass against sucrose concentration.



(3)

(ii) Use the graph to find the concentration of potato cell sap.

Concentration of cell sap = _____ % sucrose solution

(1)

(iii) Explain in terms of osmosis how you chose this value.

(2)

(Total 10 marks)

Q55.

Read the extract.

Super-bug may hit the price of coffee

The coffee bean borer, a pest of the coffee crop, can be controlled by the pesticide endosulphan. However, strains of the insect that are up to 100 times more resistant to the pesticide have emerged on the South Pacific island of New Caledonia.

For full resistance to be passed on to an offspring two copies of the new resistance allele

5 should be inherited, one from each parent. There is much inbreeding with brother-sister matings happening in every generation, so it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele.

If this resistance spreads from New Caledonia, it will mean the loss of a major control

10 method. This will present a serious threat to the international coffee industry.

(a) Suggest how the allele for resistance to endosulfan may have arisen.

(1)

(b) (i) How would you expect the proportion of normal coffee bean borers on New Caledonia to change over the next few years?

(ii) Explain why this change will take place.

(3)

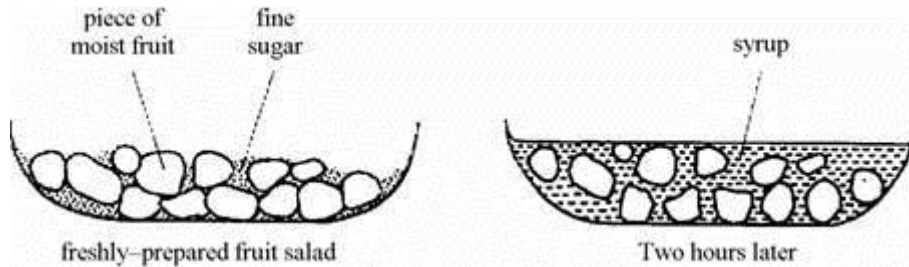
- (c) Explain why “it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele.” (lines 6-8)

(3)

(Total 7 marks)

Q56.

A cook prepares a fresh fruit salad by cutting up a variety of fruits and placing them in a bowl with layers of sugar in between. After two hours the fruit is surrounded by syrup (concentrated sugar solution).

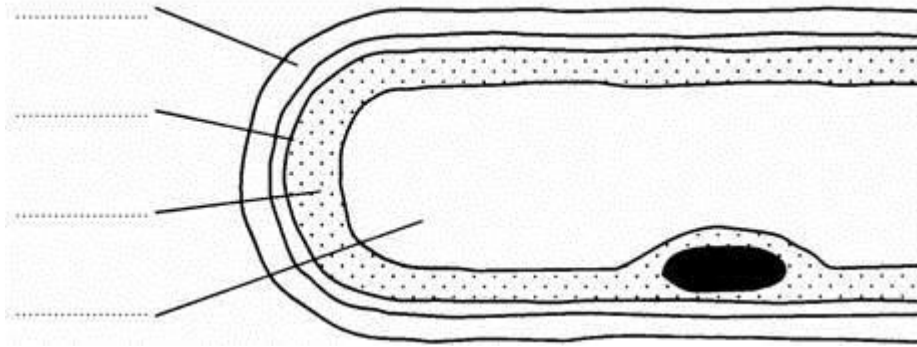


Explain, as fully as you can, why syrup (concentrated sugar solution) was produced after two hours.

(Total 4 marks)

Q57.

The drawing shows part of a root hair cell.

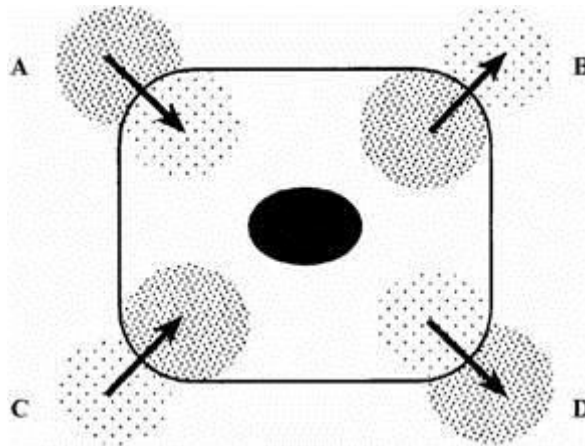


(a) Use words from the list to label the parts of the root hair cell.

cell membrane cell wall cytoplasm nucleus vacuole

(4)

(b) The diagram shows four ways in which molecules may move into and out of a cell. The dots show the concentration of molecules.



The cell is respiring aerobically.
Which arrow, **A**, **B**, **C** or **D** represents:

(i) movement of oxygen molecules; _____

(ii) movement of carbon dioxide molecules? _____

(2)

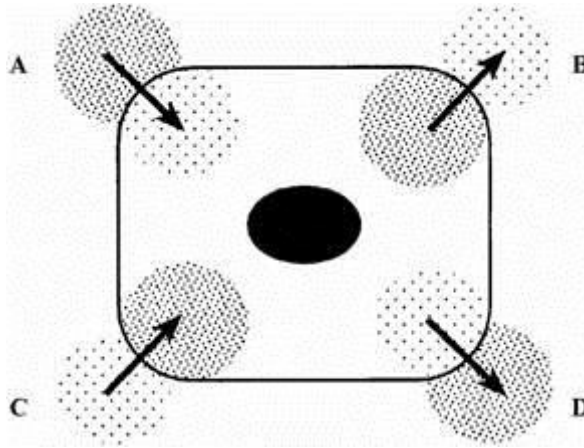
(c) Name the process by which these gases move into and out of the cell.

(1)

(Total 7 marks)

Q58.

(a) The diagram shows four ways in which molecules may move into and out of a cell. The dots show the concentration of molecules.



The cell is respiring aerobically.
Which arrow, **A**, **B**, **C** or **D**, represents:

- (i) movement of oxygen molecules; _____
 (ii) movement of carbon dioxide molecules? _____

(2)

(b) Name the process by which these gases move into and out of the cell.

(1)

(c) Which arrow, **A**, **B**, **C** or **D**, represents the active uptake of sugar molecules by the cell?

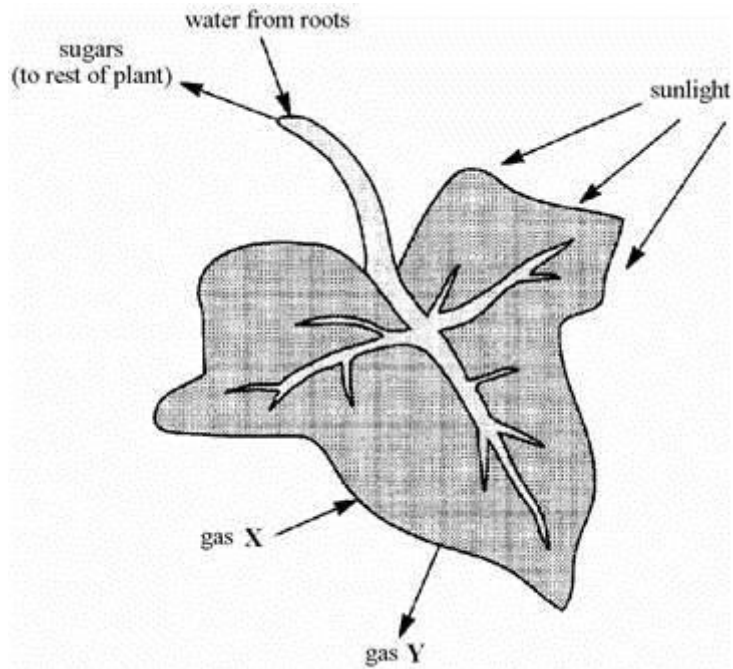
Explain the reason for your answer.

(2)

(Total 5 marks)

Q59.

The diagram shows a plant leaf during photosynthesis.



(a) Name:

(i) gas X; _____

(ii) gas Y. _____

(2)

(b) Why is sunlight necessary for photosynthesis?

(1)

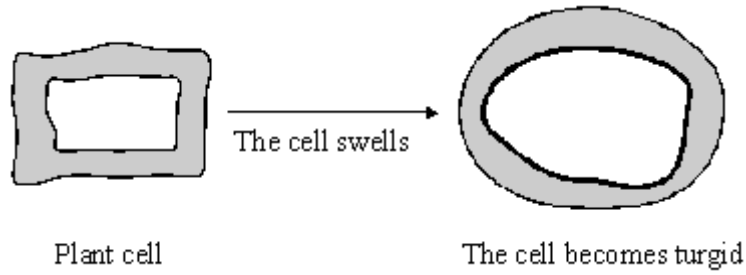
(c) Some of the sugars produced by photosynthesis are stored as starch in the roots. Explain, as fully as you can, why it is an advantage to the plant to store carbohydrate as starch rather than as sugar.

(3)

(Total 6 marks)

Q60.

(a) The diagrams show what happens to the shape of a plant cell placed in distilled water.



(i) Explain why the cell swells and becomes turgid. Name the process involved.

(2)

(ii) Give **one** feature of the cell wall which allows the cell to become turgid.

(1)

(b) Describe the change which will occur if a piece of peeled potato is placed in a concentrated sugar solution and explain why this change occurs.

(3)

(Total 6 marks)