1 After a meal rich in carbohydrates, the concentration of glucose in the small intestine changes.

The table below shows the concentration of glucose at different distances along the small intestine.

Distance along the small intestine in cm	Concentration of glucose in mol dm^{-3}
100	50
300	500
500	250
700	0

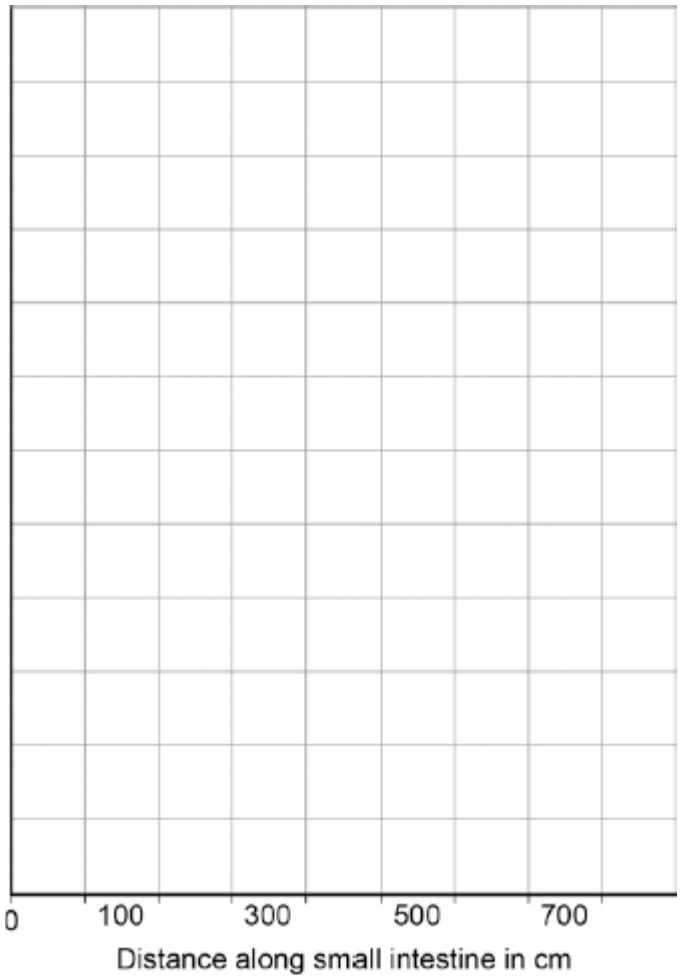
(a) At what distance along the small intestine is the glucose concentration highest?

..... cm

(1)

(b) Use the data in the table to plot a bar chart on the graph below.

- Label the *y*-axis.
- Choose a suitable scale.



(4)

(c) Look at the graph above.

Describe how the concentration of glucose changes as distance increases along the small intestine.

.....

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(2)

(d) Explain why the concentration of glucose in the small intestine changes between 100 cm and 300 cm.

.....

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(2)

(e) Explain why the concentration of glucose in the small intestine changes between 300 cm and 700 cm.

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(3)
(Total 12 marks)

2 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.

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(3)

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

.....

(1)

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

Give your answer to 2 significant figures.

.....

.....

Mean number of stomata on lower surface of leaf = ...

(2)

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

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

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(2)

(Total 11 marks)

3 All living cells respire.

(a) Respiration transfers energy from glucose for muscle contraction.

Describe how glucose from the small intestine is moved to a muscle cell.

.....

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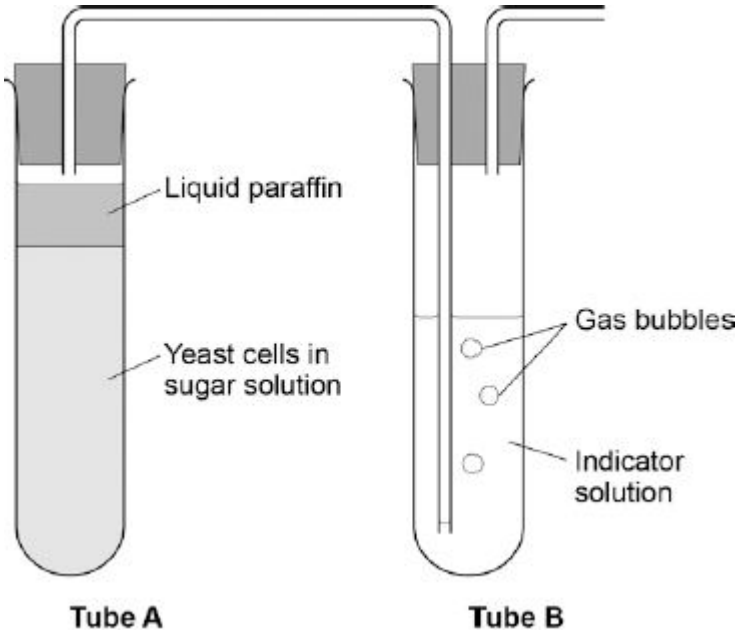
.....

(2)

(b) The diagram below shows an experiment to investigate **anaerobic** respiration in yeast cells.



What is the purpose of the liquid paraffin in Tube **A**?

Tick **one** box.

To prevent evaporation ☐

To stop air getting in ☐

To stop the temperature going up ☐

To stop water getting in ☐

(1)

(c) The indicator solution in Tube **B** shows changes in the concentration of carbon dioxide (CO_2).

The indicator is:

- **blue** when the concentration of CO_2 is very low
- **green** when the concentration of CO_2 is low
- **yellow** when the concentration of CO_2 is high.

What colour would you expect the indicator to be in Tube **B** during maximum rate of anaerobic respiration?

Tick **one** box.

Blue ☐

Green ☐

Yellow ☐

(1)

(d) Suggest how the experiment could be changed to give a reproducible way to measure the rate of the reaction.

Include any apparatus you would use.

.....

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(2)

(e) Compare anaerobic respiration in a yeast cell with anaerobic respiration in a muscle cell.

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(3)
(Total 9 marks)

4 A student investigated the effect of different sugar solutions on potato tissue.

This is the method used.

1. Add 30 cm^3 of 0.8 mol dm^{-3} sugar solution to a boiling tube.
2. Repeat step **1** with equal volumes of 0.6, 0.4 and 0.2 mol dm^{-3} sugar solutions.
3. Use water to give a concentration of 0.0 mol dm^{-3}.
4. Cut five cylinders of potato of equal size using a cork borer.
5. Weigh each potato cylinder and place one in each tube.
6. Remove the potato cylinders from the solutions after 24 hours.
7. Dry each potato cylinder with a paper towel.
8. Reweigh the potato cylinders.

The table below shows the results.

Concentration of sugar solution in mol dm^{-3}	**Starting mass in g**	**Final mass in g**	**Change of mass in g**	**Percentage (%) change**
0.0	1.30	1.51	0.21	16.2
0.2	1.35	1.50	0.15	**X**
0.4	1.30	1.35	0.05	3.8
0.6	1.34	1.28	−0.06	−4.5
0.8	1.22	1.11	−0.11	−9.0

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

.....

.....

Percentage change in mass = ... %

(2)

(b) Why did the student calculate the percentage change in mass as well as the change in grams?

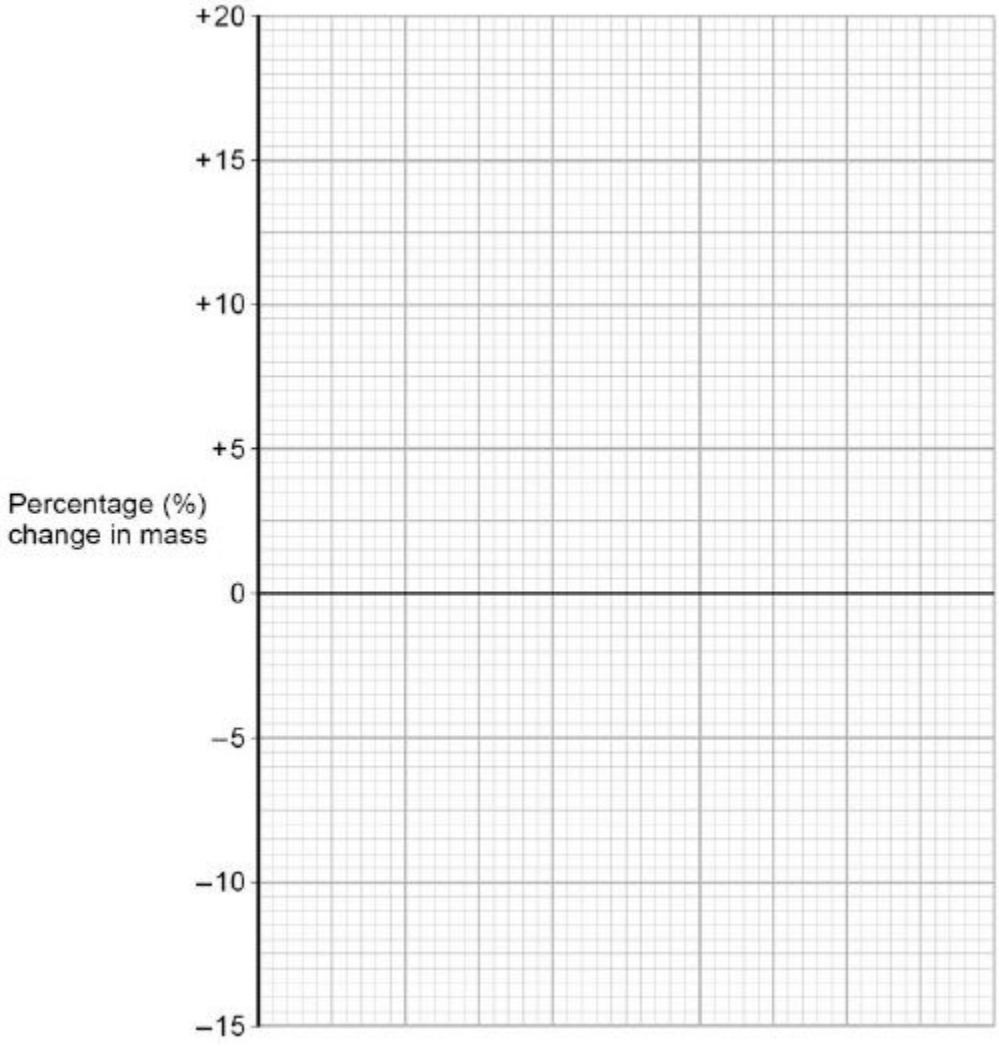
.....

.....

(1)

(c) Complete the graph using data from the table above.

- Choose a suitable scale and label for the *x*-axis.
- Plot the percentage (%) change in mass.
- Draw a line of best fit.



(4)

(d) Use your graph to estimate the concentration of the solution inside the potato cells.

Concentration = ... mol dm^{-3}

(1)

(e) The results in the table above show the percentage change in mass of the potato cylinders.

Explain why the percentage change results are positive **and** negative.

.....

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.....

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.....

(3)

(f) Suggest **two** possible sources of error in the method given above.

1.....

.....

2.....

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(2)
(Total 13 marks)

5 Explain how the human circulatory system is adapted to:

- supply oxygen to the tissues
- remove waste products from tissues.

.....

.....

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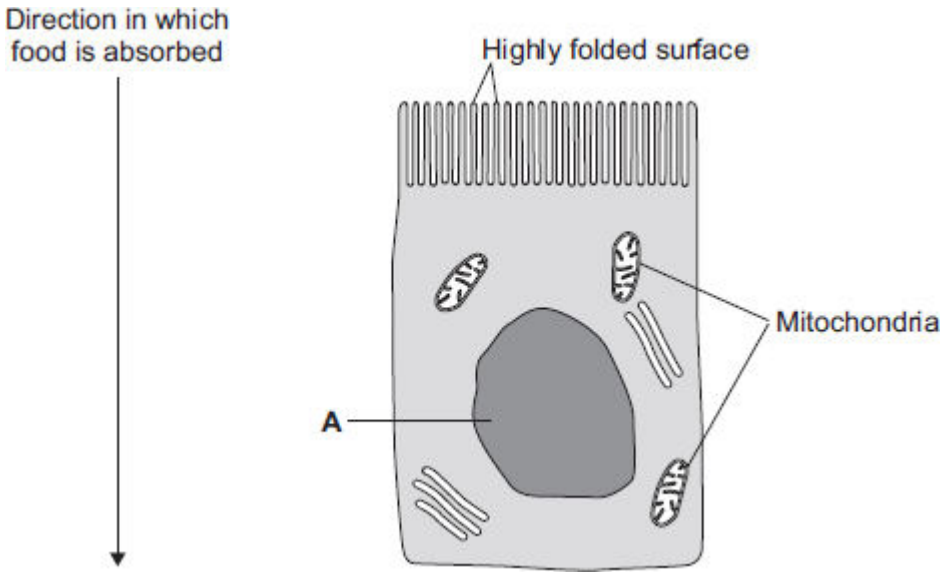
(Total 6 marks)

6 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.

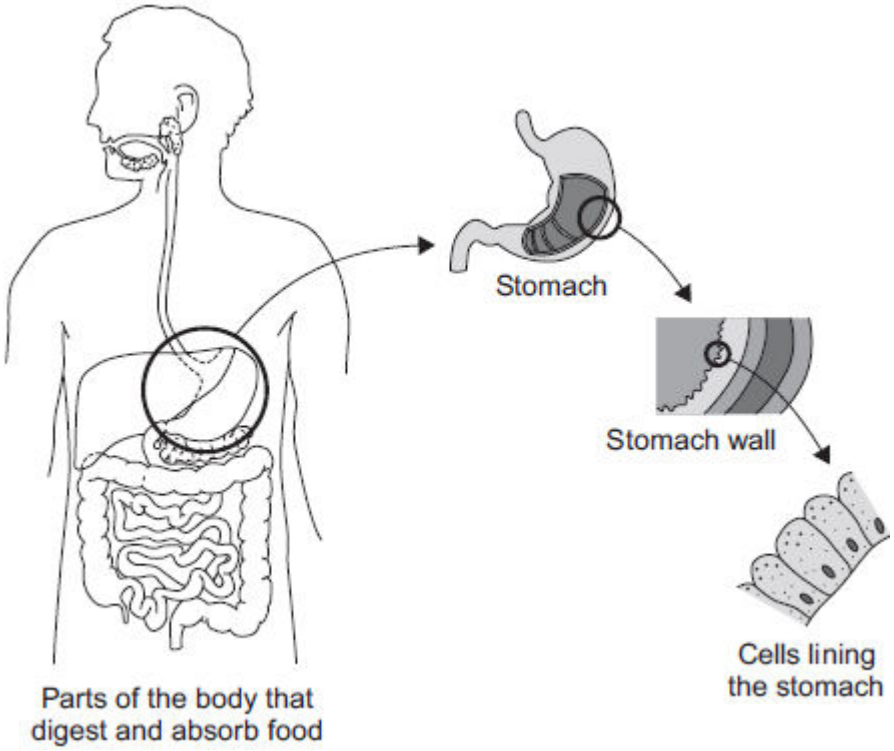
Give **one** substance that plants absorb by active transport.

.....

(1)
(Total 8 marks)

7 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?

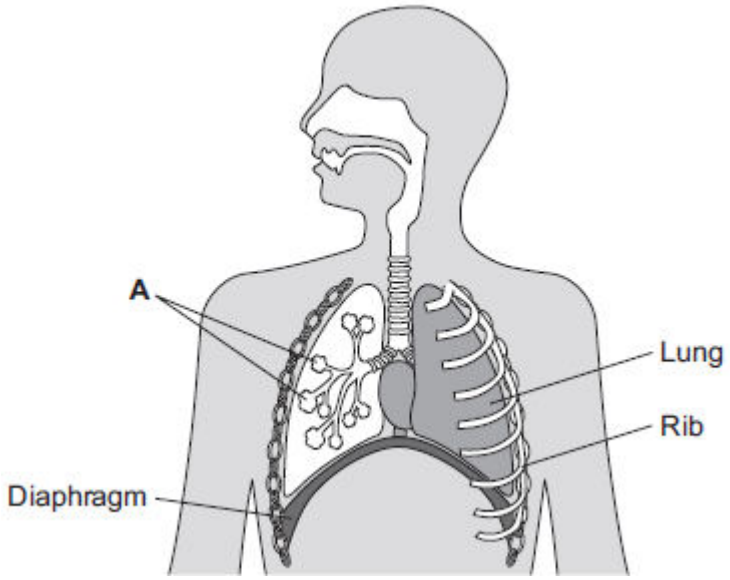
Draw a ring around the correct answer.

cell membrane **mitochondria** **nucleus**

(1)
(Total 5 marks)

8 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 .....

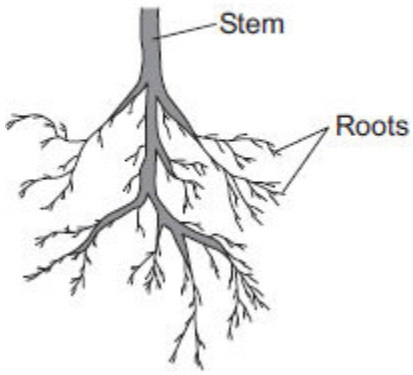
.....

(2)
(Total 6 marks)

9 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. ☐

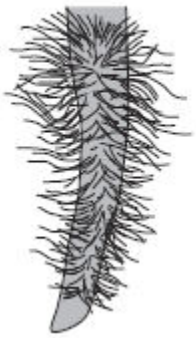
The absorption of mineral ions needs energy. ☐

(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?

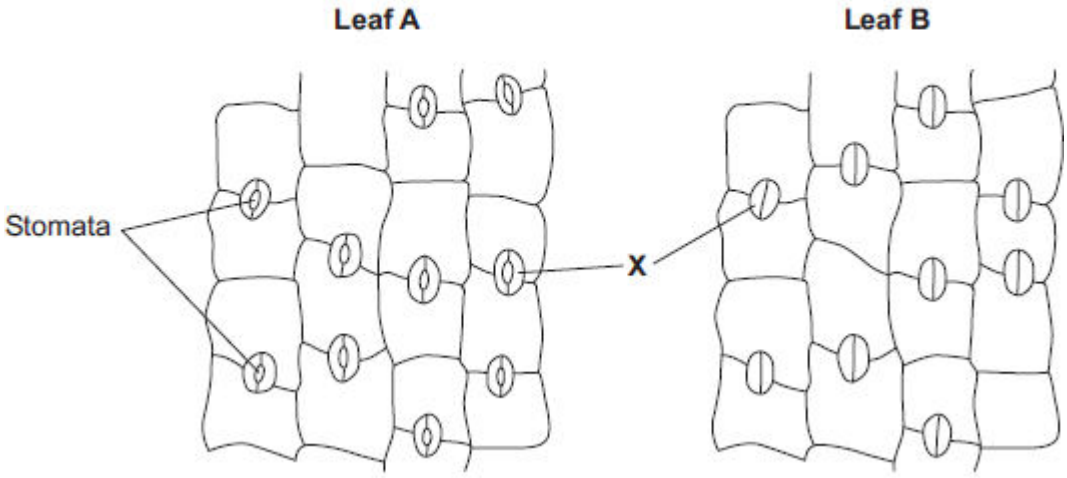
.....

.....

(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)

10 Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, **A**, **B** and **C**, on the performance of three runners on a running machine. One of the runners is shown in the image below.

© Keith Brofsky/Photodisc/Thinkstock

Table 1 gives information for each drink.

Table 1

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

(a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:
- ran on a running machine until the point of exhaustion
- each drank 500 cm^3 of a different brand of sports drink
- rested for 4 hours to recover
- ran on the running machine again and recorded how much time they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand **B** would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from **Table 1** to suggest an explanation for the students' prediction.

.....

.....

.....

.....

(2)

(ii) If the balance between ions and water in a runner's body is not correct, the runner's body cells will be affected.

Describe **one** possible effect on the cells if the balance between ions and water is **not** correct.

.....

.....

(1)

(b) When running, a runner's body temperature increases.

Describe how the brain monitors body temperature.

.....

.....

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.....

(3)

(c) (i) **Table 2** is repeated here to help you answer this question.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

People with diabetes need to be careful about drinking too much sports drink.

Use information from **Table 2** to explain why drinking too much sports drink could make people with diabetes ill.

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(3)

(ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

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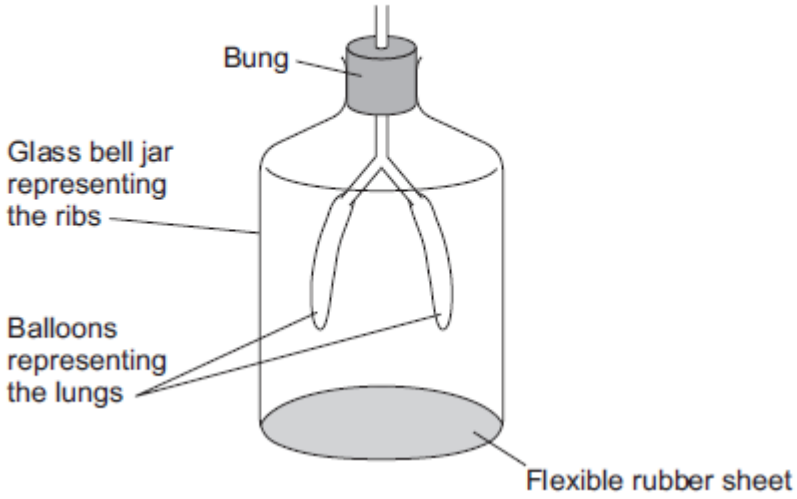
(1)

(Total 10 marks)

11 **Figure 1** shows a model representing the human breathing system.

The different parts of the model represent different parts of the human breathing system.

Figure 1



(a) (i) Which part of the human breathing system does the flexible rubber sheet represent?

.....

(1)

(ii) Explain why the balloons inflate when the flexible rubber sheet is pulled down.

.....

.....

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.....

.....

(3)

(b) (i) During breathing, oxygen moves into the blood.

Explain how oxygen moves into the blood.

.....

.....

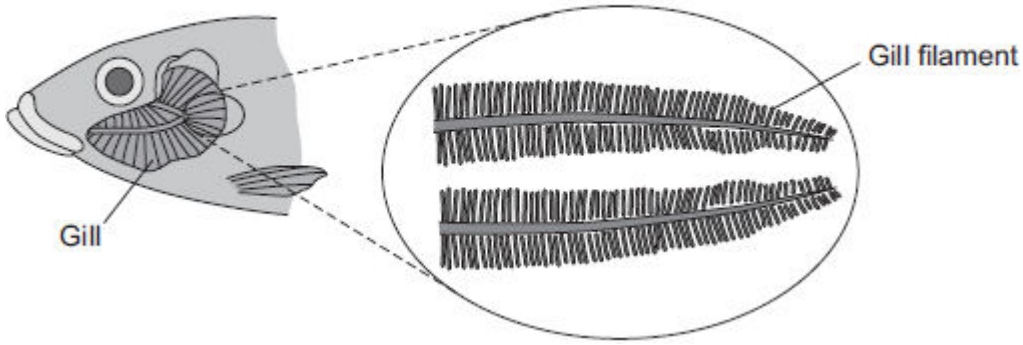
.....

.....

(2)

(ii) **Figure 2** shows a fish head and gill.

Figure 2



Fish absorb oxygen from the water. Oxygen is absorbed through the gills of the fish.

Explain **one** way in which the gills are adapted for rapid absorption of oxygen.

.....

.....

.....

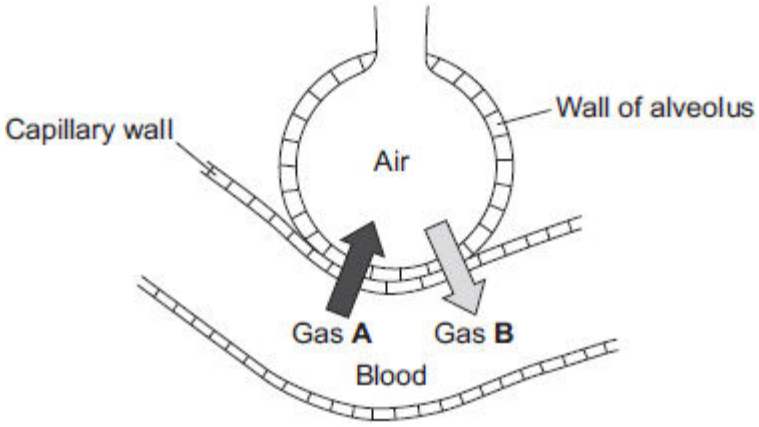
.....

(2)
(Total 8 marks)

12 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.

.....

.....

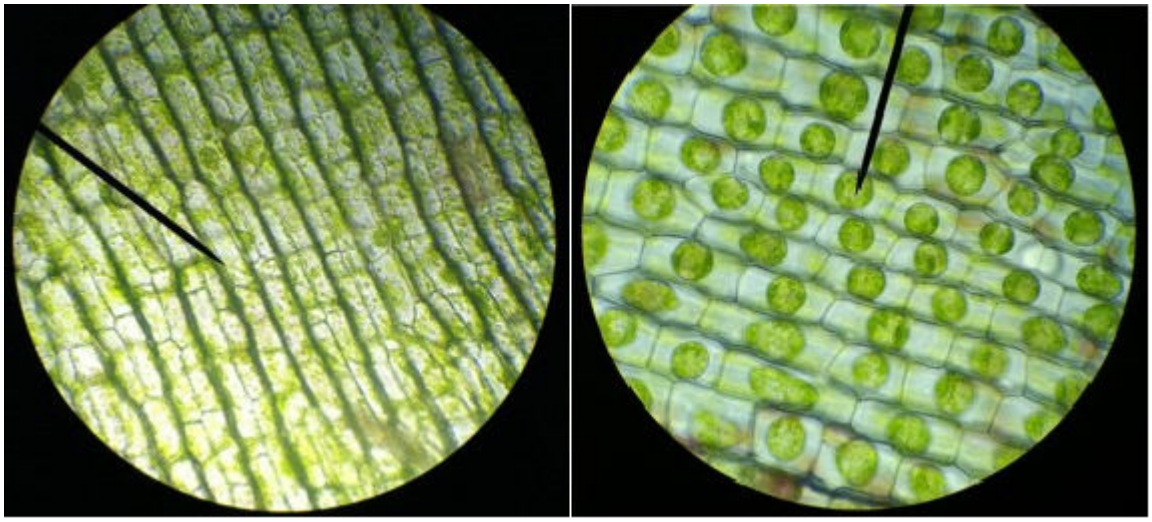
(1)
(Total 6 marks)

13 The photographs show the same cells of a common pond plant.

Photograph A shows the cells in a hypotonic solution.

Photograph B shows the same cells in a hypertonic solution.

Photograph A **Photograph B**



A & B AELODEA IN HYPOTONIC SOLUTION by fickleandfreckled [CC- BY-2.0], via Flickr.

(a) What is a **hypertonic** solution?

.....

.....

.....

.....

(2)

(b) What word is used to describe plant cells placed in:

(i) a **hypotonic** solution

.....

(1)

(ii) a **hypertonic** solution?

.....

(1)

(c) Explain what has happened to the plant cells in **Photograph B**.

.....

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(4)

(d) Animal cells will also change when placed in different solutions.

Some red blood cells are put in a hypotonic solution.

Describe what would happen to these red blood cells **and** explain why this is different from what happened to the plant cells in **Photograph A**.

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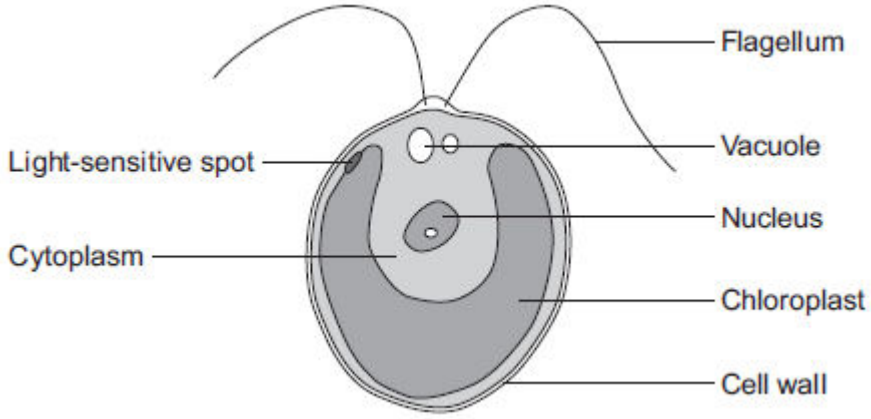
(4)
(Total 12 marks)

14 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.

water + ... $\xrightarrow{\text{Light energy}}$ ..... + oxygen

(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.

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(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.

.....

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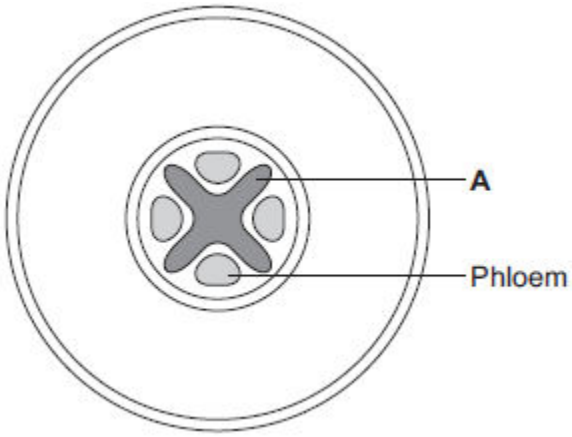
.....

.....

(3)

(Total 11 marks)

15 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.

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(2)
(Total 9 marks)

16 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.

.....

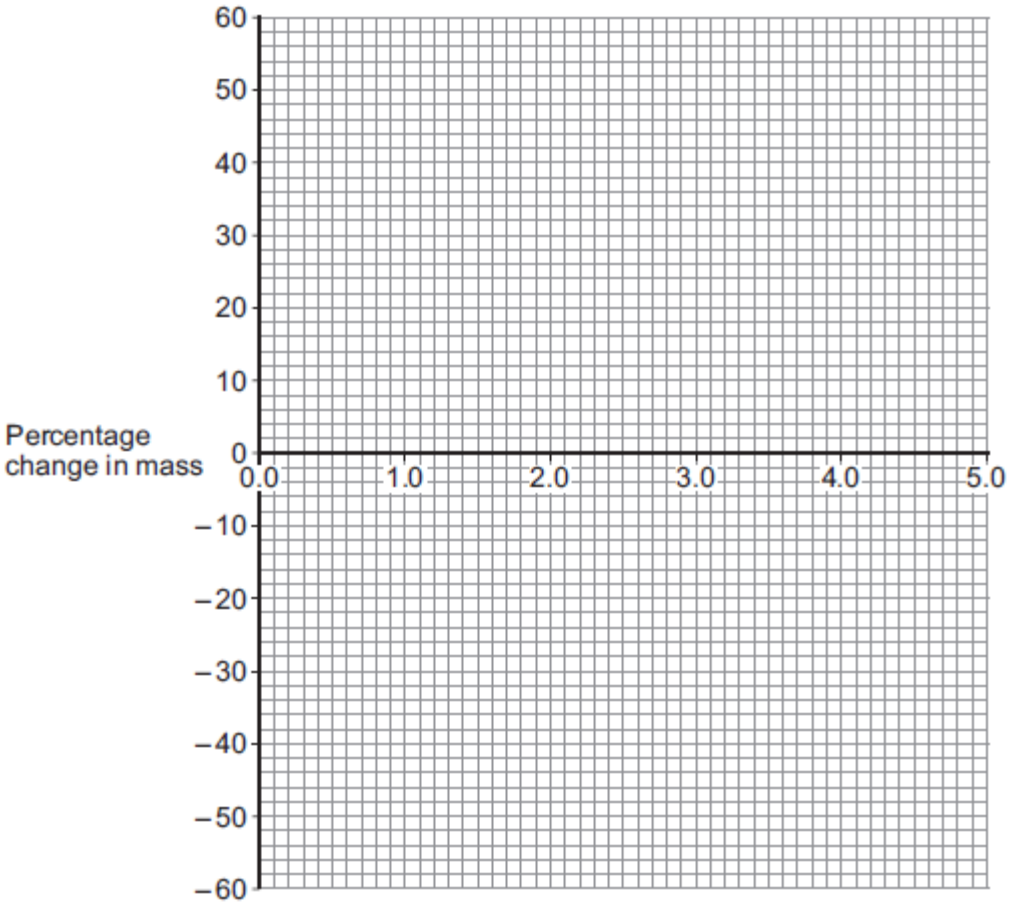
.....

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.

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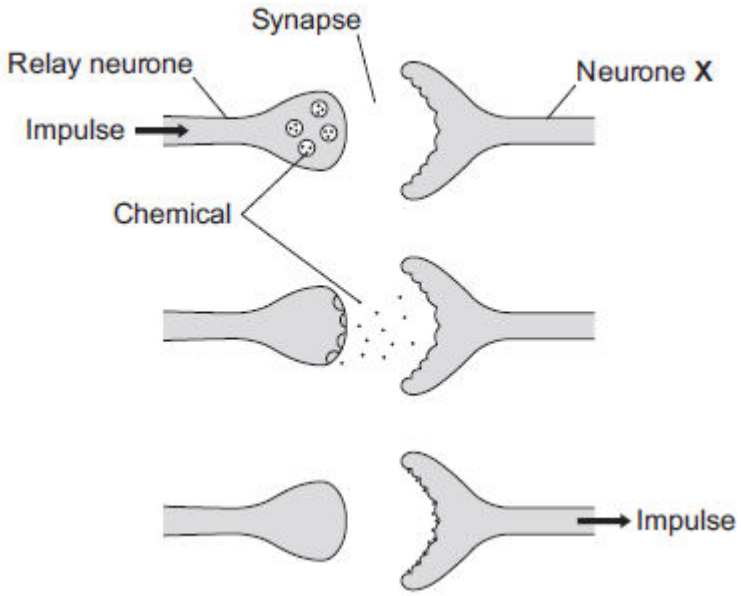
.....

(3)
(Total 19 marks)

17 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)

18 **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.

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Extra space .....

.....

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(Total 6 marks)

19 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

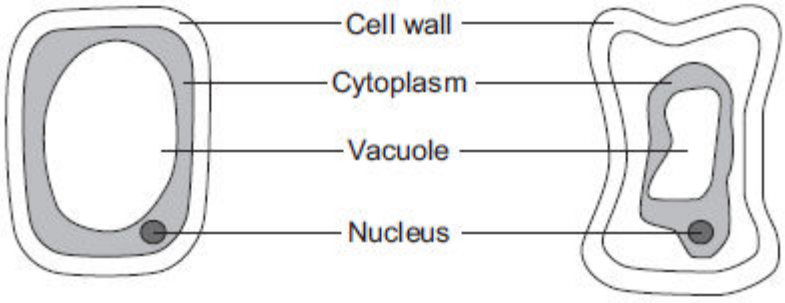
freely permeable
non-permeable
partially permeable

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)

20 Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

.....

.....

.....

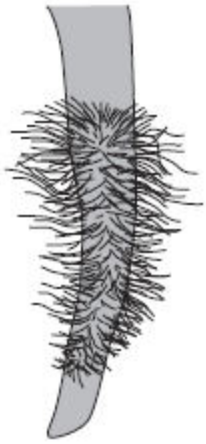
.....

.....

.....

(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.

.....

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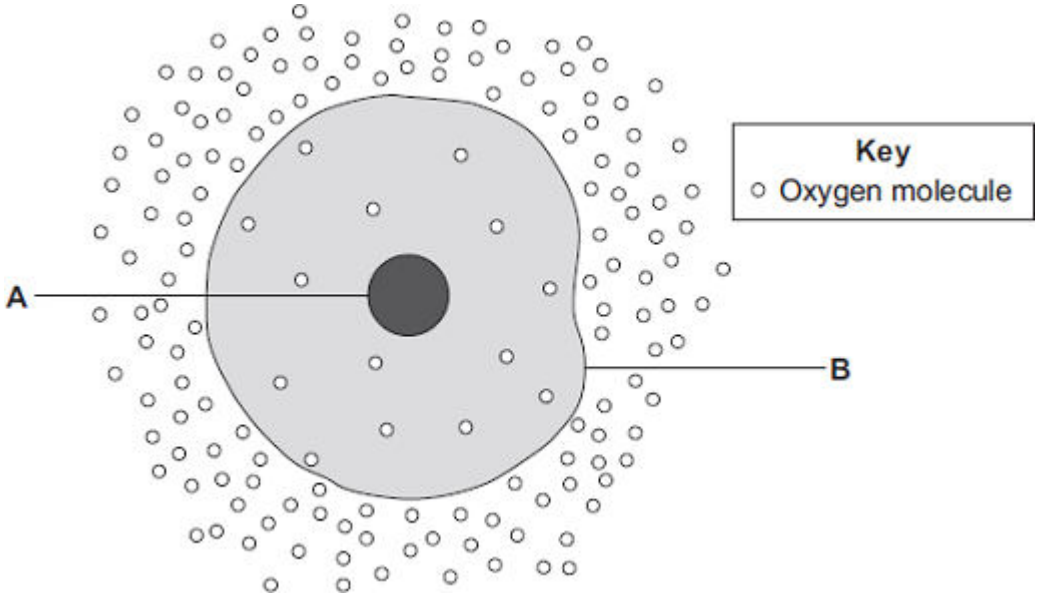
.....

(3)
(Total 6 marks)

21 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

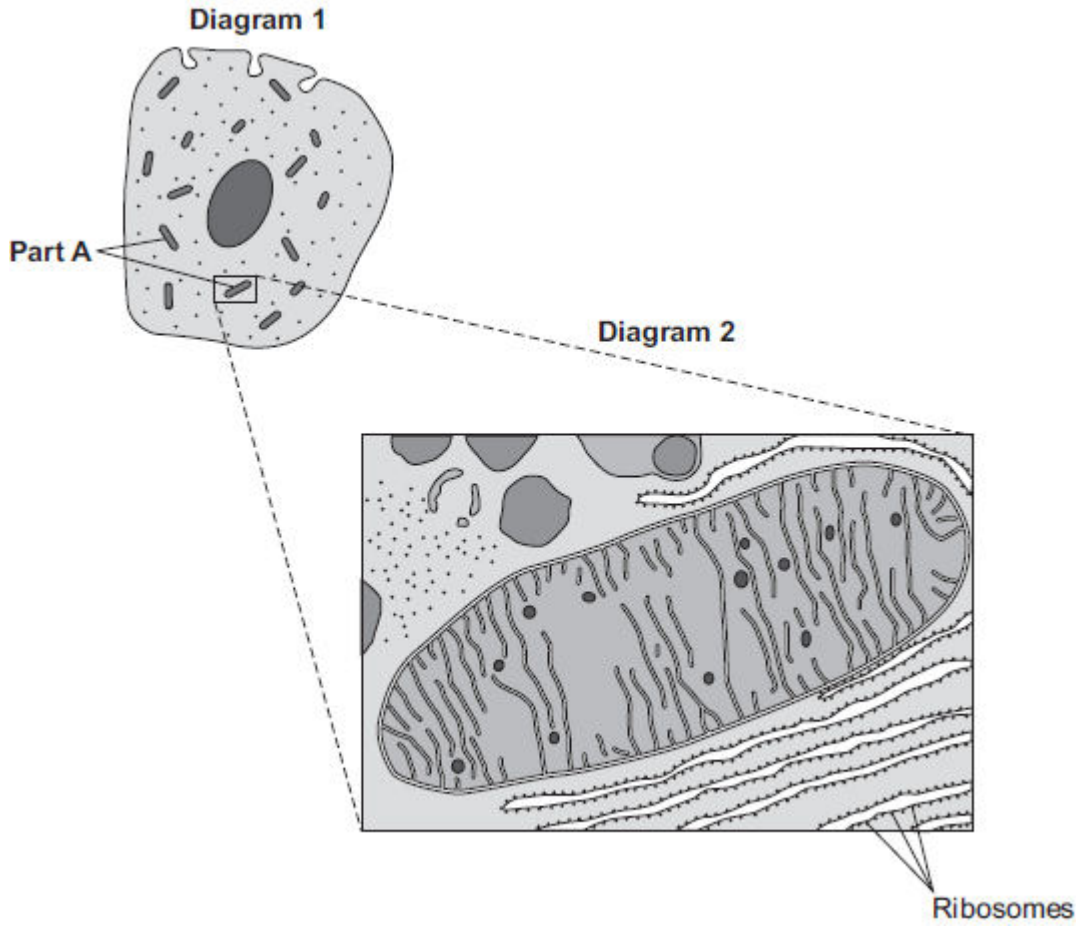
- an organ.
- a system.
- a tissue.

(1)

(Total 6 marks)

22 **Diagram 1** shows a cell from the pancreas.

Diagram 2 shows part of the cell seen under an electron microscope.



Part **A** is where most of the reactions of aerobic respiration happen.

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

.....

(1)

(ii) Complete the equation for aerobic respiration.

glucose + oxygen ⟶ ..... + ... (+ energy)

(2)

(iii) Part **A** uses oxygen.

Explain how oxygen passes from the blood to part **A**.

.....

.....

.....

.....

.....

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.....

.....

(3)

(b) The pancreas cell makes enzymes.

Enzymes are proteins.

Describe how the ribosomes and part **A** help the cell to make enzymes.

.....

.....

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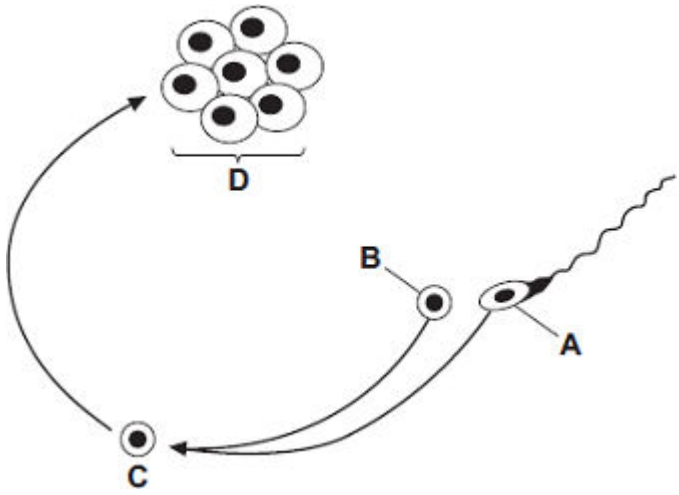
.....

(3)
(Total 9 marks)

23 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)

24 Substances can move into and out of cells.

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

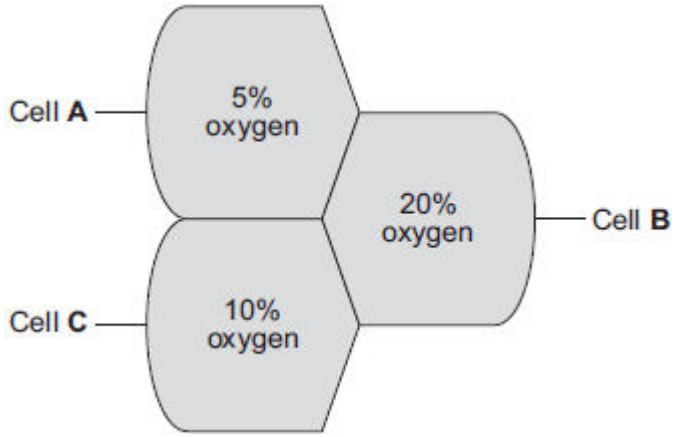
Draw a ring around **one** answer.

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**

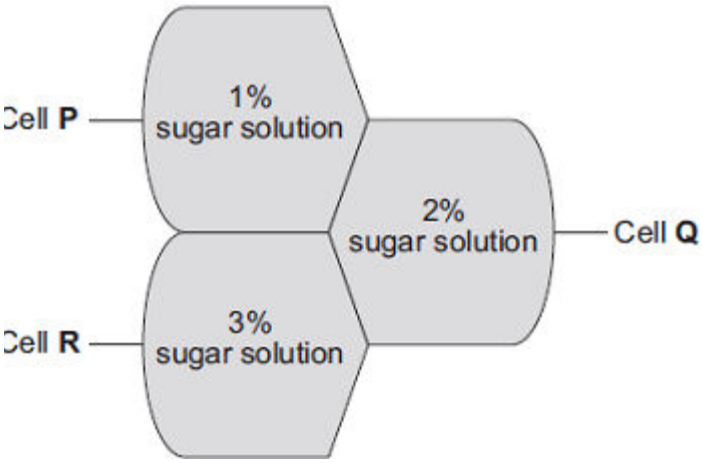
(1)

(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.

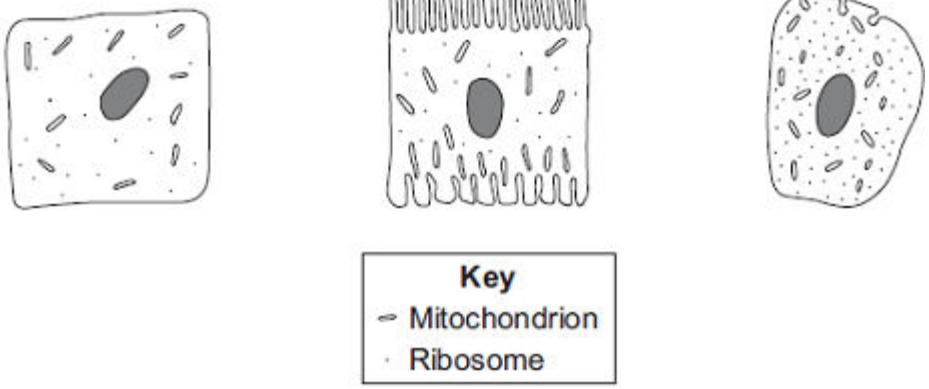
Into which cell, **P**, **Q** or **R**, will water move the fastest? ☐

(1)

(Total 4 marks)

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

A **B** **C**



(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)

26 (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 become pregnant.
- Any unsuitable embryos will be destroyed.

(i) Suggest why it is helpful to take five eggs from the ovary and not just one egg.

.....

.....

(1)

(ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion to your evaluation.

.....

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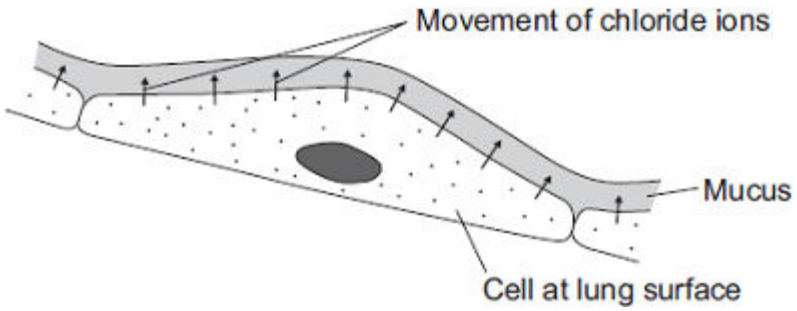
(4)

(c) In someone who has cystic fibrosis the person's mucus becomes thick.

The diagram shows how, in a healthy person, cells at the lung surface move chloride ions into the mucus surrounding the air passages.



The movement of chloride ions causes water to pass out of the cells into the mucus.

Explain why.

.....

.....

.....

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.....

.....

.....

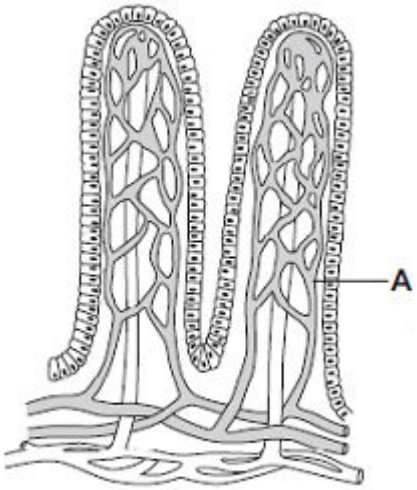
.....

(3)
(Total 11 marks)

27 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.

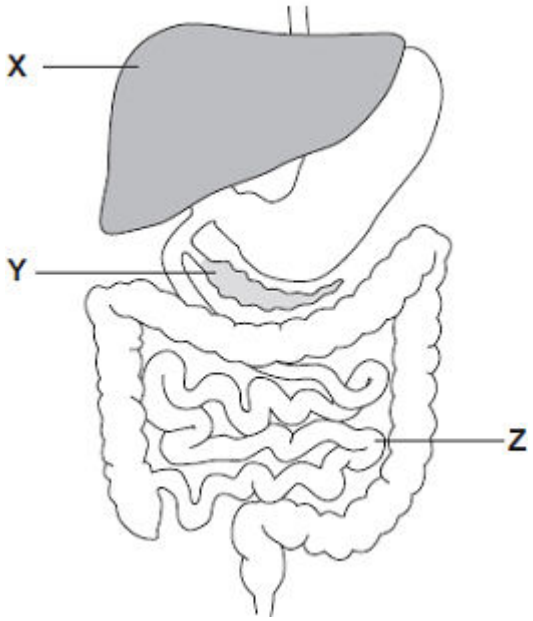
diffusion.

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.

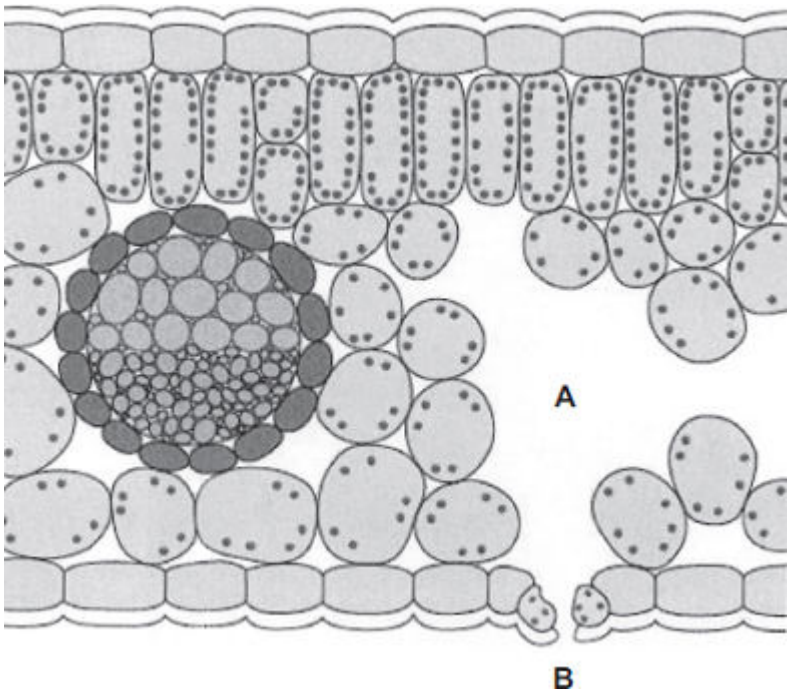
Why is it helpful to have lots of villi?

.....

.....

(1)
(Total 4 marks)

28 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)

29 Plants exchange substances with the environment.

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

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

.....

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.....

.....

.....

.....

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(4)

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

.....

.....

.....

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.....

.....

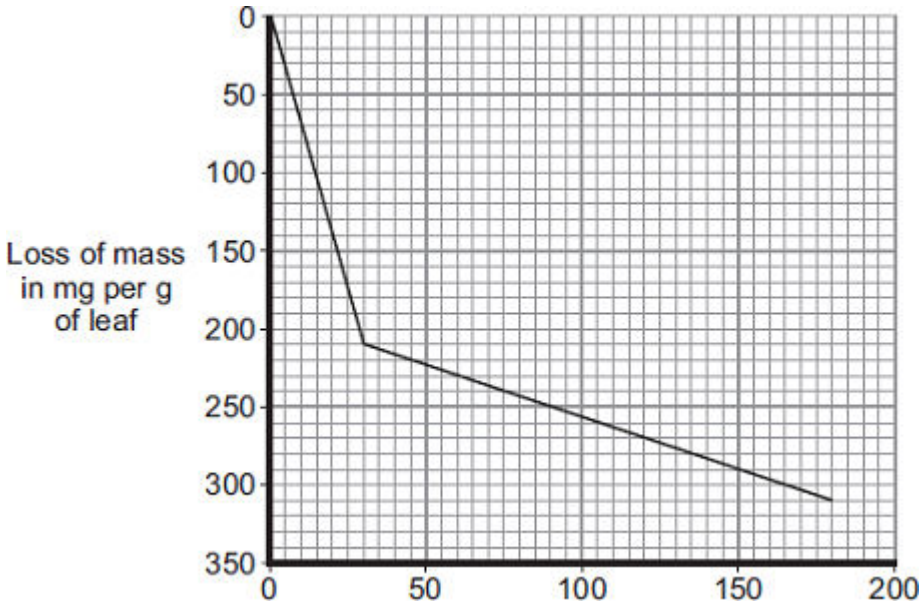
(3)

(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.

.....

.....

.....

.....

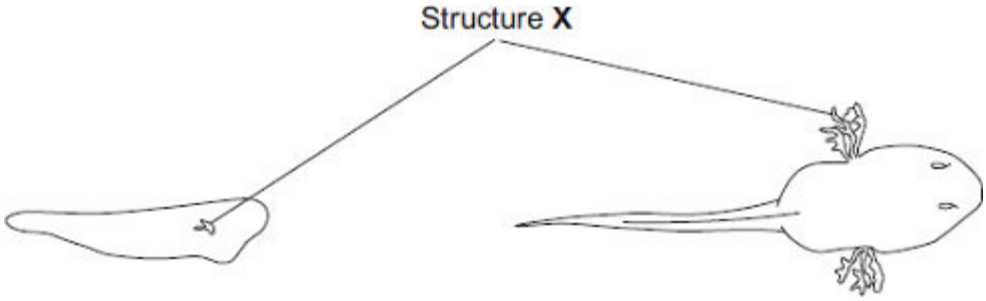
(2)

(Total 11 marks)

30 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**.

.....

.....

.....

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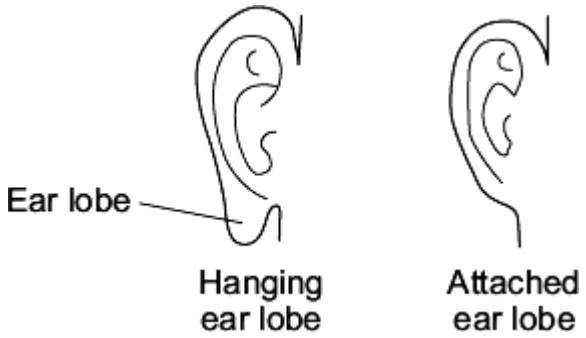
.....

.....

(4)
(Total 5 marks)

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

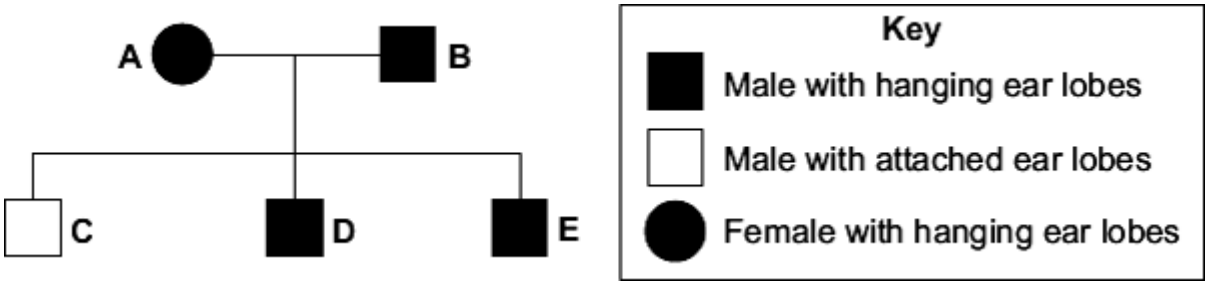
The diagrams show the two shapes of ear lobe.



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)

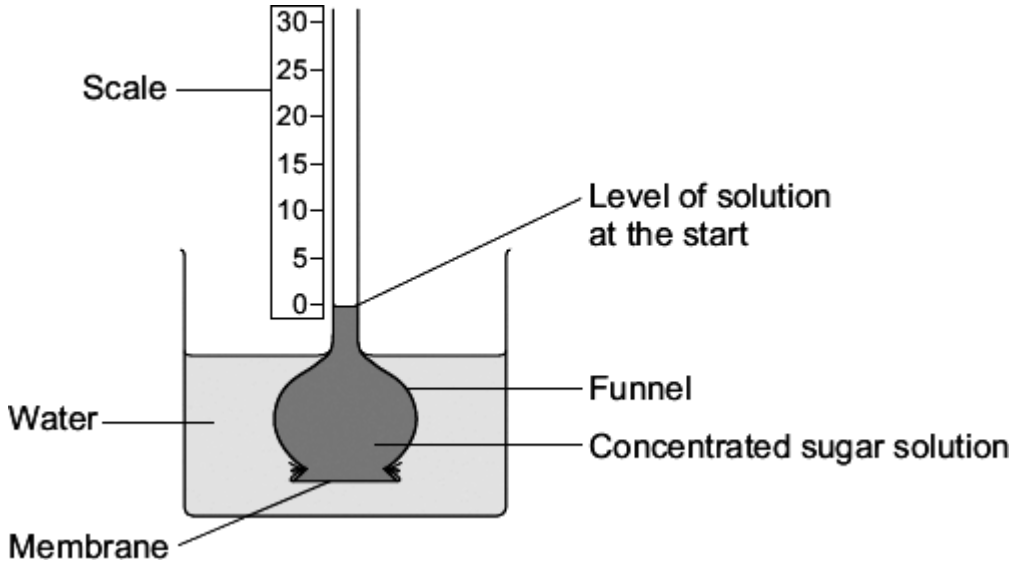
32 Some substances move through membranes.

A student set up an investigation.

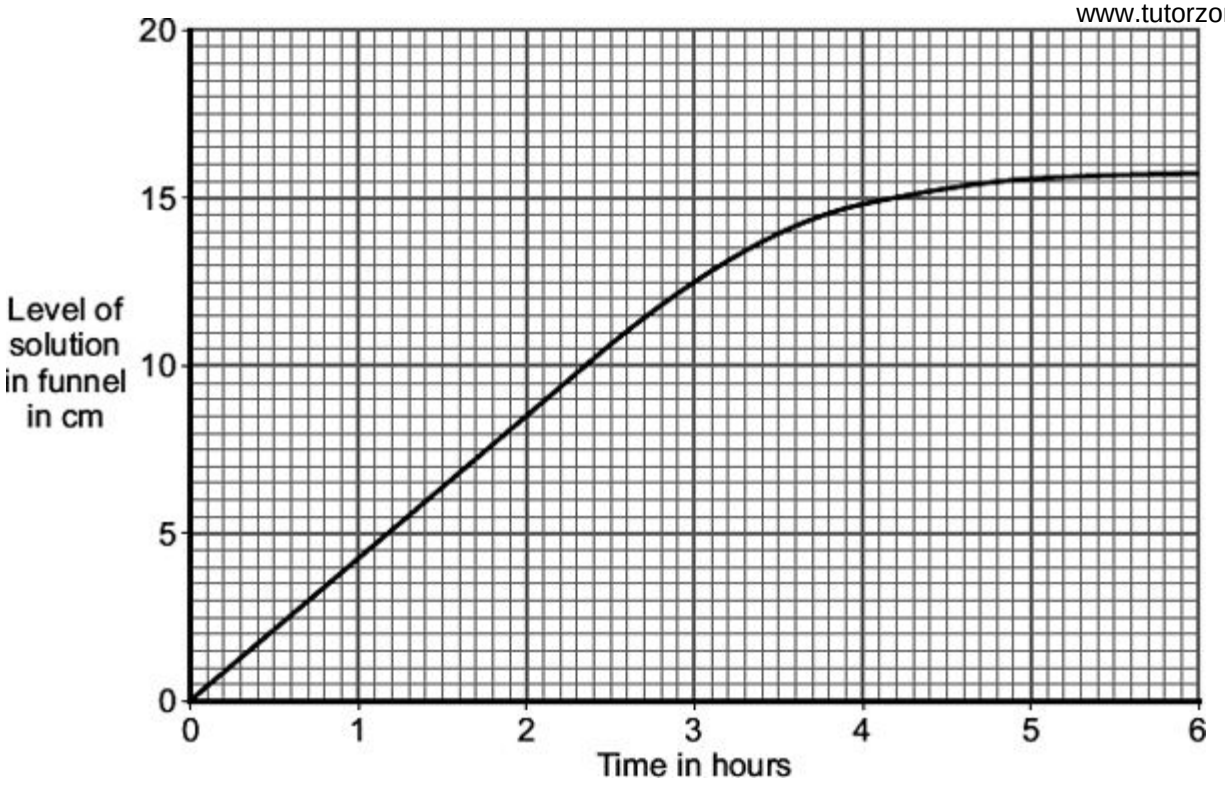
The student:

- 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.

.....

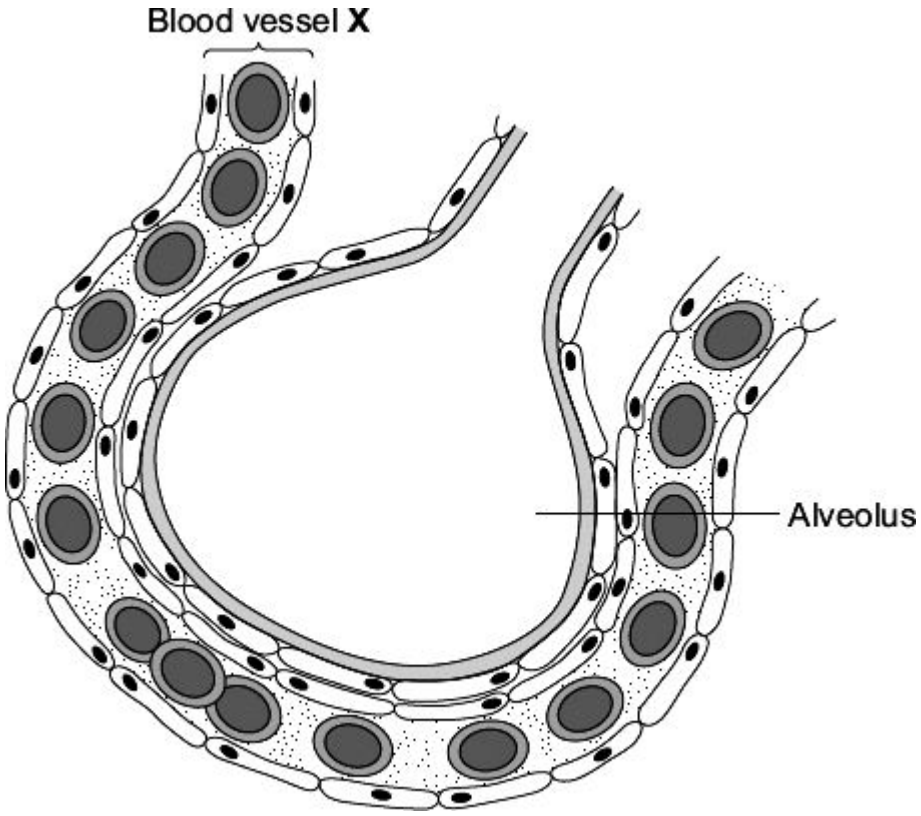
.....

.....

.....

(2)
(Total 5 marks)

33 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)

34 Doctors use dialysis to treat patients with kidney failure.

The table shows the sizes of molecules of some of the substances found in blood plasma.

Substance	Size of molecule in arbitrary units
Water	18
Sodium ion	23
Urea	60
Glucose	180
Albumin (a blood protein)	68 000

(a) Use information from the table to answer the questions.

(i) Albumin is a blood protein. Albumin is **not** removed from the blood during dialysis.

Explain why.

.....

.....

.....

.....

(2)

(ii) During a dialysis session, one patient's body mass decreased by 2 kilograms.

This decrease was mainly due to removal from the blood of one of the substances in the table.

Which substance was this? .....

(1)

(iii) The substance you named in part (a)(ii) was able to pass through the dialysis membrane.

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

The substance passed through because the

membrane was

- impermeable.
- partially permeable.
- surrounded by capillaries.

(1)

(b) For most patients, a kidney transplant is better than continued treatment using dialysis.

Kidney transplants have some disadvantages.

Give **two** disadvantages of kidney transplants.

1 .....

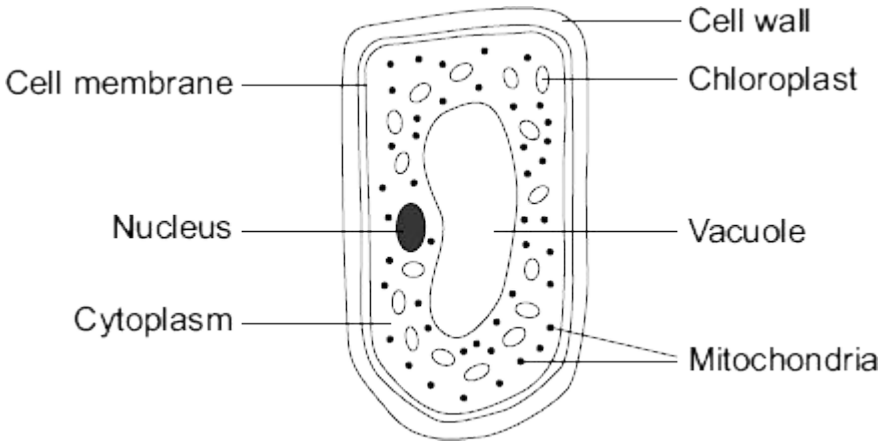
.....

2 .....

.....

(2)
(Total 6 marks)

35 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)

36 (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**
	Surround and protect the lungs
Alveoli	
	Filter the blood
Veins	
	Carry blood towards the heart
Villi	
	Absorb digested food
Ribs	
	Allow oxygen to enter the blood

(4)

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

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

diffusion.

filtration.

respiration.

(1)
(Total 5 marks)