

Transport in Cells

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

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

Topic: Transport in Cells

Q1.

Earthworms are small animals that live in soil. Earthworms have no specialised gas exchange system and absorb oxygen through their skin.

(a) What is the name of the process in which oxygen enters the skin cells?

Tick **one** box.

Active transport

Diffusion

Osmosis

Respiration

(1)

The table below shows information about four skin cells of an earthworm.

Cell	Percentage of oxygen	
	Outside cell	Inside cell
A	9	8
B	12	8
C	12	10
D	8	12

(b) Which cell has the smallest difference in percentage of oxygen between the outside and the inside of the cell?

Tick **one** box.

A	<input type="checkbox"/>
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B	<input type="checkbox"/>
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C	<input type="checkbox"/>
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D	<input type="checkbox"/>
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(1)

(c) Which cell will oxygen move **into** the fastest?

Tick **one** box.

A		B		C		D	
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(1)

- (d) Earthworms have a large surface area to volume ratio.

Suggest why a large surface area to volume ratio is an advantage to an earthworm.

(1)

- (e) The earthworm uses enzymes to digest dead plants.

Many plants contain fats or oils.

Which type of enzyme would digest fats?

(1)

- (f) Earthworms move through the soil.

This movement brings air into the soil.

Dead plants decay faster in soil containing earthworms compared with soil containing **no** earthworms.

Explain why.

(3)

- (g) When earthworms reproduce, a sperm cell from one earthworm fuses with an egg cell from a different earthworm.

Name the process when an egg cell and a sperm cell fuse.

(1)

- (h) Some types of worm reproduce by a process called fragmentation.

In fragmentation, the worm separates into two or more parts. Each part grows into a new worm.

What type of reproduction is fragmentation?

(1)

(Total 10 marks)

Q2.

A student carried out an investigation using chicken eggs.

This is the method used.

1. Place 5 eggs in acid for 24 hours to dissolve the egg shell.
2. Measure and record the mass of each egg.
3. Place each egg into a separate beaker containing 200 cm³ of distilled water.
4. After 20 minutes, remove the eggs from the beakers and dry them gently with a paper towel.
5. Measure and record the mass of each egg.

Table 1 shows the results.

Table 1

Egg	Mass of egg	Mass of egg after
------------	--------------------	--------------------------

	without shell in grams	20 minutes in grams
1	73.5	77.0
2	70.3	73.9
3	72.4	75.7
4	71.6	73.1
5	70.5	73.8

- (a) Another student suggested that the result for egg 4 was anomalous.

Do you agree with the student?

Give a reason for your answer.

(1)

- (b) Calculate the percentage change in mass of egg 3.

Percentage change in mass = _____

(2)

- (c) Explain why the masses of the eggs increased.

(3)

- (d) Explain how the student could modify the investigation to determine the concentration of the solution inside each egg.

(3)

Chicken egg shells contain calcium. Calcium ions are moved from the shell into the cytoplasm of the egg.

Table 2 shows information about the concentration of calcium ions.

Table 2

Location	Concentration of calcium ions in arbitrary units
Egg shell	0.6
Egg cytoplasm	2.1

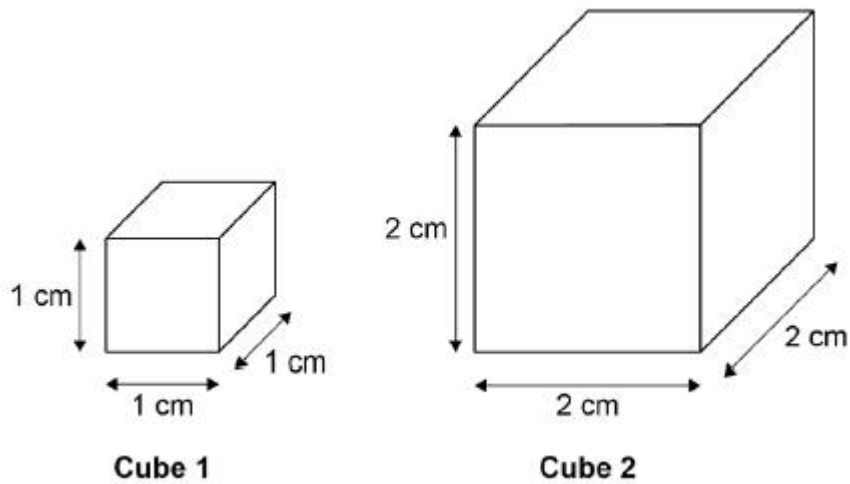
- (e) Explain how calcium ions are moved from the shell into the cytoplasm of the egg.

(3)
(Total 12 marks)

Q3.

A student used cubes of potato to investigate the effect of surface area and volume on the rate of osmosis.

The diagram shows two of the cubes of potato the student used.



The surface area to volume ratio of **cube 1** is 6:1.

- (a) Calculate the total surface area of **cube 2**.

Total surface area of **cube 2** = _____ cm²

(1)

- (b) Calculate the volume of **cube 2**.

Volume of **cube 2** = _____ cm³

(1)

- (c) Calculate the surface area to volume ratio of **cube 2**.

Use the equation:

$$\text{surface area to volume ratio} = \frac{\text{surface area}}{\text{volume}}$$

Surface area to volume ratio of **cube 2** = _____ : 1

(1)

This is the method used.

1. Cut two cubes of potato of size 2 cm × 2 cm × 2 cm
 - Cut one of these cubes into 8 cubes of potato of size 1 cm × 1 cm × 1 cm (sample **A**).
 - Do not cut the other cube (sample **B**).
 2. Measure the mass of each sample **A** and the mass of sample **B**.
 3. Place all the cubes into a beaker of distilled water.
 4. Leave for 30 minutes.
 5. Remove the cubes from the beaker and dry the surfaces with a paper towel.
 6. Measure the mass of each sample of cubes.
- (d) Why were 8 cubes of size 1 cm × 1 cm × 1 cm but only one cube of size 2 cm × 2 cm × 2 cm cube used?

(1)

- (e) Why did the student dry the surface of each potato cube in step 5 of the method?

(1)

The table below shows the student's results.

Mass at start in g	Mass at end in g	Mass change in g
--------------------	------------------	------------------

Sample A Eight cubes, each measuring 1 cm × 1 cm × 1 cm	10.4	12.2	1.8
Sample B One cube, measuring 2 cm × 2 cm × 2 cm	9.9	10.7	X

- (f) Calculate mass change **X** in the table above.

Mass change **X** = _____ g

(1)

- (g) Explain why the masses of both samples of cubes increased.

(2)

- (h) It would be better to calculate percentage change in mass rather than change in mass.

Why is this a more valid method?

Tick **one** box.

Because it makes it a fair test.

Because it makes the investigation of the samples of cubes more accurate.

Because the samples of cubes were different masses at the start of the investigation.



(1)

- (i) Explain why the mass of the cubes in sample **A** increased more than the mass of the cube in sample **B**.

(2)

(Total 11 marks)

Q4.

Gases enter and leave the blood by diffusion.

- (a) Define the term diffusion.

(1)

- (b) Name the main gases that diffuse into and out of the blood **in the lungs**.

Into the blood _____

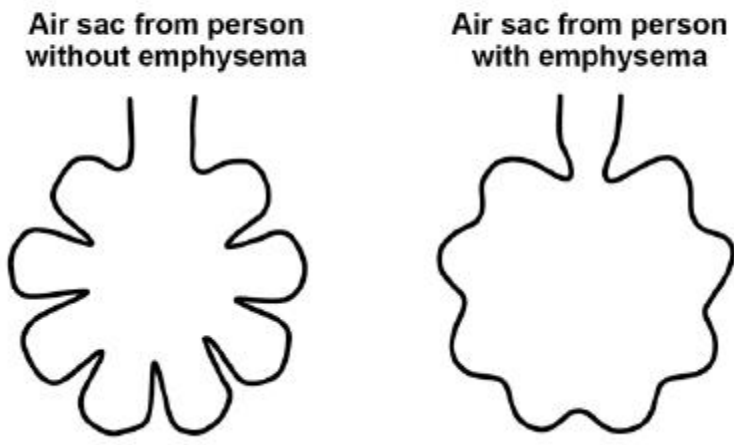
Out of the blood _____

(1)

- (c) Smoking can cause emphysema.

Look at **Figure 1** below.

Figure 1



Emphysema causes the walls of the air sacs in the lungs to break down
Explain how this will affect the diffusion of gases into and out of the blood.

(2)

Smoking during pregnancy can cause low birth mass in babies.

Table 1 shows the World Health Organisation categories for birth mass.

Table 1

Category	Birth mass in g
Above normal birth mass	> 4500
Normal birth mass	2500–4500
Low birth mass	1500–2499
Very low birth mass	1000–1499

Extremely low birth mass	< 1000
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(d) Complete **Table 2**.

Use information in **Table 1**.

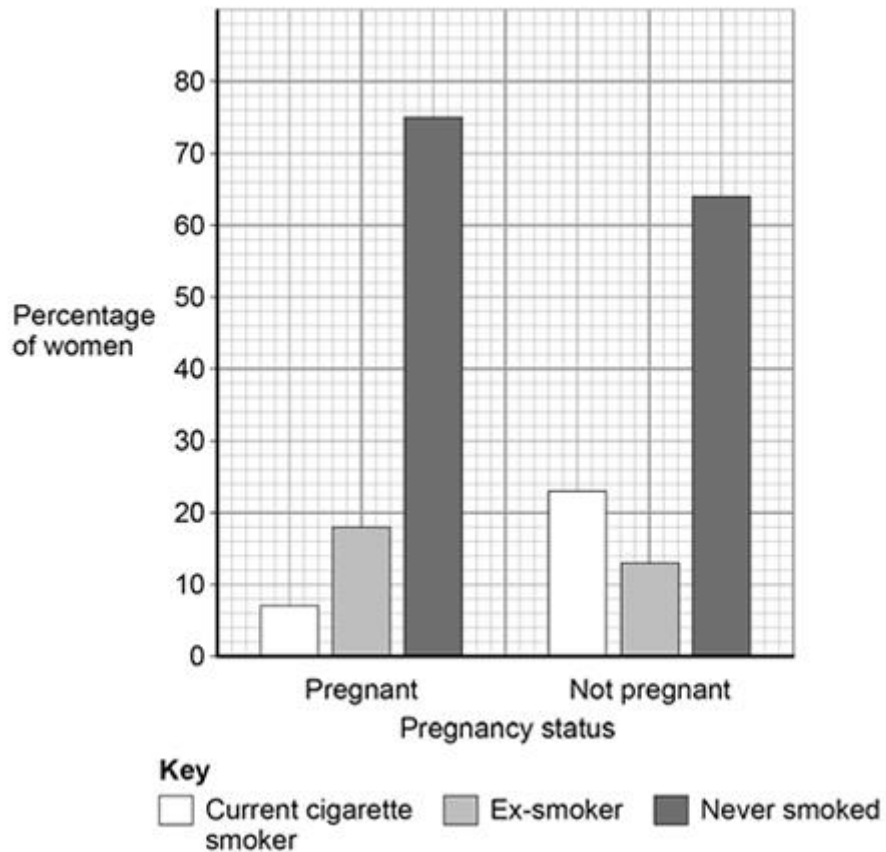
Table 2

Baby	Birth mass in g	Category
A	2678	Normal birth mass
B	1345	
C	991	

(2)

Figure 2 shows data from a study about pregnancy and smoking in women in the UK.

Figure 2



- (e) Sampling from the whole UK population would **not** be appropriate for this study.

Give **one** reason why.

(1)

- (f) Give **three** conclusions that can be made about smoking in pregnant women compared with non-pregnant women.

Use information from **Figure 2**.

1.

2.

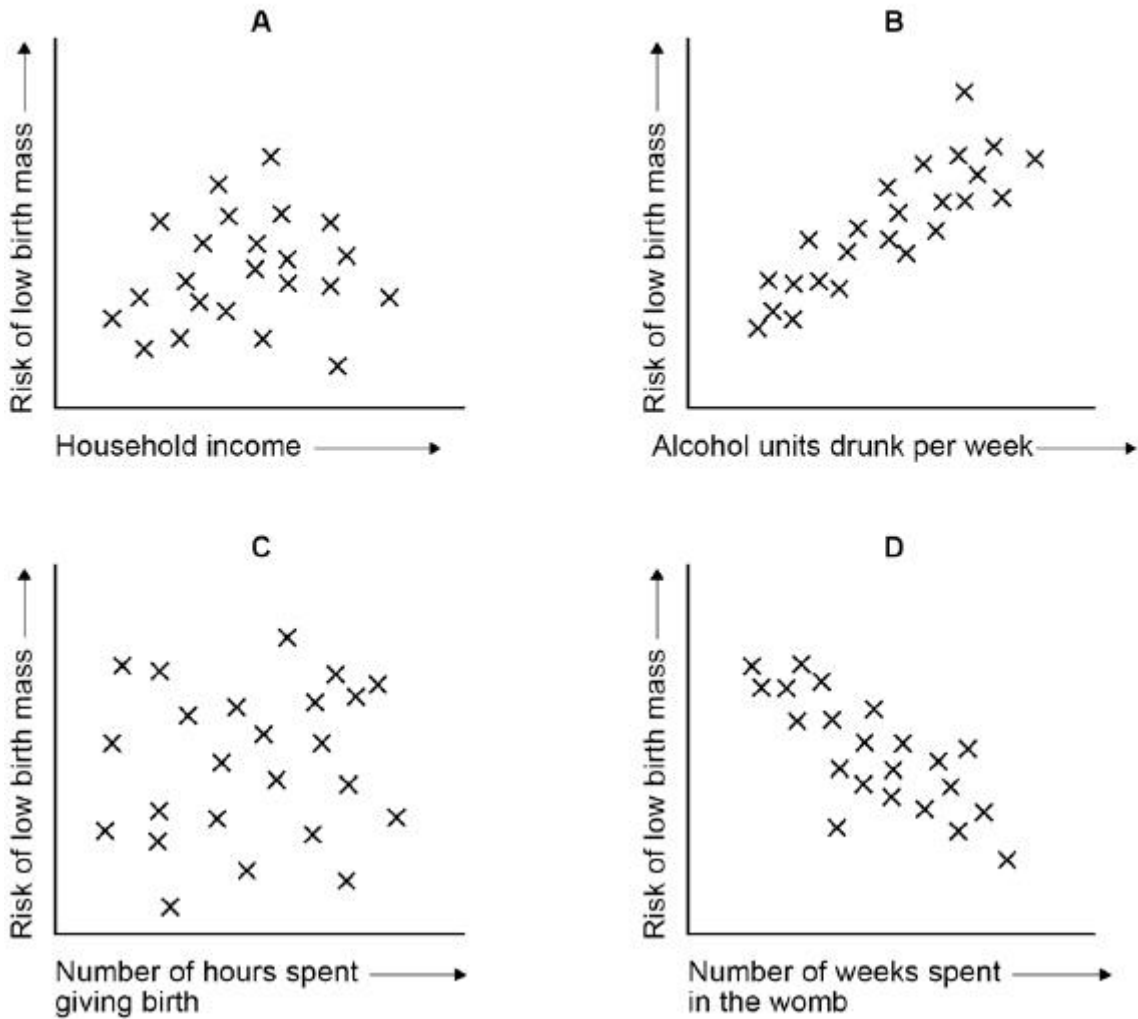
3.

(3)

Other factors can also be linked to low birth mass.

Figure 3 shows the relationship between four of these factors and the risk of low birth mass.

Figure 3



(g) What type of graph is shown in **Figure 3**?

Tick **one** box.

Bar graph

Histogram

Line graph

Scatter graph

(1)

(h) Which of the graphs in **Figure 3** shows a positive correlation?

Tick **one** box.

A B C D

(1)

(i) A student concluded that the longer a woman spends giving birth, the greater the risk of low birth mass.

Give **one** reason why the student's conclusion is **not** correct.

Use evidence from **Figure 3**.

(1)

(Total 13 marks)

Q5.

A student carried out an investigation using leaf epidermis.

This is the method used.

1. Peel the lower epidermis from the underside of a leaf.
2. Cut the epidermis into six equal sized pieces.
3. Place each piece of lower epidermis into a different Petri dish.
4. Add 5 cm³ of salt solution to the six Petri dishes. Each Petri dish should have a different concentration of salt solution.
5. After 1 hour, view each piece of epidermis under a microscope at ×400 magnification.
6. Count and record the total number of stomata present and the number of open stomata that can be seen in one field of view.

The student's results are shown in the table.

Concentration of salt	Number of stomata in	Number of open	Percentage (%) of open

solution in mol / dm ³	field of view	stomata in field of view	stomata in field of view
0.0	7	7	100
0.1	8	8	100
0.2	7	6	X
0.3	9	6	67
0.4	10	4	40
0.5	9	2	22

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

X = _____ %

(1)

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

(1)

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

(1)

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

Calculate the number of open stomata per mm² of leaf for the epidermis placed in 0.4 mol / dm³ salt solution.

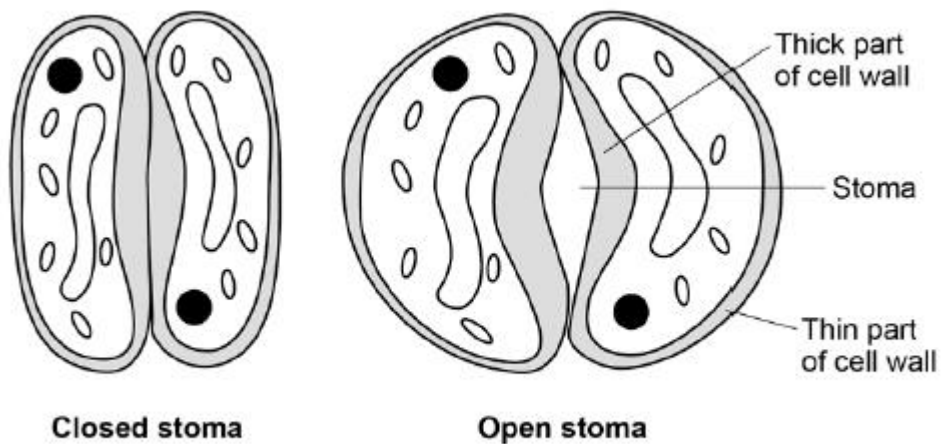
Use information from the table above.

Take π to be 3.14

Number of open stomata = _____ per mm^2

(3)

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



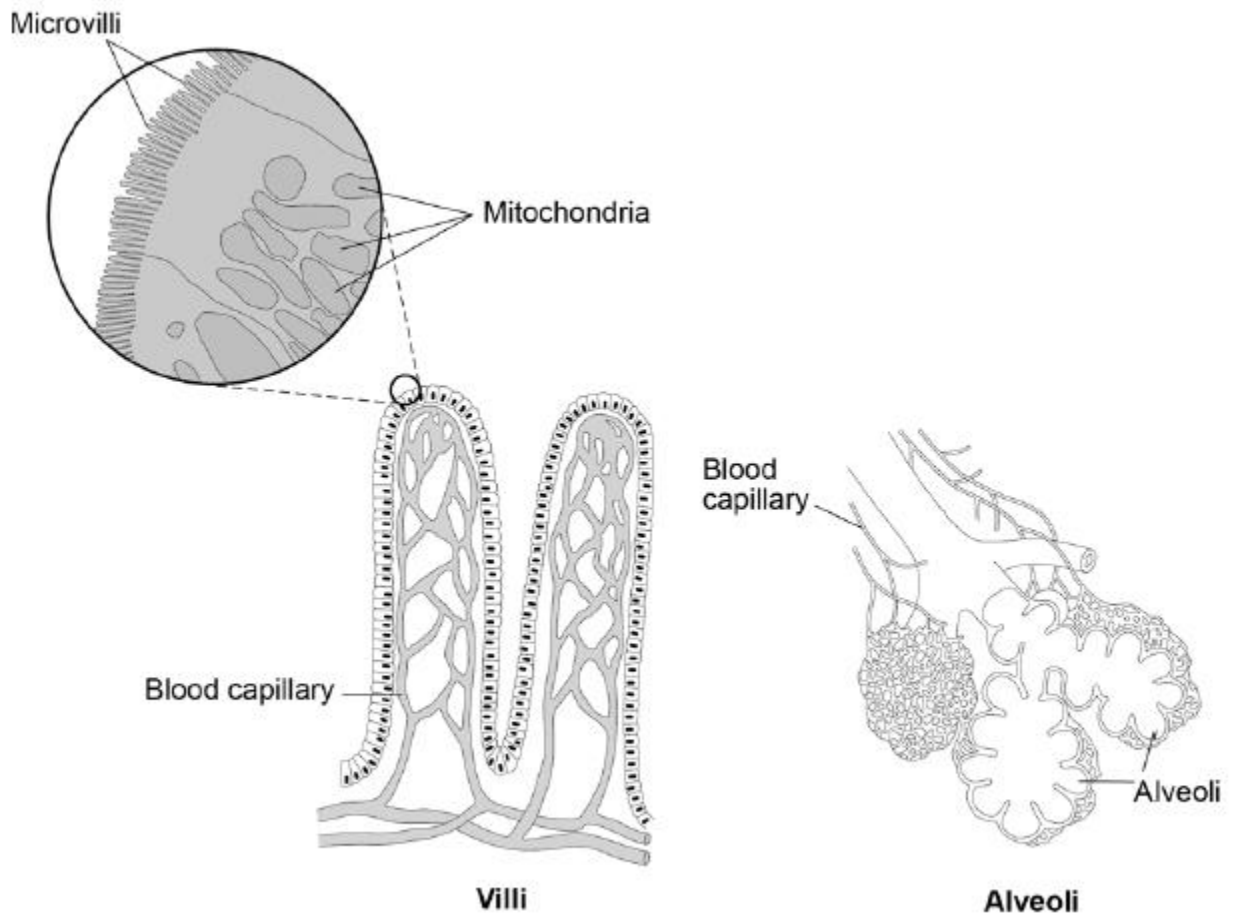
When light intensity is high potassium ions are moved into the guard cells.

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

(4)

- (d) The digestive system and the breathing system both contain specialised exchange surfaces.
- In the digestive system, digested food is absorbed into the blood stream in structures called villi.
 - In the breathing system, gases are absorbed into the blood stream in the alveoli.

The diagram below shows the structure of villi and alveoli.



Explain how the villi and the alveoli are adapted to absorb molecules into the bloodstream.

(6)

(Total 15 marks)

Q7.

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

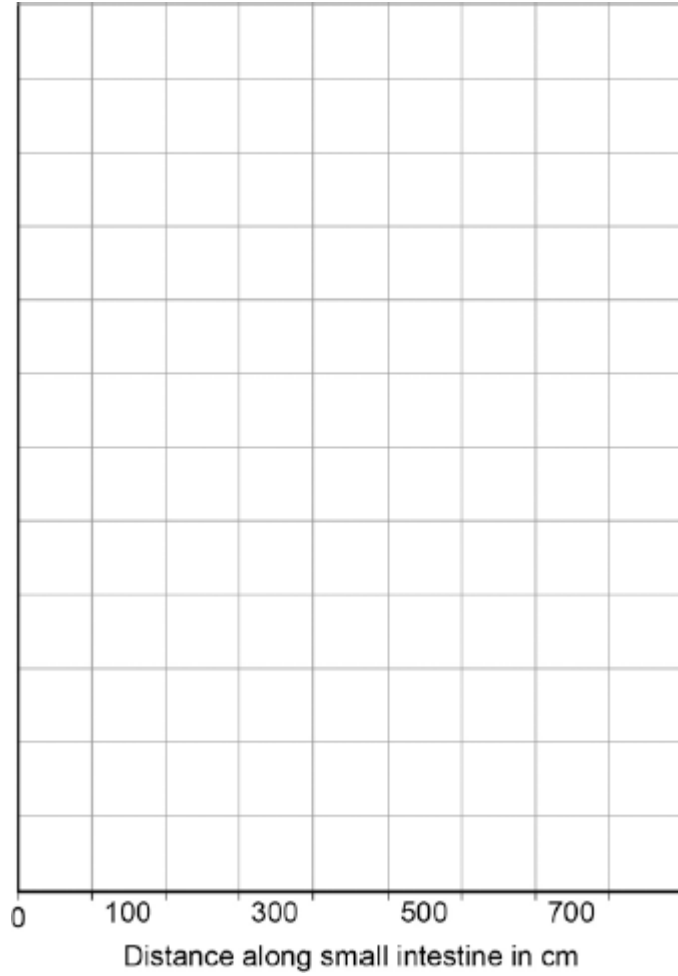
- (a) At what distance along the small intestine is the glucose concentration highest?

_____ 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.

(2)

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

(2)

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

(3)

(Total 12 marks)

Q8.

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	Lower

	surface	surface
1	3	44
2	0	41
3	1	40
4	5	42
5	1	39
Mean	2	X

Describe how the student might have collected the data.

(3)

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

(1)

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

Give your answer to 2 significant figures.

Mean number of stomata on lower surface of leaf = _____

(2)

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

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

(2)

(Total 11 marks)

Q9.

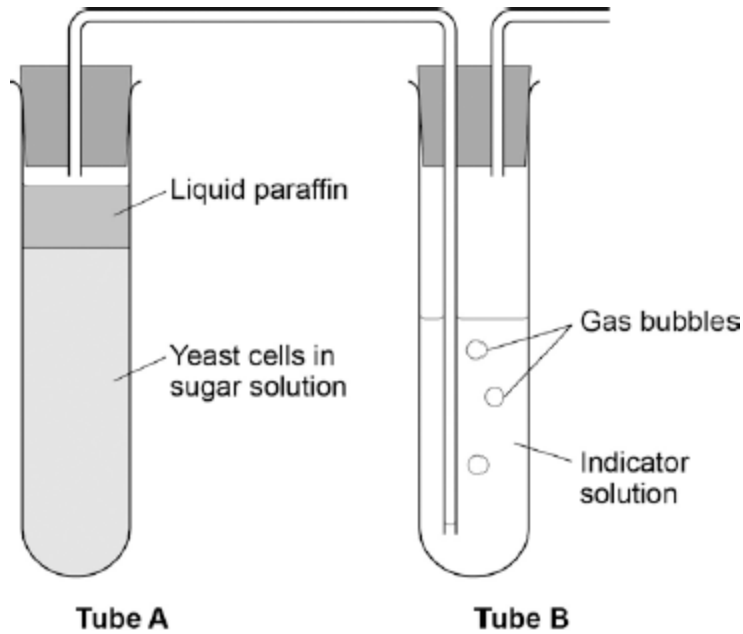
All living cells respire.

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

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

(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 (CO₂).

The indicator is:

- **blue** when the concentration of CO₂ is very low
- **green** when the concentration of CO₂ is low
- **yellow** when the concentration of CO₂ 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.

(2)

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

(3)
(Total 9 marks)

Q10.

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

This is the method used.

1. Add 30 cm³ 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 = _____ %

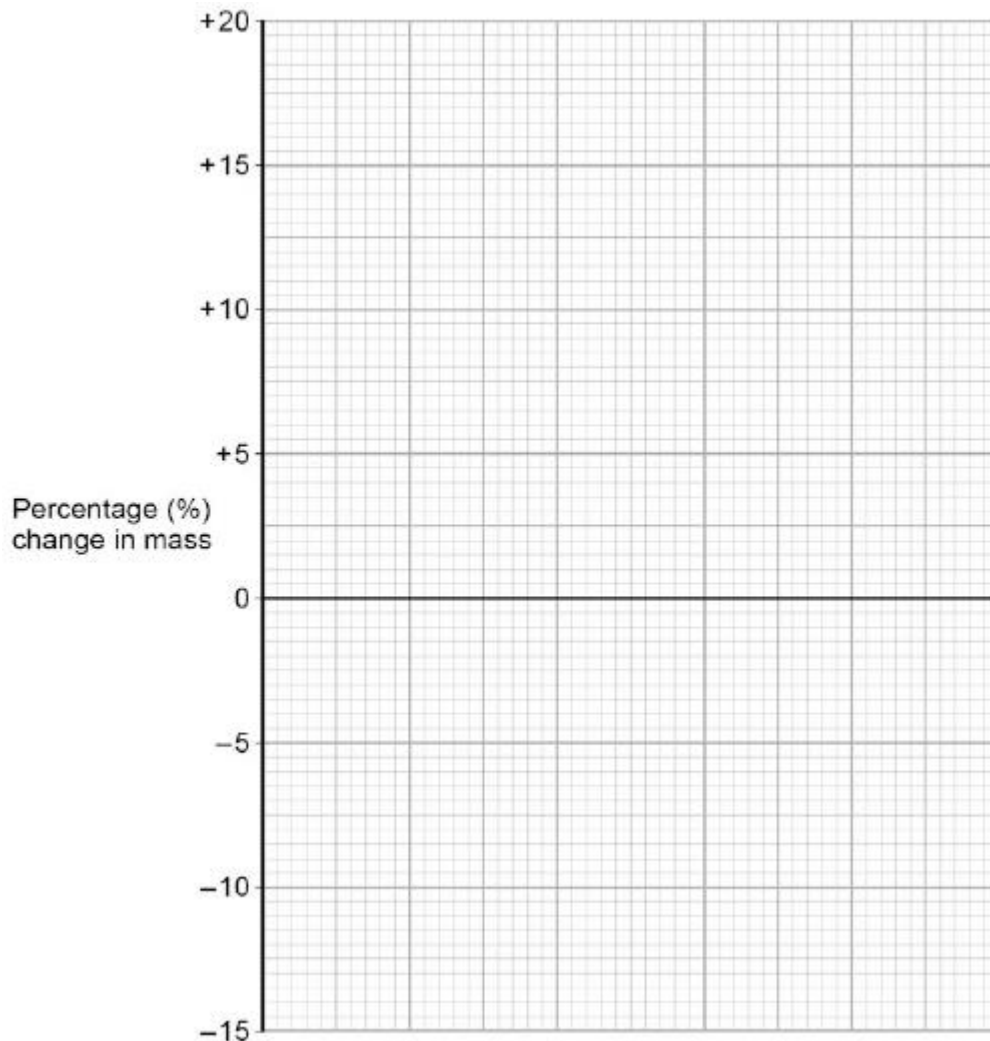
(2)

(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.

(3)

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

1.

2.

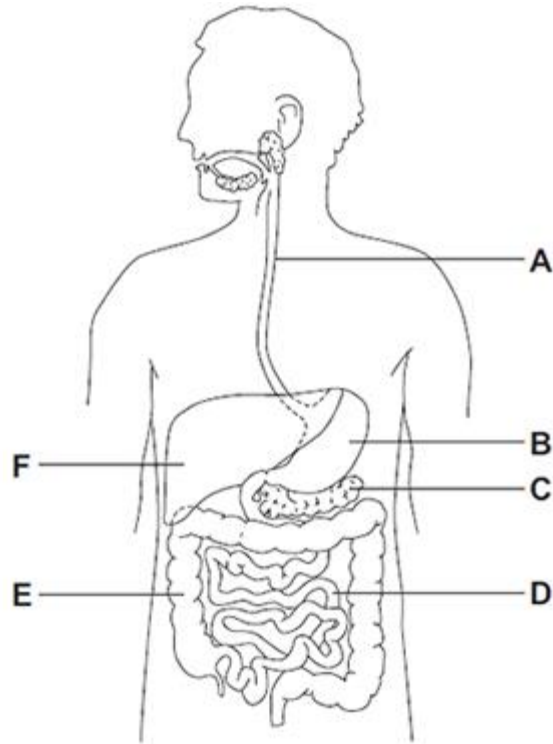
(2)

(Total 13 marks)

Q11.

Explain how the human circulatory system is adapted to:

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



- (a) (i) Which letter, **A**, **B**, **C**, **D**, **E** or **F**, shows each of the following organs?

Write **one** letter in each box.

large intestine

small intestine

stomach

(3)

- (ii) Different organs in the digestive system have different functions.
Draw **one** line from each function to the organ with that function.

Function	Organ
Digestion of fat	Large intestine
Absorption of water into the blood	Liver
Production of hydrochloric acid	Small intestine
	Stomach

(3)

(b) Glucose is absorbed into the blood in the small intestine.

Most of the glucose is absorbed by diffusion.

How does the glucose concentration in the blood compare to the glucose concentration in the small intestine?

Tick (✓) **one** box.

The concentration in the blood is higher.

The concentration in the blood is lower.

The concentration in the blood is the same.

(1)

(Total 7 marks)

Q13.

Cells, tissues and organs are adapted to take in different substances and get rid of different substances.

The table shows the concentration of four ions outside cells and inside cells.

Ion	Concentration outside cells in mmol per dm ³	Concentration inside cells in mmol per dm ³
Sodium	140	9
Potassium	7	138
Calcium	2	27
Chloride	118	3

(a) Use information from the table above to complete the following sentences.

Sodium ions will move into cells by the process
of _____ .

Potassium ions will move into cells by the process
of _____ .

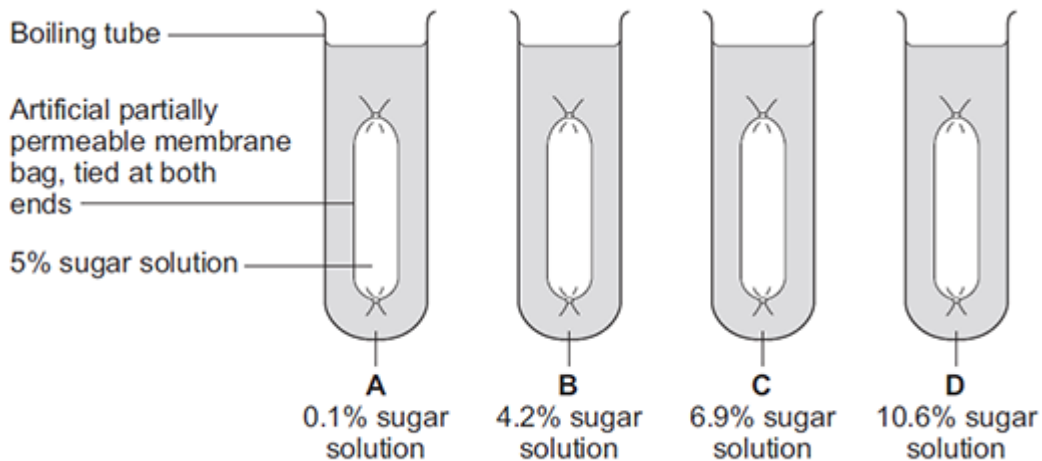
(2)

(b) Some students investigated the effect of the different concentrations of sugar in four drinks, **A**, **B**, **C** and **D**, on the movement of water across a partially permeable membrane.

The students:

- made four bags from artificial partially permeable membrane
- put equal volumes of 5% sugar solution in each bag
- weighed each bag containing the sugar solution
- placed one bag in each of the drinks, **A**, **B**, **C** and **D**
- after 20 minutes removed the bags containing the sugar solution and weighed them again.

The diagram below shows how they set up the investigation.



- (i) The bag in drink **A** got heavier after 20 minutes.

Explain why.

(3)

- (ii) In which drink, **A**, **B**, **C** or **D**, would you expect the bag to show the smallest change in mass?

Tick (✓) **one** box.

A **B** **C** **D**

(1)

- (iii) Explain why you think the bag you chose in part **(b)(ii)** would show the smallest change.

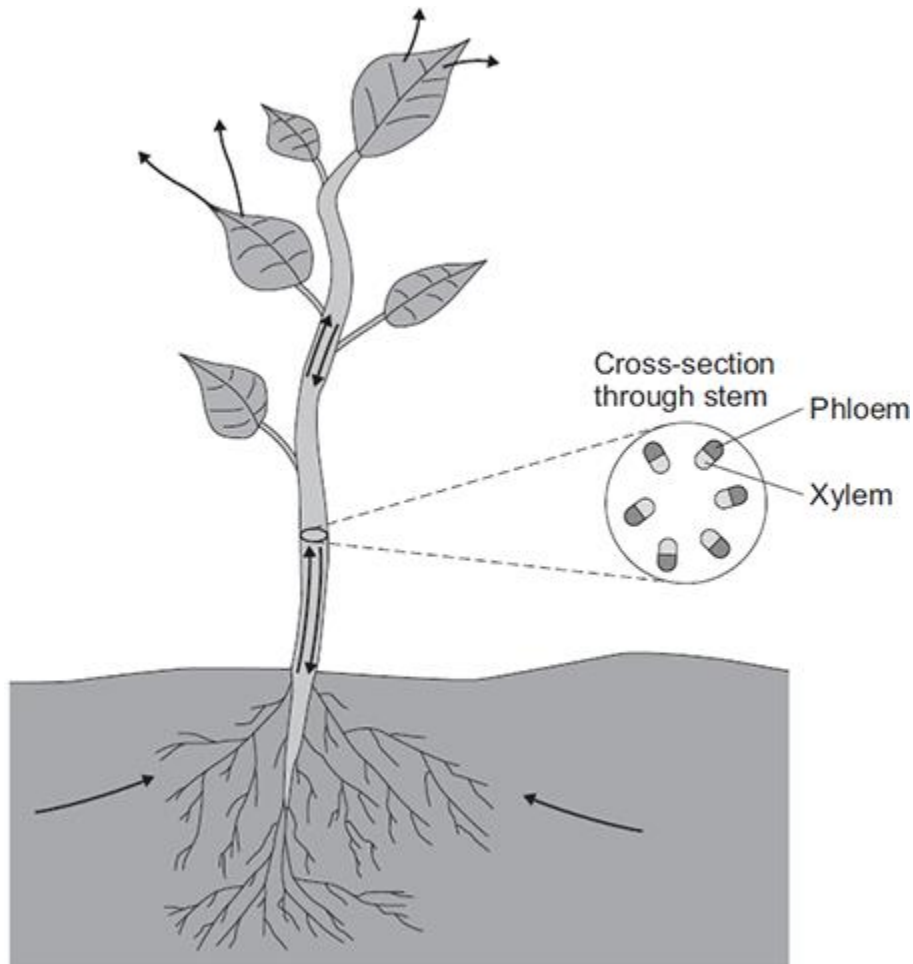
(2)
(Total 8 marks)

Q14.

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

Plants transport many substances between their leaves and roots.

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



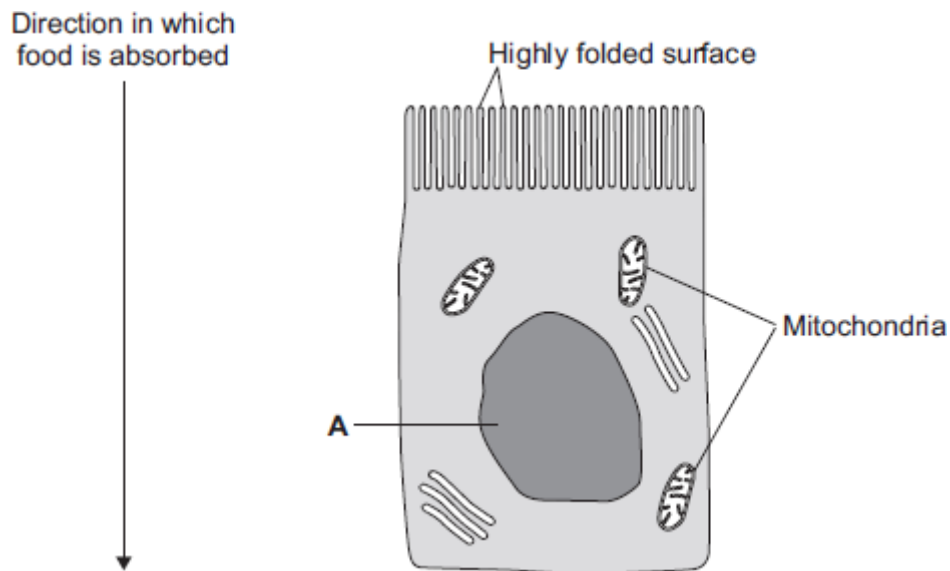
Describe how **ions**, **water** and **sugar** are obtained and transported through plants.

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

(Total 6 marks)

Q15.

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.

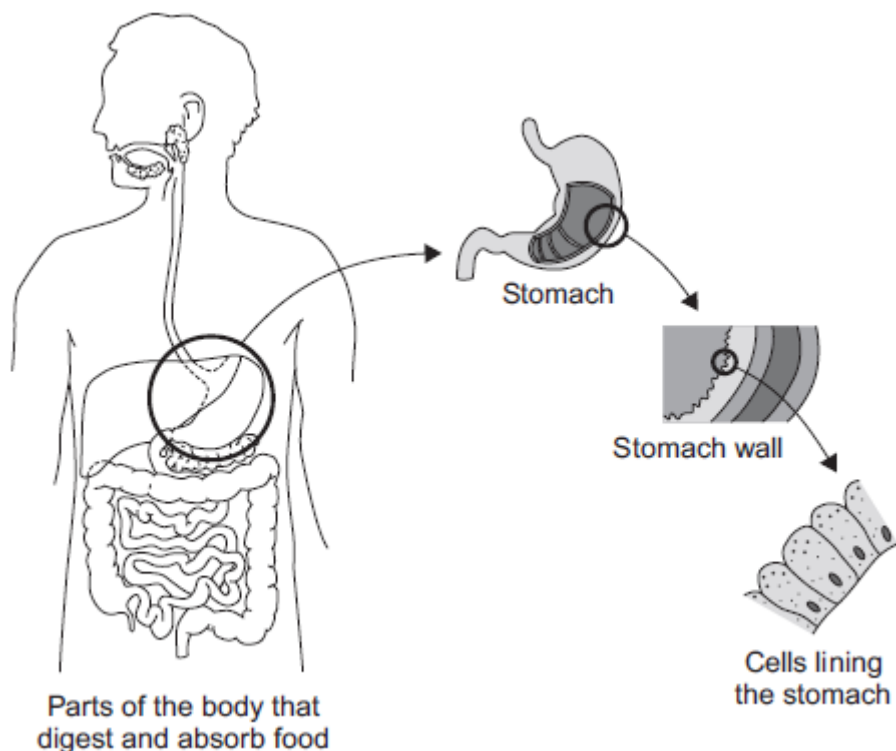
(1)

(Total 8 marks)

Q16.

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**

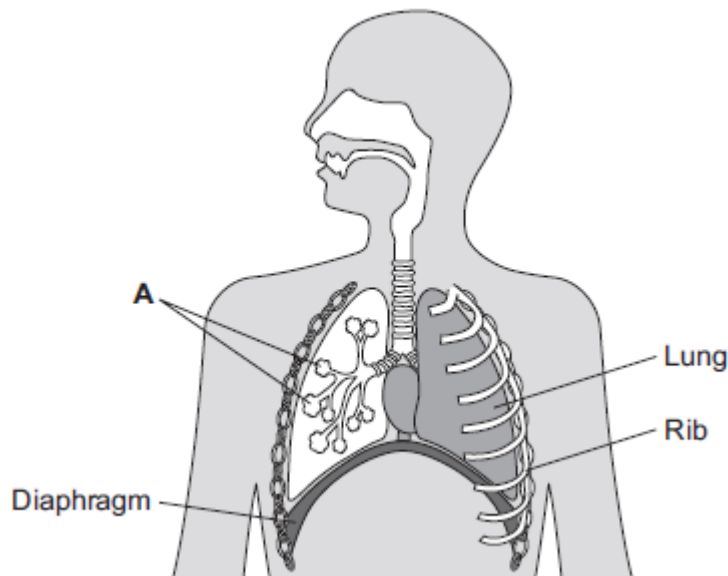
(1)

(Total 5 marks)

Q17.

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
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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)

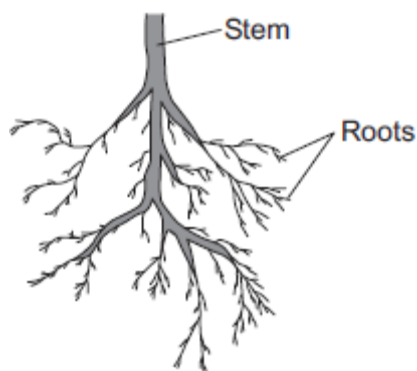
(Total 6 marks)

Q18.

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.

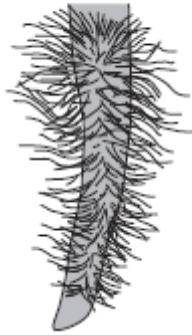
The absorption of mineral ions needs energy.

(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)

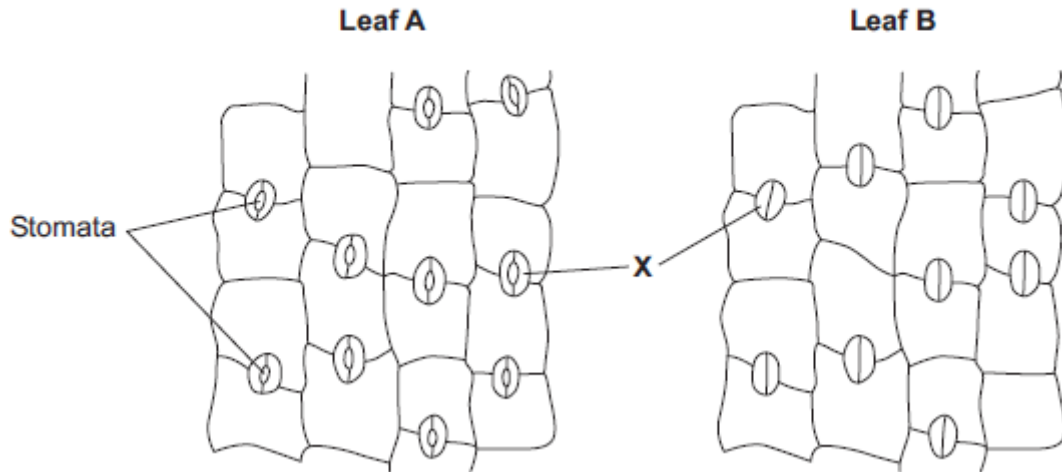
(b) The leaves of plants have stomata.

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)

Q19.

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		A	B	C

dm³			
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 cm³ 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.

(3)

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

Table 2

Nutrient per dm ³	Brand of sports drink		
	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.

(3)

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

(1)

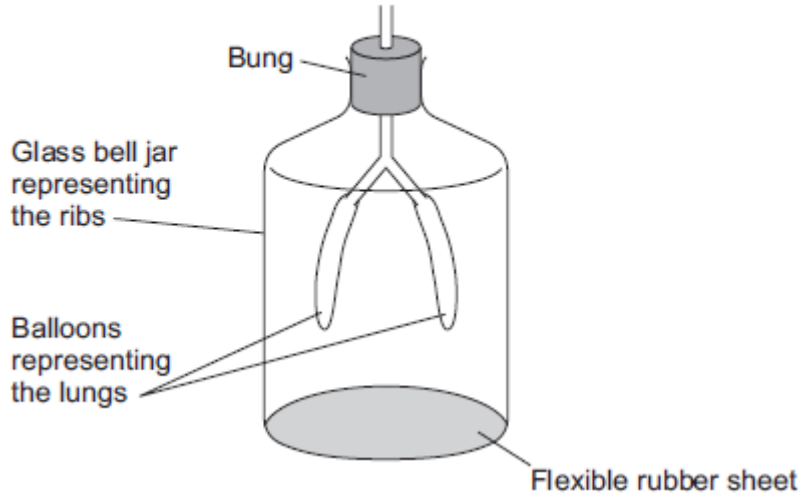
(Total 10 marks)

Q20.

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.

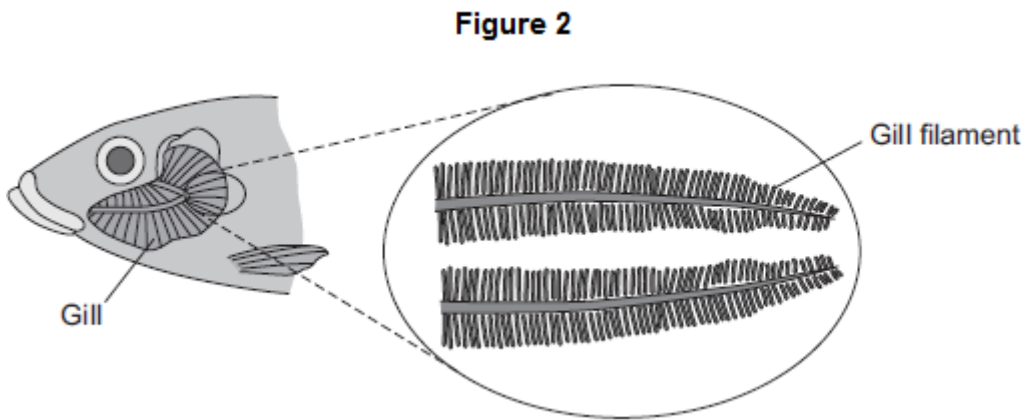
(3)

- (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.



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.

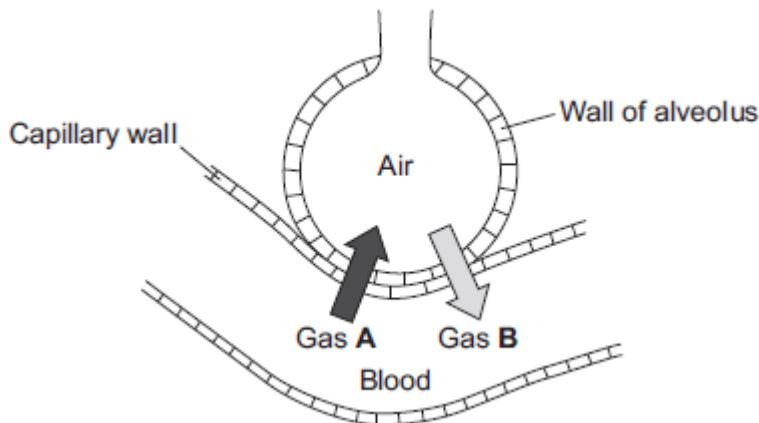
(2)
(Total 8 marks)

Q21.

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 m².

Calculate the total surface area of a human lung.

Answer _____ m²

(2)

- (c) An athlete trains to run a marathon. The surface area of each of the athlete's lungs has increased to 80 m².

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

(1)

(Total 6 marks)

Q22.

The diagrams show the same cell of a common pond plant.

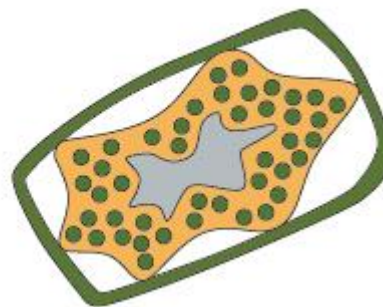
Diagram A shows the cell in a hypotonic solution.

Diagram B shows the same cell in a hypertonic solution.

Diagram A



Diagram B



- (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 cell in **diagram B**.

(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 cell in **diagram A**.

(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?

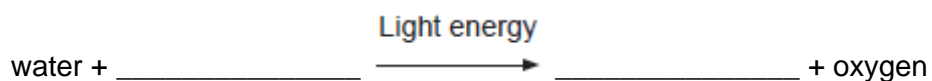
(1)

(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.

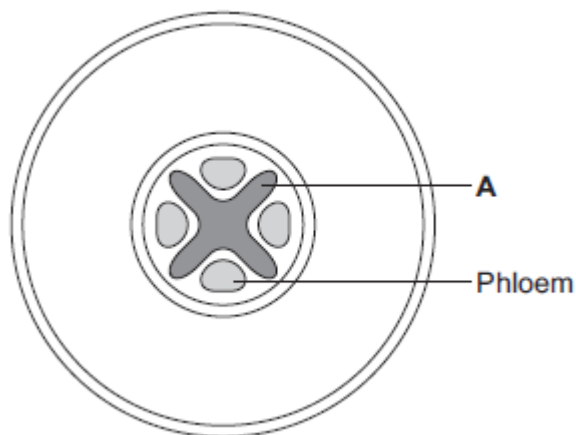
Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

(3)

(Total 11 marks)

Q24.

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.

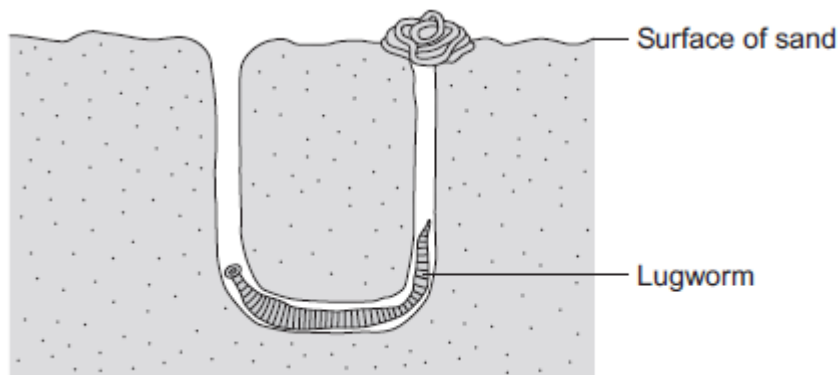
(2)

(Total 9 marks)

Q25.

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)

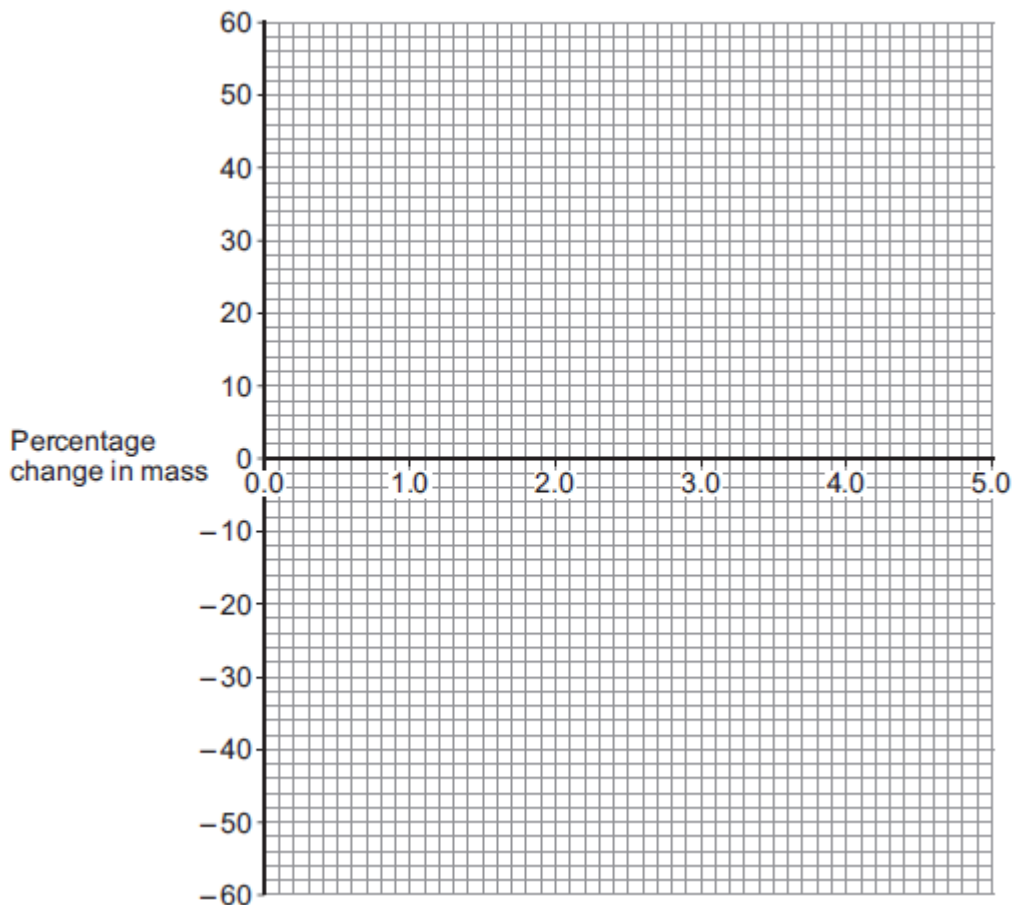
(ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

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)

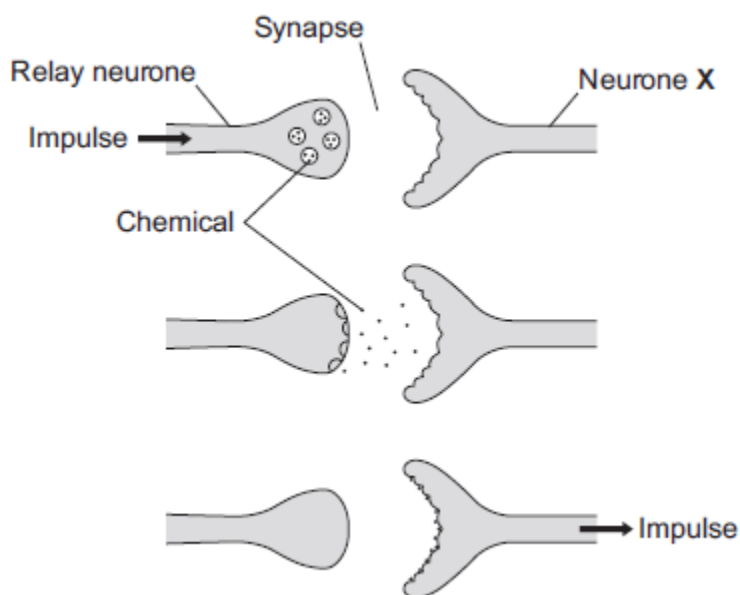
(ii) The mass of the lugworms decreased in the salt solution with a concentration of 5.0 arbitrary units.

Explain what caused this.

(3)
(Total 19 marks)

Q26.

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)

Q27.

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.

(Total 6 marks)

Q28.

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

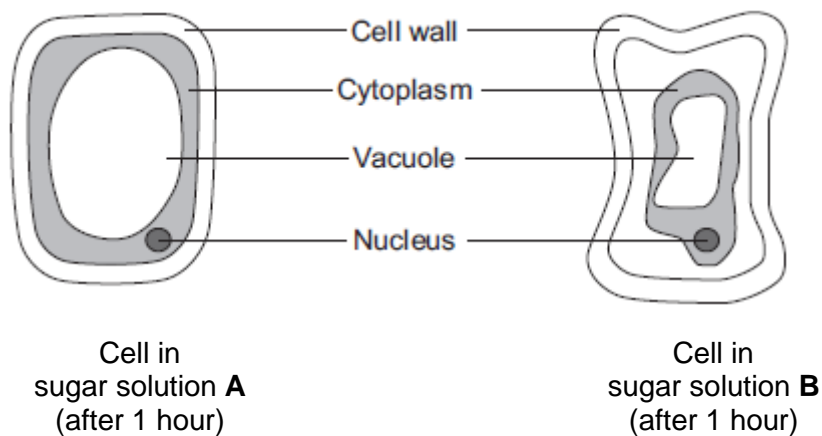
freely permeable
non-permeable
partially permeable

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.



(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)

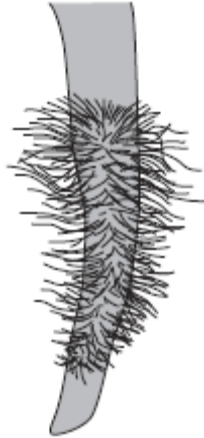
Q29.

Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

(3)

(b) The image below shows part of a plant root.



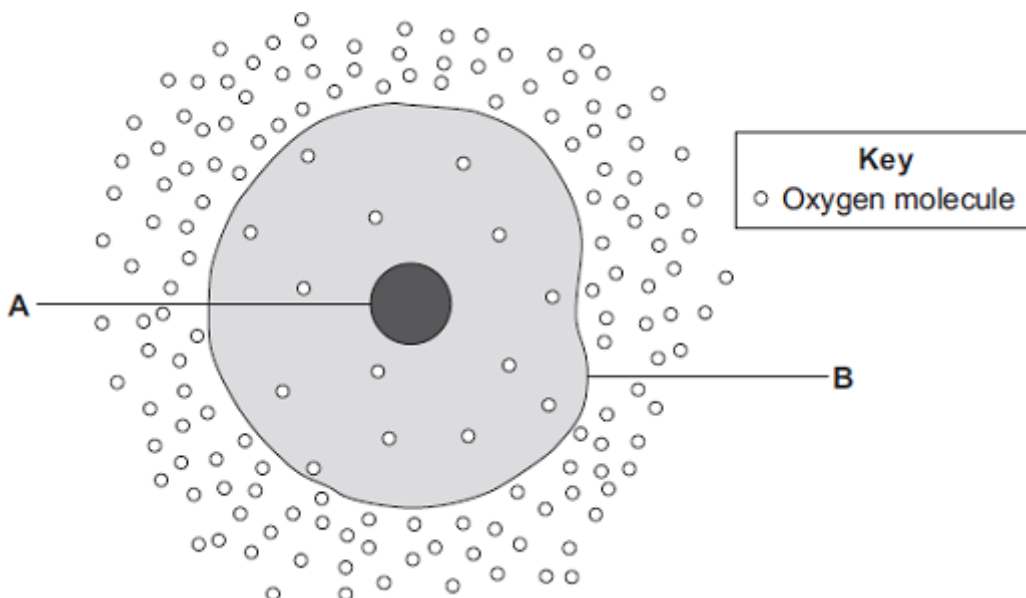
The plant root is adapted for absorbing water from the soil.

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

(3)
(Total 6 marks)

Q30.

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.

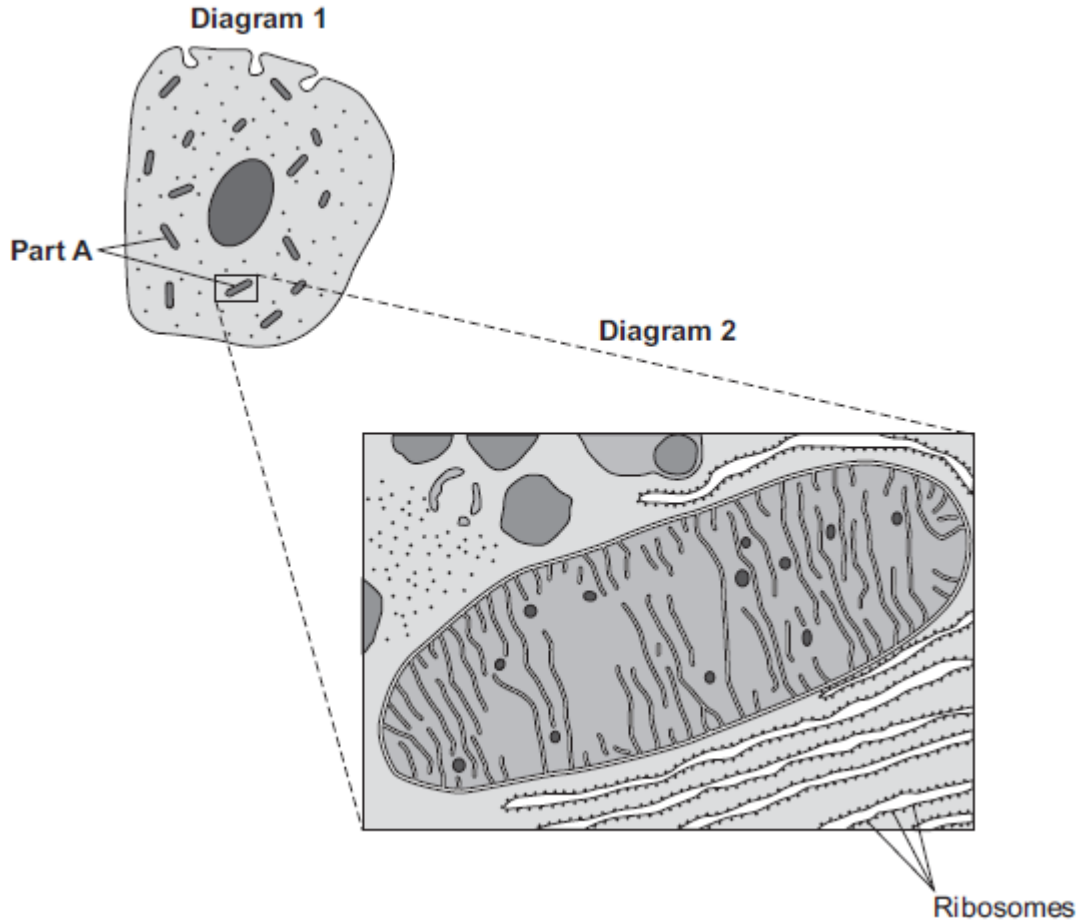
(1)

(Total 6 marks)

Q31.

Diagram 1 shows a cell from the pancreas.

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

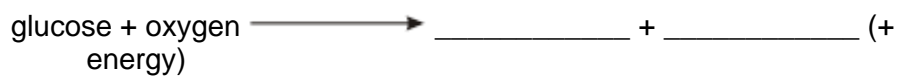


Part **A** is where most of the reactions of aerobic respiration happen.

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

(1)

- (ii) Complete the equation for aerobic respiration.



(2)

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

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

(3)

(b) The pancreas cell makes enzymes.

Enzymes are proteins.

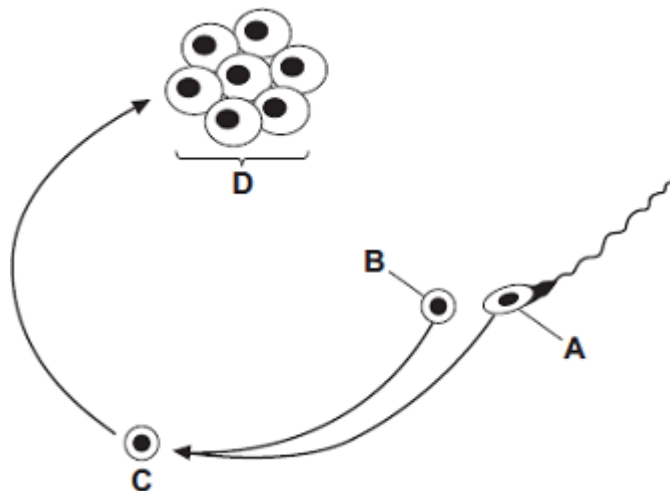
Describe how the ribosomes and part **A** help the cell to make enzymes.

(3)

(Total 9 marks)

Q32.

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)

Q33.

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.

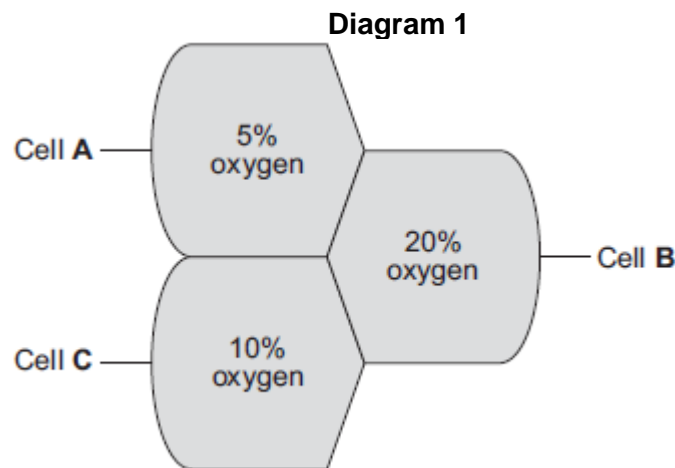
diffusion

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

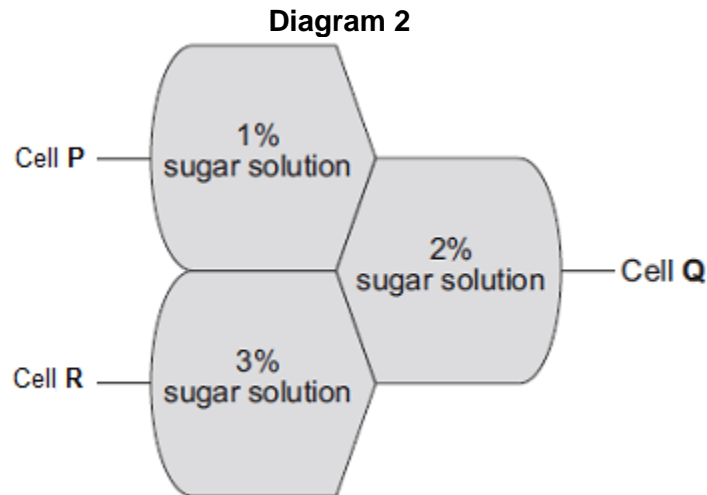
respiration

(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**.



Water can move from cell to cell.

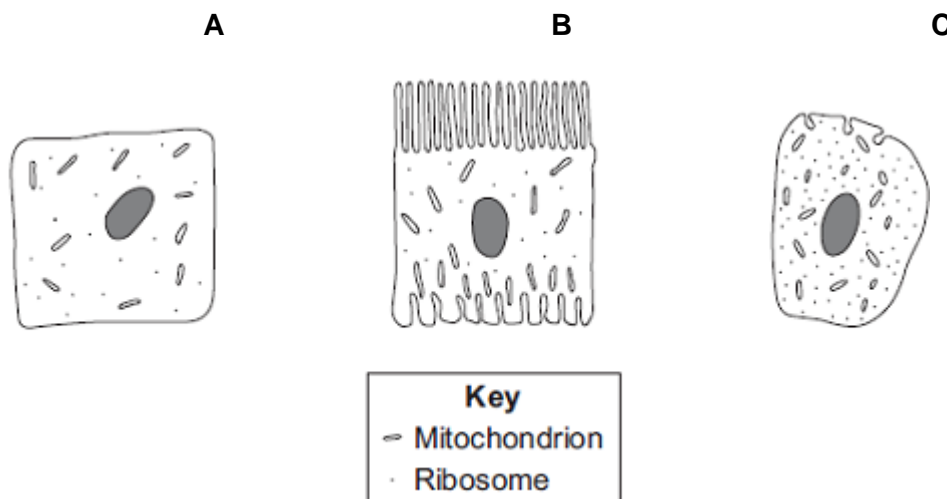
Into which cell, **P**, **Q** or **R**, will water move the fastest?

(1)

(Total 4 marks)

Q34.

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)

Q35.

- (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.

Mark schemes

Q1.

- (a) diffusion 1
- (b) A 1
- (c) B 1
- (d) (earthworm) can absorb more oxygen (in a given time)
or
 increases / more gas exchange
allow get / obtain / take in more oxygen
ignore easier absorption of oxygen
ignore references to food 1
- (e) lipase 1
- (f) more oxygen (in soil with earthworms)
allow earthworms bring oxygen to soil 1
- (for) more (aerobic) respiration
*do **not** accept anaerobic respiration* 1
- (of) bacteria / fungi / microorganisms / microbes / decomposers 1
reference to more is only needed once for the first two marking points
- (g) fertilisation
ignore sexual reproduction 1
- (h) asexual (reproduction)
allow cloning 1
- [10]**

Q2.

- (a) (yes, because) the mass change (of egg 4) is much lower than the others
allow because it / egg 4 has gained (over) 50% less mass than the others
allow it / egg 4 has gained 1.5 g and the others have all gained more than 3 g (unit required) 1

- (b) $\frac{75.7 - 72.4}{72.4} \times 100$
 or equivalent 1
- 4.6 (%)
 allow 4.558 / 4.56 (%)
 allow any correct rounding of
 4.558011049723757 1
 an answer of 4.6 / 4.56 / 4.558 scores **2** marks
- (c) (mass increased because) water entered by osmosis 1
- from a dilute solution in the beaker to a more concentrated solution in the egg (cell)
- allow from an area of high water concentration in the beaker to an area of low water concentration in the egg (cell)
 allow ref to water potential
 allow ref to 'strong' and 'weak' solutions
 ignore along / across concentration gradient
 do **not** accept 'amount' in place of concentration
- through a partially permeable membrane
 allow semi-permeable / selectively permeable membrane 1
- (d) use five (or more) different concentrations of salt / sugar solution (in beakers)
 allow any number of concentrations provided it is more than four 1
- (by) plotting percentage change (in mass / volume) on / using a graph 1
- determine the concentration where the curve / line crosses the zero percentage change (in mass / volume) 1
- (e) (ions are moved) from an area of low concentration to high concentration
 allow against the concentration gradient
 allow in terms of solution
 do **not** accept molecules 1
- (by) active transport 1
- (which) requires using energy
 do **not** accept idea of energy being created 1

Q3.

- (a) (surface area =) 24 (cm²) 1
- (b) (volume =) 8 (cm³) 1
- (c) 3 (:1)
allow ecf from (a) and (b) 1
- (d) to keep the volume (of the cubes) the same in both sets
allow to compare with the 2 x 2 x 2 cube
or
so both sets of cubes are 8 cm³
ignore to keep it fair 1
- (e) so that excess water does not contribute to the mass of the cubes 1
- (f) 0.8 (g)
if no answer given, check for answer in the table 1
- (g) (because) water moved into the cubes (by osmosis)
allow water moves in by diffusion 1
- because the solution outside the cubes was more dilute than inside the cells
allow converse
allow because the concentration of water was higher outside the cubes / in the beaker / solution than inside the cells 1
- (h) because the samples of cubes were different masses at the start of the investigation 1
- (i) more water was taken in
allow ecf for answer to (d) 1
- because they had a larger surface area to volume ratio
allow more / faster osmosis happened 1

[11]

Q4.

- (a) movement of particles from (an area of) high concentration to (an area of) low concentration
allow movement of particles down a concentration gradient
*do **not** accept along / across a concentration gradient* 1

- (b) oxygen
 allow O₂
- carbon dioxide
 allow CO₂
 in this order only
 both needed for 1 mark 1
- (c) less diffusion
 allow less gas will enter / leave the blood
 allow ecf from (b) 1
- (because of the) reduced / smaller surface area 1
- (d) **(B)** very low birth mass 1
- (C)** extremely low birth mass 1
- (e) any **one** from:
 • men would be included in the study (can't be pregnant)
 • children / older (post-menopausal) women would be included in the study
 ignore reference to cost 1
- (f) any **three** from:
 • higher percentage of pregnant women have never smoked (compared with non-pregnant women)
 • higher percentage of pregnant women are ex-smokers (compared with non-pregnant women)
 • lower percentage of pregnant women currently smoke (compared with non-pregnant women)
 • in both pregnant and non-pregnant women, the highest percentage of women have never smoked
 allow converse throughout
 allow appropriate use of correct figures throughout 3
- (g) scatter graph 1
- (h) **B** 1
- (i) there is no correlation (between the variables)
 allow (all) the points are widely scattered
 allow idea that the person with the longest birth time does not have the highest risk 1

Q5.

(a) 86

allow this answer only

*do **not** accept 85.7*

if no answer given, check for answer in the table

1

(b) as salt concentration increases, percentage of open stomata (in field of view) decreases (above 0.1 mol / dm³)

or

allow percentage of open stomata stays the same between 0.0 and 0.1 (mol / dm³) then decreases as salt concentration increases)

ignore references to number of open stomata

allow converse

allow idea that mean concentration (of salt) in guard cells is between 0.3 and 0.4 mol per dm³

1

(c) use concentrations between 0.3 (mol / dm³) and 0.4 (mol / dm³)

or

draw a graph of the data and read off the value at 50% (open stomata)

allow a list of appropriate concentrations i.e. 0.32 mol / dm³, 0.34 (mol / dm³), 0.36 (mol / dm³) etc.

1

(d) $(\pi \times 0.1875^2) = 0.11$ (mm²)

an answer of 36 scores 3 marks

1

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

1

36 (per mm²)

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

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

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

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

1

(e) (potassium) ions increase the concentration of the solution (inside guard cells)

or

(potassium) ions make cell more concentrated / less dilute

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

1

water moves into the (guard) cell by osmosis

1

cell swells unevenly (so stoma opens) 1

as inner wall is less flexible than outer wall **or** thick part of the wall is less flexible than the thin part (of the wall) 1

[10]

Q6.

(a) vena cava 1

(b) 0.5 mm = 0.05 cm 1

time = $\frac{10.00 - 0.05}{0.4}$
allow alternative correct substitution 1

24.875 1

25 (s)
an answer of 25 (s) scores 4 marks
allow 24 for 3 marks (no conversion of mm to cm)
allow 23.8 / 23.75 for 2 marks (no conversion of mm to cm and incorrect sf) 1

(c) (blood) travels through (the) pulmonary vein 1

(blood) enters left atrium 1

(blood) enters (the) left ventricle 1

(blood) leaves the heart via / through (the) aorta 1

allow blood travels through arterioles
allow blood (travels round the body and) reaches the cells / tissues via / in capillaries 1

ignore ref to valves / systole / diastole throughout

(d) **Level 3 (5-6 marks):**
 Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

Level 2 (3-4 marks):
 Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

Level 1 (1-2 marks):
 Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

No relevant content (0 marks)

Indicative content

S = structural F = functional

- (S) both have a large surface area
- (S) villi have many microvilli
- (S) alveolar walls are not flat / are folded

- (F) to maximise diffusion (of gases) / absorption of (food) molecules

- (S) both have many capillaries / good blood supply / capillaries near the surface
- (F) to maintain concentration / diffusion gradient

- (S) both have thin walls / walls that are one cell thick / one cell thick surface
- (F) to provide a short diffusion distance (for molecules to travel)

- (S) villi have many mitochondria
- (F) to provide energy for active transport (of food molecules)

- (S) cells of the villi have microvilli / more projections
- (F) to further increase the surface area / increase the number of proteins in the membrane / to allow more active transport to take place

[15]

Q7.

- | | |
|--|---|
| (a) 300 | 1 |
| (b) suitable scale on y-axis | 1 |
| label y-axis | 1 |
| 4 bars drawn correctly
<i>allow 1 mark for 3 correct bars</i> | 2 |
| (c) increases from 50 to 500 | 1 |
| then decreases from 500 to 0 | 1 |
| (d) carbohydrates broken down / digested into sugars | 1 |
| broken down by carbohydrase or amylase | 1 |
| (e) absorption of glucose | 1 |

into blood 1

by active transport
allow diffusion 1

[12]

Q8.

(a) active transport 1

(b) by transpiration stream / pull 1

in xylem 1

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

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

allow nail varnish film 3

(d) 1
allow numbers written out in a line with middle number circled 1

(e) $(44 + 41 + 40 + 42 + 39) / 5 = 41.2$ 1

41
allow 41 with no working shown for 2 marks 1
allow 41.2 for 1 mark

(f) less water lost 1

so it does not wilt 1

[11]

Q9.

(a) glucose is absorbed by diffusion into the bloodstream 1

then blood delivers glucose to muscles in capillaries 1

(b) to stop air getting in

- | | |
|--|---|
| | 1 |
| (c) yellow | 1 |
| (d) collect the CO ₂ / gas with a measuring cylinder / gas syringe | 1 |
| (volume collected) in a certain time using a timer / watch | 1 |
| (e) yeast produces ethanol but muscles produce lactic acid
<i>marks can be awarded from correct word or balanced symbol equations</i> | 1 |
| yeast produces CO ₂ but muscles do not
<i>answers must be comparative</i> | 1 |
| both release small amounts of energy
<i>ignore both occur without oxygen</i> | 1 |

[9]

Q10.

- | | |
|--|---|
| (a) $(0.15 / 1.35) \times 100$ | 1 |
| 11.1 (%)
<i>allow 11.1 (%) with no working shown for 2 marks</i> | 1 |
| (b) to allow results to be compared
or
they had different masses at the start | 1 |
| (c) axis correct scale and labelled | 1 |
| 5 points correctly plotted
<i>allow ecf from 05.1</i>
<i>allow 1 mark for 4 points correctly plotted</i> | 2 |
| line of best fit | 1 |
| (d) 0.5
<i>allow 0.45–0.55</i> | 1 |
| (e) (0.0 to 0.4) water moves into cells | 1 |

(0.6 to 0.8) water leaves cells

1

by osmosis

1

- (f) any **two** from:
- concentration of solutions
 - drying of chips
 - accuracy of balance
 - evaporation from tubes

2

[13]

Q11.

Level 3 (5–6 marks):

A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human circulatory system. The response makes logical links between content points.

Level 2 (3–4 marks):

The response is mostly relevant and with some logical explanation. Gives a broad understanding of the human circulatory system. The response makes some logical links between the content points.

Level 1 (1–2 marks):

Simple descriptions are made of the roles of some of the following: heart function, gas exchange, named blood vessels, named blood cells. The response demonstrates limited logical linking of points.

0 marks:

No relevant content.

Indicative content

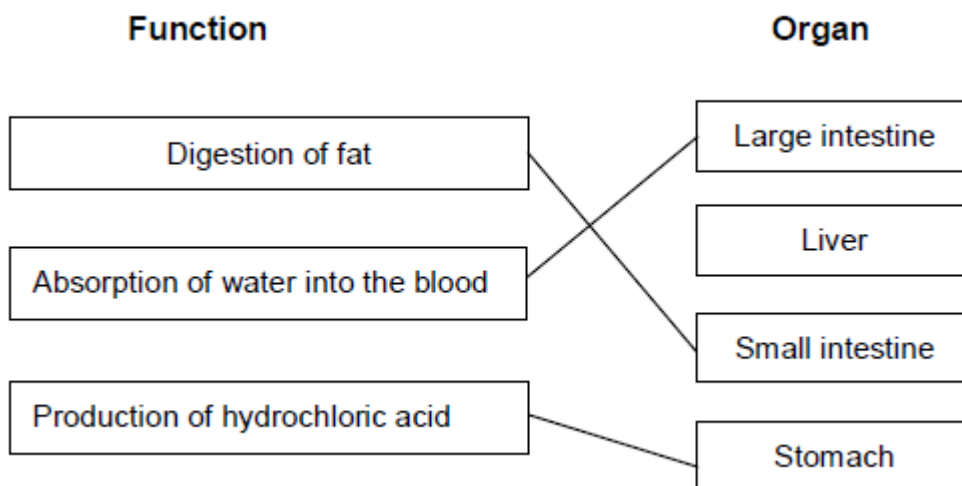
- dual / double circulatory system which means that it has higher blood pressure and a greater flow of blood to the tissues
- heart made of specialised (cardiac) muscle cells which have long protein filaments that can slide past each other to shorten the cell to bring about contraction for pumping blood
- heart pumps blood to lungs in pulmonary artery so that oxygen can diffuse into blood from air in alveoli
- blood returns to heart via pulmonary vein where muscles pump blood to the body via aorta
- oxygen carried by specialised cells / RBCs which contain haemoglobin to bind oxygen and have no nucleus so there is more space available to carry oxygen
- arteries carry oxygenated blood to tissues where capillaries deliver oxygen to cells for respiration and energy release
- thin walls allow for easy diffusion to cells
- large surface area of capillaries to maximise exchange
- waste products removed eg CO₂ diffuse from cells into the blood plasma
- blood goes back to the heart in veins which have valves to prevent backflow
- cardiac output can vary according to demand / is affected by adrenaline

accept annotated diagrams

[6]

Q12.

- (a) (i) large intestine = **E** 1
 small intestine = **D** 1
 stomach = **B** 1



- (ii) *extra lines cancel* 3

- (b) The concentration in the blood is lower. 1

[7]

Q13.

- (a) diffusion 1
active transport 1

this order only

- (b) (i) concentration (of sugar) in the bag was higher (than in the drink)
allow concentration (of sugar) in the drink was lower (than in the bag)

or

higher concentration of water outside the bag **or** in the drink / boiling tube
*allow higher water potential outside the bag **or** lower water potential inside the bag*

1

(so) water moved in (to the tubing)
*allow water moves down **its** concentration gradient*
*do **not** allow sugar moving*

1

by osmosis

allow diffusion (of water)
*do **not** allow sugar moving by osmosis **or** water moving by active transport*

1

(ii) **B**

1

(iii) close(st) to the concentration in the bag **or** to 5%
*allow small(est) diffusion gradient **or** close(st) to an equilibrium*

1

(so rate of) diffusion / osmosis is slow
allow (so) less water moves in (to the bag)
ignore ref. to sugar

1

[8]

Q14.

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

Level 3 (5–6 marks):

Processes used for obtaining specified materials are given.

and

correctly linked to the vessels that the materials are transported in

or

correctly linked to a description of the direction of movement of the materials.

For full credit, in addition to the above descriptors at least **one** of the processes must be linked to the vessel that the material is transported in **and** the direction of the movement of the material.

Level 2 (3–4 marks):

At least **one** process for obtaining a specified material is given

and

is correctly linked to the vessel that the material is transported in

or

correctly linked to a description of the direction of movement of the material

Level 1 (1–2 marks):

At least **one** process (P) for obtaining a material is given

or

at least **one** vessel (V) and the material it carries is given

or

there is a description of the direction of movement (M) for at least **one** material

0 marks:

No relevant points are made

examples of points made in the response ions:

(P) taken up by diffusion or active transport

- from an area of high to low concentration (diffusion) **or** an area of low to high concentration (active transport)

(V) travels in the xylem
 (M) to the leaves **or** from the roots / soil

Water:

(P) taken up by osmosis

- from an area of low to high concentration
 - allow high concentration of water to low concentration of water*
 - allow from high water potential to low water potential*
 - ignore along a concentration gradient*

(V) travels in the xylem
 (M) to the leaves **or** from the roots / soil

- (P) transpiration stream
- movement replaces water as it evaporates from leaves
 (V) in the xylem

Sugar:

(P) made during photosynthesis

(V) travels in the phloem

(M) to other parts of the plant **or** to storage organs **or** travels up and down

[6]

Q15.

- | | | | |
|-----|-------|---|---|
| (a) | (i) | nucleus | 1 |
| | (ii) | diffusion | 1 |
| (b) | | increases / larger surface area (for diffusion)
<i>ignore large surface area to volume ratio</i> | 1 |
| (c) | (i) | sugar / glucose
<i>accept amino acids / other named monosaccharides</i> | 1 |
| | (ii) | against a concentration gradient
or
from low to high concentration | 1 |
| | (iii) | (active transport requires) energy

(from) respiration | 1 |
| (d) | | minerals / ions
<i>accept named ion ignore nutrients</i>
do not accept water | 1 |

[8]

Q16.

(a)

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

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

2

(b) (i) diffusion
allow phonetic spelling

1

(ii) glucose

1

(iii) mitochondria

1

[5]

Q17.

(a) (i) alveoli / alveolus
allow air sacs
allow phonetic spelling

1

(ii) any **one** from:
 • protection (of lungs / heart)
 • help you breathe / inflate lungs.

1

(b) (i) diffusion

1

(ii) capillaries

1

(iii) any **two** from:
 • (have many) alveoli
allow air sacs
 • large surface / area
 • thin (exchange) surface **or** short diffusion pathway

- *accept only one / two cell(s) thick*
good blood supply / many capillaries
allow (kept) ventilated or maintained concentration gradient.

2

[6]

Q18.

- (a) (i) water / H₂O

accept oxygen

allow H₂O

*do **not** allow H²O or H₂O*

1

- (ii) the mineral ions are absorbed by active transport

1

the absorption of mineral ions needs energy

1

- (iii) have (many root) hairs

1

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

1

- (b) carbon dioxide in

or

oxygen out

or

control water loss

accept gas exchange

ignore gases in and out

ignore gain / lose water

1

- (c) (i) guard cells

1

- (ii) (stomata are) closed

allow there is no gap / space

1

- (iii) plant will wilt / droop

ignore die

1

[9]

Q19.

- (a) (i) has the least amount of glucose

*allow least amount of fat **or** no fat*

1

(to) transfer energy (for the run)
allow (to) release energy (for the run)
*do **not** allow produces energy*
*do **not** allow 'energy for respiration'*

1

(ii) any **one** from:

- cells will work inefficiently
- absorb too much water / swell / overhydrate
- lose too much water / shrink / dehydrate

ignore turgid / flaccid
cells burst is insufficient
allow cramp in muscle.

1

(b) any **three** from:

- thermoregulatory centre
- (has temperature) receptors
- (which) monitor blood temperature (as it flows through the brain)
- (temperature) receptors in the skin
- (receptors) send impulses to the brain

ignore vasoconstriction / vasodilation / sweating
allow hypothalamus
impulses sent to the thermoregulatory centre = 2 marks.

3

(c) (i) (sports drinks) contain a lot of glucose

1

(a person with diabetes) does not produce insulin **or** does not produce enough insulin

allow (person with diabetes) has cells which do not respond to insulin
*do **not** allow insulin produced by liver*

1

so blood glucose / sugar levels will rise too high **or** to a dangerous level

1

(ii) inject insulin
or
 have an insulin pump (fitted)
*do **not** allow swallow insulin*
accept exercise
accept inhale insulin
*accept take metformin **or** other correctly named drug*
allow pancreatic transplant

1

[10]

Q20.

(a) (i) diaphragm

- accept phonetic spelling* 1
- (ii) (because) the volume (inside the jar) increases 1
*maximum **two** marks if no reference to correct part of model*
- (causing) the pressure to decrease 1
- (and) air enters the balloon 1
allow oxygen
- (b) (i) (so it moves by) diffusion 1
*do **not** allow osmosis or active transport*
- from a high concentration (of oxygen) to a low concentration 1
allow down its / oxygen concentration gradient from the air
***or** to the blood*
- or**
 (because) there is a high(er) concentration (of oxygen) in the air **or** there
 is a low(er) concentration of oxygen in the blood 1
ignore reference to amount of oxygen
- (ii) many gill filaments 1
must be in the correct pairs to gain 2 marks
- (give a) large surface / area 1
*do **not** allow surface area to volume ratio*
- or**
 thin
- (so) short diffusion pathway 1
- or**
 good blood supply
- (to) maintain the concentration gradient
- or**
 water continually flows over them / continually ventilated 1
 (to) maintain the concentration gradient

[8]

Q21.

- (a) (i) diffusion 1
- (ii) carbon dioxide 1
accept CO₂ / CO2
*do **not** accept CO²*

- (iii) red blood cells 1
- (b) 70 2
- if no / incorrect answer then*
70 000 000
or
280 x 0.25 gains 1 mark
ignore doubling the answer
- (c) allows more gas / oxygen / CO₂
 (exchange) 1
- do **not** accept air*

[6]

Q22.

- (a) more concentrated 1
- must be a comparison*
- than the cell / cytoplasm 1
- accept more salty / solutes / ions*
accept cell is less concentrated than solution for 2 marks
- (b) (i) turgid 1
- (ii) plasmolysed 1
- accept flaccid*
- (c) any **four** from: 4
- water left the cell (in A)
 - by osmosis
 - from dilute to more concentrated solution
accept high to low water potential or from high to low water concentration
 - via partially permeable membrane
 - so cell membrane shrank away from cell wall
- (d) water enters the cells (by osmosis) 1
- allow 1 mark for:*
- they burst / lyse / lysis occurs 1
- water leaves and cell shrinks (if they think it is hypertonic solution)*

animal cells have no cell wall **or** plant cells have a cell wall

1

cell wall prevents lysis / bursting / allows turgidity

allow correct description

1

[12]

Q23.

(a) (i) chloroplast

1

(ii) cell wall

1

(b) (i) osmosis

accept diffusion

1

(ii) cell wall (prevents bursting)

1

(c) (i) carbon dioxide

allow correct formula

1

glucose

allow sugar / starch

1

(ii) any **two** from:

- light sensitive spot detects light
- tells flagellum to move towards light
- more light = more photosynthesis

2

(d) (cell has) larger SA:volume ratio

1

short (diffusion) distance

allow correct description

1

(diffusion) via cell membrane is sufficient / good enough

or

flow of water maintains concentration gradient

1

[11]

Q24.

(a) (i) xylem

1

- (ii) water 1
- minerals / ions / named example(s)
ignore nutrients 1
- (b) (i) movement of (dissolved) sugar 1
allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)
allow nutrients / substances / food molecules if sufficiently qualified
ignore food alone
- (ii) sugars are made in the leaves 1
 so they need to be moved to other parts of the plant for respiration / growth / storage 1
- (c) (i) mitochondria 1
- (ii) for movement of minerals / ions 1
Do not accept 'water'
 against their concentration gradient 1

[9]

Q25.

- (a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies
- or**
- one worm to light to measure change
do not allow more accurate / more precise
ignore fair test / valid / repeatable / reproducible 1
- (ii) remove solution / liquid (on outside of worm)
allow 'water' 1
- (iii) variable amounts removed from each worm
ignore reference to length of timing 1
- (iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration

- intervals
allow reference to improve blotting technique eg blot before / blot more thoroughly 1
- (b) (i) different (starting) masses / sizes / weights (at different concentrations) 1
- allows comparisons / shows pattern / shows trend 1
- (ii) (+)20
correct answer = 2 marks, with or without working
or

$$\frac{7.5 \times 100}{37.5} \quad / \quad \frac{7.5}{37.5} \quad / \quad \frac{(45.0 - 1) \times 100}{37.5}$$
for 1 mark 2
- (c) (i) graph:
- points correct
allow ± 1 mm
-1 mark per error
allow ecf from part b(ii) 2
- label on x-axis including units – ie Concentration of salt in arbitrary units 1
- line of best fit = smooth curve / ruled straight line
anomaly (4.0, -52) either plotted and ignored re. line
or not plotted
do not allow point to point
allow best fit for ecf from 2bii 1
- (ii) on graph:
- ring drawn around point at (4.0, -52)
allow (5.0, -50) if cand. line indicates this 1
- (iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% / different length of time in solutions / ref to error in blotting / balance not zeroed / error in weighing
allow some lugworms died
allow error in calculation 1
- (d) (i) 2.9 to 3.0 / correct for candidate's graph ± 0.1 1
- value of no change in mass / worms in equilibrium with soln / described

allow small(est) mass change

1

(ii) water loss

1

by osmosis / diffusion

1

from dilute region in the worm to more concentrated solution outside

allow correct description in terms of high to low water concentration / high to low water potential

salt solution is hypertonic

concentration unqualified = salt concentration

1

[19]

Q26.

(a) motor

allow efferent / postsynaptic

*allow **another** relay (neurone)*

1

(b) release of chemical (from relay neurone)

allow ecf for 'motor' neurone from (a)

allow release of neurotransmitter / named example

1

chemical crosses gap / junction / synapse

allow diffuses across

allow chemical moves to X

1

chemical attaches to X / motor / next neurone (causing impulse)

1

(c) (curare) decrease / no contraction

accept (muscle) relaxes

1

(strychnine) increase / more contraction

*if no other mark awarded allow 1 mark for (curare) decrease / no response **and** (strychnine) increase / more response*

1

[6]

Q27.

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

0 marks

No relevant content.

Level 1 (1 – 2 marks)

An example is given of a named substance

or

a process

or

there is an idea of why diffusion is important eg definition.

Level 2 (3 – 4 marks)

At least one example of a substance is given

and

correctly linked to a process in either animals or plants.

Level 3 (5 – 6 marks)

There is a description of a process occurring in either animals or plants that is correctly linked to a substance

and

a process occurring in the other type of organism that is correctly linked to a substance.

examples of points made in the response

Importance of diffusion:

- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:

- for gas exchange / respiration: O₂ in / CO₂ out
- for gas exchange / photosynthesis: CO₂ in / O₂ out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine
- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information

Description of processes might include:

- *movement of particles / molecules / ions*
- *through a partially permeable membrane*
- *(movement of substance) down a concentration gradient*
- *osmosis: turgor / support / stomatal movements*

[6]

Q28.

(a) osmosis

1

partially permeable

1

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

allow correct answers in terms of A

- vacuole is small(er)
- cytoplasm has shrunk
allow cytoplasm is smaller
- gap between cytoplasm and cell wall
- cell wall curves inwards
allow cell B is flaccid or cell A is turgid
- the (cell) membrane has moved away from the wall

2

(ii) any **one** from:

- water will move / diffuse in
- (cells) will swell
- (cells) will burst
ignore turgid

1

(c) villi give the small intestines a large surface area

1

villi have many blood capillaries

1

[7]

Q29.

(a) any **three** from:

- (water through a) partially permeable
accept 'semi permeable' / selectively permeable
- membrane
- from dilute to (more) concentrated solution
allow 'from a high concentration of water to a lower concentration (of water)'
allow 'from high water potential to low water potential'
allow 'down a concentration gradient of water'
do not accept 'along a concentration gradient of water'
- (it's a) passive (process)
allow requires no energy

3

(b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

ignore absorption

1

[6]

Q30.

- (a) (i) A = nucleus 1
- B = (cell) membrane 1
- (ii) any **two** from:
- ignore shape*
- no (cell) wall
 - no (large / permanent) vacuole
 - no chloroplasts / chlorophyll 2
- (b) because high to low oxygen / concentration **or** down gradient
- allow 'more / a lot of oxygen molecules outside'*
- ignore along / across gradient* 1
- (c) a tissue 1

[6]

Q31.

- (a) (i) mitochondrion / mitochondria
- must be phonetically correct* 1
- (ii) carbon dioxide / CO₂ 1
- water / H₂O 1
- in either order*
- accept CO₂ but **not** CO²*
- accept H₂O **or** HOH but not H²O*
- (iii) diffusion 1
- high to low concentration
- allow down a concentration gradient* 1
- through (cell) membrane **or** through cytoplasm
- do **not** accept cell wall* 1
- (b) ribosomes make proteins / enzymes 1

using amino acids 1

part A / mitochondria provide the energy for the process
allow ATP
*do **not** accept produce or make energy* 1

[9]

Q32.

(a) **A** sperm 1

B egg 1

C fertilised egg 1

D embryo 1

(b) insert into mother
ignore fertilise / check fertilisation / check viability 1

womb / uterus 1

(c) (i) one quarter 1

(ii) no / little chance of success over 42 1

reference to table of only two women in the age bracket 40-42 years became pregnant

the statement 'only 2 out of 53 40-42 year old women became pregnant / had babies' gains 2 marks

1

(iii) so fewer twins / multiple births
or
 multiple births more dangerous 1

[10]

Q33.

(a) (i) diffusion
apply list principle 1

(ii) **A**
apply list principle

- 1
- (b) (i) osmosis
apply list principle
- 1
- (ii) **R**
apply list principle

1
[4]

Q34.

- (a) **B**
- 1
- no mark for "B" alone, the mark is for B **and** the explanation.*
- large(r) surface / area **or** large(r) membrane
accept reference to microvilli
ignore villi / hairs / cilia
accept reasonable descriptions of the surface eg folded membrane / surface
*do **not** accept wall / cell wall*

- (b) (i) any **one** from:
- (salivary) amylase
 - carbohydrase
- 1
- (ii) many ribosomes
*do **not** mix routes. If both routes given award marks for the greater.*
- 1

ribosomes produce protein
accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

many mitochondria (1)

mitochondria provide energy to build / make protein (1)
accept ATP instead of energy

1

[4]

Q35.

- (a) both parents **Aa**
*accept other upper and lower case letter without key **or***

*symbols with a key
 allow as gametes shown in Punnett square*

1

aa in offspring correctly derived from parents
or

aa correctly derived from the parents given

ignore other offspring / gametes

for this mark parents do not have to be correct

1

offspring **aa** identified as having cystic fibrosis

*may be the only offspring shown **or** circled / highlighted /
 described*

1

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

*accept converse if clear, eg if you (only) took one it might
 have cystic fibrosis / might not be fertilised*

- (more) sure / greater chance of healthy / non-cystic fibrosis egg /
 embryo / child

accept some may have the allele

reference to 'suitable / good embryo' is insufficient

- greater chance of fertilisation

1

(ii) **advantages**

**to gain 3 marks both advantage(s) and disadvantage(s)
 must be given**

max 3

any **two** from:

*ignore references to abortion unless qualified by later
 screening*

- greater / certain chance of having child / embryo without cystic
 fibrosis / healthy
- child with cystic fibrosis difficult / expensive to bring up
- cystic fibrosis (gene / allele) not passed on to future generations

disadvantages

any **two** from:

- operation dangers / named eg infection

ignore risk unqualified

- ethical or religious issues linked with killing embryos

accept wrong / cruel to embryos accept right to life argument

ignore embryos are destroyed

- (high) cost of procedure
- possible damage to embryo (during testing for cystic fibrosis / operation)

plus

conclusion

a statement that implies a qualified value judgement
eg it is right because the child will (probably) not have cystic fibrosis even though it is expensive

or

eg it is wrong because embryos are killed despite a greater chance of having a healthy baby

***note:** the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage is made*

*do **not** award the mark if the conclusion only states that advantages outweigh the disadvantages*

1

(c) any **three** from:

- osmosis / diffusion
*do **not** accept movement of ions / solution by osmosis / diffusion*
- more concentrated solution outside cell / in mucus
assume concentration is concentration of solute unless answer indicates otherwise or accept correct description of 'water concentration'
- water moves from dilute to more concentrated solution
allow correct references to movement of water in relation to concentration gradient
- partially permeable membrane (of cell)
allow semi / selectively permeable

3

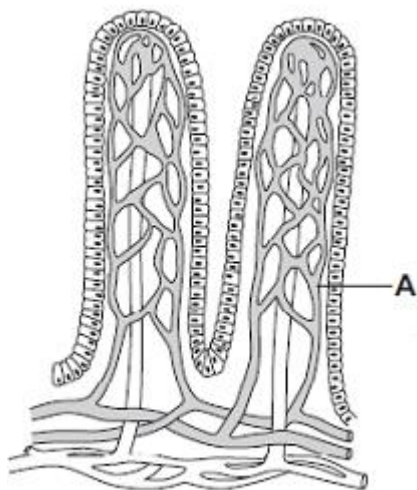
[11]

Q1.

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)

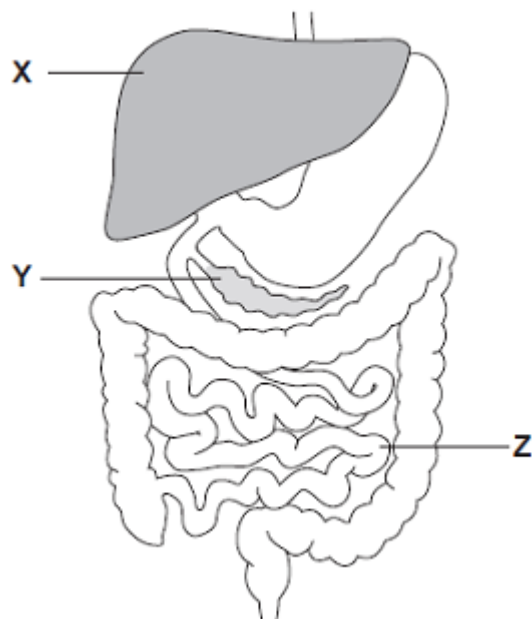
(ii) The villi absorb the products of digestion by

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.

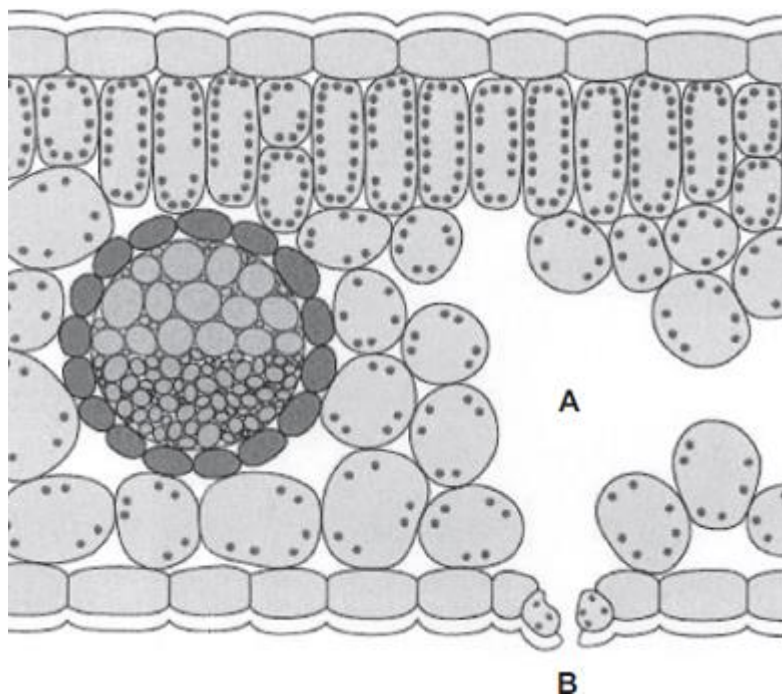
Why is it helpful to have lots of villi?

(1)

(Total 4 marks)

Q2.

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)

Q3.

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*?

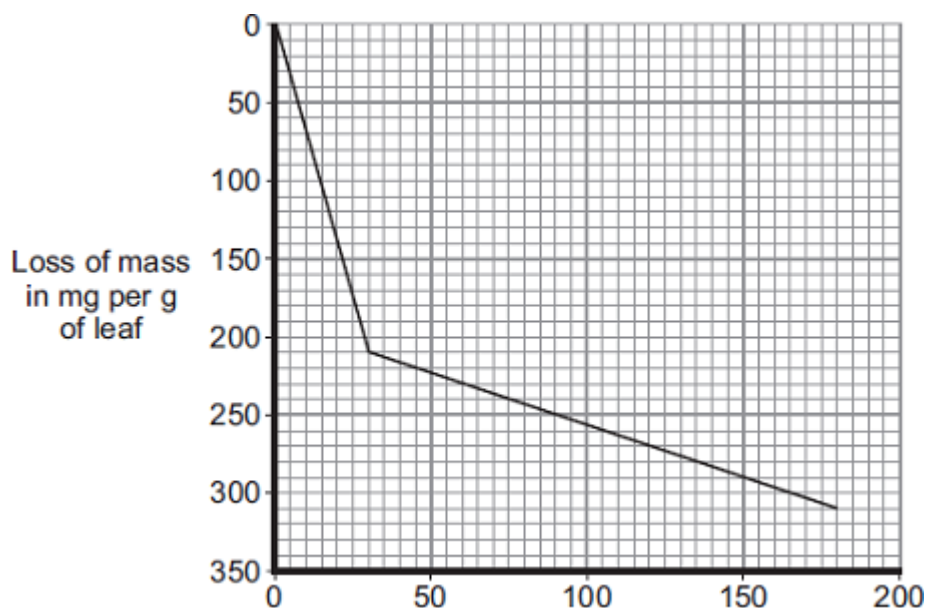
(3)

- (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)

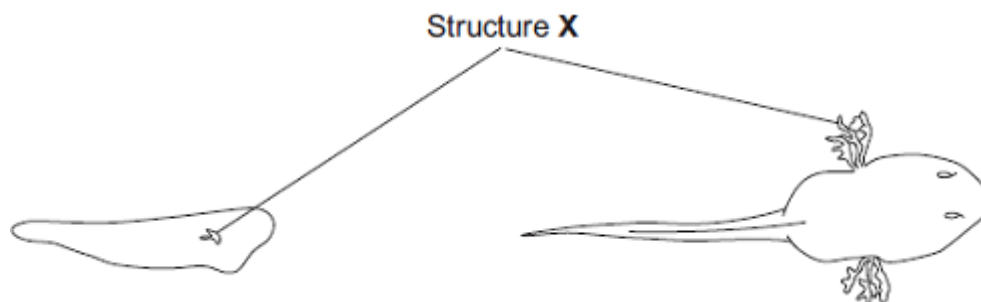
(Total 11 marks)

Q4.

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**.

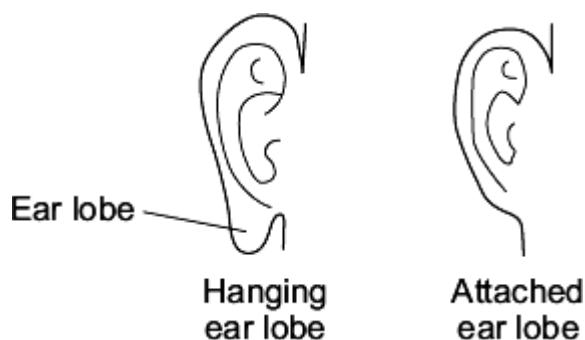
(4)

(Total 5 marks)

Q5.

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

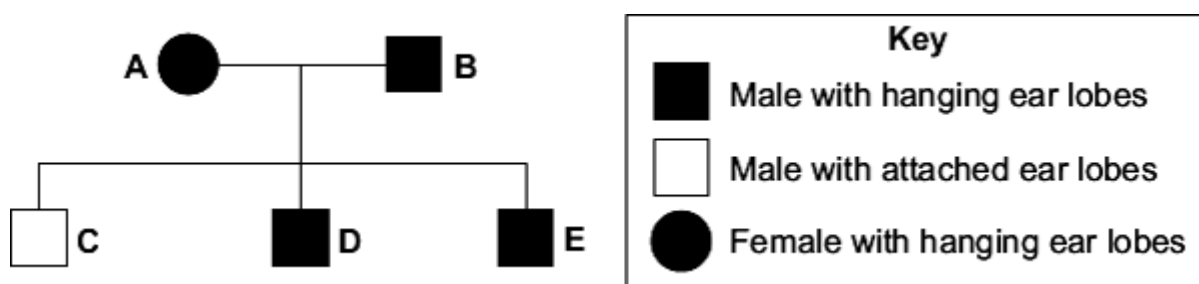
The diagrams show the two shapes of ear lobe.



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)

Q6.

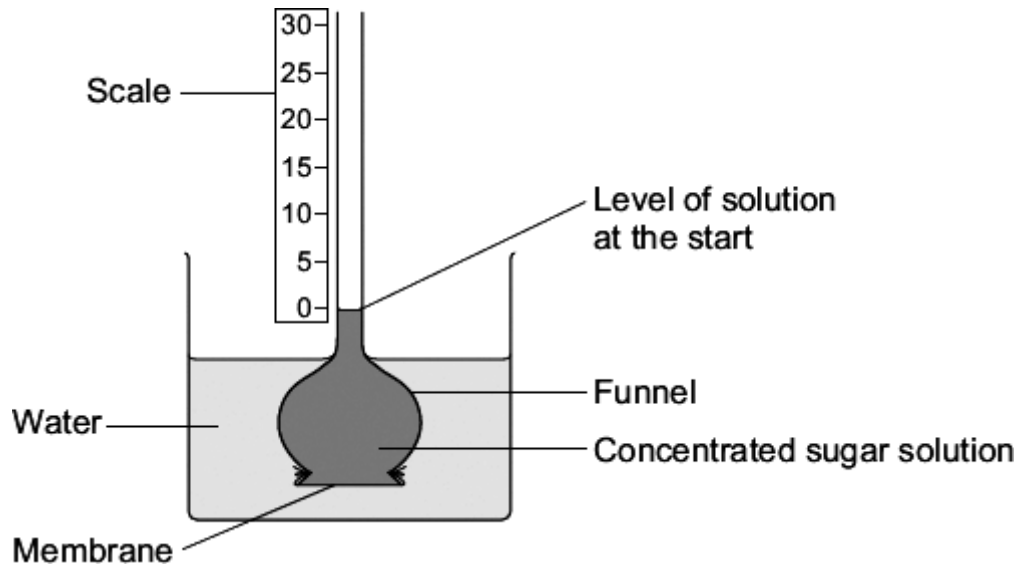
Some substances move through membranes.

A student set up an investigation.

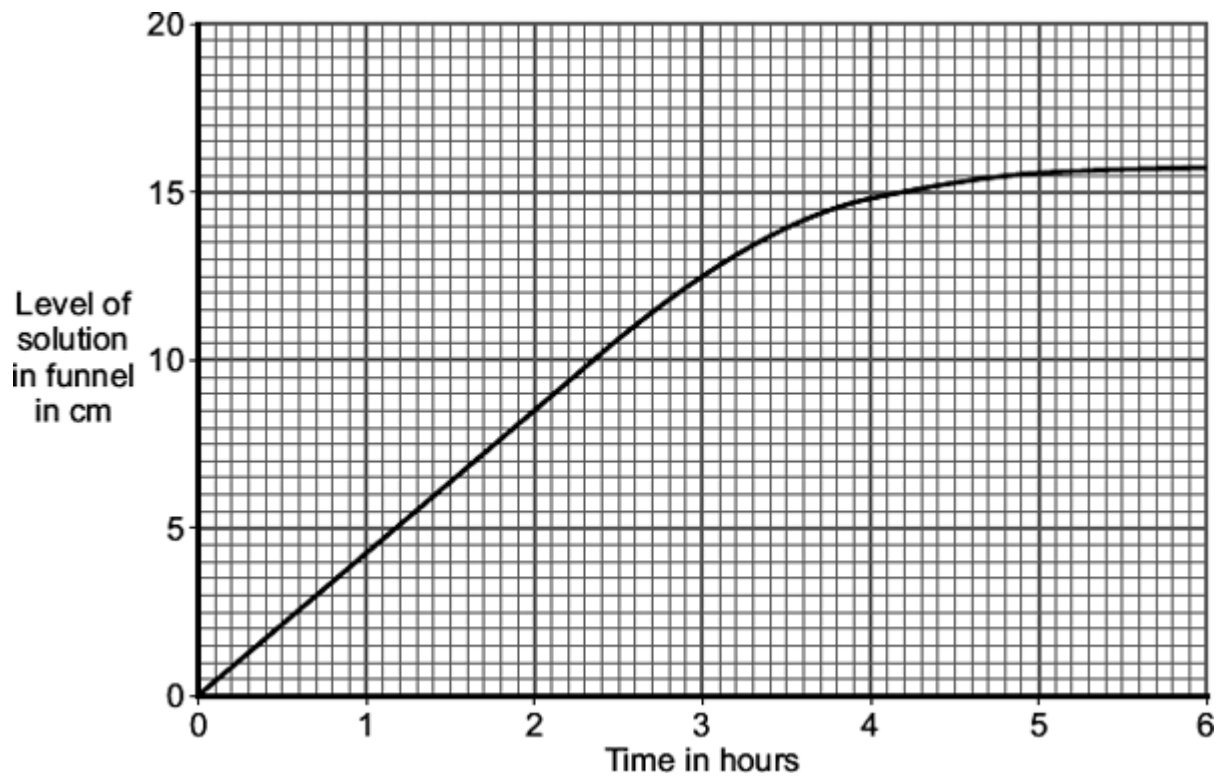
The student:

- 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?

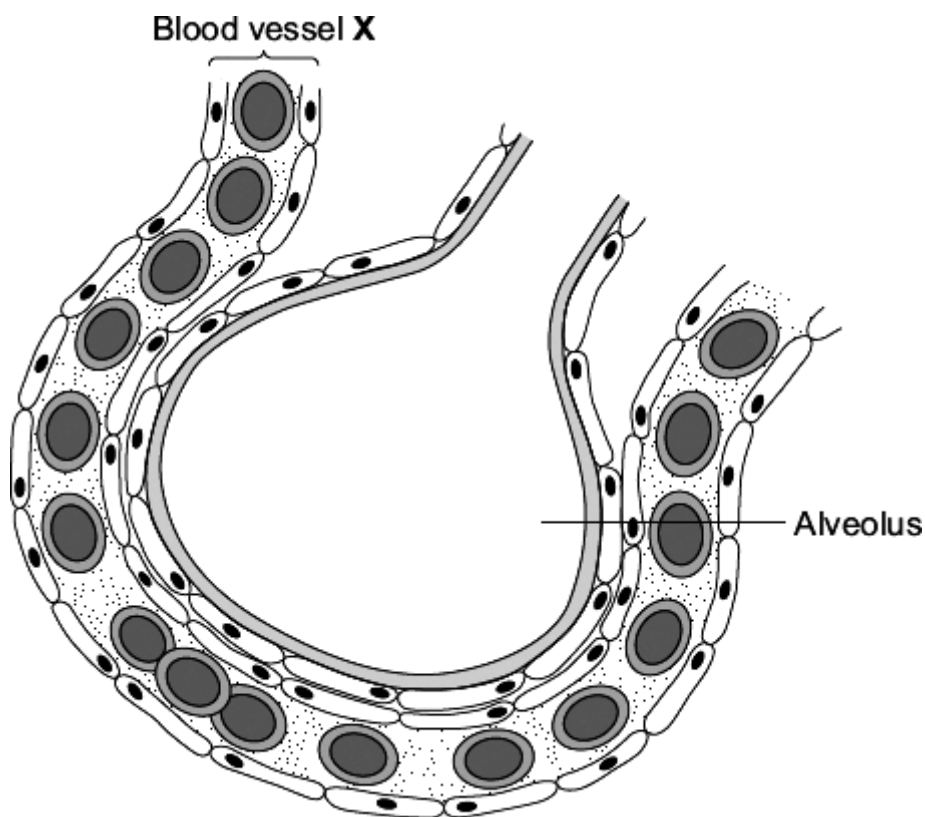
Give the reason for your answer.

(2)

(Total 5 marks)

Q7.

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)

Q8.

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. _____

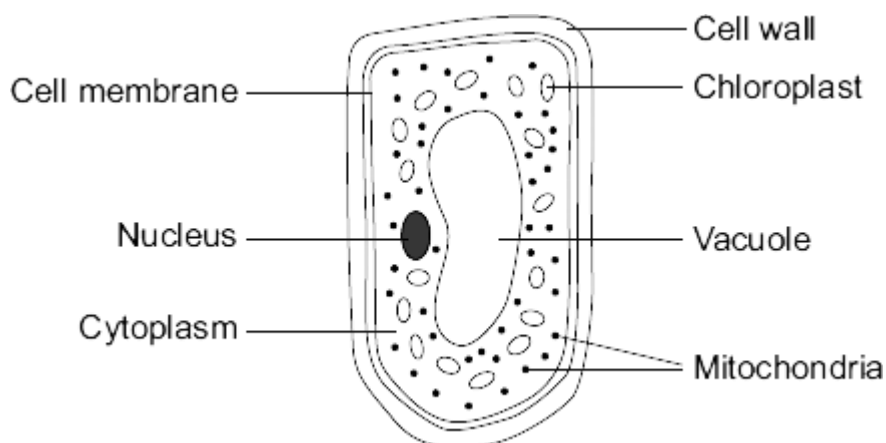
2. _____

(2)

(Total 6 marks)

Q9.

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)

Q10.

(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)

Q11.

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)

Q12.

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

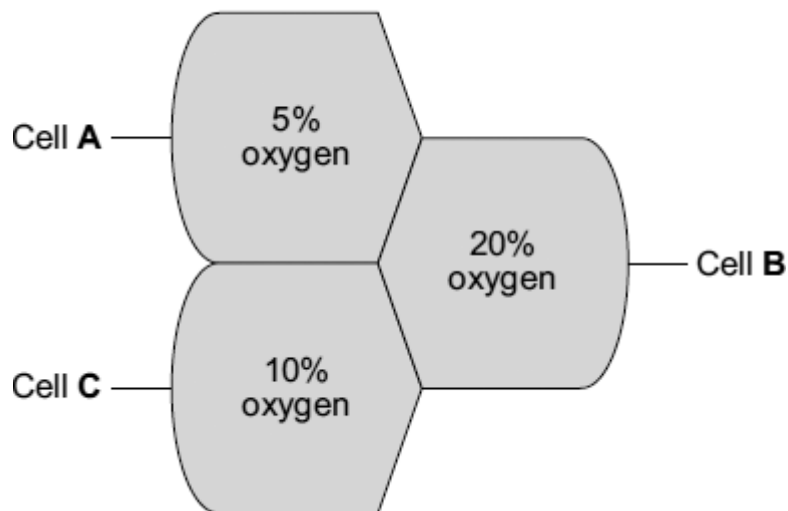
digestion

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

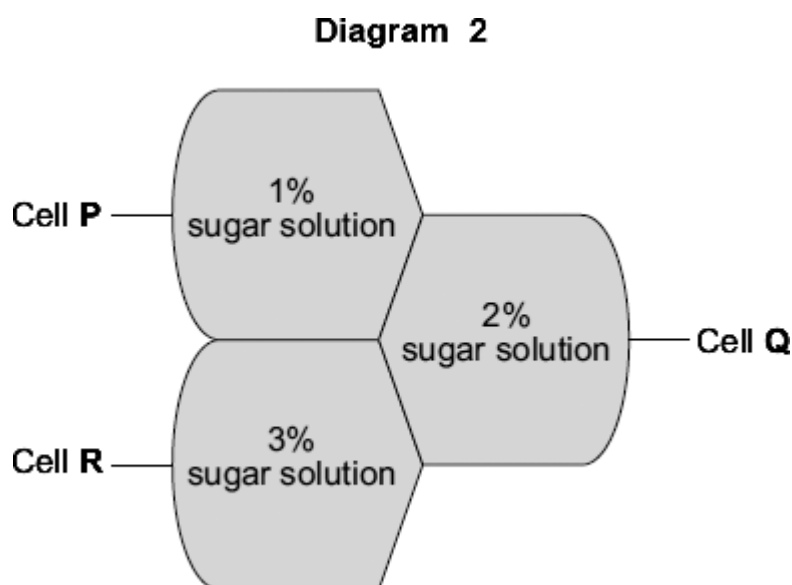
respiration

(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**.



Water can move from cell to cell.

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

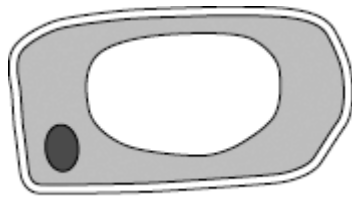
(1)

(Total 4 marks)

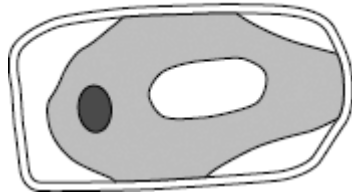
Q13.

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)

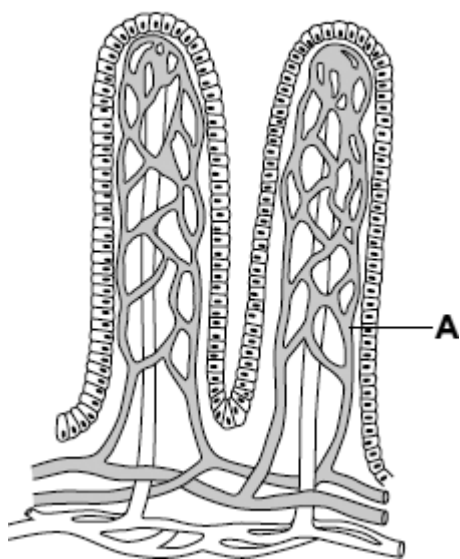
(Total 4 marks)

Q14.

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)

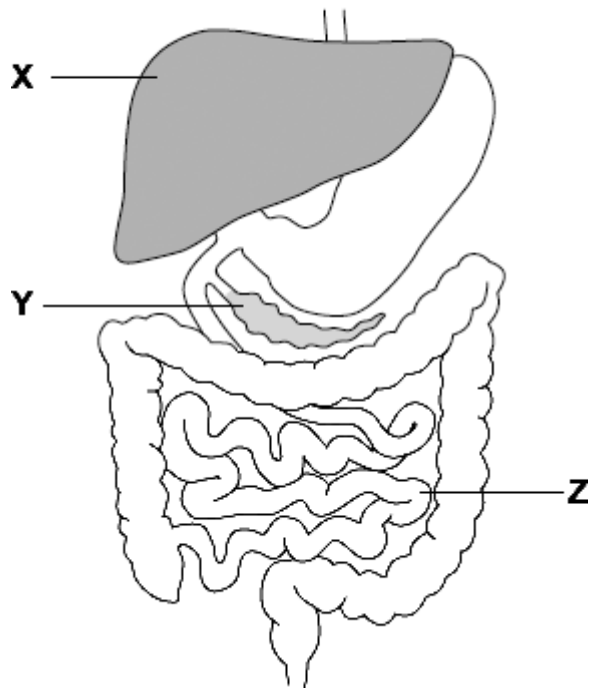
(ii) The villi absorb the products of digestion by

- 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.

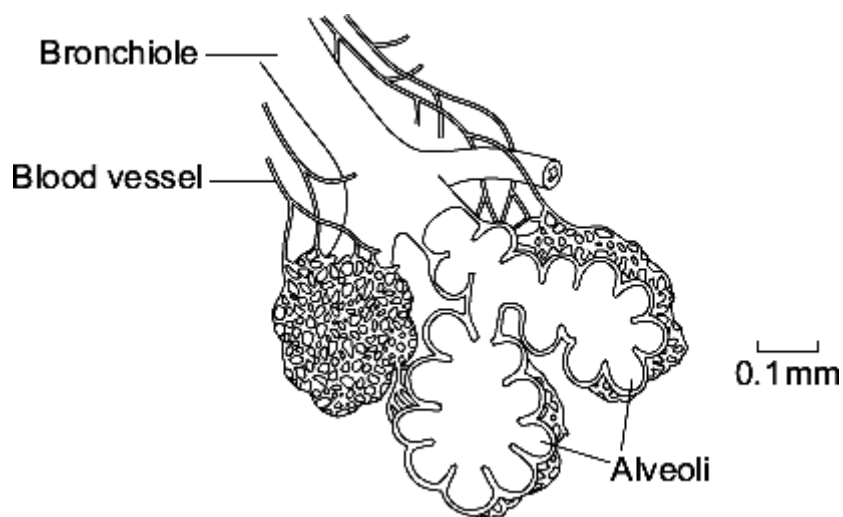
Why is it helpful to have lots of villi?

(1)

(Total 4 marks)

Q15.

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)

Q16.

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

(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?

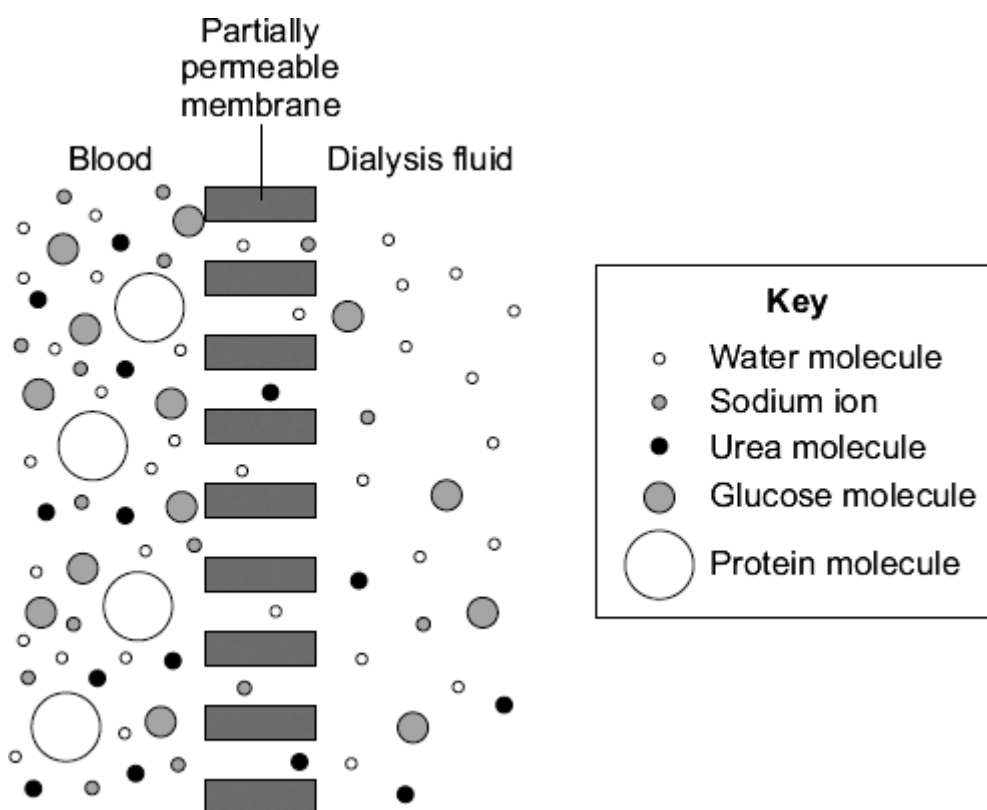
(1)

(Total 4 marks)

Q18.

Dialysis can be used to treat a person with kidney disease.

The diagram shows blood and dialysis fluid separated by a partially permeable membrane.



Blood plasma and dialysis fluid contain several substances dissolved in water.

The table shows the concentrations of some of these substances in dialysis fluid and in the blood plasma of a person with kidney disease immediately before dialysis.

Substance	Concentration of substance in grams per dm ³	
	Blood plasma of person with kidney disease	Dialysis fluid
Sodium ions	3.26	3.15
Urea	0.45	0.00
Glucose	0.90	0.99
Protein	60.00	0.00

- (a) Protein molecules are **not** able to move from the blood to the dialysis fluid. Use information from the diagram to explain why.

(1)

- (b) Urea molecules move from the blood into the dialysis fluid.

(i) Give the name of this type of movement. _____

(1)

(ii) Why do the urea molecules move in this direction?

Use information from the table to help you to answer this question.

(1)

- (c) The concentration of sodium ions in the blood plasma will change during dialysis.

Suggest a value for the concentration of sodium ions in the plasma at the end of dialysis.

Use information from the table.

Concentration of sodium ions = _____ grams per dm³

(1)

- (d) For most patients a kidney transplant is better than continued treatment by dialysis.

(i) Give **two** advantages of having a kidney transplant rather than treatment by dialysis.

1. _____

2. _____

(2)

(ii) Give **two** possible disadvantages of having a kidney transplant.

1. _____

2. _____

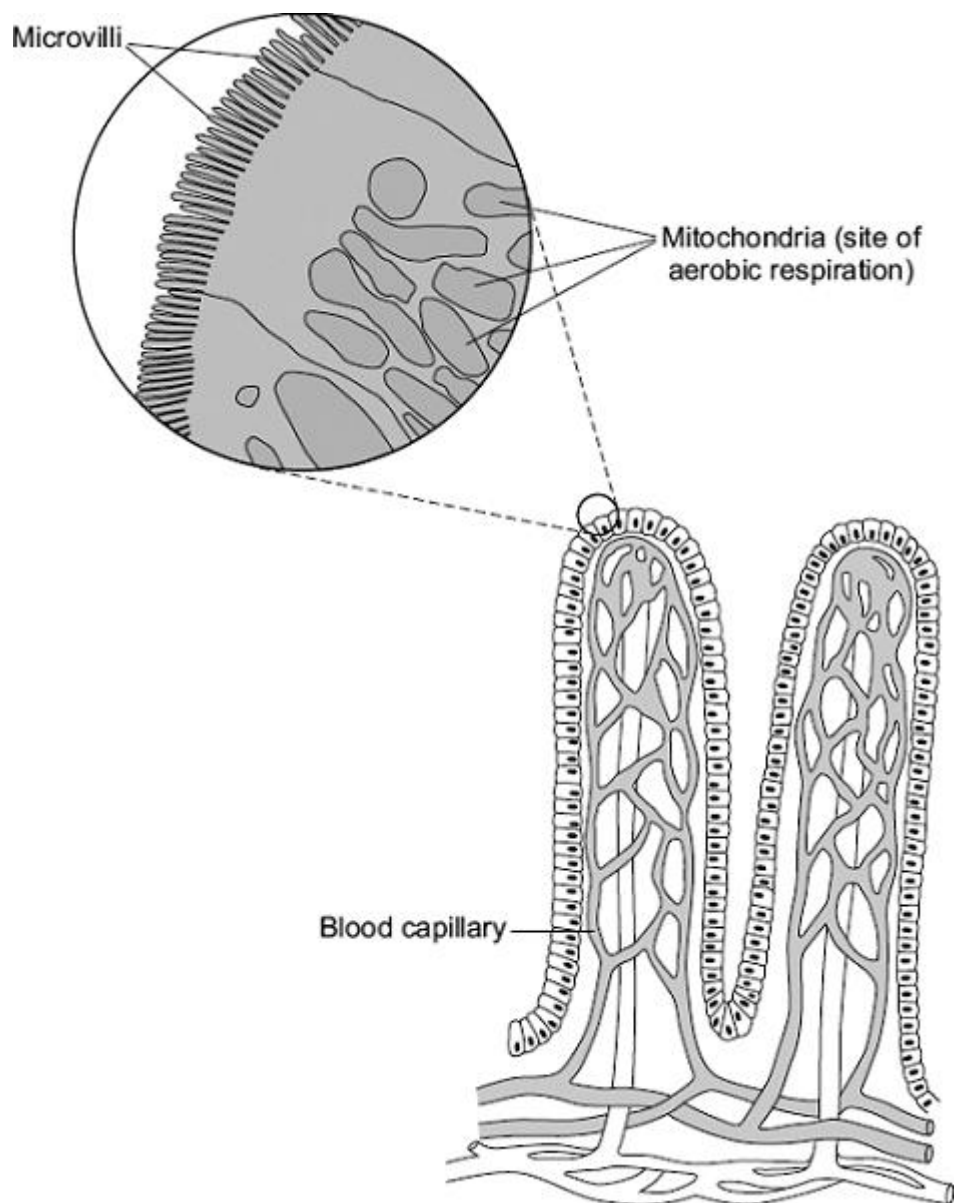
(2)

(Total 8 marks)

Q19.

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.

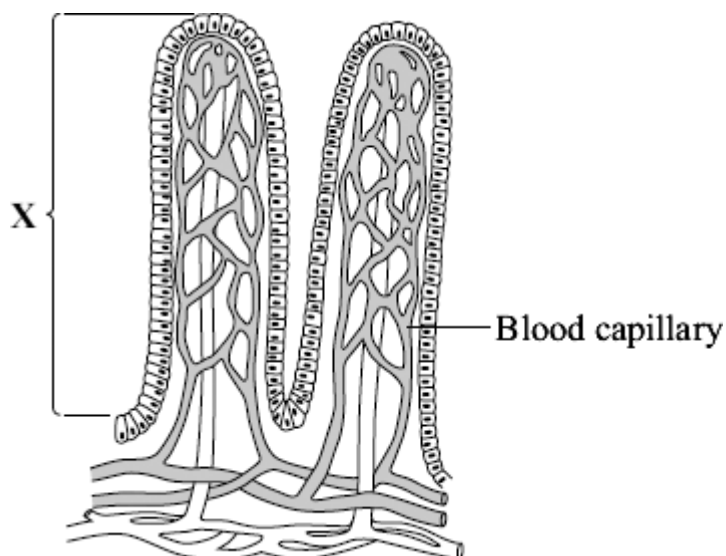


Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

(Total 5 marks)

Q20.

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.

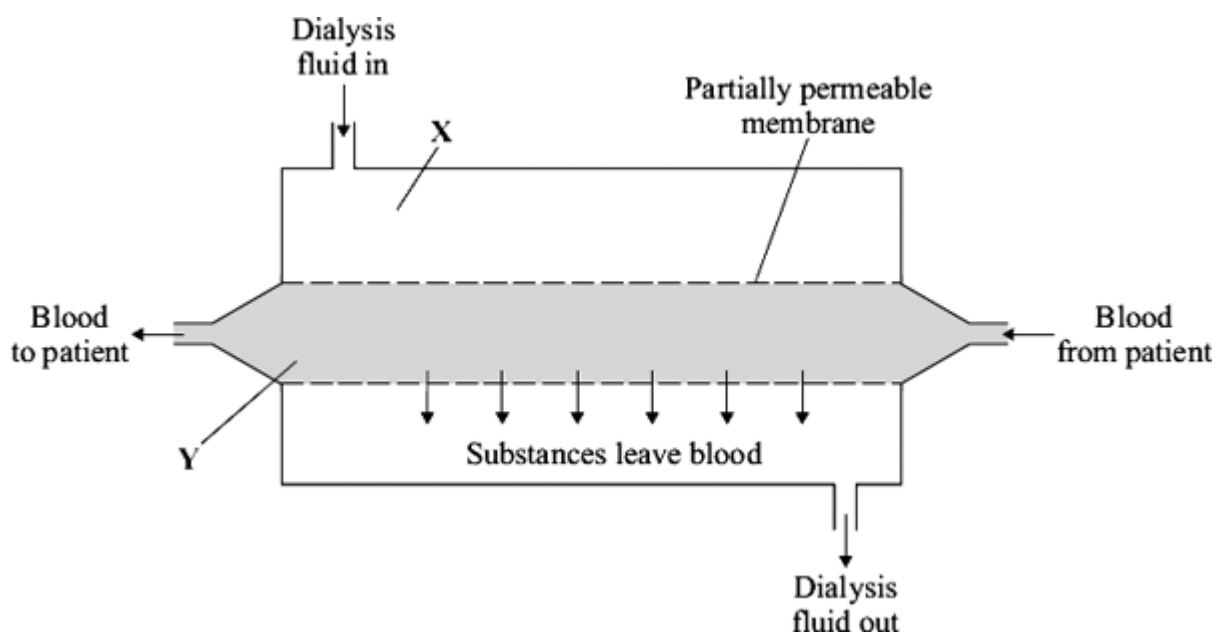
diffusion **fermentation** **transpiration**

(1)

(Total 5 marks)

Q21.

People with kidney disease may be treated by dialysis.
The diagram shows a dialysis machine.



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

A person loses mass during dialysis. One patient lost 2.2 kilograms during a dialysis session.

(i) This person lost mass mainly because the substance

- | |
|------|
| salt |
| urea |

water

was removed from the blood.

(1)

(ii) This substance was able to pass through the partially permeable membrane

because its molecules are

large.
round.
small.

(1)

(iii) The concentration of sodium ions at **X** is 3.15 grams per dm³.

At the end of a dialysis session, the most likely concentration of sodium ions

at **Y** would be

0.00
3.15
6.85

grams per dm³.

(1)

(b) The table shows the cost, in the UK, of treating one patient who has kidney disease.

Treatment	Cost per year in pounds
Dialysis	30 000
Kidney transplant: operation + first year's medical care medical care in each further year	51 000 5 000

(i) During the first year, dialysis treatment is cheaper than a kidney transplant.

How much cheaper is dialysis treatment? _____ pounds

(1)

(ii) After some time, the cost of treating a patient by a transplant operation would be cheaper than continual treatment by dialysis.

How many years would it take?

Draw a ring around **one** answer.

2 years

3 years

4 years

(1)

- (iii) A transplant patient needs to take drugs for the rest of his life to suppress the immune system.

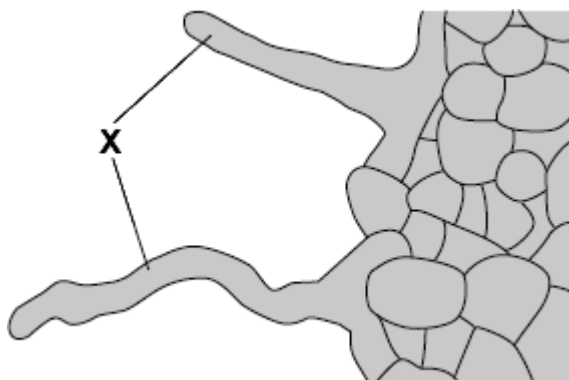
Why is this necessary?

(1)

(Total 6 marks)

Q22.

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



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

Draw a ring around **one** answer.

root hair

stoma

villus

(1)

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

1. _____

2. _____

(2)

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

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

alveoli.

(i) Carbon dioxide enters leaves through

stomata.
villi.

(1)

(ii) Carbon dioxide enters leaf cells by

active transport.
diffusion.
reabsorption.

(1)

(Total 5 marks)

Q23.

Diffusion and active transport take place in healthy kidneys.

(a) Explain what is meant by:

(i) diffusion _____

(2)

(ii) active transport _____

(2)

(b) Describe, as fully as you can, how urine is produced by the kidneys.

(5)
(Total 9 marks)

Q24.

- (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.

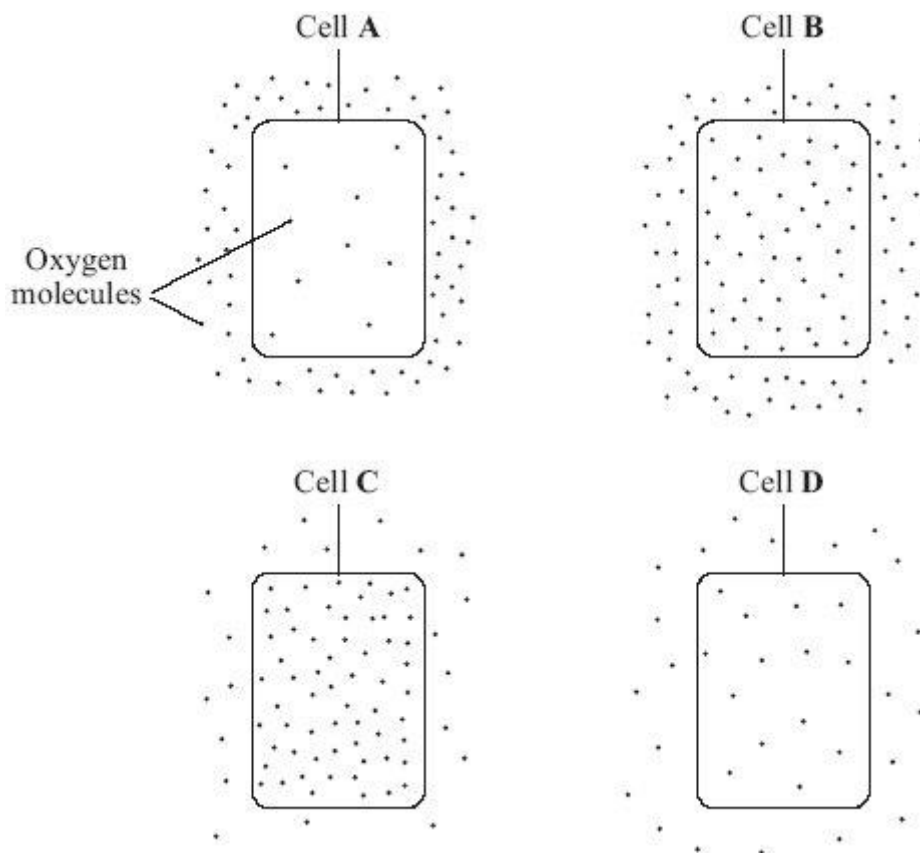
Explain how information from the table provides evidence for this.

(2)

(Total 6 marks)

Q25.

(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)

Q26.

(a) Which **two** of the following substances are found in the urine of a healthy person?

Tick (✓) **two** boxes.

Glucose

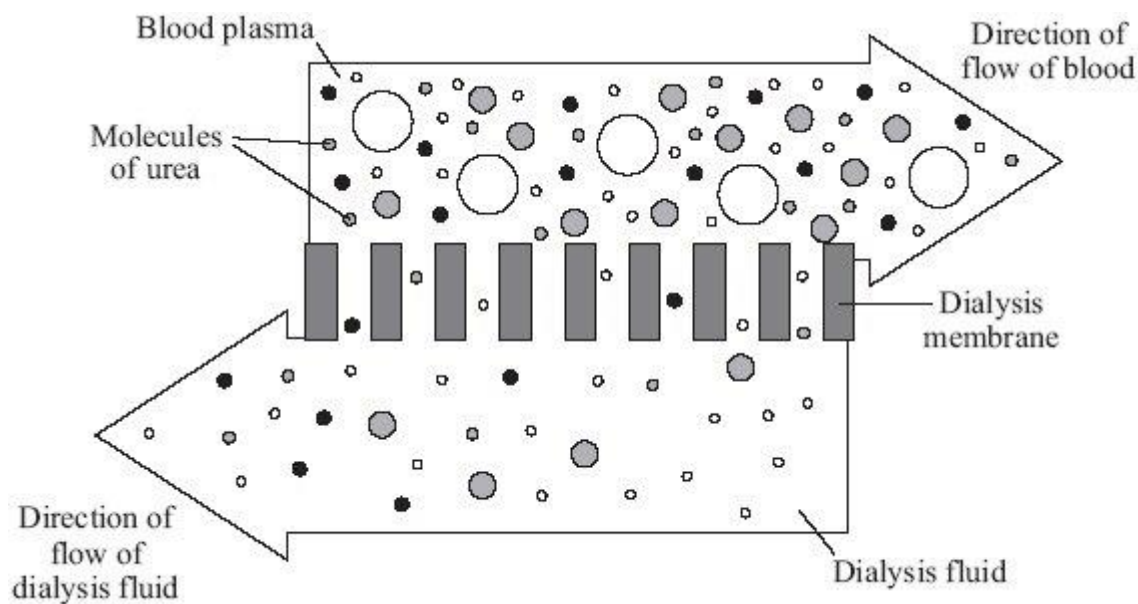
Mineral ions

Proteins

Water

(2)

- (b) A person with kidney disease can be treated by dialysis. The diagram shows how dialysis works. The circles represent molecules of different substances.



Draw a ring around the correct word or phrase to complete each sentence.

- (i) During dialysis, urea moves out of the blood cells
blood plasma
dialysis fluid . (1)

- (ii) During dialysis, urea moves into the blood cells
blood plasma
dialysis fluid . (1)

- (iii) Urea moves by the process of diffusion
digestion
transpiration . (1)

- (iv) To allow the movement of urea, the dialysis membrane is impermeable
partially permeable
thick . (1)

(v) The urea can pass through the membrane because

the urea molecules are

- large
- round
- small

(1)

(c) For most patients a kidney transplant is better than continued dialysis treatment.

Tick (✓) **one** box to complete the sentence.

One major problem with a kidney transplant is that

drug treatment is needed to suppress the immune system.

hospital visits are needed three times a week.

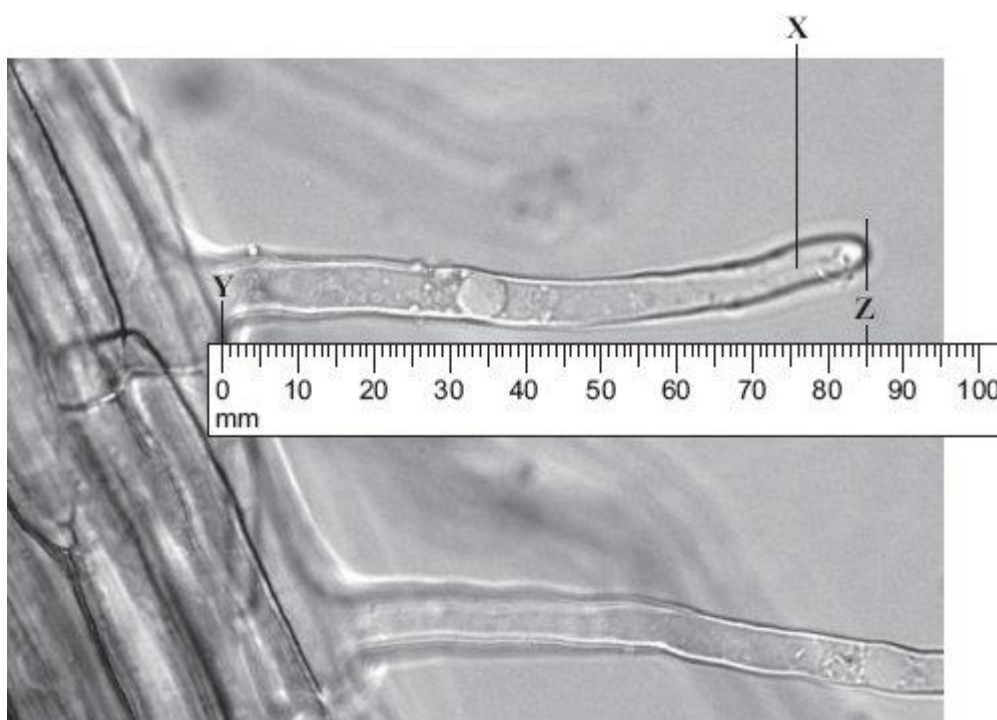
yearly costs are higher than for dialysis.

(1)

(Total 8 marks)

Q27.

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?

(2)

(Total 6 marks)

Q28.

(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?

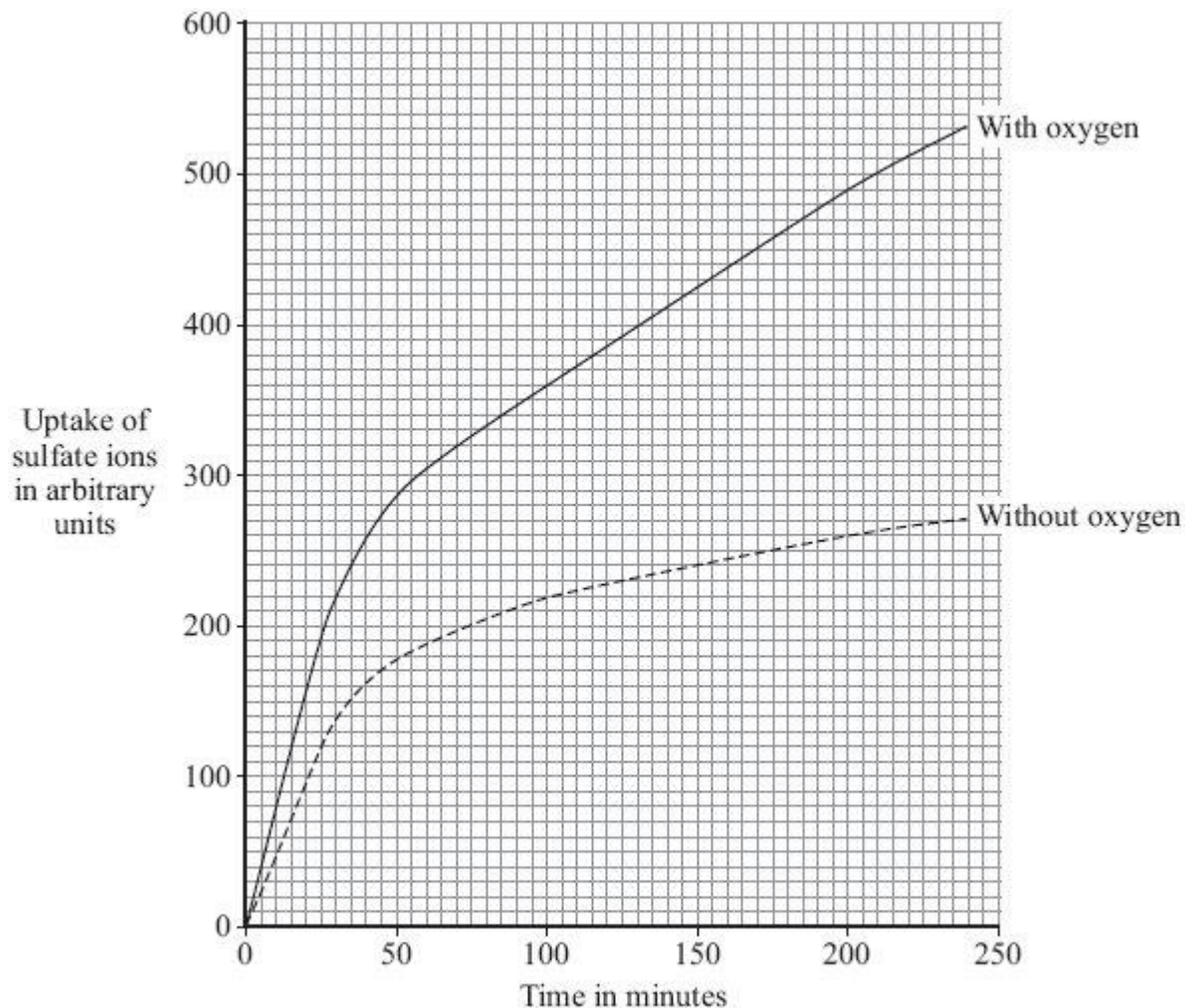
Draw a ring around your answer. **Yes / No**

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.

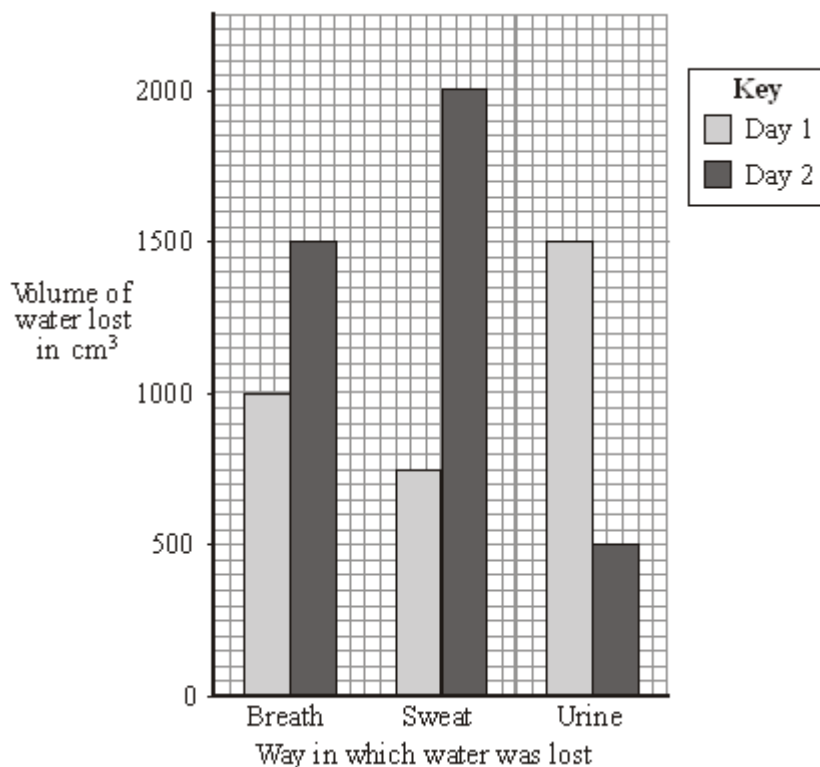
(3)

(Total 7 marks)

Q29.

The bar chart shows the amount of water lost from the body of a student on two different days.

The student ate the same amount of food and drank the same amount of liquid on the two days. The temperature of the surroundings was similar on the two days.



(a) The total volume of water lost on day 1 was 3250 cm³.

How much water was lost on day 2? Show all your working.

_____ cm³

(2)

(b) The student did much more exercise on one of the days than on the other.

On which day did he do more exercise? Day _____

Give **two** reasons for your answer.

1. _____

2. _____

(2)

(c) (i) Which **one** of these is a chemical reaction that produces water in the body?

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

Breathing

Osmosis

Respiration

Sweating

(1)

(ii) How does sweating help the body?

(1)

(iii) If the body loses more water than it gains, it becomes dehydrated.
The concentration of the solution surrounding the body cells increases.
This causes the cells to lose water.

By which process do cells lose water?

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

Breathing

Osmosis

Respiration

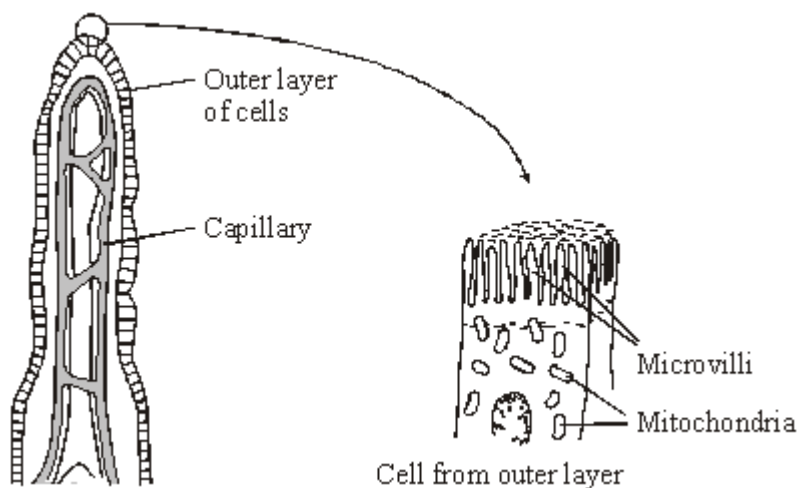
Sweating

(1)

(Total 7 marks)

Q30.

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 _____

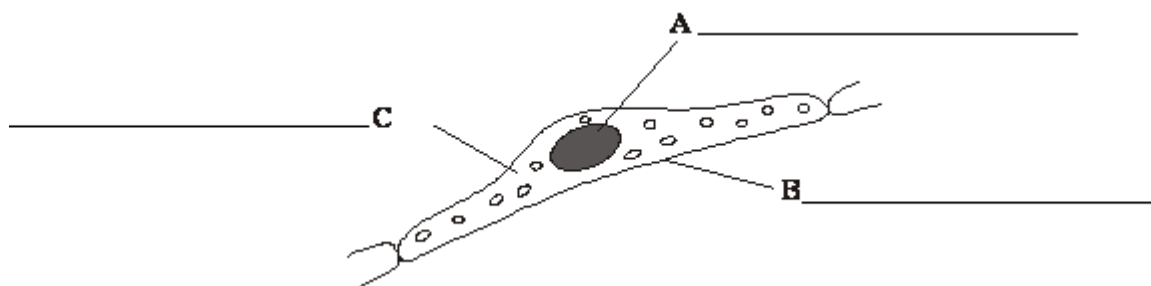
Mitochondria _____

(2)

(Total 4 marks)

Q31.

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)

Q32.

In fish and chip shops, potatoes are cut into chips several hours before they are cooked.

The amount of water in the chips must be kept constant during this time.

To keep the water in the chips constant, the chips are kept in salt solution.

A student investigated the effect of different concentrations of salt solution on the mass of chips.

- He weighed each of five chips.
- He placed each chip into a different concentration of salt solution.
- After one hour he removed the chips, then reweighed them.

His results are shown in the table.

Concentration of salt solution	0 M	0.5 M	1 M	2 M	3 M
Mass of chip at start in grams	2.6	2.8	2.8	2.5	2.6
Mass of chip after one hour in grams	2.7	2.8	2.7	2.3	2.1

- (a) (i) In which concentration of salt solution did the chip gain mass?

_____ M

(1)

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

The chip gained mass because water entered by

digestion osmosis respiration

(1)

- (b) In which concentration of salt solution should the chips be kept?

_____ M

Give a reason for your answer.

(2)

- (c) How could the student have made his investigation more reliable?

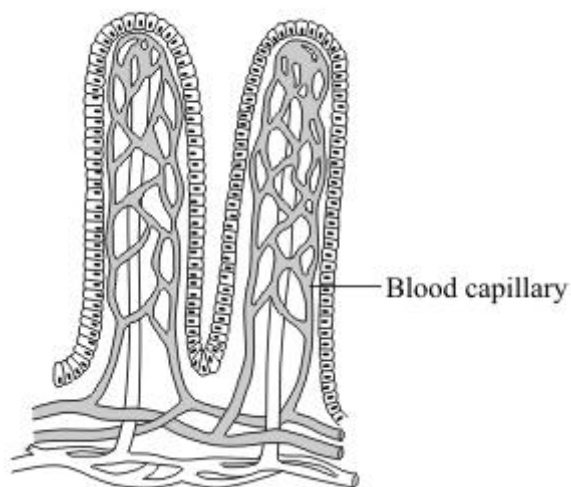
(1)

(Total 5 marks)

Q33.

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)

Q34.

The table shows the concentrations of some substances in one person's blood plasma, kidney filtrate and urine.

Substance	Concentration in grams per dm ³		
	Plasma	Filtrate	Urine
Water	900.0	900.0	950.0
Protein	78.0	0.0	0.0
Glucose	0.8	0.8	0.0
Amino acids	0.4	0.4	0.0
Urea	0.3	0.3	20.0
Sodium ions	2.8	2.8	3.5

- (a) (i) Protein is **not** present in the filtrate.

Explain why.

(1)

- (ii) Glucose is filtered out of the blood by the kidney and is then completely reabsorbed back into the blood.

What is the evidence for this in the table?

(2)

- (iii) Glucose is reabsorbed into the blood by active transport.

Give **two** ways in which active transport differs from diffusion.

1. _____

2. _____

(2)

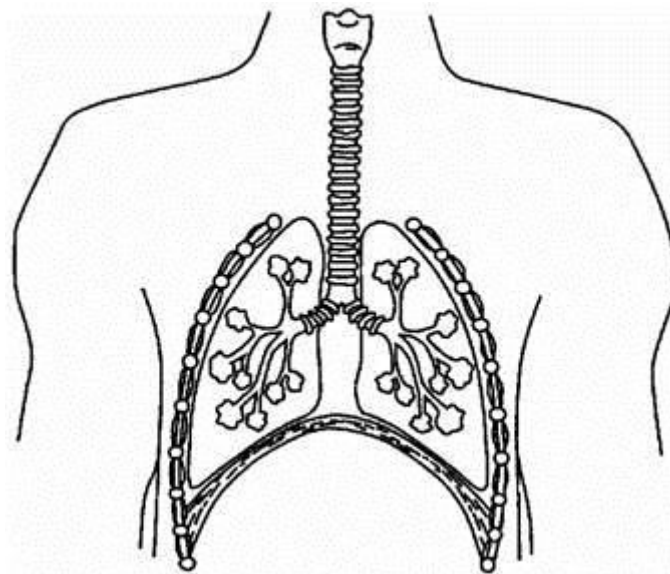
- (b) The concentration of urea is much higher in the urine than in the filtrate.
Explain what causes this.

(1)

(Total 6 marks)

Q35.

The diagram shows the human breathing system.



- (a) Place on the diagram:
- (i) a letter **X** where oxygen enters the blood;
 - (ii) an arrow showing the direction the diaphragm moves when we breathe in.
- (b) List the following structures in the order the air passes through them when we breathe in.

(1)

(1)

alveoli bronchi bronchioles trachea

1. _____

2. _____

3. _____

4. _____

(1)

(c) By what process does oxygen enter the blood? Draw a ring around your answer.

diffusion

digestion

osmosis

respiration

(1)

(Total 4 marks)

Mark schemes

Q1.

- (a) (i) capillary 1
- (ii) diffusion 1
- (b) (i) Z 1
ignore any names
- (ii) large / increased surface / area 1
allow all food absorbed
 or to absorb more food
 or improved diffusion 1
- [4]**

Q2.

- (a) xylem **and** phloem 1
either order
allow words ringed in box
allow mis-spelling if unambiguous
- (b) (i) movement / spreading out of particles / molecules / ions / atoms 1
ignore names of substances / 'gases'
- from high to low concentration
accept down concentration gradient
ignore 'along' / 'across' gradient
ignore 'with' gradient 1
- (ii) oxygen / water (vapour) 1
allow O₂ / O₂
ignore O² / O
allow H₂O / H₂O
ignore H²O 1
- [4]**

Q3.

- (a) solution in soil is more dilute (than in root cells) 1
concentration of water higher in the soil (than in root cells)

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

1

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

1

so energy needed to move ions

or

ions are moved against concentration gradient

the direction of the concentration gradient must be expressed clearly

accept correct reference to water potential or to concentrations of water

1

(b) any **three** from:

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

3

(c) (i) 0.67/0.7

accept 0.66, 0.666666... or $\frac{2}{3}$ or 0.6

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

100

*if answer incorrect allow evidence of $\frac{100}{150}$ for **1** mark
 do **not** accept 0.6 or 0.70*

2

(ii) during the first 30 minutes

any **one** from:

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

1

so there was more evaporation

ignore 'water loss'

or

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

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

1

[11]

Q4.

(a) oxygen / O₂

allow O₂

do not accept O²

or

carbon dioxide / CO₂

allow CO₂

do not accept CO²

1

(b) any **four** from:

ignore references to tail used for locomotion

ignore reference to nostrils

- because structure X / gills has threads / filaments **or** is thin **or** tadpole has longer tail
- there is an increased surface area
- there is a shorter diffusion pathway
- therefore an increase in exchange
ignore food
- eyes (now visible in older tadpole)
- so that food / danger etc can be seen
accept reference to a good blood supply
accept increased water flow over gills / tail will increase diffusion of gases

4

[5]

Q5.

(a)



*the shape must be (roughly) circular **and** not shaded, for the mark*

accept the shape drawn in the key if it is not contradictory

- (b) dominant 1
- (c) (i) a half (50%) 1
- (ii) Some of B's sperm cells have an X chromosome 1

[4]

Q6.

- (a) water enters (funnel / sugar solution) **or** water diffuses in (to the funnel)
do not accept if diffusion of sugar 1

 membrane partially / selectively / semi permeable **or** by osmosis
allow description 1

 because concentration (of sugar) greater
 inside funnel than outside / water / in beaker
assume 'concentration' refers to sugar unless candidate indicates otherwise
the position of the solutions may be implied 1
- (b) (level / it) rises more slowly **or** levels out earlier **or** does not rise as much
accept inference of less steep gradient (of graph)
allow less / slower osmosis / diffusion / less water passes through or less water enters funnel
allow water enters / passes through slower 1

 less difference in concentration (between solution / funnel and water / beaker)
accept due to lower diffusion / concentration gradient / described 1

[5]

Q7.

- (a) (i) capillary 1
- (ii) diffusion 1
- (iii)

Carbon dioxide	low(er)	high(er)
----------------	---------	----------

1

Oxygen	high(er)	low(er)
--------	----------	---------

1 mark for each correct row

- | | | | |
|-----|------|-----------------|---|
| | | | 1 |
| (b) | (i) | red blood cells | 1 |
| | (ii) | haemoglobin | 1 |

[6]

Q8.

- | | | | |
|-----|----------------------|---|---|
| | | | 1 |
| (a) | (i) | (too) big | 1 |
| | | cannot fit / pass through filter / through (pores) in membrane / cannot be filtered
<i>too big to be filtered = 2 marks</i> | 1 |
| | (ii) | water | 1 |
| | (iii) | partially permeable | 1 |
| (b) | any two from: | | |
| | | <ul style="list-style-type: none"> • hazards of operation / named eg • may be rejected or need to use immunosuppressant drugs / long term drug use or transplant may need to be replaced • susceptible to other infections • shortage of donors • high <u>initial</u> cost | 2 |

[6]

Q9.

- | | | | |
|-----|----------------------|---|---|
| | | | 1 |
| (a) | (i) | (cell) membrane | 1 |
| | (ii) | vacuole | 1 |
| (b) | any two from: | | |
| | | <ul style="list-style-type: none"> • (cell) wall • chloroplast(s)
<i>ignore chlorophyll</i> | |

- vacuole
ignore cell sap

2

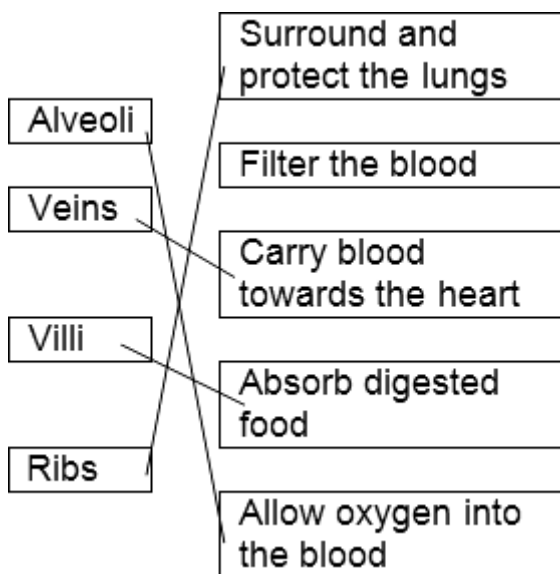
(c) diffusion

1

[5]

Q10.

(a)



4 correct = 4 marks

3 correct = 3 marks

2 correct = 2 marks

1 correct = 1 mark

extra line from a structure cancels the mark

4

(b) diffusion

1

[5]

Q11.

- (a) (i) diffusion is down the concentration gradient
for a description of diffusion
ignore along / across gradients

1

to enter must go up / against the concentration gradient
accept by diffusion ions would leave the root

or

concentration higher in the root / plant

or

- 1
- concentration lower in the soil
- (ii) active transport
allow active uptake 1
- (b) (i) (root hairs →) large surface / area 1
- (ii) (aerobic) respiration
do not allow anaerobic 1
- releases / supplies / provides / gives energy
accept make ATP (for active transport)
do not allow 'makes / produces / creates' energy 1
- (iii) starch is energy source / store (for active transport)
allow starch can be used in respiration
do not allow 'makes / produces / creates' energy 1
- [7]

Q12.

- (a) (i) diffusion 1
- (ii) A 1
- (b) (i) osmosis 1
- (ii) R 1
- [4]

Q13.

- (a) *correct names of cell components are required*
it = cell in sugar solution
- any **two** from:
- accept reverse only if clearly stated answer refers to cell in distilled water*
- smaller vacuole
 - smaller / less cytoplasm
allow protoplasm for cytoplasm
 - cell membrane / cytoplasm not (fully) against cell wall

accept plasmolysed / flaccid / less turgid

or
 cell membrane / cytoplasm (partly) pulled away from cell wall
ignore reference to nucleus / water
ignore explanations

or
 space / liquid / sugar solution between cell
 membrane / cytoplasm and cell wall

2

- (b) water passed / moved out (of cell) by osmosis / diffusion
accept reverse answer if clearly refers to cell in distilled water

1

more concentrated (solution) outside
assume reference to concentration refers to solute
concentration unless answer refers to water concentration

or
 less concentrated (solution) inside

or
 lower water concentration outside

accept references to hypertonic / hypotonic solutions or water potential

or
 higher water concentration inside

1

[4]

Q14.

- (a) (i) capillary

1

- (ii) diffusion

1

- (b) (i) Z

ignore any names

1

- (ii) large / increased surface / area / **or** to absorb more food **or** improved diffusion
allow all food absorbed

1

[4]

Q15.

- (a) large surface / large area

1

thin / short distance (from air to blood) / one cell thick / two cells thick 1

good blood supply / many capillaries / capillary network / many blood vessels
ignore moist surface 1

(b) (i) diffusion
ignore gaseous exchange 1

(ii) brings (more) oxygen / air into the lungs / alveoli 1

keeps O₂ level high in alveoli

or

maintains concentration difference (between alveoli and blood) / keeps O₂ concentration in alveoli > O₂ concentration in blood gains **2** marks 1

[6]

Q16.

active transport needs energy **or** diffusion is not energy-dependent 1

any **three** from:

- (energy from) aerobic respiration
- more respiration with O₂ **or** more energy release with O₂
- (aerobic) respiration / energy release occurs in mitochondria
*do **not** allow anaerobic*
- xylose / other sugars absorbed by diffusion / not by active transport
allow active transport is selective / specific
***or** active transport can distinguish glucose and xylose* 3

[4]

Q17.

(a) because water enters (the cell / it / named cell)
*do **not** accept salt / sugar / solution entering* 1

by osmosis / diffusion

if osmosis / diffusion not given accept concentration inside cell greater than outside cell

assume concentration refers to solute concentration unless answer indicates otherwise

allow water goes up the concentration gradient

*allow water goes down its concentration gradient
 do **not** accept if diffusion of salt / sugar*

1

through a partially permeable membrane

*allow semi / selectively permeable membrane **or** description*

1

(b) (plant cells) have (cell) wall

accept animal cells have no (cell) wall

ignore reference to cell membrane

*do **not** accept reference to other organelles **or** any
 implication that animal cells have a cell wall eg plant cells
 have a thicker cell wall*

1

[4]

Q18.

(a) (protein molecules too) big **or** larger than pore size

allow cannot fit through the pores / hole / gaps

1

(b) (i) diffusion

1

(ii) high to low concentration

ignore along gradient / across gradient

or high concentration in blood, low concentration in dialysis fluid

allow there is none in dialysis fluid

or down concentration gradient

or correct use of numbers

1

(c) any value between 3.15 and 3.25 (inclusive)

1

(d) (i) any **two** from:

- kidney works all the time **or** dialysis works for short time
ignore enables an active life

or

dialysis needs regular trips to hospital / regular treatment / long term treatment

accept kidney transplant is one off treatment

- kidney maintains correct concentration all the time **or** no build-up as between dialysis sessions

- no need to regulate diet **or** correct example – eg low salt / low protein / low fluid intake as with dialysis

- cheaper in the long term

2

(ii) any **two** from:

- rejection / described **or** need to use immunosuppressants **or** need to take drugs for life
allow may need later replacement
- susceptible to other infections
- hazards of operation / anaesthetic
- shortage of donors / match
- high initial cost

2

[8]

Q19.

D – *many* microvilli (1)

Ex – provide large surface area (1)

five points made

max 3 descriptions

max 3 explanations

D – *many* capillaries / *good* blood supply (1)

Ex – maintain concentration / diffusion gradient **or** quickly removes food (1)

D – thin wall / one cell thick surface / capillaries near surface (1)

allow villi are thin

ignore villi are one cell thick

Ex – short distance for food to travel (1)

D – *many* mitochondria (1)

Ex – provide energy / ATP for active uptake / transport (1)

[5]

Q20.

(a) (i) villus

1

(ii) its outer surface is one cell thick

cancel 1 mark for each extra box ticked

1

it has a large surface area

1

it has good blood supply

1

(b) diffusion 1 [5]

Q21.

(a) (i) water 1
(ii) small 1
(iii) 3.15 1
(b) (i) 21 000 1
(ii) 2 years 1
(iii) prevent rejection 1 [6]

Q22.

(a) (i) root hair 1
(ii) any **two** from:
ignore food
• water
• ions / minerals / nutrients / salts / correct named eg nitrates
ignore N,P,K
• oxygen 2
(b) (i) stomata 1
(ii) diffusion 1 [5]

Q23.

(a) (i) movement of atoms / molecules / ions
accept particles
allow dissolved substances
ignore reference to membranes 1

(substance) moves from high to low concentration
*allow down the gradient ignore
 across / along / with a gradient*

1

(ii) any **two** from:

- movement of molecules / ions
*accept particles
 allow dissolved substances this point once only in (a)(i) and
 (a)(ii)*
- from low to high concentration
*allow up / against the gradient
 ignore across / along / with a gradient*
- requires energy / respiration
accept requires ATP

2

- (b) • **filtration** of blood **or**
 described re small (molecules)through / large not
ignore diffusion

1

max **four** from:

- **reabsorption** / substances taken back into blood
- (reabsorption) of all of the sugar / glucose
- (reabsorption) of some of ions / of ions as needed by body
- (reabsorption) of some of water / of water as needed by the body
- urea present in urine
accept urea not reabsorbed
- reabsorption of water by osmosis / diffusion **or** reabsorption of sugar / ions by active transport

4

[9]

Q24.

- (a) (i) glucose **and** galactose

1

(ii) any **three** from:

Evidence:

- absorption reduced by cyanide
allow converse

- absorb faster (than other sugars)

Explanation:

- active transport needs energy
- less / no energy available / released if cyanide is there
or less / no energy if no / less respiration
allow energy produced
ignore cyanide prevents respiration

3

- (b) all / the sugars / they can be absorbed when gut poisoned / with cyanide or when no respiration

1

(diffusion) does not need an energy supply

1

[6]

Q25.

- (a) A

1

- (b) (i) diffusion

1

- (ii) respiration

1

- (iii) mitochondria

1

- (iv) photosynthesis

1

[5]

Q26.

- (a) mineral ions

1

water

each extra box ticked cancels 1 mark

1

- (b) (i) blood plasma

1

- (ii) dialysis fluid

1

- (iii) diffusion

1

- (iv) partially permeable

- 1
- (v) small 1
- (c) drug treatment is needed to suppress the immune system 1

[8]

Q27.

- (a) root hair 1
- (b) (i) 85 1

if incorrect unit added = 0

- (ii) 0.85 1
- ignore working or lack of working
accept correct answer from candidate's (i) for 2 marks*
- $\frac{85}{100}$ *with no answer or wrong answer gains 1 mark*
- accept ecf*
- 2

- (iii) absorb more water / ions 2
- allow 'get / collect / take in / take up / soak up / suck up' for absorb
allow 'lots' for more
allow 'moisture' for water
allow 'minerals / salts / nutrients' for ions
do **not** allow food or named foods
absorb water / ions gains 1 mark*
- or**
- large surface area to absorb water / ions (2)
- large surface area linked to incorrect function = 1
ignore small so short diffusion pathway*

[6]

Q28.

- (a) No 1
- no mark
if yes max 1 for correct statement*
- diffusion is down the concentration gradient
- accept by diffusion ions would leave the root*

to enter must go up / against the concentration gradient
or concentration higher in the root
or concentration lower in the soil

1

(b) (i) 0.9 **or** 3.25

for correct answer with or without working

*if answer incorrect 1.3 **or** their rate – 0.4 gains 1 mark*

***or** 130 – 40 **or** 90 gains 1 mark*

2

(ii) (uptake) by active transport

1

requires energy

more energy from aerobic respiration

1

or

more energy when oxygen is present

1

[7]

Q29.

(a) 4000

*award **both** marks for correct answer, irrespective of working*

1500 + 2000 + 500 gains 1 mark

2

(b) day 2 (no mark)

any **two** from:

max 1 mark if correct day not identified or if no day given

- more (water in) breath / breathing

- more (water in) sweat / sweating

accept a lot of sweating

- less (water in) urine

if no other marks awarded allow 1 mark for more water lost on day 2

2

(c) (i) respiration

1

(ii) cools / removes heat owtte

ignore 'maintains body temperature' unqualified

1

(iii) osmosis

1

Q30.

- (a) any **two** from:
- transport up / against concentration gradient / low to high concentration
 - uses energy
 - use of protein / carrier
- 2
- (b) microvilli – large(r) surface area
accept have carriers
- 1
- mitochondria – release energy **or** make ATP
*do **not** accept 'makes energy'*
- 1

[4]

Q31.

- (a) **A** nucleus
- 1
- B** (cell) membrane
- 1
- C** cytoplasm
- 1
- (b) (i) it is thin
- 1
- (ii) diffusion
- 1

[5]

Q32.

- (a) (i) 0
- 1
- (ii) osmosis
- 1
- (b) 0.5
- 1

no change in mass / weight
allow 'chip / it stays the same'

1

or

no (net) osmosis / same amount of water in and out

- (c) repeat / use more chips in each solution
allow use of other people's results
*do **not** allow 'get more results' unqualified*
*do **not** allow leave longer / use more concentrations / better instrumentation*

1

[5]

Q33.

(a) any **two** from:

- large surface / area **or** many villi **or** have microvilli
accept big surface / area
- thin surface **or** thin wall **or** surface 1-cell thick **or** capillaries near surface **or** permeable **or** partially permeable
accept they are thin
*do **not** allow thin **cell** wall*
- many blood vessels **or** many capillaries **or** capillary network **or** good blood supply
ignore 'constant blood flow' owtte
ignore extras eg moist or reference to gases
- have enzymes
ignore release enzymes
 - *accept reference to lacteal as 5th point*
 - *allow reference to having mitochondria*

2

- (b) (i) small(er) (surface area) / flat(ter) / short(er)
or not as folded
or fewer capillaries owtte
allow small(er) lacteal
ignore references to wide / thick / spread out etc

1

- (ii) less absorption (of digested food) / less digestion / diffusion
accept slower for less
accept description of less digestion
accept less food can get in
*do **not** allow zero absorption*
*do **not** allow 'collection' of nutrients*

1

[4]

Q34.

- (a) (i) protein is large (molecule) / too big to pass through filter 1
- (ii) glucose is present in the filtrate 1
ignore units 1
- or**
- 0.8 in filtrate
- no glucose is present in the urine
- or**
- 0 in urine 1
- (iii) active transport – up / against (concentration) gradient 1
it = active transport throughout 1
- or**
- from low to high (concentration)
- uses energy / ATP 1
accept needs specific carrier / specific protein (in cell membrane) for 1 mark
- (b) water reabsorption / taken out 1
other substances cancel mark
- or**
- water taken into blood / body 1

[6]

Q35.

- (a) correctly labelled on diagram
- (i) 'X' on an alveolus 1
centre of X on the alveolus wall or inside the alveolus
not if the centre is outside
- (ii) arrow pointing downwards

accept anywhere but must point down

1

(b) in sequence

1 trachea

2 bronchi

3 bronchioles

4 alveoli

1

(c) diffusion

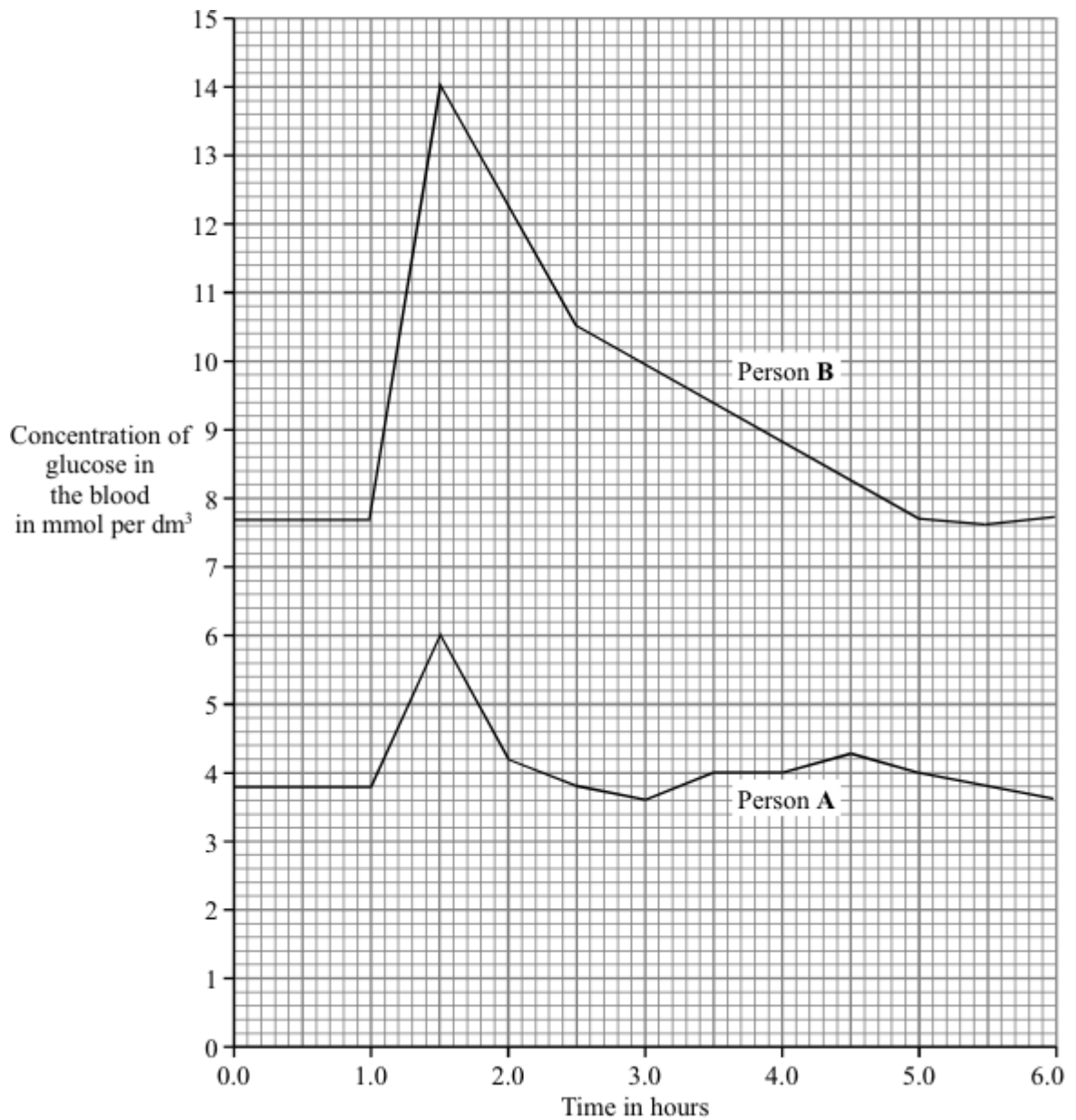
accept positive indicator

1

[4]

Q1.

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)

Q2.

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)

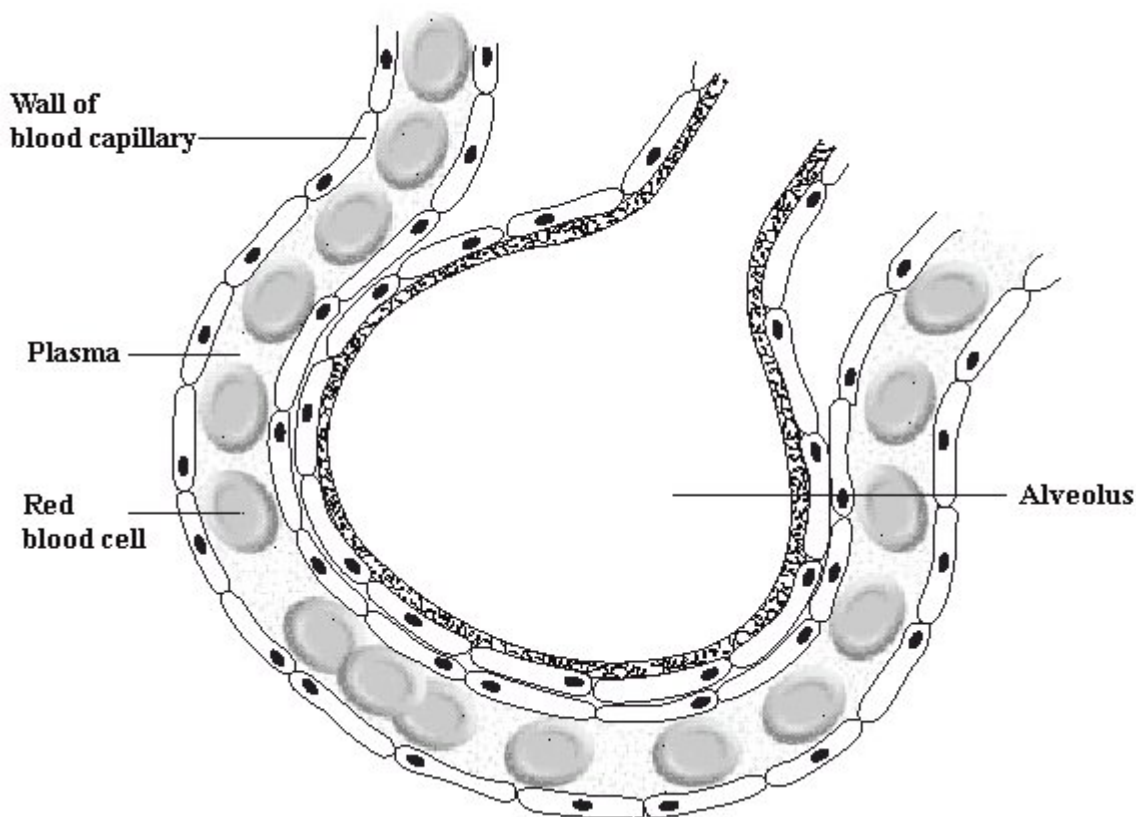
(ii) Suggest a process which would allow these ions to be absorbed from the pond water by the plant cells.

(1)

(Total 3 marks)

Q3.

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)

Q4.

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

Choose your answers from the list in the box

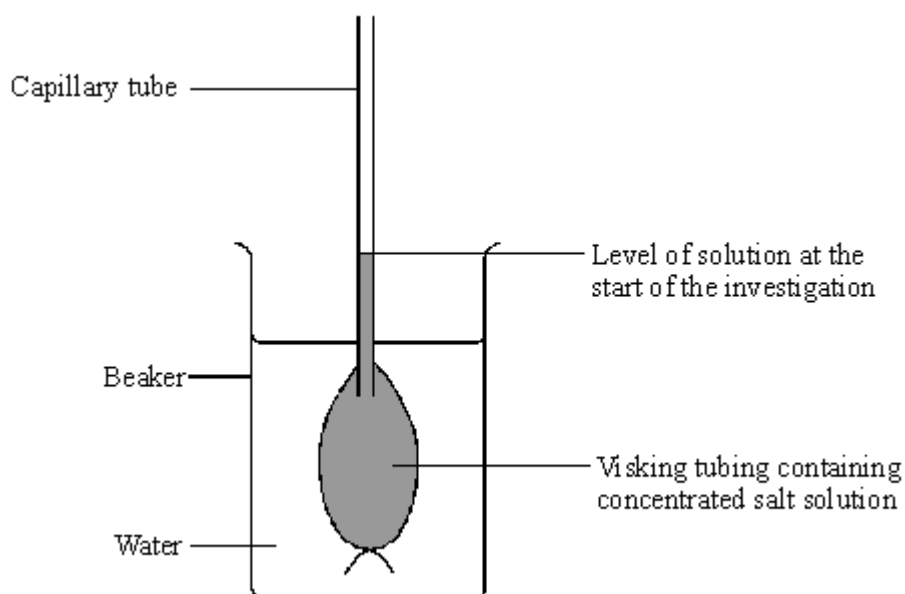
breathing diffusion digestion osmosis respiration

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)

Q5.

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)

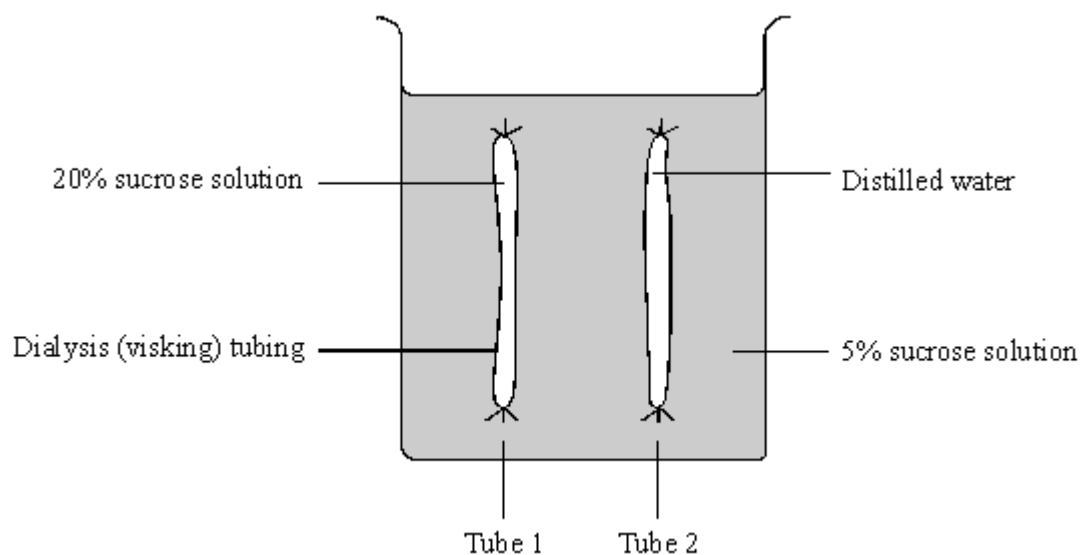
(ii) Use your knowledge of osmosis to explain why this happens.

(2)

(Total 6 marks)

Q6.

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.

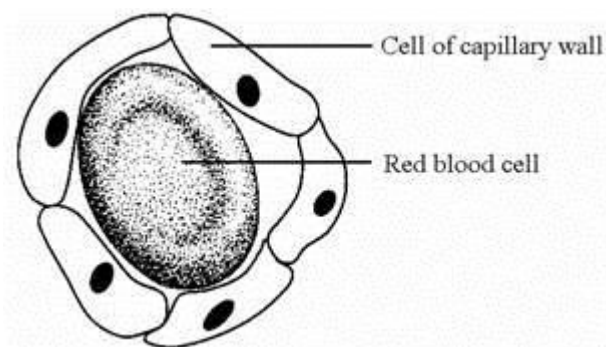
(6)

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

(2)
(Total 8 marks)

Q7.

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. _____

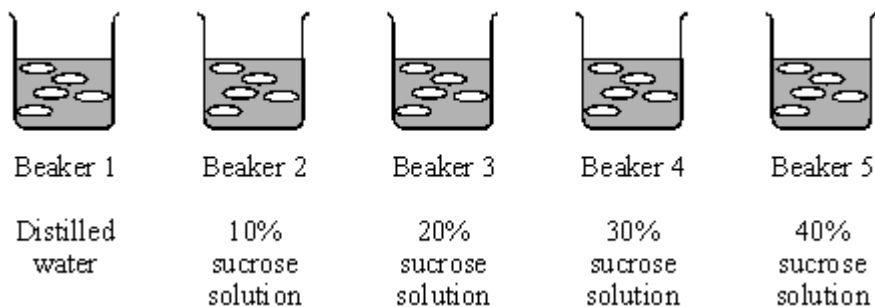
(2)

- (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)

Q8.

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.

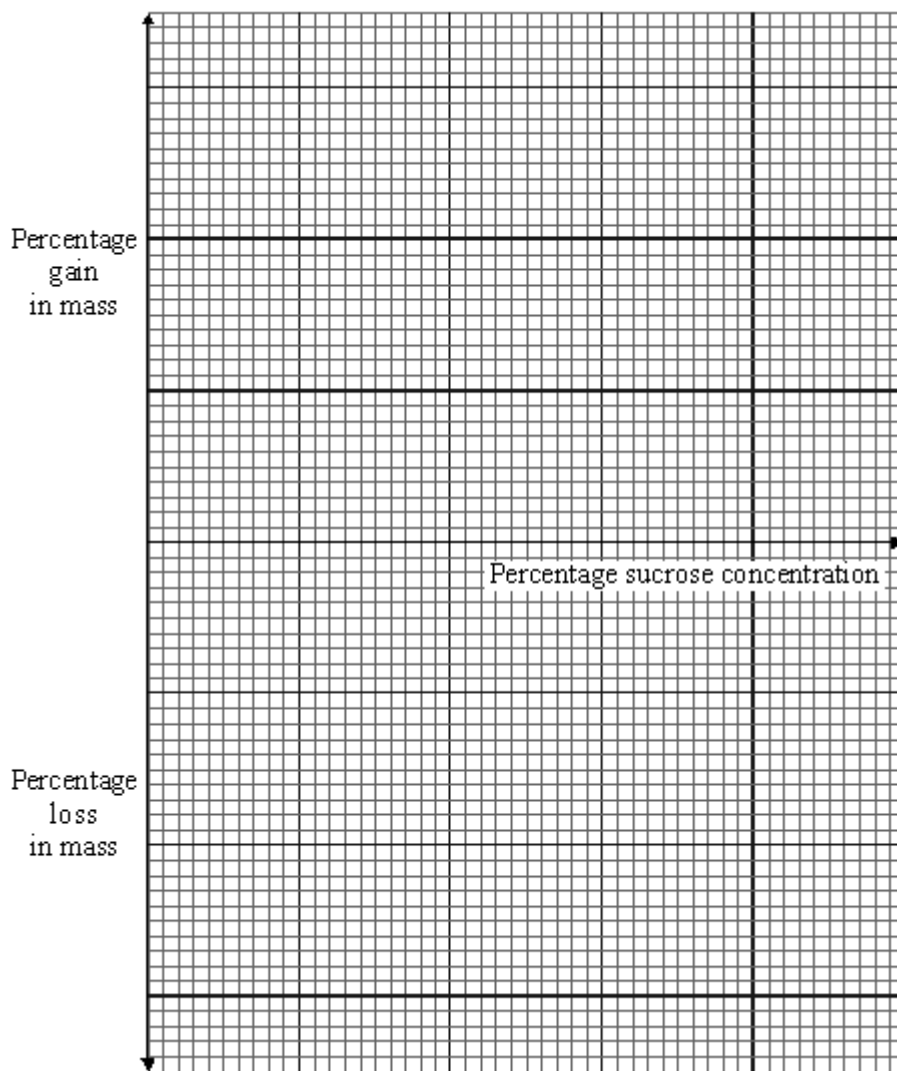
	Beaker 1	Beaker 2	Beaker 3	Beaker 4	Beaker 5
Final mass in g	13.0	12.2	9.0	7.9	7.3
Initial mass in g	10.0	10.6	10.0	10.1	10.4

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)

Q9.

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.

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

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

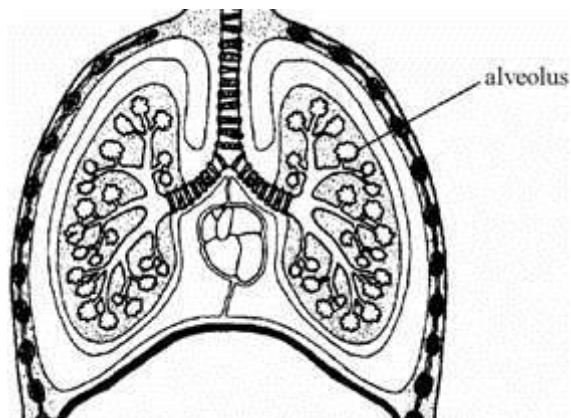
(c) Explain why "it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele." (lines 6-8)

(3)

(Total 7 marks)

Q10.

(a) The drawing shows some of the organs in the human thorax.

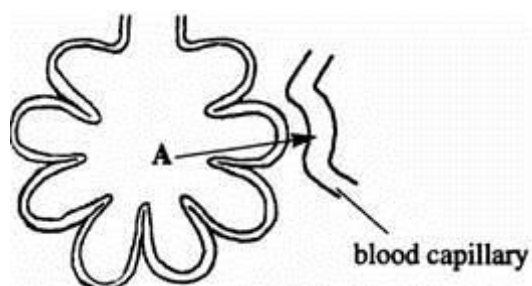


On the drawing, use guidelines to label:

- (i) the heart;
- (ii) a rib;
- (iii) the diaphragm;
- (iv) the trachea.

(4)

(b) The drawing shows a section through an alveolus.



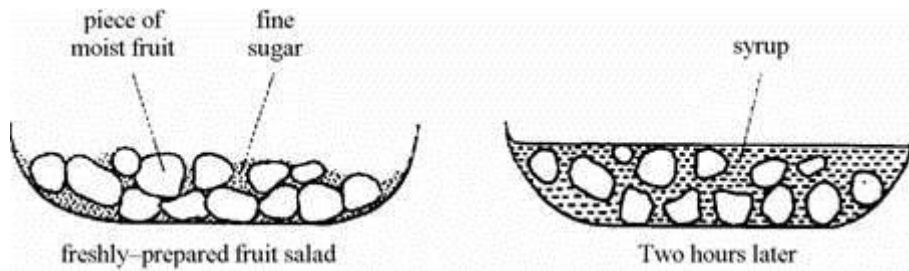
At **A**, oxygen moves from the air in the alveolus into the blood capillary. Explain, as fully as you can, how oxygen moves into the blood.

(2)

(Total 6 marks)

Q11.

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).

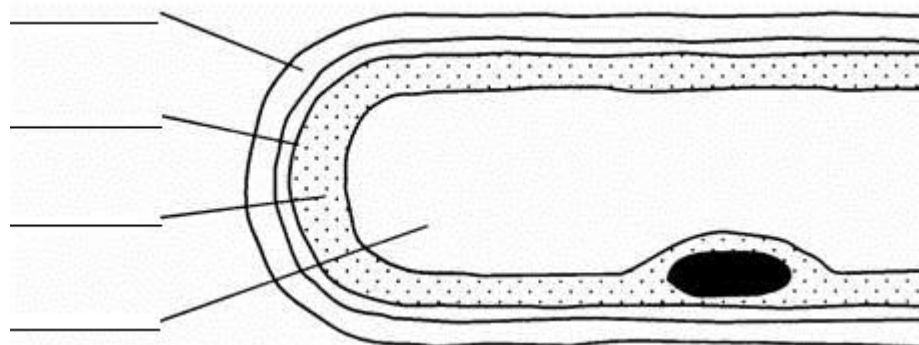


Explain, as fully as you can, why syrup (concentrated sugar solution) was produced after two hours.

(Total 4 marks)

Q12.

The drawing shows part of a root hair cell.

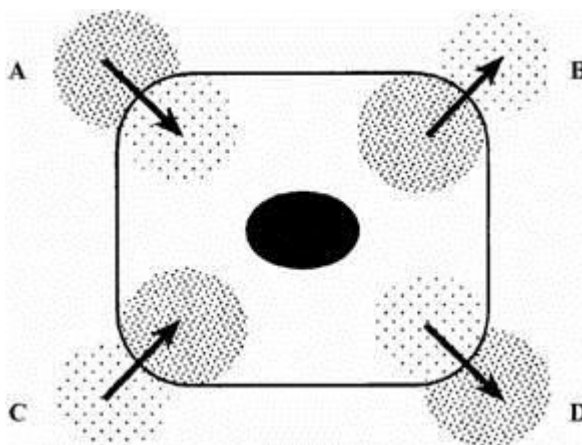


(a) Use words from the list to label the parts of the root hair cell.

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)

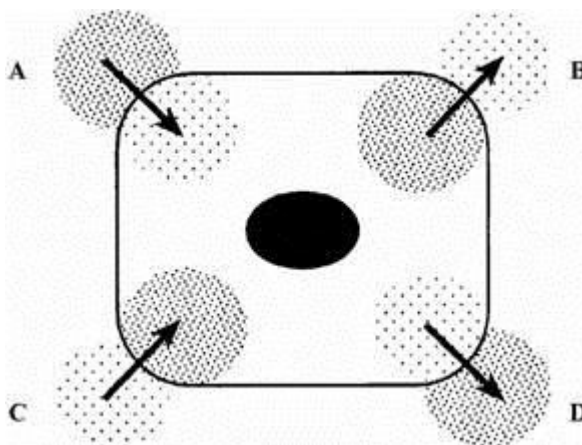
- (c) Name the process by which these gases move into and out of the cell.

(1)

(Total 7 marks)

Q13.

- (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?

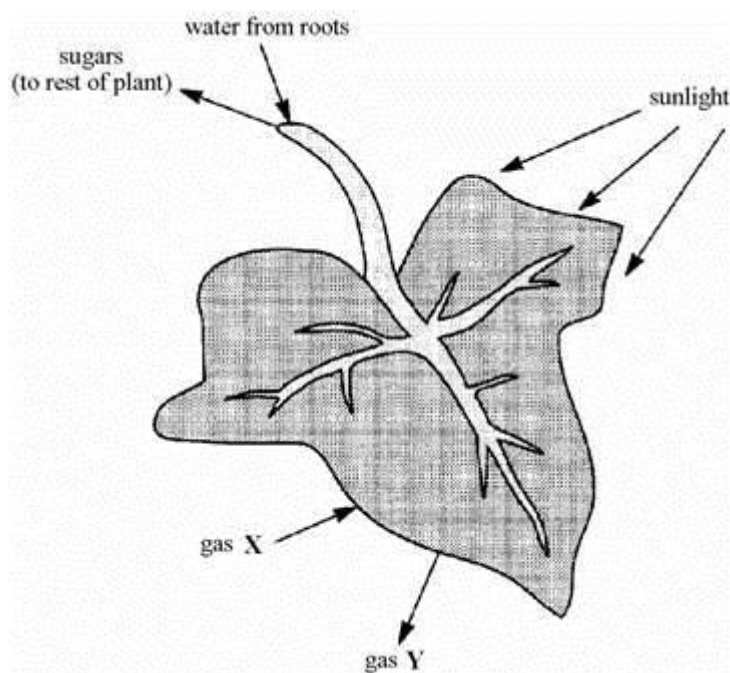
Explain the reason for your answer.

(2)

(Total 5 marks)

Q14.

The diagram shows a plant leaf during photosynthesis.



(a) Name:

(i) gas X; _____

(ii) gas Y. _____

(2)

(b) Why is sunlight necessary for photosynthesis?

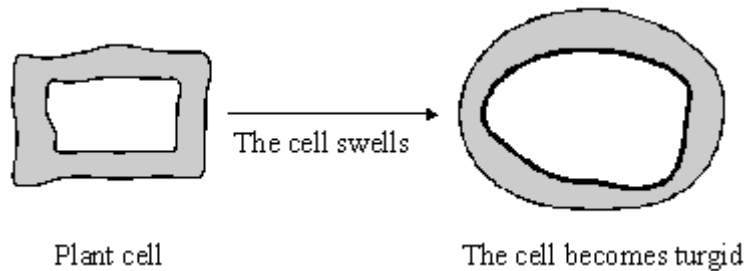
(1)

- (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)

Q15.

- (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)

Q16.

Plant roots obtain some of their mineral salts from the soil by active transport.

What is involved in *active transport*?

(Total 4 marks)

Q17.

Plants need chemical energy for respiration and for active transport.

- (i) Write a balanced chemical equation which represents the process of respiration in plants.

(2)

- (ii) Describe the process of active transport in the root hair cells of plants.

(3)
(Total 5 marks)

Q18.

As they go higher up a mountain, mountaineers take less oxygen into their bodies with each breath, as shown in the table below.

HEIGHT	MILLIGRAMS OF OXYGEN TAKEN INTO LUNGS WITH EACH NORMAL BREATH	MILLIGRAMS OF OXYGEN INTO BLOOD WITH EACH NORMAL BREATH	
		AT FIRST	AFTER STAYING AT 4500 METRES FOR TWO WEEKS
sea-level	300	60	90
1500 metres	250	50	
3000 metres	200	40	
4500 metres	150	30	45

- (a) (i) How does the amount of oxygen taken into the blood with each breath vary with the amount of oxygen breathed into the lungs with each breath?

(2)

- (ii) Use the idea of diffusion to explain why the amount of oxygen taken into the blood varies in this way.

(1)

- (b) (i) How does staying at an altitude of 4500 metres for two weeks affect the mountaineers?

(2)

- (ii) Suggest an explanation for this.

(1)

(iii) Add the two missing figures to the right-hand column of the table.

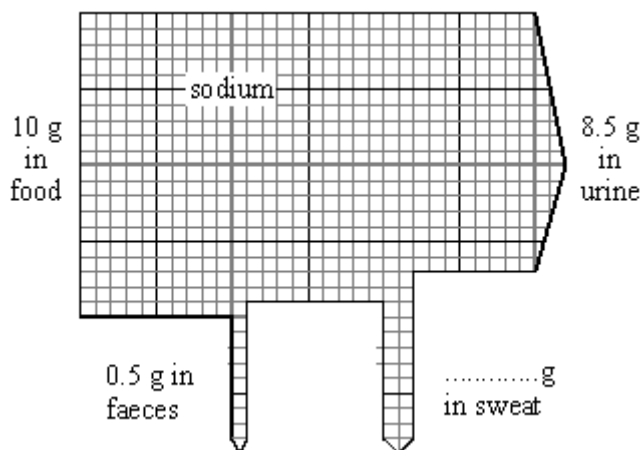
(2)

(Total 8 marks)

Q19.

To stay healthy, the amount of sodium in your body must not change very much.

On average, a girl takes in 10 grams of sodium a day in the food she eats.
The diagram shows what happens to this sodium.



(a) Add the missing figure to the diagram.

(1)

(b) The girl goes on holiday to a very hot place.
Her diet stays the same but she now loses 12g of sodium each day in sweat.

(i) How will this affect the amount of sodium she loses each day in her urine?

(1)

(ii) What should the girl do to make sure that her body still contains enough sodium?

(1)

(c) Usually, there is no glucose in urine. All of the glucose is re-absorbed from your kidney tubules back into your blood. Complete the following sentences to describe how this happens.

The glucose is re-absorbed by a process called _____

This process is needed because some of the glucose is re-absorbed against

(2)
(Total 5 marks)

Mark schemes

Q1.

- (a) (i) 6 1
- (ii) 4 1
- (b) (i) pancreas 1
ignore islets of langerhans
- (ii) 'X' anywhere between >1 and ≤ 2 hours 1
anywhere in that column
- (c) any **four** from:
- water movement
*do **not** accept solution*
- out of cells
- dilute to concentrated solution
*accept reference to correct gradient -
 high ∇ to low ∇ **or** high to low 'water concentration'
 must be unambiguous – i.e. **not** 'high to low concentration'
 accept low to high concentration*
- reference to partially / selectively
 permeable membranes **or** described
- cells shrink / get smaller
*allow crenated
 ignore plasmolysed / flaccid / floppy
 etc*
- 4

[8]

Q2.

- (i) in diffusion: material moves high to low concentration 1
- here: concentration in cells > concentration in water **or**
 uptake is against the concentration gradient **or** by diffusion ions would move out 1
- (ii) active transport / active uptake 1

[3]

Q3.

- (i) On diagram:
- oxygen arrow to blood from air **and** CO₂ arrow to air from blood 1
- oxygen arrow to red blood cell 1
- CO₂ arrow from plasma 1
- (ii) diffusion 1
- (iii) large surface **or** large area 1
*do **not** accept space*

[5]

Q4.

- in correct sequence:
- breathing 1
- diffusion 1
- respiration 1

[3]

Q5.

- (a) movement of water [1]
- from high concentration (of water) to low concentration (of water)
or
 from (an area of) dilute solution to an area of concentrated solution [1]
- through a differentially **or** partially **or** selectively **or** semi permeable
 membrane [1] 3
- (b) (i) it will rise 1
- (ii) water enters visking tubing [1]
- because the concentration of water outside is greater than the
 concentration inside
or
 because the concentration of salt **or** solute is greater inside the tubing than
 outside [1]
or

to equalise concentration water has to enter visking tubing [2]

2

[6]

Q6.

- (a) award **3** marks per tube for each key idea

for tube 1:

expands **or** gets firmer **or** bigger **or** inflates

it gains water

because the concentration of water is less than its surroundings

make sure answer is about water movement and not sucrose solution

3

for tube 2

gets floppy **or** flaccid **or** contracts

it loses water

because the concentration of water is greater than its surroundings

3

- (b) any **2** from:

uptake of water by root (hair) **or**
movement from cell to cell within
plant

*do **not** credit references to diffusion unless it is clear that the candidate is referring to the diffusion of water*

guard cell function

maintain turgor

water absorption in the large intestine

reabsorption of water from the
nephron **or** collecting duct or in
kidney **or** osmoregulation in kidney

allow osmosis in other animals if some use is shown

2

[8]

Q7.

- (i) any **two** from:

urea

carbon dioxide

water

lactic acid

2

- (ii) higher concentration of glucose **or** more glucose in blood than cells

1

diffuses across

1

[4]

Q8.

- (a) (i) change in weight was due to changes in potato
or osmosis **or** not due to outside liquid
ignore 'to make fair test'

1

- (ii) beaker 2 = 15.1(%) gain
allow 15%

1

beaker 4 = 21.8(5) loss

not 21.7

allow -22%

if no minus or no 'loss' check graph

1

beaker 5 = 29.8(%) loss

allow -30%

1

- (b) (i) both axes correct values
 and scales > ½ of each axis
ignore lack of minus signs on vertical axis

1

points correct

< ± ½ square

allow answers in (a)(ii)

1

line correct

allow curve of best fit which can miss 10, 15

or straight lines between points

*do **not** allow one straight line or sketched line*

bar graph zero marks

1

- (ii) point where line crosses axis (eg 15-16% sucrose)
allow point from candidate's graph (± 0.5%)

1

- (iii) any **two** from:

looking for understanding that water in equilibrium

no change in mass

not **net** movement of water
or water entry and exit are equal

because sucrose solution same
 concentration as cell sap **or** sucrose has
 same water potential as cell contents

allow because the concentrations are the same (inside and out)

2

[10]

Q9.

(a) mutation

for 1 mark

1

(b) fall,
 idea that resistant beetles more likely to survive to breed,
 ∴ their offspring more likely to appear in the next generation

for 1 mark each

3

(c) inbreeding between resistant brothers and sister,
 will produce some individuals with 2 copies of the resistance allele,
 if 2 of these individuals breed all their offspring will be resistant

for 1 mark each

3

[7]

Q10.

(a) correctly labelled structures (i – iv)

each for 1 mark

*(allow labels as words or numbers: allow without guidelines
 if unambiguously labelled)*

4

(b) *ideas of*
 diffusion
 greater concentration of oxygen in alveolus / high to low oxygen concentration
 membrane / alveolus permeability

any two for 1 mark each

2

[6]

Q11.

ideas that

sugar has dissolved in moisture (on surface of fruit)
 this solution more concentrated than solution inside fruit
 osmosis / diffusion movement of water out of fruit
 through partially permeable membrane (of fruit cells)

any four for 1 mark each

allow explanations in terms of concentrations of water molecules for full marks

[4]

Q12.

- (a) (cell) wall
 (cell) membrane
 cytoplasm
 vacuole

for 1 mark each

4

- (b) (i) A

- (ii) B

for 1 mark each

2

- (c) diffusion (reject osmosis)

for 1 mark

1

[7]

Q13.

- (a) (i) A

- (ii) B

for 1 mark each

2

- (b) diffusion

*(reject osmosis)
 for one mark*

1

- (c) C

because uptake against a concentration / diffusion gradient
 (reject osmosis)

(if C not given, then idea of movement essential)

for 1 mark each

2

[5]

Q14.

- (a) (i) carbon dioxide / CO₂ (reject CO)

- (ii) oxygen / O₂ / O (water vapour neutral)
for 1 mark each 2
- (b) (provides) energy
for one mark 1
- (c) starch insoluble therefore water not taken in by osmosis
or
 sugar is soluble / has small molecules may diffuse out therefore lost
(ignore ref. to cells bursting)
- or**
 starch has large molecules
 cannot diffuse therefore retained
for 1 mark each 3

[6]

Q15.

- (a) (i) water (molecules) enter(s) (the cell)
or water (molecules) pass(es) through the (semi-permeable) cell membrane 1
- by osmosis
or because the concentration of water is greater outside (the cell than inside it the vacuole)
 accept because of the concentration gradient provided there is no contradiction 1
- (ii) any **one** from
- (it is) elastic
- (it is) strong
- (it is fully) permeable (to water)
or water can pass through it
 do not credit semi-permeable
 do not credit cell membrane is semi-permeable 1
- (b) (the piece of) potato shrinks
or loses its turgor
or becomes flabby
or becomes flaccid
or plasmolysis occur

or cytoplasm pulls away from the cell wall

(because) concentration of sugar

or because concentration of water

1

(solution) is greater than concentration inside the cell / vacuole

inside the cell / vacuole is greater than concentration (of water) outside

1

water is drawn out of the cell

1

[6]

Q16.

any **four** from

molecules / ions

do not credit mineral salts

move(d) through / across the cell

wall / membrane

against (a / the) concentration

gradient

by a series of chemical

reactions

(because) diffusion cannot occur

energy (required)

(supplied by) respiration

oxygen required for respiration (to occur)

[4]

Q17.

(i) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

energy is neutral

1

formulae all correct

with no omissions / deletions

correctly balanced

credit 1 mark if the answer is the exact reverse of an incorrect answer for (a)

1

(ii) and **three** from

take up of (soluble) substances / ions against the concentration gradient

or when the concentration (of the substance / ions) is greater inside the cell / cytoplasm than outside it

through the (semi-permeable) (cell) membrane energy from mitochondria

*or energy from respiration
not just energy*

3

[5]

Q18.

(a) (i) increasing one increases the other

gains 1 mark

but

they increase in proportion/ 1/5 taken in at first / 3/10 taken in after 2 weeks

gains 2 marks

2

(ii) *idea that* more/faster diffusion with higher concentration

for 1 mark

or

with more oxygen particles/molecules (in same space)

1

(b) (i) can take more oxygen from (the same) air/changes from 30 to 45/increases by 15

gains 1 mark

but

takes 50% more or 1.5 times as much

gains 2 marks

2

or

increases by 15 mg breath

(ii) more red blood cells develop

or

more haemoglobin in the blood
(*not just 'acclimatises'*)

for 1 mark

1

(iii) 75
60

each for 1 mark

2

Q19.

- (a) 1
for 1 mark 1
- (b) (i) there will be less / no sodium (per day) (in her urine)
for 1 mark 1
- (ii) *idea that*
she should take in more (sodium (chloride) / salt)
(*allow* stay indoors / in shade **or** be less active)
for 1 mark 1
- (c) active transport / uptake
(*do not allow* diffusion / osmosis)
the concentration / gradient
for 1 mark each 2