AQA B3.1 Movement of molecules in and out of cells LEVEL 1 Q

154 minutes

154 marks

Q1. The table shows the percentage of some gases in the air a boy breathed in and out.

Gases	**Air breathed in**	**Air breathed out**
carbon dioxide	0.04%	4.0%
oxigen	20.0%	16.0%
water vapour	1.0%	6.0%

(a) What happens in the lungs to change the levels of oxygen and carbon dioxide in this way?

Oxygen .....

.....

.....

Carbon dioxide .....

.....

.....

(4)

(b) Compare the percentage of water vapour in the air breathed out with the percentage in air breathed in.

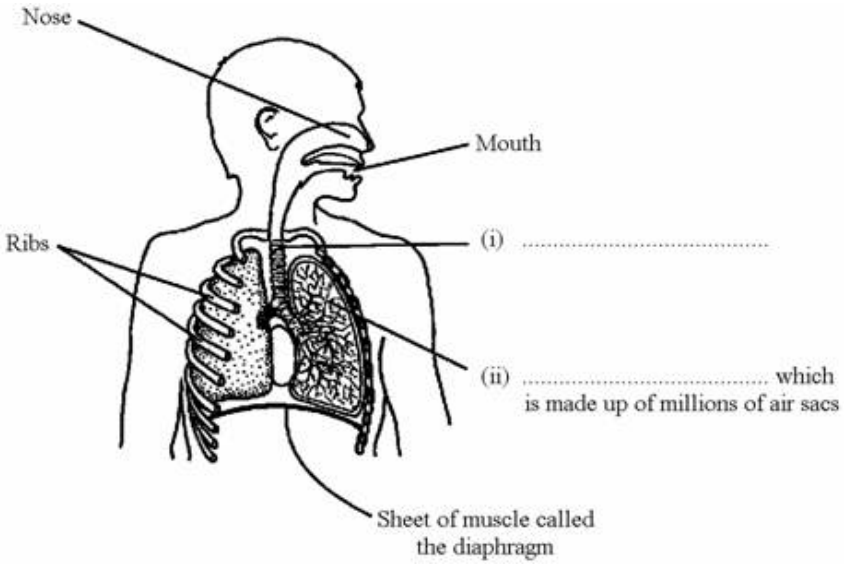
.....

(2)

(Total 6 marks)

Q2. The diagram shows the human breathing system.

(a) Complete the labels (i) and (ii).



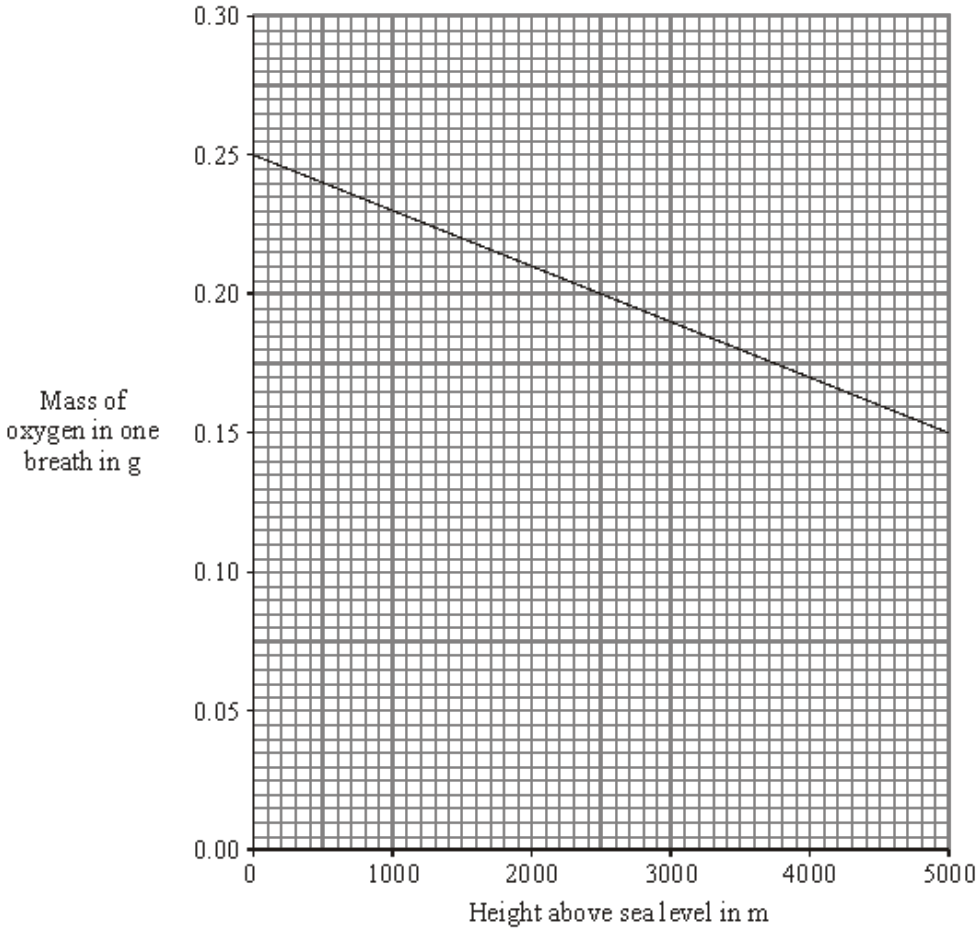
(2)

(b) Complete the following sentence.

When we breathe out, the mixture of gases which leaves the air sacs contains **more** ..... and **less** ..... than the mixture of gases which enters the air sacs.

(2)
(Total 4 marks)

Q3. (a) The graph shows how the mass of oxygen you breathe in changes as you climb up a mountain.



Describe, in as much detail as you can, how the mass of oxygen in one breath changes as you climb from sea level to 3000 m.

.....

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.....

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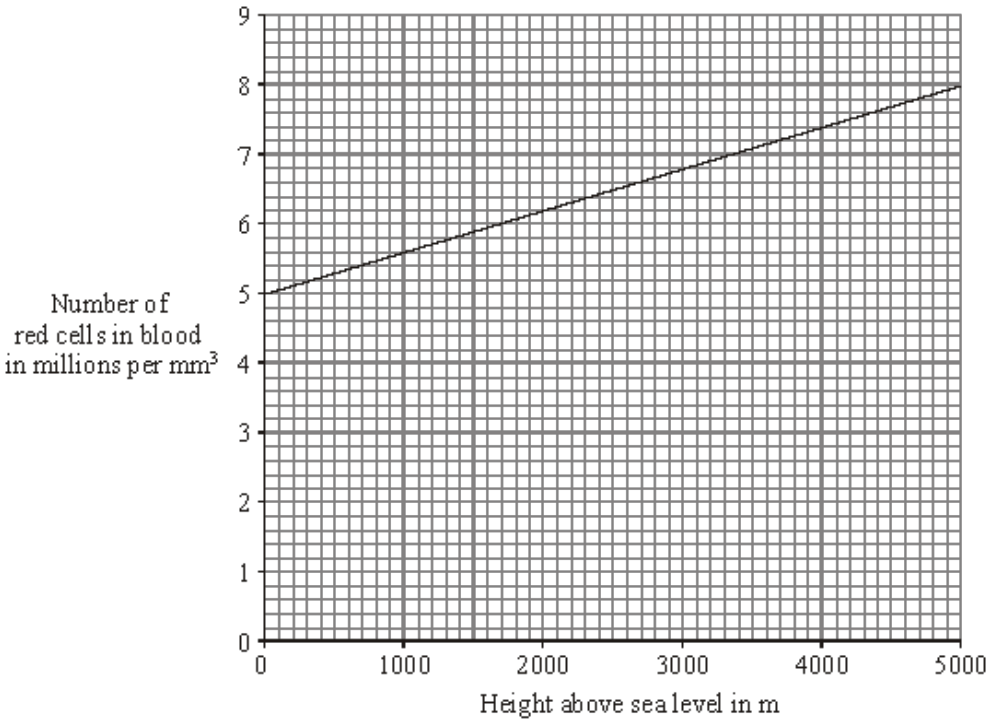
.....

.....

(3)

(b) People who live high up in mountainous areas have more red blood cells than people who live at sea level. The graph below shows how the number of red blood cells changes with height above sea level.



(i) How many more red blood cells does a person living at 3000 m above sea level have than someone living at sea level? Show clearly how you work out your answer.

.....

.....

Increase in number of red blood cells = ...millions per m^3

(2)

(ii) What is the advantage of having more red blood cells?

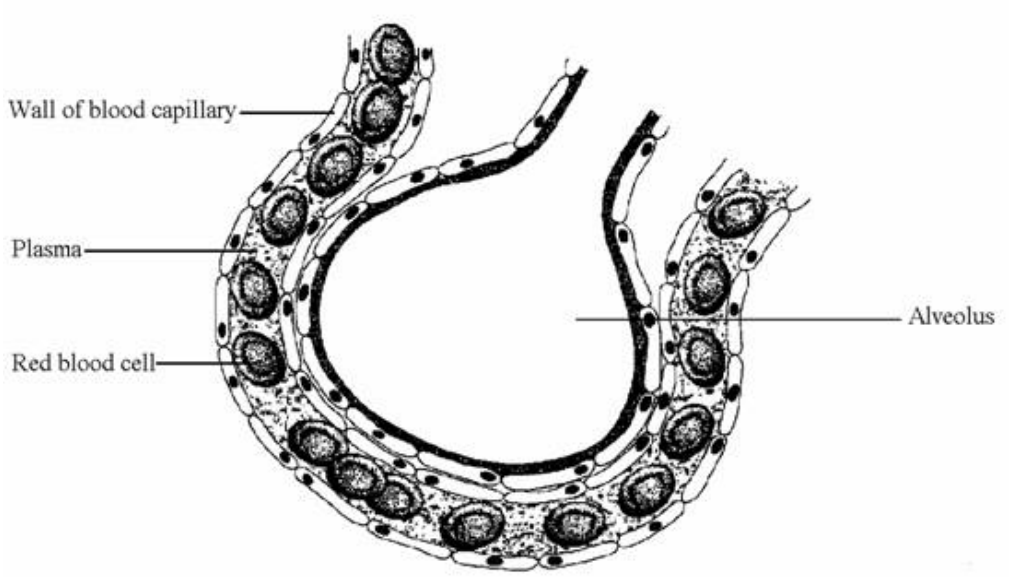
.....

.....

(1)

(Total 6 marks)

Q4. The diagram shows a part of a lung that is involved in gaseous exchange in a human.



(i) Draw and label, on the diagram, **one** arrow to show the direction of movement of oxygen between the alveolus and capillary.

(1)

(ii) Draw and label, on the diagram, **one** arrow to show the direction of movement of carbon dioxide, between the alveolus and capillary.

(1)

(iii) Give the function of the red blood cell in this process.

.....

.....

.....

(1)
(Total 3 marks)

Q5. The table gives information about a geranium plant and a cactus plant.

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

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

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

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

.....

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.....

(Total 5 marks)

Q6. Complete the table by writing the correct process next to its description.

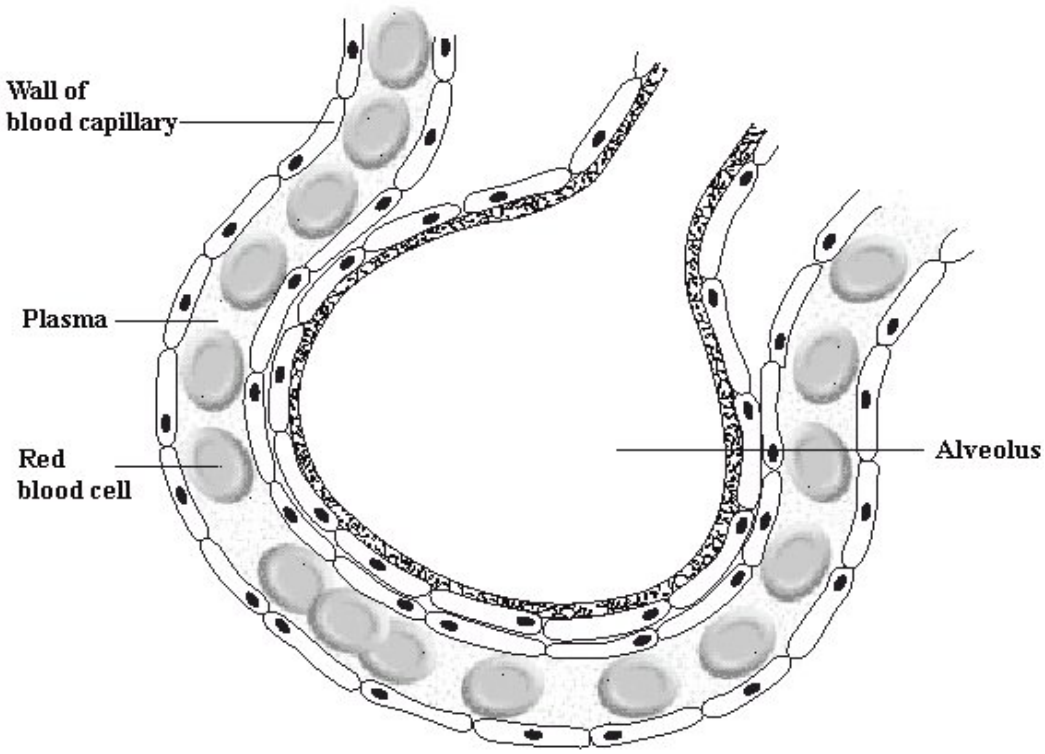
Choose your answers from the list in the box

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)

Q7. 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)

##

A runner might drink a special 'sports drink' at intervals during a marathon race. The table shows the substances present in a sports drink.

Substance	**Percentage**
Water	
Sugar	5.0
Ions	0.2

(a) Complete the table to show the percentage of water in the sports drink.

(1)

(b) The runner sweats and also breathes heavily during the race.

(i) Why does the runner need to sweat?

.....

(1)

(ii) Which **two** substances in the table are lost from the body in sweat?

.....

(1)

(iii) Which substance in the table is lost from the body during breathing?

.....

(1)

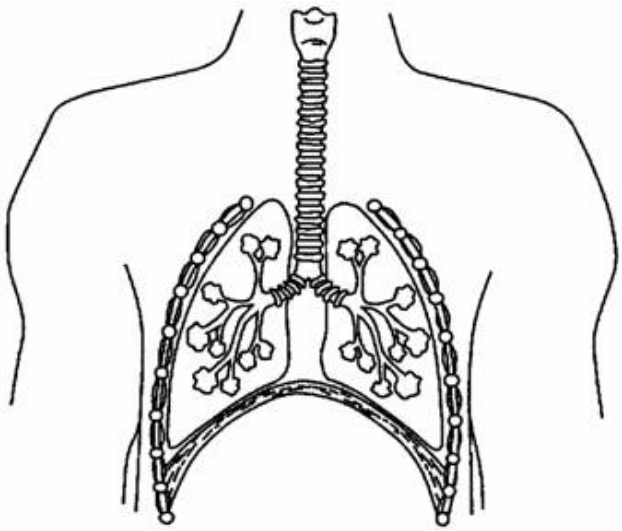
(c) How does the sugar in the sports drink help the athlete during the marathon?

.....

.....

(2)
(Total 6 marks)

Q9. The diagram shows the human breathing system.



(a) Place on the diagram:

(i) a letter **X** where oxygen enters the blood;

(1)

(ii) an arrow showing the direction the diaphragm moves when we breathe in.

(1)

(b) List the following structures in the order the air passes through them when we breathe in.

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)

Q10. Long distance runners are advised to take several drinks during a race.

The table gives the composition of two drinks, Isotonic and Cola.

Drink	**Sugar concentration in grams per litre**	**Sodium ion concentration in mmol per litre**	**Chloride ion concentration in mmol per litre**
Isotonic	73	24	12
Cola	105	3	1

Explain why Isotonic would be the best drink for a long distance runner on a hot day.

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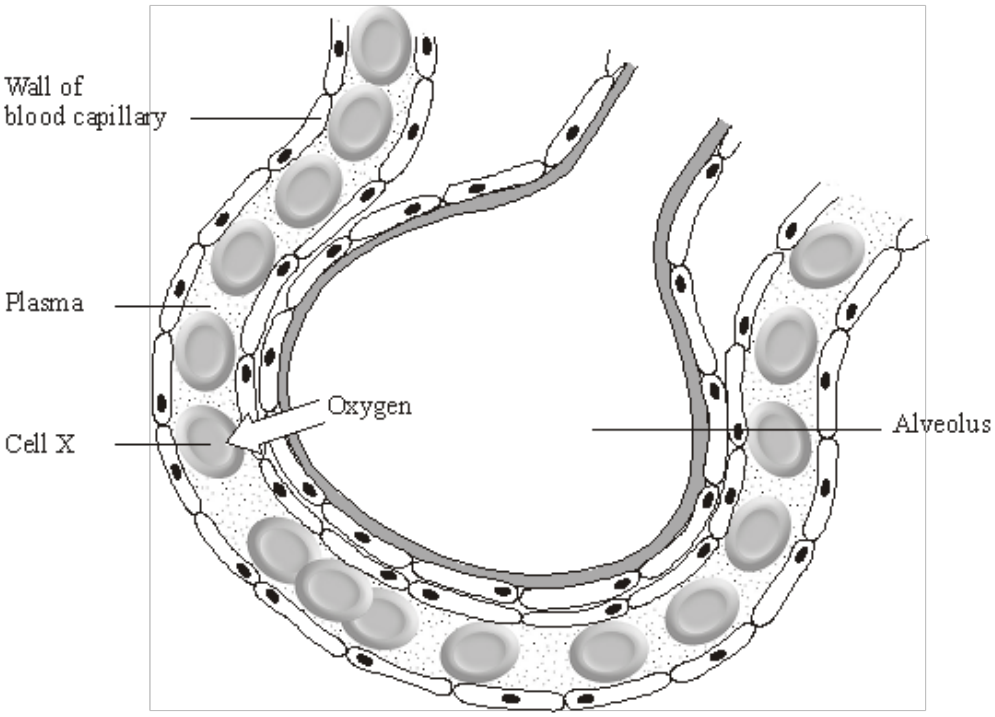
.....

.....

.....

(Total 2 marks)

Q11. The diagram shows a small part of a lung.



(a) The arrow on the diagram shows the movement of oxygen from the air in the alveolus to cell **X.**

Complete the sentences by drawing a ring around the correct answer.

(i) Cell **X** is a

platelet
red cell
white cell

(1)

(ii) Oxygen moves from the air in the alveolus into cell **X** by

diffusion
filtration
respiration

(1)

(iii) The substance in cell **X** that combines with oxygen is called

glycogen
haemoglobin
lactic acid

(1)

(iv) Cell **X** does **not** have

a cell membrane
cytoplasm
a nucleus

(1)

(b) **On the diagram**, draw an arrow to show the movement of carbon dioxide during gas exchange.

(1)
(Total 5 marks)

Q12. 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?

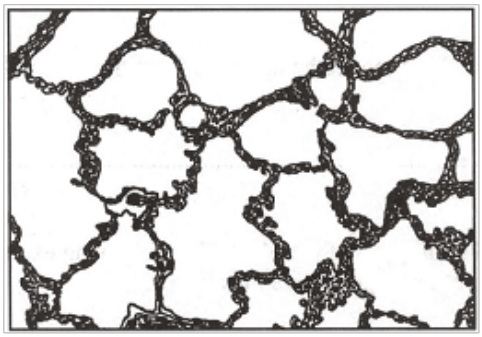
.....

.....

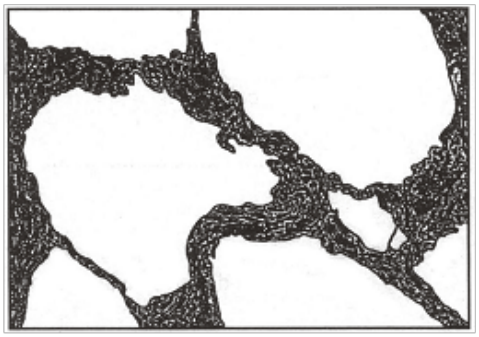
(1)
(Total 5 marks)

Q13. Emphysema is a lung disease.

(a) The drawings show sections through the lung of a healthy person and through the lung of a person with emphysema. The drawings are drawn to the same scale.



Section through the lung of a healthy person



Section through the lung of a person with emphysema

Use information from the drawings to answer the questions.

What effect does emphysema have on:

(i) the thickness of the surface used for gas exchange

.....

.....

(1)

(ii) the total area available for gas exchange?

.....

.....

(1)

(b) Two men did the same amount of exercise.
One man was in good health. The other man had emphysema.

The results are shown in the table.

	Man with good health	**Man with emphysema**
Oxygen entering blood in dm3 per minute	2.1	1.1
Air flow into lungs in dm3 per minute	90.7	46.0

The man in good health was able to take more oxygen into his blood than the man with emphysema.

Calculate how much more oxygen was taken into the blood per minute by the man in good health. Show your working.

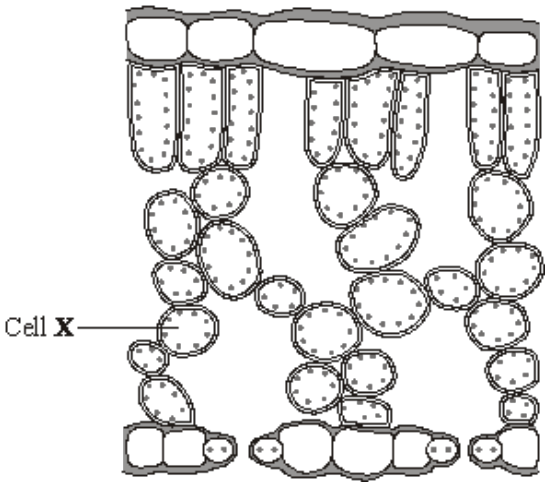
.....

.....

Answer = ... dm^3 per minute

(2)
(Total 4 marks)

Q14. (a) The diagram shows a section through a plant leaf.
Water evaporates from cell **X**.



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

(1)

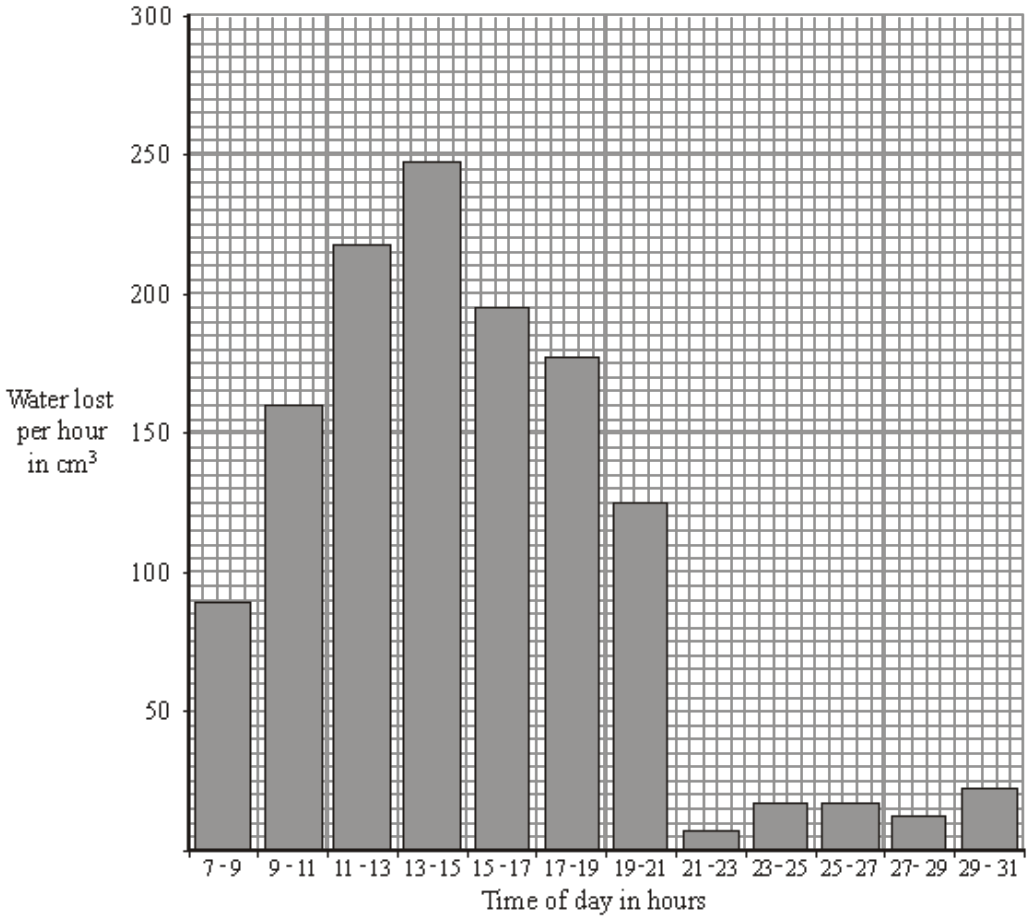
(ii) Name the process by which water vapour is lost from a leaf.

Draw a circle around **one** answer.

osmosis **transpiration** **wilting**

(1)

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



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

.....

(1)

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

.....

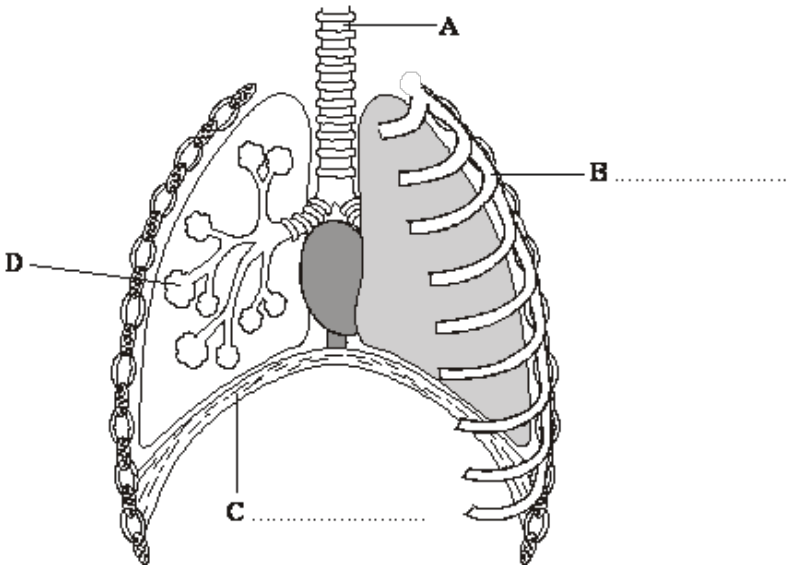
.....

.....

.....

(2)
(Total 5 marks)

Q15. The diagram shows the human breathing system.



(a) On the diagram, label structures **B** and **C**.

Choose your answers from the list in the box.

alveoli	**diaphragm**	**rib**	**trachea**

(2)

(b) (i) Which letter, **A**, **B**, **C** or **D**, shows the site of gas exchange? .....

(1)

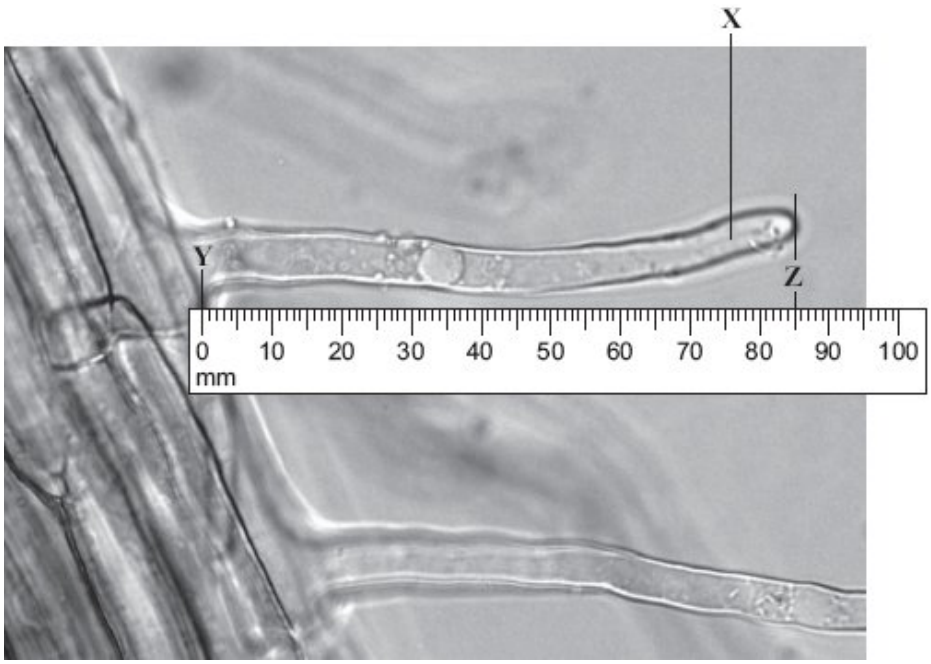
(ii) Which **one** of the following gases has a higher concentration in exhaled air than in inhaled air?

Draw a circle around **one** answer.

carbon dioxide **nitrogen** **oxygen**

(1)
(Total 4 marks)

Q16. 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?

.....

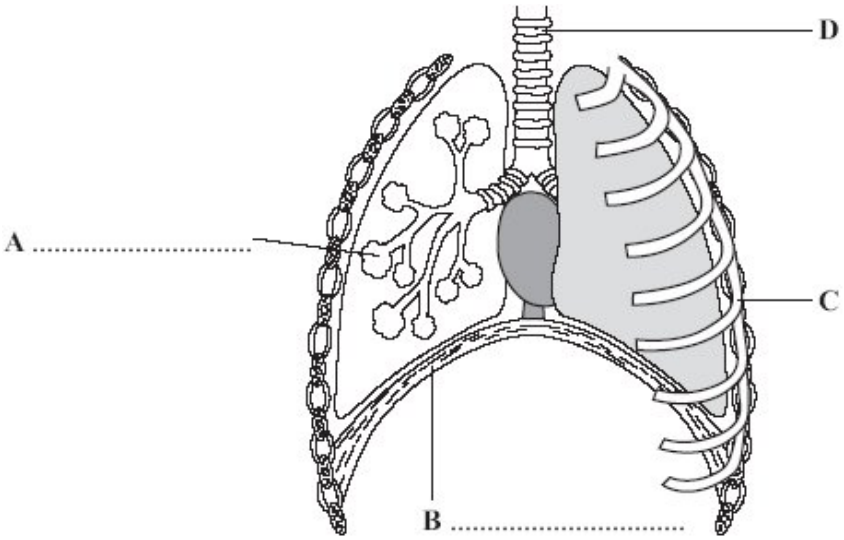
.....

.....

.....

(2)
(Total 6 marks)

Q17. The diagram shows the human breathing system.



(a) On the diagram, label structures **A** and **B**.

Choose your answers from the words in the box.

alveolus	**capillary**	**diaphragm**	**rib**

(2)

In the lungs, oxygen passes from the air into the blood.
Carbon dioxide passes from the blood into the air.

(b) Which letter, **A**, **B**, **C** or **D**, shows where oxygen enters the blood? ☐

(1)

(c) When oxygen enters the blood it combines with haemoglobin.

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

(i) Haemoglobin is found in the

plasma
red blood cells
white blood cells

.

(1)

(ii) Most of the carbon dioxide is carried by the

plasma
red blood cells
white blood cells

.

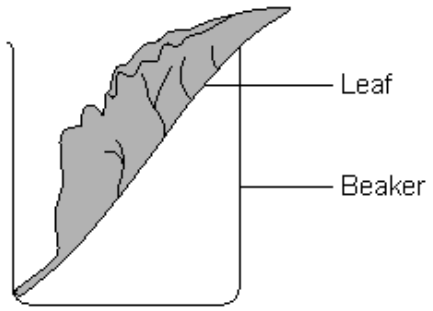
(1)
(Total 5 marks)

Q18. Four leaves were removed from the same plant. A waterproofing agent was spread onto some of the leaves, as follows:

- leaf **A** on both surfaces
- leaf **B** on the lower surface only
- leaf **C** on the upper surface only
- leaf **D** on neither surface.

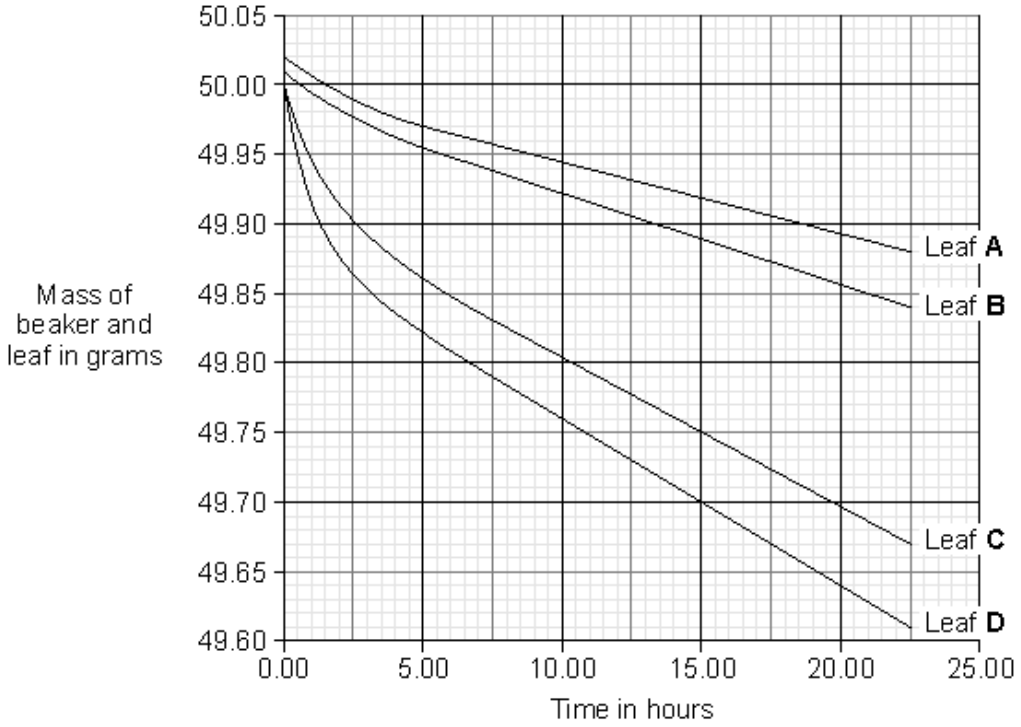
Each leaf was then placed in a separate beaker, as shown in **Diagram 1**.

Diagram 1



Each beaker was weighed at intervals.

The results are shown in the graph.



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

(i) Which leaf, **A**, **B**, **C** or **D**, loses water most rapidly? ☐

Evidence .....

.....

(1)

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

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

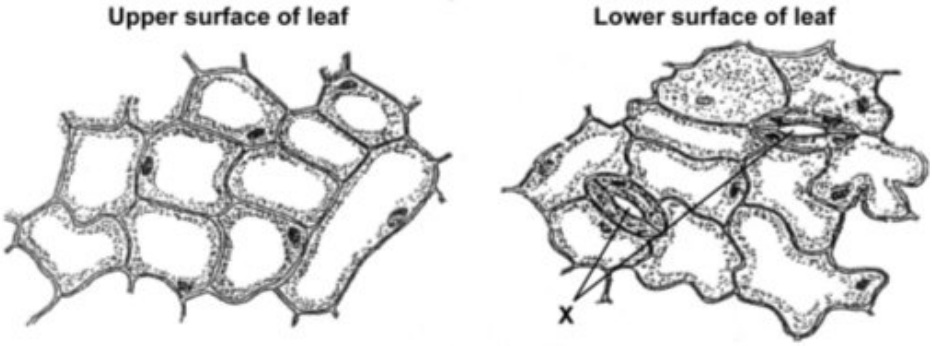
Evidence .....

.....

(1)

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

Diagram 2



(i) Name the spaces labelled **X** .....

(1)

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

.....

.....

.....

.....

(2)
(Total 5 marks)

Q19. In fish and chip shops, potatoes are cut into chips several hours before the chips 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 five chips.

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

	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? .....

(1)

(ii) Explain why the chip gained mass in this solution.

.....

.....

.....

.....

.....

(2)

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

Give the reason for your answer.

.....

.....

.....

.....

.....

(2)
(Total 5 marks)

Q20. A marathon runner loses a lot of sweat during a race.

(a) Complete the following sentence.

Sweat contains water and .....

(1)

(b) The table shows the concentration of glucose, ions and protein in four sports drinks, **A**, **B**, **C** and **D**.

Runners drink sports drinks to replace the water lost in sweating. Replacing water is called rehydration.

Scientists have shown that the ratio of the glucose concentration, in g per dm^3, to the ion concentration, in mg per dm^3, in a drink affects the rate of rehydration.

The nearer this ratio is to 1:1, the faster the body rehydrates.

Drink	**Glucose in g per dm^3**	**Ions in mg per dm^3**	**Protein in g per dm^3**	**Glucose to ion ratio**
A	110	22	1.2	5:1
B	64	96	0.0	2:3
C	72	80	0.0	.....
D	138	23	0.2	.....

(i) Which drink, **A**, **B**, **C** or **D**, would give the runner most energy?

(1)

(ii) Calculate the glucose to ion ratios for drinks **C** and **D**.

Write your answers in the table.

(2)

(iii) Which drink, **A**, **B**, **C** or **D**, would rehydrate the runner the fastest? ☐

(1)

(c) The kidney controls the amount of water in the runner's body.

The table shows:

- the volume of water filtered from the blood
- the volume of urine produced in one day.

	Volume per day in dm^3
Water filtered from blood	180
Urine	2

Calculate the volume of water reabsorbed into the blood in one day.

.....

Volume of water that is reabsorbed ..... dm^3

(1)

(d) On a hot sunny afternoon:

- man **A** sat in the shade, drinking beer
- man **B** went jogging in the desert.

Man **A**

Man **B**

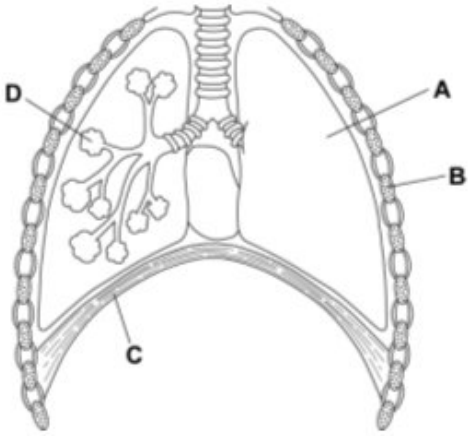
Complete the table to compare the volume and concentration of urine produced by the kidneys of the two men.

Tick (✓) **one** box on each row.

Compared with Man A	The same	Higher	Lower
the volume of urine produced by man **B** would be			
the concentration of urine produced by man **B**'s kidneys would be			

(2)
(Total 8 marks)

Q21. The diagram shows a section through the chest.



For each question write the correct letter in the box.

Which structure, **A**, **B**, **C** or **D**, is:

(a) a rib ☐ **(1)**

(b) the diaphragm ☐ **(1)**

(c) an alveolus? ☐ **(1)**

(d) Complete the following sentences.

(i) When we breathe in the rib cage moves ..... and the diaphragm becomes ..... .

(2)

(ii) Alveoli are adapted for absorbing ..... .

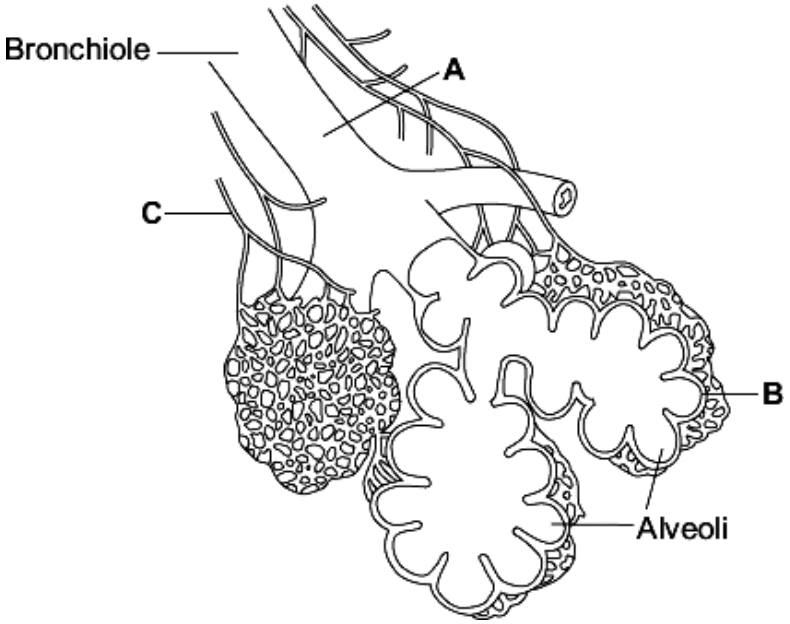
(1)

(Total 6 marks)

Q22. People with asthma sometimes find it difficult to breathe.

Diagram 1 shows part of a human lung. Bronchioles are tubes that carry air to the alveoli.

Diagram 1

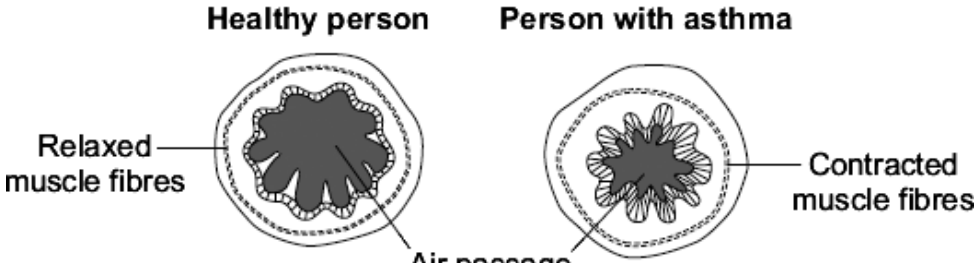


(a) Which letter, **A**, **B** or **C**, shows where oxygen enters the blood?

(1)

(b) **Diagram 2** shows a section through a bronchiole of a healthy person and of a person suffering from asthma.

Diagram 2



Air passage

The person with asthma may find it difficult to breathe.

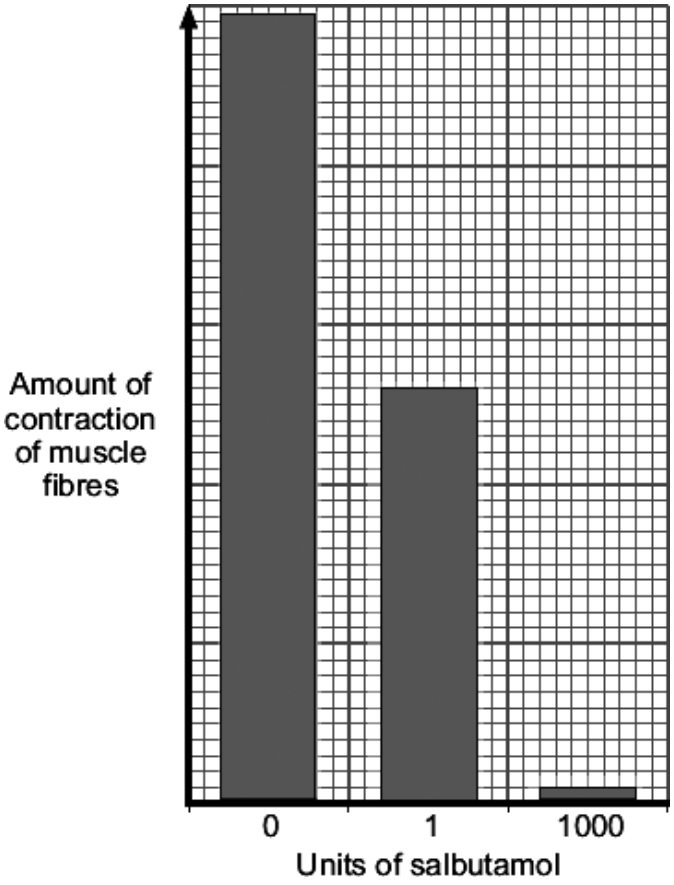
Use information from **Diagram 2** to give the reason for this.

.....

.....

(1)

(c) A person has asthma. The bar graph shows the effect of the drug salbutamol on the contraction of the muscle fibres in the wall of this person's bronchioles.



(i) Describe the effect of salbutamol on the person's muscle fibres.

.....

.....

(1)

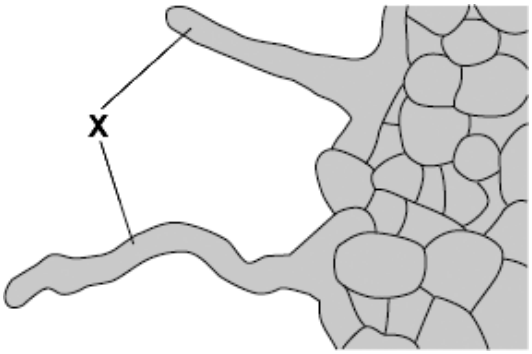
(ii) How does salbutamol help this person?

.....

.....

(1)
(Total 4 marks)

Q23. The diagram shows part of a plant root. A large number of structures like the ones labelled **X** grow out of the surface of the root.



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

Draw a ring around **one** answer.

root hair **stoma** **villus**

(1)

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

1 .....

2 .....

(2)

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

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

(i) Carbon dioxide enters leaves through

alveoli.
stomata.
villi.

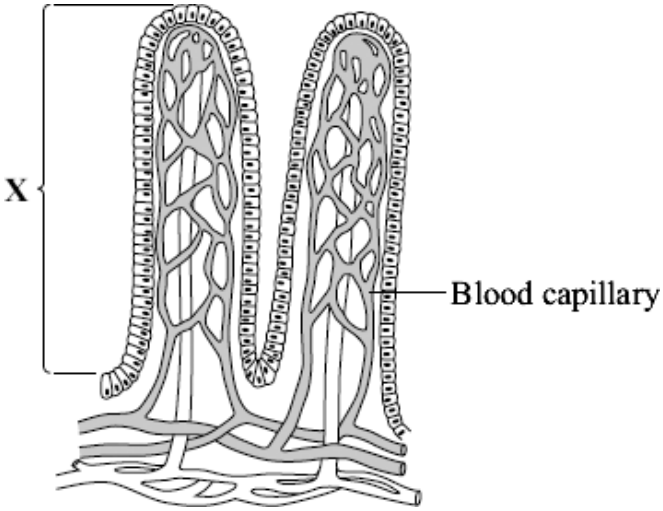
(1)

(ii) Carbon dioxide enters leaf cells by

active transport.
diffusion.
reabsorption.

(1)
(Total 5 marks)

Q24. 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.

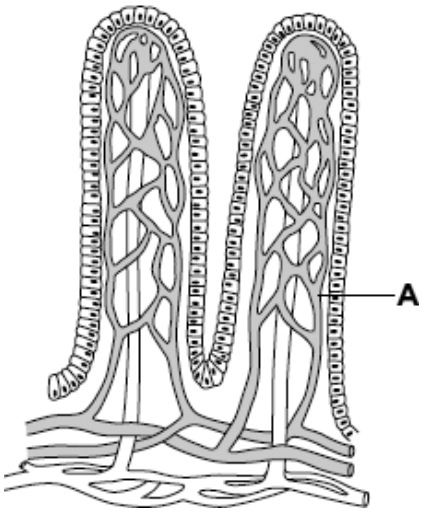
diffusion **fermentation** **transpiration**

(1)
(Total 5 marks)

Q25. 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)

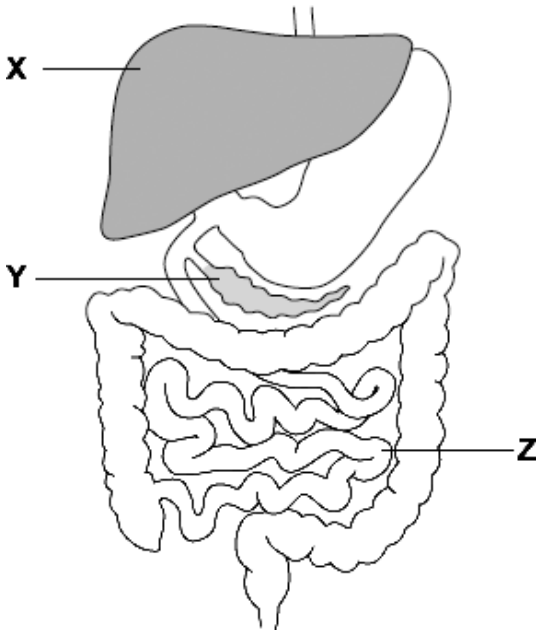
(ii) The villi absorb the products of digestion by

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)

Q26. Substances can move into and out of cells.

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

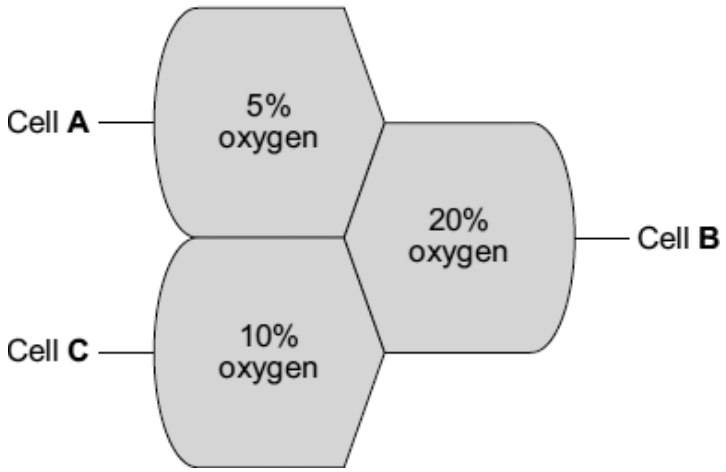
Draw a ring around **one** answer.

diffusion **digestion** **photosynthesis**

(1)

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

Diagram 1



Oxygen can move from cell to cell.

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

(1)

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

Draw a ring around **one** answer.

breathing **osmosis** **respiration**

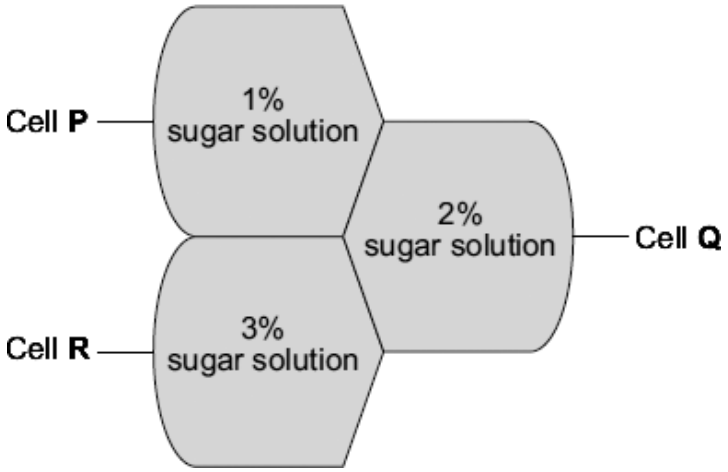
(1)

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

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

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

Diagram 2



Water can move from cell to cell.

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

(1)
(Total 4 marks)

Q27. (a) Draw a ring around the correct answer to complete the sentence.

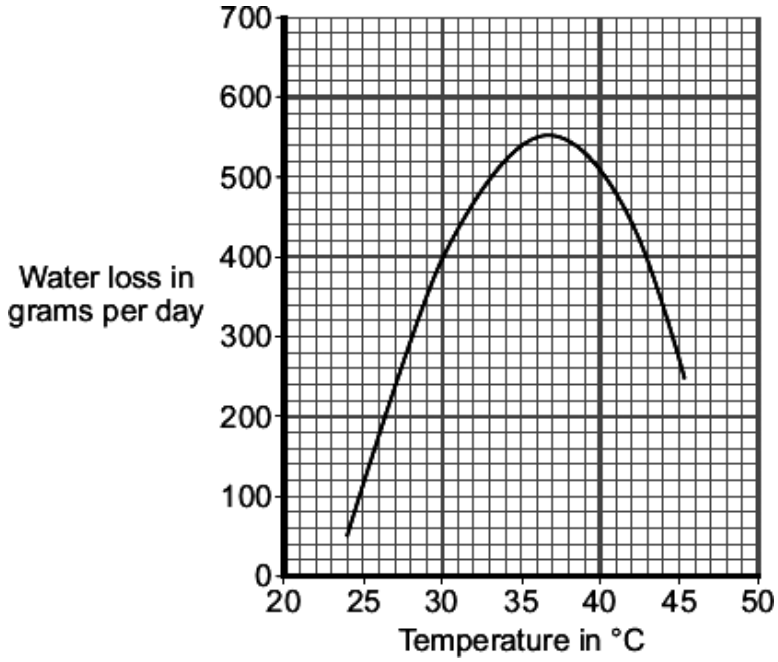
A plant loses water from its leaves by a process called

- distillation.
- respiration.
- transpiration.

(1)

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

The graph shows the results.



Describe the effect of increasing the temperature on water loss from the plant.

.....

.....

.....

.....

(2)

(c) Under different conditions, plants open or close their stomata.

(i) How does closing its stomata help a plant?

.....

.....

(1)

(ii) In the investigation described in part (b), which temperature range would cause most of the stomata to close?

Draw a ring around **one** answer.

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

(1)
(Total 5 marks)

Q28. (a) **List A** gives four structures in the human body.

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

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

List A – Structure	**List B – Function**
	Surround and protect the lungs
Alveoli	
	Filter the blood
Veins	
	Carry blood towards the heart
Villi	
	Absorb digested food
Ribs	
	Allow oxygen to enter the blood

(4)

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

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

- diffusion.
- filtration.
- respiration.

(1)
(Total 5 marks)

Q29. Plants lose water vapour from their leaves. Most of this water vapour is lost through the stomata.

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

Plants lose water vapour by

distillation.
filtration.
transpiration.

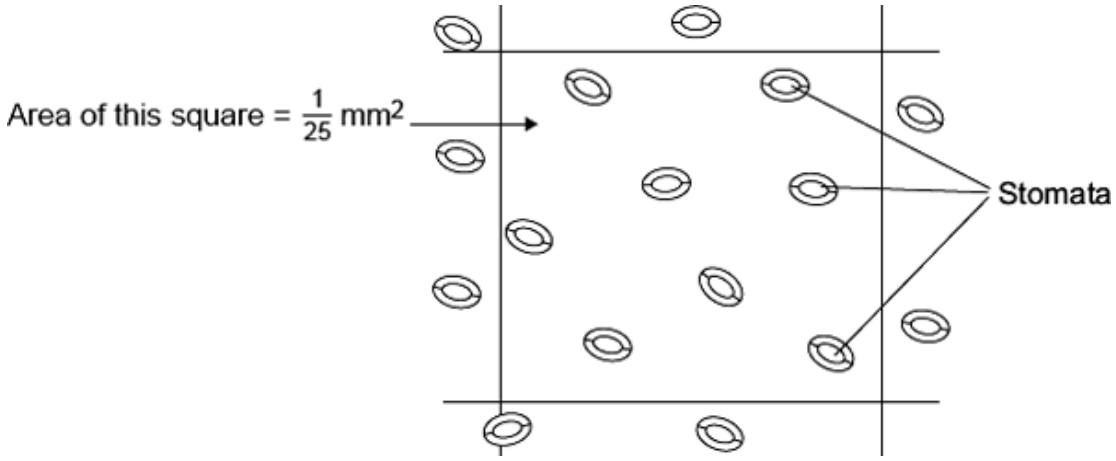
(1)

(b) A class of students investigated the number of stomata per mm^2 on the upper surface and on the lower surface of the leaves of three species of plant, **P**, **Q** and **R**.

The students placed samples of the surface cells onto a grid on a microscope.

Student **X** counted the stomata on the lower surface of a leaf from one of the plant species.

The diagram shows part of the grid that student **X** saw under the microscope.



(i) Complete the calculation to estimate the number of stomata per mm^2 on the lower surface of this leaf.

Number of stomata in $\frac{1}{25}$ mm^2 = ...

Number of stomata in 1 mm^2 = ...

(2)

The table shows the mean results for the class.

Plant species	Mean number of stomata per mm^2 of leaf	
	Upper surface of leaf	Lower surface of leaf
P	40	304
Q	0	11
R	85	195

(ii) Student **X** had counted the stomata on the lower surface of a leaf from one of the plant species.

Use your answer to part **(b)(i)**, and information in the table, to help you to answer this question.

From which plant species, **P**, **Q** or **R**, was student **X**'s leaf most likely to have been taken? ☐

(1)

(iii) Species **Q** is normally found growing in hot, dry conditions.

Explain **one** way in which species **Q** is adapted for living in hot, dry conditions.

Use information from the table.

.....

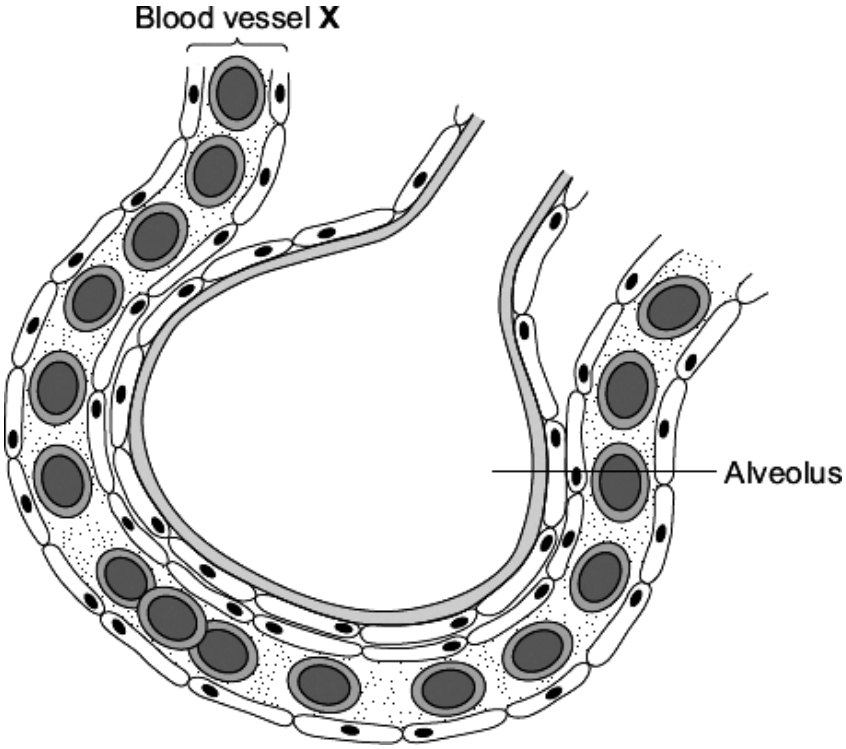
.....

.....

.....

(2)
(Total 6 marks)

Q30. 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

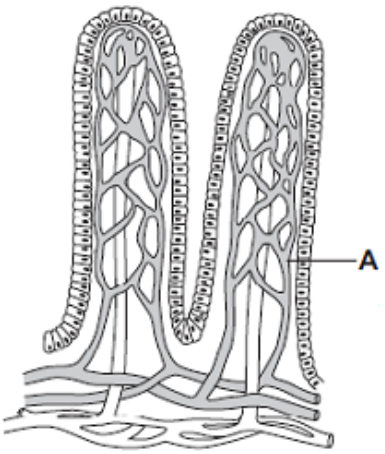
- carbon dioxide.
- haemoglobin.
- urea.

(1)
(Total 6 marks)

Q31. 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)

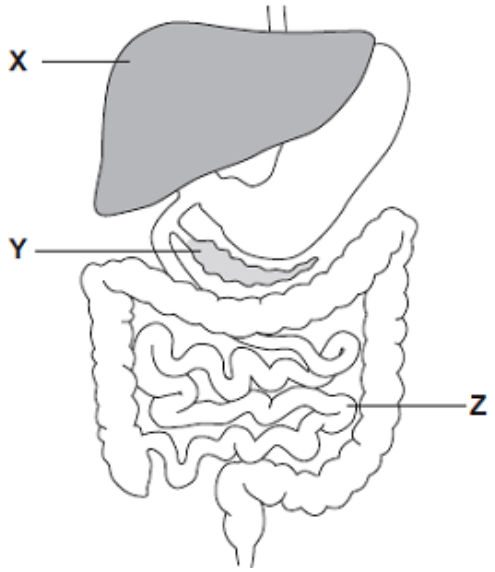
(ii) The villi absorb the products of digestion by

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)

Q32. Substances can move into and out of cells.

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

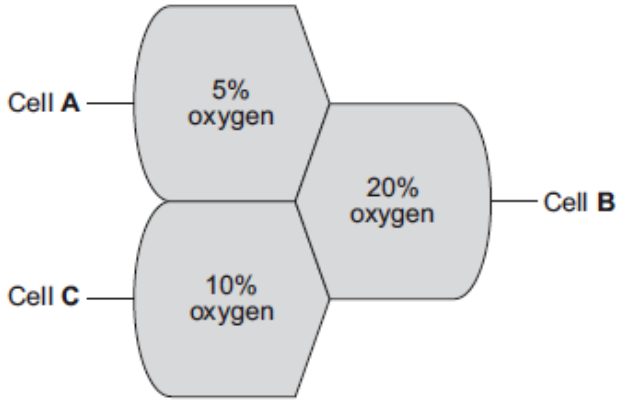
Draw a ring around **one** answer.

diffusion **digestion** **photosynthesis**

(1)

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

Diagram 1



Oxygen can move from cell to cell.

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

(1)

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

Draw a ring around **one** answer.

breathing **osmosis** **respiration**

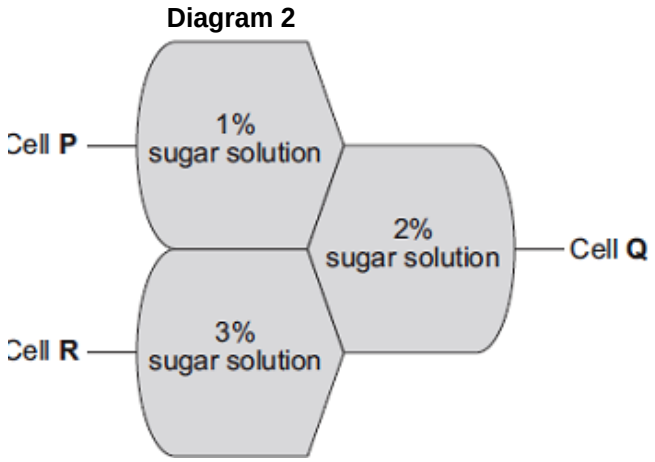
(1)

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

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

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

Diagram 2



Water can move from cell to cell.

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

(1)
(Total 4 marks)