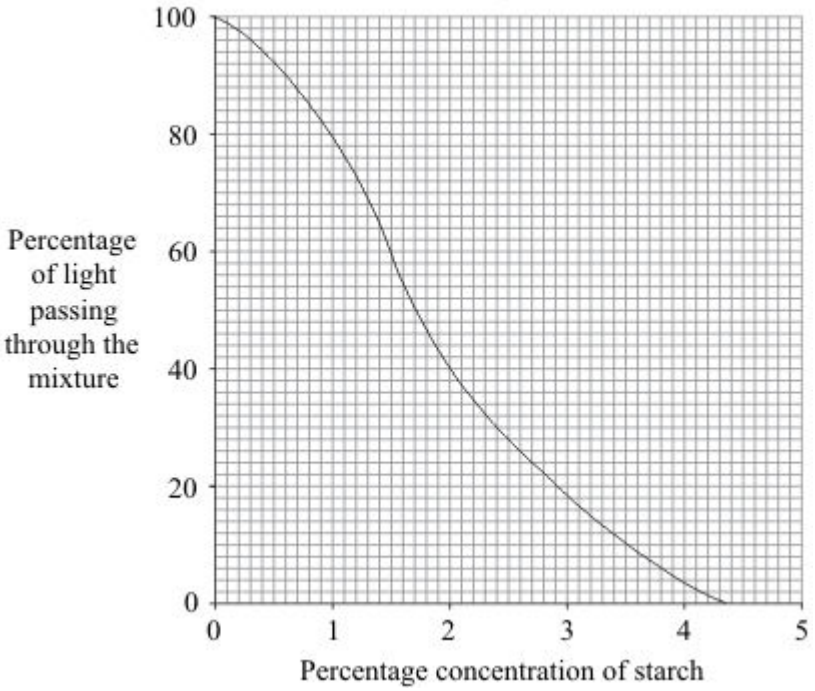
1 A manufacturer of slimming foods is investigating the effectiveness of carbohydrases from different microorganisms.

Iodine solution is a pale golden brown, transparent solution. Starch reacts with iodine to form a dark blue mixture.

Known concentrations of starch are added to iodine solution. The mixture is placed in a colorimeter which measures the percentage of light passing through the mixture.

Graph 1 shows the results.

Graph 1



(a) Explain why less light passes through the mixture when the starch is more concentrated.

.....

.....

.....

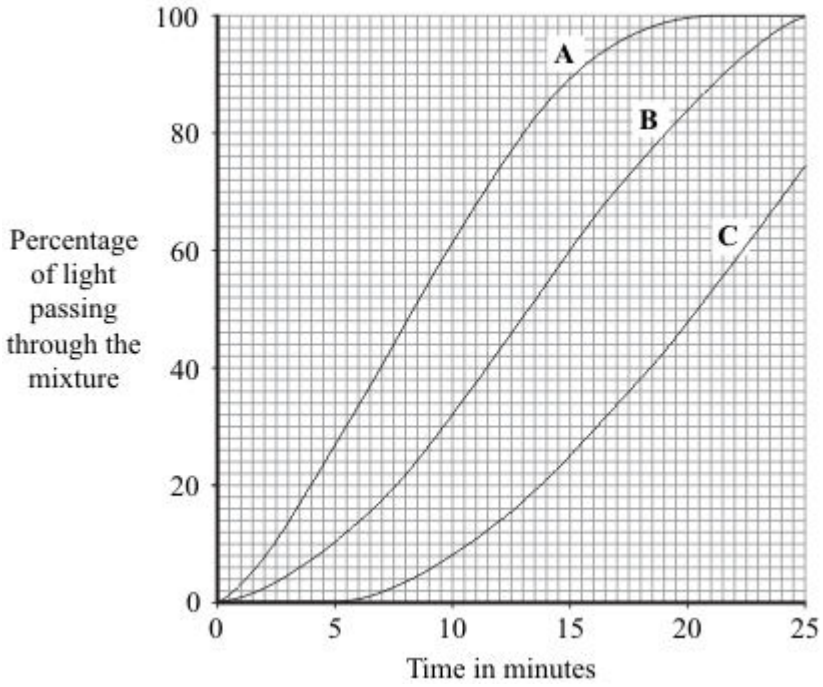
(1)

(b) The manufacturer adds carbohydrase from each of three different microorganisms, **A**, **B** and **C**, to starch in flasks at 40 °C.

Every minute a sample of the mixture is added to iodine solution and placed in the colorimeter.

Graph 2 shows these results.

Graph 2



(i) When the concentration of starch reaches 2 %, digestion is considered to be sufficient for the next stage in the manufacture of the slimming food.

How long does this take for the most effective carbohydrase?

Show clearly how you work out your answer.

.....

.....

..... minutes

(2)

(ii) Explain why the manufacturer carried out the investigation at 40 °C.

.....

.....

.....

.....

.....

(2)

(c) Carbohydrases convert starch into glucose. To complete the manufacture of the slimming food the glucose should be converted into fructose.

(i) Name the enzyme which would be used to convert glucose into fructose.

.....

(1)

(ii) Explain why fructose, rather than glucose, is used in slimming foods.

.....

.....

.....

.....

.....

(2)

(Total 8 marks)

2 (a) Draw a ring around **one** word to answer each of the following questions.

(i) Which type of blood vessel carries blood out of the heart?

artery **capillary** **vein**

(1)

(ii) Which type of blood vessel allows substances to enter and leave the blood?

artery **capillary** **vein**

(1)

(b) Use words from the box to complete the sentences.

alveoli	**cell membrane**	**nucleus**
plasma	**red blood cells**	**villi**

Oxygen enters the blood through the walls of the ..... .

Most of the oxygen transported by the blood is carried in the

..... .

A red blood cell is different from other body cells because it does not have a

..... .

(3)
(Total 5 marks)

3 (a) The table shows the effect of exercise on the action of one person's heart.

	At rest	**During exercise**
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm^3	75	120
Heart output in cm^3 per minute	5400	

(i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

.....

.....

.....

.....

Answer = ... cm^3 per minute

(2)

(ii) During exercise, more oxygen is carried to the working muscles.

Explain why this is helpful during exercise.

.....

.....

.....

.....

.....

(2)

(b) Give **two** other changes in the body that help to increase the amount of oxygen delivered to the working muscles during exercise.

1 .....

.....

2 .....

.....

(2)
(Total 6 marks)

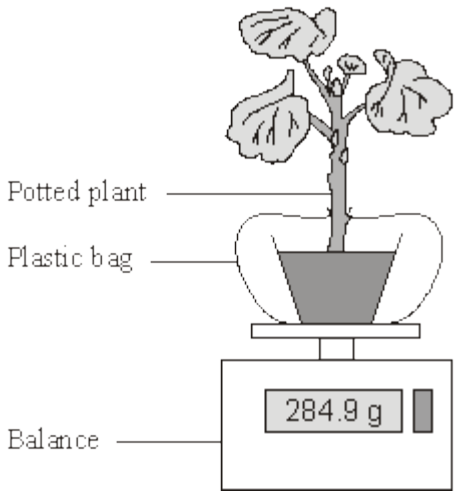
4

(a) Name the process by which water is lost from plant leaves.

.....

(1)

(b) Some students set up the apparatus shown in the diagram to measure the water loss from a potted plant.



The apparatus was placed in different environmental conditions:

A in still air at 20 °C.
B in still air at 25 °C.
C in a wind at 20 °C.
D in a wind at 25 °C.

Readings from the balance were recorded by a datalogger at 10-minute intervals.

The results are given in the table.

Time in minutes	Balance reading in grams			
	A	**B**	**C**	**D**
0	285.6	284.6	282.9	280.9
10	285.3	284.2	282.4	280.2
20	284.9	283.8	281.9	279.4
30	284.7	283.4	281.4	278.8

(i) Under which conditions, **A**, **B**, **C** or **D**, was water lost most rapidly? ☐

(1)

(ii) Explain, as fully as you can, why water was lost most rapidly under these conditions.

.....

.....

.....

.....

.....

(2)
(Total 4 marks)

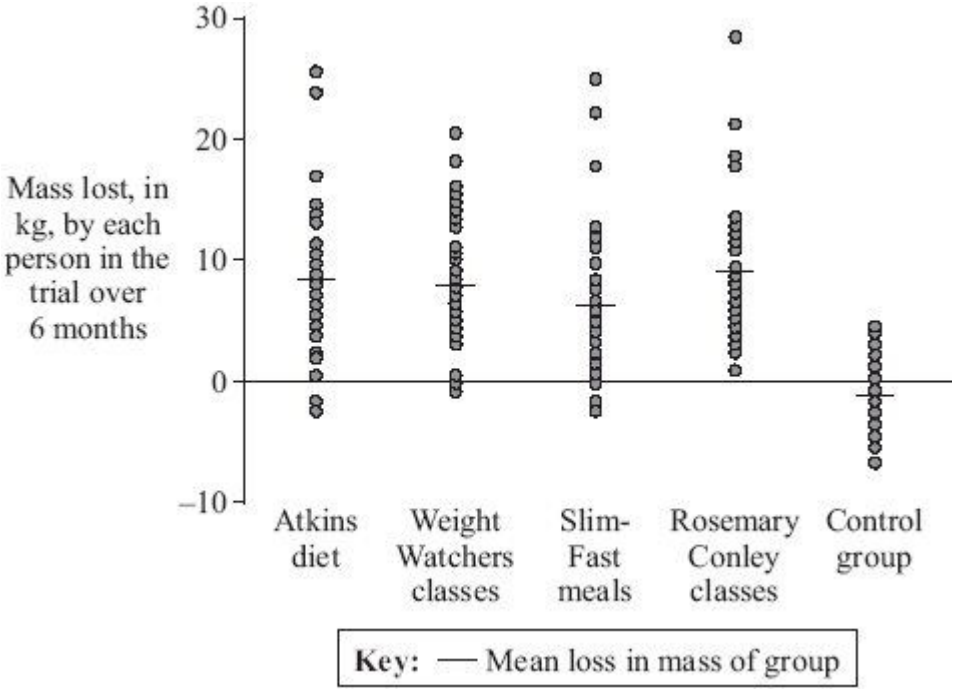
5 Many people who are overweight try slimming programmes.

A research study evaluated four different slimming programmes over 6 months.

Scientists selected a group of 40 people for each slimming programme and a control group.

Each of the five groups was matched for age, gender and mass.

The graph shows the results of the study.



Adapted from British Medical Journal, 2006, volume 332, pages 1309 –1314.

(a) Give **two** control variables that were used in this study.

1 .....

2 .....

(2)

(b) Give **two** conclusions that can be drawn from the results of this study.

1 .....

.....

2 .....

.....

(2)

(c) The costs of the four programmes were:

- Atkins book cost £3
- Rosemary Conley classes cost £140 for 6 months
- Weight Watchers classes cost £170 for 6 months
- Twice-daily Slim-Fast meal replacements cost £240 for 6 months.

Use this information and the graph to answer this question.

Which is the most cost effective of the four programmes?

.....

Explain the reason for your answer.

.....

.....

.....

.....

(2)

(d) Some slimming programmes include daily exercise.

Explain how daily exercise helps a person to lose mass.

.....

.....

.....

.....

(2)
(Total 8 marks)

6 A manufacturer is trying to improve the quality of the biological detergent he produces.

Scientists at his company carried out the following experiments on enzymes:

- Samples of lipase were collected from five different types of bacterium, **A**, **B**, **C**, **D** and **E**.
- The samples were diluted to give the same concentration of lipase.
- Agar jelly containing a lipid was prepared in a dish. This forms a cloudy mixture which becomes clear when the lipid is digested.
- Five small holes were cut into the agar.
- Two drops of lipase solution from bacterium **A** was added to hole **A**.
- This process was repeated for each sample of lipase.

Diagram 1 shows the appearance of the dish.

Diagram 1

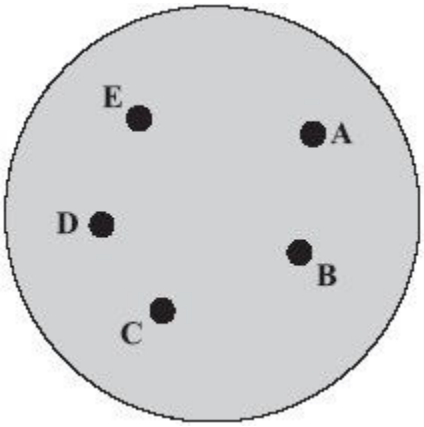
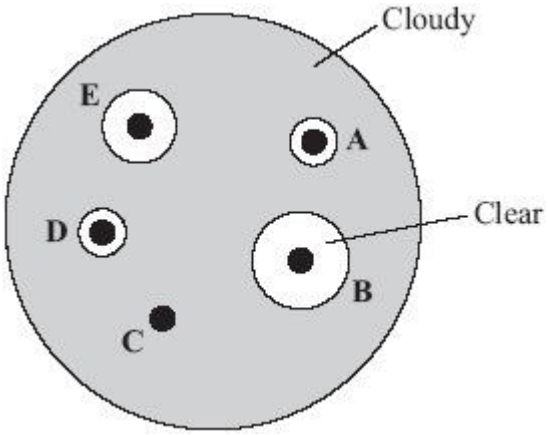


Diagram 2 shows the appearance of the dish 24 hours later.

Diagram 2



(a) (i) Which type of bacterium, **A**, **B**, **C**, **D** or **E**, produced the most effective lipase in this investigation?

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

(1)

(ii) Explain your answer.

.....

.....

(1)

(b) The manufacturer plans to add the most effective lipase to the washing powders he produces.

Suggest **two** other factors he should investigate before deciding which lipase is the most effective.

1 .....

.....

2 .....

.....

(2)

(c) Many biological detergents cannot be used at high temperatures.

Explain why.

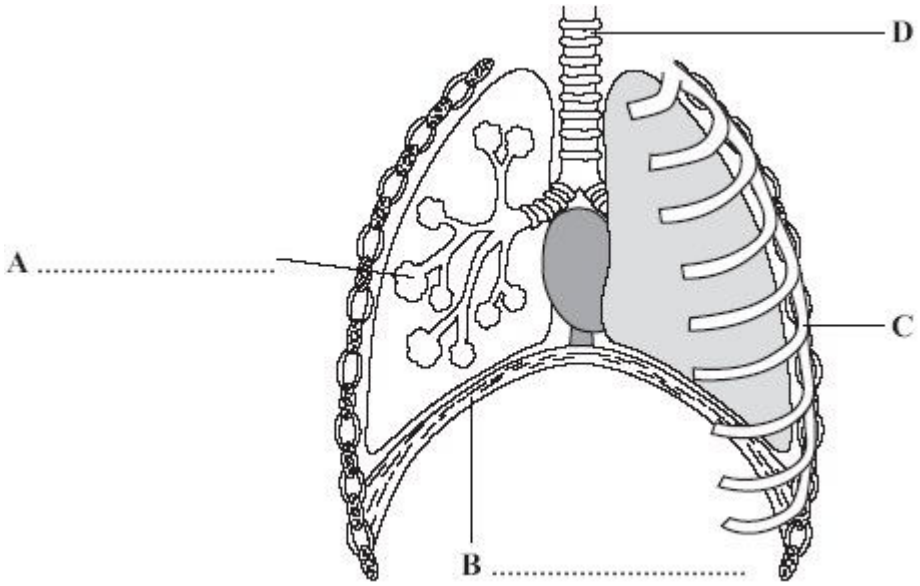
.....

.....

(1)

(Total 5 marks)

7 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

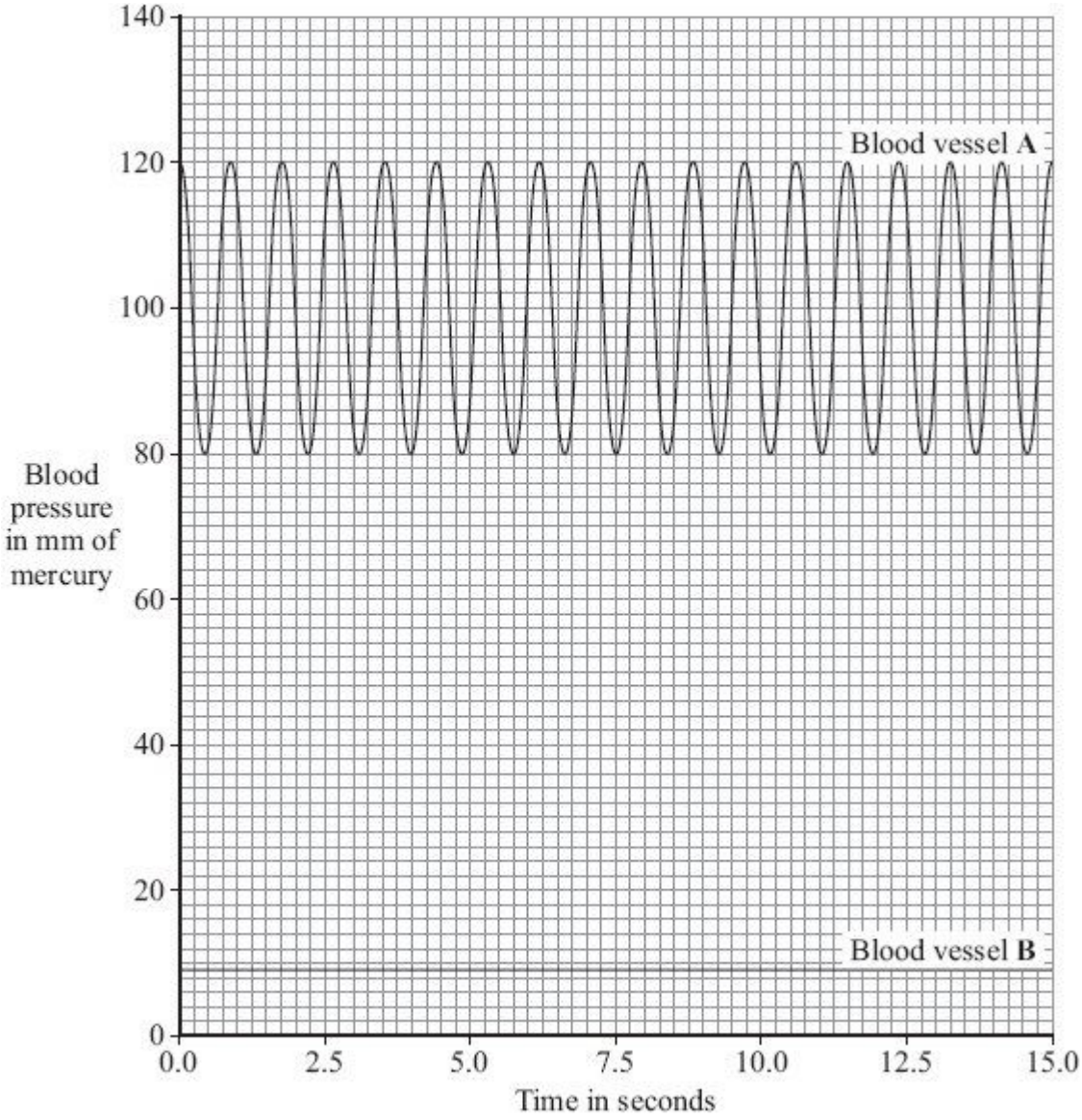
plasma
red blood cells
white blood cells

.

(1)
(Total 5 marks)

8 The heart pumps blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest.
The blood pressure was measured in an artery and in a vein.



(a) Which blood vessel, **A** or **B**, is the artery?

Blood vessel .....

Give **two** reasons for your answer.

Reason 1 .....

.....

Reason 2 .....

.....

(2)

(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? .....

(1)

(ii) Use your answer from part (b)(i) to calculate the person's heart rate per minute.

.....

.....

Heart rate = ... beats per minute

(1)

(c) During exercise, the heart rate increases. This supplies useful substances to the muscles and removes waste materials from the muscles at a faster rate.

(i) Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1 .....

2 .....

(2)

(ii) Name **one** waste substance that must be removed from the muscles at a faster rate during exercise.

.....

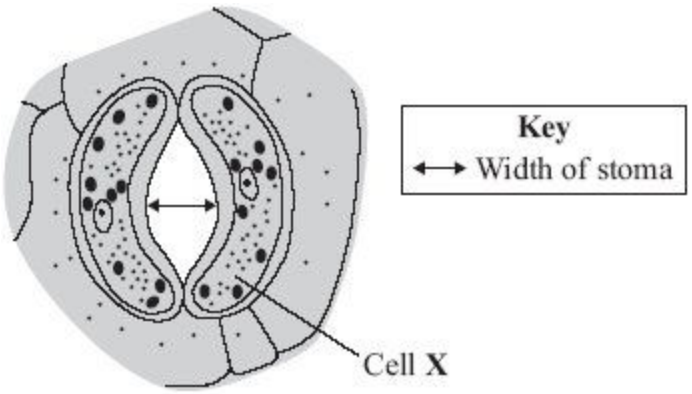
(1)

(Total 7 marks)

9

Plant leaves have many stomata.

The diagram shows a stoma.



(a) Name cell **X** .....

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** normally grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day	**Mean width of stomata as a percentage of their maximum width**	
	In hours	**Species A**	**Species B**
	0	95	5
Dark	2	86	5
	4	52	6
	6	6	40
	8	4	92
	10	2	98
Light	12	1	100
	14	0	100
	16	1	96
	18	5	54
	20	86	6
Dark	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 5 marks)

10 Bile is produced in the liver, stored in the gall bladder, then released into the small intestine.

(a) Explain how bile affects the digestion of food in the small intestine.

.....

.....

.....

.....

(2)

(b) Bile contains bile pigments and cholesterol.

If the diet contains too much cholesterol, some of it may form ‘gallstones’ in the bile.

These gallstones may prevent bile from moving out of the gall bladder into the small intestine.

Bilirubin is a yellow-brown bile pigment. This pigment is produced by the liver from haemoglobin released by broken-down red blood cells.

Suggest how gallstones may produce the following symptoms:

(i) very pale faeces

.....

.....

.....

.....

(2)

(ii) jaundice (a yellow tinge to the skin).

.....

.....

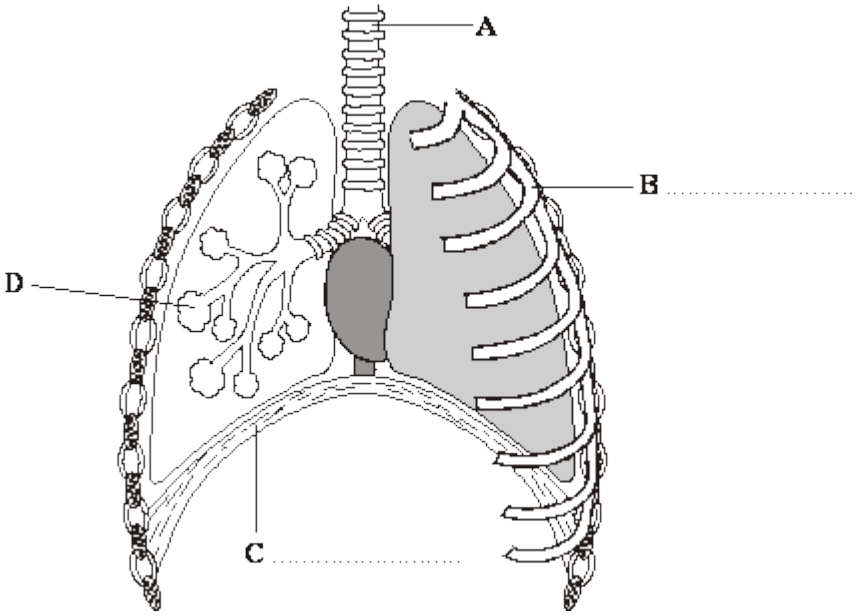
.....

.....

(2)

(Total 6 marks)

11 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)

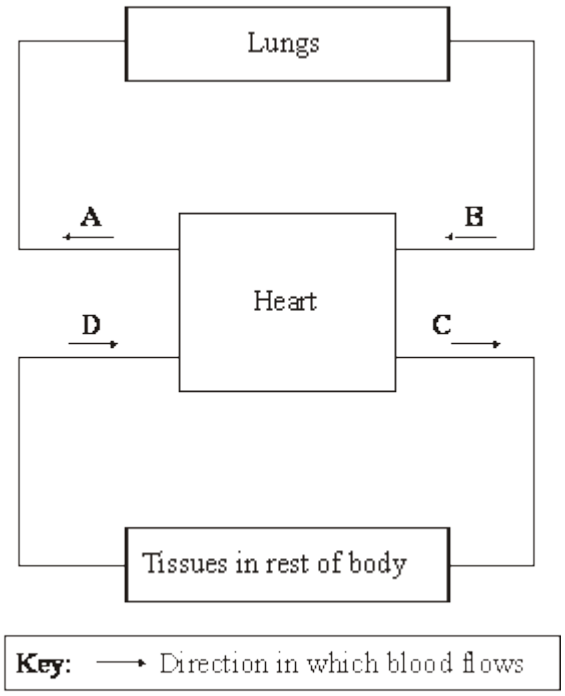
(ii) Which **one** of the following gases has a higher concentration in exhaled air than in inhaled air?

Draw a circle around **one** answer.

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

(1)
(Total 4 marks)

12 The diagram represents the human blood circulation system.



(a) **A**, **B**, **C** and **D** are blood vessels.

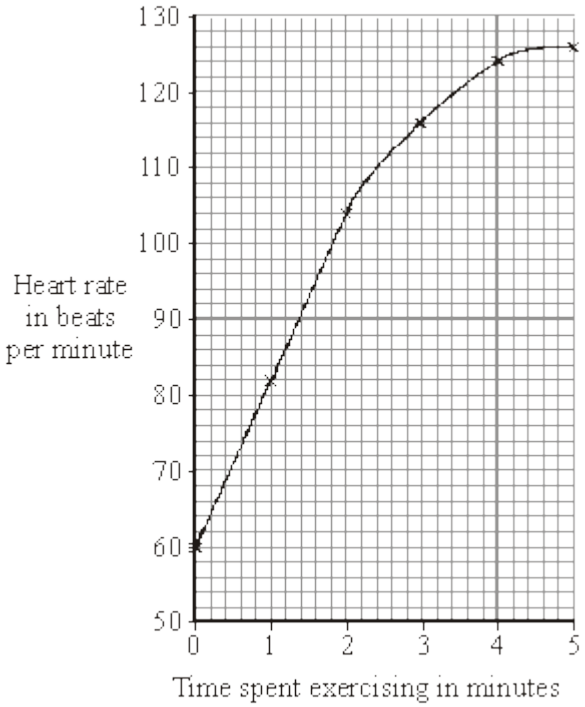
(i) Give the letter of **one** blood vessel that is an artery. .....

(1)

(ii) Give the letter of **one** blood vessel that is a vein. .....

(1)

(b) A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise. The results are shown in the graph.



(i) What was the student's heart rate before the exercise began?

..... per minute

(1)

(ii) How long was it before the student's heart rate reached 124 beats per minute?

..... .minutes

(1)

(c) Which of the following parts of the blood carries most oxygen?

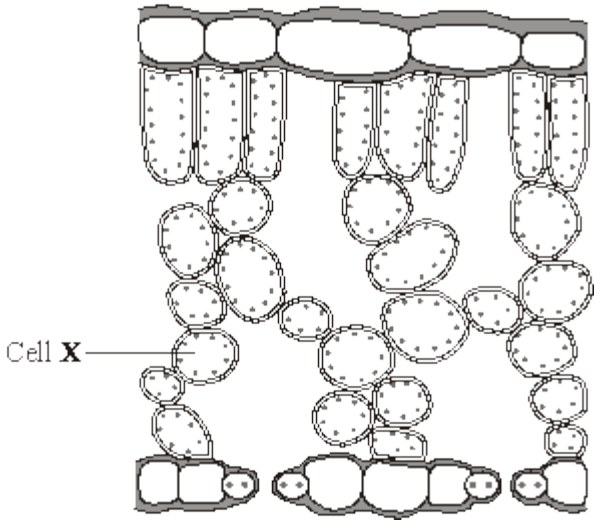
Draw a circle around **one** answer.

plasma **red blood cells** **white blood cells**

(1)
(Total 5 marks)

-

13 (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)

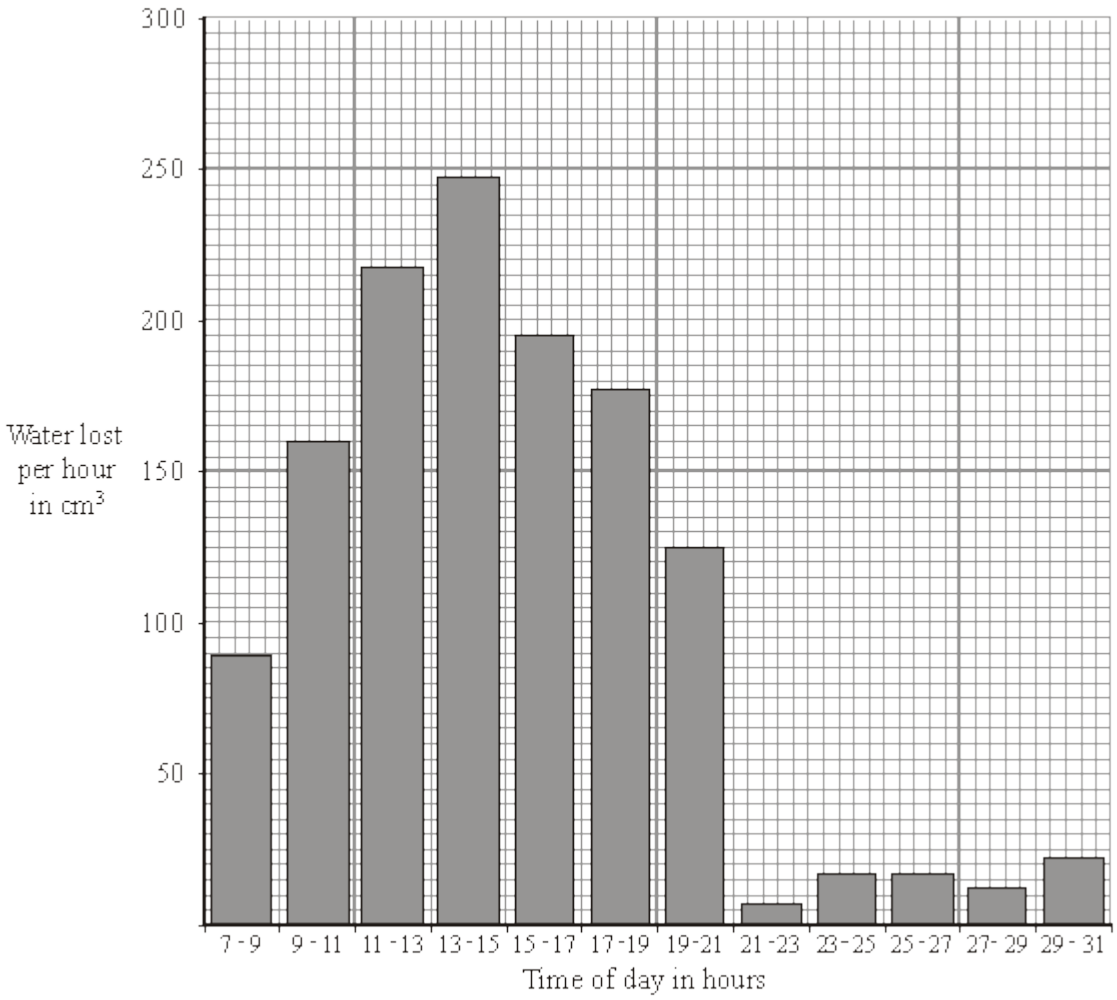
(ii) Name the process by which water vapour is lost from a leaf.

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.

.....

.....

.....

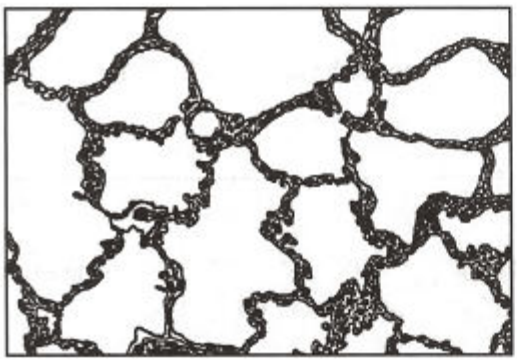
.....

(2)

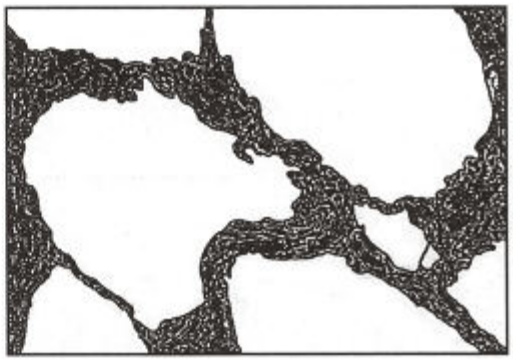
(Total 5 marks)

14 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.

.....

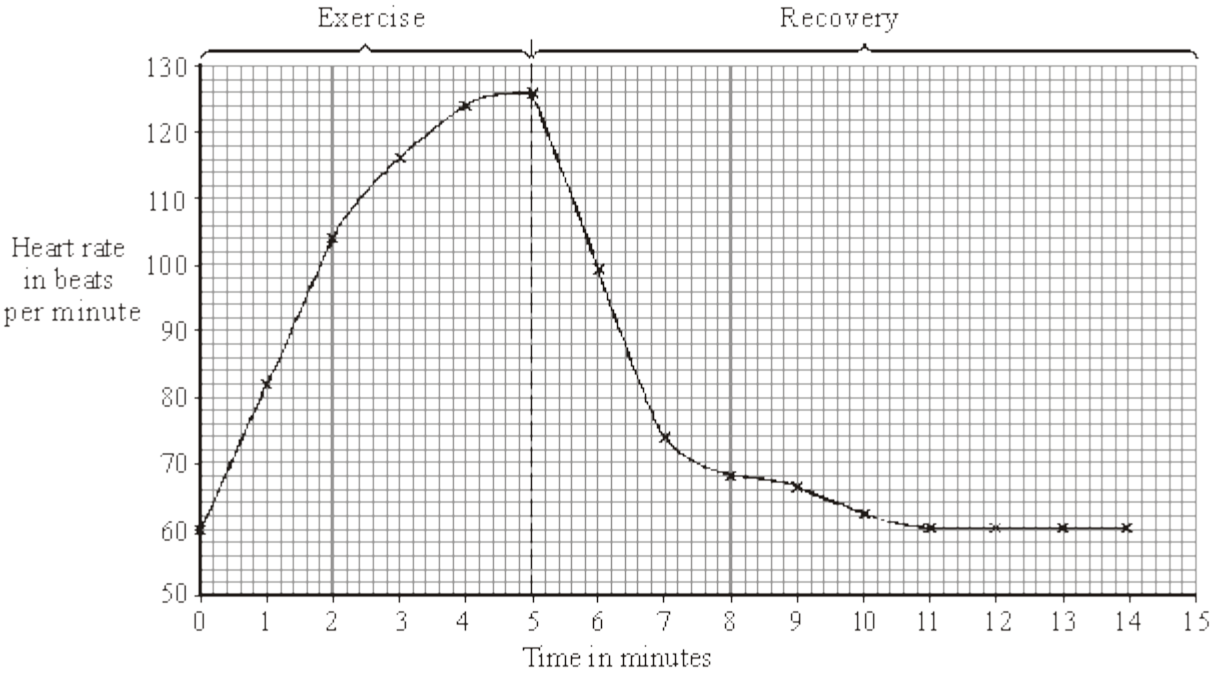
.....

Answer = ... dm^3 per minute

(2)
(Total 4 marks)

15 A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise and also during recovery.

The results are shown in the graph.



(a) Describe, in as much detail as you can, the changes in heart rate between 0 and 14 minutes.

.....

.....

.....

.....

.....

.....

.....

(3)

(b) How do arteries supplying the leg muscles alter the rate of blood flow through them during exercise?

.....

.....

(1)

(c) Explain how an increase in heart rate helped the student during exercise.

.....

.....

.....

.....

.....

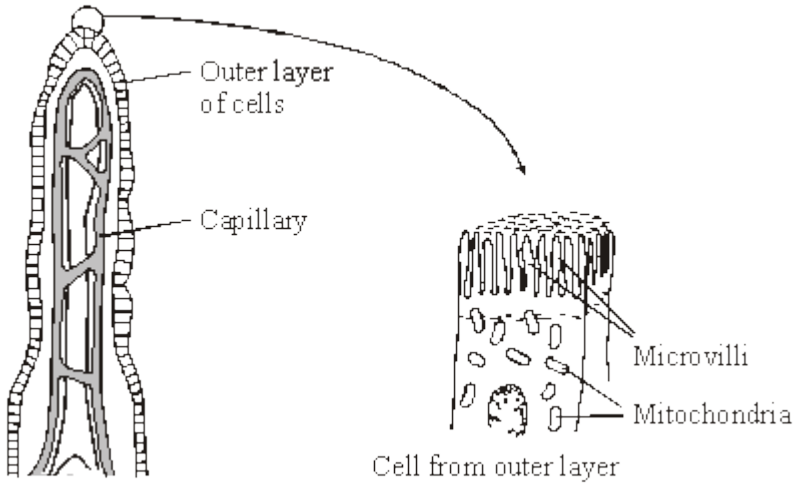
.....

.....

.....

(4)
(Total 8 marks)

16 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)

17 A popular diet book claims that a low-carbohydrate diet results in quicker weight loss and a more healthy body than a low-fat diet.

Scientists carried out an investigation to see if this claim is true.

- They used 120 overweight volunteers divided into two equal groups.
- **Group 1** was given a diet containing less than 20 g of carbohydrate per day.
- **Group 2** was given a low-fat diet. This contained less than 30% of energy from fat and less than 300 mg of cholesterol per day.
- Both groups were given the same exercise programmes and a weekly information meeting.
- Both groups were allowed only 2000 kilocalories per day.

The results after 24 weeks are shown in the table.

	Group 1 Low-carbohydrate diet	**Group 2 Low-fat diet**
Proportion of volunteers who completed the trial	76%	57%
Mean change in body mass	−12.9%	−6.7%
Mean change in body fat mass	−9.4 kg	−4.8 kg
Mean change in blood HDL concentration	+55 mg per litre	−16 mg per litre
Mean change in blood LDL concentration	+16 mg per litre	−74 mg per litre

(a) What was the independent variable in this investigation?

.....

(1)

(b) Give **one** variable that the scientists tried to control in this investigation.

.....

(1)

(c) Give **two** ways in which the method used by the scientists could have led to unreliable data.

1 .....

.....

2 .....

.....

(2)

(d) Does the data support the claim in the book?

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

Give **two** reasons for your answer.

1 .....

.....

2 .....

.....

(2)

(Total 6 marks)

18 Enzymes are used in biological detergents.

(a) Name the type of enzyme that digests stains containing fats.

.....

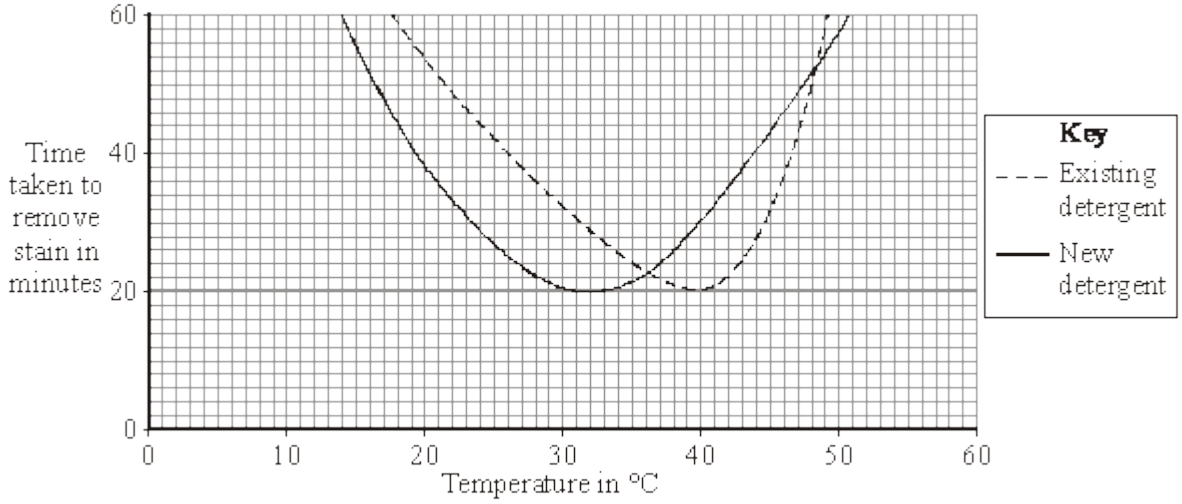
(1)

(b) A new detergent is marketed as being 'environmentally-friendly'.

Scientists compared the performance of this new detergent with an existing detergent.

They measured the time taken by the two detergents to remove a fat stain at different temperatures.

The graph shows their results.



(i) Describe the effect of increasing the temperature on the time taken by the existing detergent to remove the stain.

.....

.....

.....

.....

(2)

(ii) The new detergent works at a lower temperature than the existing one.

Is the new detergent likely to be more 'environmentally-friendly' than the existing detergent?

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

Explain the reason for your answer.

.....

.....

.....

.....

(2)

(c) Neither detergent works well at 60 °C.

Explain why.

.....

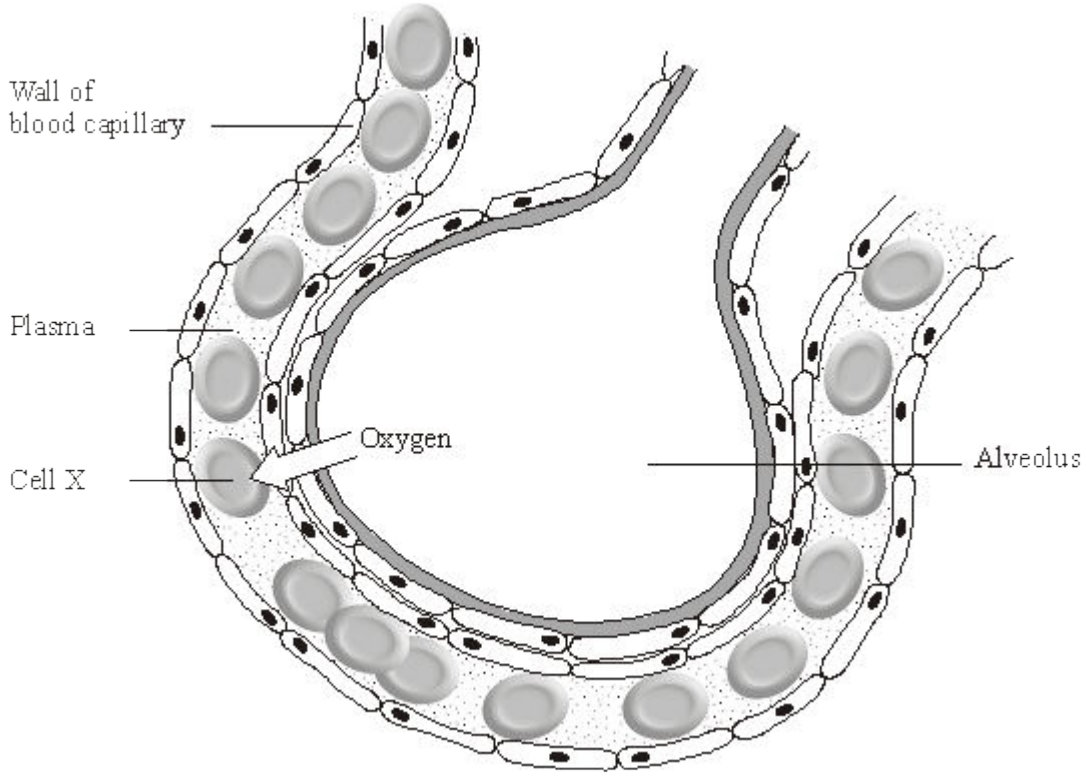
.....

.....

.....

(2)
(Total 7 marks)

19 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

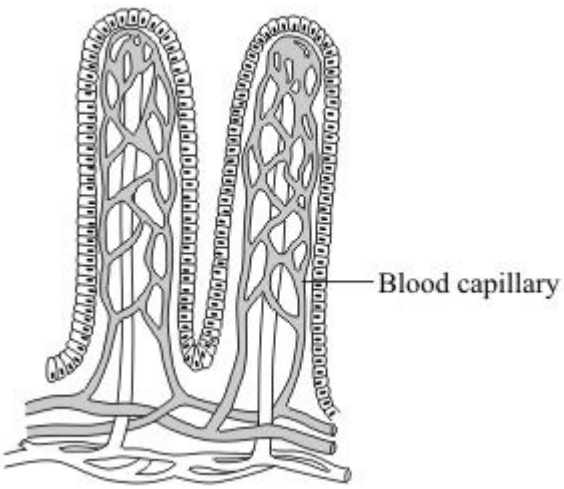
(1)

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

(1)
(Total 5 marks)

20 **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 .....

.....

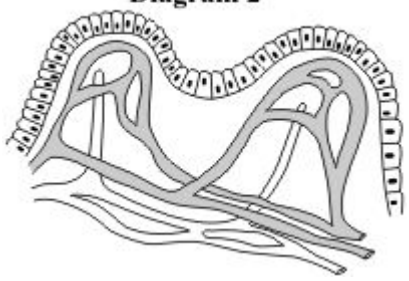
2 .....

.....

(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)

21 A group of students looked at stomata on four different species of plants, **A, B, C** and **D**. They estimated the number of stomata per cm^2 on the upper and lower surfaces of the leaves of the four species.

Their results are shown in the table.

Plant species	Estimated number of stomata per cm^2 of leaf surface	
	Upper surface of leaf	Lower surface of leaf
A	4000	28 000
B	0	800
C	8500	15 000
D	8000	26 000

(a) Which plant species probably lives in a dry region? ☐

Explain the reason for your answer.

.....

.....

.....

.....

.....

.....

(3)

(b) All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this could help the plants to survive better.

.....

.....

.....

.....

(2)
(Total 5 marks)

22 *Obesity* is a factor that affects Coronary Heart Disease (CHD).

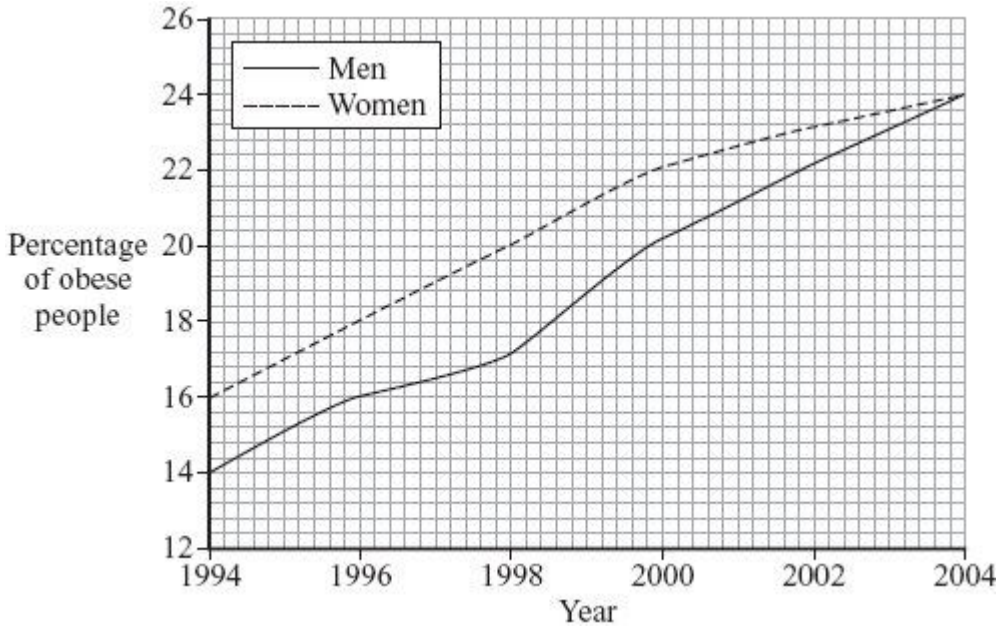
(a) What is meant by *obesity*?

.....

.....

(1)

(b) The graph shows how the percentages of obese men and women in the UK changed between 1994 and 2004.



(i) Describe how the percentage of obese women changed between 1994 and 2004.

.....

.....

.....

.....

(2)

(ii) The percentage of obese men changed between 1994 and 2004.

Suggest **two** reasons for this change.

1. .....

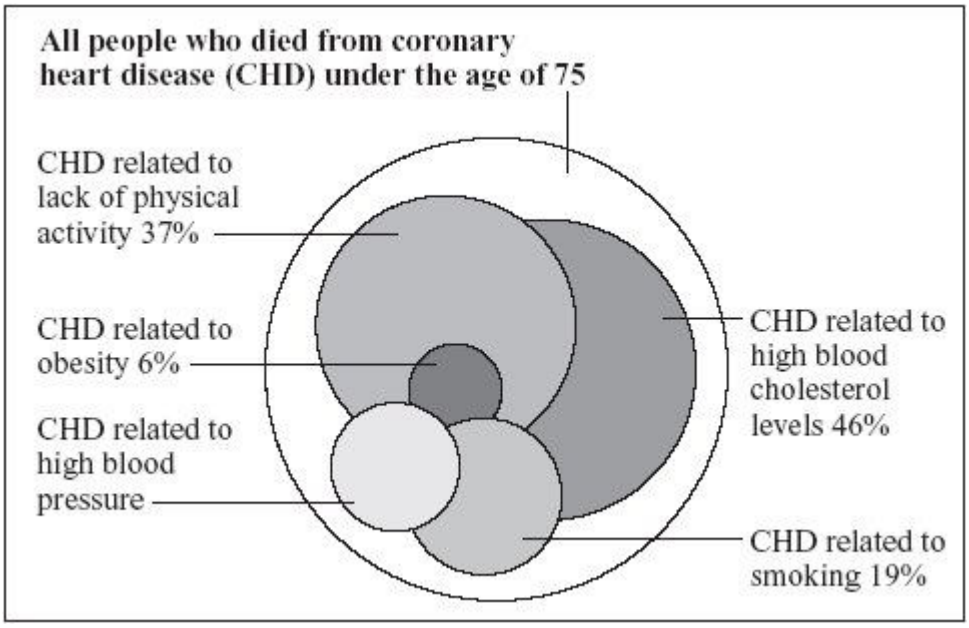
.....

2. .....

.....

(2)

(c) The chart below is published by the British Heart Foundation. It shows how death from CHD is related to a number of different factors.



copyright National Heart Forum

Each factor is represented by a circle.

The bigger the circle, the more people are affected by the factor.

(i) What is the main factor causing death from CHD?

.....

(1)

(ii) Estimate the percentage of deaths from CHD related to high blood pressure.

..... %

(1)

(iii) The data are shown as overlapping circles instead of a bar chart. The percentages of deaths related to the different factors add up to more than 100%.

What does this tell you about some of the people who died from CHD?

.....

.....

(1)

(Total 8 marks)

23 It is legal in the UK to use certain recreational drugs but illegal to use others.

(a) Tobacco is a legal drug. Pregnant women are strongly advised not to smoke.

Explain how a fetus may be affected if the mother smokes tobacco.

.....

.....

.....

.....

(2)

(b) Illegal drugs are classified as Class **A**, **B** or **C**. Class **A** drugs are the most dangerous. The use of Class **A** drugs attracts the most serious punishments and fines.

- Cannabis is a Class **C** drug.
- These are some facts about cannabis.
- It is less addictive than amphetamines, tobacco or alcohol.
- It may cause mental illness.
- It does not seem to cause major social problems.
- It may be a 'gateway' drug to more harmful substances.
- It has a higher tar content than tobacco.
- It has an effect on the heart, similar to the effects of exercise.
- It can upset the control of blood pressure.
- Use the above information to answer these questions.

(i) Give **two** reasons why many people think that cannabis should be classified as a Class **A** or Class **B** drug.

1. .....

.....

2. .....

.....

(2)

(ii) Give **two** reasons why many people think that cannabis should not be classified as an illegal drug.

1. .....

.....

2. .....

.....

(2)

(Total 6 marks)

24 (a) We control many conditions inside our bodies.

Name **three** conditions which are controlled inside our bodies.

1. .....

2. .....

3. .....

(3)

(b) Hormones are used to control fertility in women.

Use words from the box to complete the sentences.

antibiotic	**contraceptive drug**	**fertility drug**	**vaccine**

A woman can prevent pregnancy by taking a .....

A woman can be helped to become pregnant by taking a .....

(2)

(c) Some drugs are addictive.

(i) Name **one** addictive drug.

.....

(1)

(ii) Explain why it is very difficult to give up using an addictive drug.

.....

.....

.....

.....

(2)

(Total 8 marks)

25 Complete the table to show which part of the blood carries out each function.

Choose your answers from the list.

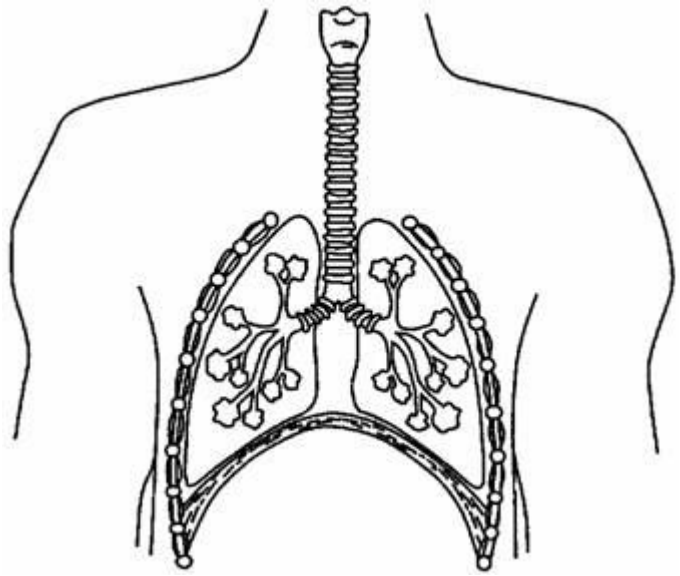
plasma **platelet** **red blood cell** **white blood cell**

The first answer has been done for you.

Function	Part of the blood
Transports most of the carbon dioxide	*plasma*
Transports most of the oxygen	
Helps blood to clot at a wound	
Defends the body against microorganisms	
Transports the products of digestion	

(Total 4 marks)

26 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)

27 Bread contains starch, protein and fat.

(a) Complete each sentence by choosing the correct words from the box.

amino acids	**protein**
fat	**starch**
fatty acids	**sugar**

Amylase speeds up the digestion of ..... . The product of this digestion is ..... . Protease speeds up the digestion of ..... . The product of this digestion is ..... .

(4)

(b) Why do molecules of starch, protein and fat need to be digested?

.....

.....

(2)

(c) In which part of the digestive system does the digestion of starch begin?
Draw a ring around your answer.

large intestine **mouth** **small intestine** **stomach**

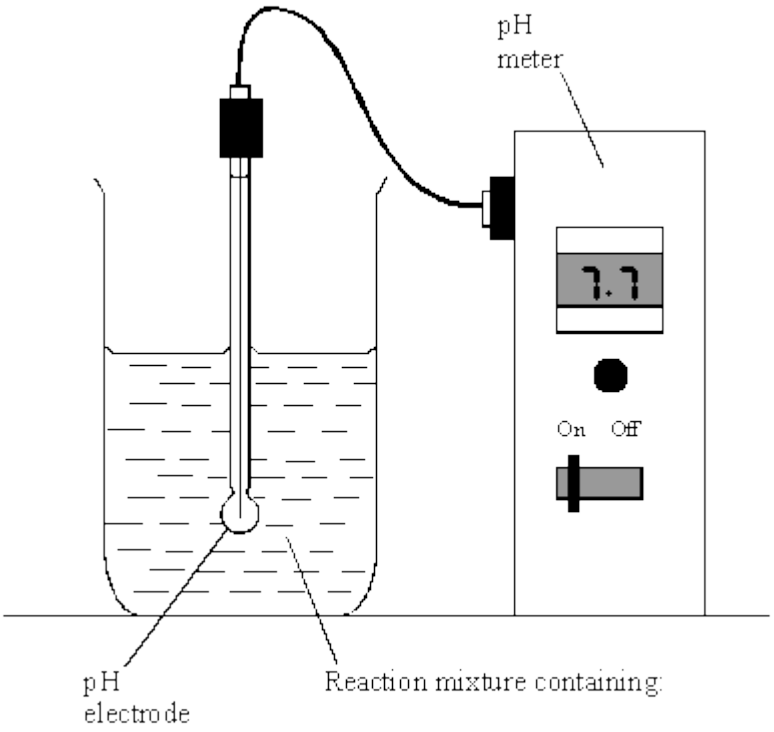
(1)

(d) What do we call substances like amylase and protease which speed up chemical reactions?

.....

(1)
(Total 8 marks)

28 The diagram shows the apparatus used to investigate the digestion of milk fat by an enzyme. The reaction mixture contained milk, sodium carbonate solution (an alkali) and the enzyme. In Experiment **1**, bile was also added. In Experiment **2**, an equal volume of water replaced the bile. In each experiment, the pH was recorded at 2-minute intervals.



Either: Experiment 1 **or: Experiment 2**

milk (contains fat)	milk (contains fat)
sodium carbonate solution	sodium carbonate solution
bile	water
enzyme	enzyme

The results of the two experiments are given in the table.

Time in minutes	pH	
	Experiment 1: with bile	Experiment 2: no bile
0	9.0	9.0
2	8.8	9.0
4	8.7	9.0
6	8.1	8.8
8	7.7	8.6
10	7.6	8.2

(a) Milk fat is a type of lipid. Give the name of an enzyme which catalyses the breakdown of lipids.

.....

(1)

(b) What was produced in each experiment to cause the fall in pH?

.....

(1)

(c) (i) For Experiment **1**, calculate the average rate of fall in pH per minute, between 4 minutes and 8 minutes. Show clearly how you work out your final answer.

.....

.....

.....

..... pH units per minute

(2)

(ii) Why was the fall in pH faster when bile was present?

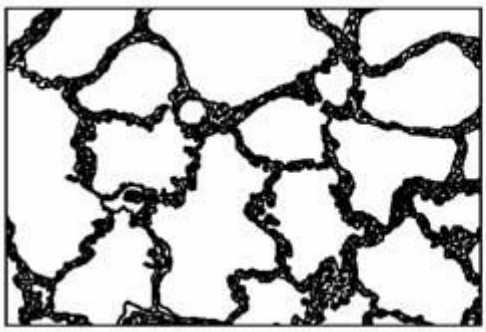
.....

.....

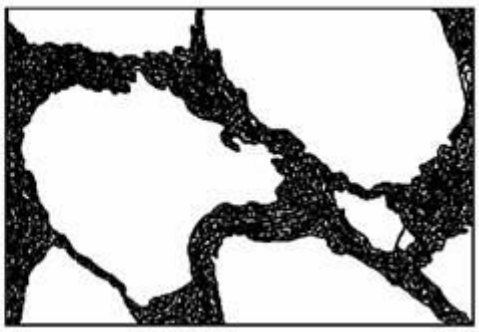
(1)

(Total 5 marks)

29 Emphysema is a disease of the lungs. People who smoke cigarettes are more likely to suffer from emphysema. The diagrams show lung tissue from a healthy person and lung tissue from a person with emphysema. The diagrams are drawn to the same scale.



Lung tissue from a healthy person



Lung tissue from a person with emphysema

Explain how emphysema reduces the amount of oxygen which diffuses into the blood

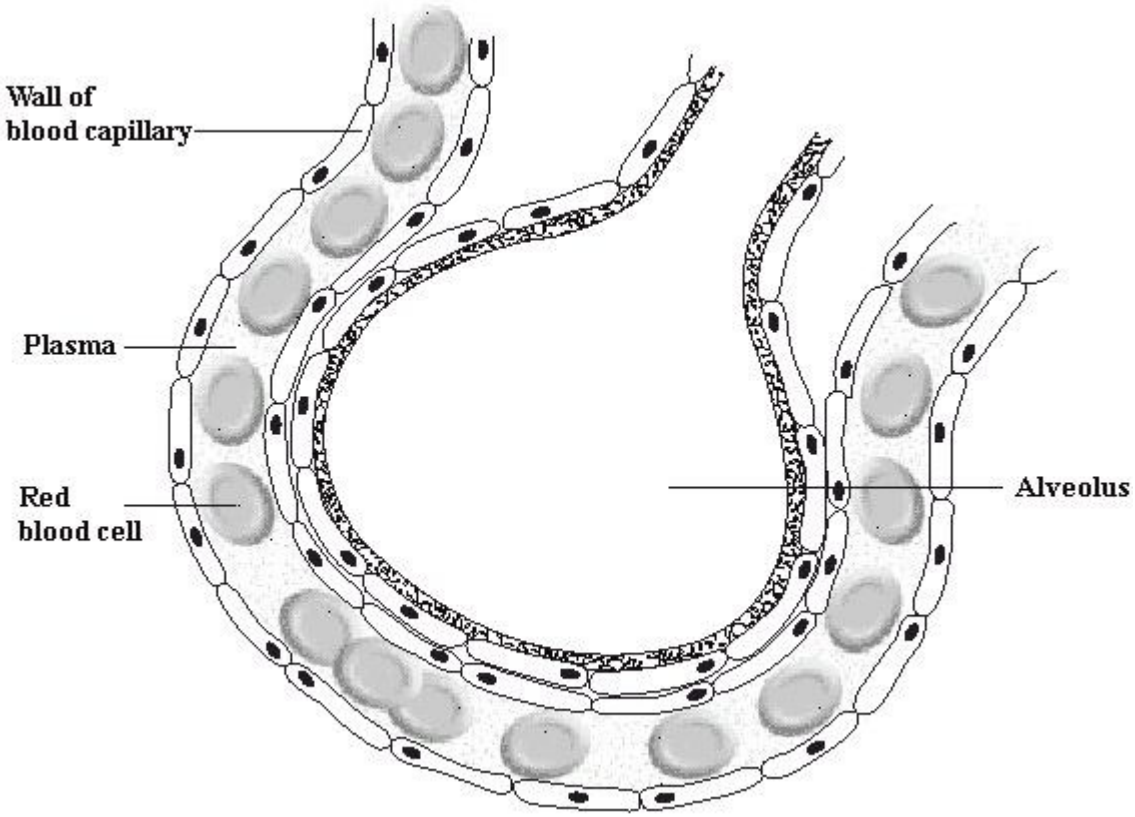
.....

.....

.....

(Total 2 marks)

30 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)

31 (a) (i) What name is given to an enzyme which catalyses the breakdown of protein?

.....

(1)

(ii) What product is formed when protein is broken down by the enzyme?

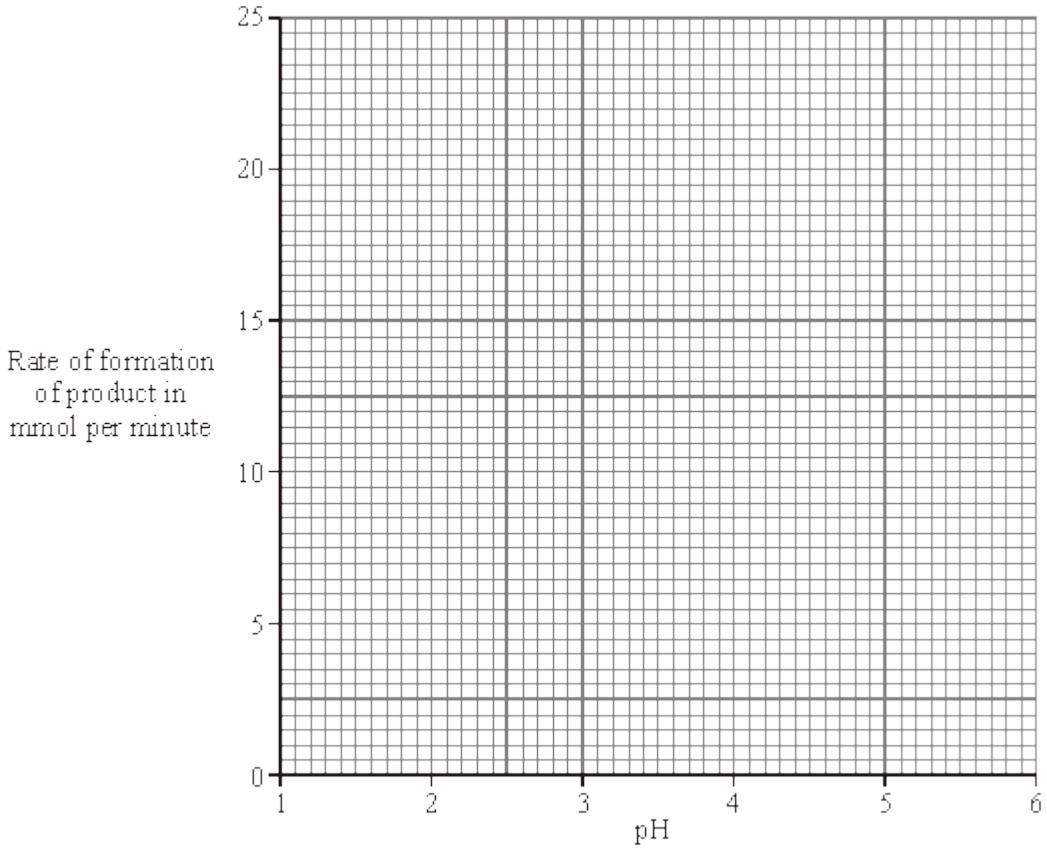
.....

(1)

The table shows the effect of pH on the activity of an enzyme which catalyses the breakdown of protein.

pH	1.0	2.0	3.0	4.0	5.0
Rate of formation of product in mmol per minute	10.5	23.0	10.5	2.5	0.0

(b) Draw a graph of the data in the table.



(3)

(c) The enzyme is produced by the human digestive system.

(i) At what pH does this enzyme work best? .....

(1)

(ii) Suggest which part of the digestive system produces this enzyme.

.....

(1)

(d) Why is it necessary to break down proteins in the digestive system?

.....

.....

.....

.....

.....

.....

(3)
(Total 10 marks)

32 Four leaves were removed from the same plant. Petroleum jelly (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**: none applied

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

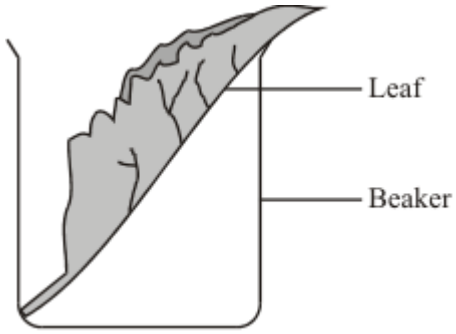
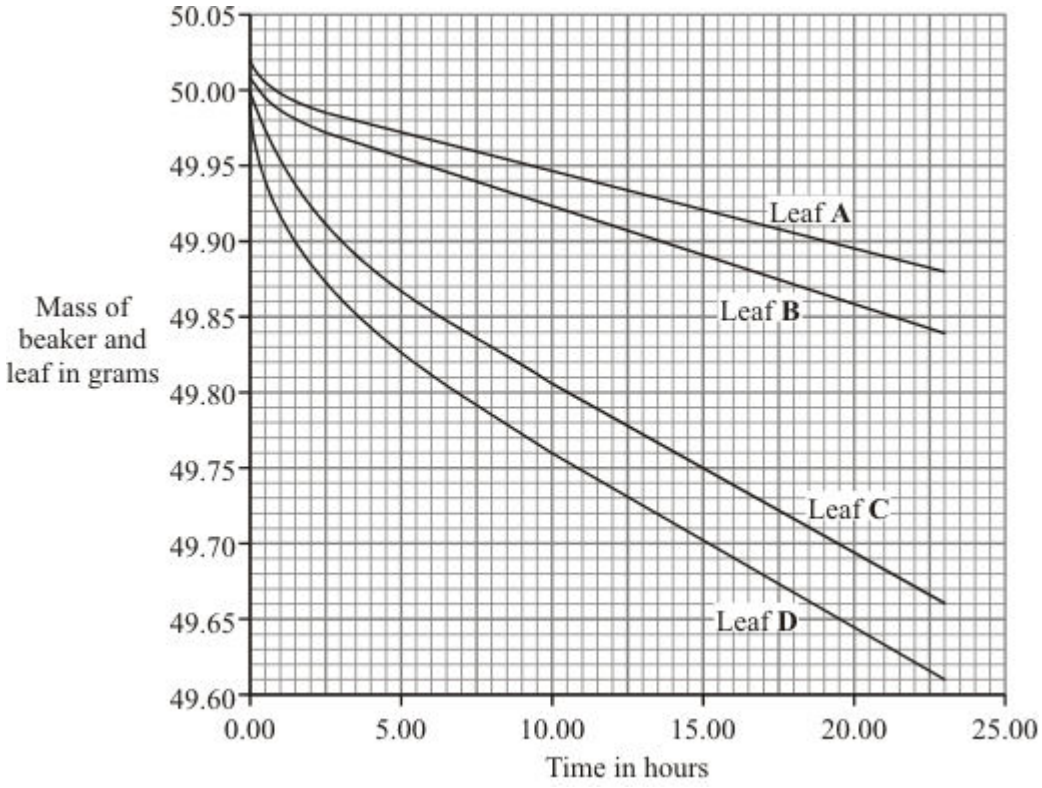


Diagram 1

Each beaker was weighed at intervals. The results are shown in the graph.



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

(i) Which surface (upper or lower) loses water most rapidly? .....

Evidence .....

.....

(1)

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

Evidence .....

.....

(1)

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

Upper Surface of Leaf **Lower Surface of Leaf**

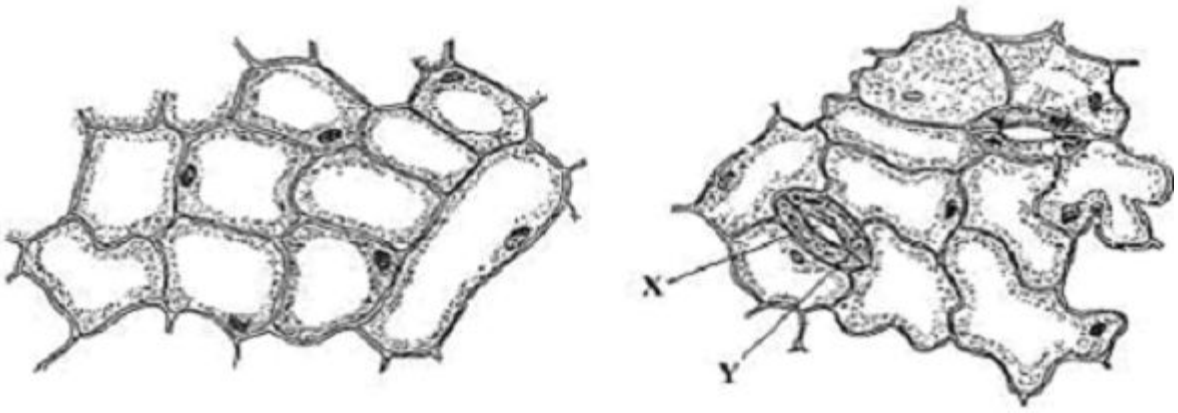


Diagram 2

(i) Name space **X** and cell **Y**.

X .....

Y .....

(2)

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

.....

.....

.....

.....

(2)

(Total 6 marks)

33 The photograph shows a red blood cell in part of a blood clot. The fibres labelled **X** are produced in the early stages of the clotting process.

(a) Suggest how the fibres labelled **X** help in blood clot formation.

.....

(1)

(b) The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.

Use the formula to calculate the magnification of the photograph.

Diameter on photograph = Real diameter × Magnification

.....

.....

.....

Magnification = ...

(2)

(c) Some blood capillaries have an internal diameter of approximately 0.01 millimetres.

(i) Use information given in part (b) to explain why only one red blood cell at a time can pass through a capillary.

.....

(1)

(ii) Explain the advantages of red blood cells passing through a capillary one at a time.

.....

.....

.....

.....

.....

.....

(3)

(Total 7 marks)

34 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)

35 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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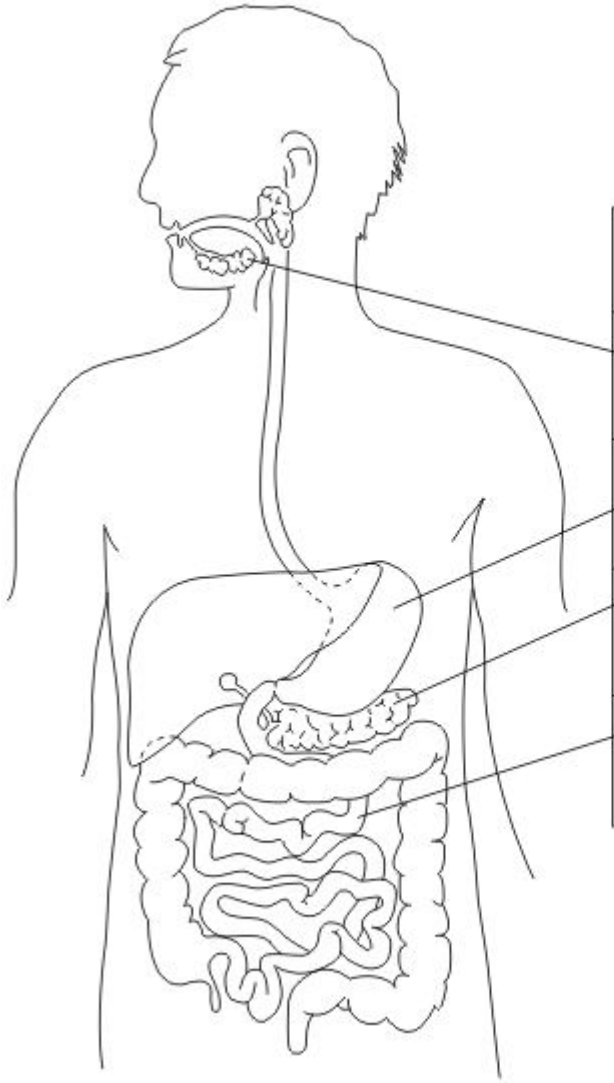
.....

.....

(Total 5 marks)

36 The diagram gives information about some parts of the human digestive system.



Organ	pH of digestive juice	Enzymes produced
Salivary gland	7	Amylase
Stomach	2	Protease
Pancreas	8.5	Amylase Lipase Protease
Small intestine	8.5	Amylase Lipase Protease

(a) (i) Name the organ which **makes** bile.

.....

(1)

(ii) Label this organ with the letter **X** on the diagram.

(1)

Information in the table may help you to answer parts (b) and (c).

(b) Name **two** parts of the digestive system where protein is digested.

1 .....

2 .....

(2)

(c) Suggest **two** reasons why starch is not digested in the stomach.

1 .....

.....

2 .....

.....

(2)
(Total 6 marks)

37 (a) (i) Name the red pigment found in red blood cells.

.....

(1)

(ii) Describe, in detail, the function of this red pigment.

.....

.....

.....

.....

(2)

(b) Describe **one** other way in which the structure of a red blood cell is different from the structure of a white blood cell.

.....

.....

(1)
(Total 4 marks)

38 Complete each sentence about the heart by choosing the correct words from the box.

an artery	an atrium	a cuspid valve
a semi-luna valve	a vein	

A ventricle fills with blood by the contraction of ..... .

When a ventricle contracts, blood is forced into ..... .

When a ventricle relaxes, the backflow of blood into it is prevented by the closing of

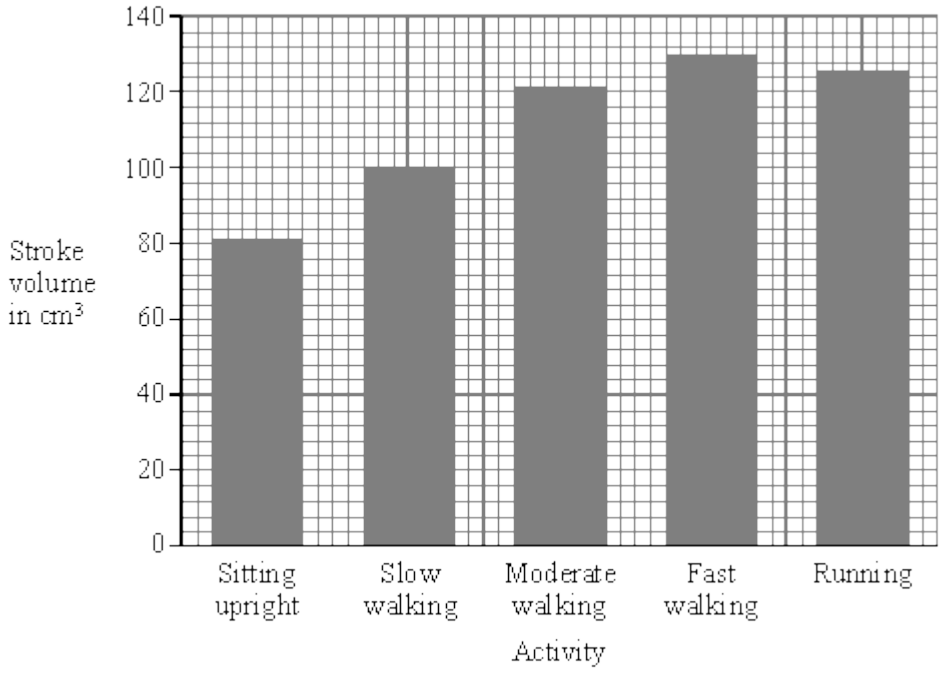
..... .

(Total 3 marks)

39 A person did five different activities in turn. These activities needed increasing amounts of energy. For each activity two measurements were made. These were the rate of contraction of the left ventricle and its stroke volume (the volume of blood pumped at each beat). From these measurements the cardiac volume was calculated.

Some of these results are shown in the table and the bar chart.

Activity	**Rate of contraction of left ventricle in beats per minute**	**Cardiac output in cm^3 per minute**
Sitting upright	68	5 500
Slow walking		8 000
Moderate walking	98	12 000
Fast walking	130	17 500
Running	150	19 000



(a) (i) Describe how a person can count the rate of beating of the left ventricle.

.....

.....

(1)

(ii) Calculate the rate of ventricle contraction in beats per minute when the person was walking slowly. Show clearly how you work out your final answer.

.....

.....

.....

.....

Rate of ventricle contraction..... beats per minute.

(2)

(iii) The pattern of results for stroke volume shows an anomalous result when the person is running. In what way is it anomalous?

.....

.....

(1)

(iv) There was a change in cardiac output when the person's movement changed from fast walking to running. How did the heart produce this change?

.....

.....

(1)

(b) Over a period of time, regular exercise can strengthen the heart muscle. This change in the heart muscle enables a person to run for longer before lactic acid build up occurs. Explain the reason for this.

.....

.....

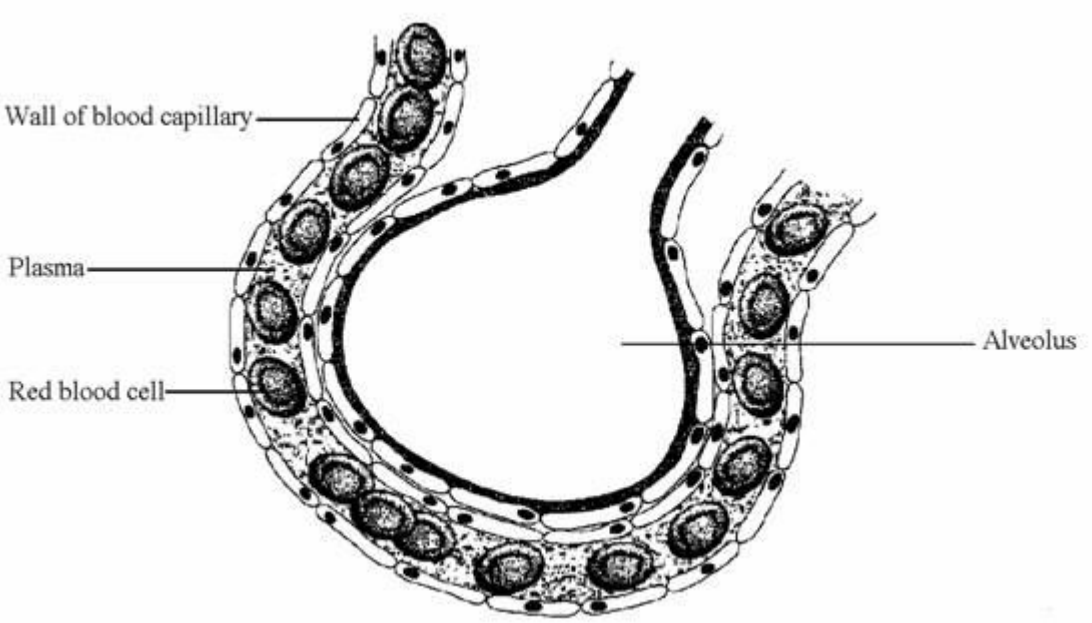
.....

.....

(2)

(Total 7 marks)

40 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.

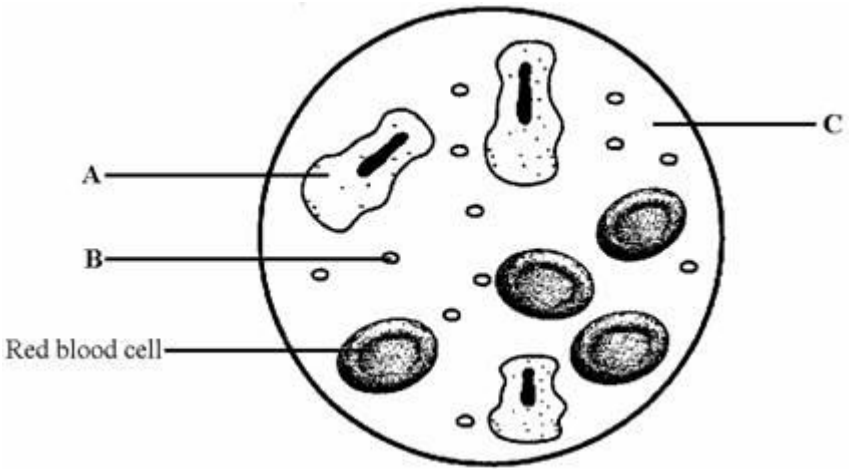
.....

.....

.....

(1)
(Total 3 marks)

41 The diagram shows four parts of blood.



(a) Complete the table to give the name and function of the parts labelled **A**, **B** and **C**.

Letter	Name	Function
A	.....	....
B	.....	....
C	.....	....

(6)

(b) Red blood cells contain haemoglobin. Explain how this enables red blood cells to pick up oxygen from the alveoli and release it to cells in other parts of the body.

.....

.....

.....

.....

.....

.....

.....

(4)

(Total 10 marks)

42 (a) Complete the following sentences.

Green plants produce their own food by a process called photosynthesis. In this process the raw materials are ..... and carbon dioxide. Glucose and ..... are produced. ..... energy is absorbed by the green substance called ..... .

(4)

(b) Name **two** things that can happen in the plant to the glucose produced in photosynthesis.

1. .....

2. .....

(2)

(c) Plants need mineral salts.

(i) Through which part do mineral salts get into the plant?

.....

(1)

(ii) Explain why water is important in this process.

.....

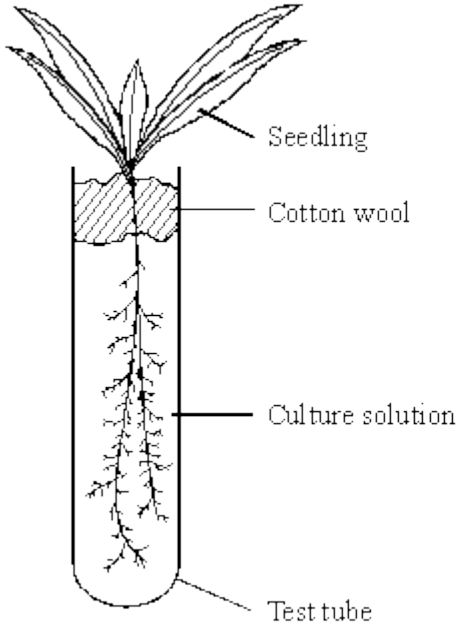
.....

.....

.....

(2)

Some students set up water cultures to find out how plants use nitrates.
They had two sets of nutrient solutions.
A full solution provided the plant with all the required nutrients.
The results table shows the average mass of the seedlings after 28 days of growth.



Culture solution	Average mass of seedling in g
distilled water	0.14
full solution with no nitrates	0.29
full solution	0.43

(d) (i) Give a conclusion you could make from these results.

.....

.....

(1)

(ii) Calculate the difference in average mass caused by the addition of nitrates to the culture solution.

.....

(1)

(iii) What are nitrates used for in the seedling?

.....

(1)

(iv) Some factors need to be controlled to keep this test fair. Name **two** of them.

1. .....

2. .....

(2)

(v) Suggest **one** way you could improve the experiment.

.....

(1)

(Total 15 marks)

43 (a) What type of blood vessels join arteries to veins?

.....

(1)

(b) How are oxygen and carbon dioxide carried in the blood?

.....

.....

.....

.....

(2)

(c) List **three** things that are carried around the body in the blood plasma.

1. .....

2. .....

3. .....

(3)

(Total 6 marks)

44 The following sentences are about the blood system. Choose words from the list in the box to complete these sentences. You may use a word once or not at all.

diffuse	lowered	narrow	one
raised	spread	two	wide

Capillaries have thin walls which are ..... .cell thick. This allows nutrients from digested food to ..... through and reach the cells of organs. Capillaries are very ..... .and so blood flow through an organ is slowed down and blood pressure is ..... .

(Total 4 marks)

45 (a) Complete the table to give one site where digestive substances are made.

Digestive substance	One site of production
bile	
amylase	
lipase	
protease	

(4)

(b) Describe **two** ways that the mouth can break down starchy foods.

.....

.....

.....

.....

(2)

(c) Describe how the liver helps to digest fats.

.....

.....

.....

(2)

(Total 8 marks)

46 (a) Photosynthesis is a process that takes place in green plants.

(i) What type of energy is needed for this process?

.....

(1)

(ii) What substance in the plant absorbs this energy?

.....

(1)

(iii) In which part of the plant cell does photosynthesis take place?

.....

(1)

(iv) Write a balanced chemical equation for photosynthesis.

..... → .....

(3)

(b) Describe **two** ways you could speed up photosynthesis.

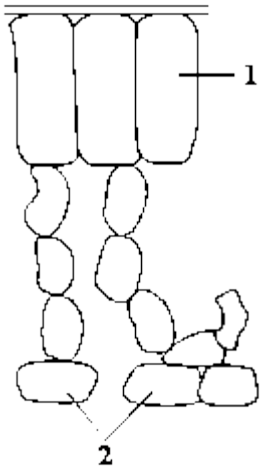
.....

.....

.....

(2)

(c) The diagram shows the outline of a cross-section of a leaf. Name cells **1** and **2** and describe how they are involved in photosynthesis.



.....

.....

.....

.....

.....

.....

.....

.....

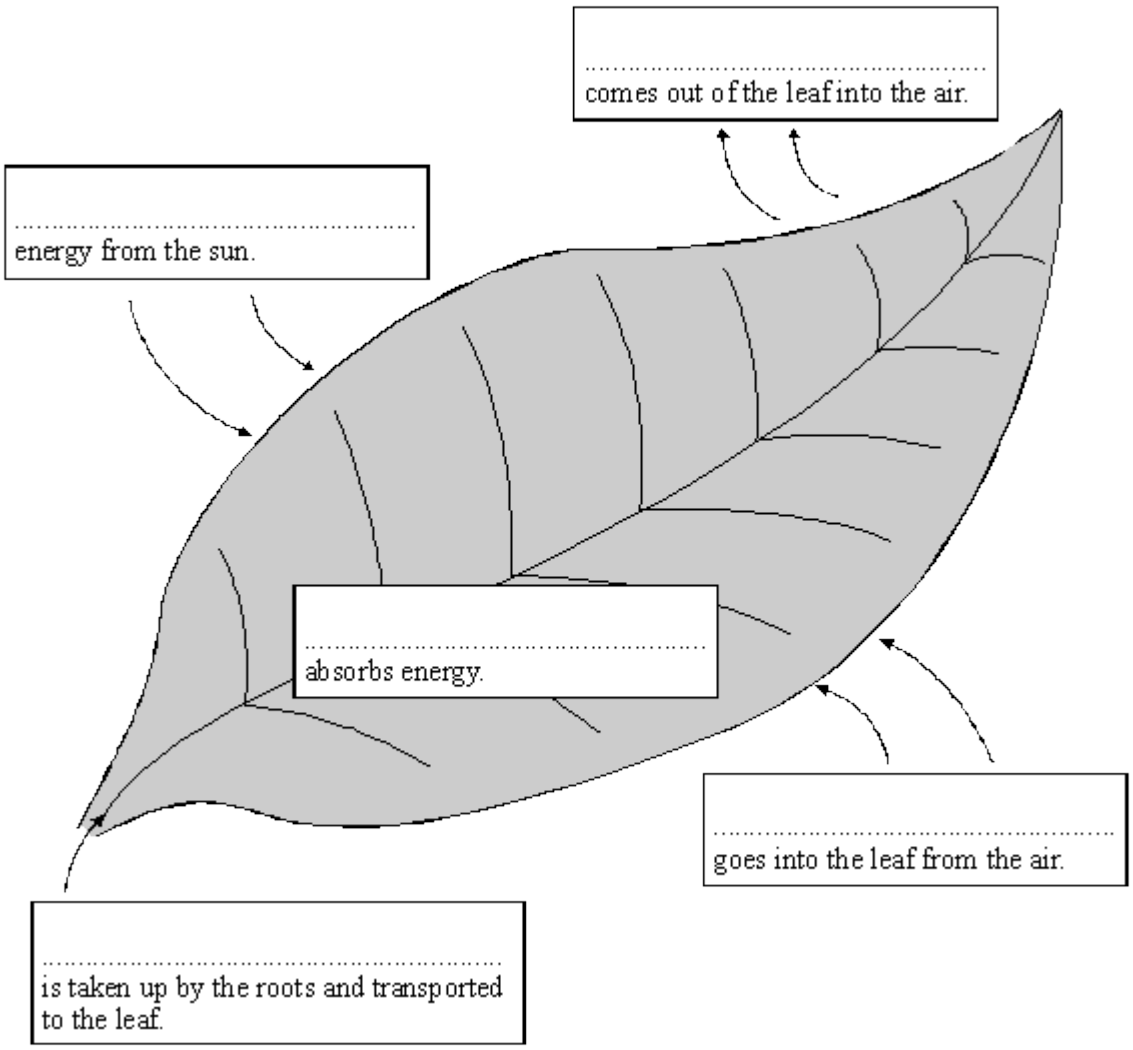
(4)

(Total 12 marks)

47 The diagram shows how a leaf of a green plant makes glucose.

(a) Use words from the box to complete the labels on the diagram. You may use each word once or not at all.

carbon dioxide	chlorophyll	glucose	heat
light	oxygen	water	



(5)

(b) (i) Compete the following sentence.

Glucose in food is a type of ..... . When we eat it, it gives us energy.

(1)

(ii) The plant turns some of the glucose into starch. Why is starch useful to the plant?

.....

.....

(1)

(iii) What does the plant do with the rest of the glucose?

.....

(1)

(c) (i) What is the name of the process outlined in the diagram?

.....

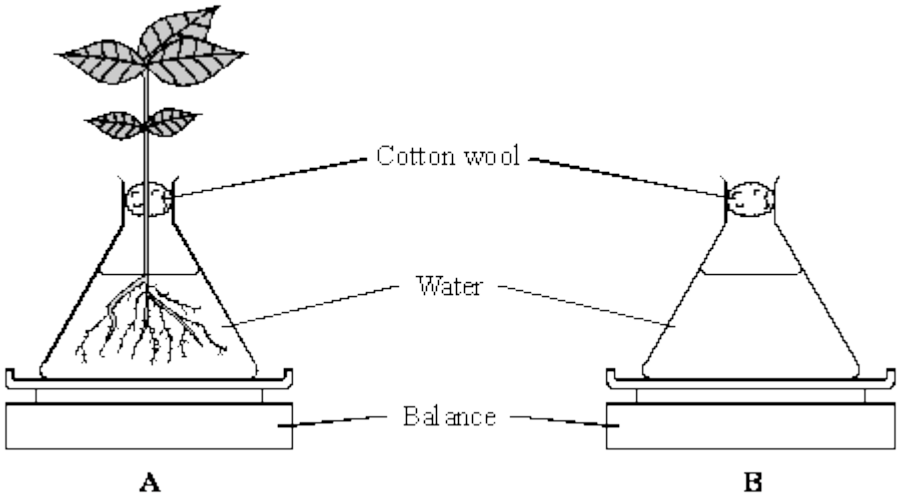
(1)

(ii) Give **one** way that leaves are adapted to do this process.

.....

(1)
(Total 10 marks)

48 Some students set up the following apparatus.



The balances show the same mass at the start of the investigation.

After 24 hours the mass of flask **B** was the same but the mass of flask **A** had changed.

(i) Describe and explain the change to the mass of flask **A**.

.....

.....

.....

.....

.....

(3)

(ii) Why did the students need to set up flask **B**?

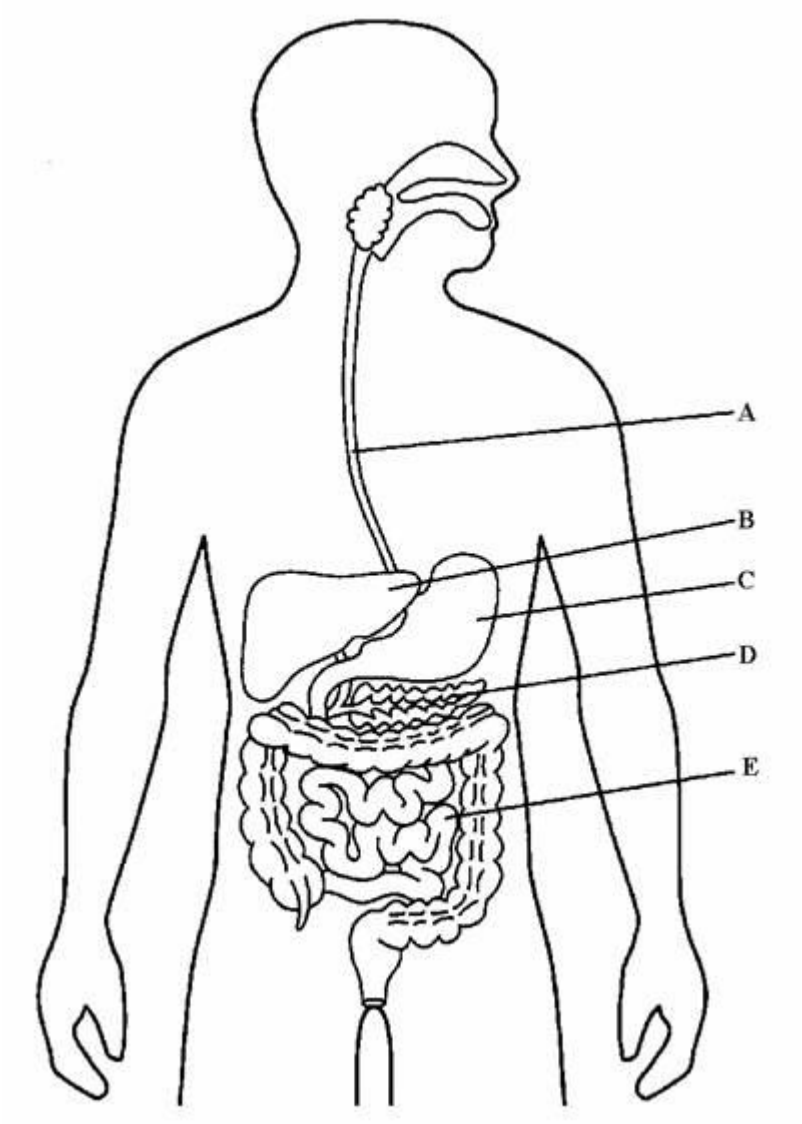
.....

.....

(1)

(Total 4 marks)

49 The diagram shows part of the human digestive system.



(i) Name part **B**.

.....

(1)

(ii) Describe the role of **B** and **D** in reducing blood sugar levels.

.....

.....

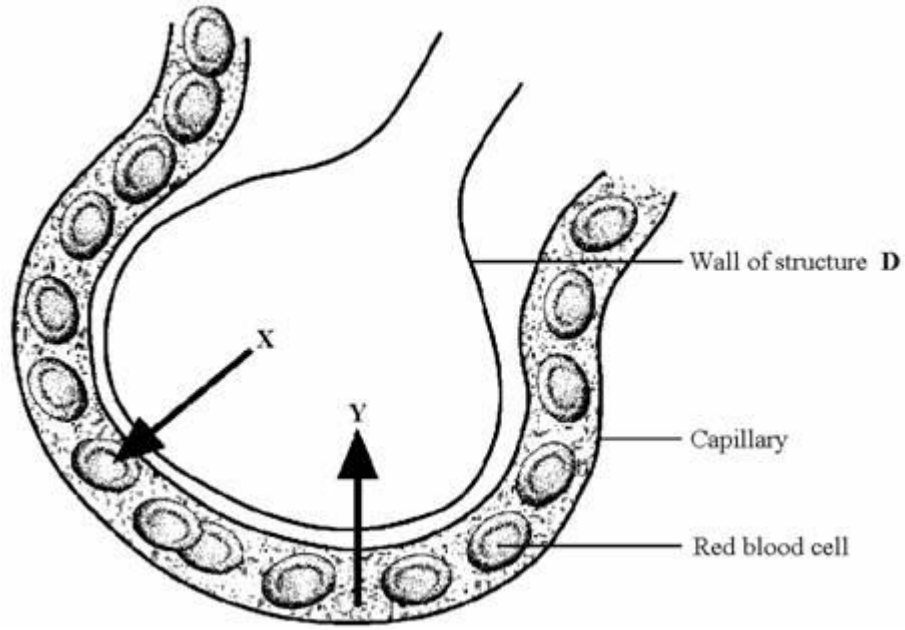
.....

.....

.....

(2)
(Total 3 marks)

50 The diagram shows an enlargement of structure **D**.



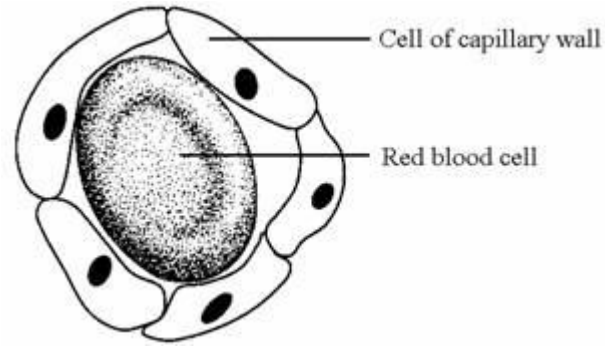
The arrows show the direction of the gases exchanged in this structure. Name gas **X** and gas **Y**.

X .....

Y .....

(Total 2 marks)

51 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)

52 (a) Describe, as fully as you can, the job of

(i) the circulatory system.

.....

.....

(2)

(ii) the digestive system.

.....

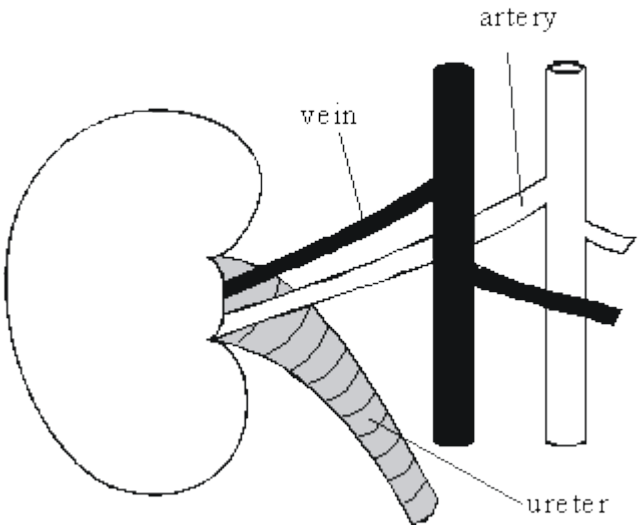
.....

.....

.....

(3)

(b)



The drawing shows a kidney, its blood supply and the ureter (a tube which carries urine from the kidney to the bladder). The amount and composition of the urine flowing down the ureter change if the blood in the artery contains too much water. Describe these changes and explain how they take place.

.....

.....

.....

.....

.....

.....

(4)
(Total 9 marks)

53 (a) Put a tick (✓) in the correct boxes in the table below to show which of the parts given are present in the cells and organisms listed.

	CYTOPLASM	NUCLEUS	CELL WALL	GENES
Leaf mesophyll cell				
Sperm				

(2)

(b) (i) What is the main job of a leaf mesophyll cell?

.....

.....

(1)

(ii) Explain **one** way in which the structure of the leaf mesophyll cell helps it to carry out its job.

.....

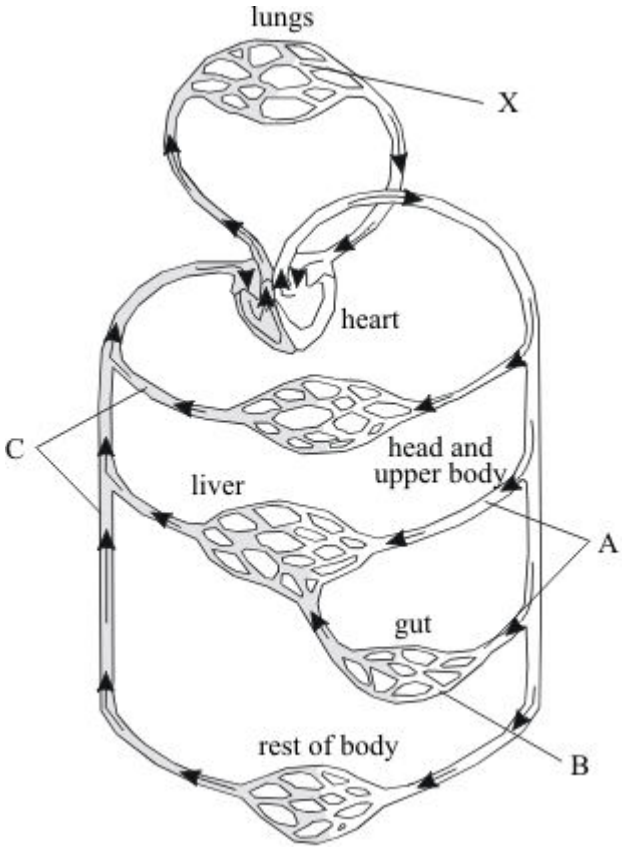
.....

.....

.....

(2)
(Total 5 marks)

54 The diagram shows part of the circulatory system.



(a) Name the types of blood vessel labelled A, B and C on the diagram.

A .....

B .....

C .....

(3)

(b) What is the job of the circulatory system?

.....

.....

(1)

(c) Give **two** ways in which the composition of blood changes as it flows through the vessels labelled X on the diagram.

1 .....

.....

2 .....

.....

(2)
(Total 6 marks)

55 A dog runs across the road in front of a car. The driver slams her foot on the brakes.

(i) Explain how the nervous system brings about this response.

.....

.....

.....

.....

.....

.....

.....

(4)

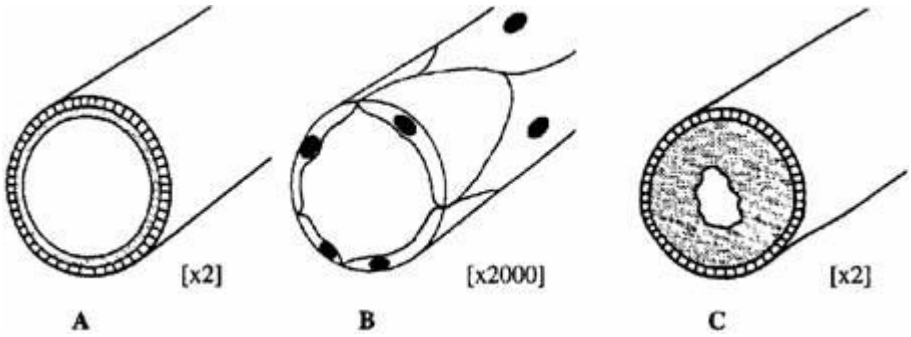
(ii) Explain why alcohol consumption would affect the driver's response.

.....

.....

(1)
(Total 5 marks)

56 The drawings show the structure of three types of blood vessel, **A**, **B** and **C**. They are drawn to the scales indicated.



(a) Name the **three** types of blood vessel.

A .....

B .....

C .....

(3)

(b) Describe the job of blood vessel **B**.

.....

.....

.....

.....

(2)
(Total 5 marks)

57 A market gardener produces large numbers of attractive, large flowered geranium plants.

(a) Give two advantages to the gardener of producing geraniums from cuttings rather than from seeds.

1 .....

.....

2 .....

.....

(2)

(b) Gardeners often cover trays of cuttings with large polythene bags.

Suggest **one** advantage of this.

.....

.....

(1)
(Total 3 marks)