

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2003



**BIOLOGY (HUMAN)
FOUNDATION TIER**

3415/F

F

Monday 2 June 2003 1.30 pm to 3.45 pm

In addition to this paper you will require:
a ruler.
You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		14	
2		15	
3		16	
4		17	
5		18	
6		19	
7		20	
8		21	
9		22	
10		23	
11		24	
12			
13			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 2 hours 15 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 135.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Answer **all** questions in the spaces provided.

1 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

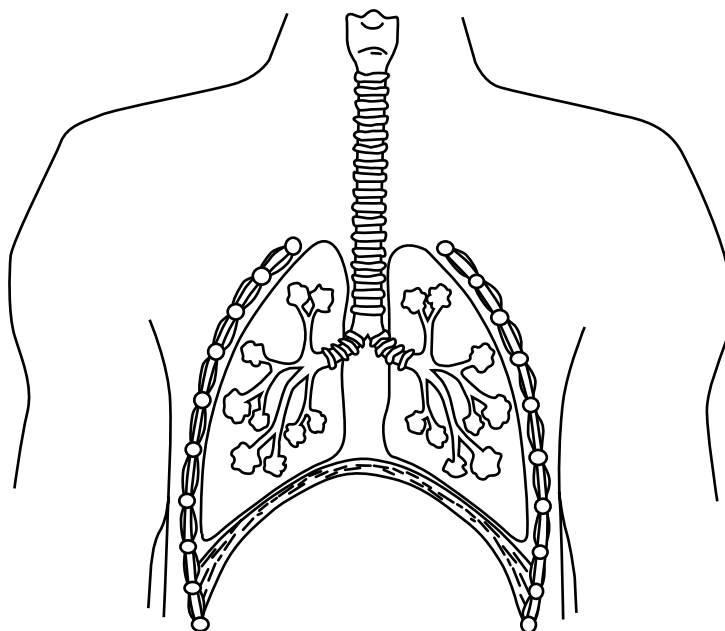
The first answer has been done for you.

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	

(4 marks)

4

2 The diagram shows the human breathing system.



(a) Place on the diagram:

- (i) a letter **X** where oxygen enters the blood; *(1 mark)*
- (ii) an arrow showing the direction the diaphragm moves when we breathe in. *(1 mark)*

(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 mark)

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

diffusion **digestion** **osmosis** **respiration**

(1 mark)

4

Turn over ►

3 Complete each sentence by choosing the correct terms from the box.

23	46	ADH	DNA	XX	XY	YY
dominant	female	male	recessive	strong	weak	

A gene is made up of a substance called Genes are found on chromosomes and most human cells contain pairs of chromosomes. In females the two sex chromosomes are , but in males the two sex chromosomes are

Alleles are alternative forms of a gene. Two healthy parents can sometimes have a child with a genetic disorder such as cystic fibrosis. This is because cystic fibrosis is caused by a allele.

The two parents are healthy because they also have the allele.

(6 marks)

6

4 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 marks)

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

.....

(2 marks)

(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 mark)

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

.....

(1 mark)

8

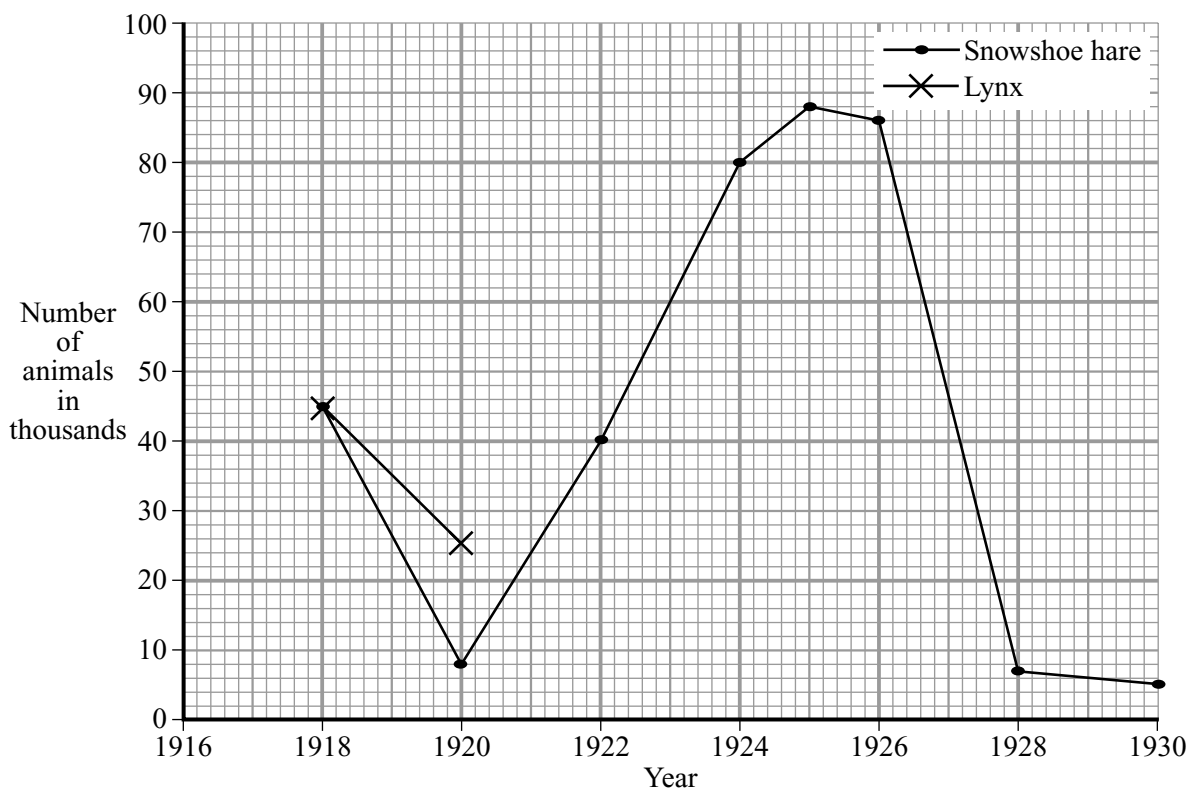
TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 5 The lynx is a wild cat which lives in Canada. The table shows the number of lynx trapped in a part of Canada in certain years.

Year	Number of lynx in thousands
1918	45
1920	25
1922	10
1924	20
1926	40
1928	50

The snowshoe hare is another wild animal found in Canada. The graph shows the number of snowshoe hares trapped in the same years. The lynx eats the snowshoe hare.



- (a) Draw a graph of the data in the table. The first two points have been plotted for you.

(2 marks)

(b) From your graph, predict how many lynx were trapped in 1925.

..... thousand
(1 mark)

(c) Use the information to answer the following.

(i) What would you expect to happen to the number of lynx trapped in 1930? Draw a ring around your answer.

rise **fall** **stay the same**

(1 mark)

(ii) Give a reason for your answer to part (c) (i).

.....
.....
(1 mark)

(d) The lynx is a predator. What is a predator?

.....
.....
(1 mark)

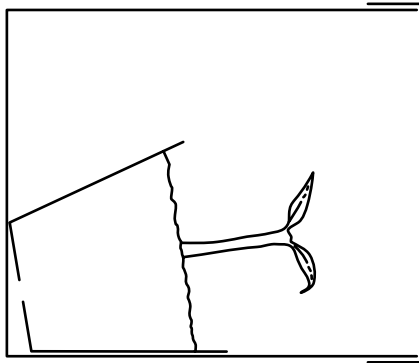
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TURN OVER FOR THE NEXT QUESTION

Turn over ►

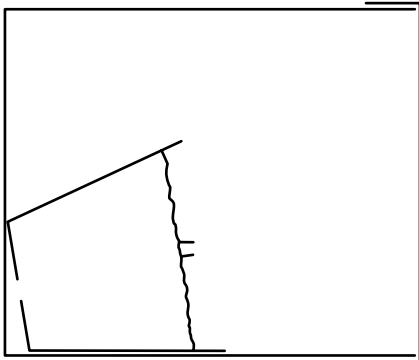
- 6 A young tomato plant was placed on its side, in the dark, as shown in Diagram 1.

Diagram 1



- (a) Complete Diagram 2 to show how you would expect the plant to look after two days.

Diagram 2

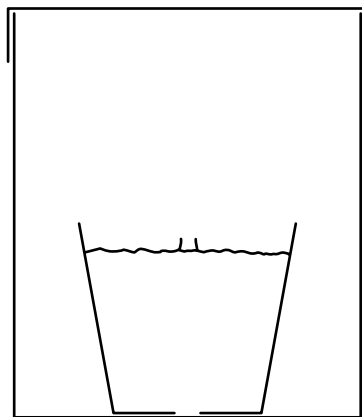


(2 marks)

- (b) The plant pot was then turned through 90°, as shown in Diagram 3.

Complete Diagram 3 to show how you would expect the plant to look after two more days.

Diagram 3



(2 marks)

- (c) Suggest why the tomato plant was kept in the dark during this experiment.

.....

(1 mark)

- 7 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 mark)*

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

- (i) Why does the runner need to sweat?

.....
(1 mark)

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

.....
(1 mark)

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

.....
(1 mark)

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

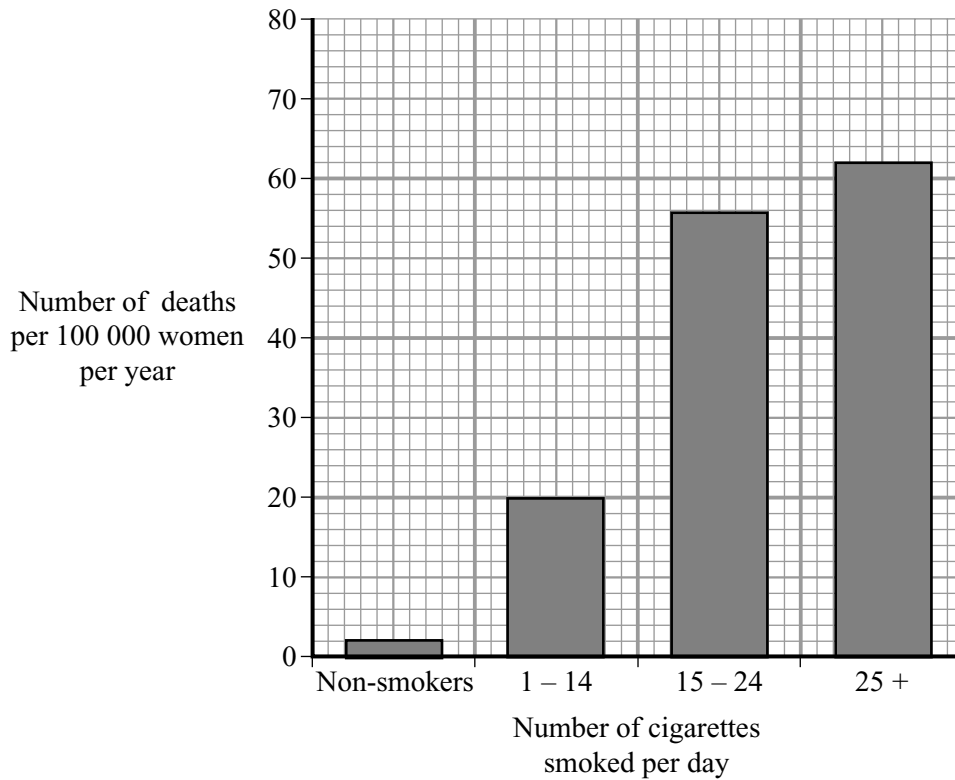
.....
.....
(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ►

8 The bar graph shows how cigarette smoking affects the number of deaths from bronchitis and emphysema in women.



(a) (i) Of the women who smoke 25+ cigarettes per day, how many die each year from bronchitis and emphysema?

.....per 100 000.
(1 mark)

(ii) The death rate for women who smoke 25+ cigarettes per day is higher than the death rate for non-smokers. How much higher is it?

.....per 100 000.
(1 mark)

(b) Name **one** other disease caused by cigarette smoking.

.....
(1 mark)

(c) Tobacco smoke contains carbon monoxide.

- (i) What effect does carbon monoxide have on the amount of oxygen that can be carried by the blood?

.....
(1 mark)

- (ii) What effect does cigarette smoking by pregnant women have on the average birth mass of their babies?

.....
(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

9 The table compares some features of a polar bear and the Malayan sun bear. The polar bear lives in the Arctic where the climate is cold. The Malayan sun bear lives in warm tropical forests.

	Polar bear	Malayan sun bear
Colour of fur	White	Black
Thickness of fur in cm	5	2
Thickness of fat layer under skin in cm	11	1
Surface area compared to body size	Low	High

Use information from the table to explain how the polar bear is better adapted than the Malayan sun bear for survival in arctic 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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(5 marks)



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

an artery an atrium a cuspid valve
a semi-lunar 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

(3 marks)

(b) Angina pectoris is a warning of a possible heart attack.

(i) Some of the stages which may occur in the development of angina pectoris are given below. They are not listed in the correct order.

- 1 – Heart muscles do not receive enough oxygen.
- 2 – The heart muscles contract less efficiently.
- 3 – A deposit on the walls of the coronary arteries causes them to become narrower.
- 4 – The heart muscles do not obtain enough energy.

Put these events in the correct order by writing the numbers in the boxes. The first box has been done for you.

3			
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(1 mark)

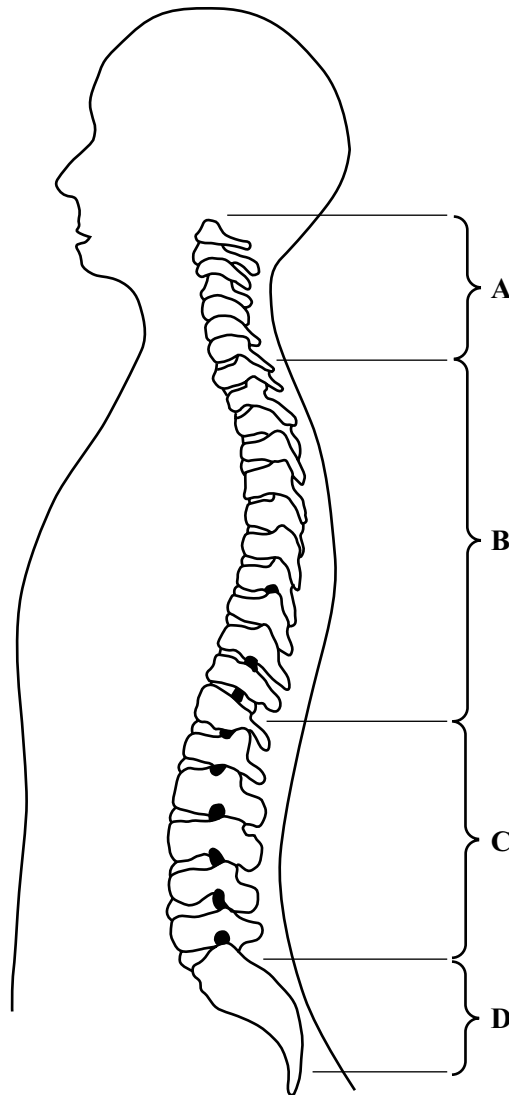
(ii) A person with angina pectoris decided to eat less butter and cream. Give **one** reason to explain why this could help to prevent the angina becoming worse.

.....

.....

(1 mark)

11 The diagram shows the vertebral column. The main regions are labelled **A**, **B**, **C** and **D**.



(a) Give the name of region **A**.

Choose the answer from the list.

cervical **lumbar** **sacral** **thoracic**

A is the region.

(1 mark)

(b) The table shows some features of regions of the vertebral column. Finish the table by entering the correct letter from the diagram.

Features of region	Shown by letter
Strongest vertebrae with large processes for muscle attachment.	
Vertebrae small and loosely attached for movement in many directions.	
Only a little movement between vertebrae. Form attachment for ribs.	

(3 marks)

(c) The table shows a comparison of three foods.

Food	Protein in grams per 100g	Calcium in milligrams per 100g
Cheese	25	810
Eggs	12	56
Herring	16	100

Information in the table shows that cheese is the best of these foods for the development of the skeleton in a growing person. Explain why cheese is the best of these three foods.

.....

.....

.....

.....

.....

.....

(3 marks)



Turn over ►

- 12 (a) List A shows the names of some parts of the male reproductive system. List B gives the functions of these parts.

Draw a straight line from each part in List A to its related function in List B.

List A

Testes contained in scrotum outside body cavity

Prostate gland

Spongy tissue in penis

Smooth muscle in lining of sperm duct

List B

Produces an alkaline fluid for sperm to swim in

Lower temperature helps sperm development

Forces sperm along by peristalsis

Fills with blood during intercourse

(3 marks)

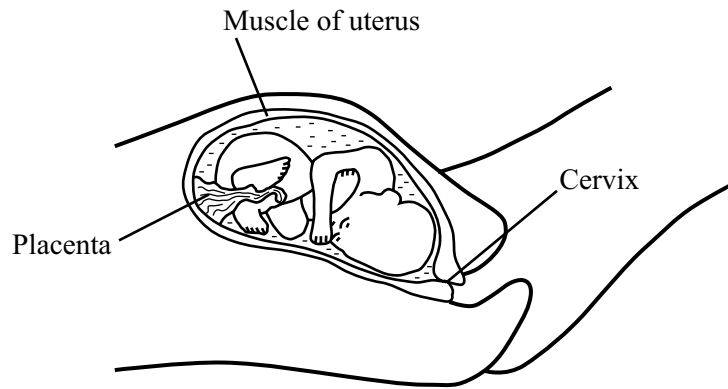
- (b) Select the statement which best completes the definition of fertilisation. Draw a ring round the number of this statement.

Fertilisation is the fusion of:

- | | |
|--------------------------------------|---|
| a sperm with a follicle in the ovary | 1 |
| several sperm with an egg cell | 2 |
| a sperm nucleus with an egg nucleus | 3 |
| semen with an egg cell | 4 |

(1 mark)

(c) The diagram shows a baby in a mother shortly before birth.



Changes occur to each of the labelled structures as birth occurs. Describe what these changes are.

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.

.....

.....

.....

.....

.....

.....

(3 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 13 (a) (i) Fossils are used in the study of human evolution. Explain why bones and teeth are normally the only fossils found.

.....

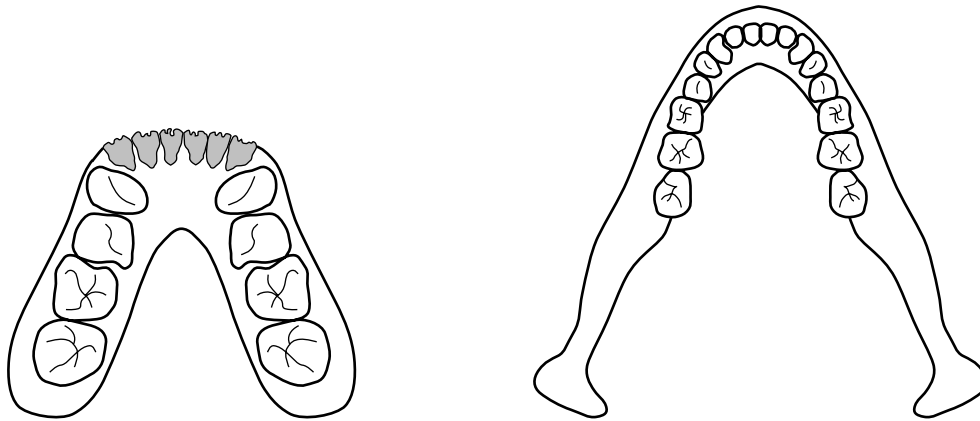
(1 mark)

- (ii) Often, only a few bones are found scattered over a large area. Suggest **one** reason for this.

.....

(1 mark)

- (b) The diagram shows the lower jaw of a young *Australopithecus*. A modern human jaw is shown for comparison.



Australopithecus jaw

Modern human jaw

It is not possible to have a full understanding of this *Australopithecus* fossil jaw. Suggest **one** reason for this.

.....

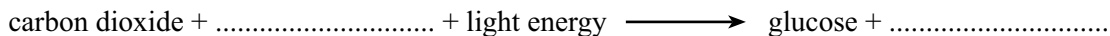
(1 mark)

- (c) It is thought that about 12 000 years ago, *Homo sapiens* began planting crops of wheat instead of wandering in search of food. They began selecting better yielding plants for growing. Suggest **two** reasons why these changes caused them to stay in one place.

.....

(2 marks)

14 (a) The equation describes the process of photosynthesis.



(i) Write in the names of the **two** missing substances. (2 marks)

(ii) Name the green substance which absorbs the light energy.

..... (1 mark)

(b) (i) In bright sunlight, the concentration of carbon dioxide in the air can limit the rate of photosynthesis. Explain what this means.

.....
.....
..... (2 marks)

(ii) Give **one** environmental factor, other than light intensity and carbon dioxide concentration, which can limit the rate of photosynthesis.

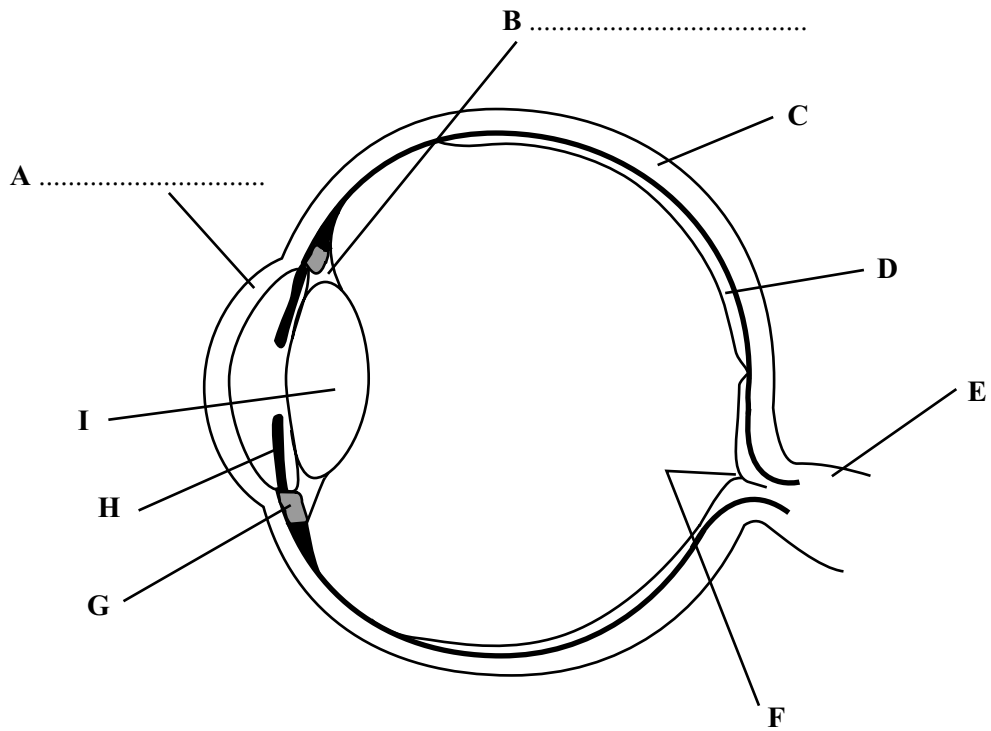
..... (1 mark)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ►

15 The diagram shows a section through the eye.



(a) On the diagram, label parts **A** and **B**. (2 marks)

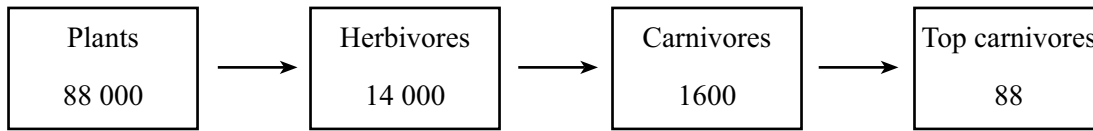
(b) Give the letter, **A** to **I**, of the part which controls the amount of light entering the eye.

Letter.....
(1 mark)

(c) What is the function of part **E**?

.....
(1 mark)

16 The diagram shows a food chain in a pond. The figures show the amounts of energy in each type of organism, in kilojoules per m² of pond per year.



(a) Calculate the percentage of the energy in the plants that is passed to the top carnivores. Show clearly how you work out your final answer.

.....

.....

.....

Answer%
(2 marks)

(b) In the space below, draw a pyramid of biomass for this food chain. Label your drawing with the names of the organisms.

(2 marks)

(c) If humans ate organisms from this food chain, it would be more efficient to eat plants than to eat herbivores. Why is this?

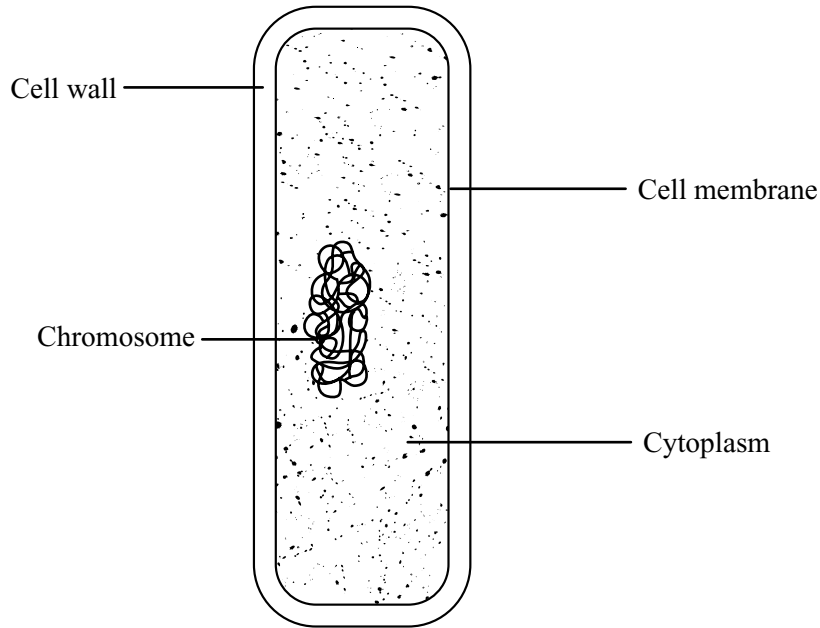
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.....

(1 mark)

Turn over ►

17 (a) The diagram shows a bacterial cell.



A bacterial cell is smaller than a human cell. Give **two** other ways in which the bacterial cell is different from a cell in the human body.

- 1
- 2 (2 marks)

(b) Describe and explain **two** natural defences which help to prevent bacteria entering and harming the human body.

- 1
-
- 2
- (2 marks)

- (c) The table shows changes in resistance to the antibiotic penicillin in one species of bacterium between 1991 and 1996.

Years	Percentage of cases where bacteria were resistant to penicillin
1991–92	7
1993–94	14
1995–96	22

A doctor was asked to treat a patient who had a sore throat.

- (i) How does penicillin help to treat infection?

.....
(1 mark)

- (ii) Use the data in the table to suggest why the doctor should **not** prescribe penicillin.

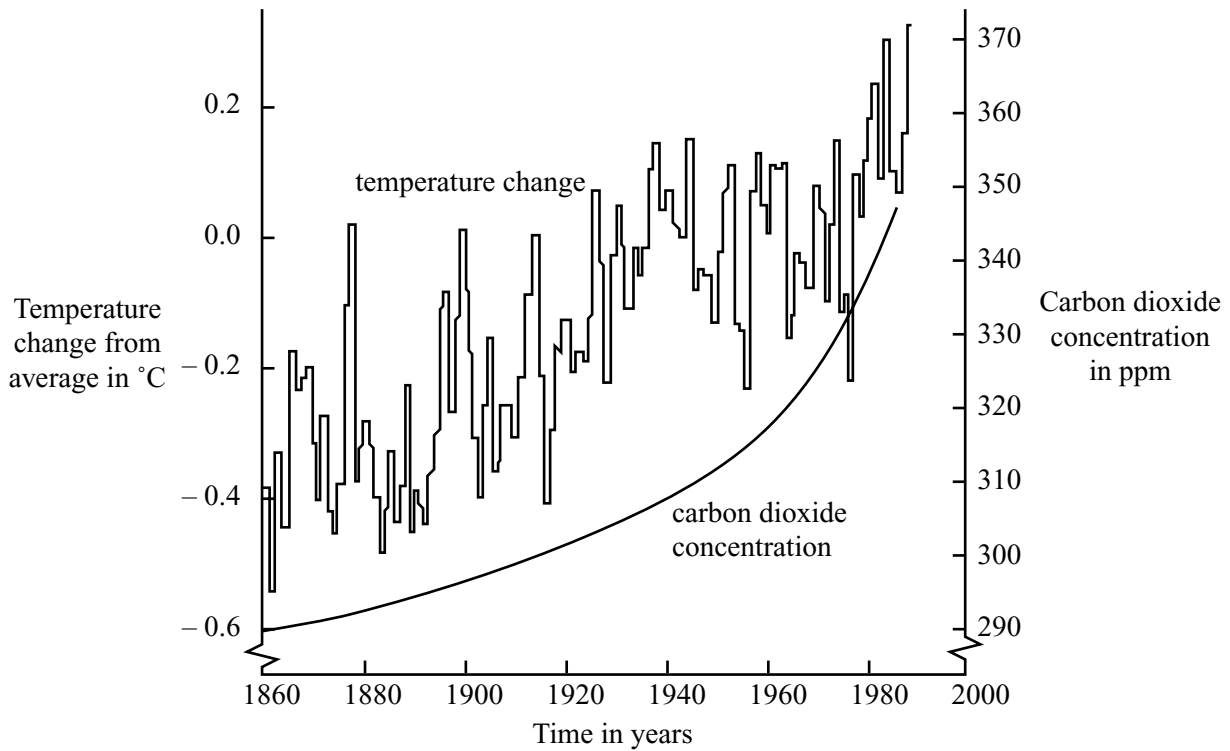
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(2 marks)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ►

18 The graph shows changes in temperature and in carbon dioxide concentration in the earth's atmosphere between 1860 and 1990.



(a) Give **two** human activities which may have helped to increase the concentration of carbon dioxide in the atmosphere.

1

2

(2 marks)

(b) (i) Describe the changes in temperature shown by the graph between 1860 and 1990.

.....

(2 marks)

(ii) Do the data in the graph prove that increased carbon dioxide concentrations in the atmosphere caused the changes in temperature you described in part (b) (i)? Give a reason for your answer.

.....

(1 mark)

- (c) Describe **one** way in which a change in temperature such as that shown in the graph might affect the environment.

.....

.....

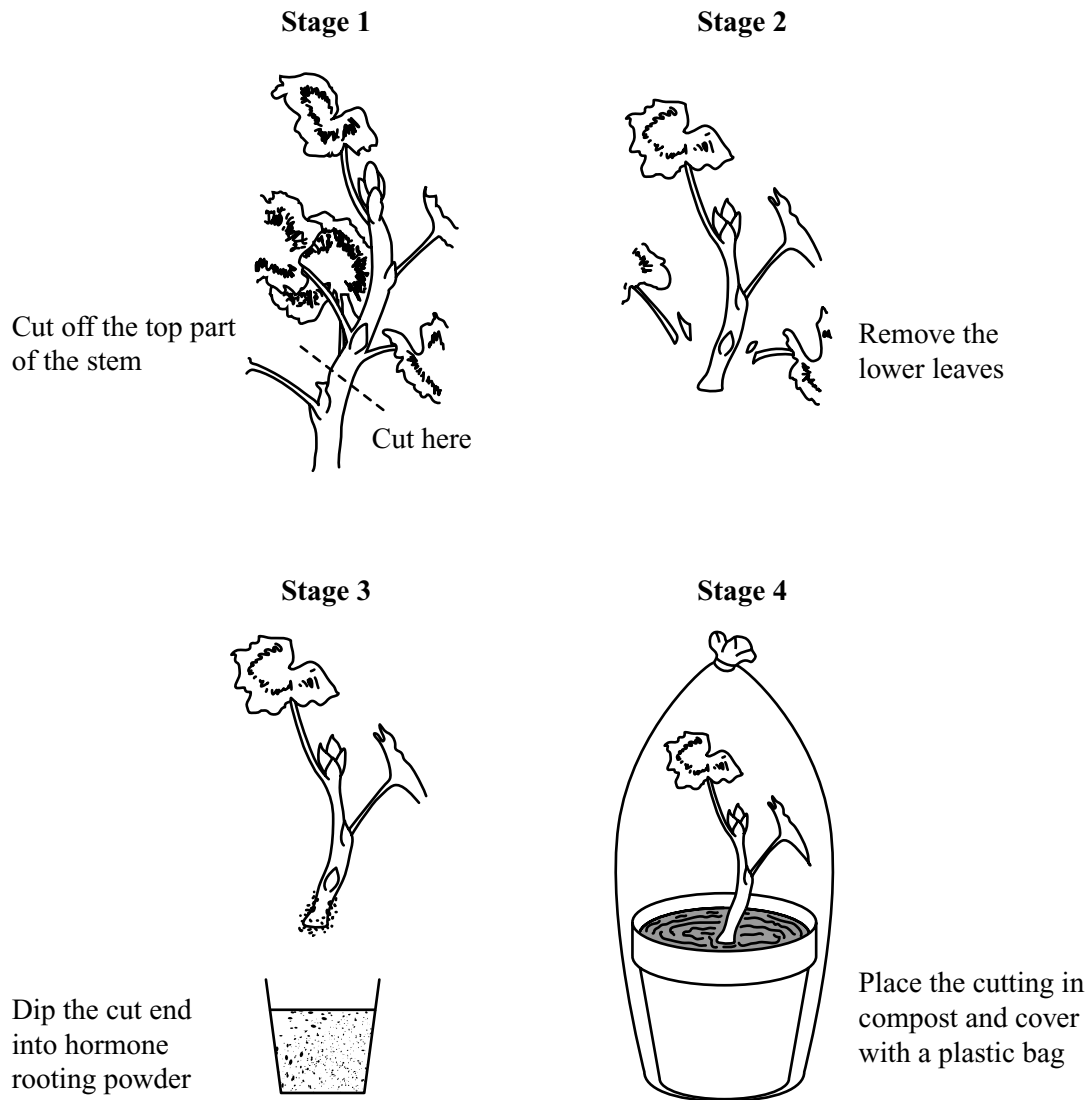
(1 mark)

$\frac{\quad}{6}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 19 (a) New plants can be produced from a parent plant by taking cuttings. The diagram shows how this is done.



(i) Hormone rooting powder stimulates the growth of new roots (Stage 3). Why would the cutting die without roots?

.....
(1 mark)

(ii) Why were the cutting and the pot of soil covered with a plastic bag (Stage 4)?

.....
(1 mark)

(b) A new variety of plant was developed by a gardener. Would the first plant of this new variety have been grown from a seed or from a cutting taken from another plant? Explain your answer as fully as you can.

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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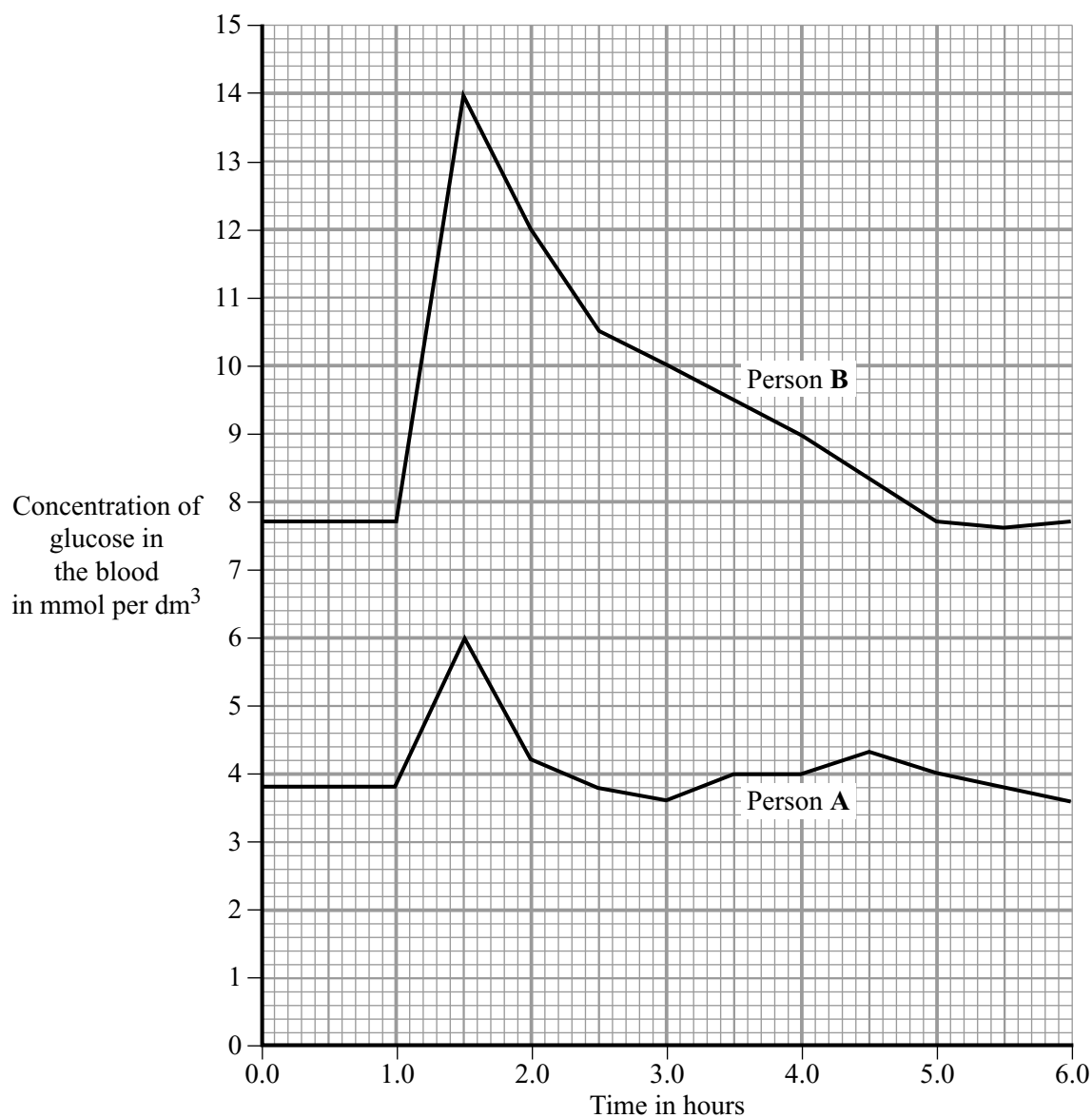
(3 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 20 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 mark)

- (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 mark)

(b) A diabetic person does not produce enough insulin.

(i) Which organ produces insulin?

.....
(1 mark)

(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 mark)

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

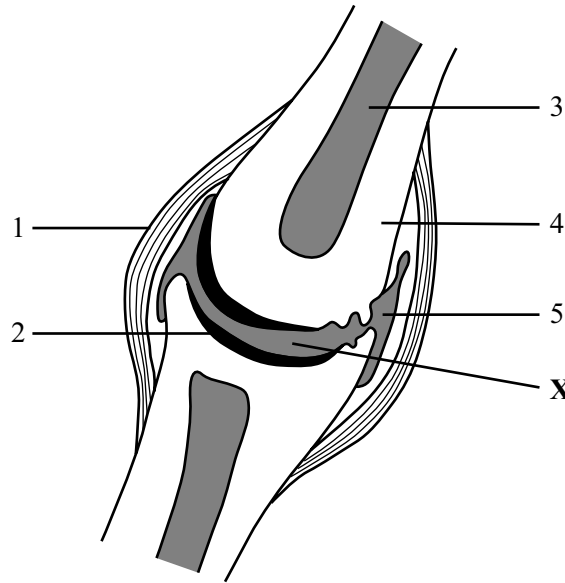
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(4 marks)

8

TURN OVER FOR THE NEXT QUESTION

Turn over ►

21 The diagram shows a section of a synovial joint.



- (a) One of the numbered tissues has great strength to hold the bones together. It is also slightly elastic so that movement at the joint is possible. Give the number which labels this tissue and its name.

Number of tissue

Name of tissue..... (1 mark)

- (b) Describe the function of the part labelled X.

.....

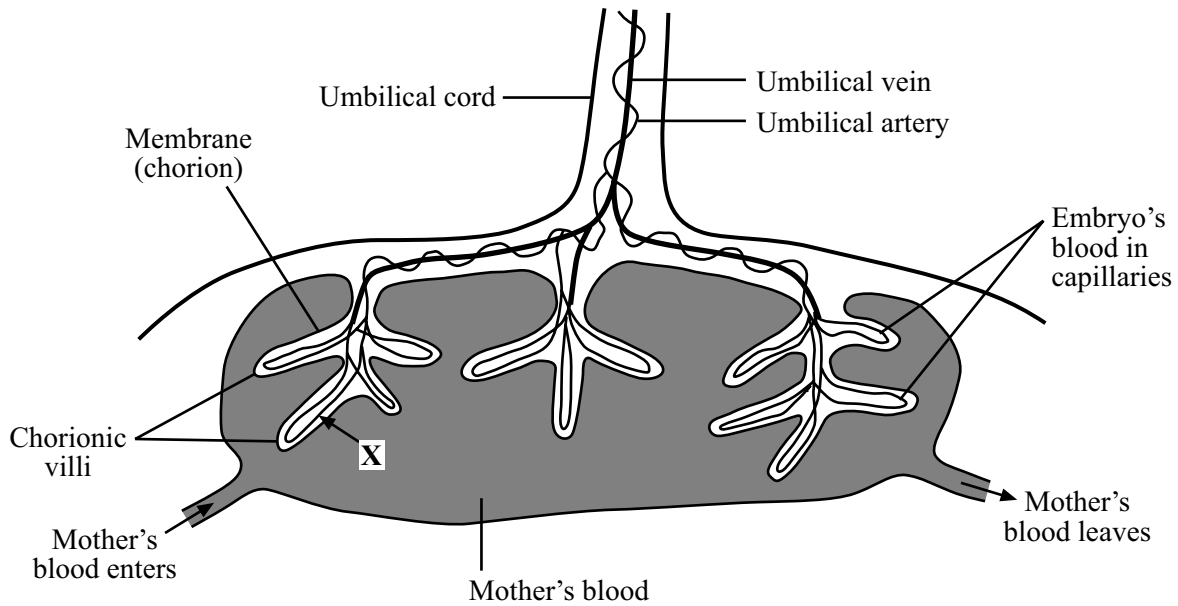
 (1 mark)

- (c) The joint shown in the diagram has been damaged by osteoarthritis. A person with a joint like this would find movement difficult. Use information in the diagram to help explain the reason for this.

.....

 (3 marks)

22 The simplified diagram shows some parts of the placenta and umbilical cord.



(a) Clearly draw an arrow on the diagram to show the direction of blood flow in the umbilical vein. (1 mark)

(b) Name **one** substance which passes in the direction of arrow X.

..... (1 mark)

(c) The chorion is a thin membrane which is not fully permeable. Explain the importance of both of these features to an embryo.

.....

 (2 marks)

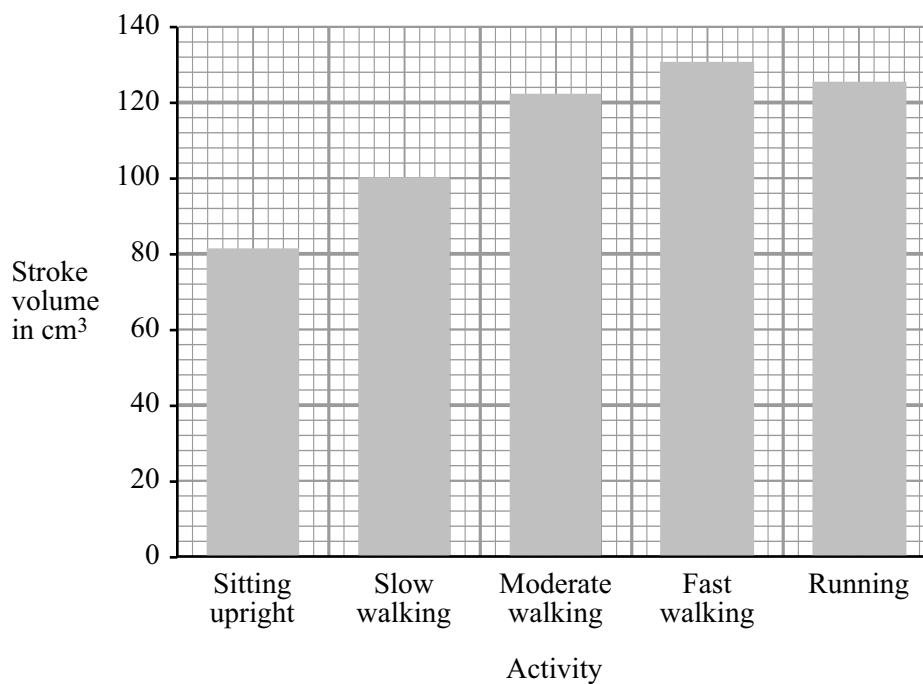
(d) Describe how the shape of the chorionic villi, as shown in the diagram, helps the placenta to function.

.....
 (1 mark)

- 23 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 mark)

- (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 marks)

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

.....
.....

(1 mark)

- (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 mark)

- (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.

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(2 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

24 Humans are primates. The diagrams show the skeletons of two other primates.

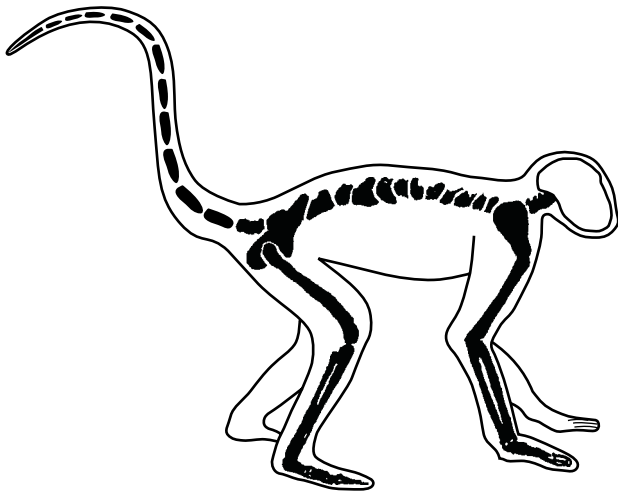


Diagram A

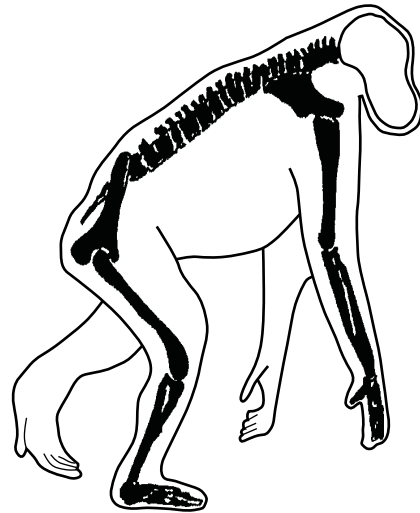


Diagram B

(a) Give **one** characteristic of primates which has not been shown in the diagrams.

.....
(1 mark)

(b) Diagram **B** shows a primate which is more closely related to humans than the animal shown in Diagram **A**. Describe **one** feature shown in the diagrams which shows this to be true.

.....
.....
(1 mark)

(c) The animal shown in Diagram **B** is a primate related to humans. It also has certain features which are different from those in humans. Describe **two** of these differences.

.....
.....
.....
.....
(2 marks)

END OF QUESTIONS