

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2005



**BIOLOGY (HUMAN)
HIGHER TIER**

3415/H

Monday 6 June 2005 1.30 pm to 3.45 pm

H

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

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

Time allowed: 2 hours 15 minutes

Instructions

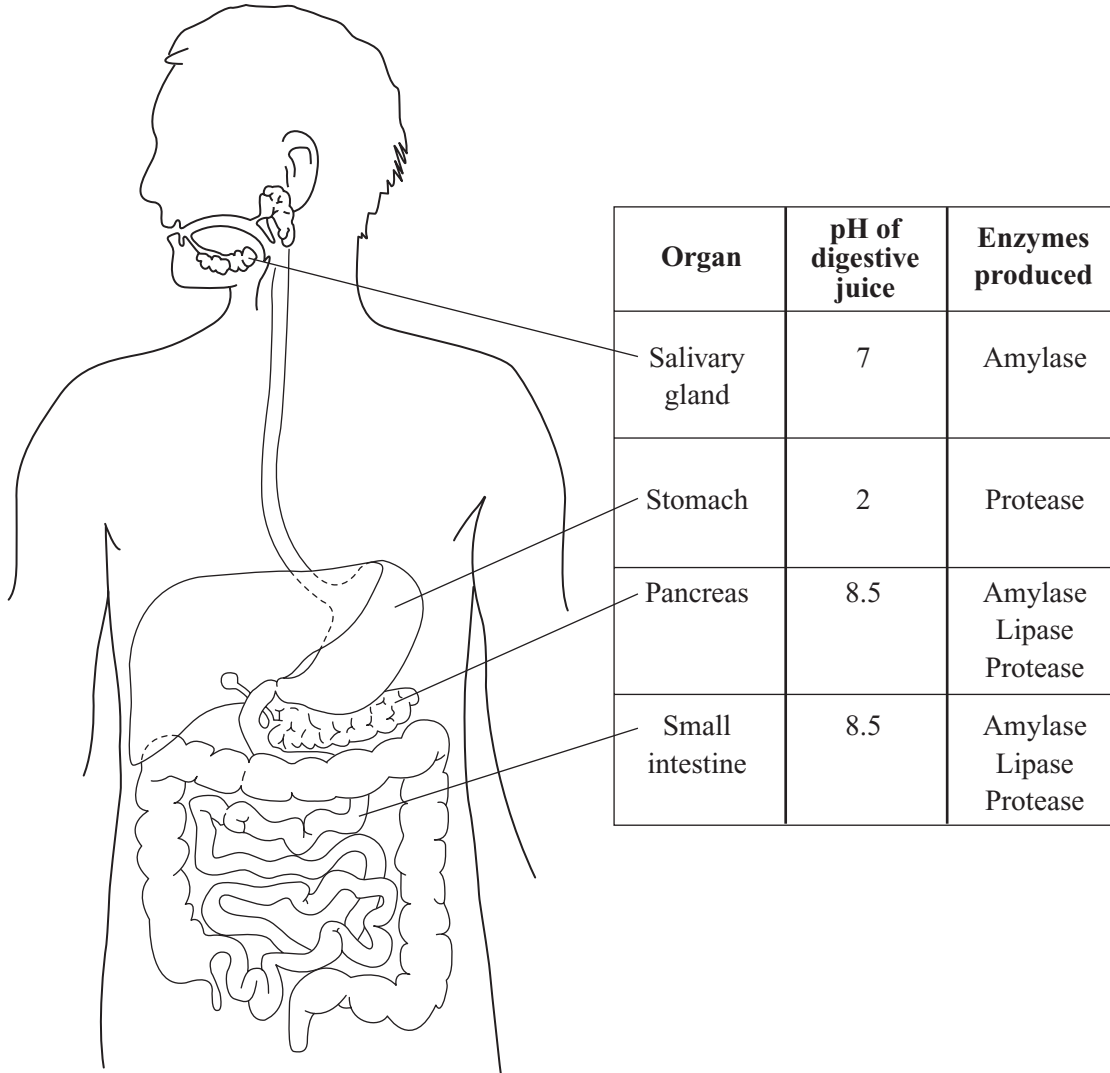
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

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



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

.....
(1 mark)

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

(1 mark)

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 marks)

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

1

.....

2

.....

(2 marks)

(d) The contents of the small intestine are liquid but the faeces are much more solid.

Explain what causes this to happen.

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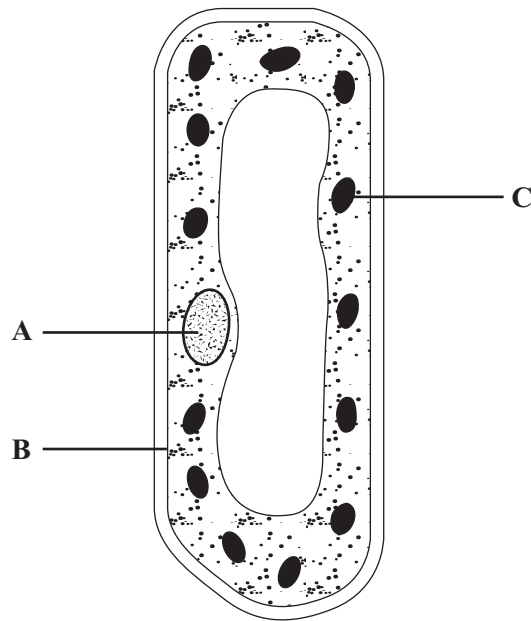
(3 marks)

9

TURN OVER FOR THE NEXT QUESTION

Turn over ►

2 The diagram shows a cell from a plant leaf.



(a) Name structures **A** and **B**.

A

B

(2 marks)

(b) Structure **C** is a chloroplast. What is the function of a chloroplast?

.....

(1 mark)

(c) The table gives one difference between a plant cell and an animal cell.

Complete the table to give **two** more differences.

Plant cell	Animal cell
1. Has chloroplasts	1. No chloroplasts
2.	2.
3.	3.

(2 marks)

- 3 The table shows the effects that two different concentrations of sulphur dioxide in the air had on the growth of rye grass plants.

Sulphur dioxide concentration in the air in micrograms per m ³	9.0	191.0
Number of leaves per plant	85.6	47.3
Total leaf area in cm ²	417.2	203.6
Dry mass of stubble in grams	0.48	0.22

- (a) What human activity releases sulphur dioxide into the air?

.....
(1 mark)

- (b) (i) What effect does sulphur dioxide have on rainwater?

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

- (ii) Use information from the table to describe **one** effect of sulphur dioxide on the leaves of the grass plants.

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

- (c) The stubble consists of the bases of the stems of the plants and the roots left in the soil after harvesting.

Use your answer to part (b) to explain why the dry mass of the stubble was less at the higher concentration of sulphur dioxide.

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

4 Auxin is a hormone made by the tips of plant shoots.

Figure 1 shows the movement of auxin in two young shoots, **A** and **B**, which were treated in different ways. 'X' shows where auxin was made. Both shoots were kept in the dark.

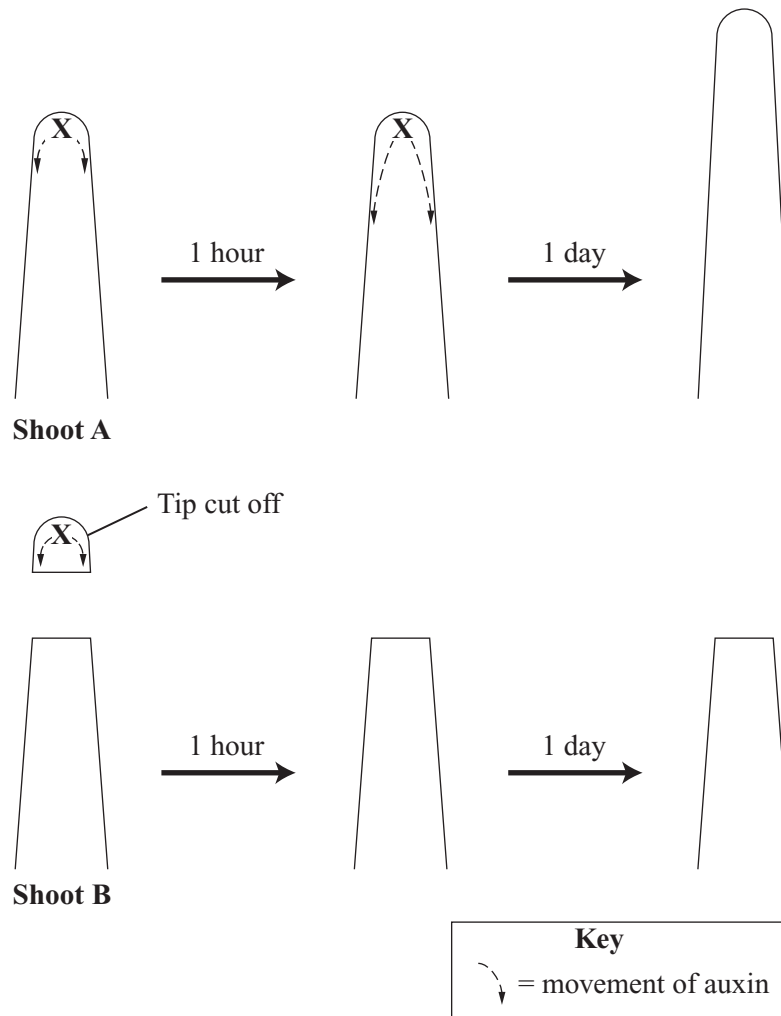


Figure 1

(a) Explain the difference in the growth of shoot **A** and shoot **B** at the end of one day.

.....

.....

.....

.....

.....

(4 marks)

- (b) A third shoot, **C**, was grown in a box so that light shone onto it from only one side. **Figure 2** shows movement of auxin in this shoot and the result of the experiment.

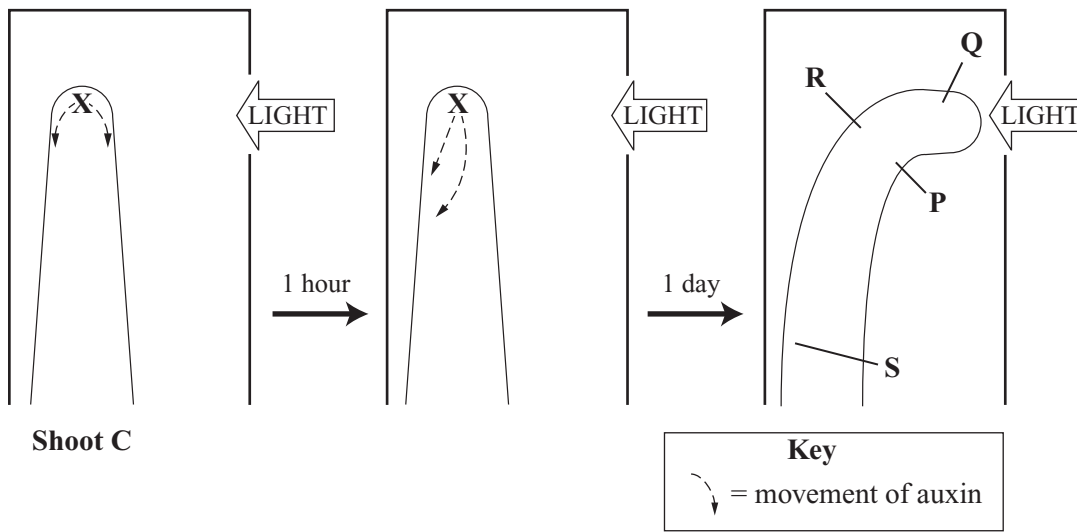


Figure 2

- (i) Describe the movement of auxin in shoot **C** after one hour.

.....
(1 mark)

- (ii) Auxin causes plant cells to elongate (grow longer).

At which point, **P**, **Q**, **R** or **S**, would cells have elongated the most?
Draw a ring around **one** answer.

P **Q** **R** **S**

(1 mark)

- (c) Plant hormones are sometimes used by humans to control plant growth. Give **two** examples of this.

1

.....

2

.....

(2 marks)

5 (a) Fossils provide evidence for evolution.

(i) What is a fossil?

.....
(1 mark)

(ii) How do fossils provide evidence for evolution?

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

(b) Doctors give antibiotics to patients to kill bacteria in their bodies.

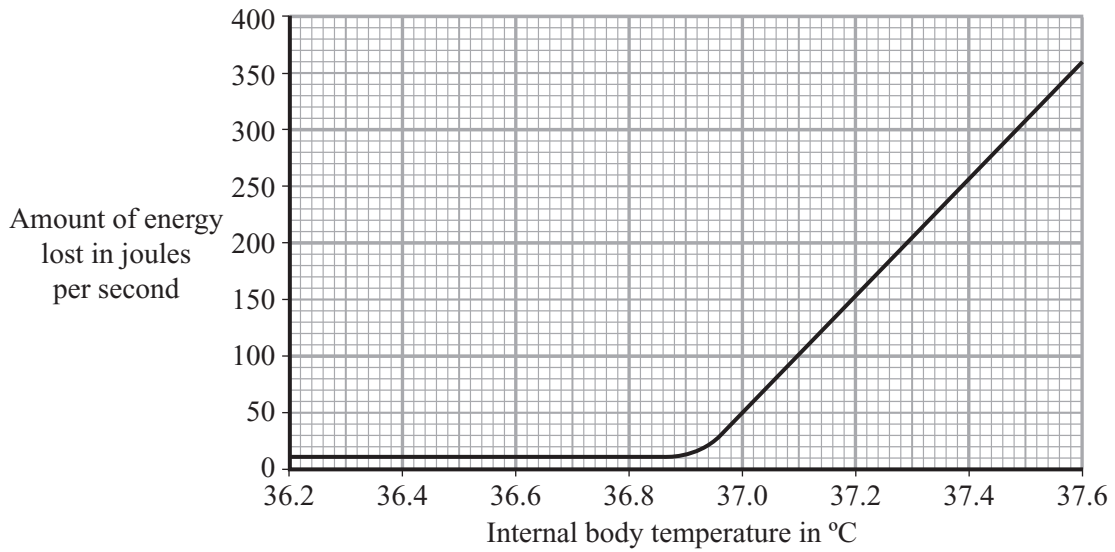
Explain how the overuse of antibiotics has led to the evolution of antibiotic-resistant bacteria.

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)

6

- 6 The internal body temperature determines how much a person sweats. The graph shows the effect of different internal body temperatures on a person’s rate of energy loss by sweating.



- (a) How much more energy was lost from the body each second by sweating when the body temperature was 37.6°C than when it was 36.6°C? Show clearly how you work out your final answer.

.....

Amount of energy = joules per second
 (2 marks)

- (b) Explain why a person would feel more thirsty when the body temperature was 37.6°C than when it was 36.6°C.

.....

(2 marks)

- (c) Explain how sweating helps to control body temperature.

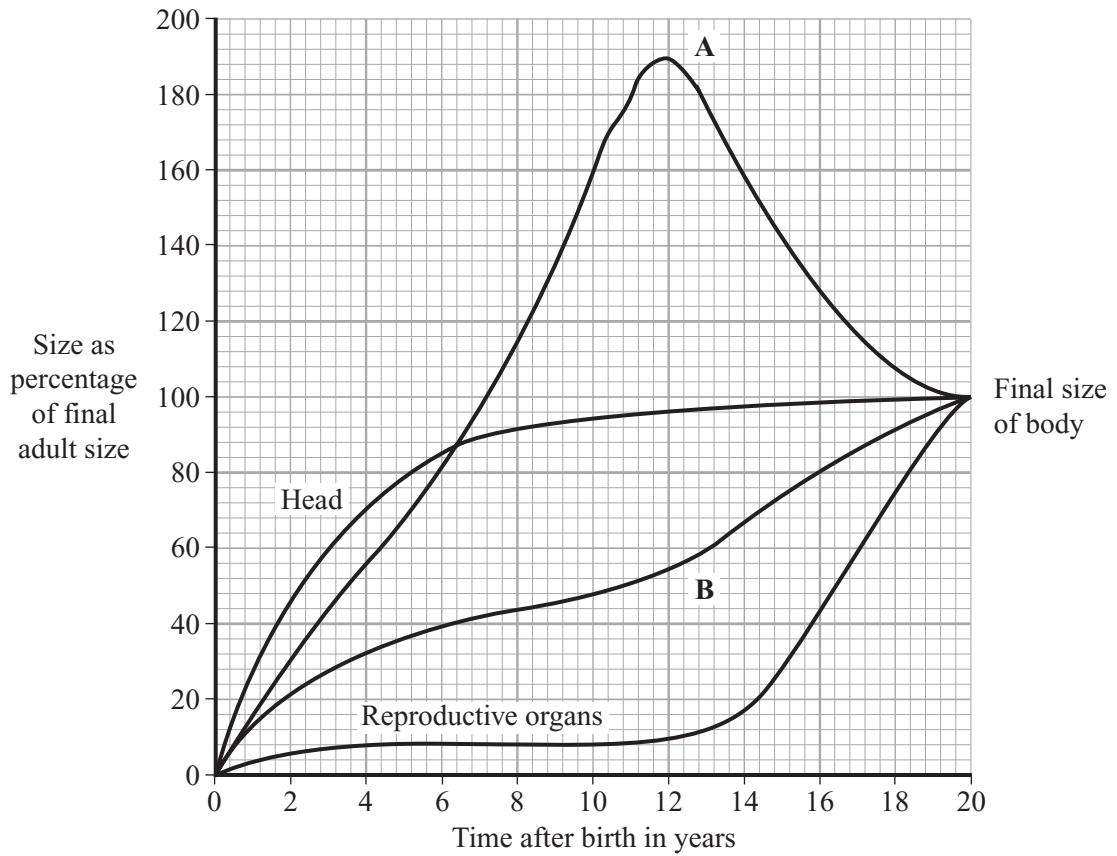
.....

(3 marks)



Turn over ►

7 (a) The graph shows the relative growth rates of three parts of the body compared with the whole body.



(i) Which of the two lines, **A** or **B**, represents the size of the body?

Explain the reason for your answer.

.....

 (1 mark)

(ii) What is the percentage size of the head when a person is aged four years?

.....
 (1 mark)

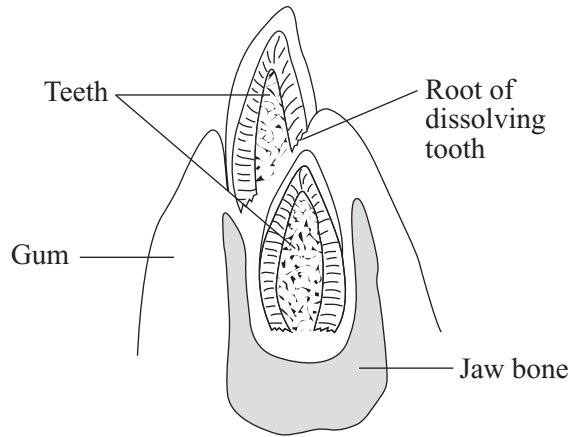
(iii) At what age does the graph show puberty starting?

Explain the reason for your answer.

.....

 (1 mark)

(b) The diagram shows a section of a child's lower jaw.



Describe how the diagram shows that it is the jaw of a child aged more than six years.

.....

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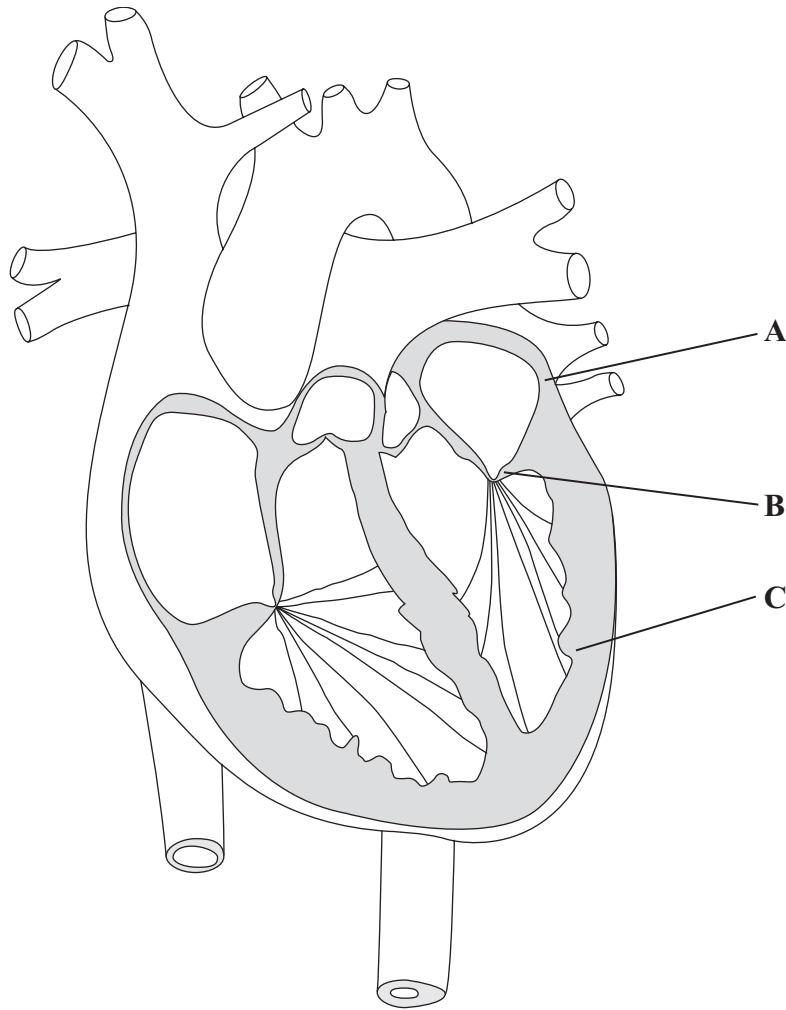
(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 8 (a) The diagram shows a section of the heart.



- (i) One stage of the heart cycle is the contraction of the part labelled **A**.

What is the effect of this contraction?

.....
(1 mark)

- (ii) In some people the flaps of the part labelled **B** do not fit together properly. This causes the heart to be less efficient in pumping oxygenated blood to the organs of the body.

Suggest the reason for this.

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

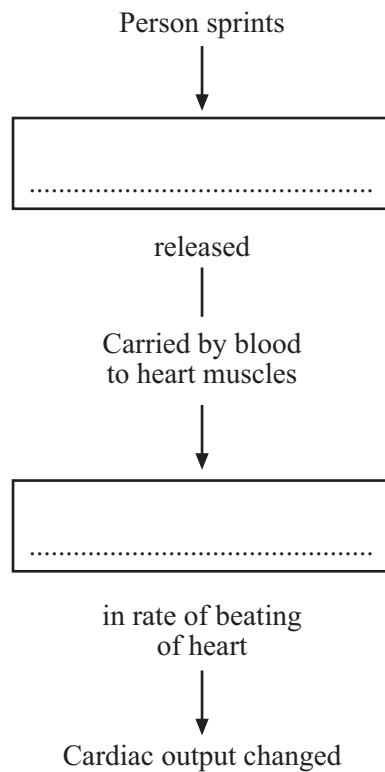
(iii) Explain how the action of the part labelled **C** helps to cause the blood pressure.

.....
(1 mark)

(b) When a person starts to run fast there is a change in the cardiac output of the heart. The flow diagram below shows one way in which the body can cause this change.

Choose words from the box to complete the flow diagram. Enter the words that you choose in the boxes on the diagram.

adrenalin	decrease	impulse
increase	insulin	oestrogen



(2 marks)

5

Turn over ►

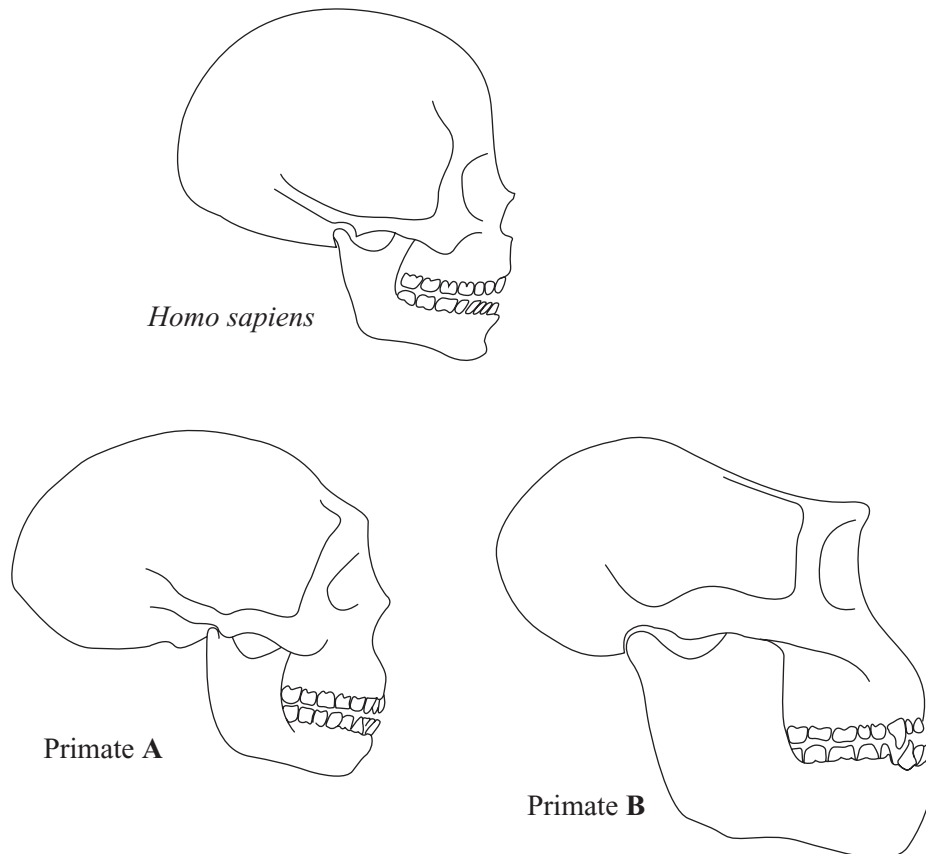
- 9 (a) (i) Human fossils normally consist only of bones and teeth. Explain the reason for this.

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

- (ii) How can the use of radioisotopes help in the study of human fossils?

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

- (b) The diagram shows a skull of *Homo sapiens* and the fossil skulls of two other primates.



Not drawn to scale

It was once thought by some scientists that both primates **A** and **B** were direct ancestors of *Homo sapiens*. It is now thought that only primate **A** is an ancestor.

Use information in the diagram to help suggest an explanation for this change of opinion.

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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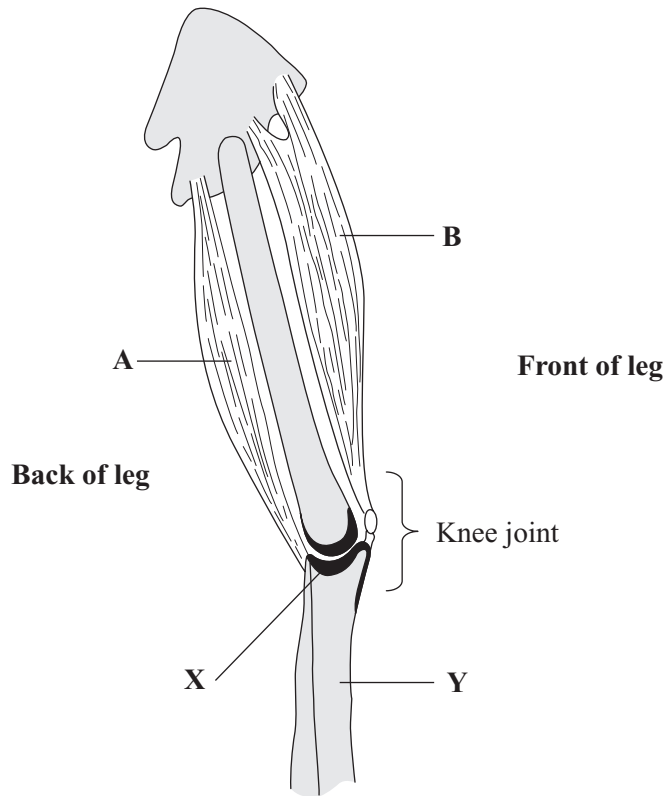
(3 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

10 (a) The diagram shows some of the bones and muscles of the leg.



(i) The structures labelled **A** and **B** are *antagonistic* muscles. Use the diagram to help explain what is meant by the term *antagonistic* muscles.

.....

.....

.....

(2 marks)

(ii) The part labelled **X** may develop osteoarthritis due to general wear and tear. The part labelled **Y** may develop osteoporosis with increasing age.

Explain how each of these conditions could make it difficult for a person to use the leg.

X – osteoarthritis.....

.....

Y – osteoporosis.....

.....

(2 marks)

(b) Ligaments are part of the skeleton of a living person. They are very strong and slightly elastic.

Explain why each of these properties is necessary for the efficient functioning of the skeleton.

Very strong

.....

Slightly elastic

.....

(2 marks)

$\frac{\quad}{6}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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

.....
(1 mark)

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

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

(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 mark)

(c) Cigarette smoke contains carbon monoxide. A woman smoked cigarettes throughout her pregnancy.

Explain how the carbon monoxide in cigarette smoke could harm her developing fetus.

.....
.....
.....
.....
.....
.....
(3 marks)

12 The diagram shows the flow of energy through a forest. The figures are in kilojoules of energy per square metre per year.



(a) What percentage of the energy in the trees is passed on as food for the carnivores?
Show clearly how you work out your final answer.

.....
.....

..... per cent
(2 marks)

(b) Give **three** reasons why so little of the energy in the trees is passed on to the carnivores.

1

.....

2

.....

3

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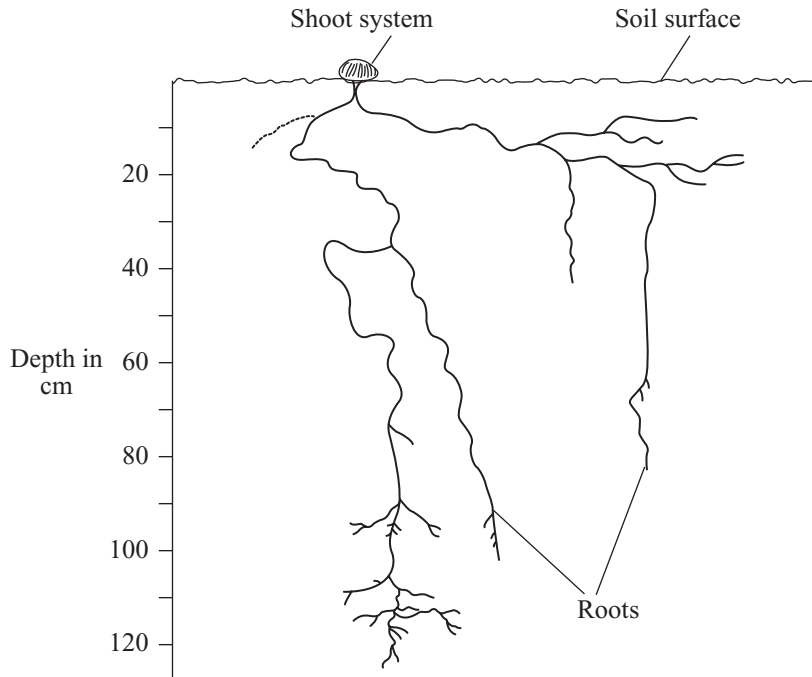
(3 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

13 The diagram shows the desert plant, *Fredolia*.



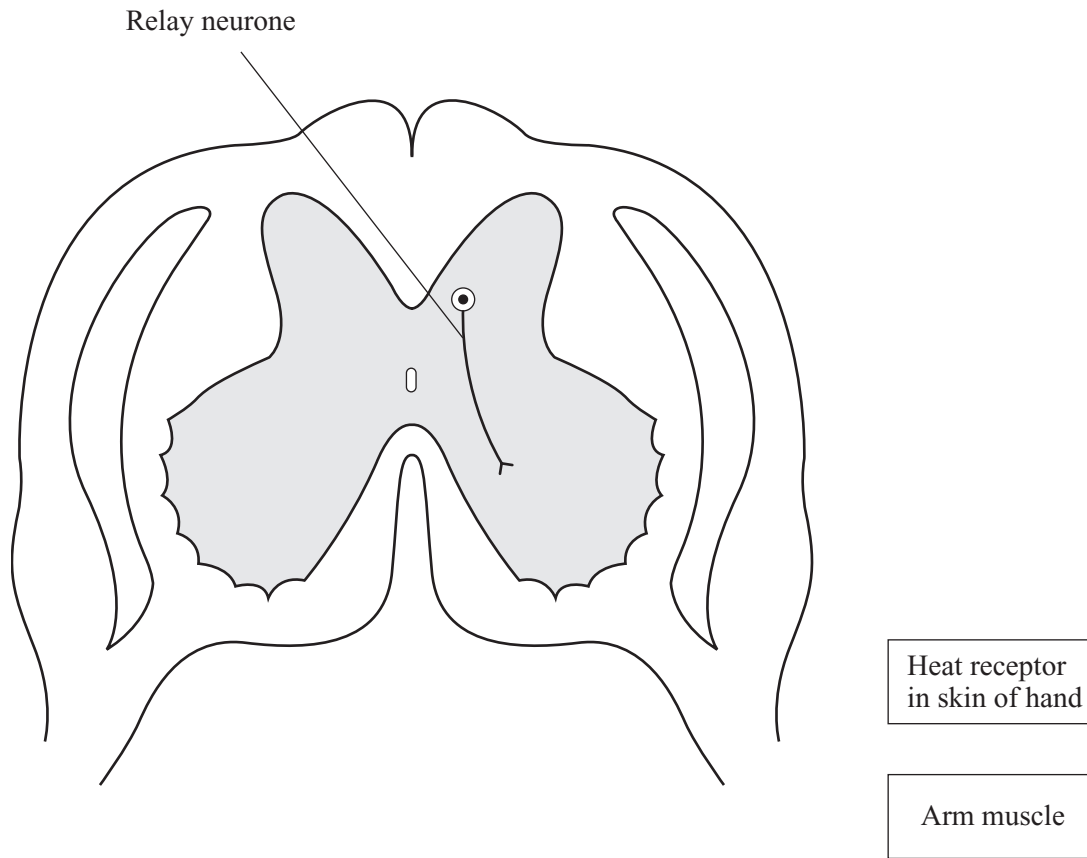
Describe and explain **three** adaptations of *Fredolia*, which you can see in the diagram, that help it to survive in dry conditions.

- 1
-
- 2
-
- 3
-

(3 marks)

3

14 The diagram shows a section through the spinal cord.



(a) Coordination of a reflex movement of the arm, in response to the hand touching a hot object, involves three neurones. One of these, the relay neurone, is shown in the diagram. Complete the nerve pathway between the receptor and the muscle on the diagram by drawing and labelling:

- (i) the sensory neurone;
- (ii) the motor neurone.

(2 marks)

(b) The nerve pathway linking the heat receptor in the hand with the arm muscle is about 1.5 metres in length. It would take the nervous impulse 0.02 seconds to travel this distance along a neurone. However, it takes about 0.5 seconds for the arm to start moving during the reflex response to the heat stimulus.

Explain the difference.

.....

.....

.....

.....

(2 marks)

4

Turn over ►

- 15** Oestrogen, luteinising hormone (LH) and follicle stimulating hormone (FSH) work together to coordinate the menstrual cycle. A woman will be infertile if her pituitary gland does not release enough follicle stimulating hormone (FSH).

Explain how injections of FSH could increase her chances of having a baby.

.....

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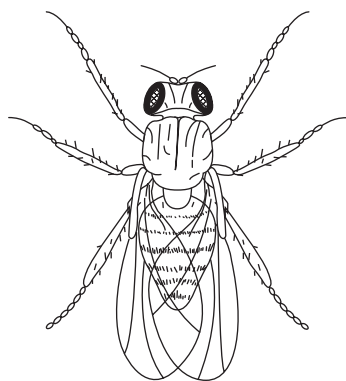
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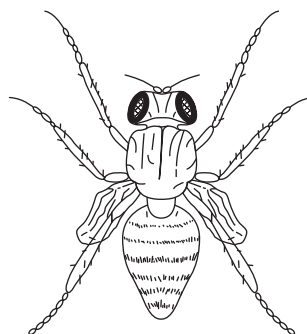
(3 marks)

3

16 The fruit fly, *Drosophila*, has either long wings or vestigial wings, as shown in the diagram.



Long-winged fly



Vestigial-winged fly

The size of the wings is determined by a pair of alleles: **A** and **a**.
Long-winged flies have one of two possible genotypes: **AA** or **Aa**.
Vestigial-winged flies have only one genotype: **aa**.

- (a) (i) What is the genotype of a heterozygous fly?

.....
(1 mark)

- (ii) Why can vestigial-winged flies only have the genotype **aa**?

.....
(1 mark)

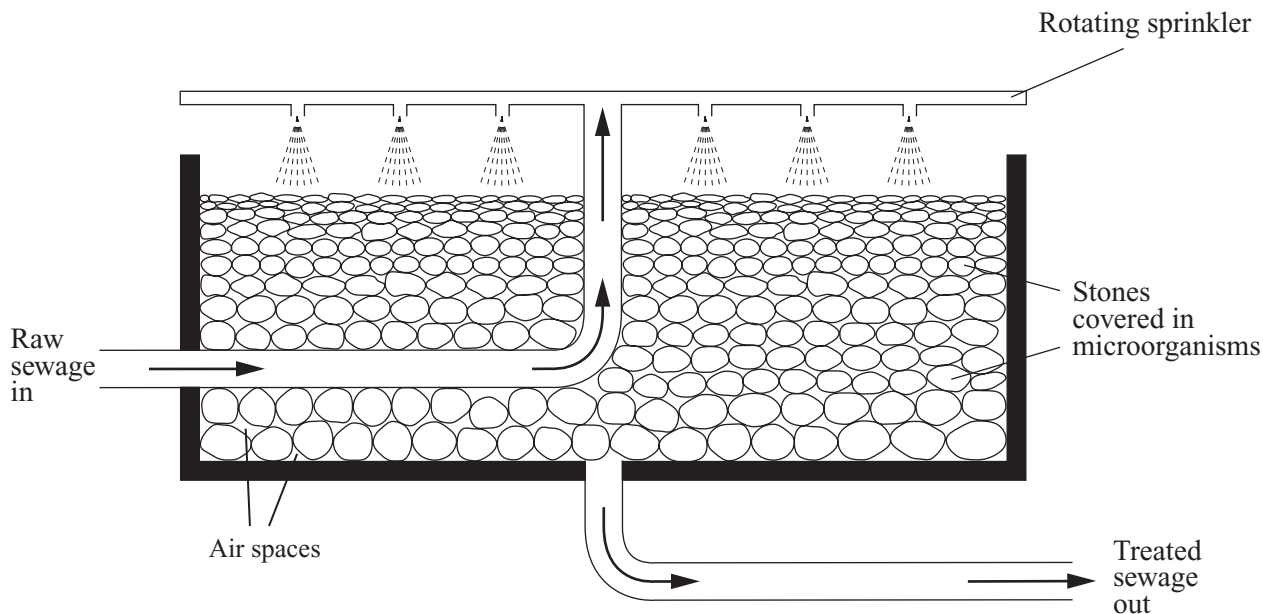
- (b) A male and a female long-winged fly were crossed. They produced 96 offspring. 72 of the offspring had long wings and 24 had vestigial wings. Use a genetic diagram to explain this.

(4 marks)

6

Turn over ►

17 The diagram shows a section through a sprinkler bed at a sewage works.



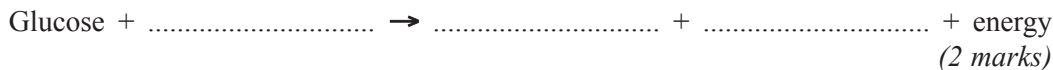
(a) Microorganisms, living in the sprinkler bed, break down organic chemicals in the sewage using aerobic respiration.

(i) Describe and explain **two** features shown in the diagram which allow efficient aerobic respiration in the sprinkler bed.

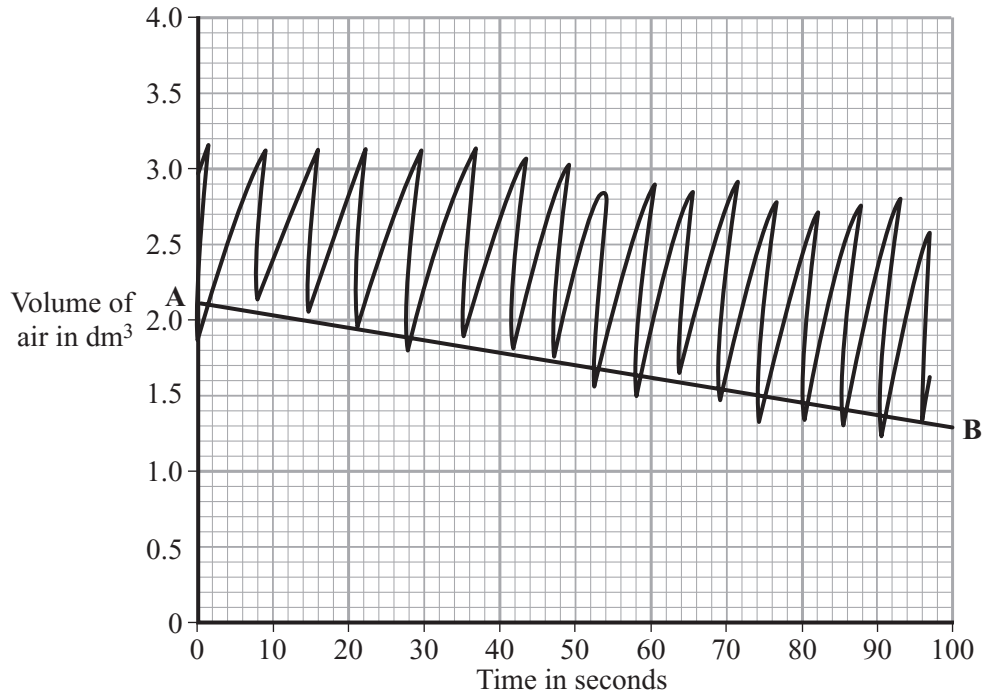
- 1
-
- 2
-

(2 marks)

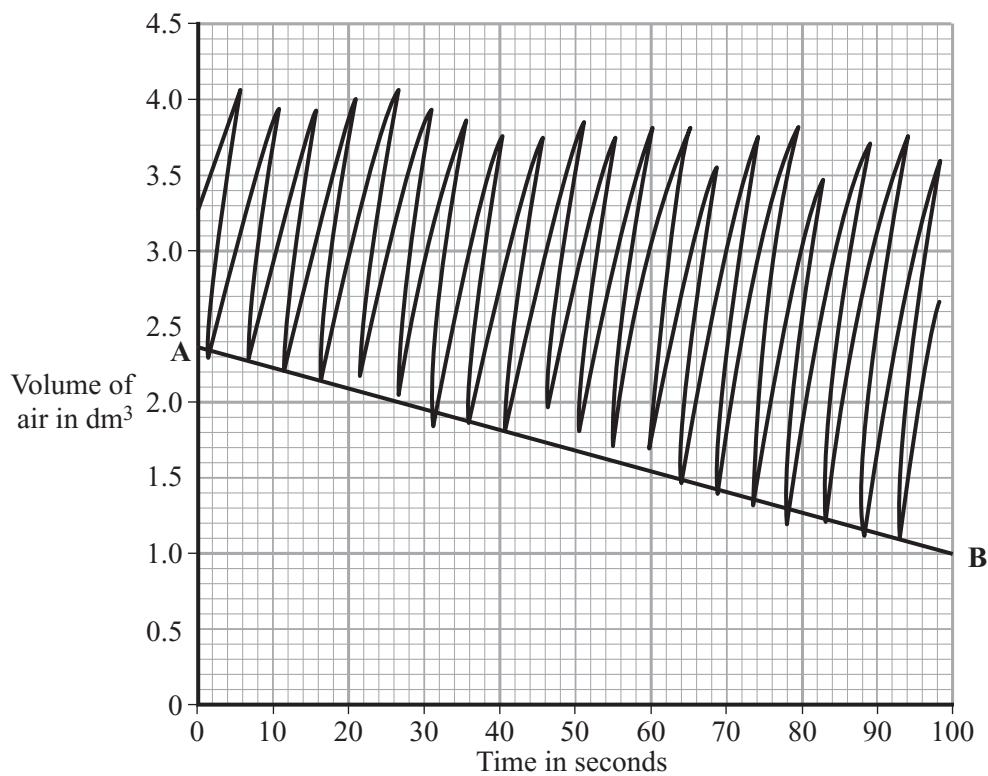
(ii) Complete the following equation to show the breakdown of glucose by aerobic respiration.



- 18 A student's breathing was monitored before and after vigorous exercise. The student breathed in and out through a special apparatus. The graphs show the changes in the volume of air inside the apparatus. Each time the student breathed in, the line on the graph dropped. Each time the student breathed out, the line went up.



Before exercise



After exercise

(a) How many times did the student breathe in per minute:

before exercise;

after exercise?

(1 mark)

(b) On each graph, the line **A – B** shows how much oxygen was used. The rate of oxygen use before exercise was 0.5 dm³ per minute.

Calculate the rate of oxygen use after exercise.

.....
.....
.....

Rate of oxygen use after exercise = dm³ per minute
(2 marks)

(c) The breathing rate and the amount of oxygen used were still higher after exercise, even though the student sat down to rest.

Why were they still higher?

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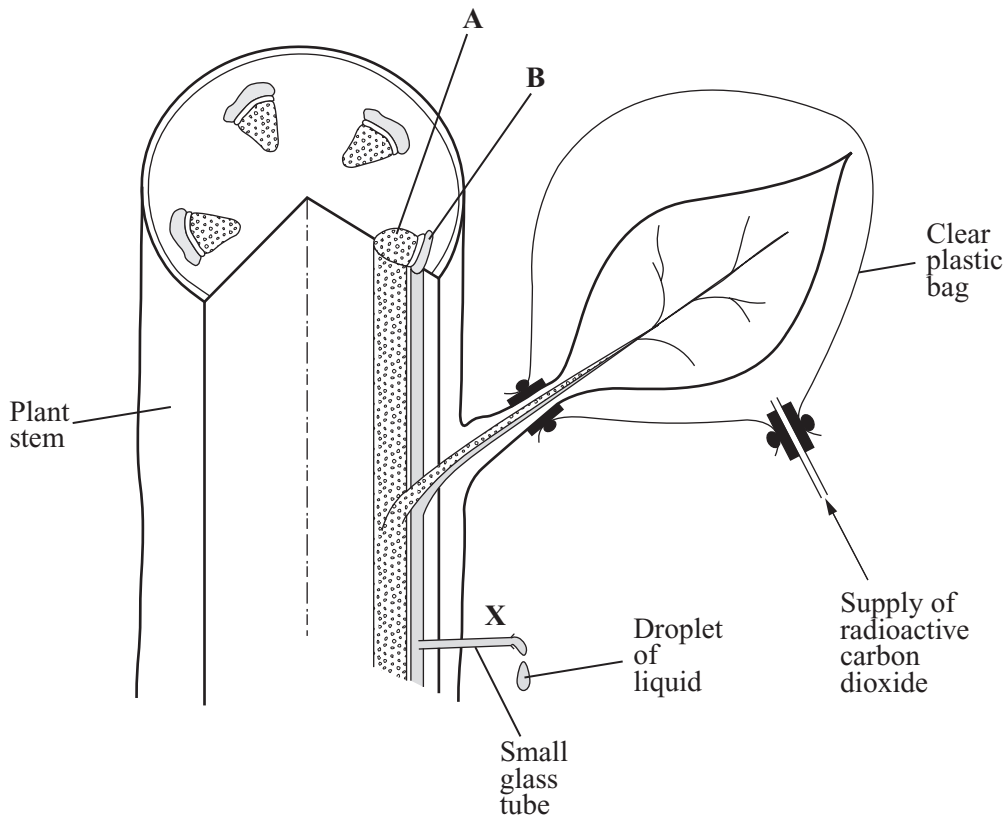
(4 marks)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 19 The diagram shows how carbon dioxide, containing radioactive carbon atoms, was supplied to a leaf attached to a plant stem. A small tube was inserted into the stem at point X. Droplets of liquid from tissue B were collected from the tube.



- (a) (i) Name tissue A, which carries water and minerals from the roots.

.....
(1 mark)

- (ii) Name tissue B.
(1 mark)

- (b) When radioactive carbon dioxide was supplied during daylight, the droplets of liquid which appeared at X were radioactive. The droplets were not radioactive when radioactive carbon dioxide was supplied in the dark. Explain these observations.

.....
.....
.....
.....
.....
.....

(3 marks)

20 (a) (i) Name the two types of nuclear division in cells.

.....

 (1 mark)

(ii) Describe the role of these types of division in the human life-cycle of reproduction and growth.

.....

 (2 marks)

(b) Complete the table about the hormones which are present in a mother's body during the development or birth of a baby.

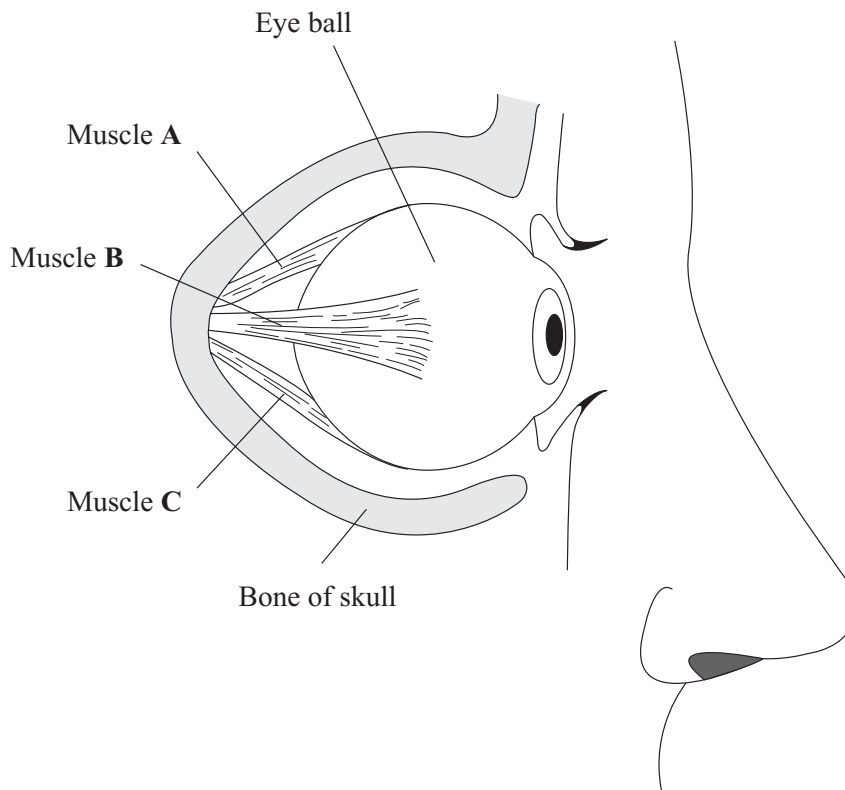
Hormone	Produced by	One effect of the hormone
Human chorionic gonadotrophin (HCG)
Oxytocin
Progesterone

(3 marks)

6

Turn over ►

- 21 (a) The diagram shows an eyeball in position in the skull, with three of the muscles used to move the eye. These muscles are skeletal muscles.



- (i) Which of the three muscles can cause the eye to look downwards?

.....
(1 mark)

- (ii) Name the origin and insertion of muscle **B**. Explain the reason for your answer.

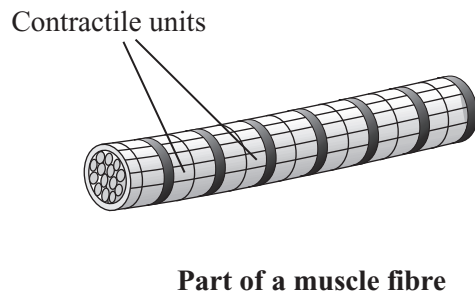
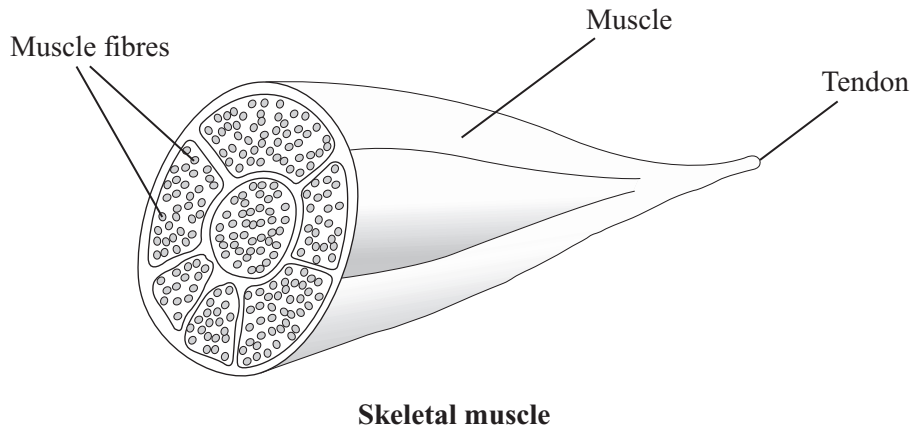
Origin

Insertion.....

Explanation

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

(b) The diagram shows a cross-section of a skeletal muscle and a small part of a muscle fibre.



Muscles can contract fully to cause maximum bending of a joint. They can also contract slightly to cause partial bending.

Explain how the structures shown enable these two actions to occur.

.....

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.....

(3 marks)

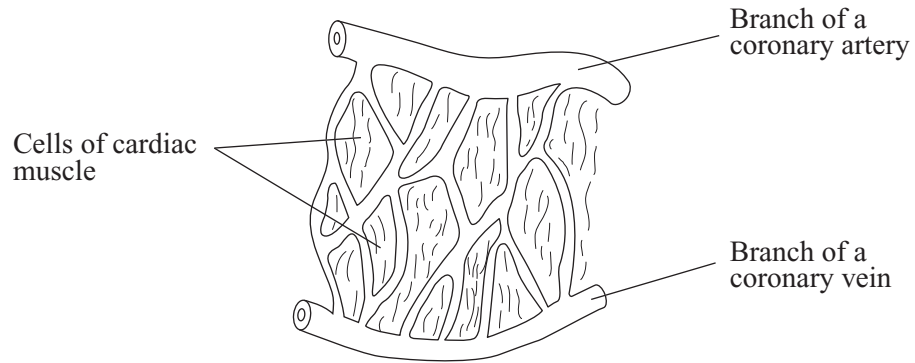
6

Turn over ►

- 22 (a) (i) Describe **one** way in which the functioning of cardiac muscle is different from that of skeletal muscle.

.....
(1 mark)

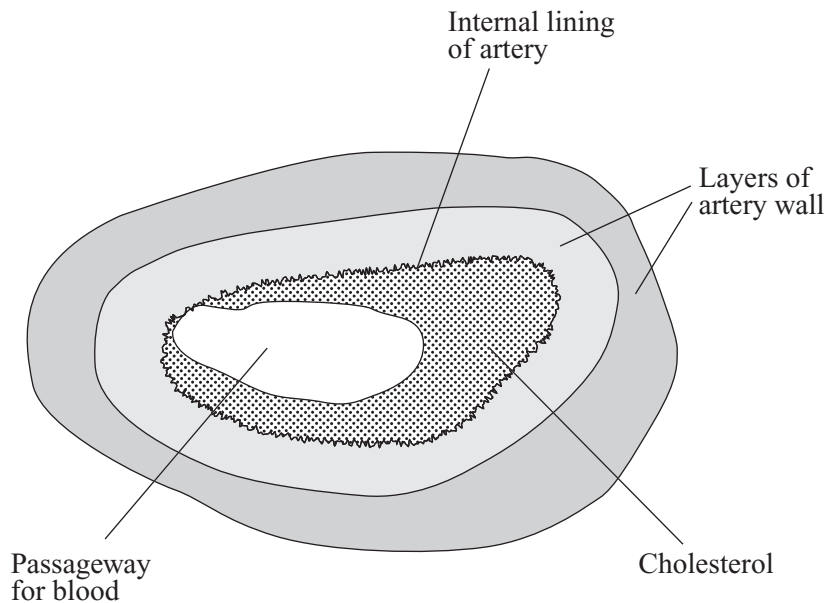
- (ii) The diagram shows a small part of the blood supply to the walls of the heart.



Describe how this arrangement of the blood vessels helps the heart to beat.

.....
(1 mark)

- (b) The diagram shows a cross-section of a branch of a coronary artery.



(i) Explain why this artery is unhealthy.

.....
(1 mark)

(ii) What is the relationship between the condition of this artery and high blood pressure?

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

(iii) A person, who has arteries in the condition shown, may find that on taking exercise the cardiac output of the heart cannot increase.

Suggest an explanation for this.

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

(iv) When the cardiac output cannot increase, the person may suffer angina pectoris.

Describe **one** effect of this condition that the person would notice.

.....
(1 mark)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 23 The average sizes of brains of certain fossils were calculated. This was done by measuring the volume of the cranium which held the brain in the skull.

The table shows the results.

Primate	Volume of brain in cm ³	% increase in volume compared with previous primate
<i>Australopithecus</i>	500	
<i>Homo habilis</i>	680	36.0
<i>Homo erectus</i>	900	32.5
<i>Homo sapiens</i>	1325

- (a) Complete this table by entering the % increase for *Homo sapiens*. Show clearly how you work out your answer.

.....

.....

.....

.....

(2 marks)

- (b) The evolution of humans has shown an increase in reasoning power.

Which primate in the table has shown the greatest advance? Use information in the table to help you explain your answer.

.....

.....

(1 mark)

- (c) The advance in the reasoning power of humans helped in the development of civilisation. Between 8000 and 5000 BC farming methods were first established. At the same time settled villages of about 200 inhabitants were also established.

Use this information to help explain how these changes contributed to the evolution of civilisation.

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(3 marks)

END OF QUESTIONS

6

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE