

Surname		Other Names	
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Candidate Signature			

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General Certificate of Secondary Education
June 2006



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

**BIOLOGY (HUMAN)
Foundation Tier**

3415/F

F

Wednesday 7 June 2006 1.30 pm to 3.45 pm

For this paper you must have:

- a ruler

You may use a calculator.

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.
- Answer the 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.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use			
Number	Mark	Number	Mark
1		17	
2		18	
3		19	
4		20	
5		21	
6		22	
7		23	
8		24	
9		25	
10		26	
11			
12			
13			
14			
15			
16			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

- 1 Complete the table to show which organ of the human body carries out each function.

Choose your answers from the list in the box.

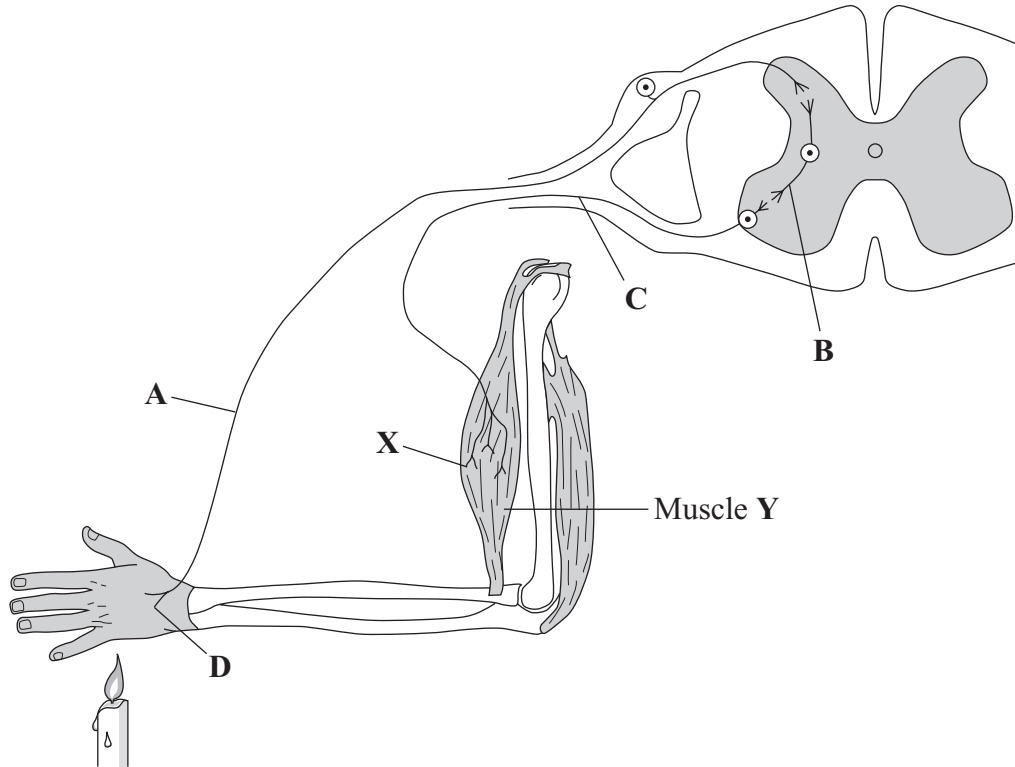
brain eye heart liver ovary pancreas stomach

Function	Organ
Pumps blood around the body	
Releases eggs	
Detects light	
Produces hydrochloric acid	
Produces insulin	

(5 marks)

5

2 The diagram shows the parts of the nervous system which act when the hand touches a hot object.



(a) Which letter, A to D, shows:

- (i) the sensory neurone;
- (ii) the motor neurone;
- (iii) the receptor?

(3 marks)

(b) What happens to muscle Y when impulses arrive at point X?

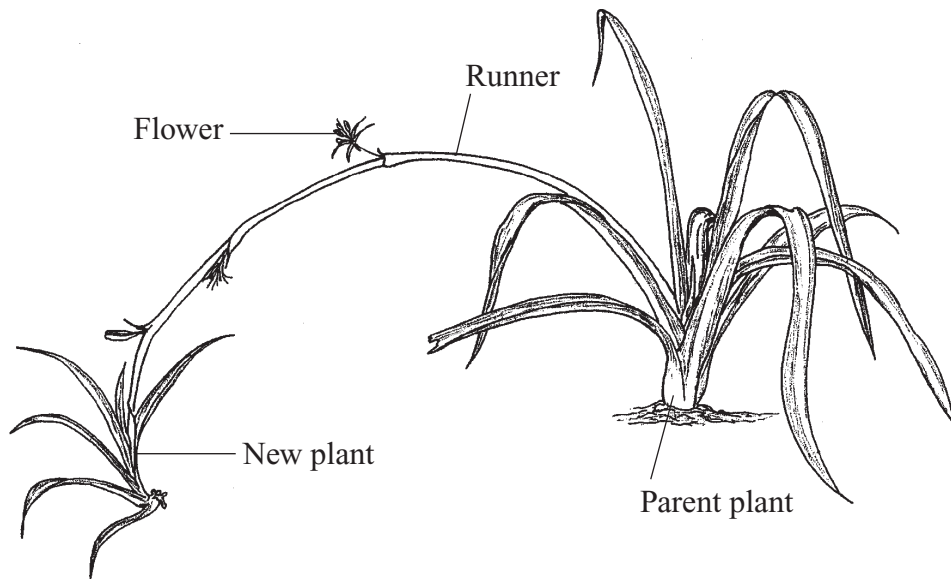
.....
(1 mark)

(c) Moving the hand away from the hot object is a reflex action. What is a reflex action?

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

(2 marks)

3 The diagram shows a house plant.



Complete the sentences about reproduction in this plant. Choose the correct words from the box.

asexual	clones	different	families
gametes	identical	sexual	

This plant reproduces in two different ways:

EITHER New plants may grow from the ends of the runners. Many new plants can form in this way. This is an example of reproduction. All the offspring plants will be genetically Scientists call groups of offspring produced in this way

OR In the flowers, male and female will fuse together and grow into seeds. This is an example of reproduction. All the offspring plants grown from the seeds will be genetically

(6 marks)

- 4 The table gives information about urine and sweat produced by a person on two different days. On one day the weather was cold and on the other it was hot. The person did the same amount of exercise, and ate and drank the same, on each day.

	Cold day	Hot day
Volume of sweat in dm ³	0.62	1.22
Volume of urine in dm ³	1.50	0.90
Concentration of salt in urine in grams per dm ³	9.50	12.80

- (a) (i) The person sweats more on the hot day.

Why is this helpful?

.....

 (1 mark)

- (ii) Why is the volume of urine lower on the hot day?

.....

 (1 mark)

- (b) The person took in the same amount of salt in food and drink on both days.

Why is the salt concentration of the urine higher on the hot day?

.....

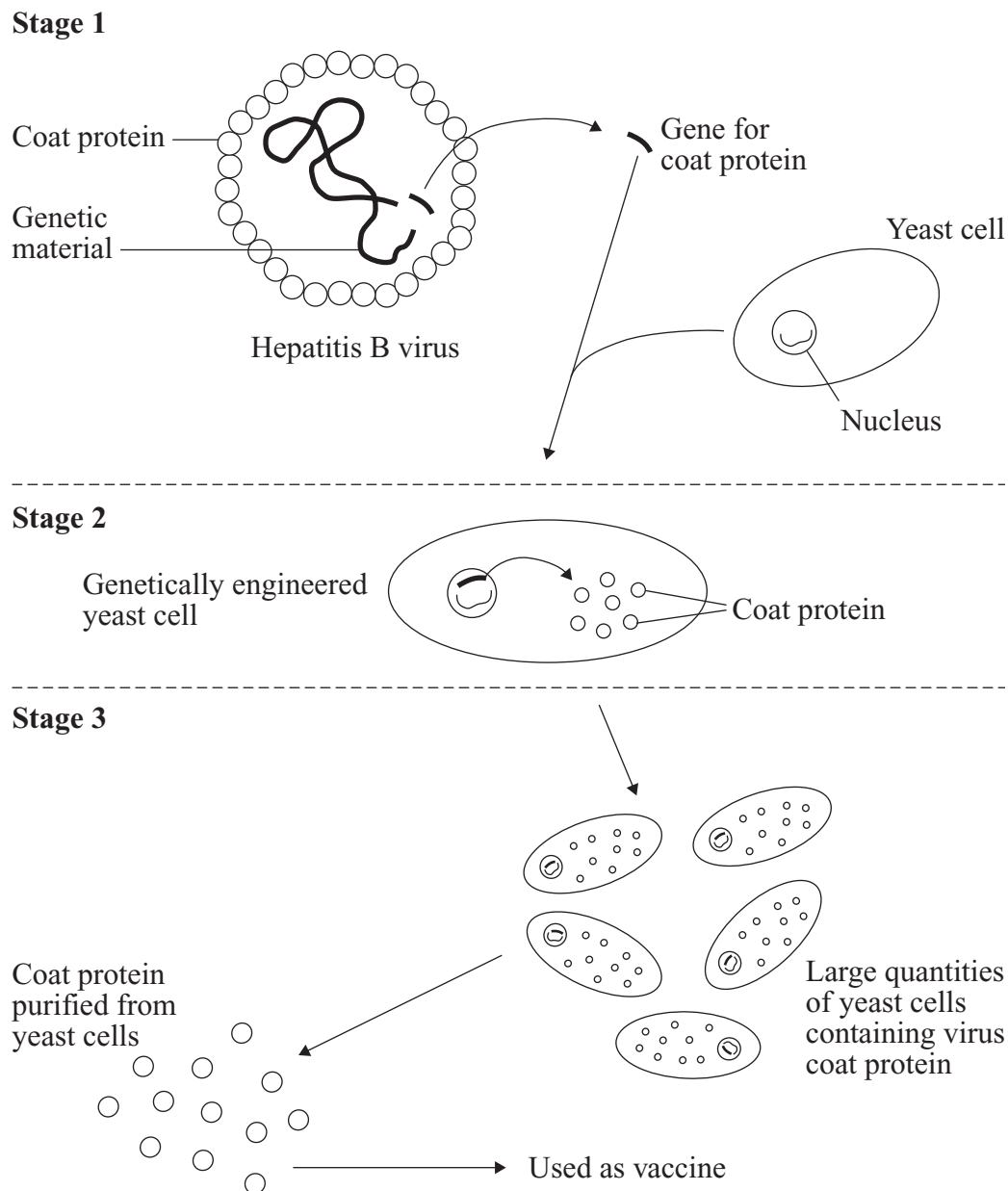
 (1 mark)

- (c) Give **one** other way by which a large amount of water is lost from the human body each day.

.....

 (1 mark)

- 5 Hepatitis B is a dangerous human disease. It is caused by a virus. The diagram shows how a vaccine against hepatitis B can be made by genetic engineering.



- (a) Use the diagram to answer the following questions.

- (i) What part of the virus is put into the yeast cell at **Stage 1**?

.....
(1 mark)

- (ii) What part of the virus is produced by the yeast cell at **Stage 2**?

.....
(1 mark)

(b) In each of parts (i), (ii) and (iii), draw a ring around **one** answer.

A vaccine is injected into a person. The vaccine helps fight the disease.

(i) Which cells respond to the vaccine?

platelets

red blood cells

white blood cells

(1 mark)

(ii) Which substance is produced by the cells in part (b)(i)?

antibiotics

antibodies

mucus

(1 mark)

(iii) Following vaccination, the hepatitis B virus may enter the body again. If this happens, the substance in part (b)(ii) will be produced

at the same rate.

more rapidly.

more slowly.

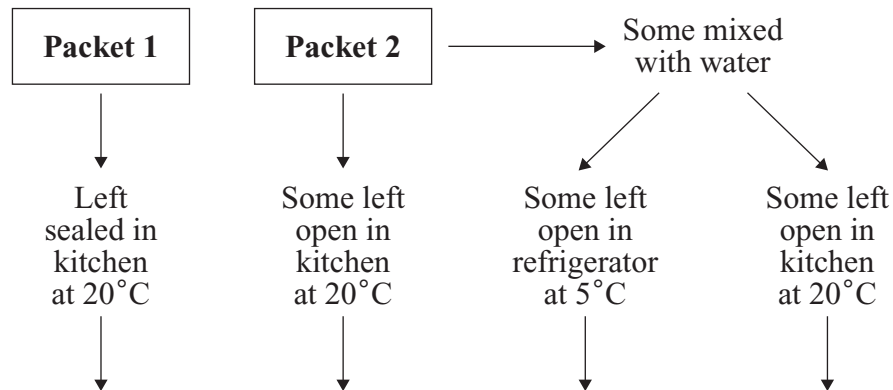
(1 mark)

5

Turn over for the next question

Turn over ►

6 Two packets of dry, powdered soup were treated as shown in the flow chart.



Results:

After 5 days	No mould	No mould	No mould	Mould
After 10 days	No mould	No mould	Mould	Mould

(a) What **two** conditions are needed to help the mould grow quickly?

1

2

(2 marks)

(b) In each of parts (i), (ii) and (iii), complete the sentences by drawing a ring around **one** answer.

(i) **Packet 1** did not go mouldy because the packet kept out mould spores and

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

(1 mark)

(ii) This gas is needed by the mould for

nutrition. **photosynthesis.** **respiration.**

(1 mark)

(iii) In the refrigerator, this process occurs

at the same rate. **more quickly.** **more slowly.**

(1 mark)

7 Complete the sentences by choosing the correct words from the box.

diffusion	high	low	membrane	nucleus
osmosis	photosynthesis	respires	wall	wilts

Oxygen enters cells by the process of This is the movement of molecules from where they are at a concentration to where they are at a concentration.

Water molecules pass from a dilute solution into a concentrated solution through the partially permeable cell This process is called

A plant if the cells are short of water.

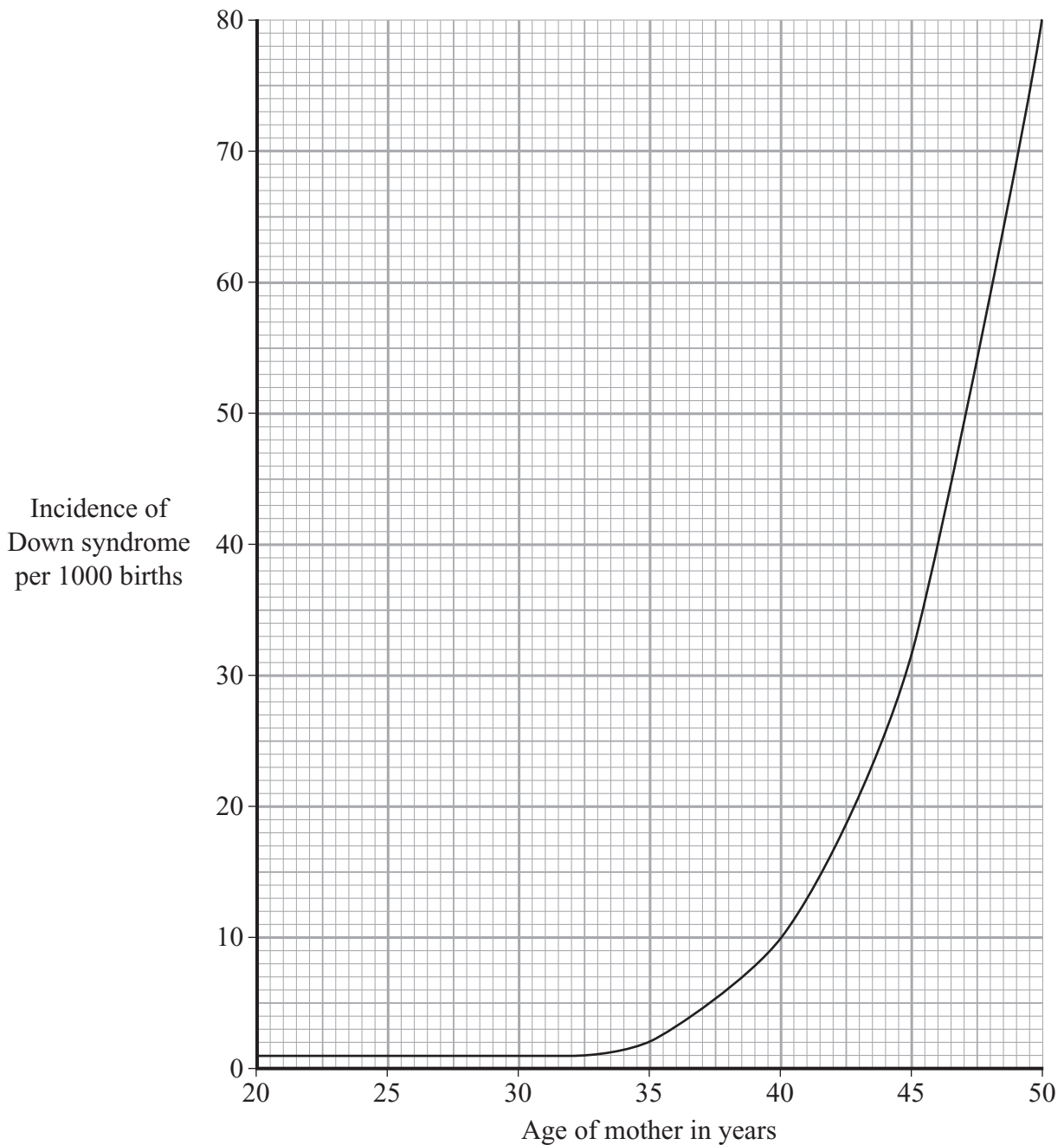
(6 marks)

6

Turn over for the next question

Turn over ►

- 8 The chance of having a Down syndrome baby depends on the age of the mother. This is shown in the graph.



- (a) What is the chance of having a Down syndrome baby for mothers aged:
- (i) 40 years; per 1000 births
(1 mark)
- (ii) 45 years? per 1000 births
(1 mark)

- (b) **Diagram 1** shows some of the chromosomes from one cell of a baby with Down syndrome.
Diagram 2 shows the same chromosomes from one cell of an unaffected baby.

Diagram 1 (Down Syndrome)

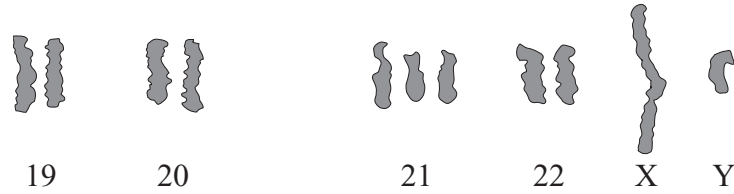


Diagram 2 (Unaffected)



- (i) Describe **one** way in which the chromosomes in the Down syndrome baby are different from those in the unaffected baby.

.....
 (2 marks)

- (ii) What is the sex of these babies? Give evidence from the diagrams for your answer.

.....
 (1 mark)

- (c) What substance, found in a chromosome, controls inherited characteristics?

Draw a ring around **one** answer.

carbohydrate

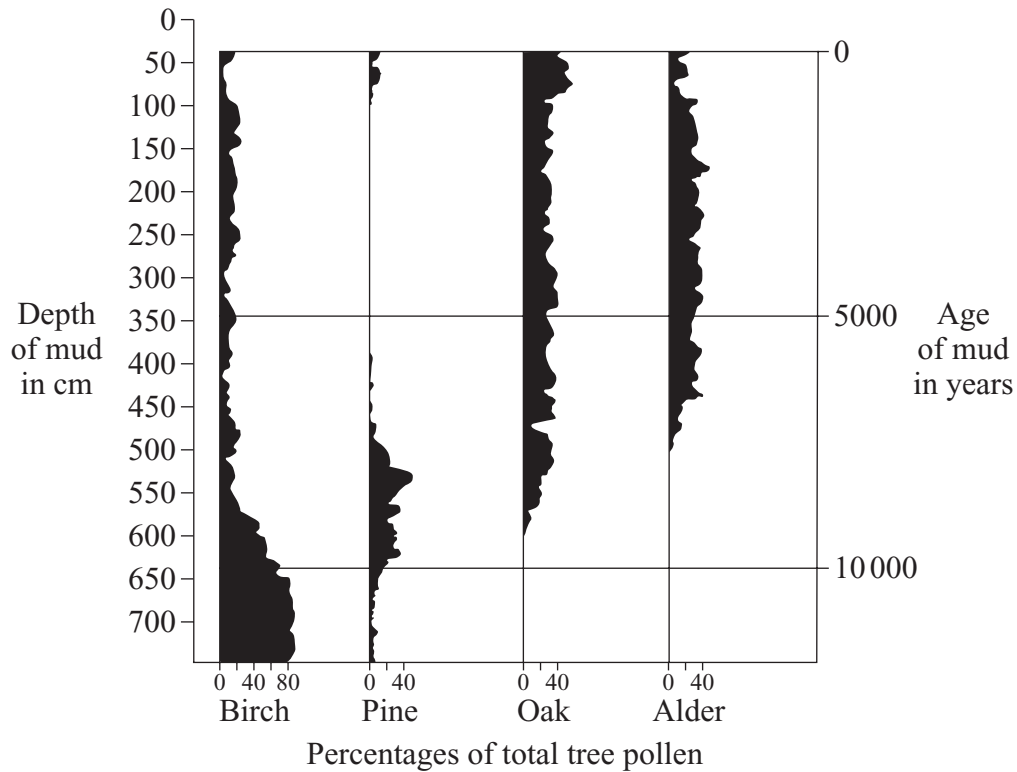
DNA

enzyme

(1 mark)

6

- 9 Pollen grains from trees which grew long ago can be found buried in the mud at the bottom of lakes. The diagram shows the percentages of pollen grains from different tree species which were found at different depths in the mud at the bottom of a lake.



- (a) The pollen from trees which grew a long time ago is found deeper in the mud than pollen from trees which grew more recently.

Explain why.

.....

.....

.....

.....

(2 marks)

(b) In each of parts (i) and (ii), draw a ring around **one** answer.

(i) Which species of tree was most common 10 000 years ago?

birch **pine** **oak** **alder**

(1 mark)

(ii) How many years ago were pine trees the most common?

700 **2 300** **8 200** **11 200**

(1 mark)

(c) Trees like birch and pine require less water to grow than oaks and alders. Use the pollen data to suggest:

(i) what the climate was like 9000 years ago;

.....
.....

(1 mark)

(ii) what the climate was like 5000 years ago.

.....
.....

(1 mark)

6

Turn over for the next question

Turn over ►

10 The table gives some information about the 100 metres and 10 000 metres running races.

	100 metres	10 000 metres
Speed of top athlete in kilometres per hour	37	21.5
Total energy used in kilojoules	200	3000
Energy used per metre in kilojoules		0.3

- (a) (i) In the 10 000 metres race, the athlete used energy at the rate of 0.3 kilojoules per metre.
Use the following formula to calculate the energy used per metre in the 100 metre race.

$$\text{Energy used per metre} = \frac{\text{Total energy used}}{\text{Distance}}$$

Show clearly how you work out your answer.

.....
 kilojoules
 (2 marks)

- (ii) Use information from the table to explain what caused the difference in the amount of energy used per metre for the two races.

.....
 (1 mark)

- (b) At the end of each race, the athlete continues to breathe heavily. This helps the athlete to take in extra oxygen to break down the waste produced in anaerobic respiration.

- (i) What do scientists call this extra oxygen requirement?

Draw a ring around **one** answer.

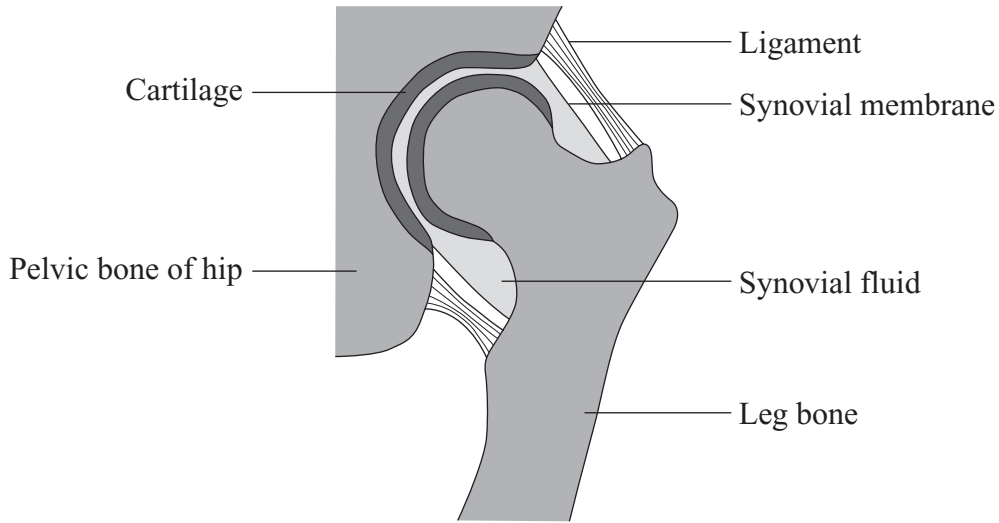
oxygen debt **oxygen deficit** **oxygen shortage**
 (1 mark)

- (ii) What is the waste product of anaerobic respiration in a human?

Draw a ring around **one** answer.

alcohol **glucose** **lactic acid**
 (1 mark)

11 The hip joint is a synovial joint. The diagram shows its structure.



Complete the table using labels from the diagram.

Function	Label
Acts as a shock absorber	
Holds the joint together	
Acts as a lubricant to reduce friction	

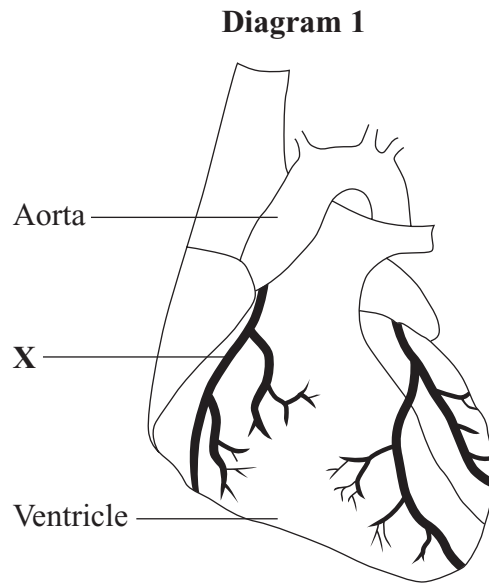
(3 marks)

3

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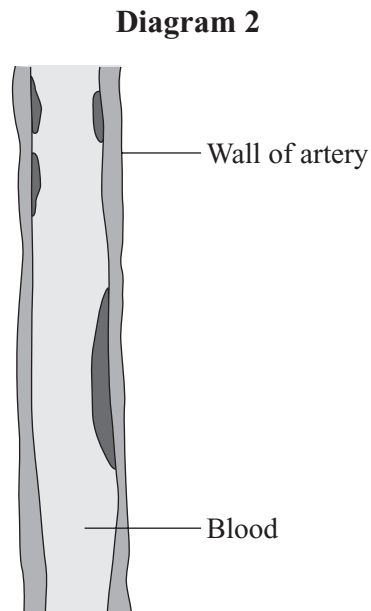
12 **Diagram 1** shows the external structure of the heart.



(a) What is the name of the artery labelled **X**?

.....
(1 mark)

(b) **Diagram 2** shows the internal structure of part of this artery in a person.



(i) Describe **one** way in which the artery in **Diagram 2** is unhealthy.

.....
.....

(1 mark)

(ii) The condition shown in **Diagram 2** is caused by eating the wrong type of food.

What type of food could cause this condition?

.....
.....

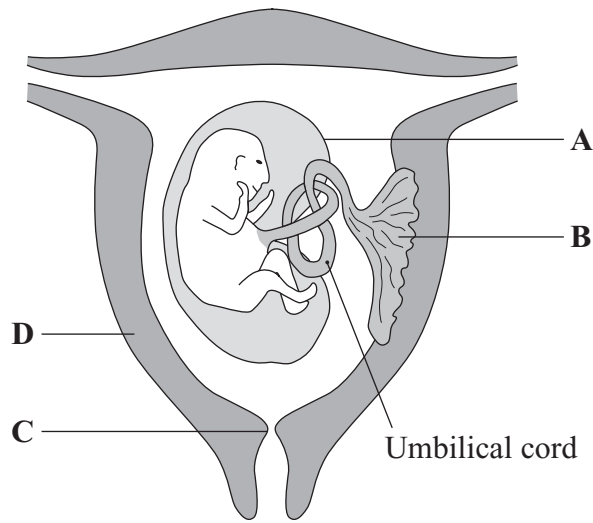
(1 mark)

3

Turn over for the next question

Turn over ►

13 The diagram shows an embryo in a uterus a few weeks after the beginning of development.



(a) (i) What is the name of the membrane labelled **A**?

.....
(1 mark)

(ii) What structures are present in the umbilical cord?

.....
(1 mark)

(iii) The part labelled **B** and the umbilical cord work together to help the embryo to develop. Describe how they do this.

Part **B**.....
.....
Umbilical cord.....
.....
(2 marks)

(b) Development of the baby in the uterus is followed by birth. Describe the actions of the parts labelled **C** and **D** during birth.

C.....
.....
D.....
.....
(2 marks)

14 Complete the sentences by placing **one** word in each space.

Choose the words from those in the box.

cervical	lumbar	movement
sacral	shock	thoracic

The vertebral column is S-shaped so that it can absorb

It has several regions, each of which is adapted for its own particular functions.

The vertebrae in the region are adapted for the attachment of ribs.

The head can be moved easily because the vertebrae of the region are small and loosely attached.

(3 marks)

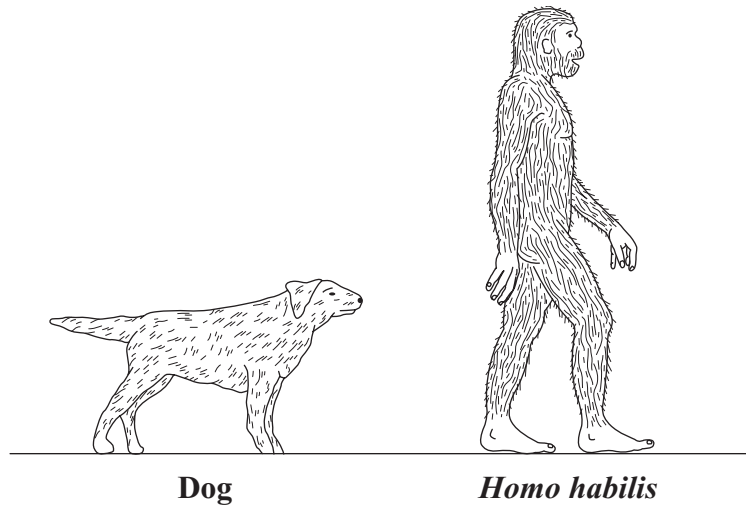
3

Turn over for the next question

Turn over ►

15 (a) The drawing shows **two** mammals.

Homo habilis is an early human.



(i) Describe **one** feature shown in the drawing which shows that they are both mammals.

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

(ii) Describe **one** other feature of mammals which is **not** visible in the drawing.

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

(iii) There is evidence that *Homo habilis* made and used tools.

What feature shown in the drawing suggests this?

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

- (b) About 12 000 years ago *Homo sapiens* started to grow crops such as wheat. As agriculture developed, wheat plants were selected which gave bigger yields of grain. *Homo sapiens* then started to live in larger groups.

Suggest **three** reasons why these developments led to the formation of permanent villages.

.....

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(3 marks)

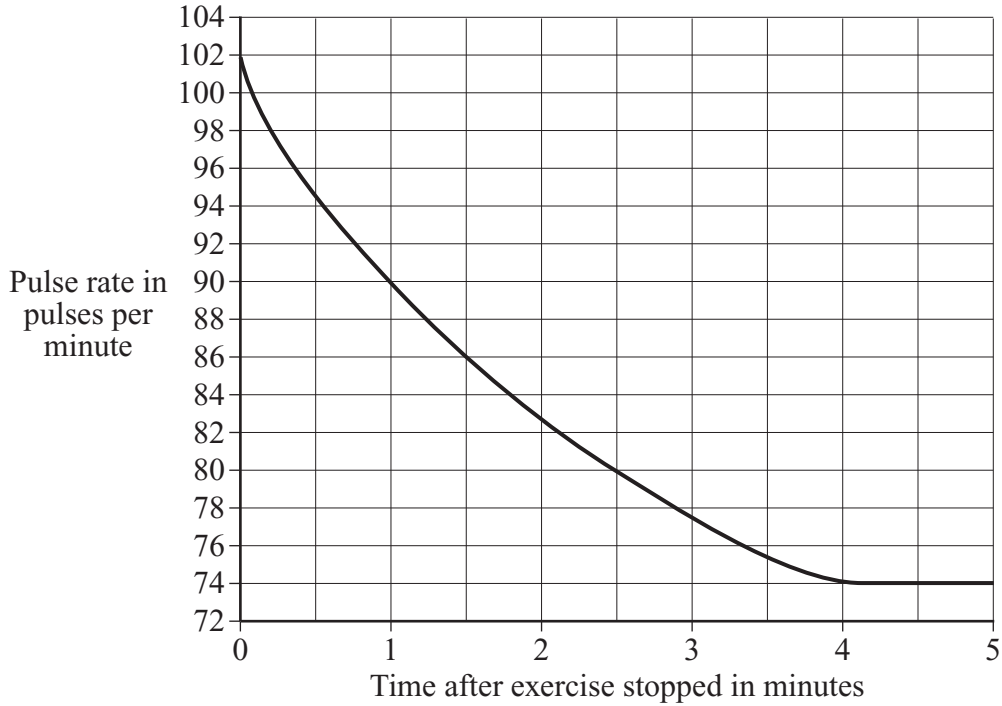
6

Turn over for the next question

Turn over ►

- 16** The pulse rate of a person at rest was 74 pulses each minute. The person then ran for a few minutes. When the exercise stopped the pulse rate was measured for the following five minutes of rest.

The results of these measurements are shown in the graph.



- (a) How long did it take for the pulse rate to return to its normal resting rate?

..... minutes
(1 mark)

- (b) What was the pulse rate $1\frac{1}{2}$ minutes after the exercise finished?

..... pulses per minute
(1 mark)

- (c) How does the contraction of the ventricles of the heart cause the pulse in the arteries?

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

17 A slice of bread contains 300 kilojoules of energy.
A typical teenage girl needs 10 200 kilojoules of energy each day.

- (a) A girl eats only bread and drinks only water for one day.
How many slices of bread must she eat to supply her energy needs for the day?

Show clearly how you work out your final answer.

.....

.....

..... slices of bread
(2 marks)

- (b) Most of the carbohydrate in bread is starch.

- (i) Name **one** part of the digestive system where starch is digested.

.....
(1 mark)

- (ii) Name the enzyme which digests starch.

.....
(1 mark)

- (iii) Name **one** product of starch digestion.

.....
(1 mark)

- (iv) Name **one** part of the digestive system where the products of starch digestion are absorbed into the blood.

.....
(1 mark)

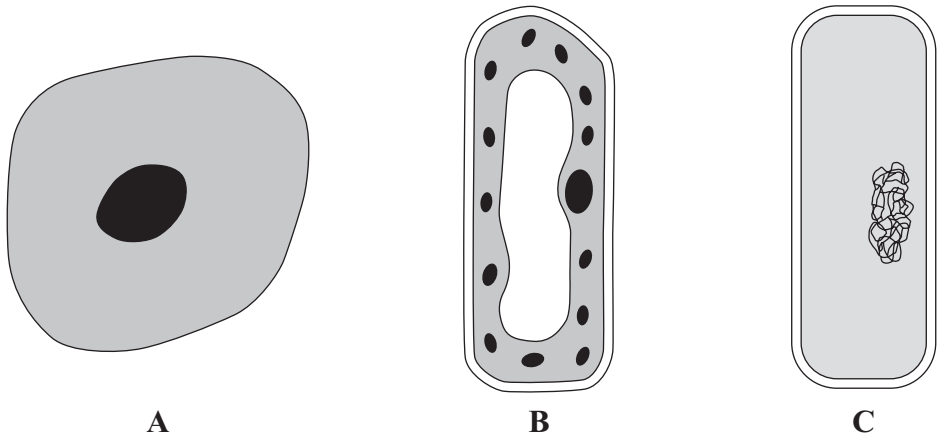
6

Turn over for the next question

Turn over ►

18 Tuberculosis (TB) is a disease caused by a bacterium.

(a) The diagram shows three types of cell.



(not to scale)

(i) Which cell, **A**, **B** or **C**, is a bacterium?
(1 mark)

(ii) Describe **one** feature you can see in the diagram which helps you to identify this cell as a bacterium.
.....
(1 mark)

(b) TB is spread by coughs and sneezes. It is more common when people live together in crowded conditions. TB usually affects the lungs first, although other organs may later become infected.

(i) Why is TB more likely to spread when people live in crowded conditions?
.....
.....
(1 mark)

(ii) Why does TB affect the lungs first?
.....
.....
(1 mark)

(iii) How could TB later spread to other regions of the body?
.....
.....
(1 mark)

- (c) The human body has several natural defences against bacteria. Some of these prevent bacteria from entering the body. Others act once the bacteria have entered.

Give **two** ways in which the body stops bacteria from entering.

1

2

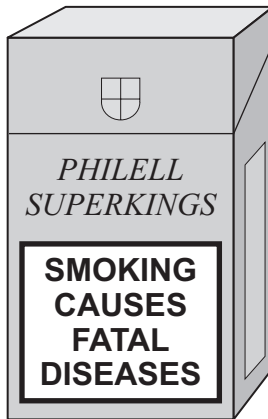
(2 marks)

7

Turn over for the next question

Turn over ►

19 The following warning was printed on a packet of cigarettes.



Explain how cigarette smoking can cause fatal diseases.

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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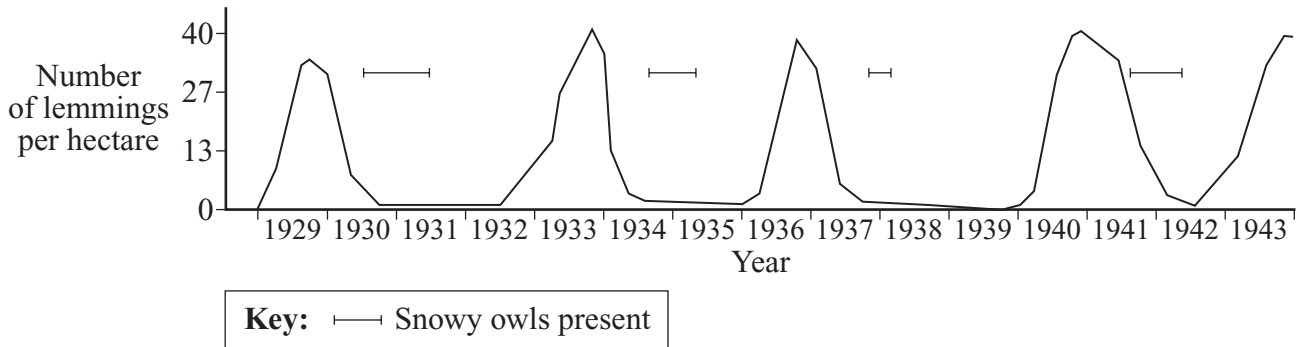
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.....

(5 marks)

5

20 The lemming is a small mammal which eats plants. The snowy owl is a predator. The graph shows changes in the population of lemmings in one area of northern Canada.



(a) What is a *predator*?

.....

 (2 marks)

(b) It is unlikely that the snowy owls caused the decreases in the lemming population. What evidence from the graph supports this?

.....

 (1 mark)

(c) Suggest what environmental conditions might have caused the sudden decreases in the lemming population.

.....

 (3 marks)

- 21 The table shows gas production by a plant at different light intensities and at two different concentrations of carbon dioxide.

Light intensity in arbitrary units	Rate of gas production at 20 °C in cm ³ per hour	
	at 0.03 % carbon dioxide	at 1 % carbon dioxide
0	0.00	0.00
10	0.27	0.30
20	0.44	0.60
30	0.54	0.80
40	0.60	0.89
50	0.60	0.95

- (a) (i) Name the gas which was produced by the plant.

.....
(1 mark)

- (ii) Name the process which produced this gas.

.....
(1 mark)

- (b) The data obtained with 0.03 % carbon dioxide are plotted on the graph on the opposite page.

Draw a graph of the data obtained with 1 % carbon dioxide. Draw this on the same graph paper.

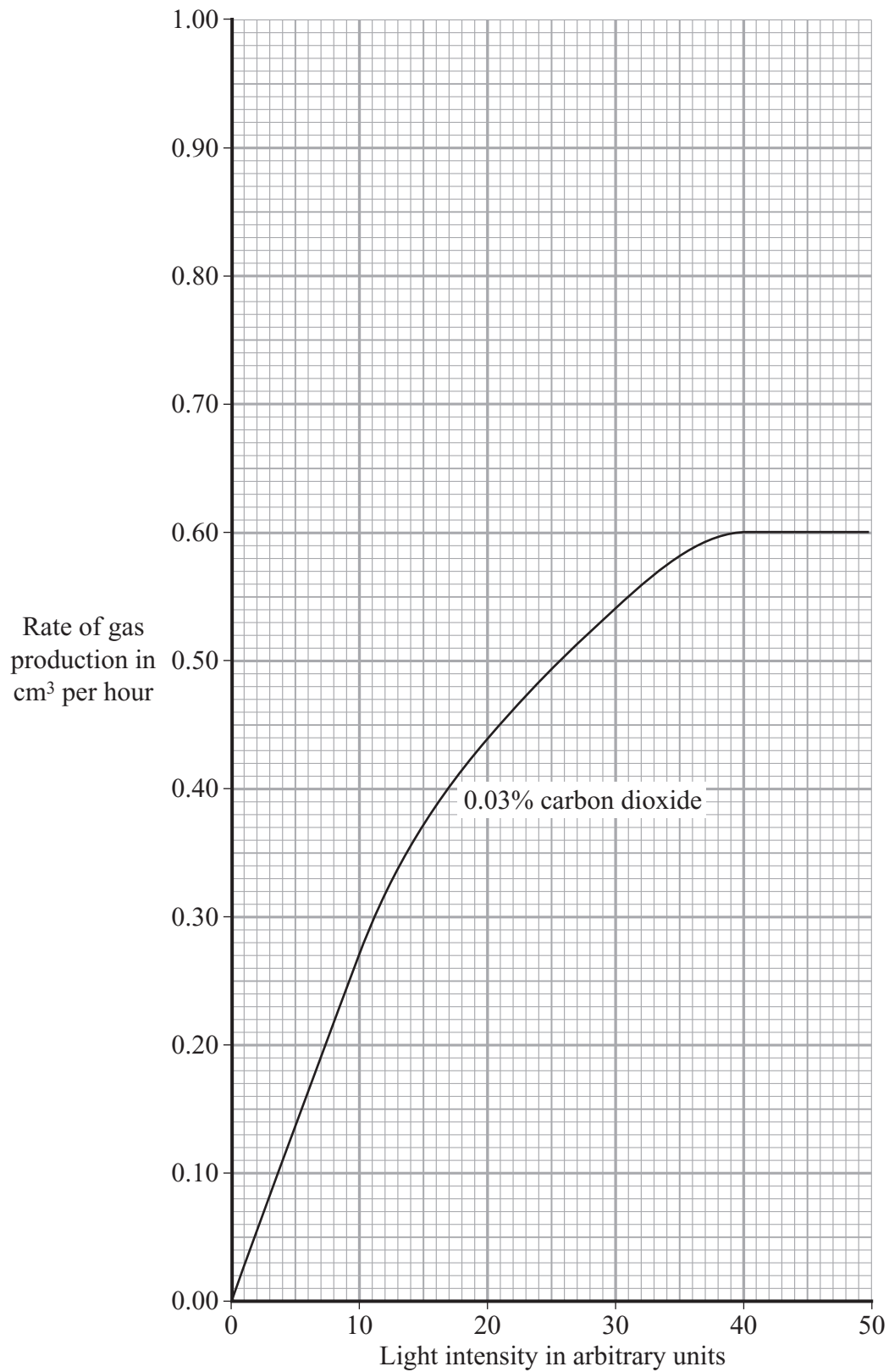
(3 marks)

- (c) Give **two** environmental factors which might have limited the rate of gas production at 50 units of light intensity and 0.03 % carbon dioxide.

1

2

(2 marks)



22 Explain how the burning of fossil fuels can harm the environment.

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)

5

- 23 (a) Scientists use fossilised bones and teeth when studying the origins of humans. Often only a few fossils are found.

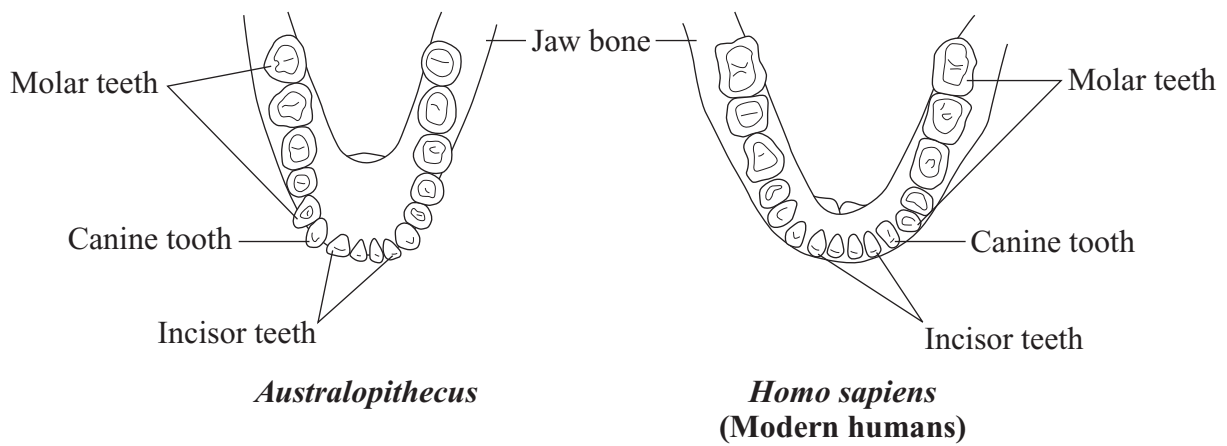
Suggest **one** reason why there are only a few fossils.

.....
.....

(1 mark)

- (b) *Australopithecus* was a small bipedal animal with both ape and human characteristics. Some scientists thought that it was an ancestor of *Homo sapiens*. Others thought that it was not on the direct line of evolution of modern humans.

The diagram shows the lower jaw of *Australopithecus*. The lower jaw of *Homo sapiens* is also shown for comparison.



- (i) Describe **two** features shown in the diagram which suggest that *Australopithecus* was an ancestor of *Homo sapiens*.

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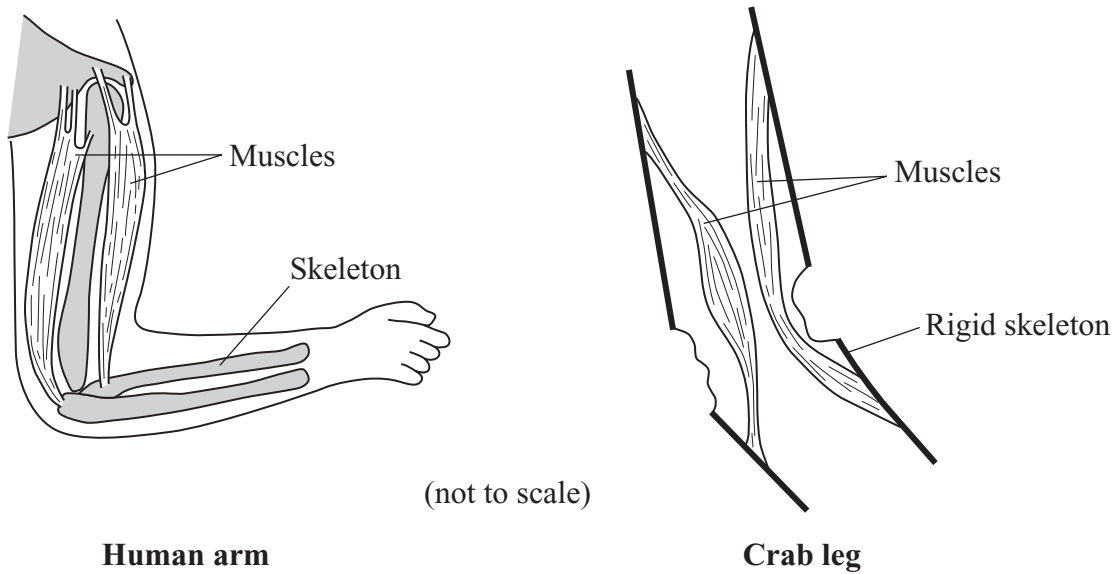
(2 marks)

- (ii) Describe **one** feature shown in the diagram which suggests that *Australopithecus* was **not** an ancestor of *Homo sapiens*.

.....
.....

(1 mark)

24 (a) The diagram shows the skeleton and muscles of a human arm and part of a crab leg.



(i) The human arm and the crab leg both have joints.

Describe **one** other way in which the structure of the human arm and the crab leg is similar.

.....
.....

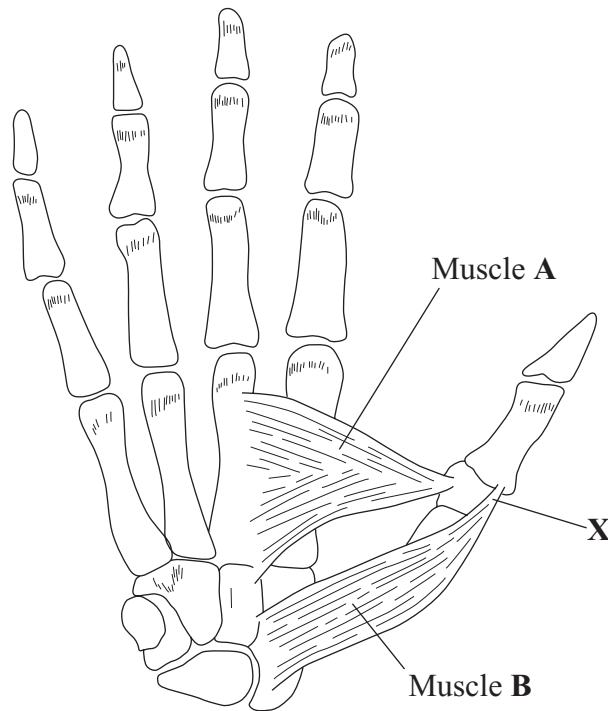
(1 mark)

(ii) Describe **one** way in which the structure of the human arm is different from the crab leg.

.....
.....

(1 mark)

(b) The diagram shows the skeleton of a hand with two muscles which can move the thumb.



(i) The thumb can be moved either towards **or** away from the fingers.

Describe how these muscles can cause these **two** different actions.

.....

.....

.....

.....

(2 marks)

(ii) If the structure labelled **X** is accidentally torn, movement of the thumb is difficult.

Suggest the reason for this.

.....

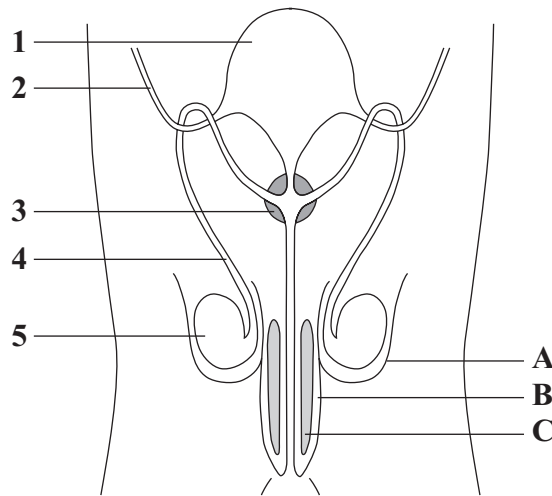
.....

(1 mark)

5

Turn over ►

25 The diagram shows the structure of the male reproductive system and part of the urinary system from the front.



(a) The table shows the functions of two of the parts numbered 1–5 in the diagram. Write the number of each of these parts in the second column.

Part	Number
Contains smooth muscle to move sperm	
Adds a liquid secretion to sperm before they are released	

(2 marks)

(b) During intercourse live sperm are released near the cervix.

Describe, in the correct order, the parts played by the structures labelled **A**, **B** and **C** to enable this to happen.

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.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

26 Four students thought that smokers would have higher heart rates than non-smokers. They each measured the pulse rate of one adult. The table shows the results as recorded by the students.

Person	Pulse rate	Heart rate in beats per minute
A (non-smoker)	78 beats in one minute	78
B (non-smoker)	36 beats in 30 seconds	72
C (smoker)	160 beats in 120 seconds	
D (smoker)	12 beats in 10 seconds	

(a) Enter the heart rates for persons C and D. (1 mark)

(b) Suggest **one** reason why the students could not come to a firm conclusion about the effects of smoking on the rate of heartbeat.

.....
.....

(1 mark)

(c) Person B had a stroke volume of 70 cm³. What was the cardiac output (cm³ per minute) of this person? Show your working.

.....
.....

..... cm³ per minute
(2 marks)

(d) During exercise the cardiac output increases. What is the advantage of this increase for the contracting muscles?

.....
.....

(1 mark)

(e) Regular athletic training can strengthen the heart muscles. This causes an increase in the stroke volume. Suggest **one** reason to explain why this change can help a person running a race.

.....
.....

(1 mark)

There are no questions printed on this page

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Question 23 Source: adapted from TOMKINS, *The Origins of Mankind*, Cambridge University Press, 1984

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