

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2005



**BIOLOGY (SPECIFICATION B)
HIGHER TIER**

3411/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		10	
2		11	
3		12	
4		13	
5		14	
6		15	
7		16	
8		17	
9		18	
		19	
		20	
		21	
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 2 hours 15 minutes

Instructions

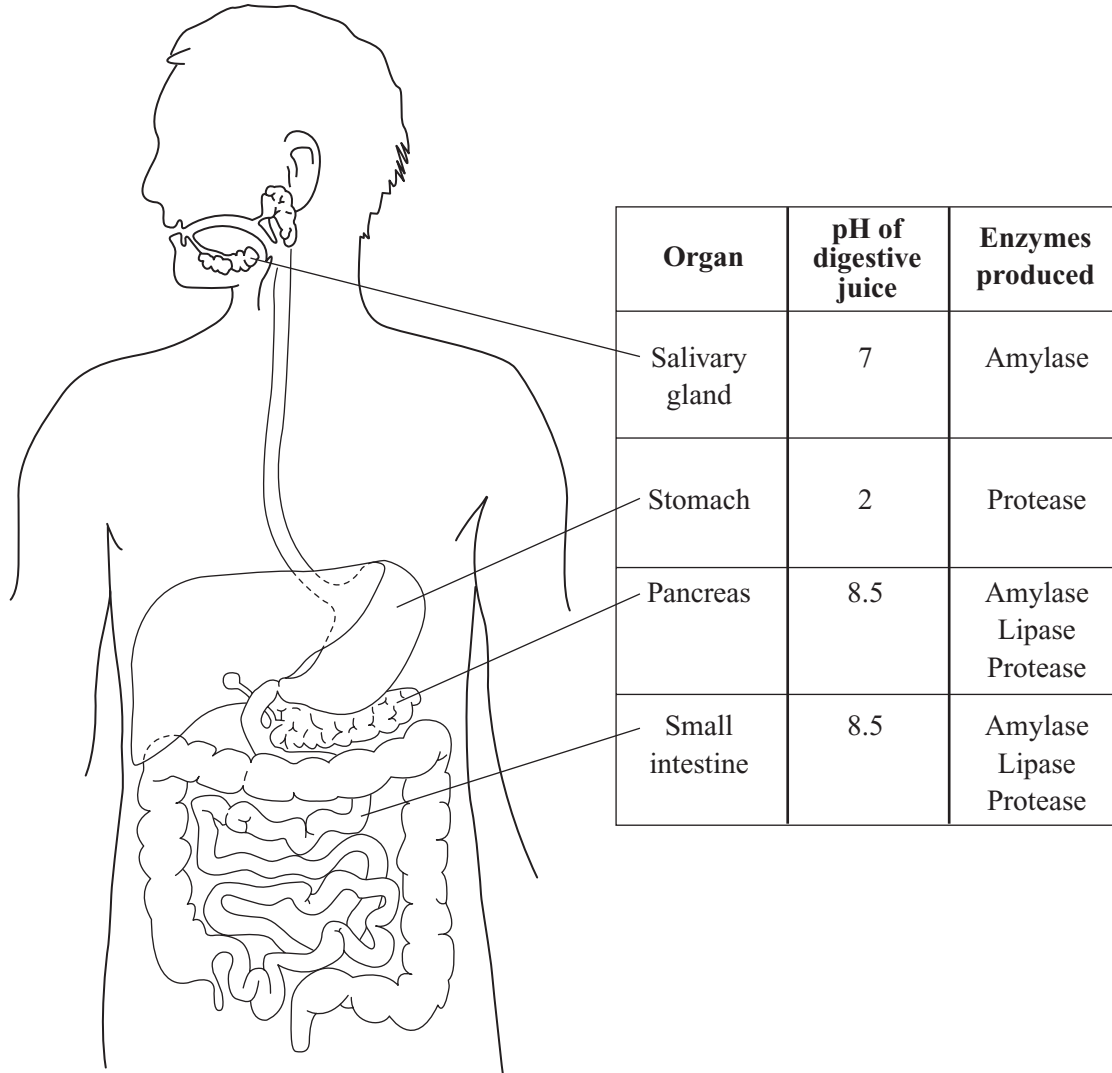
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

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

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2

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(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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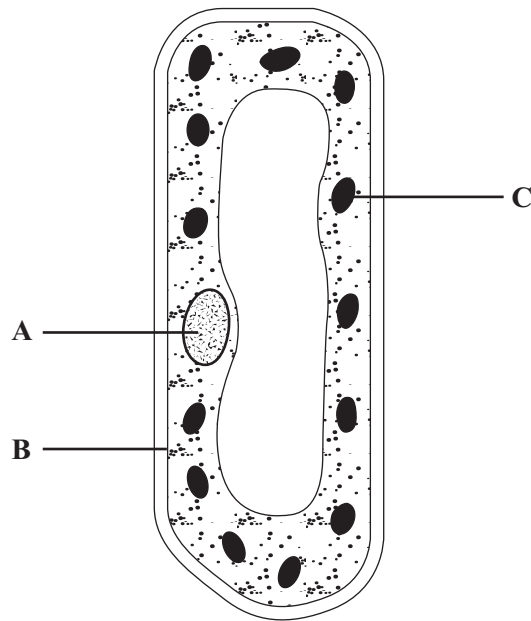
(3 marks)

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.

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(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.

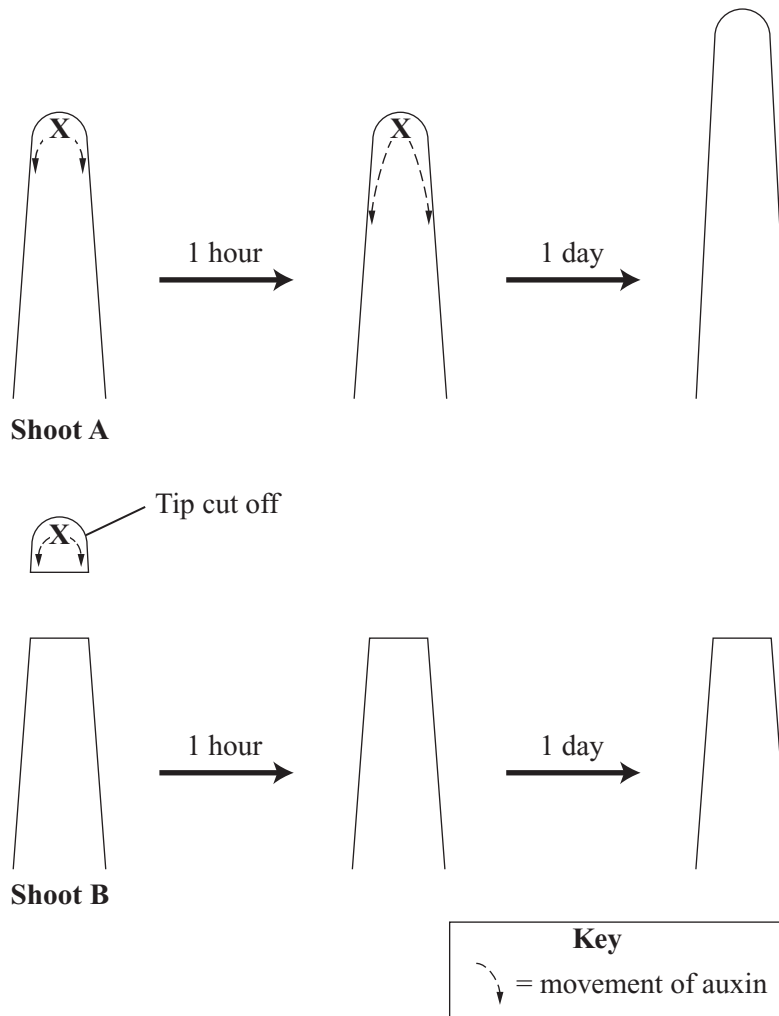


Figure 1

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

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(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.

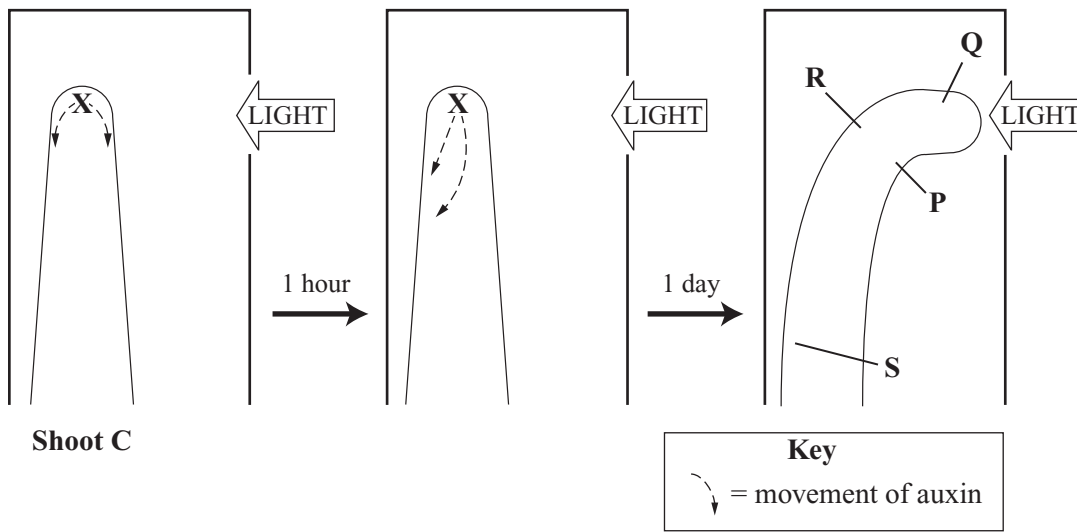


Figure 2

- (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

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(2 marks)

5 (a) Fossils provide evidence for evolution.

(i) What is a fossil?

.....
(1 mark)

(ii) How do fossils provide evidence for evolution?

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(2 marks)

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

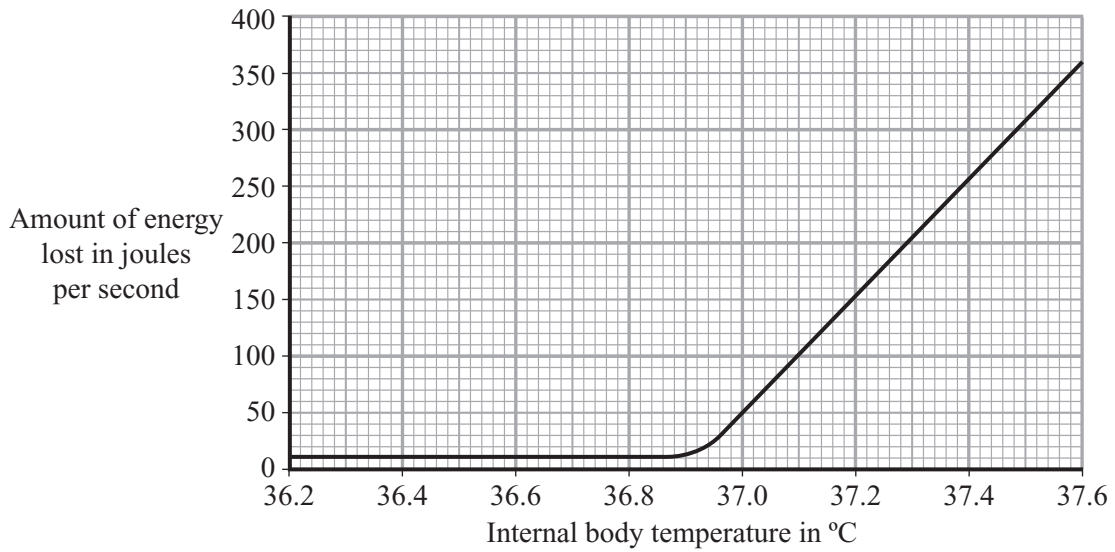
Explain how the overuse of antibiotics has led to the evolution of antibiotic-resistant bacteria.

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.

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(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 Yoghurt can be made by adding bacteria to warm milk. Sometimes cheese is made when bacteria are added to warm milk.

(a) (i) Suggest why the milk should be warm when the bacteria are added.

.....
(1 mark)

(ii) Yoghurt can be made in school. Suggest a safe temperature for this to be done. Choose from the list. Put a ring around your answer.

0°C 25°C 37°C 50°C 100°C
(1 mark)

(b) In yoghurt manufacture it is important that oxygen should be kept out of the mixture.

(i) Explain why it is important that the mixture should **not** contain oxygen.

.....
(1 mark)

(ii) Explain how bacteria cause milk to clot to form yoghurt.

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

(c) In the manufacture of cheese, the bacteria produce curds and whey from the milk.

(i) Describe how the appearance of curds is different from that of whey.

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

(ii) Suggest how curds could be separated from the whey.

.....
(1 mark)

(iii) How are the curds changed into cheese?

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

8 Read the passage.

MMR is a triple vaccine used to protect against three viral diseases. Weakened strains of the three viruses are injected together. The weakened strains cause the body to become immune to the diseases. The vaccine is usually given to children between one and two years old.

Some people believe that the vaccine can trigger a response called autism in children. Autism damages the mental and social development of the child. The vaccine can also lead to problems in the large intestine.

- (a) What are the **three** diseases that the MMR vaccine protects against?

..... (1 mark)

- (b) Use the information in the passage and your own knowledge to evaluate whether a parent should or should not have their child vaccinated.

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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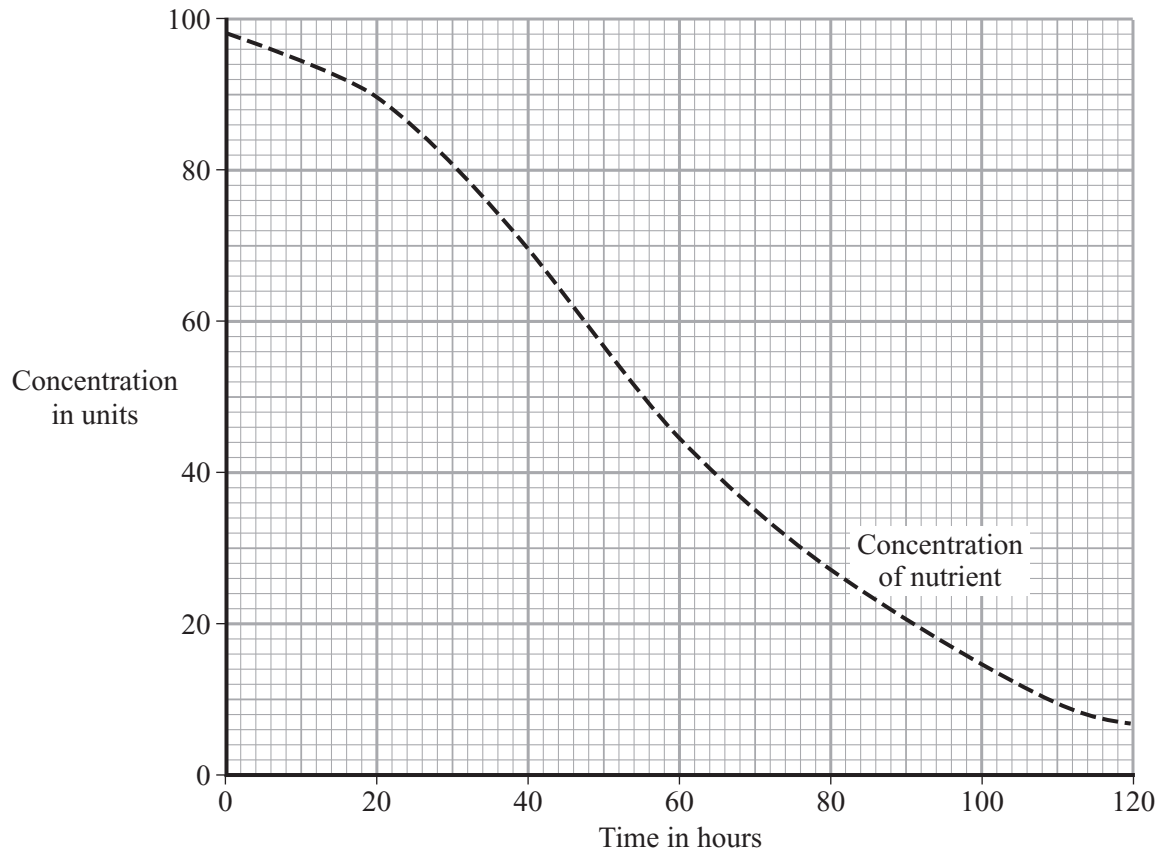
(5 marks)

6

Turn over ▶

- 9 Antibiotics are useful drugs. The antibiotic, amoxycillin, can be manufactured by growing a mould in a nutrient solution in a fermenter.

The graph shows how the concentration of the nutrient changes over time, in a fermenter.



- (a) The table shows how the concentration of amoxycillin changes in the fermenter.

Time, in hours	0	20	40	60	80	100	120
Concentration of amoxycillin, in units	0	1	57	86	93	98	99

On the grid above, draw the graph for amoxycillin production.

(2 marks)

- (b) Explain why the nutrient concentration in the fermenter changes over time.

.....

.....

(1 mark)

(c) Describe the relationship between the concentration of nutrient and the concentration of amoxycillin.

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

(2 marks)

(d) Why do doctors give their patients antibiotics?

.....
.....

(1 mark)

$\frac{\quad}{6}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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

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(1 mark)

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

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.....
(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.

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(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.

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(3 marks)

11 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.

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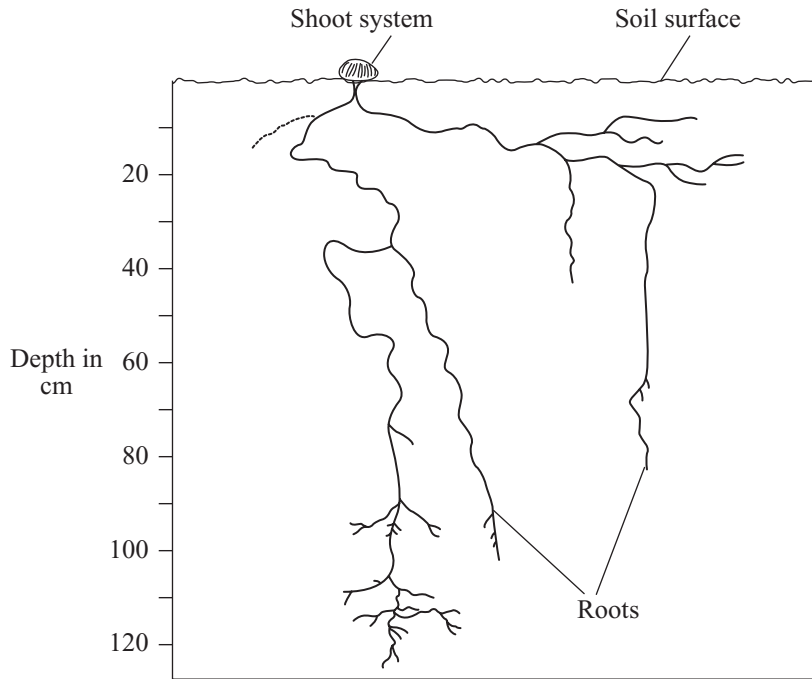
(3 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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



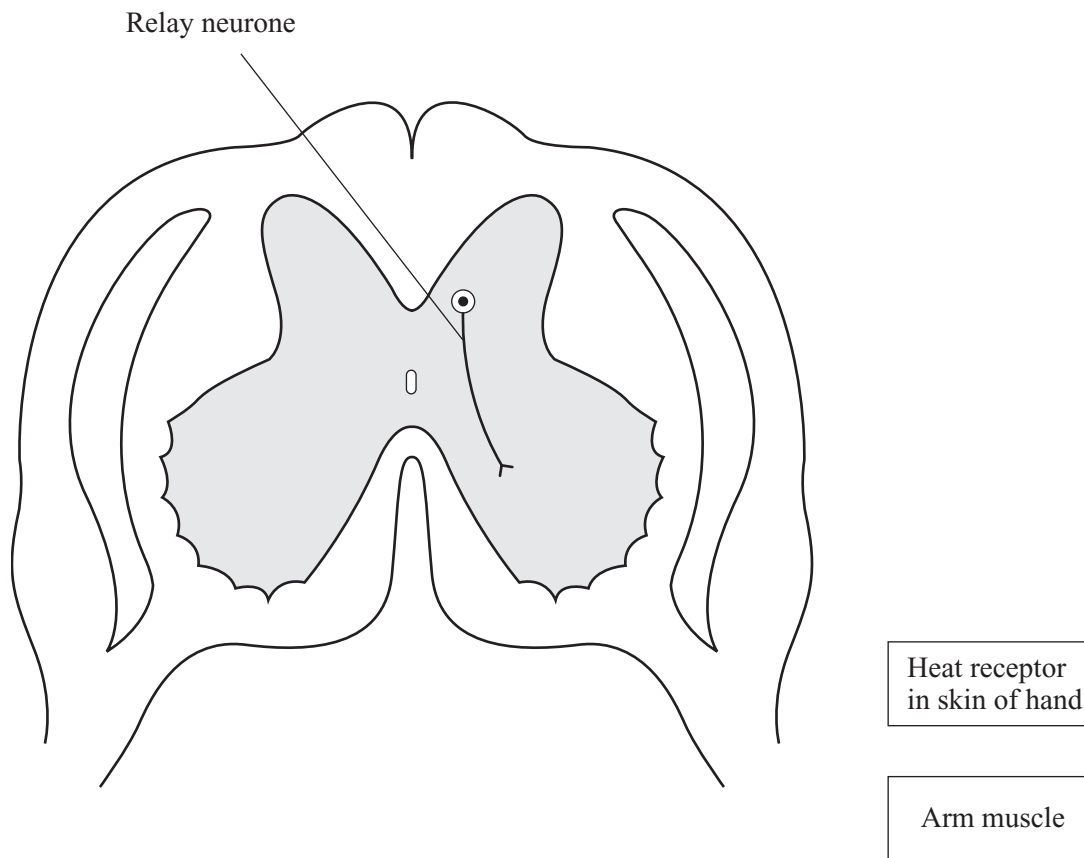
Describe and explain **three** adaptations of *Fredolia*, which you can see in the diagram, that help it to survive in dry conditions.

- 1
- 2
- 3

(3 marks)

3

13 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.

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(2 marks)

4

Turn over ►

14 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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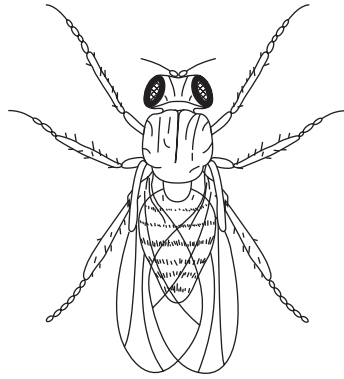
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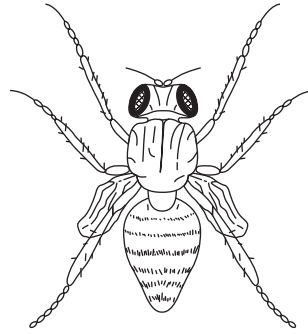
(3 marks)

3

15 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?

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(1 mark)

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

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(1 mark)

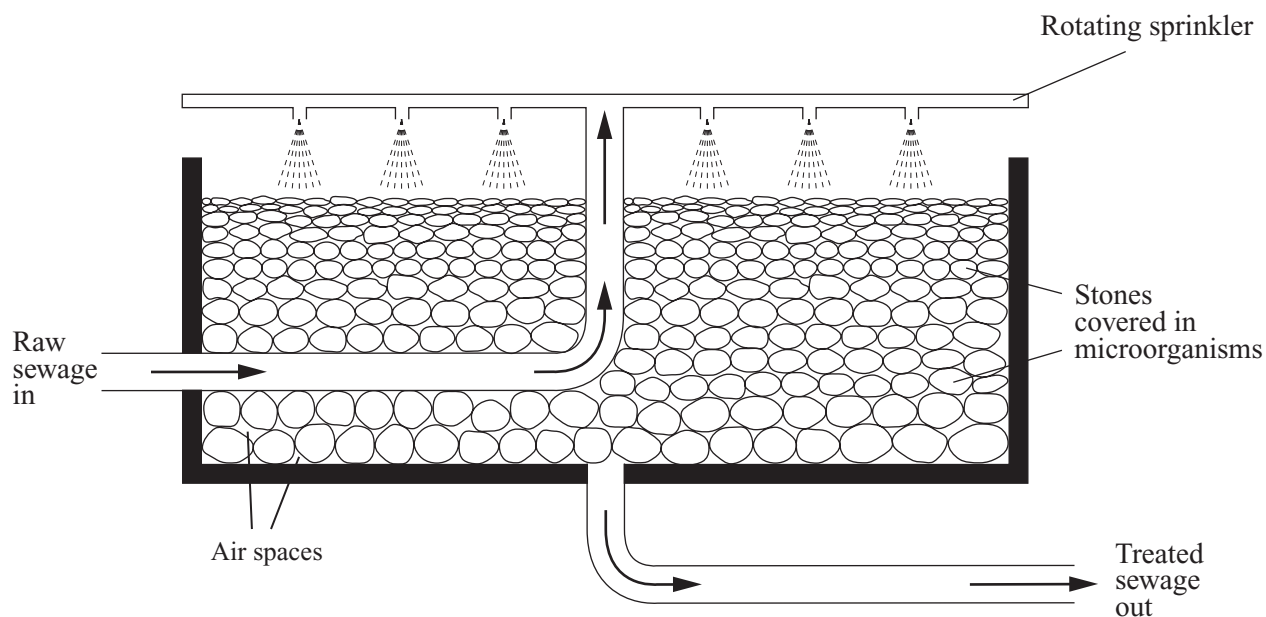
- (b) A male and a female long-winged fly were crossed. They produced 96 offspring. 72 of the offspring had long wings and 24 had vestigial wings. Use a genetic diagram to explain this.

(4 marks)

6

Turn over ►

16 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

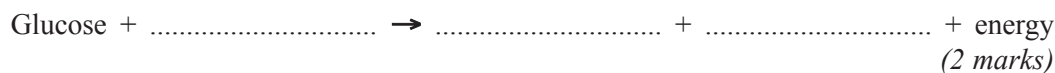
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2

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(2 marks)

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



- (b) The stones on top of the sprinkler bed are green due to the growth of algae. Stones found 0.5 metres below the surface do not have algae growing on them.

Explain why.

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(2 marks)

- (c) Sometimes raw sewage enters a river without passing through a sewage works.

Explain how this will affect organisms that live in the river.

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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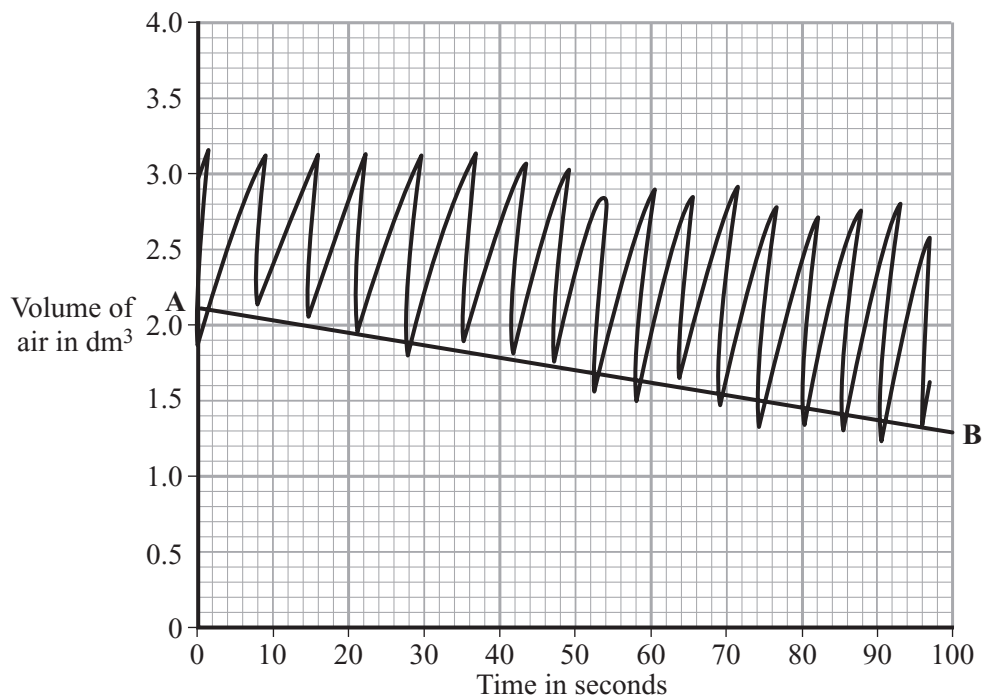
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(4 marks)

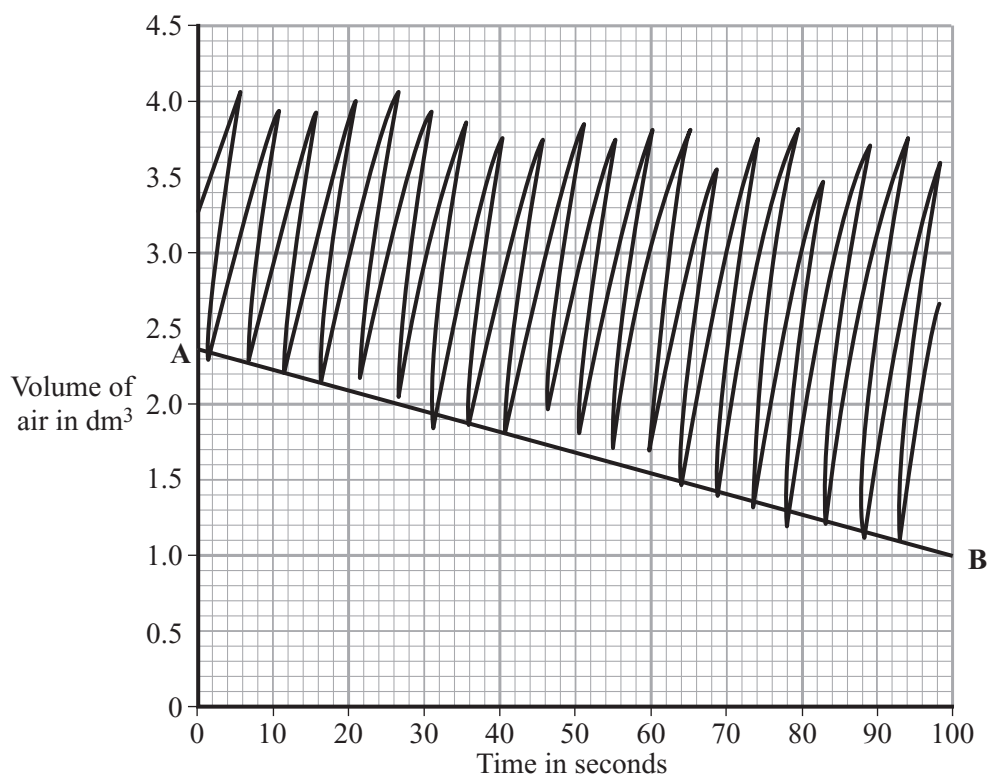
10

Turn over ►

- 17 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.

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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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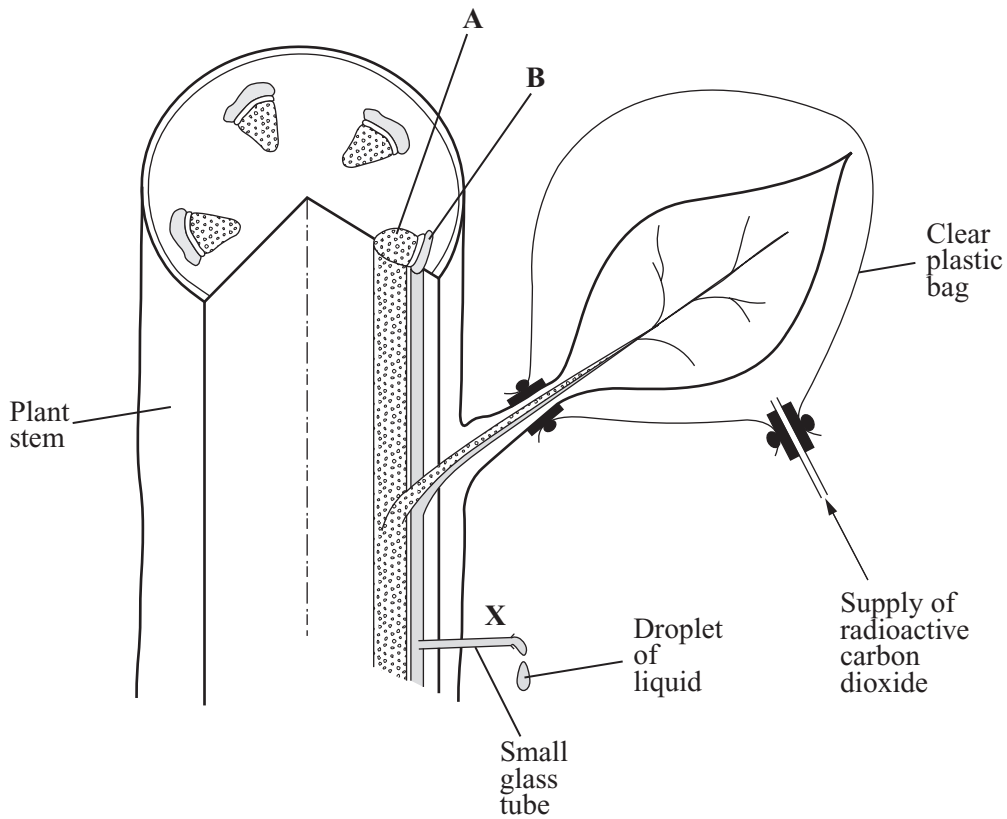
(4 marks)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 18 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.

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(3 marks)

19 Regular exercise is important, as it helps to maintain an efficient supply of blood to the muscles, the heart and the lungs. This is helped by an increase in the heart rate during exercise.

(a) Explain why it is necessary for the heart rate to increase during exercise.

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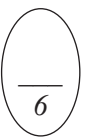
(4 marks)

(b) Some people exercise by road running.

Explain how cartilage in the joints helps to absorb the shock of running on hard roads.

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(2 marks)

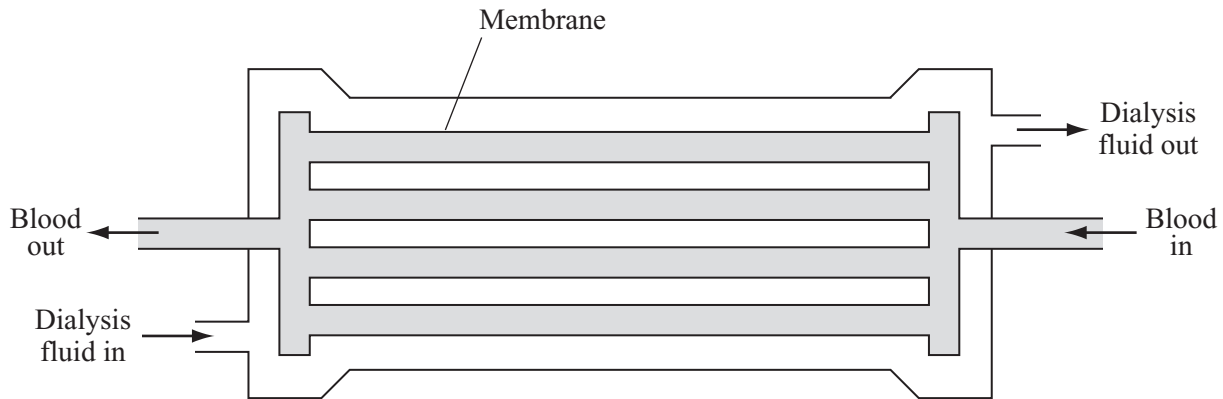


TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 20 A woman suffers a minor infection that affects her kidneys. She is sent to hospital for treatment with a dialysis machine.

A simplified diagram of a dialysis machine is shown below.



- (a) Explain why the membrane is important in the dialysis machine.

.....

.....

(2 marks)

- (b) Some of the components of the woman's blood and of the dialysis fluid entering the machine are shown in the table.

Component	Woman's blood entering machine	Dialysis fluid entering machine
Blood cells	✓	×
Glucose	✓	✓
Urea	✓	×

Key: ✓ = present × = absent

Use the information in the table to explain the composition of the dialysis fluid entering the machine.

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(4 marks)

(c) One alternative to treatment with a dialysis machine is to have a kidney transplant.

Suggest why a kidney transplant might **not** be suitable in this woman's case.

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(2 marks)

(d) Before dialysis treatment begins, the dialysis machine must be filled with blood. The woman has blood group **O**.

(i) What features of her blood make it group **O**?

.....

.....

(2 marks)

(ii) Why must the blood in the dialysis machine, before her treatment begins, also be blood group **O**?

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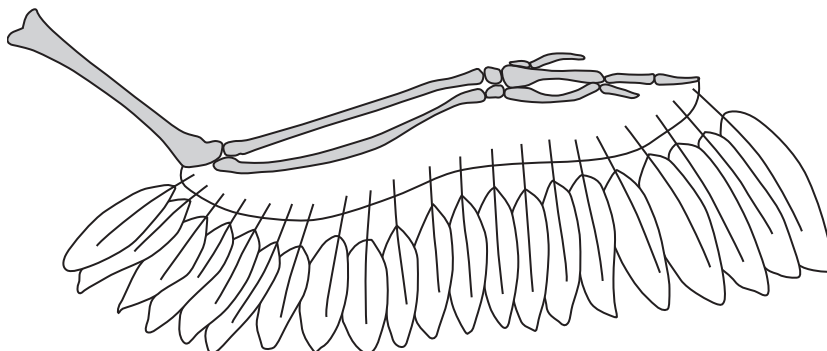
(1 mark)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

21 The diagram shows the arrangement of bones and flight feathers in a bird's wing.



- (a) The arrangement of bones in a bird's wing is similar to the arrangement in mammalian limbs.

How does the arrangement of bones in a bird's wing compare with the arrangement in the human arm?

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(2 marks)

- (b) (i) Describe the function of flight feathers.

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(2 marks)

- (ii) Describe how the flight feathers help the bird to fly during both the upstroke and the downstroke of the wing.

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(3 marks)

END OF QUESTIONS