OCR
Oxford Cambridge and RSA

F

Wednesday 18 November 2020 – Morning

GCSE (9–1) Biology A (Gateway Science)

J247/02 Paper 2 (Foundation Tier)

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **36** pages.

ADVICE
- Read each question carefully before you start your answer.

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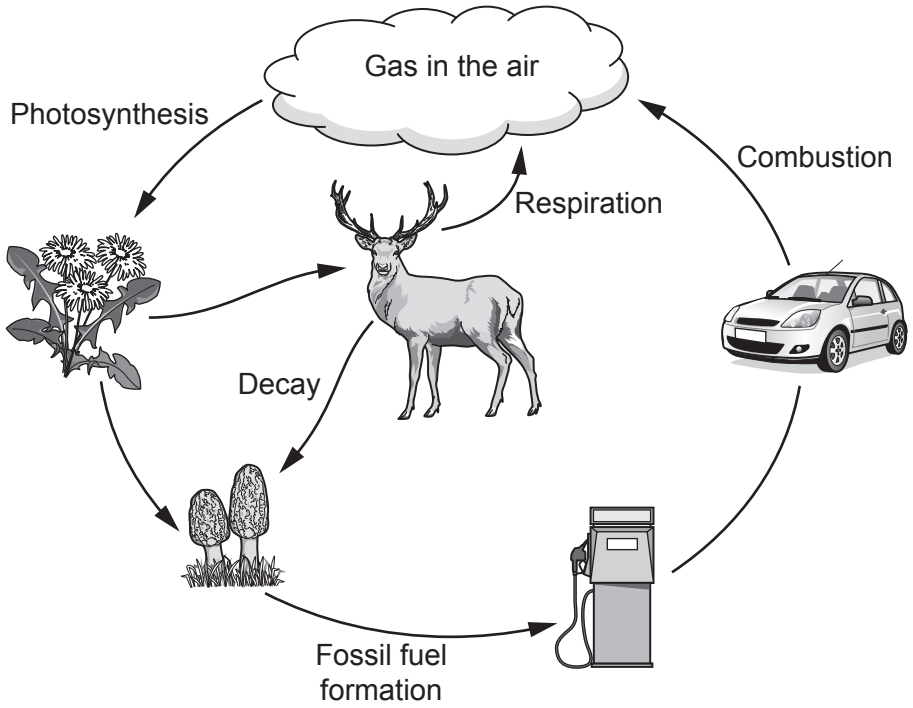
SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

Write your answers to each question in the box provided.

1 The diagram shows part of a cycle in an ecosystem.



What is the name of the cycle shown in the diagram?

A Carbon cycle

B Hydrogen cycle

C Nitrogen cycle

D Sulfur cycle

Your answer ☐ **[1]**

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2 Goldfish are a species of fish.

What name is given to all the goldfish living in a pond?

A A community

B An ecosystem

C A habitat

D A population

Your answer ☐ **[1]**

3 The table shows features of **meiosis**.

	Type of cells made	**Genetic variation introduced**
A	body cells	✓
B	body cells	✗
C	gametes	✓
D	gametes	✗

Which row in the table is correct?

Your answer ☐ **[1]**

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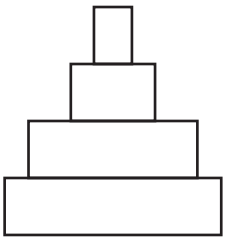
4 This is a food chain for organisms in a forest.

Oak tree ⟶ Greenfly ⟶ Ladybird ⟶ Blackbird

Which is the correct shape for a pyramid of **biomass** for this food chain?

A



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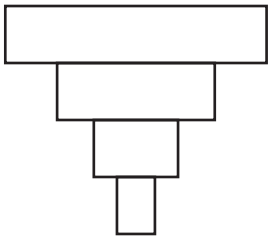
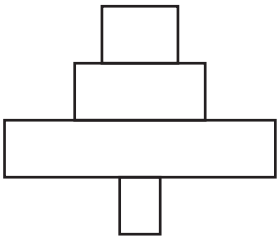
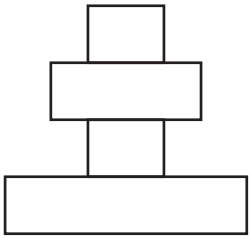


C



D



Your answer ☐ **[1]**

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5 Seedbanks store many types of seed for long periods of time.

Why were seedbanks set up?

A To act as a store of biodiversity.

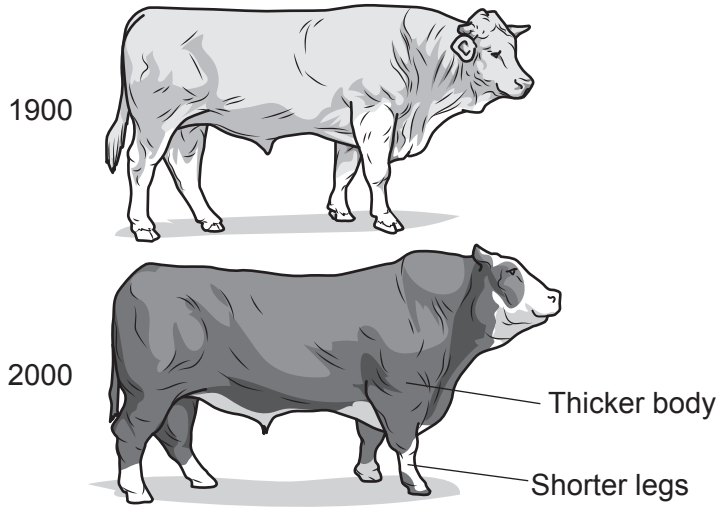
B To be used to feed animals if food is short.

C To store pathogens for future use.

D To supply seeds to farmers at a cheaper cost.

Your answer ☐ **[1]**

6 The drawings show typical cattle kept by farmers in 1900 and in 2000.



Which process would have been used between 1900 and 2000 to produce these changes in the cattle?

A Artificial classification

B Biological control

C Natural selection

D Selective breeding

Your answer ☐ **[1]**

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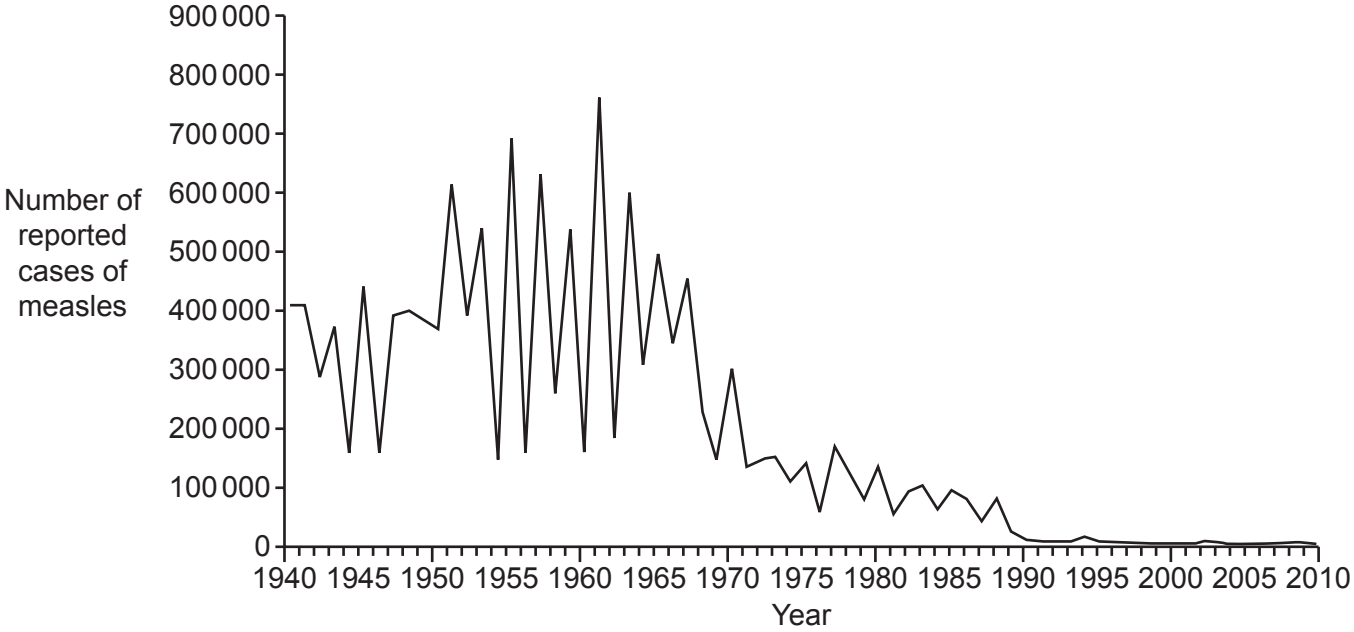
7 The graph shows the number of reported cases of measles in England and Wales between 1940 and 2010.



In which year was the measles vaccine likely to have been introduced?

A 1940

B 1952

C 1968

D 1982

Your answer ☐ **[1]**

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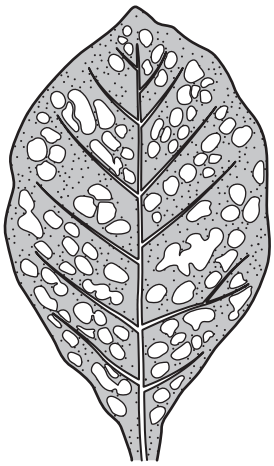
8 The drawing shows a leaf from a tobacco plant that has tobacco mosaic disease.



What type of pathogen causes tobacco mosaic disease in plants?

A Bacterium

B Fungus

C Protist

D Virus

Your answer ☐ **[1]**

9 Scientists found DNA from a Stone Age woman trapped in gum from a tree. The woman had chewed the tree gum. Using this DNA scientists were able to predict some of her features.

Which feature would scientists have been able to predict from her DNA alone?

A Body weight

B Diet

C Eye colour

D Height

Your answer ☐ **[1]**

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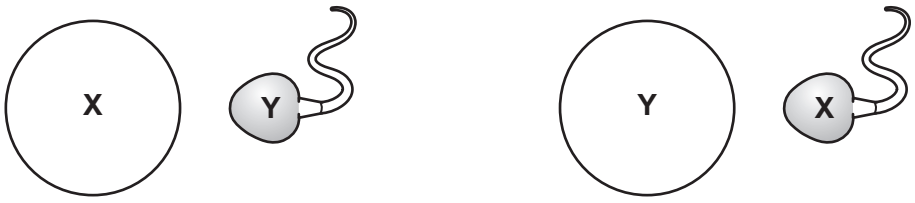
10 The diagrams show gametes and sex chromosomes.

Which diagram shows the correct combination of sperm and egg to produce a **male** baby?



A **B**

C **D**

Your answer ☐ **[1]**

11 Gregor Mendel studied the inheritance of characteristics in pea plants.

Which of these is a possible reason why he chose pea plants for his experiments?

A Pea plants can produce many offspring, quite quickly.

B Pea plants can reproduce asexually.

C Pea plants do not develop mutations.

D Pea plants do not produce gametes.

Your answer ☐ **[1]**

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12 Tigers have a diploid number of 38 chromosomes.

How many chromosomes are present in a tiger sperm cell?

A 2

B 19

C 38

D 72

Your answer ☐ **[1]**

13 What is meant by the term **natural classification**?

A Classifying organisms according to their uses.

B Classifying organisms using many of their common characteristics.

C Using a key to classify organisms.

D Using a single feature to classify organisms.

Your answer ☐ **[1]**

14 Which of these is an **advantage** of using hydroponics for crop production?

A Fertilisers are not required for crop growth.

B The crops can be grown in areas where the soil is poor.

C The crop plants do not need extra support.

D The crops will not be eaten by pests.

Your answer ☐ **[1]**

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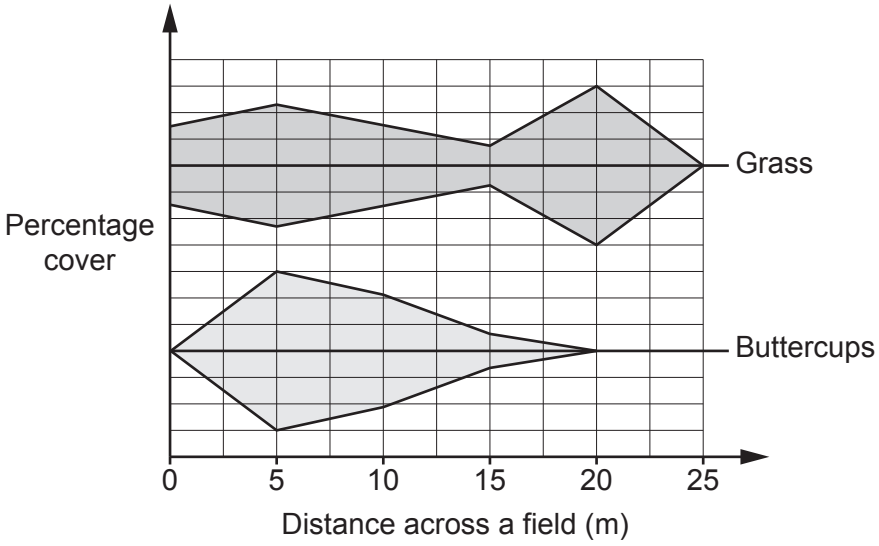
15 A group of students collected some measurements from a field.
They plotted the measurements on this graph.



Which technique have the students used to collect the data?

A Capture-recapture

B Random quadrats

C Scaling up

D Transect line with quadrats

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

16 **Fig. 16.1** shows a plant that grows in South America called stevia.

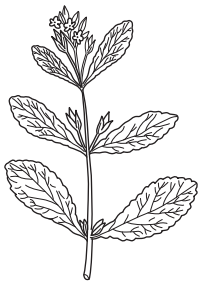

Fig. 16.1

(a) **Fig. 16.2** shows a food web containing stevia.

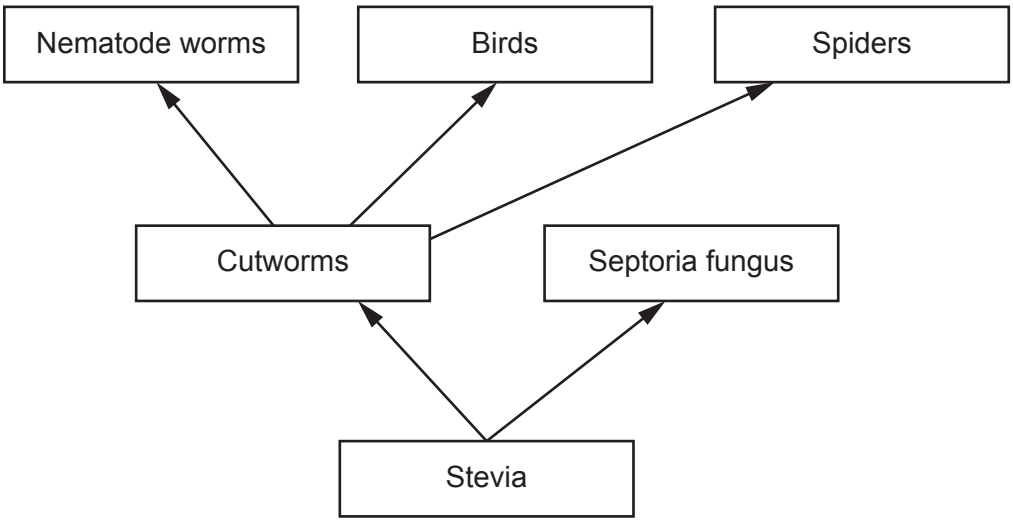

Fig. 16.2

(i) Write down the number of trophic levels in this food web.

..... **[1]**

(ii) What is the source of energy for this food web?

..... **[1]**

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(iii) Septoria fungus is a parasite of stevia.

Explain what is meant by the term **parasite**.

.....

.....

..... **[2]**

(b) The leaves of stevia taste very sweet. People are now trying to grow stevia as a crop.

Stevia farmers often add nematode worms to their fields.

Explain why farmers do this.

Use **Fig. 16.2** in your answer.

.....

.....

.....

.....

..... **[3]**

(c) A chemical in the stevia leaves makes them taste sweet. This chemical is **not** a sugar. People with diabetes need to know if the food they eat contains sugar.

(i) Describe how you could test some stevia leaves to prove that they do **not** contain sugar.

Reagent used .....

Method .....

.....

Expected result .....

..... **[3]**

(ii) Will using stevia in foods help people with type 2 diabetes?

Explain your answer.

.....

.....

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..... **[2]**

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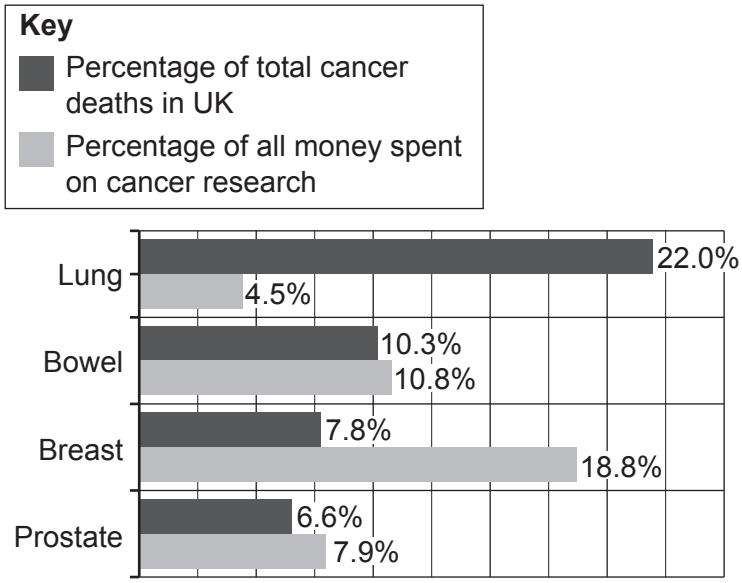
17 The graph shows information about the four most common types of cancer in the UK.



(a) Which type of cancer has the **largest** difference between the percentage of total deaths and the percentage of money spent on research?

Tick (✓) **one** box.

Lung ☐

Bowel ☐

Breast ☐

Prostate ☐ **[1]**

(b) Treatment for cancer often involves powerful medicines that stop cells dividing all over the body.

Write down the name of the type of cell division that occurs when body cells divide.

..... **[1]**

(c) Many types of cancer have been linked to certain genes.

Scientists are trying to find ways to change the genes in embryos to reduce the risks of cancer.

(i) What name is given to the process scientists use to change the genes of an organism?

..... **[1]**

(ii) Write down **one** reason why some people disagree with the process given in **(c)(i)**.

.....

..... **[1]**

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18 **Fig. 18.1** shows a drawing of a very small insect that feeds on the leaves of pine trees.

Fig. 18.1

Scientists can estimate the number of insects on a tree using capture-recapture.

First, they collect some insects from the tree.

Fig. 18.2 shows the equipment they use.

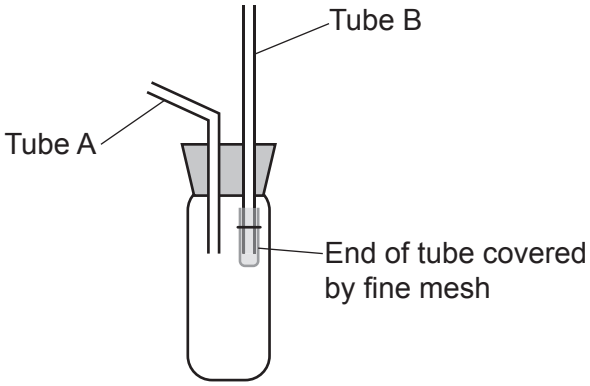

Fig. 18.2

(a) Give the **name of the equipment** and **explain how** the scientists would use it to collect insects.

Name of equipment .....

How it is used .....

.....

.....

.....

..... **[3]**

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(b) The scientists capture 25 insects from the tree and then mark them. This is their first sample.

They then release the insects and sample the tree again two days later. In this second sample there were 30 insects and 3 had been marked.

(i) Estimate the population size of insects on the tree.

Use this formula:

$$\text{Estimated population size} = \frac{\text{Number in first sample} \times \text{Number in second sample}}{\text{Number in second sample previously marked}}$$

Estimated population size = ... **[2]**

(ii) To mark each insect the scientists put a small spot of paint on the underside of the insect.

Explain why they marked the underside of the insects and not the top.

.....

.....

..... **[2]**

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(c) The scientists wanted to see if there was a link between the level of pollution in the air and the number of insects on the trees.

They sampled trees at different distances from a factory that was releasing sulfur dioxide.

Fig. 18.3 shows their results.

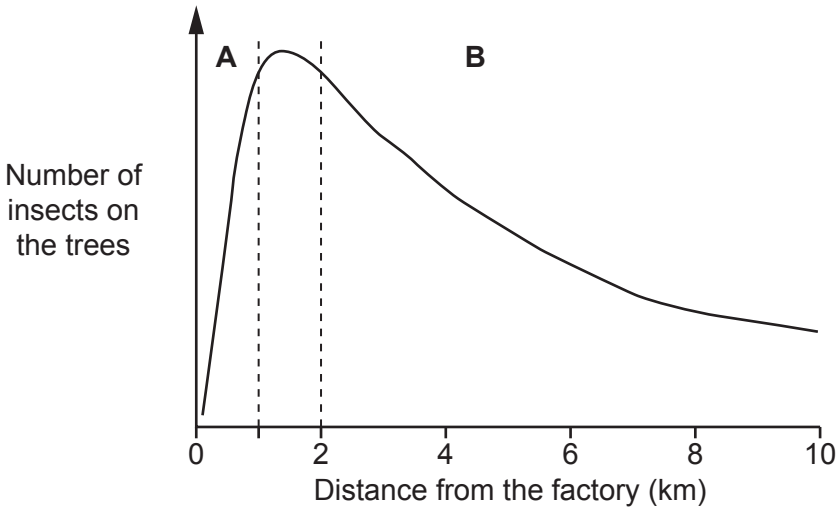

Fig. 18.3

(i) The scientists found that sulfur dioxide can make the waxy cuticle of leaves thinner.

Suggest how this could explain the number of insects on the trees, further from the factory, in section **B** of the graph in **Fig. 18.3**.

.....

.....

.....

.....

..... **[2]**

(ii) Look at section **A** of the graph in **Fig. 18.3**. Which is a possible explanation for the shape of the graph nearest the factory, in section **A**?

Tick (✓) **one** box.

Low concentrations of sulfur dioxide kill the insects. ☐

Low concentrations of sulfur dioxide make the insects reproduce faster. ☐

Very high concentrations of sulfur dioxide kill the insects. ☐

Very high concentrations of sulfur dioxide make the insects reproduce faster. ☐

[1]

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19 Fanconi anaemia is a genetic disorder. The disorder causes a decrease in the number of platelets in the blood.

(a) Write down **one** possible symptom of Fanconi anaemia.

.....

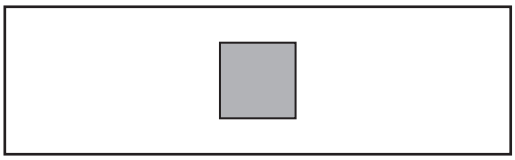
..... **[1]**

(b) Fanconi anaemia also causes a decrease in white blood cells and red blood cells.

The table shows ranges for blood components in people **without** Fanconi anaemia.

Blood component	**Number per mm^3**
red blood cell	4.5 million – 6.5 million
white blood cell	6.0 thousand – 16.0 thousand
platelet	0.15 million – 0.40 million

(i) The diagram shows a microscope slide containing blood from a patient.



The volume of blood under the slide is 0.1 mm^3 and it contains 1000 white blood cells.

Calculate the number of white blood cells per mm^3 of blood.

Number = ... per mm^3 **[2]**

(ii) Does the blood sample provide evidence that the patient has Fanconi anaemia?

Use the table and your answer to part **(b)(i)** to justify your answer.

.....

..... **[1]**

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20 Gardeners use dead plant material to make compost. They add this compost to soil where they are growing plants.

(a) What do plant roots get from compost in the soil?

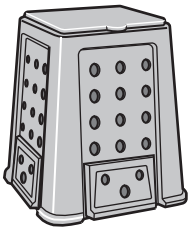
Put a (ring) around the correct answer.

carbon dioxide **minerals** **nitrogen gas** **oxygen gas**

[1]

(b) Compost can be made in a composting bin. In the bin **aerobic** bacteria turn dead plant material into compost.

The drawing shows a composting bin.



Explain why the composting bin needs holes in it.

.....

.....

..... **[2]**

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(c) A new way of making compost is called bokashi. In this process the compost is made **anaerobically** in a different type of composter.

Scientists compare the normal methods of making compost with bokashi.

This is their method:

- Take one large pile of dead plant material
- Divide the material into two samples of equal mass
- Place one sample into the normal composter and place one sample into the bokashi composter
- Measure the temperature in each composter every 10 days
- After 40 days, measure the mass of the compost.

Why did the scientists put the same mass of compost in each composter?

Tick (✓) **one** box.

To allow valid comparisons of the results. ☐

To decrease the temperature. ☐

To make the measurements more accurate. ☐

To make the results repeatable. ☐

[1]

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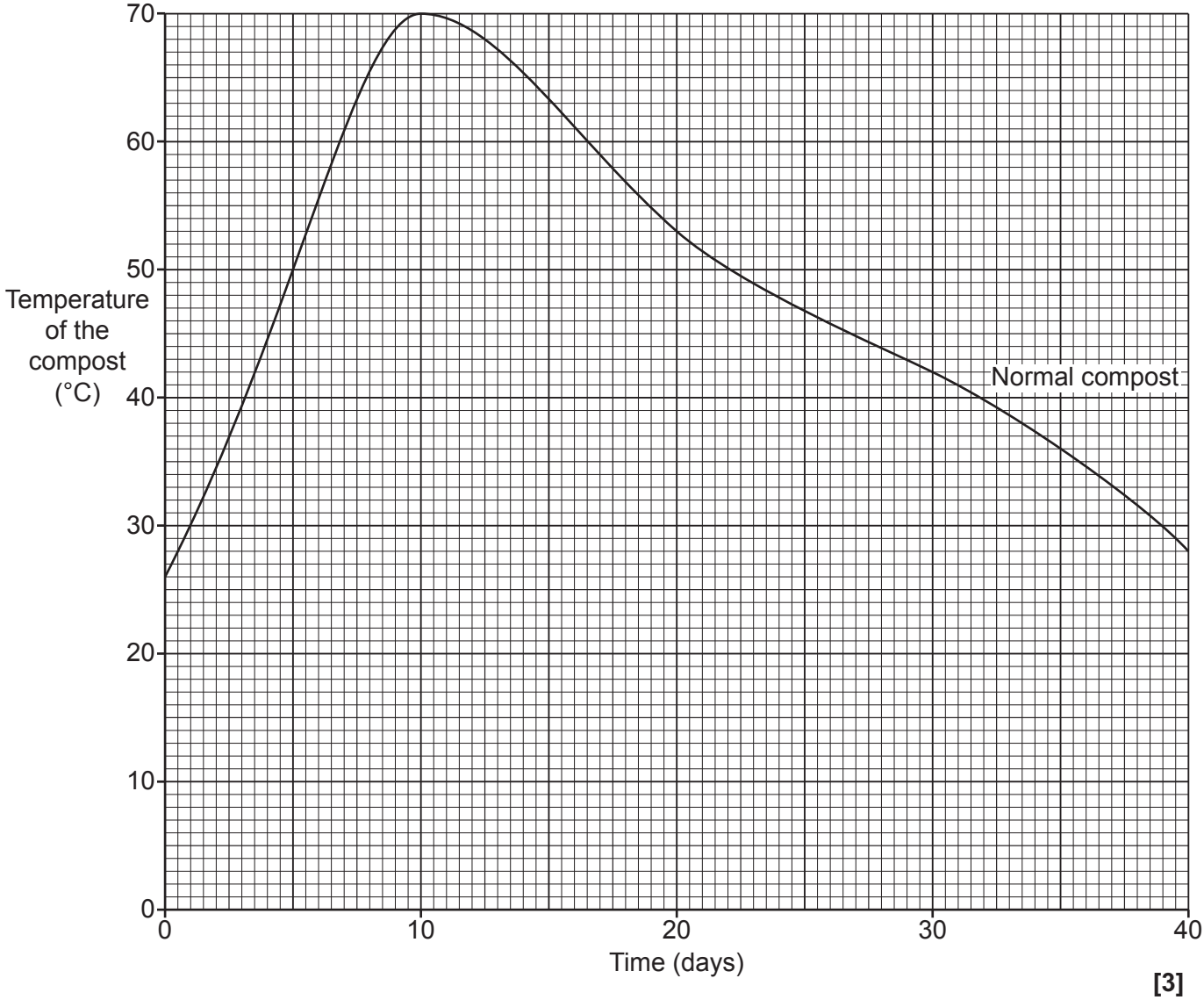
(d) **Table 20.1** shows the scientists' temperature measurements.

	Temperature of the compost (°C)	
Time (days)	**Normal compost**	**Bokashi compost**
0	26	26
10	70	27
20	53	29
30	42	31
40	28	28

Table 20.1

(i) The scientists' results for the normal compost are plotted on the grid.

Complete the graph by plotting the results for the **bokashi** compost and draw a curve of best fit.



[3]

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(ii) Describe the change in the temperature of the **normal** compost during the investigation.

.....

.....

.....

..... **[2]**

(iii) Use data from **Table 20.1** to calculate the difference between the maximum temperature of the normal compost and the maximum temperature of the bokashi compost.

Difference = ... °C **[2]**

(iv) Which **two** statements explain this difference in temperature between the two types of compost?

Tick (✓) **two** boxes.

- Both types of compost are made by aerobic respiration. ☐
- Normal compost is made by aerobic respiration. ☐
- Normal compost is made by anaerobic respiration. ☐
- Aerobic respiration and anaerobic respiration release the same amount of energy. ☐
- Aerobic respiration releases more energy than anaerobic respiration. ☐
- Aerobic respiration releases less energy than anaerobic respiration. ☐

[2]

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(e) **Table 20.2** shows the scientists' results for the mass of the compost.

	Normal compost	**Bokashi compost**
Mass at start (kg)	1500	1500
Mass after 40 days (kg)	760	1200

Table 20.2

(i) The mass of the normal compost has decreased by 19 kg per day.

Calculate the decrease in mass of the bokashi compost per day.

Give your answer to the nearest **whole** number.

Decrease = ...kg per day **[3]**

(ii) Carbon dioxide is given off in the making of the compost. This causes most of the decrease in mass.

Scientists think that the bokashi method of composting might be better for the environment.

Use your answer from part **(e)(i)** to justify the scientists' conclusion.

.....

.....

..... **[1]**

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21 Hypercholesterolemia (HC) is caused by a dominant allele on chromosome 19. This allele has mutations which cause a change in the order of DNA nucleotides.

(a) Write the words **allele**, **chromosome** and **nucleotide** in the boxes to show their size from smallest feature to largest feature.

Smallest feature	
Largest feature	

[1]

(b) One in 500 people are heterozygous for HC.

There are 66 000 000 people in the UK.

Calculate how many people in the UK are heterozygous for HC.

Number of people = ... **[1]**

(c) A woman who does **not** have HC and a man who is heterozygous are expecting a baby.

What is the probability of the baby having HC?

Complete the genetic diagram to explain your answer.

D is the dominant HC allele and **d** is the recessive allele.

		Man	
		D	**d**
Woman	**d**		
	d		

Probability = ... **[2]**

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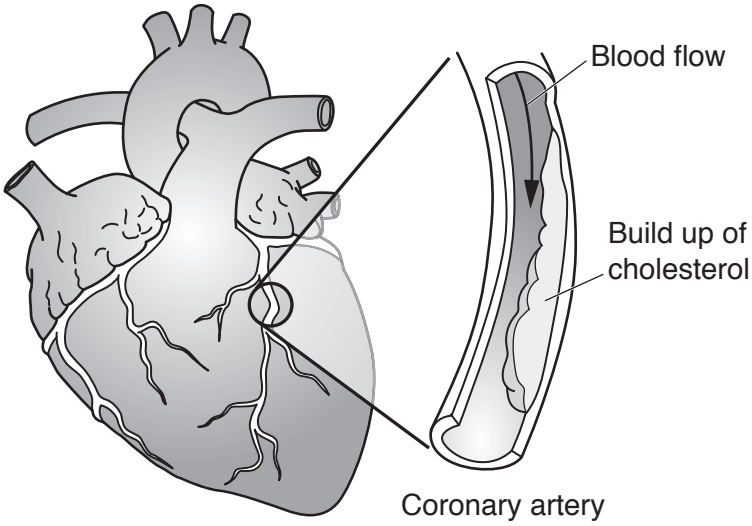
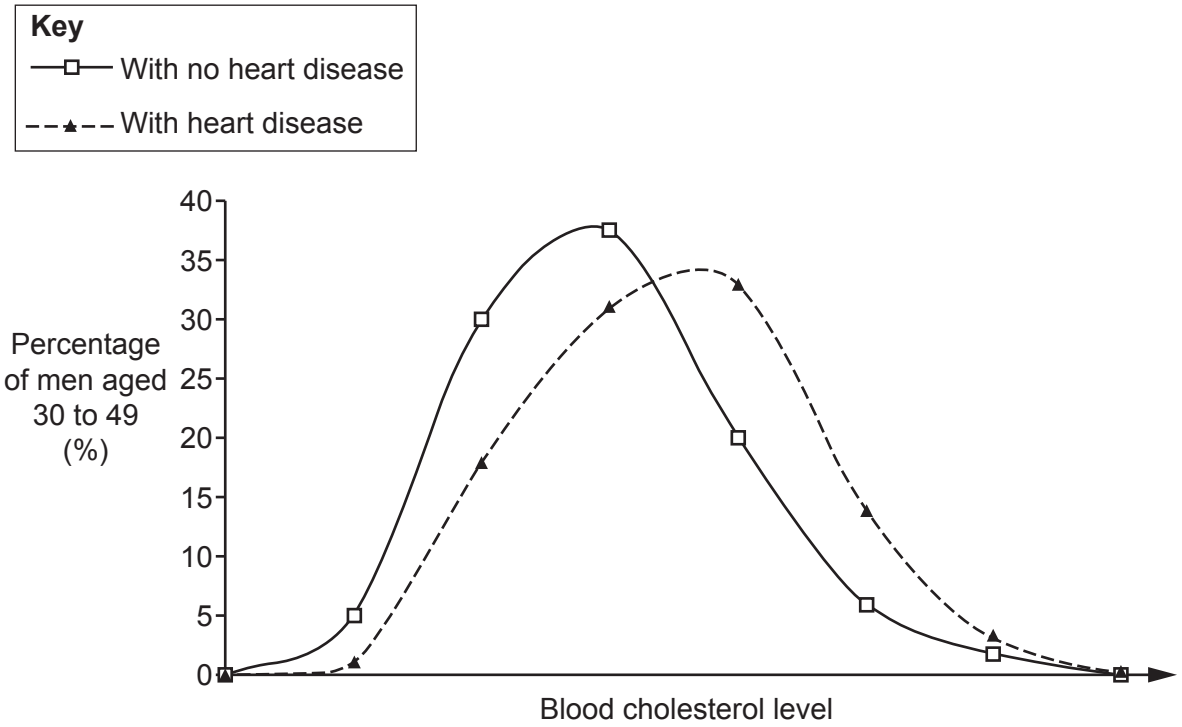
(d)* People with HC are more likely to get heart disease. The diagram shows the heart of a person who has heart disease.



The graph shows the results of a study of men aged 30 to 49. The study measured the cholesterol levels in the blood of the men. It also recorded if the men developed signs of heart disease.



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Explain the possible link between cholesterol and heart disease and if this link is supported by the graph.

Use evidence from the diagram and the graph in your answer.

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..... **[6]**

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22 **Fig. 22.1** shows the water cycle occurring in a lake.

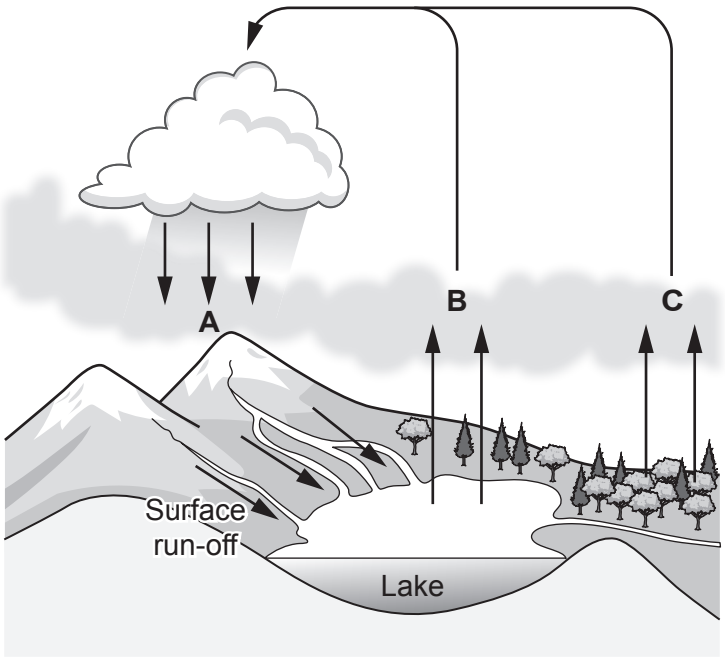

Fig. 22.1

(a) Draw a line to the correct name for the three processes labelled **A**, **B** and **C** in **Fig. 22.1**.

	Evaporation
A	
	Photosynthesis
	Precipitation
B	
	Respiration
	Translocation
C	
	Transpiration

[3]

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(b) Surface run-off water passes through soil and back into the lake.

Write down **one** reason why surface run-off water is important to organisms living in the lake.

.....

..... **[1]**

(c) Scientists investigate antibiotic pollution in two different lakes.

They collect samples of water from the two lakes. The scientists then use aseptic techniques to investigate how resistant the bacteria in the water are to antibiotics. **Fig. 22.2** shows the apparatus they use.

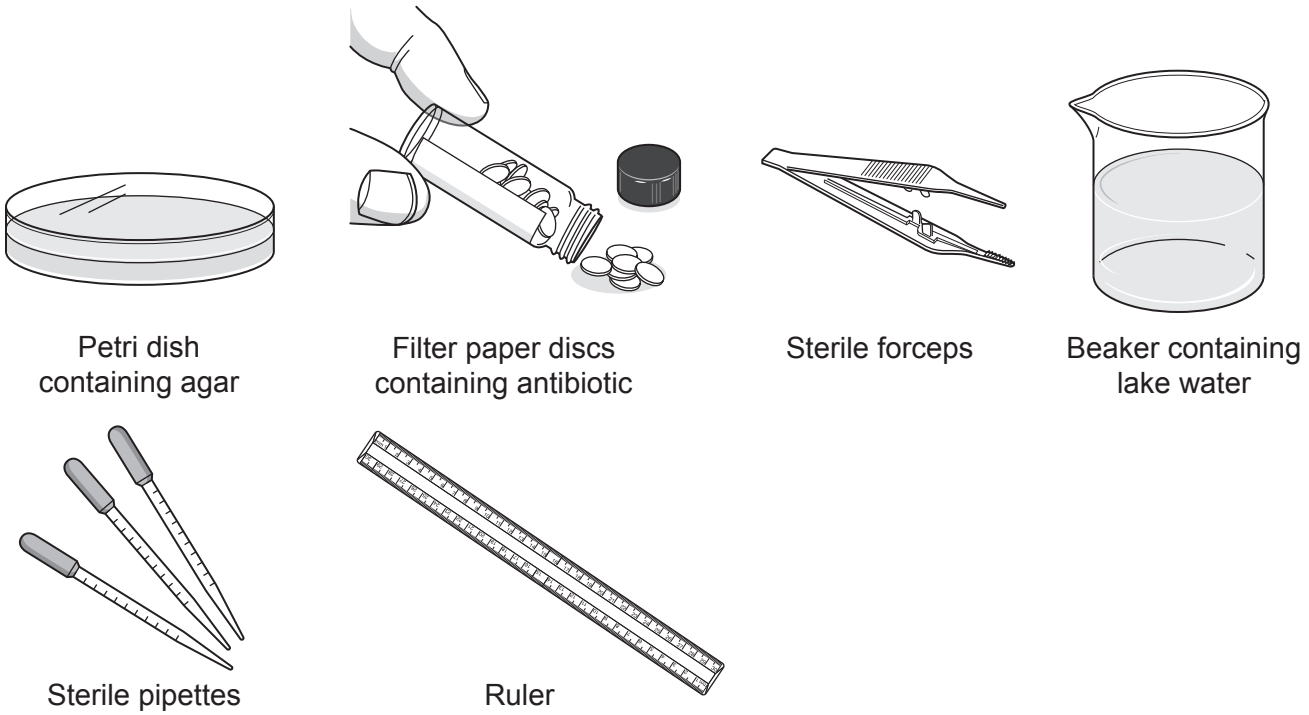

Fig. 22.2

Describe how the scientists could use **this** apparatus to **measure** how resistant the bacteria are to antibiotics.

.....

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..... **[4]**

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(d) The scientists also counted how many species of bacteria were resistant to antibiotics and how many species of bacteria were killed by antibiotics.

The scientists found these results.

	Number of different species of bacteria	
	In Lake Bellandur	In Lake Jakkur
Resistant to antibiotics	53	35
Killed by antibiotics	28	37

Which lake has the **highest** levels of antibiotic pollution?

Tick (✓) **one** box.

Lake Bellandur ☐

Lake Jakkur ☐

Explain your answer.

.....

.....

.....

..... **[2]**

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23 Zebras (**Fig. 23.1**) have evolved to live in hot grassland in Africa.

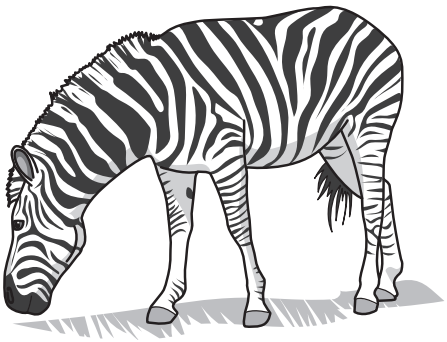

Fig. 23.1

(a) Scientists have tried to find out why zebras have evolved stripes on their body.

One theory is that the stripes help to keep the zebra cooler than other colours. Scientists did an experiment to test this theory. They covered barrels of cold water with the skin of different animals. Then they measured the temperature of the water several hours later.

The results are shown in **Fig. 23.2**.

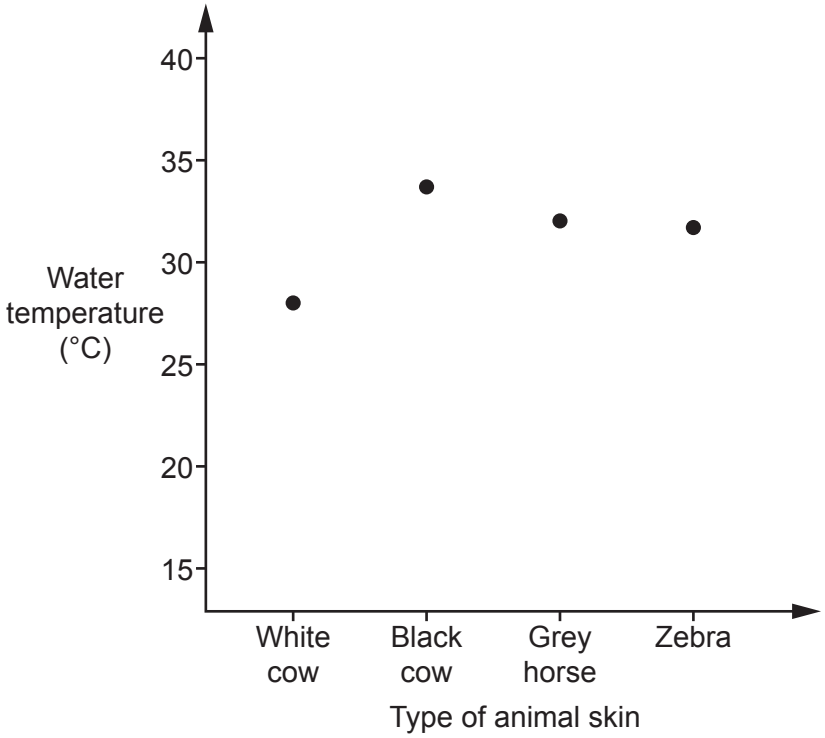

Fig. 23.2

(i) Do the results in **Fig. 23.2** support the theory that stripes keep zebras cool? Explain your answer.

.....

.....

..... **[1]**

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(ii) The scientists were aiming to investigate if it was **only** the colour of the skin that affected temperature regulation.

Suggest **one** improvement the scientists could make to ensure they **only** investigate the **colour** of the skin.

Explain your answer.

.....

.....

..... **[1]**

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(b) Another theory says that the stripes make a zebra less likely to be bitten by insects.

To test this theory scientists made models of zebras and covered them with sticky tape. One model was black. The other models had different widths of stripes.

Fig. 23.3 shows the number of insects that stuck to the tape.

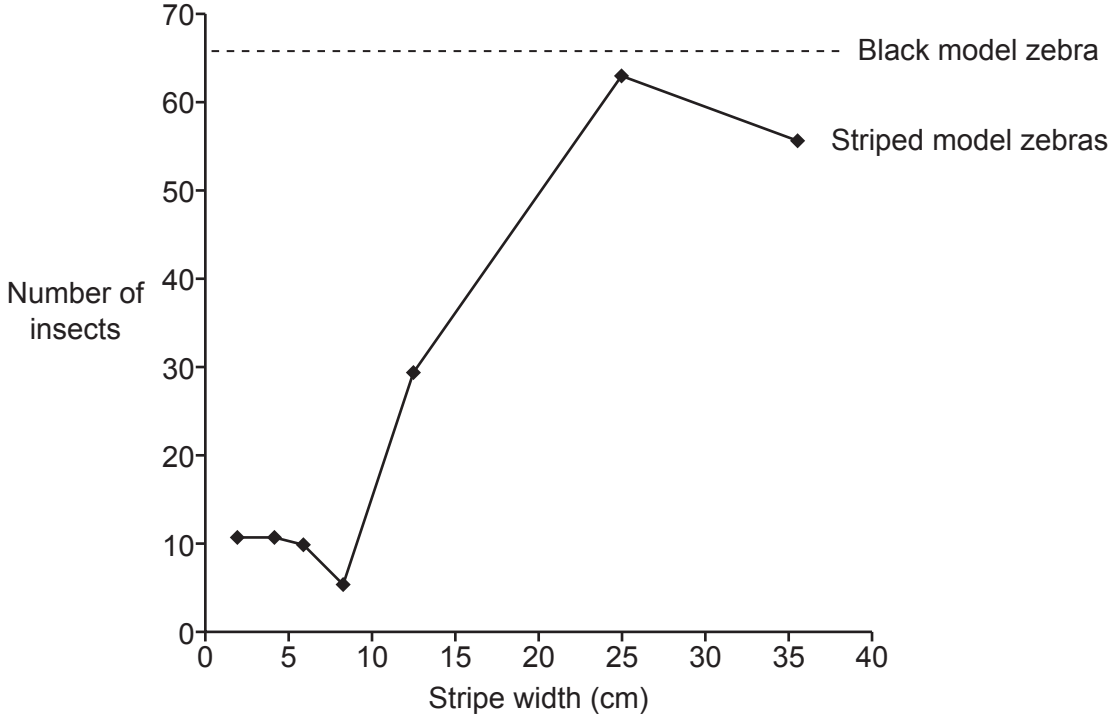

Fig. 23.3

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(i) Describe what **Fig. 23.3** shows about the link between zebra stripes and protection from insects.

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.....

.....

..... **[2]**

(ii) Horse blankets are used to cover horses when they are outside. Companies have started to produce horse blankets with zebra stripes.

Use the information in **Fig. 23.3** to suggest what width of stripe should be used to reduce insect bites.

Explain your answer.

.....

..... **[1]**

(iii) Biting insects can spread pathogens between animals.

Use the theory of natural selection to explain how zebra stripes could have developed.

.....

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..... **[3]**

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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