OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



EXAM QUESTION PACK

B5.2 NATURAL SELECTION AND EVOLUTION

SCORE	PERCENTAGE
/88	%

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Gateway Biology A (9-1)

Natural selection and evolution

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **88**.
- The total number of marks may take into account some 'either/or' question choices.

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1 What are the names of the two scientists who first suggested the theory of natural selection?

A Darwin and Mendel
B Mendel and Wallace
C Wallace and Darwin
D Watson and Crick

Your answer ☐

[1]

2 The rock pocket mouse is a small grey coloured mouse that lives in Mexico.

These mice are the main food for owls.

Rattlesnakes also feed on these mice.In most areas of Mexico the ground is covered in grey rocks.

In one area the ground is covered with black rocks.

The black rocks were formed about 1000 years ago when a volcano erupted.

Scientists make two observations:

- very occasionally a black mouse is born to grey parents due to a mutation
- black mice are well camouflaged.

Use these observations to explain why most of the mice in this area are black and not the usual grey.

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[4]

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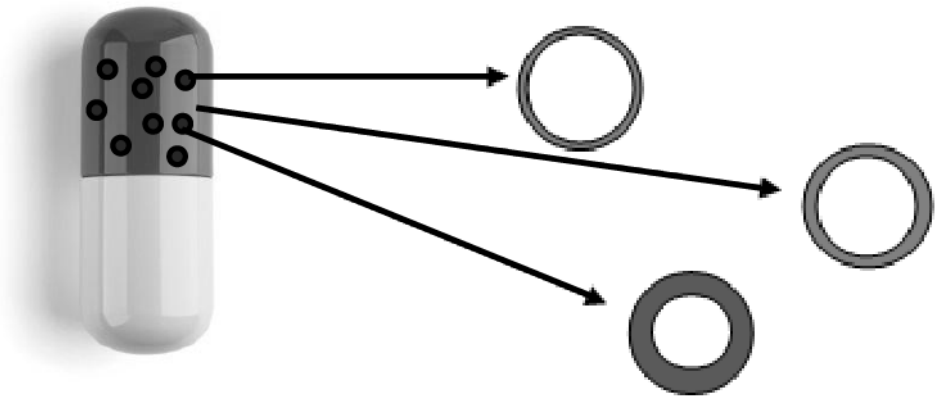
3 Erythromycin is an antibiotic drug.

Erythromycin is usually given to patients in a capsule.

The capsule has lots of small spheres containing the drug.

The walls of the spheres are different thicknesses.

They are made of a carbohydrate polymer.



(i) Explain why the drug is released from the spheres in the small intestine.

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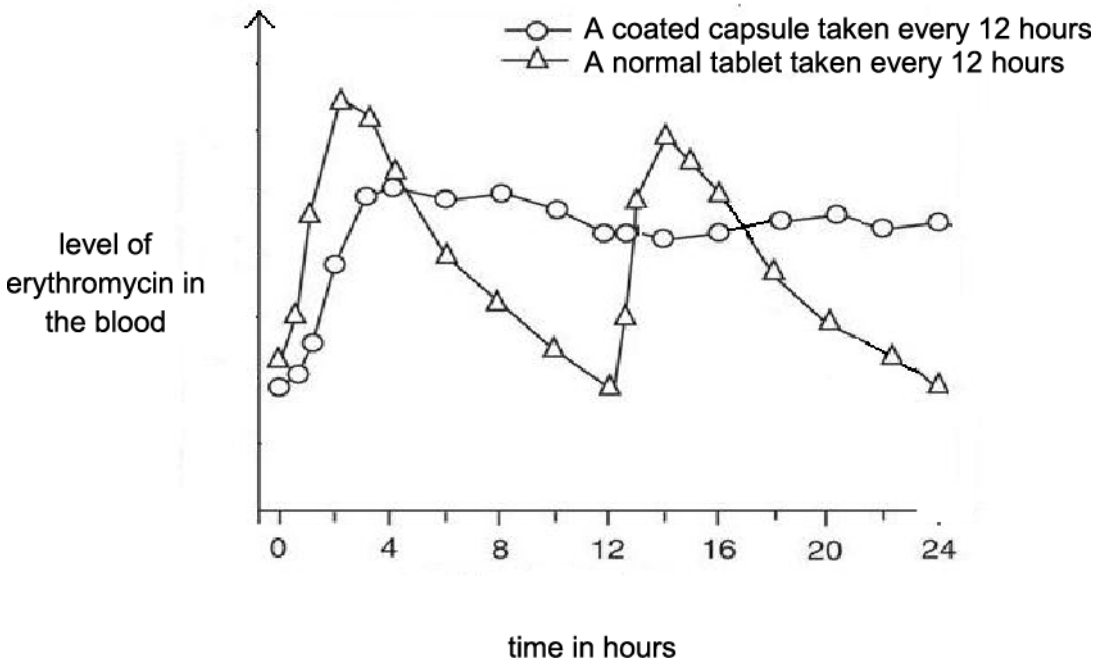
[2]

(ii) * The graph shows the levels of erythromycin in the blood when given using this capsule and in a normal tablet.

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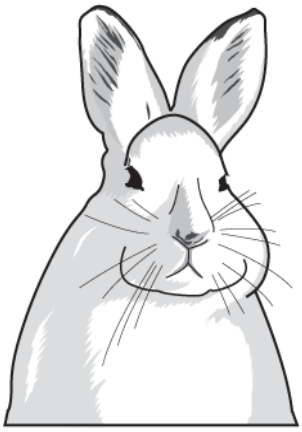
Explain the shape of the two graphs and why it is better to give erythromycin in capsules.

[6]

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4 Snowshoe hares live in parts of Canada.

They are preyed on by animals called lynx.



snowshoe hare



lynx

Where the lynx and hares live there is snow on the ground for long periods of time.

Scientists have made observations to explain why snowshoe hares have white fur.

Here are their observations.

A Hares are all born with slightly different coloured fur.

B Lynx are trying to find food and hares are trying not to be eaten.

C The hares with the fur colour best suited to the conditions survive.

D The hares that survive pass on their genes for fur colour.

Charles Darwin made observations about natural selection.

Match the scientists' observations to Charles Darwin's observations by writing the correct letter **A, B, C and D** in the table.

Charles Darwin's observation	Scientists' observation
survival of the fittest	

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competition for resources	
inheritance of successful adaptations	
presence of natural variation	

[2]

5 Snowshoe hares live in northern Canada where there is snow on the ground for much of the year.

Snowshoe hares are preyed on by animals called lynx.

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Here are their observations.

A Hares are all born with slightly different coloured fur.

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6(a) The diagram shows two types of ladybird.



7 spotted ladybird
Coccinella septempunetata



Harlequin ladybird
Harmonia axyridis

All ladybirds are arthropods.

Put a tick (✓) next to the correct comparison of the classification of the two types of ladybirds.

They are classified in …

… the **same** class, genus and species. ☐

… a **different** class, genus and species. ☐

… the **same** class and genus but **different** species ☐

… the **same** class but **different** genus and species ☐

[1]

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(b) Ladybirds may get their common name from the fact that they can fly.

The Ancient Greeks might have classified ladybirds in the same group as birds.

(i) What name is given to the type of classification system used by the Ancient Greeks?

---

[1]

(ii) Give **one** reason why this type of system is not used now.

---

[1]

7 Strains of bacteria are now becoming resistant to antibiotics.

Which process is causing this resistance?

A Genetic modification
B Natural classification
C Natural selection
D Selective breeding

Your answer [ ] [1]

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8 Hedgehogs are covered in small spines.

When they are frightened they often roll up into a ball and keep still.



(i) In country areas, where badgers live, this is an advantage to the hedgehogs.

In cities, where there are many roads, this is a disadvantage.

Explain these two conclusions.

--- [2]

(ii) Scientists have noticed that a new type of hedgehog is increasing in numbers in cities.

These hedgehogs do not roll up. They run away when frightened. The scientists think that genes control this behaviour.

Explain how this type of hedgehog may become more common in cities.

Use ideas about natural selection.

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[4]

9 Which statement **best** describes the development of the theory of evolution by natural selection?

A Darwin and Mendel working together
B Darwin and Wallace working independently
C Darwin and Wallace working together
D Mendel working on his own

Your answer [ ] [1]

10 Which approach would be used to classify organisms by phylogenetics?

A Compare the structure of the organisms' internal organs
B Look at DNA base sequences
C Look at the behaviour of the organisms
D Study fossils

Your answer [ ] [1]

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[4]

12 Which of these is a feature of an **artificial** classification system?

A It shows evolutionary links between organisms.
B It can be based on similarities in DNA.
C It may compare the amino acids in proteins.
D It uses a single difference or similarity between organisms.

Your answer [1]

13 How does the fossil record provide evidence for evolution?

A It provides information about **all** extinct organisms.
B It shows that all organisms have evolved at the same rate.
C It shows that many small changes can result in a large change in organisms over time.
D It shows that changes in phenotype occurring during life can be passed on in the genes.

Your answer [1]

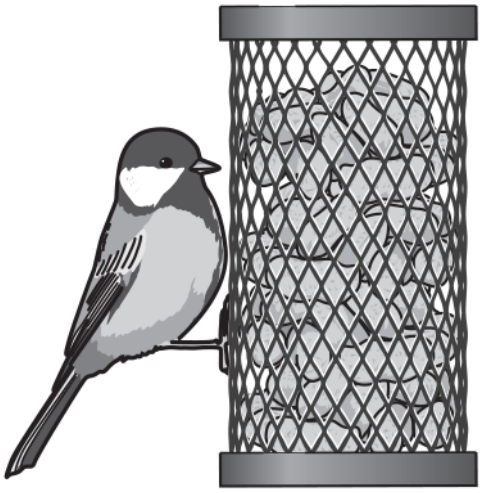
14 Blue tits are small birds seen in gardens.

Many people in the UK feed birds nuts using a bird feeder, as shown in the diagram below.

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Scientists measured the mean lengths of blue tits' beaks in the UK.

They found that blue tit beaks in the UK are slightly longer than blue tit beaks in the rest of Europe.

Very few people in the rest of Europe put bird feeders out for their birds.

Use Charles Darwin's theory of natural selection to explain why the blue tits in the UK have slightly longer beaks than those in the rest of Europe.

[4]

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15 Some people get very painful headaches called migraines.

Scientists think that this is caused by a protein in the brain called CGRP.

Levels of the CGRP protein are higher in the brains of people who get migraines.

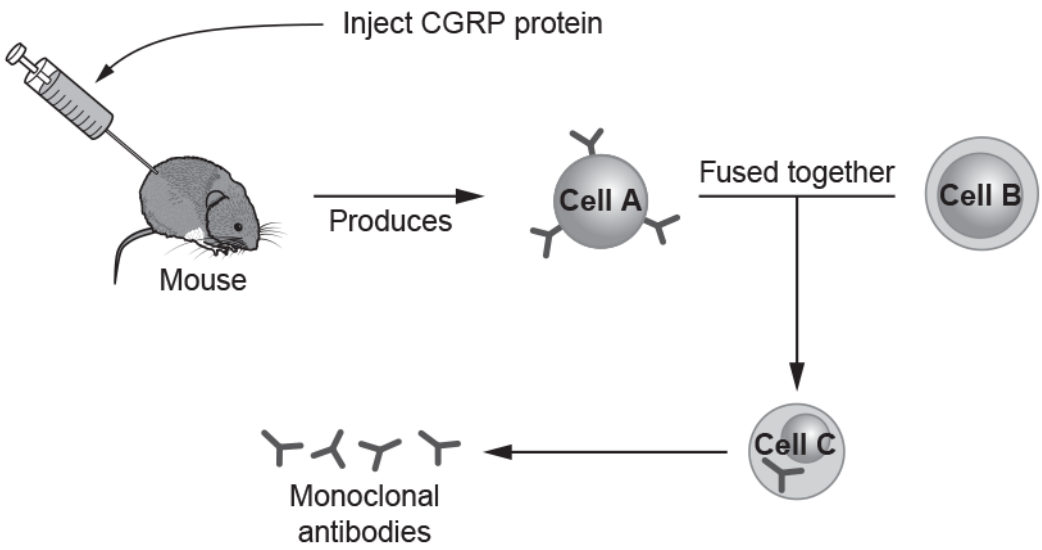
Doctors are trying to find a treatment to prevent migraines.

They have produced an antibody against the CGRP protein.

The antibodies used in the investigation were monoclonal antibodies.

They can be made by injecting CGRP protein into a mouse.

The diagram shows this process.



Draw lines to identify each type of cell shown in the diagram.

Cell A	Cancer cell
Cell B	Lymphocyte
Cell C	Hybridoma

[2]

16(a) Rats are a major pest in many areas of the world. They can reduce food security and spread diseases.



Warfarin is a chemical that is used as a rat poison. It stops platelets working in the blood.

Describe the function of platelets in the blood.

---

[2]

(b) Some rats are resistant to warfarin. When fed with large amounts of warfarin the rats do not die.

Scientists found that the resistance is due to the dominant allele **R**.

Two resistant rats (**Rr**) mate.

Complete this genetic diagram to find the ratio of resistant rats to non-resistant rats that would be expected to be produced.

		Rr	
		.....	.....
Rr	R	.....	.....
	r	.....	.....

Ratio = ... [3]

(c) After several years, the percentage of resistant rats in the population had increased.

Use Darwin's theory of natural selection to explain this observation.

[3]

(d) Scientists are now trying to find another poison to use on rats.

They have introduced a chemical called phosphine. This blocks the action of mitochondria in rat cells.

Explain why this might kill rats.

[3]

17 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]

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18 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]**

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

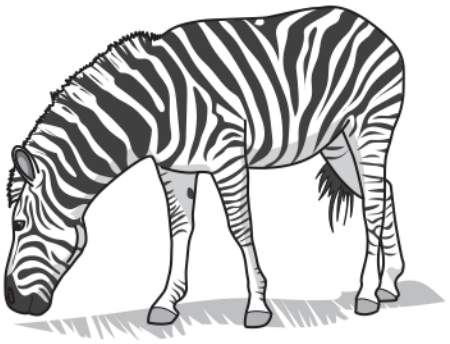


Fig. 23.1

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.**

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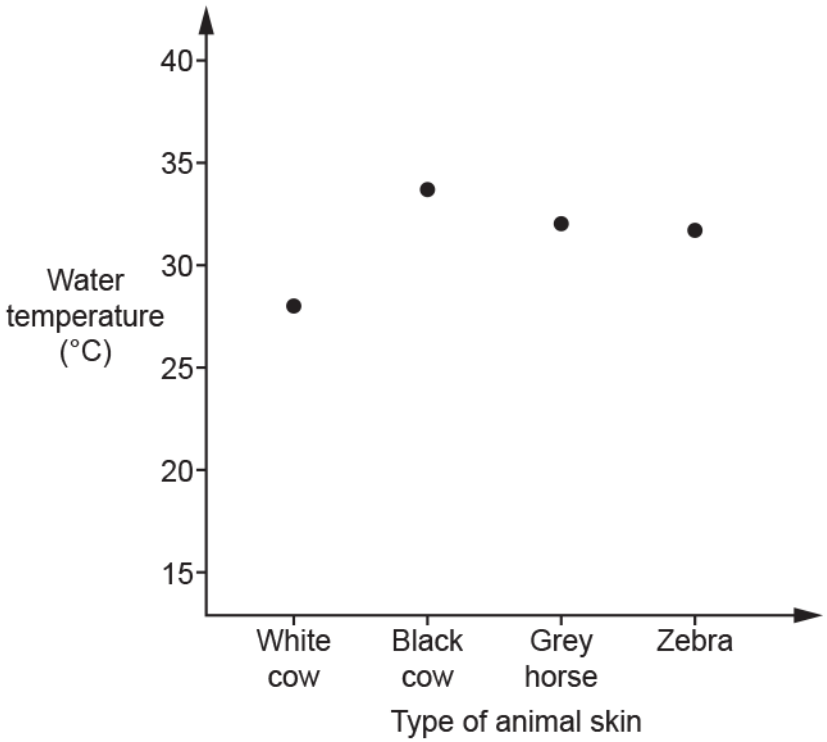


Fig. 23.2

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

---

[1]

(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.

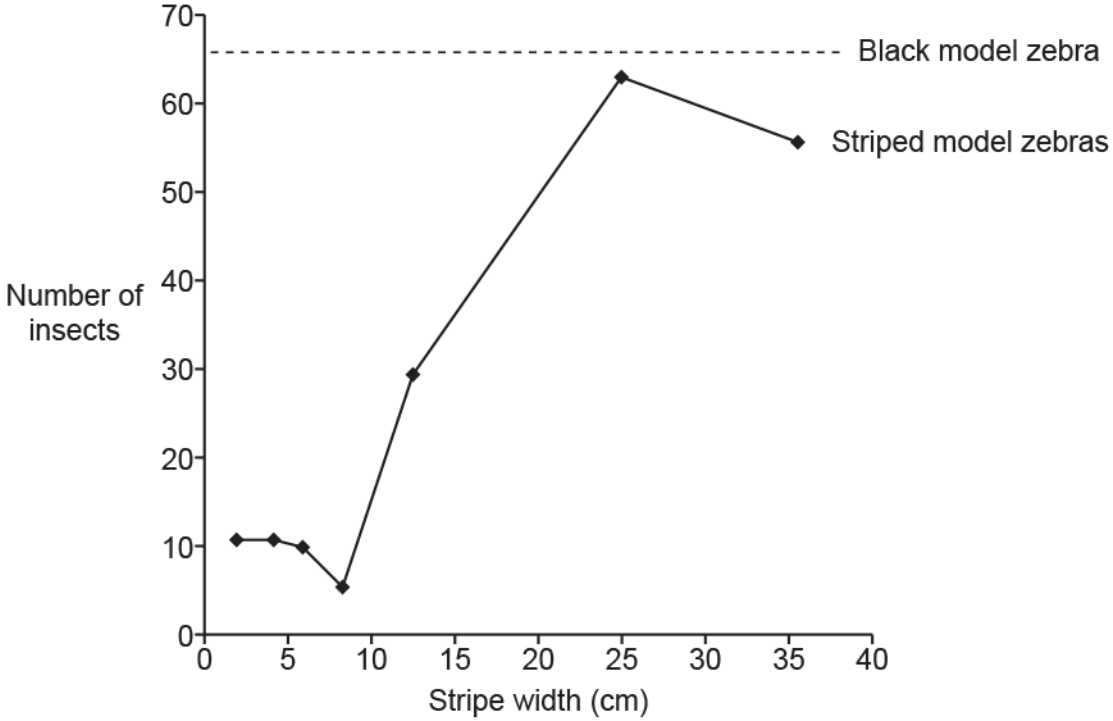


Fig. 23.3

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

[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.

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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.

---

[3]

20 Which of these is a **similarity** between selective breeding and natural selection?

A Cause a change in organisms' genotypes but not phenotypes.
B Humans decide which organisms will reproduce.
C Only some organisms reproduce.
D Take place over many thousands of years.

Your answer ☐ [1]

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21 Darwin and Wallace both developed theories of natural selection. Both of their theories were developed after making observations on islands.

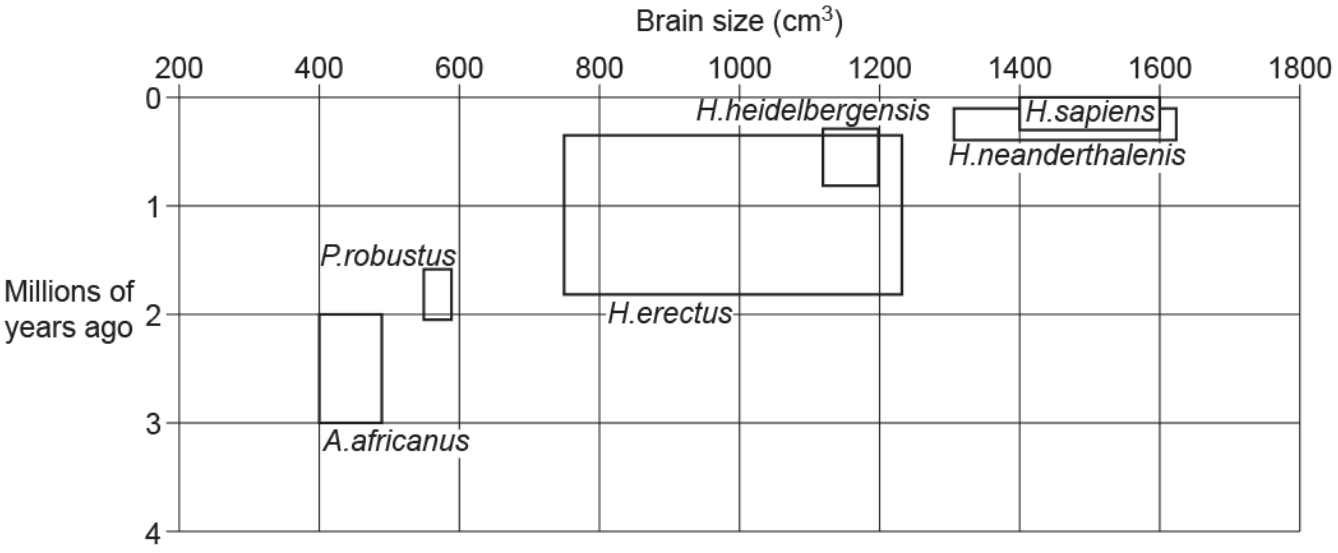
What is the most likely explanation for this?

A Conditions on neighbouring islands are very similar.
B Different characteristics were observed in organisms on islands compared to the mainland.
C There are no selection pressures for organisms on islands.
D There is no competition for food on islands.

Your answer ☐ [1]

22 Humans belong to the species *H.sapiens*.

H.sapiens have evolved from a number of possible ancestors. The graph shows five of these ancestors.



What conclusion about human evolution can be made from the graph?

A A larger brain meant that the species were better adapted to their environment.
B *H.sapiens* outcompeted the other species which then became extinct.
C In general, the more recently a species first appears, the larger its brain size.
D There is no correlation between brain size and when a species first appeared.

Your answer ☐ [1]

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23 What is meant by the term phylogenetics?

A Classifying organisms using many common characteristics.

B Constructing diagrams to predict how characteristics are inherited.

C The study of evolutionary relationships based on molecular studies.

D Using a single common feature to determine evolutionary relationships.

Your answer [ ] [1]

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24(a) Zebras (**Fig. 17.1**) have evolved to live in hot grassland in Africa.

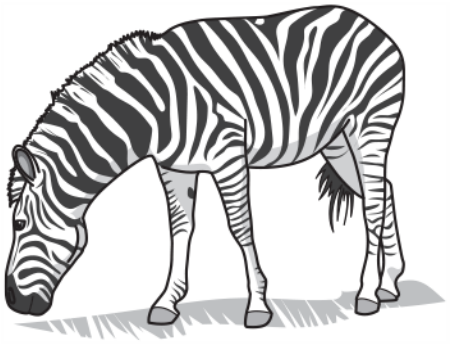


Fig. 17.1

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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.

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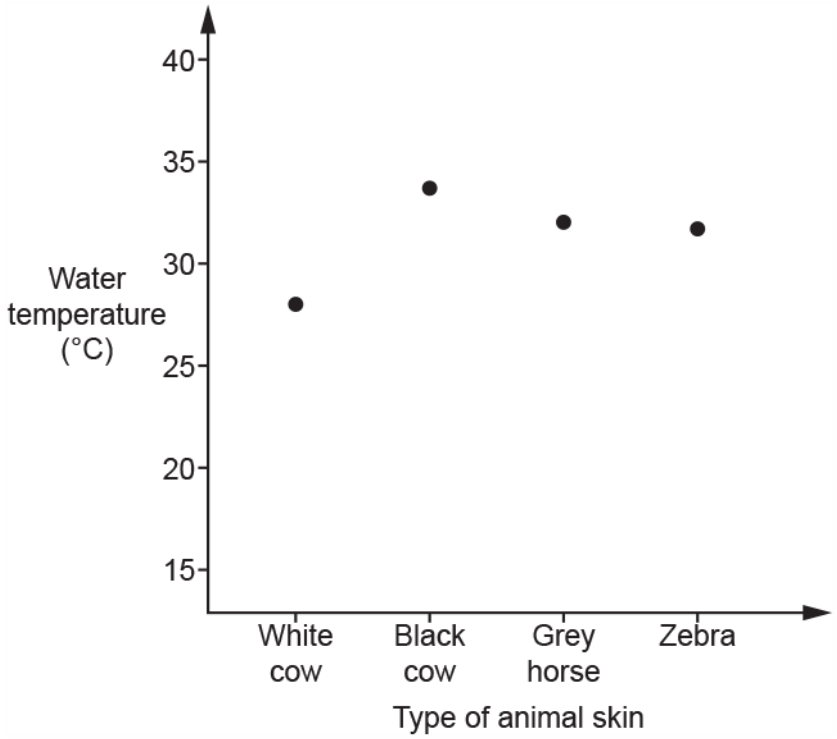


Fig. 17.2

(i) Do the results in **Fig. 17.2** support the theory that stripes keep zebras cool?
Explain your answer.

---

[1]

(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.

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[1]

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

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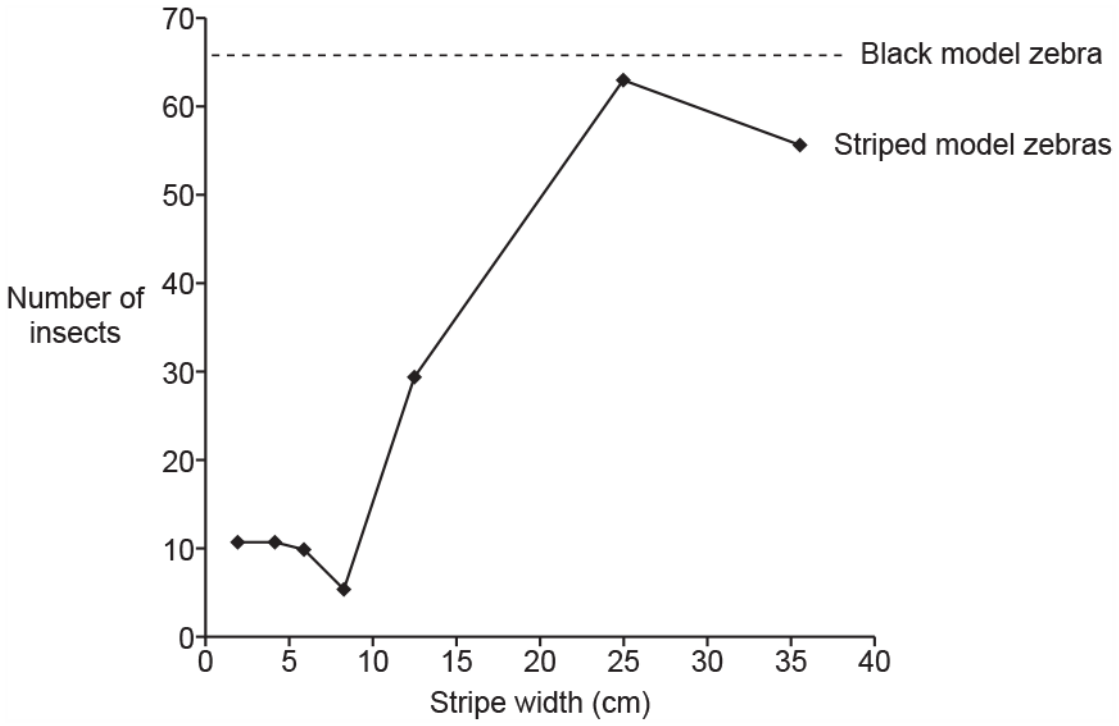


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Explain your answer.

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[3]

25(a) 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.

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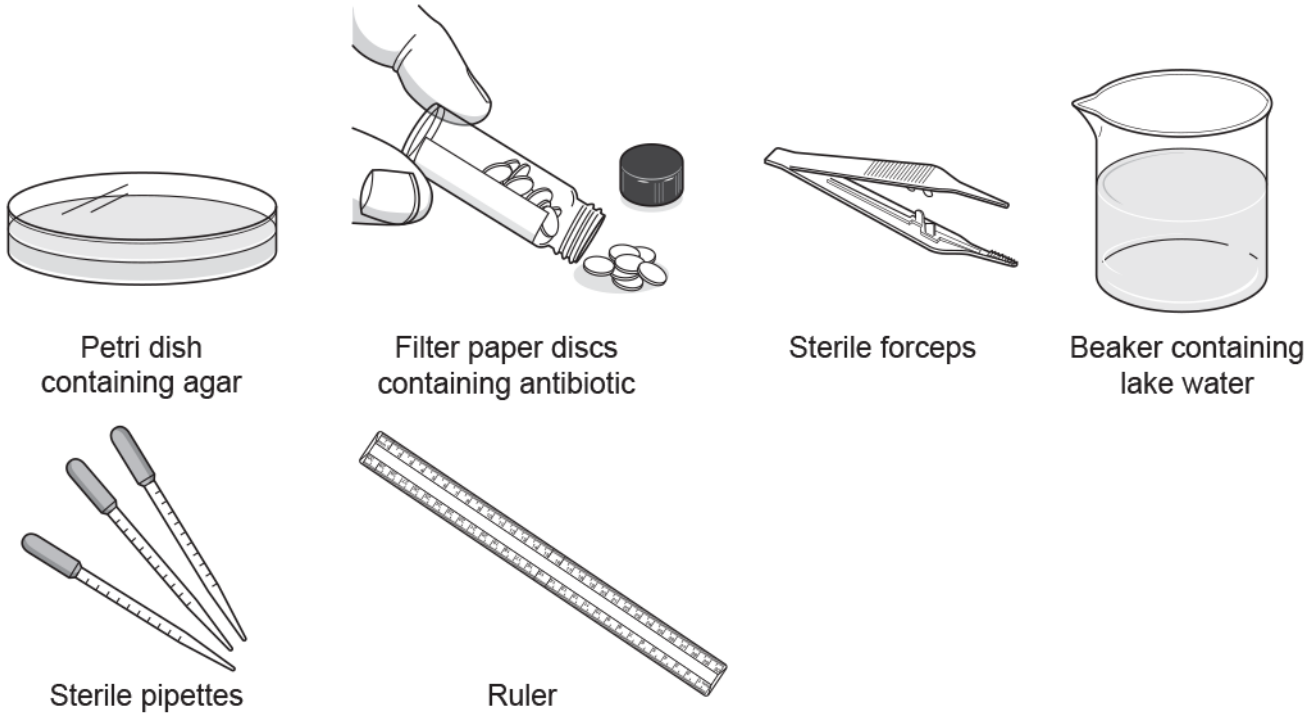


Fig. 22.2

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

---

[4]

(b) 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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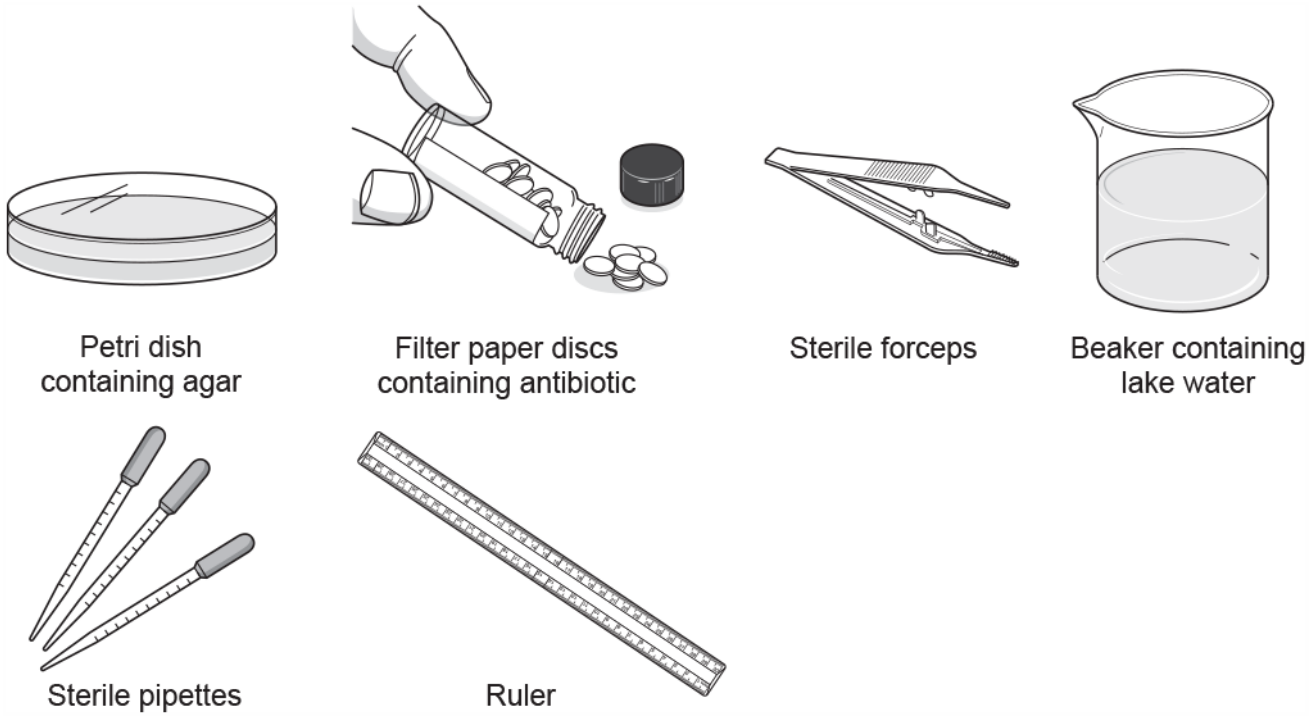


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[2]

END OF QUESTION PAPER

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