

BIOLOGY



EXAM QUESTION PACK

B5.2 NATURAL SELECTION AND EVOLUTION

SCORE

/88

PERCENTAGE

%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

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.

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.

[4]

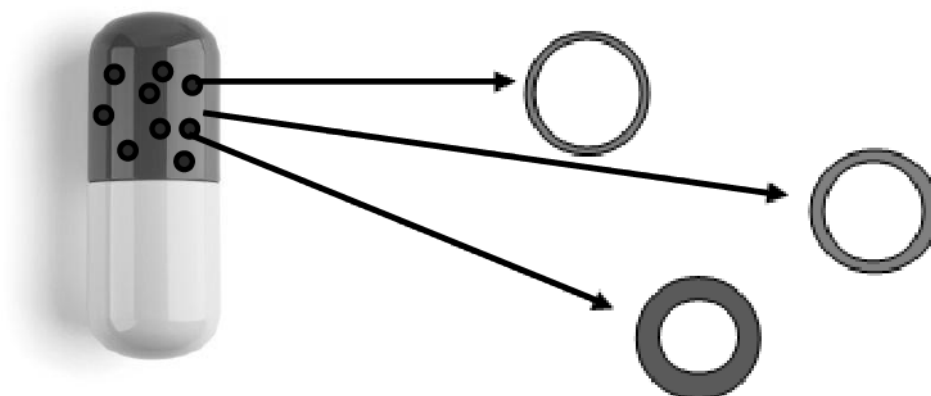
3 Erythromycin is an antibiotic drug.

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.

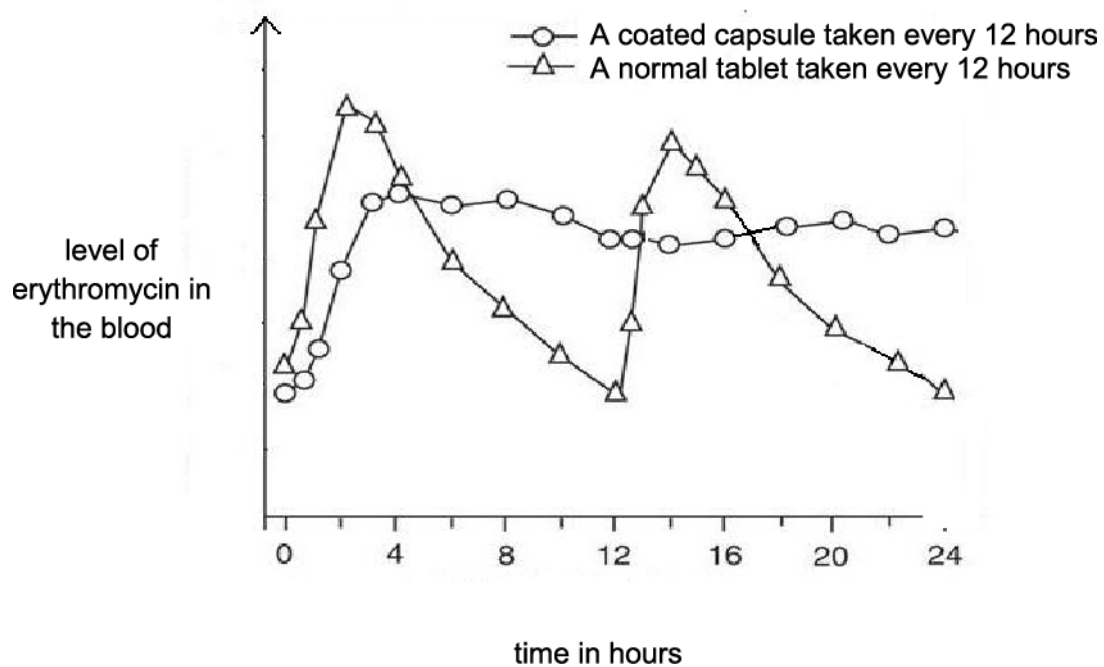
They are made of a carbohydrate polymer.



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

----- [2]

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

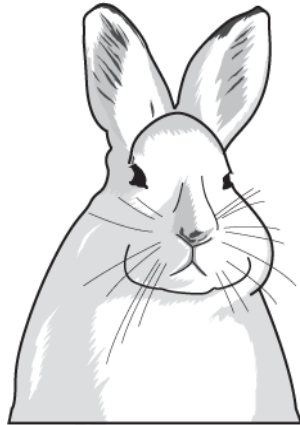


Explain the shape of the two graphs and why it is better to give erythromycin in capsules.

[6]

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	

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.

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	
competition for resources	
inheritance of successful adaptations	
presence of natural variation	

[2]

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



7 spotted ladybird
Coccinella septempunctata



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]

(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]

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.

[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]

11 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.

41

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.

[1]

A It provides information about **all** extinct organisms.

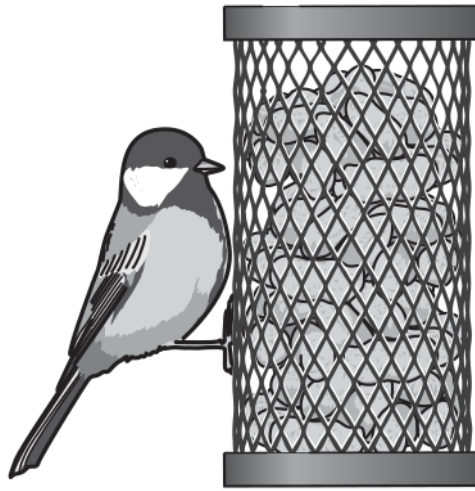
B It shows that all organisms have evolved at the same rate.

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.

[1]

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



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]

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.

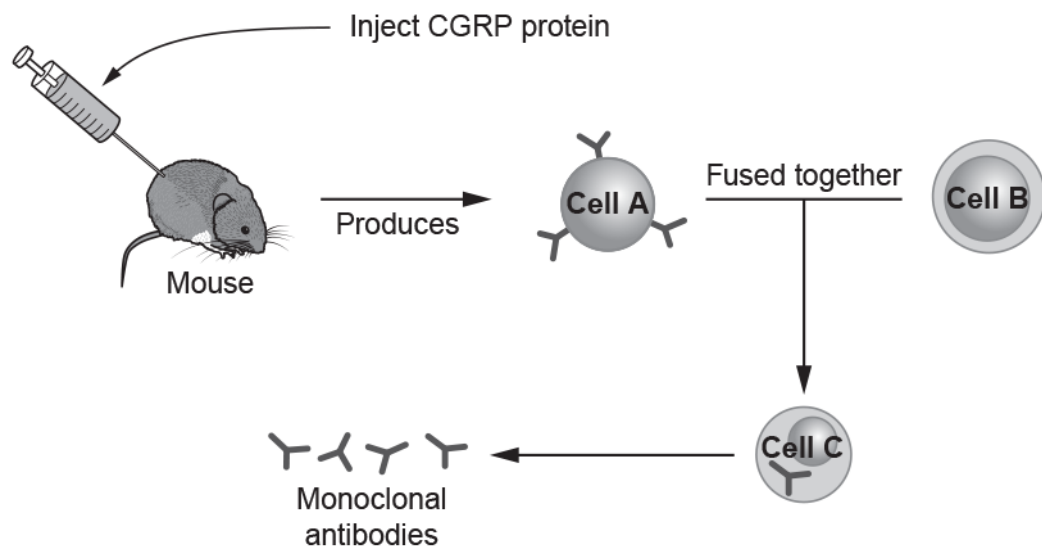
Doctors are trying to find a treatment to prevent migraines.

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]

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.

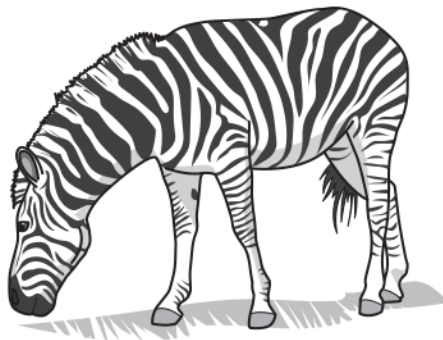


Fig. 23.1

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**.

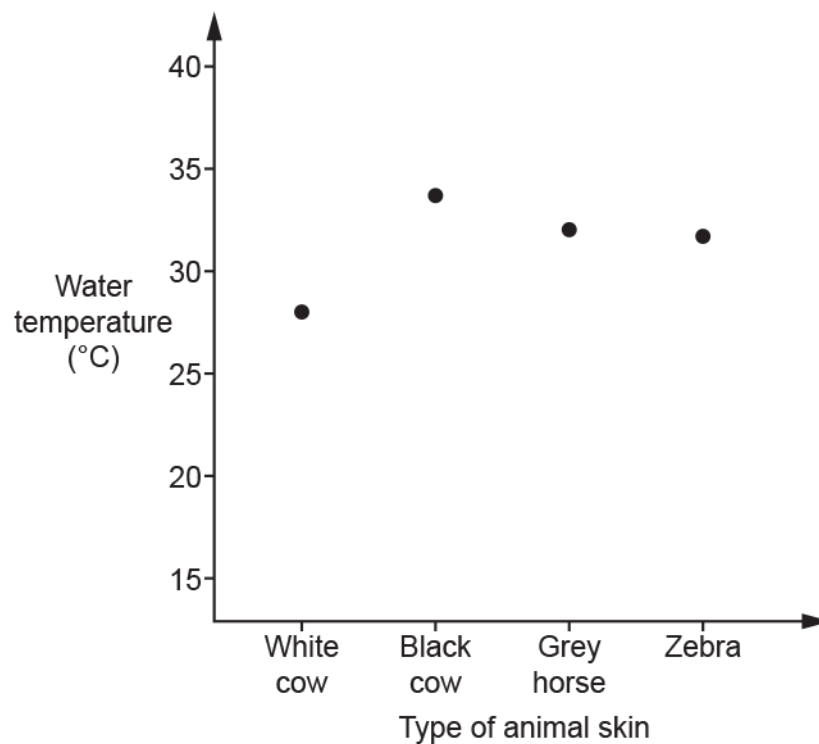


Fig. 23.2

- (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]

- (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.

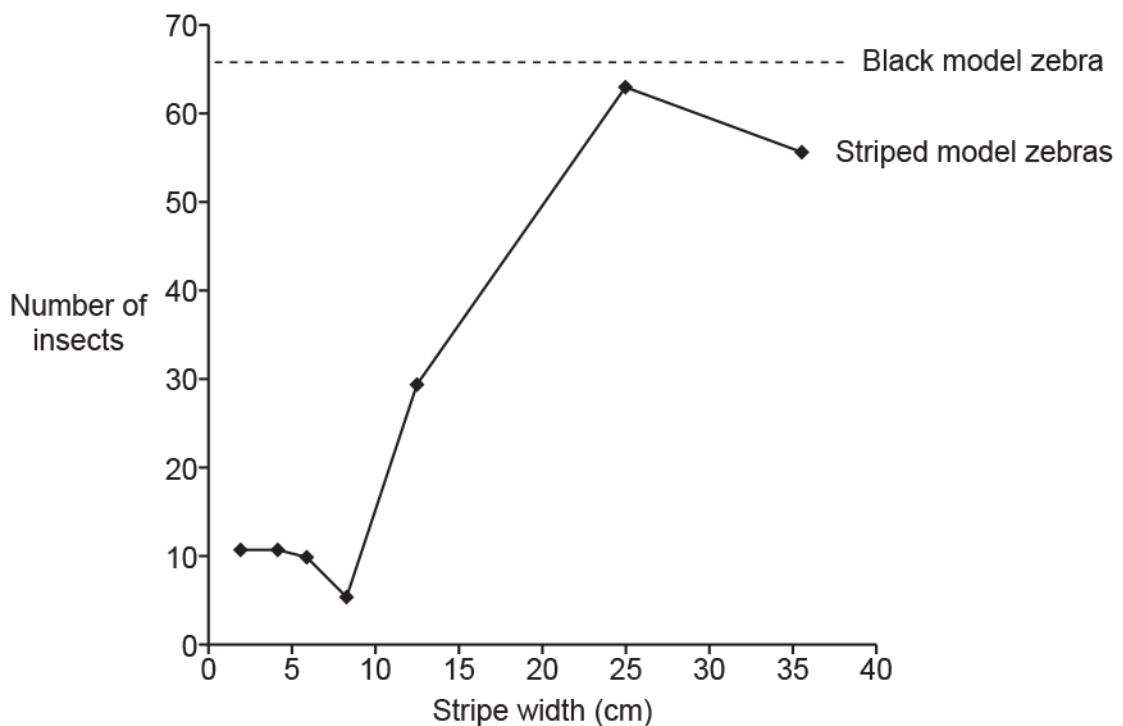


Fig. 23.3

- (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.

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]

- 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?

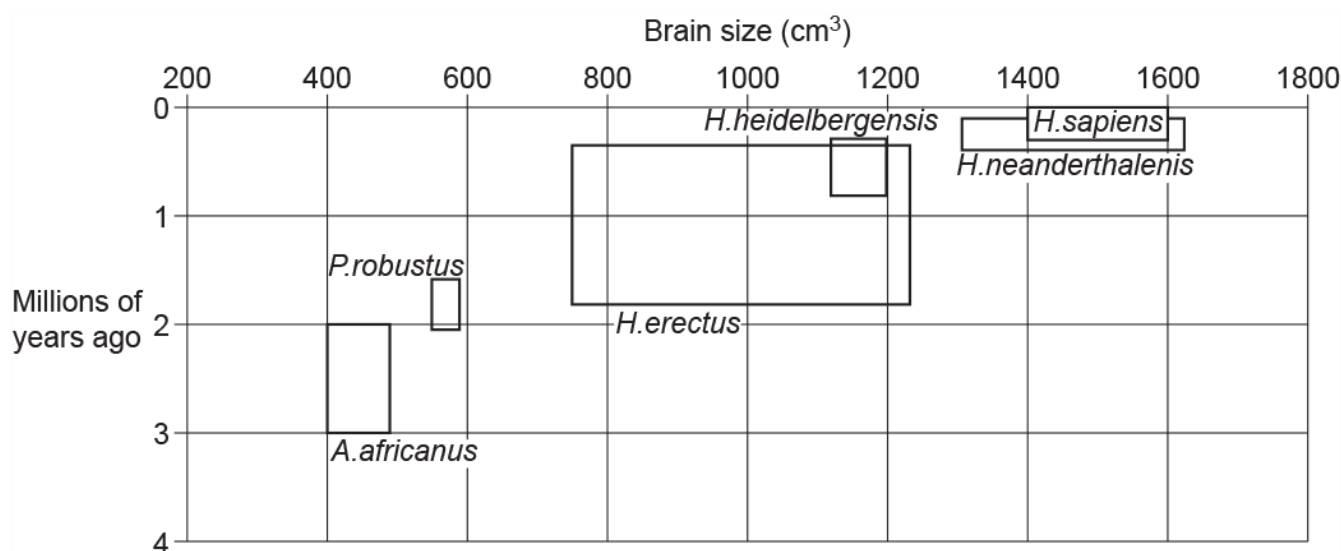
- A Conditions on neighbouring islands are very similar.
- B Different characteristics were observed in organisms on islands compared to the mainland.
- C There are no selection pressures for organisms on islands.
- D There is no competition for food on islands.

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]

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]

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

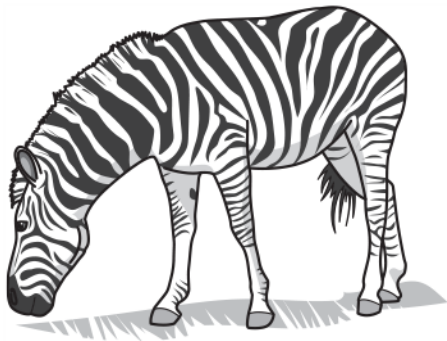


Fig. 17.1

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. 17.2.

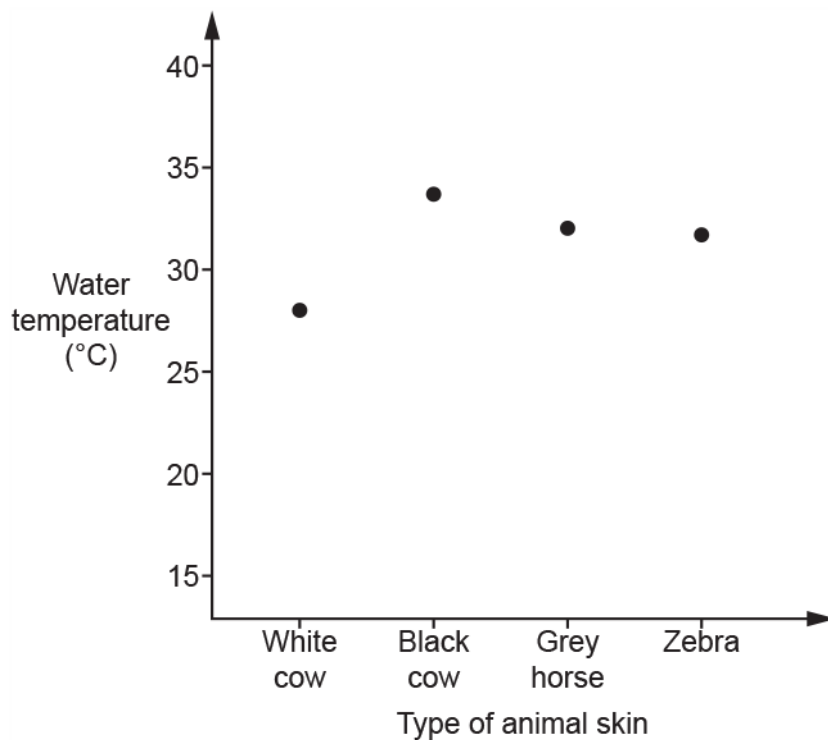


Fig. 17.2

- (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.

----- [1]

(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. 17.3 shows the number of insects that stuck to the tape.

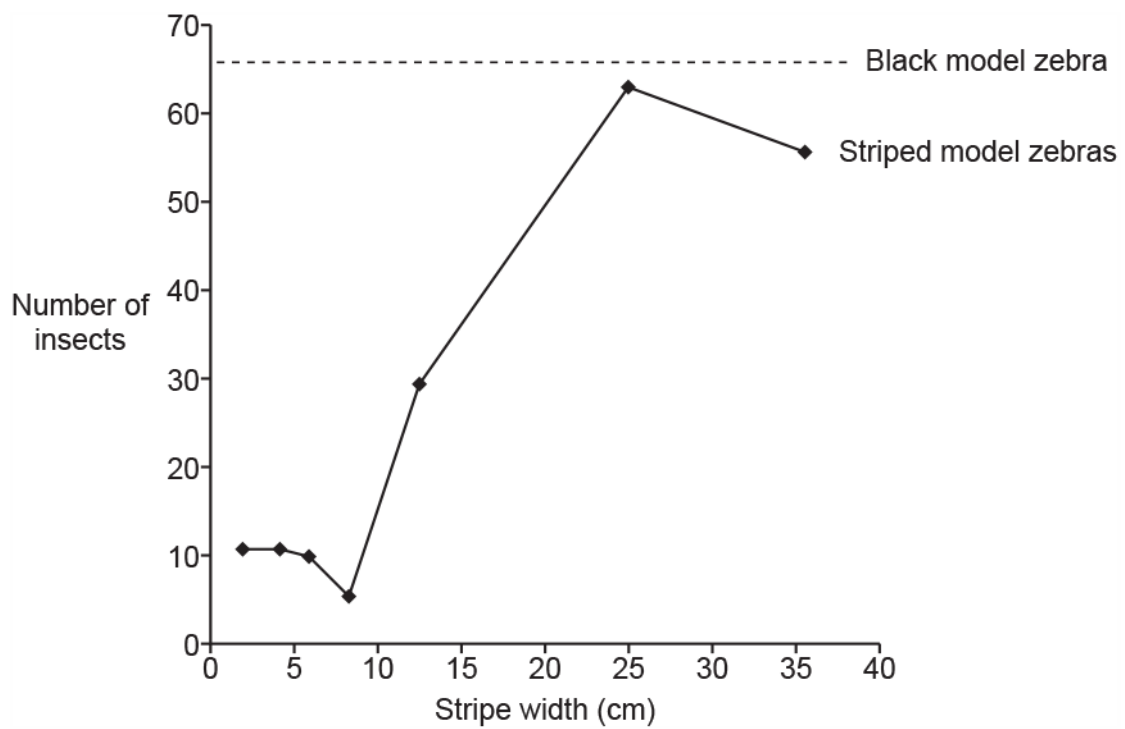


Fig. 17.3

(i) Describe what Fig. 17.3 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. 17.3** 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.

----- [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.

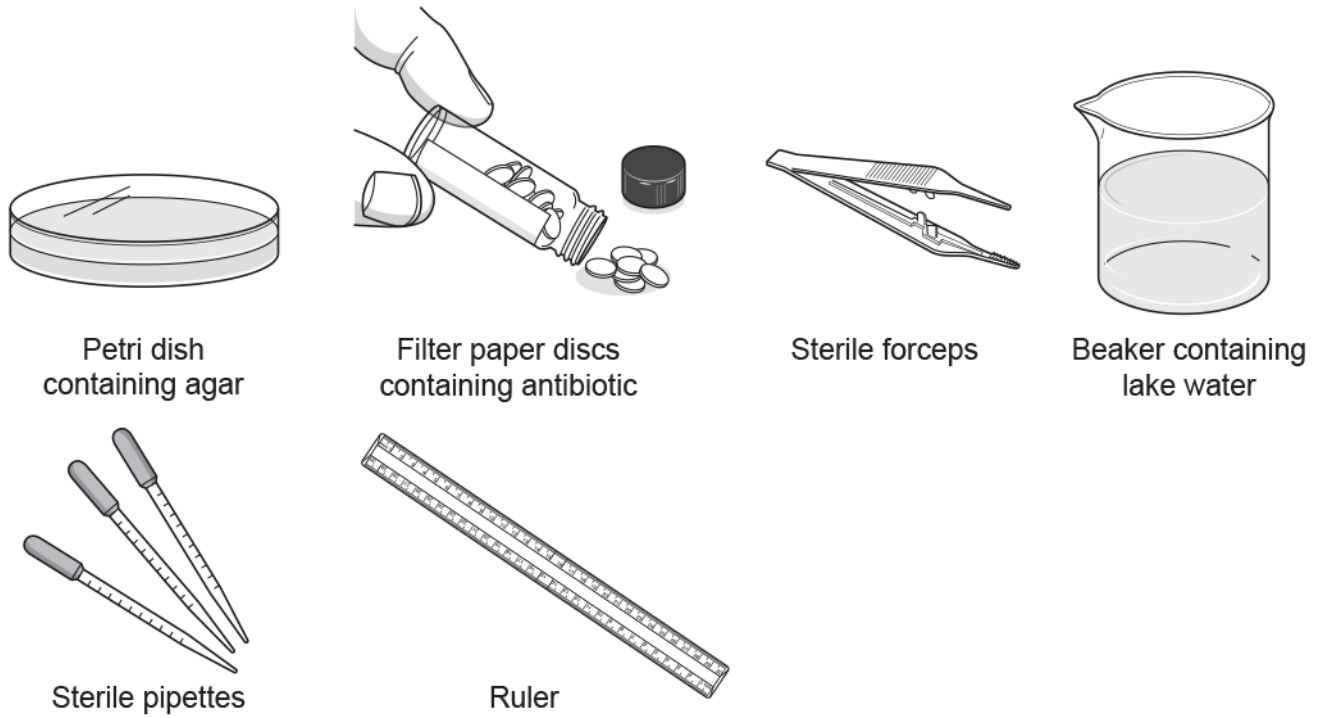


Fig. 22.2

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]

26(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. 16.2** shows the apparatus they use.

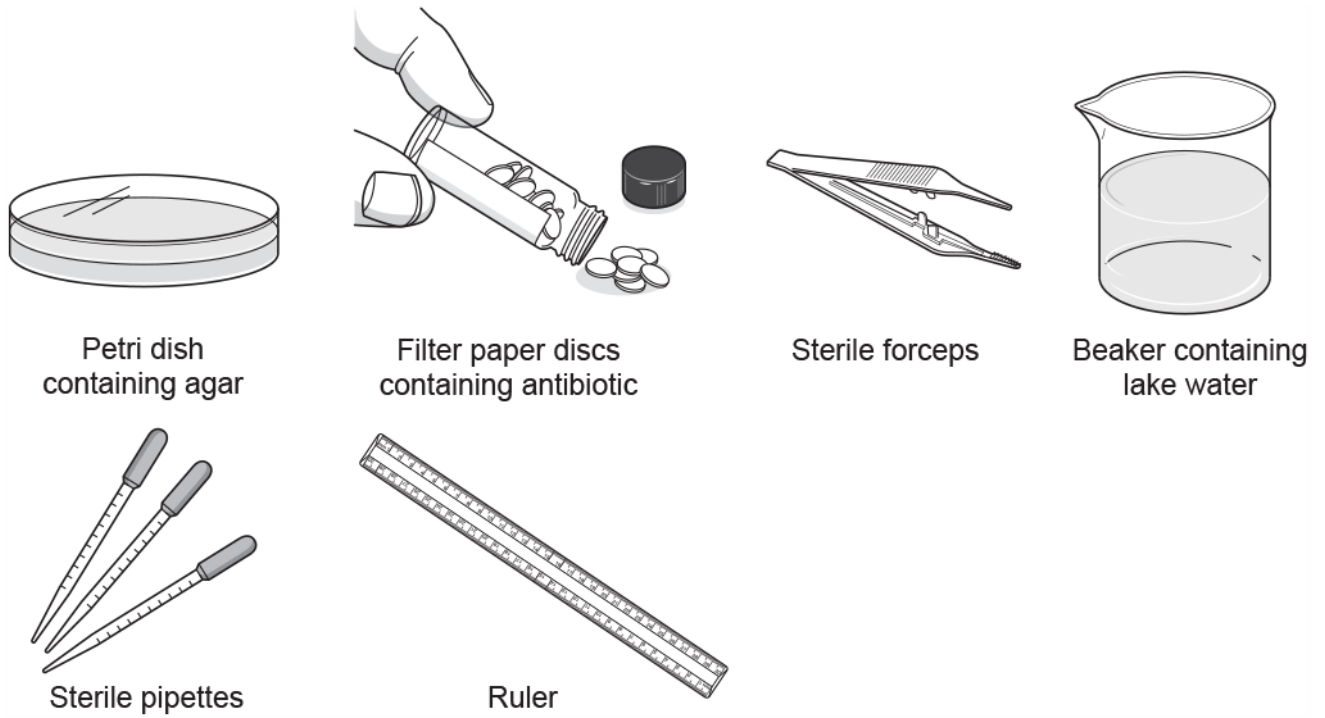


Fig. 16.2

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]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			Total	1	
2			process involves natural selection (1)	1	
			mice fed on by snakes / owls (1)	1	
			black mice less likely to get eaten by snakes / owls (1)	1	
			can pass on the gene for black colour (1)	1	
			Total	4	
3		i	coat is digested (1)	1	
		i	by enzymes present in small intestine (1)	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	* Please refer to the marking instructions on point 10 for guidance on how to mark this question. Level 3 (5–6 marks) Explains the shapes of the two graphs in the effectiveness / safety of the drugs delivery system. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Explains the shapes of the two graphs the total dosage of the drugs. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Simply describes the patterns in the graph. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	AO3.2a: Analyse the information and judge the relative effectiveness of the two delivery systems - links this to the advantages / disadvantages of keeping a steady, intermediate level in the blood - with tablet high levels may be toxic - if reduce the dose, then when levels low it may not kill all bacteria - reference to allowing resistant strains to develop AO2.2: Apply knowledge to demonstrate an understanding of how the capsules and tablets work in delivering the drug - any statement regarding the total dosage for the two delivery methods - dosage rises rapidly because of rapid absorption into the blood stream - dosage falls fast because it is rapidly broken down - capsules allow staggered release of drug dosage - this is because walls are different thicknesses of the capsule - therefore different digestion time - conventional tablet releases drug all at once - tablet may not have a coating AO2.1: Apply knowledge and understanding in reading the graphical information - Simple description of the patterns of the two lines on the graph.
			Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
4			Charles Darwin's observation	2	all four correct = 2 marks three or two correct = 1 mark one or none correct = 0 marks
			Scientists' observation		
			survival of the fittest		
			competition for resources		
			inheritance of successful adaptations		
			presence of natural variation		
			Total	2	
5			Charles Darwin's observation	2	three or four correct = 2 marks two correct = 1 mark one or none correct = 0 marks
			Scientists' observation		
			survival of the fittest		
			competition for resources		
			inheritance of successful adaptations		
			presence of natural variation		
			Total	2	
6	a		the same class, genus and species.	1	more than one answer = 0
			different class, genus and species.		
			same class and genus but different species		
			same class but different genus and species		
	b	i	an artificial (system) (1)	1	
		ii	we use a system based on evolutionary relationships / does not allow any predictions to be made about other characteristics / does not allow any predictions to be made about evolutionary relationships (1)	1	allow DNA / genetics used to classify now allow this classification only uses one characteristic ora allow this classification cannot be based on ancestral relationships ora
			Total	3	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7			C ✓	1 (AO1.1)	<u>Examiner's Comments</u> This question proved to be the most challenging question in section A. Many candidates did not recognise this was an example of natural selection. The most common incorrect answer was genetic modification, answering A instead of C.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
8		i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over by cars ✓	2 (AO 2 × 2.1)	ALLOW in country/advantage/where badgers live hedgehogs have defence against predators/badgers ALLOW hedgehogs have a reduced risk of being eaten <u>Examiner's Comments</u> More than half of candidates achieved at least one mark here. This question differentiated well between all abilities. Those candidates that didn't score did not link the hedgehogs to each conclusion properly. E.g. advantage/in country/where badgers live to correct conclusion. Exemplar 9 was credited 1 mark for the advantage conclusion. Exemplar 9 In country areas, when badgers come to prey on hedgehogs, the hedgehogs have protection, as badgers are protected. They never go to touch the hedgehogs. [2]

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	hedgehogs that run away are more likely to survive / less likely to get run over ✓ they will reproduce ✓ pass on the allele/gene for running away ✓ over time/many generations (running away will become more common) ✓	4 (AO 4 × 2.1)	ALLOW ORA for each marking point ALLOW reference to how change occurred e.g. mutation for running away ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is pass on / genes are passed on Examiner's Comments A number of candidates achieved at least 1 mark, mainly that hedgehogs which run away are more likely to survive. A small number of candidates confused natural selection with genetic engineering. Exemplar 10 shows an answer credited 3 out of 4 marks. Exemplar 10 because these Hedgehogs don't stay still and run away they can't get ran over as easily and they don't get eaten by predators that can get through the spines. This could be natural selection as only Hedge hogs who have survived are able to pass on these genes to offspring. [4]
			Total	6	
9			B ✓	1 (AO1.1)	Examiner's Comments This question tested recall of knowledge AO1.1. Many candidates incorrectly chose C. This was a very common response indicating that candidates knew the names of the scientists involved but thought that Darwin and Wallace worked together on the theory of evolution by natural selection. It is important for candidates to realise that theories can develop with research from scientists who are conducting this work independently.
			Total	1	

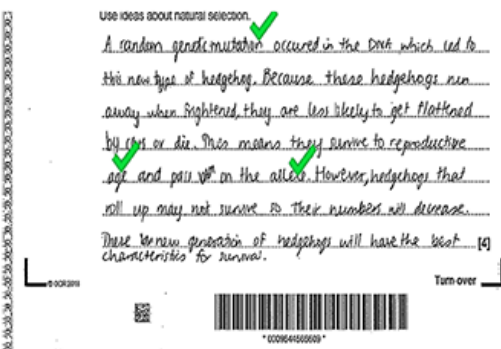
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
10			B ✓	1 (AO1.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
11		i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over by cars ✓	2 (AO 2 × 2.1)	ALLOW in country/advantage/where badgers live hedgehogs have defence against predators/badgers ALLOW hedgehogs have a reduced risk of being eaten <u>Examiner's Comments</u> This AO2.1 question was answered well overall. Candidates did not gain marks if they didn't correctly link their responses specifically to country or city areas. Just referring to roads was insufficient, however, candidates referring to many roads gained a mark as this distinguished the difference between city and country areas. The terms rural and urban were acceptable alternatives to country and city, in candidates' explanations. A common error was to say the rolling up was camouflage without explaining the answer.
		ii	hedgehogs that run away are more likely to survive / less likely to get run over ✓ to they will reproduce ✓ pass on the allele/gene for running away ✓ over time/many generations (running away will become more common) ✓	4 (AO 4 × 2.1)	ALLOW ORA for each marking point ALLOW reference to how change occurred e.g. mutation for running away ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is pass on / genes are passed on <u>Examiner's Comments</u> This application of knowledge of natural selection question usually resulted in candidates gaining at least two marks. This was usually for identifying that the hedgehogs that could run away had a higher survival rate and could go on to breed. Higher ability candidates were able to link this to the advantageous gene and some could refer to the process occurring over time. Fewer candidates scored the last two marking points because they referred not to the advantageous gene, but in general to genes, mutation (not mutated gene) or to the trait or characteristic or behaviour of running away, and, for the last

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					point, stating that because run away hedgehogs survived to breed, their numbers exceeded the numbers of roll up ones, simply because the roll up ones died.  Examination technique needs candidates to focus on applying their knowledge to a new scenario, and to answer the question asked, not to talk in generic terms. Exemplar 1  This candidate has been credited 3 marks. A mark is gained for identifying that a mutation has occurred to produce the running away hedgehog. They have gained a second mark for recognising they survive to reproductive age. Many candidates just referred to breeding or producing offspring which were deemed acceptable responses for that particular marking point. Also a third mark was gained for 'pass on the allele' has been given as they clearly understand that it is referring to the advantage of running away/genetic mutation for the advantageous gene. The candidate has not gained a mark for the new generation of hedgehogs as this does not reference the idea of the process repeating over several generations/overtime.
			Total	6	

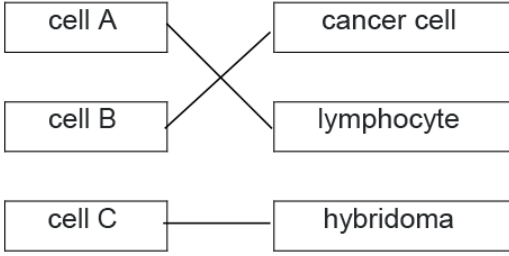
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
12			D	1 (AO 2.1)	<u>Examiner's Comments</u> Usually candidates scored on this AO2.1 question, choosing D. Candidates who had difficulty applying their understanding often chose B, incorrectly linking their knowledge of the use of DNA in classification.
			Total	1	
13			C	1 (AO 1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
14			all organisms show variation / mutation causes variation ✓ Any three from: the blue tits with the longer beaks get more food / ORA ✓ they are more likely to survive / ORA ✓ they reproduce and pass on the alleles for longer beaks / ORA ✓ over many generations beak length increases in the blue tit population / ORA ✓	4 (AO 1.1) (AO 2.1 x3)	ALLOW description of variation in beak length in the original population ALLOW the blue tits with the longer beaks get access bird feeders IGNORE pass on genes ALLOW idea of many repeats of cycle <u>Examiner's Comments</u> The AO2.1 aspect to this question was well answered by many candidates. Lower ability candidates wrote a generic description of natural selection, not appreciating they needed to link their answers to blue tits. The first AO1.1 marking point was often missed, with most candidates limiting their marks by not mentioning mutation or variation. Most candidates were able to say that the longer beaks could better access food, leading to better chance of survival. Even the higher ability candidates were not able to distinguish between gene and allele and many referred also to the passing on of characteristics, phenotypes or traits instead of the allele. It is important that candidates demonstrate an understanding that the specific allele is passed on during reproduction, rather than just referencing the gene. Very few candidates explained the change in the allele frequency over many generations, and loose descriptions such as eventually, overtime or a few generations did not score.
			Total	4	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15			 <pre> graph LR A[cell A] --- AC[cancer cell] B[cell B] --- BL[lymphocyte] C[cell C] --- CH[hybridoma] </pre>	2 (AO 1.1)	all correct = 2 marks one or two correct = 1 mark <u>Examiner's Comments</u> The vast majority of candidates managed to score both marks on this AO1.1 question.
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
16	a		clots the blood ✓ prevents bleeding / allows wounds to heal / forms a scab ✓	2 (AO 1.1)	IGNORE clump blood ALLOW prevents pathogens getting into the body <u>Examiner's Comments</u> There was some confusion in the responses describing the role of platelets whereby candidates thought platelets had a role in the specific immune response. Only higher ability candidates gained a mark here.
	b		R r R RR Rr r Rr rr Rr ratio 3 : 1 ✓ ✓ ✓	3 (AO 2.1) 	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		Any three from: variation with some rats resistant and some who are not ✓ (resistant rats) more likely to survive/less likely to be killed ORA ✓ (resistant rats more likely) reproduce ORA ✓ pass on the allele / gene for resistance ORA ✓	3 (AO 2.1)	IGNORE selective breeding ALLOW mutation for resistance ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on <u>Examiner's Comments</u> Candidates had to apply their knowledge of natural selection to explain why the percentage of resistant rats was increasing. There were a range of marks given for this question. Most none scoring responses were too vague and not using key terms. Most candidates did not appreciate that there was variation for resistance within the population.
	d		Any two from: (stops/less) respiration ✓ (no/less) energy/ATP ✓ key process interrupted e.g. cell metabolism/protein synthesis/chemical reactions/active transport ✓	3 (AO 2.1)	<u>Examiner's Comments</u> This question was one of the most challenging application of knowledge and understanding questions. The most common awarded mark was appreciation that energy release would be affected. A lot of responses were very general and would say the rat can't breathe or can't get any oxygen.
			Total	11	
17			A ✓	1 (AO1.1)	
			Total	1	
18			B ✓	1 (AO1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
19	a	i	Yes (no marks) cooler than black/grey skin OR Yes (no marks) lighter skin is cooler OR No (no marks) zebra skin was similar temperature to the other barrels OR No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours OR idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	ALLOW use painted towels to cover barrels ALLOW for same type of skin e.g. hair-free skin
	b	i	Any two from: zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	2 (AO2 x 3.1a)	ALLOW insect bites for insects IGNORE length of stripe ALLOW width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	ALLOW width tolerance between 7-9cm and least number of insects (on tape)

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	Any three from: stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	ALLOW some more striped than others ALLOW offspring produced / breed together IGNORE selective breeding ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on IGNORE over time
			Total	8	
20			C ✓	1 (AO1.1)	
			Total	1	
21			B ✓	1 (AO1.1)	
			Total	1	
22			C ✓	1 (AO2.1)	
			Total	1	
23			C ✓	1 (AO1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
24	a	i	Yes (no marks) cooler than black/grey skin OR Yes (no marks) lighter skin is cooler OR No (no marks) zebra skin was similar temperature to the other barrels OR No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours OR idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	ALLOW use painted towels to cover barrels ALLOW for same type of skin e.g. hair-free skin
	b	i	Any two from: zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	2 (AO2x3.1 a)	ALLOW insect bites for insects IGNORE length of stripe ALLOW width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	ALLOW width tolerance between 7-9cm and least number of insects (on tape)

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	Any three from: stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	ALLOW some more striped than others ALLOW offspring produced / breed together IGNORE selective breeding ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on IGNORE over time
			Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
25	a		idea that water is added from (each) lake to a (separate) Petri dish using (sterile) pipette ✓ filter paper/antibiotic disc is placed in (the centre of) each dish with the (sterile) forceps ✓ Petri dishes are incubated ✓ idea that the inhibition zone/clear area/area with no bacteria growth around the discs is measured ✓	4 (AO4 x 1.2)	ALLOW idea of repeats ALLOW idea of setting up a control
	b		Lake Bellandur– no mark Any two from: more (antibiotic) resistant bacteria / more species of bacteria are resistant to antibiotics / ORA ✓ Lower number of bacteria killed by antibiotics / less species of bacteria killed by antibiotics / ORA ✓ this lake contains a higher ratio of resistant bacteria compared to bacteria killed by antibiotics✓ (antibiotic) resistant bacteria more likely to survive/reproduce with more (antibiotic) pollution ORA✓	2 (AO2 x 3.2a)	Incorrect or no lake given then no marks ALLOW bacteria are more resistant (antibiotic) DO NOT ALLOW more resistant to bacteria IGNORE immune ALLOW only 28 species are killed ALLOW idea of natural selection causing increased resistant bacteria with more (antibiotic) pollution
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
26	a		idea that water is added from (each) lake to a (separate) Petri dish using (sterile) pipette ✓ filter paper/antibiotic disc is placed in (the centre of) each dish with the (sterile) forceps ✓ Petri dishes are incubated ✓ idea that the inhibition zone/clear area/area with no bacteria growth around the discs is measured ✓	4 (AO4 x 1.2)	ALLOW idea of repeats ALLOW idea of setting up a control
	b		Lake Bellandur– no mark Any two from: more (antibiotic) resistant bacteria / more species of bacteria are resistant to antibiotics / ORA ✓ Lower number of bacteria killed by antibiotics / less species of bacteria killed by antibiotics / ORA ✓ this lake contains a higher ratio of resistant bacteria compared to bacteria killed by antibiotics✓ (antibiotic) resistant bacteria more likely to survive/reproduce with more (antibiotic) pollution ORA ✓	1 (AO2 x 3.2a)	Incorrect or no lake given then no marks ALLOW bacteria are more resistant (antibiotic) DO NOT ALLOW more resistant to bacteria IGNORE immune ALLOW only 28 species are killed ALLOW idea of natural selection causing increased resistant bacteria with more (antibiotic) pollution
			Total	6	