OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

B5.2 NATURAL SELECTION AND EVOLUTION

SCORE	PERCENTAGE
/88	%

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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	

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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.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2** **(3–4 marks)** **Explains the shapes of the two graphs the total dosage of the drugs.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1** **(1–2 marks)** **Simply describes the patterns in the graph.** *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.* **0 marks** *No response or no response worthy of credit.*	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**	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td></td><td></td><td>
<table>
<tr><th>Charles Darwin's observation</th><th>Scientists' observation</th></tr>
<tr><td>survival of the fittest</td><td>C</td></tr>
<tr><td>competition for resources</td><td>B</td></tr>
<tr><td>inheritance of successful adaptations</td><td>D</td></tr>
<tr><td>presence of natural variation</td><td>A</td></tr>
</table>
</td><td>2</td><td>all four correct = 2 marks
three or two correct = 1 mark
one or none correct = 0 marks</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>5</td><td></td><td></td><td>
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<tr><td>6</td><td>a</td><td></td><td>
<table>
<tr><td>the same class, genus and species.</td><td></td></tr>
<tr><td>different class, genus and species.</td><td></td></tr>
<tr><td>same class and genus but different species</td><td></td></tr>
<tr><td>same class but different genus and species</td><td>✓</td></tr>
</table>
</td><td>1</td><td>more than one answer = 0</td></tr>
<tr><td></td><td>b</td><td>i</td><td>an artificial (system) (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>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)</td><td>1</td><td>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</td></tr>
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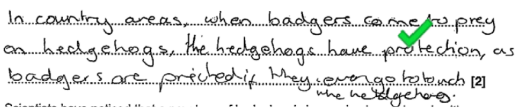
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Question			Answer/Indicative content	Marks	Guidance
7			C ✓	1 (AO1.1)	Examiner's Comments This question proved to be the most challenging question in section A. Many candidates did not recognise this was an example of natural section. The most common incorrect answer was genetic modification, answering A instead of C.
			Total	1	

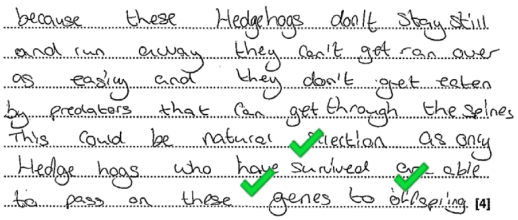
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Question			Answer/Indicative content	Marks	Guidance
8		i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over 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 badges 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 prickly. They can go to bunch the hedgehogs. [2]

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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 <u>Examiner's Comments</u> 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 don't get ran over as easily and they don't get eaten by predators that can get through the selves 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)	<u>Examiner's Comments</u> 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	

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

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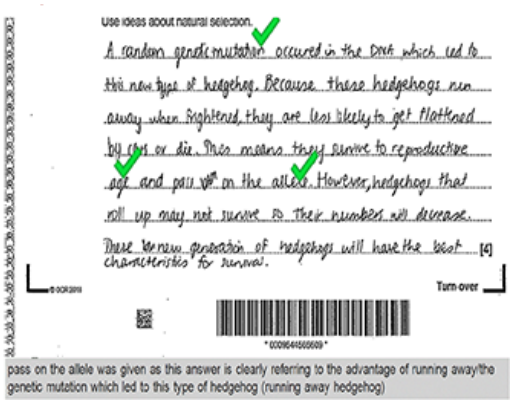
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Question			Answer/Indicative content	Marks	Guidance
11		i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run 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

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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  Use ideas about natural selection. A random genetic mutation occured in the DNA which led to this new type of hedgehog. Because these hedgehogs run away when frightened, they are less likely to get flattened by cars or die. This means they survive to reproductive age and pass on the allele. However, hedgehogs that roll up may not survive so their numbers will decrease. These new generation of hedgehogs will have the best characteristics for survival. [4] Turn over pass on the allele was given as this answer is clearly referring to the advantage of running away/the genetic mutation which led to this type of hedgehog (running away hedgehog) 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	

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Question			Answer/Indicative content	Marks	Guidance
12			D	1 (AO 2.1)	Examiner's Comments 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	

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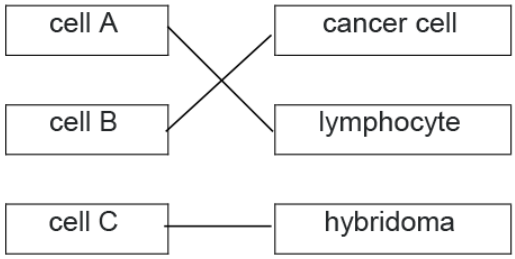
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Question			Answer/Indicative content	Marks	Guidance
14			all organisms show variation / mutation causes variation ✓ **Any three from:** the blue tits with the longer beaks get more food / ORA ✓ they are more likely to survive / ORA ✓ they reproduce 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 Examiner's Comments 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**	

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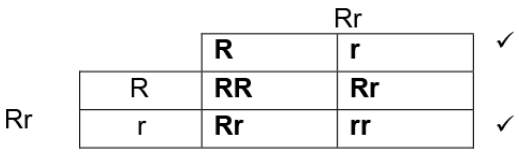
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Question			Answer/Indicative content	Marks	Guidance
15				2 (AO 1.1)	all correct = 2 marks one or two correct = 1 mark <u>Examiner's Comments</u> The vast majority of candidates managed to score both marks on this AO1.1 question.
			Total	**2**	

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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		 ✓ ✓ ratio 3 : 1 ✓	3 (AO 2.1) (AO 3.2b)	correct gametes = one mark correct genotypes of offspring = 1 mark ALLOW ECF for ratio ALLOW 3 in 4 <u>Examiner's Comments</u> The majority of candidates achieved two or three marks correctly identifying the gametes and genotypes. Most went onto correctly identifying the ratio if they achieved the gametes mark. Very few candidates achieved the error carried forward mark.

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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 Examiner's Comments 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)	Examiner's Comments 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**	

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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)

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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**	

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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 (AO2x3.1a)	**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)

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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	

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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	

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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**	

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