AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.6.2.2

Evolution

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**6**
Available paper years	**2018–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.6.2.2 Evolution

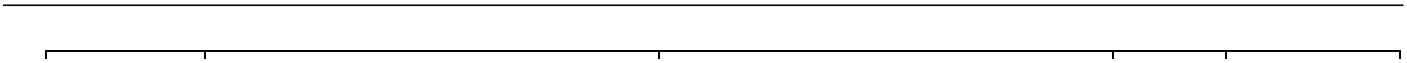
Answer 01 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
02	**Level 3:** Relevant points (advice / reasons) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (advice / reasons) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2 AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content **precautions with reasons** • do not prescribe fluroquinolone / antibiotics for mild infections • because they will get better due to the body's normal immune system • do not prescribe fluroquinolone / antibiotics for viral infections / colds / flu • because antibiotics do not kill viruses • if you do prescribe fluroquinolone / antibiotics make sure the patient finishes the course • because any bacteria left may develop resistance, survive and reproduce rapidly (due to lack of competition) • only prescribe fluroquinolone if the patient has the new strain • because routine use would lead to an increase in resistant bacteria **other relevant content** • doctors and nurses in the practice / hospital should be using antibacterial / alcohol hand wash between each patient **and / or** disinfectant to clean wards • to kill (resistant) bacteria • doctors should isolate patients with this strain of bacteria • to prevent other patients getting the resistant infection		4.6.3.4 4.3.1.8
Total		**6**	

4.6.2.2 Evolution

Answer 01 · Mark scheme

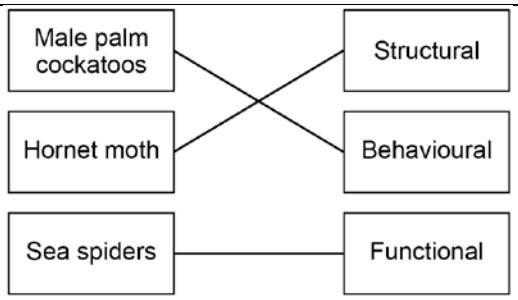
June 2018 | 8464/B/2H | Original Q2



4.6.2.2 Evolution

Answer 02 · Mark scheme

June 2019 | 8464/B/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec.
04.1	 all correct for **2** marks allow **1** mark for one or two correct line(s) additional lines from a box on the left negates the mark for that box		2	AO2 4.7.1.4
04.2	any **four** from: • growing on other plants means support to absorb more light (for photosynthesis) • bright colours attract pollinators **or** bright colours attract insects to transfer pollen • large quantities of pollen (increases the likelihood of pollen transfer) and so more seeds / reproduction • tiny / light seeds will travel long distances to grow in new areas • many seeds mean many new plants so will out-compete other species	allow to obtain water / minerals / ions / glucose from the other plant ignore nutrients allow fertilisation for transfer of pollen allow tiny / light seeds will travel away from competitors allow many seeds so more (orchids) will survive	4	AO2 4.7.1.4 4.7.1.1 4.4.1.1

4.6.2.2 Evolution

Answer 02 · Mark scheme

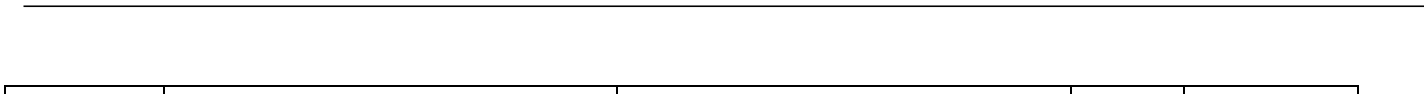
June 2019 | 8464/B/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	any **four** from: • mutations for purple flower (in ancestral species) • isolation **or** change in environment e.g. area had more insects • (plants with purple flowers) survive and breed • (plants with purple flowers) pass on allele / gene / DNA / mutation • until they were so different they could no longer interbreed (with the ancestral species)	allow genetic variation gives purple flowers allow purple orchid more suited to a new environment allow genetic material for allele allow breed successfully for interbreed	4	AO2 4.7.1.4 4.7.1.1 4.4.1.1
04.4	species **D** because it has the lowest number of amino acids different (in the sequence) **or** because it has the lowest number of differences in the sequence **or** only one / sixth amino acid is different	must be an attempt at an explanation to gain this mark allow because it has the highest number of amino acids which are the same (in the sequence) allow because it has only one difference in the sequence allow only the glycine / gly has been changed to tyrosine / tyr	1 1	AO3 4.6.4 4.6.1.3 4.6.1.4
Total			**12**	

4.6.2.2 Evolution

Answer 02 · Mark scheme

June 2019 | 8464/B/2H | Original Q4



4.6.2.2 Evolution

Answer 03 · Mark scheme

November 2021 | 8464/B/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	13.55 (mm) **and** 13.60 (mm)		1	AO2 4.6.2.2
	$\frac{13.60\ (mm) - 13.55\ (mm)}{2000 - 1984}$	allow $\frac{0.05}{16}$ allow correct working from other pairs of readings	1	
	0.003125 (mm/year) **or** 3.125×10^{-3} (mm/year)	allow correct answer from other pairs of readings allow a correct answer given to any number of significant figures	1	

4.6.2.2 Evolution

Answer 03 · Mark scheme

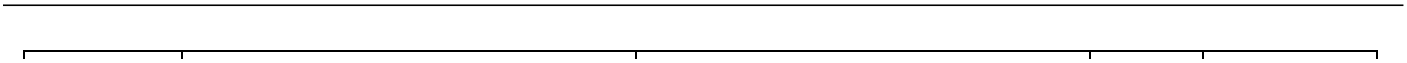
Question	Answers	Mark	AO / Spec. Ref.
04.2	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content • there is variation in beak length (in this bird population) • variation is due to mutations • beak length is controlled by gene(s) • birds with longer beaks can reach more nuts / food **or** birds with longer beaks can fight with **or** outcompete birds with shorter beaks • therefore have more energy from food • so can produce more offspring **or** reproduce more • those offspring that inherit the long beak allele more likely to survive • which is natural selection • pass allele **/** gene (for long beak) on • repeated over many generations • birds are evolving to have longer beaks For **Level 3** detail of process of evolution must be linked to beak length **and** implication of several generations is required.		4.6.2.1 4.6.2.2

04.3		allow converse if clearly referring to human evolution		AO2
	shorter life cycle / span	ignore shorter life	1	AO2
	more offspring		1	AO3
	(so) the genetics of the population changes faster		1	4.6.2.2 4.6.3.1
		allow effect of mutations seen sooner / faster **or** humans can see evolution in birds during the course of a human life(time)		
		allow more fossil evidence		
04.4	similar / same phenotype		1	AO1 4.6.2.2
	similar genotype / DNA (profile)		1	4.6.3.1
	(can reproduce / breed and) produce fertile offspring		1	
Total			**15**	

4.6.2.2 Evolution

Answer 03 · Mark scheme

November 2021 | 8464/B/2H | Original Q4



4.6.2.2 Evolution

Answer 04 · Mark scheme

June 2023 | 8464/B/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	humans have not found evidence of every species		1	AO3 4.6.3.2 4.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	fossils	allow fossil record allow remains of organisms allow DNA do **not** accept fossil fuels	1	AO1 4.6.3.1 4.6.3.2 4.6.3.3

4.6.2.2 Evolution

Question	Answers	Mark	AO / Spec. Ref.
02.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	

	Indicative content
	Methods of reducing rate of evolution and linked explanation
	• doctors should not prescribe antibiotics inappropriately
	  ○ so fewer *C. difficile* are exposed to antibiotic(s)
	• do not use antibiotics to treat mild (bacterial) infection
	  ○ because the immune system can respond (to mild bacterial infection)
	• do not use antibiotics to treat (any) viral infections
	  ○ because antibiotics do not kill viruses
	• patients should complete their course of antibiotics
	  ○ so (more likely that) all *C. difficile* are killed
	  ○ so none survive to mutate (and form resistant strains)
	• the agricultural use of antibiotics should be restricted
	  ○ so fewer *C. difficile* are exposed to antibiotic(s)
	• hand washing after going to toilet
	  ○ will reduce spread of *C. difficile*
	• people with diarrhoea / *C. difficile* should stay away from school / work
	  ○ to reduce spread of *C. difficile*
	• develop new antibiotic against *C. difficile*
	  ○ so all *C. difficile* are killed
	  ○ so none survive to mutate and form (another) resistant strain
	• develop vaccine against *C. difficile*
	  ○ would decrease the use of antibiotics
	For **Level 3**, answers must refer to method(s) and linked explanation(s).
			4.6.3.4
			4.6.3.1
			4.6.2.2

Total Question 2	**8**

4.6.2.2 Evolution

Answer 05 · Mark scheme

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(more) thyroxine secreted / released from thyroid (gland)	allow (more) thyroxine is produced / made / created **alternative answer** (more) adrenaline secreted / released / produced / made / created (1) from adrenal gland (1)	1 1	AO1 4.5.3.6

Question	Answers	Mark	AO / Spec. Ref.
04.2	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2
	No relevant content	0	
	Indicative content **trends** • percentage of population with resistance increased for 6 months **or** percentage of population with resistance increased when warfarin was given • then decreased after warfarin stopped being given • the decrease is slower than the increase • the change from increase to decrease is not instant (when warfarin stops being given at 6 months) • manipulated figures **increase explanations** • some rats have allele(s) / gene(s) for resistance to warfarin • this is due to (random) mutation(s) • (therefore) more likely to survive if warfarin is being used • rats with resistance reproduce • passing on allele / gene (for resistance) to next generation • repeats for several / many generations until all / most of population is resistant • several generations within 6 months **decrease explanations** • when warfarin is not used, rats with resistance are outcompeted for food / mates / territory / shelter by non-resistant rats • rats with resistance are killed by larger non-resistant rats • (therefore) rats without resistance become more likely to reproduce For **Level 3**, answers must explain increase **and** decrease in percentage of population resistant to warfarin.		4.6.2.2 4.6.3.1 4.6.3.4

Total Question 4	8

4.6.2.2 Evolution

Answer 06 · Mark scheme

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	behaviour(al)	allow functional	1	AO2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	any **two** from: • (new) predators • (new) disease / pathogen • competition for food • lack of mates	ignore habitat ignore competition unqualified allow hunters / poachers allow named example allow lack of food allow competition for mates	2	AO1 4.6.3.3 4.7.1.3

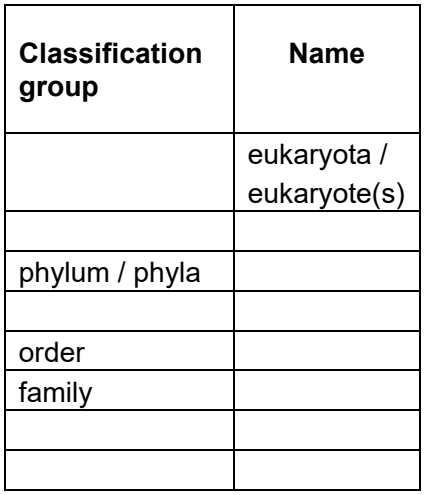
4.6.2.2 Evolution

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		allow skeleton **or** hard parts for bones throughout ignore compression ignore reference to oxygen		
	(plesiosaur) died and sank (to bottom of ocean / sea)		1	AO2
	any **two** from: • (plesiosaur died and) is buried in sediment / sand / mud / silt	do **not** accept plesiosaur (died and) is buried in rock(s)	2	AO1 4.6.3.2
	• (only) soft parts decayed / eaten **or** bones were not decayed / eaten			
	• bone(s) / remains replaced by minerals	allow mineralisation of bones allow bone(s) left imprint in mud / sand / sediment (that then hardened to rock) ignore bones turned to stone / rock		

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	any **two** from: • fossil record may be incomplete • DNA will be destroyed by fossil formation • no evidence of soft tissues which are decomposed (before fossilisation) • only able to study phenotype (from fossils)	allow not all fossils have been found allow (some) fossils may have been destroyed allow there are not enough fossils (to study) allow chromosomes / genes / alleles will be destroyed by fossil formation allow fossils do not contain DNA / chromosomes / genes / alleles allow only able to study observable characteristics (of bones / skeleton)	2	AO2 4.6.2.1 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5		**2** marks for 4 correct **1** mark for 2 or 3 correct **No** marks for 1 correct ignore italics and upper / lower case letters	2	AO1 AO2 4.6.4

Classification group	Name
	eukaryota / eukaryote(s)
phylum / phyla	
order	
family	

4.6.2.2 Evolution

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	Cryptoclidus eurymerus	ignore italics and upper / lower case letters do **not** accept Cryptoclididae eurymerus	1	AO2 4.6.4

Total Question 5	**11**

4.6.2.2 Evolution

Answer 01 · Examiner comments

June 2018 | 8464/B/2H | Original Q2

Question 2 (standard demand)

02 This was an 'extended response' question, marked using a holistic 'levels of response' mark scheme. Students were asked to explain the advice that doctors should be given to prevent the spread of a new strain of *Pseudomonas*. They were told that infections caused by the strain occurred in hospitals and that they could only be treated with one antibiotic, fluroquinolone.

Most students who took this paper showed good appreciation of how best to prevent the spread of such an infection and achieved at least a level 2 mark (47% of students). There were some excellent answers which easily accessed the highest award within level 3 (2% of students).

Many students failed to supply good biological explanations for the precautions they gave and so restricted themselves to the level 2 criteria of attempted logical linking and a not fully clear account. Common examples of this were references to bacteria becoming 'immune' to the antibiotic, or even the patient becoming immune to the antibiotic and the bacteria becoming 'stronger' if they were not all killed. Basic hygiene rules to 'stop the spread' as given in the stem were restricted to level 1. Many students gave no relevant content (0 marks) because they suggested that all hospital patients, or everyone in the world, should be given the new antibiotic. Many thought that it should be used as a vaccine to immunise everyone.

There were several misunderstandings:

- The question asked for advice that should be given to doctors. Answers based on advice to patients rarely gained above level 1. Doctors are not responsible for developing vaccines, so answers that focused on this alone could not be given credit.
- Answers that suggested that 'everyone should be given antibiotics' because they are a protective, preventative measure were inappropriate.
- Bacteria may develop resistance to an antibiotic but not 'immunity'. Some students also implied that that any bacteria remaining after use of antibiotics might simply be 'stronger'.
- Some students believed that the 'patient' developed resistance to the antibiotic or that the 'antibiotic became resistant to the bacteria', as opposed to the resistance being developed 'by the bacteria' and 'against the antibiotic'.
- Some students thought that antibiotic resistance only developed 'over time' and, therefore, suggested that antibiotics should only be administered for short periods. Others believed that dosage was significant and argued for either small or large doses of antibiotics to be given.

4.6.2.2 Evolution

Answer 02 · Examiner comments — June 2019 | 8464/B/2H | Original Q4

Question 4 (standard & standard/high demand)

04.1 Almost all students gained credit for knowing at least one correct adaptation and 78% gained two marks for all correct links.

04.2 This question provided a large range of responses with over half giving one or two correct explanations of the adaptations of orchid plants. The most common was that brightly coloured flowers would attract insects or bees for pollination, but some did not gain the mark as they just stated 'to attract bees' without explaining how this would help the orchid plant. Some students thought the bright colours might be a warning to 'predators'.

Growing attached to other plants could be linked to obtaining more (sun)light or to the symbiotic idea of obtaining water, minerals or glucose, but the vague idea of 'nutrients' is insufficient at this level. Large quantities of pollen needed to be linked to increased reproduction or seeds to gain a mark, and not to attracting insects, so was less often awarded.

A number of students linked the light seeds to wind dispersal but needed to take this further than just 'to spread' and link it to growing in new areas or further away. Thousands of seeds needed to be linked to the idea of a large population able to withstand competition or not face extinction. 12% of students gained three or four marks.

04.3 In the last series most students did not understand selective breeding, but possibly due to emphasis this year by teachers on this topic, many now tried to apply the selective breeding process to this question which is essentially about natural selection and speciation.

Fewer than a quarter of students gained one mark usually for identifying that the purple flower was the result of a (random) mutation. As previously, any indication that the plant 'mutated' itself resulted in this mark not being awarded. The other mark often seen was for the idea that the plant with a purple flower survived and bred.

12% of students were able to continue the process and gain two to four marks. Many missed marks at this stage by referring to asexual reproduction. The final marking point regarding speciation was very rarely seen.

Answer 02 · Examiner comments — June 2019 | 8464/B/2H | Original Q4

04.4 73% of students correctly identified species D as being most like the ancestral species. Those that did not, usually gave species A as it had the same colour flower. 31% of students were able to give a precise reason related to the fact that 9 of the 10 amino acids in the sequence were the same or that there was only one difference in the sequence. Describing this as 'the nearest' or 'most similar' was insufficient.

4.6.2.2 Evolution

Answer 03 · Examiner comments

November 2021 | 8464/B/2H | Original Q4

Question 4 (standard, standard/high and high demand)

Students coped well with the challenging scale of the graph in Figure 4. Generally, the students could read figures from the graph, with most selecting sensible data to use for the rate calculation. The graph was a straight line, so students could use data from any points on the graph to calculate the rate. Higher-attaining students used the data suggested (from 1984 and 2000) which were easier points to read from the graph.

Explanations of the process of evolution that could cause the trend in the graph were often not clear. Inferences that the bird feeder caused beaks of individual birds to grow longer were common. A small proportion of students showed understanding that evolution involves alleles/genes and fewer showed understanding that evolution occurs over many generations.

Students could often make one part of an explanation regarding studying evolution in birds rather than humans. Most frequently, this was an understanding that a shorter life cycle or shorter time before reproducing was relevant. Weaker responses did not go far enough to gain a mark, such as ‘birds don’t live as long as humans’. Very few students could describe evidence that would show that two individual birds are the same species, with answers often being vague, such as ‘both have wings’.

4.6.2.2 Evolution

Answer 04 · Examiner comments

June 2023 | 8464/B/2H | Original Q2

Question 2 (Standard demand)

02.1 In this question students were asked to identify why the percentage of species that are extinct is only an estimate. Over 95% of students gave the correct answer.

02.2 Most students could state that fossils or DNA are used as evidence to study species that have become extinct. References to fossil fuels were seen and did not gain credit. A few students misread the question and gave details of the reasons why species become extinct instead.

02.3 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the three levels of response at the top of the scheme, giving a hierarchy of response. Within each level there are 2 marks.

In this question, students were asked to explain how the evolution of an antibiotic-resistant bacterium could be slowed down. As students were asked to explain how this could be done, it was necessary to link suggested actions with reasons in order to achieve higher level marks.

The question was not asking how antibiotic resistant bacteria evolve in the first place and neither was it about genetic engineering.

Students achieving Level 1 gave simple unconnected but appropriate suggestions such as 'isolation of infected people' or 'don't use antibiotics when not necessary'. To enter Level 2 there had to be evidence of at least an attempt at linking an idea with the underlying reason(s) behind it together with some limited but additional relevant information. To enter Level 3 students had to make several appropriate points as well as show at least one clear, logical link.

The most frequently seen suggestion was that patients should complete courses of antibiotics. This was often correctly linked with the need to kill all *C. difficile* but fewer answers then went on to say that none would therefore (survive and) mutate to form resistant strains.

Simple rewording of the question did not gain credit. Answers that simply said 'so the bacteria would not be able to evolve and become antibiotic resistant' added nothing else to be credited.

Other points that were commonly made included references to isolation of patients and to hand washing. The question context here was of infection of the digestive system by *C. difficile* and, therefore, suitable qualification of hand washing, such as 'after going to the toilet' or 'before preparing food' was required in order for a strong, reasoned link to be credited. Vague answers relating to 'good hygiene' only were insufficient. Some students thought that diet and exercise would kill the bacteria.

Several students made references to doctors not prescribing antibiotics inappropriately but few students went on to explain why. Similarly, the reason for not using antibiotics for mild infections – 'the body's own immune system can respond effectively' – was rarely seen. Students do seem to appreciate, though, that antibiotics cannot kill viruses and so a mention of this linked to no antibiotics being used in such cases often gained credit.

Some answers suggested that new antibiotics might be developed but the idea that antibiotics can be made 'stronger' is incorrect. As with the point about completing courses of antibiotics, the advantage of a new antibiotic would need to be linked to 'all *C. difficile* being killed' or 'none could survive to mutate' in order to gain credit for a linked statement.

Some students commented on developing a vaccine against *C. difficile* but very few then managed to link this to an explanation.

The indicative content in the mark scheme can never cover all ideas that are worthy of credit, but are there to guide examiners. Other ideas such as 'Treatment with several antibiotics at the same time to kill all of them' was another appropriate method with linked explanation.

Many students referred to 'it' in their answer. Sometimes this meant antibiotics and other times this meant bacteria. We always read for context to make sense of the term 'it'.

'Immune bacteria' was not an acceptable alternative to resistant bacteria. It was assumed that bacteria referred to in a response meant *C. difficile*.

0 7 . 3 A bacterium called *Clostridioides difficile* (*C. difficile*) can infect the human digestive system.

C. difficile can multiply and produce toxins. The toxins cause diarrhoea.

Doctors are concerned that new strains of *C. difficile* may evolve.
Antibiotics may **not** be able to kill these new strains.

Explain how the evolution of antibiotic resistant *C. difficile* can be slowed down.

[6 marks]

the evolution of the antibiotic resistant C. difficile can be slowed down by getting people who have it on the antibiotics instantly and make sure they take the full course correctly. Another way to stop the evolution from happening so quick is by quarantining people who have it or have been near someone who had it to stop it spreading and developing fast. also staying out/away from lots of heat as that lets bacteria multiply faster.

The student (from a Foundation tier paper) has given bullet point 7 and then linked bullet points 14 and 15 from the indicative content. This exceeds the minimum requirement to meet the Level 2 descriptor, but does not meet the Level 3 descriptor, therefore 4 marks were awarded.

4.6.2.2 Evolution

Answer 04 · Examiner comments June 2023 | 8464/B/2H | Original Q2

0 2 . 3 A bacterium called *Clostridioides difficile* (*C. difficile*) can infect the human digestive system.

C. difficile can multiply and produce toxins. The toxins cause diarrhoea.

Doctors are concerned that new strains of *C. difficile* may evolve.
Antibiotics may **not** be able to kill these new strains.

Explain how the evolution of antibiotic resistant *C. difficile* can be slowed down.

[6 marks]

Evolution of antibiotic resistant C. difficile can be slowed down if the overuse of the antibiotics used to treat this bacterial disease, is reduced by taking precautions. These might be ~~that's~~ making ~~the~~ the rules for its prescription more strict and actually having the regulations properly in place.
Another way is to encourage people to use full course of their antibiotic treatment even if the symptoms are relieved, because ~~even~~ when it is not used fully, ~~antibiotics~~ bacteria that's left alive can reproduce and develop resistance to the drug which is what ~~it~~ might cause it to evolve.
Also for lighter symptoms, if it is not serious, it might be better for the body to overcome the bacteria by itself to not ~~enter~~ introduce the drug to the bacteria.

The student (from a higher paper) has given bullet point 1 from the indicative content. They link bullet points 7 and 8. In the final paragraph they link bullet points 3 and 4. This exceeds the minimum required for the Level 3 descriptor, therefore 6 marks were awarded.

4.6.2.2 Evolution

Answer 05 · Examiner comments

Question 4 (standard, standard/high & high demand)

04.1 Many students referred to increased adrenaline release as referred to increased thyroxine release. Either approach could gain 2 marks. Some students gave responses that were slightly too vague, such as just 'adrenaline' rather than the idea of 'adrenaline is released'. Some confusion was seen between the thyroid gland, adrenal gland and the pituitary. References to TSH and TRH were seen, but are beyond the specification and this was not required for the award of full marks.

Where students did not gain credit, it was common for them to give answers describing why the BMR had increased in terms of the need to compete for food or the need to gain more energy quicker in order to be able to compete.

04.2 Most students only described the data, and were therefore limited to Level 1. Simply repeating figures from the table could not gain any credit. It was also common for students to link the increase with the idea of resistant rats reproducing, enabling Level 2 to be reached.

It was less common for an appropriate link to be made to a decrease in population. Many students made an attempt at linking the decrease to competition but where this had been attempted, it was often only repeating information given in the stem of the question.

Some students misinterpreted the question and referred to antibiotic resistance, bacteria, and the immune system. It was common to see references to white blood cells and memory cells. Some students did not mention resistance at all, but used 'immunity' instead. Immunity is not synonymous with resistance, therefore credit could not be given for indicative content that referred to immunity. A common misconception was that the warfarin caused a mutation. Some students incorrectly assumed that the table showed the population size.

Where students had attempted to explain the increase by referring to a mutation, it was more common to see them stating that the mutation had been caused by giving warfarin and the need for the rats to adapt. Likewise, there were many references to 'survival of the fittest' and 'natural selection' with no further qualification.

If a student had made any attempt to explain how resistance was passed on to offspring, it was more common for them to express it in terms of 'the resistance' being passed on rather than the gene/allele. A few students attempted to explain trends in terms of dominant/recessive alleles.

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4.6.2.2 Evolution

Answer 05 · Examiner comments June 2024 | 8464/B/2H | Original Q4

Rats with resistance to warfarin have a smaller mean mass than rats that are **not** resistant to warfarin.

Smaller rats are often at a disadvantage when competing against larger rats.

Explain the trends in the data when warfarin was being given and when warfarin was no longer given.

Use **Table 1**.

[6 marks]

- From 0 months when warfin was given only a few amount of rats had resitanse
- From 0 – 4 months where warfain was given shows an increase of rats being resicant to warfan
- Showing how ene rats had a mutation that now allowed more of them to Survive
- At 6 months warfin was stop being given but has reached its peak (more rats are resitance)
- 8 - 12 months decrease of population of rats rescance because warfin wasnt given there was no need for the rats to have that mutation anymore
- 12 months reached the lowest since the start

This student has described both trends, as shown on the indicative content in the mark scheme. They also link the increase in the percentage of the population that are resistant to warfarin with an explanation. This is in the third paragraph.

The student does not explain the decrease when warfarin stopped being given, therefore the response meets and exceeds the generic Level 2 descriptor, but does not match Level 3, therefore 4 marks were awarded.

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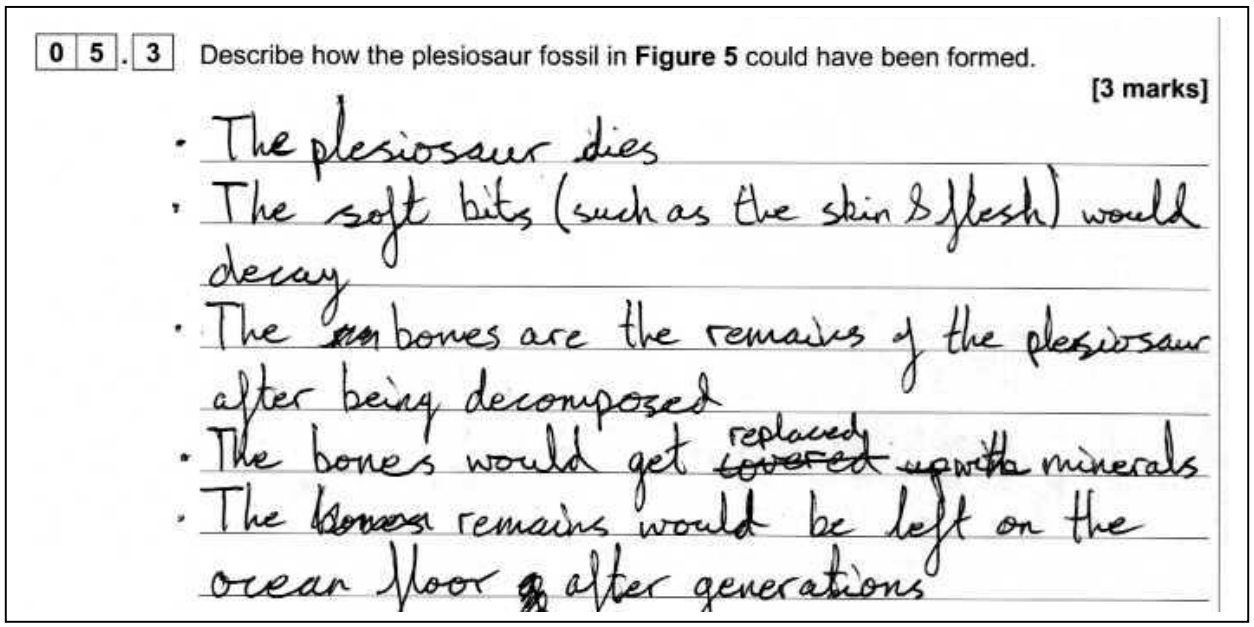
Question 5 (Standard and Standard/High demand)

05.1 This was a poorly answered question with only one third of students giving the correct answer. Environmental, structural and physical were commonly seen wrong answers. Many students didn't give a type of adaptation as the question had asked but instead described the adaptations of the Plesiosaur.

05.2 The majority of students scored 2 marks with marking points 1 and 3 most commonly seen. Many students referred to lack of food or lack of prey as alternatives to competition for food.

A commonly seen error was just stating 'food availability' without linking it to a shortage. Competition unqualified was also another regularly seen answer but did not receive credit as students needed to describe what the competition was for. There was some confusion with abiotic factors such as temperature, oxygen, climate change or space being given by some students.

05.3 Two thirds of students gained one or more mark. Only 8% of students gained three marks. The marking point that the plesiosaur 'died and sank' was rarely seen and this was usually the reason 2-mark answers didn't pick up the 3rd mark as in the example below which scored 2 marks as there was no reference to sinking after dying.



0 5 . 3 Describe how the plesiosaur fossil in **Figure 5** could have been formed.

[3 marks]

- The plesiosaur dies
- The soft bits (such as the skin & flesh) would decay
- The bones are the remains of the plesiosaur after being decomposed
- The bones would get ~~covered~~ replaced with minerals
- The bones remains would be left on the ocean floor after generations

Many students were awarded bullet point 1, for the idea of being buried / covered in sediment (or similar) but some responses incorrectly referred to being buried in rocks which did not allow the mark to be awarded.

Bullet point 2 was often misunderstood as there were lots of references to the body or plesiosaur or bones decaying as students failed to appreciate that only the soft parts decay when fossils form, despite the photograph.

Bullet point 3 was awarded infrequently. Sometimes students had the idea of imprints forming in the 'rock' rather than in mud / sand / sediment. The most commonly seen approach which scored the mark was the idea that minerals replace the bones.

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References to compression or pressure, a lack of decay due to a lack of oxygen and references to other factors needed for decay (such as microbes or higher temperature) were often seen but these were insufficient in the context of this question.

Some students referred to how the fossil could be found and assembled by scientists rather than how the fossil formed, indicating that some students misunderstood the question. Incorrect references to natural selection and evolution were also seen.

05.4 Students found this question challenging. Insufficient responses included 'there not being any plesiosaurs alive' or 'none still living to study', that 'no-one saw them' or 'you couldn't tell how old the fossils were'. There were some vague statements given such as 'lack of evidence'.

Many students referred to DNA not being present but failed to link this idea to DNA being destroyed during the formation of fossils.

05.5 Fewer than 25% of students could complete all four spaces in the classification of the plesiosaur, but a further 30% gained one mark for two or three correct words in the correct spaces. There was frequent evidence of students knowing the first letter of the group, but they got no further, or created words based on this known first letter. Mnemonics were regularly seen, but often without fully correct corresponding responses.

0 5 . 5 **Table 1** shows part of the classification of a plesiosaur.

Complete **Table 1**.

[2 marks]

Table 1

Classification group	Name
Domain	Predator
Kingdom	Animalia
Phylum	Chordata
Class	Reptilia
	Plesiosaur
	Cryptoclididae
Genus	Cryptoclidus
Species	eurymerus

King Philip Came over for Good Soup

The student has learnt a mnemonic, but cannot put this to good use. A response of one word correct out of four did not gain a mark due to the level of demand of this question.

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