AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.6.3.4

Resistant bacteria

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**4**
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.

4.6.3.4 Resistant bacteria

Answer 01 · Mark scheme June 2018 | 8464/B/2F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07	**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**	

4.6.3.4 Resistant bacteria

Answer 02 · Mark scheme

June 2023 | 8464/B/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	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.
07.2	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

4.6.3.4 Resistant bacteria

Answer 02 · Mark scheme

June 2023 | 8464/B/2F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07.3	**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 7	8

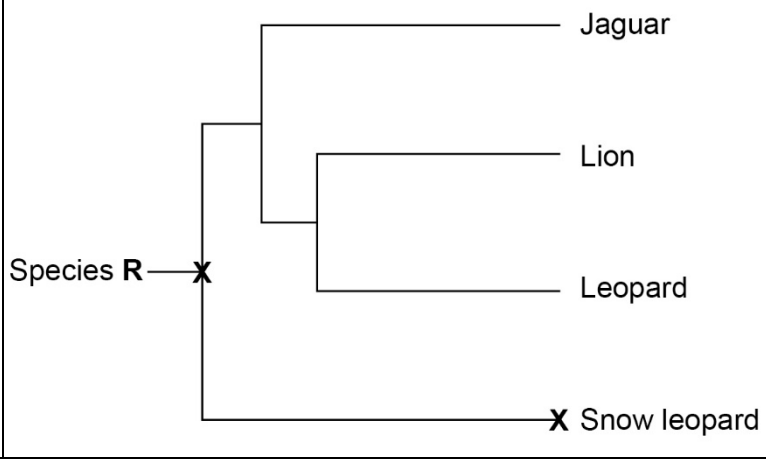
4.6.3.4 Resistant bacteria

Answer 03 · Mark scheme

June 2024 | 8464/B/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	leopard		1	AO2 4.6.4

Question	Answers	Mark	AO / Spec. Ref.
04.2	a branch / line drawn at any point between 'X' marks, labelled 'tiger(s)'  	1	AO3 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	a species that the other species evolved from		1	AO3 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	natural selection		1	AO1 4.6.2.2 4.6.3.1

4.6.3.4 Resistant bacteria

Answer 03 · Mark scheme

June 2024 | 8464/B/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	any **two** from: • drought • ice age • global warming	if none of these awarded allow **1** mark for climate change ignore weather	2	AO1 4.6.3.3
	• volcanic activity • asteroid collision	if neither of these awarded allow **1** mark for catastrophic event **or** natural disaster		
	• (new) predators	allow named example allow hunters		
	• (new) disease / pathogen	allow named example		
	• competition for food	allow lack of food		
	• competition for mates	allow lack of mates ignore competition unqualified		
	• lack of habitat **or** habitat change	ignore environment change ignore isolation ignore pollution		

4.6.3.4 Resistant bacteria

Answer 03 · Mark scheme

June 2024 | 8464/B/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	any **one** from: • if species is extinct • if (fossil) species is unknown • evolution is (usually) slow • (fossils) show (evolutionary) change	ignore fossils are (usually) very old	1	AO1 4.6.4 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	**(D) → B → A → E → C**	allow **1** mark for link **B → A** allow **1** mark for link **A → E** allow **1** mark for link **E → C**	3	AO2 4.6.3.1 4.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	antibiotic resistant bacteria will continue to evolve bacteria reproduce very rapidly		1 1	AO3 4.6.3.1 4.6.3.4

Total Question 4	12

4.6.3.4 Resistant bacteria

Answer 04 · Mark scheme

June 2025 | 8464/B/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	any **one** from: • (skin / body / plesiosaur) decays • skin was not fossilised • not enough evidence • no-one has seen one • fossils are (usually) from bones	 allow (skin / body / plesiosaur) not preserved allow no evidence allow description such as no DNA or no photographs allow no-one was there (at the time)	1	AO2 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(limbs / feet / legs / arms / hands are) flat(tened) / streamlined / paddle-like / wide	allow flippers / fins	1	AO2
	for swimming	allow for movement / propulsion / pushing (through water or out of water onto land) allow to hold on to mate allow to kill prey allow to fight / protect / defend	1	AO3 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	behavioural		1	AO2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	200 (million years ago)	allow two hundred ignore addition of 'million years ago'	1	AO2 4.6.3.2

4.6.3.4 Resistant bacteria

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	130 **and** 180 50 (million years)	allow (one small square is 5 million years, so) 10 × 5 ignore addition of 'million years'	1 1	AO2 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	not all plesiosaur fossils have been discovered some plesiosaur fossils will have been destroyed		1 1	AO2 4.6.3.2 4.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	plesiosaur **B** existed before plesiosaur **C**		1	AO3 4.6.3.1 4.6.3.2

4.6.3.4 Resistant bacteria

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	any **two** from: • bacteria have a short life-cycle (so rapid evolution) • bacteria are continuing to evolve • can study the DNA of bacteria • bacteria are more easily available	allow converse if clearly referring to fossils allow evolution in bacteria is fast(er) allow (many) fossilised species are extinct allow not able to study DNA from fossils allow fossils do not contain DNA / chromosomes / genes / alleles allow many / some fossils have been destroyed allow there are gaps in the fossil record	2	AO3 4.6.3.1 4.6.3.2 4.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.9	(people with infections of antibiotic-resistant bacteria) cannot be treated (with those antibiotics)	allow (antibiotic-resistant) bacteria cannot be killed allow antibiotics will not work allow the infection may kill people allow development of new antibiotic(s) is costly / slow	1	AO3 4.6.3.4

Total Question 4	13

4.6.3.4 Resistant bacteria

Answer 02 · Examiner comments June 2023 | 8464/B/2F | Original Q7

Question 7 (Standard demand)

07.1 In this question students were asked to identify why the percentage of species that are extinct is only an estimate. Over 85% of students gave the correct answer.

07.2 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.

07.3 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.

4.6.3.4 Resistant bacteria

Answer 02 · Examiner comments June 2023 | 8464/B/2F | Original Q7

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' it 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.

4.6.3.4 Resistant bacteria

Answer 02 · Examiner comments June 2023 | 8464/B/2F | Original Q7

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 it~~ 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 ~~the~~ when it is not used fully, ~~antibiotics~~ bacteria that's left alive can reproduce and develop resistance to the drug which is what ~~or~~ 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 ~~antibiotics~~ introduce the drug to the bacteria.

The student (from a Higher tier 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.

4.6.3.4 Resistant bacteria

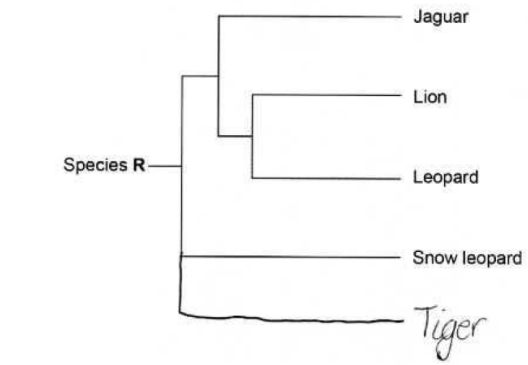
Answer 03 · Examiner comments

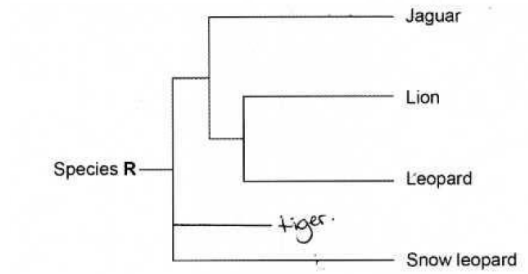
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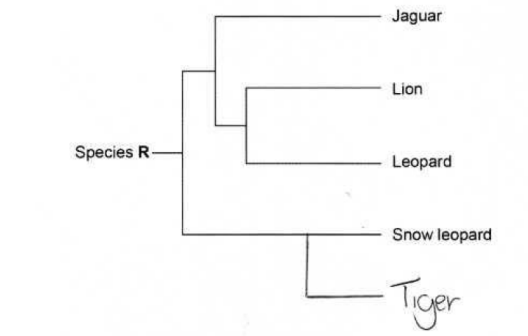
Question 4 (low & standard demand)

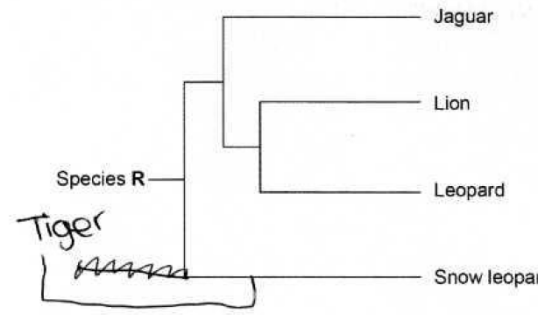
04.1 Most students could interpret the evolutionary tree correctly.

04.2 Most students could add the line and label to the Figure. Students who did not score the mark did not label their line or labelled it incorrectly, 'lion' being frequently used. Other incorrect responses linked their line with other lines on the diagram.







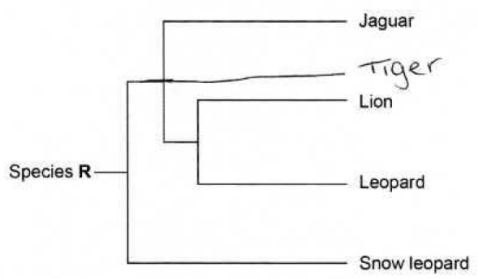


The above examples were correct, even the fourth example despite reading right to left.

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4.6.3.4 Resistant bacteria

Answer 03 · Examiner comments June 2024 | 8464/B/2F | Original Q4



This response is incorrect.

04.3 The majority of students could identify what 'species R' represented.

04.4 Most students knew that evolution occurs by the process of natural selection.

04.5 Many students could give two possible causes of extinction. The most common correct responses described predators or lack of food or loss of habitat.

04.6 Most students expressed their answers in line with marking point 1 or marking point 4, with the majority saying to compare old species with those of today or seeing what they used to look like. Alternatively, for the first marking point students responded 'to see what animals there used to be before they became extinct'.

There was confusion evident in answers, with many students referring to what fossils are or references to history, what life was like in the past or how big/old the fossils were. Some students referred to fossils showing the skeletal structure but didn't compare it to the structure of the species today or discuss any change that could be seen between different fossils.

There were also many responses that referred to fossils being hundreds or thousands of years old or giving us knowledge of species that existed thousands of years ago, which is a misconception regarding geological time.

04.7 Rarely did students score 3 marks for this question, indicating that the process of evolution was not clearly understood. Students frequently linked:

- A to E or E to C
- B to A was less frequently linked.

Some students also included D in their responses even though D had already been given as the first stage.

04.8 More than 50% of students gained both marks here. A significant number of students only ticked one box, or ticked more than two boxes.

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Answer 04 · Examiner comments

June 2025 | 8464/B/2F | Original Q4

Question 4 (Low and Standard demand)

04.1 Many students gave correct ideas about skin decaying, or a lack of evidence. Many students repeated the information provided and simply stated 'they are extinct'. Repeating information provided can never be given credit.

04.2 For marking point 1, students could either describe how structure A was adapted, such as 'wide' or 'paddle-like', or use a term such as fin or flipper.

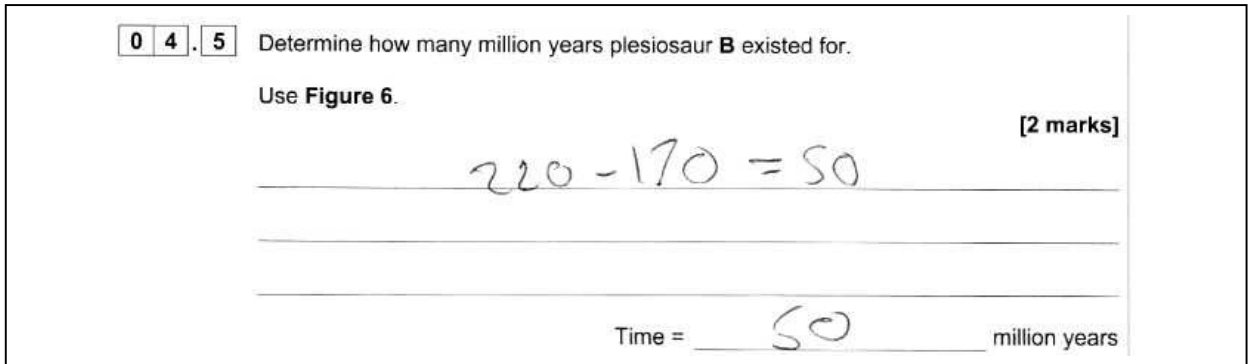
Marking point 2, for the explanation of how the structure would help the plesiosaur survive in the ocean, was more commonly seen than marking point 1.

A surprising number of students thought the label was directed at the neck. These responses could not gain credit.

04.3 Over 60% of students could identify the adaptation as behavioural.

04.4 Two thirds of student correctly interpreted the figure.

04.5 Many students made two correct readings and calculated the number of years correctly. Where errors were made, this was most often for misinterpreting the scale. 170 was frequently seen instead of 180.



This student took two incorrect readings from the figure, therefore gains no marks, despite the final answer given being the same as the mark scheme. They have clearly demonstrated that they reached the answer through an incorrect method.

04.6 Two thirds of students could identify two reasons why the exact date of extinction can only be estimated.

04.7 Almost 70% of students could select the correct statement as evidence.

04.8 The most common correct answer was that (some) fossils have been destroyed. Few students gained both marks.

04.9 Students had difficulty expressing their responses, and again, repeating information from the question was insufficient. Some students were too vague to gain credit, with responses such as 'it makes you ill'. Some misconceptions between antibiotic resistance and the term 'immunity' were seen and some students showed confusion over what was resistant, such as stating that the body is resistant.

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