AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.7.1.3

Biotic factors

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**8**
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.

4.7.1.3 Biotic factors

Answer 01 · Mark scheme June 2018 | 8464/B/2H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	<table><tr><th>Factor</th><th>Biotic</th><th>Abiotic</th></tr><tr><td>Diseases</td><td>✓</td><td></td></tr><tr><td>Herbivores</td><td>✓</td><td></td></tr><tr><td>Temp</td><td></td><td>✓</td></tr><tr><td>Water</td><td></td><td>✓</td></tr></table>	allow **1** mark for 2 or 3 correct	2	AO1 4.7.1.3 4.7.1.2
01.2	(leaves block light near tree so) more light (as you move outwards)	allow low light intensity under tree ignore Sun	1	AO2 4.7.2.1
	for photosynthesis	allow less photosynthesis under the tree	1	AO1 4.7.2.1 4.4.1.1 4.4.1.3
	(which) produces (more) glucose / proteins (for growth)	ignore growth ignore food allow molecules, cell components or other correct substances instead of proteins if no other mark awarded allow less water / ions / minerals / nutrients under the tree	1	AO1 4.7.2.1 4.4.1.1 4.4.1.3
01.3		in this order		AO1 4.7.2.1
	quadrat	correct spelling only	1	
	light meter	allow lux meter allow light intensity meter allow light data logger	1	
01.4	1.5(0) (m^2)	allow 15 000 cm^2	1	AO2 4.7.2.1

4.7.1.3 Biotic factors

Answer 01 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	to keep light (intensity) as similar as possible	allow the light (intensity) might change ignore references to temperature ignore weather ignore Sun	1	AO3 4.7.2.1
01.6	any **one** from: • repeat (investigation) around the tree • repeat (investigation) for other trees / areas • sample every one metre • count the number of each species present (rather than percentage cover)	allow repeat in different directions ignore repeats unqualified ignore repeat at different times / days / seasons ignore different size quadrat ignore random sampling	1	AO3 4.7.2.1
01.7	daisy		1	AO3 4.7.2.1
01.8	as light (intensity) increased so did the percentage / cover of plants up to 100% / maximum at 175 (arbitrary units)	ignore directly proportional ignore positive correlation unqualified ignore distance	1 1	AO3 4.7.2.1

4.7.1.3 Biotic factors

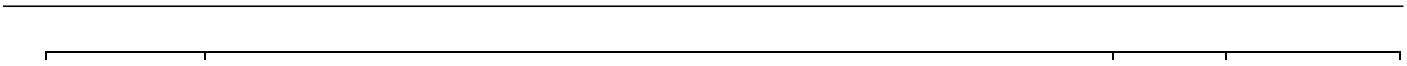
Answer 01 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any pair from: • (lack of) water / rain (1) because the leaves are stopping the rain **or** because the roots of the tree are absorbing it (1) • (lack of) minerals / ions (1) because the tree (roots) have absorbed them (1) • temperature (1) because less thermal energy from the sun is reaching under the tree canopy (1)	ignore carbon dioxide do **not** accept oxygen allow soil moisture allow magnesium / nitrate / nutrients allow too cold / cooler allow 'heat' for thermal energy allow pH / acidity (1) because (some) fallen leaves are acidic (1)	2	AO2 4.7.2.1
Total			**15**	

4.7.1.3 Biotic factors

Answer 01 · Mark scheme

June 2018 | 8464/B/2H | Original Q1



4.7.1.3 Biotic factors

Answer 02 · Mark scheme

June 2019 | 8464/B/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	repeat for another ten quadrats		1	AO3 4.7.2.1
	use a random method to place the quadrats		1	
05.2		an answer of 4.8×10^5 scores **5** marks an answer of 481 766.4 **or** 481 766 **or** 480 000 scores **4** marks an answer of 15 744 × 4 × 7.65 scores **3** marks an answer of 15 744 (m^2) scores **2** marks		AO2 4.7.2.1
	(area of field =) 62 × 164 + 164 × 68 ÷ 2 **or** equivalent		1	
	15 744 (m^2)		1	
	15 744 × 4 × 7.65	allow use of incorrect area allow $\frac{7.65}{0.25} \times 15744$	1	
	481 766.4	allow 481 766 **or** 480 000	1	
	4.8×10^5	allow incorrect calculation expressed correctly	1	

4.7.1.3 Biotic factors

Answer 02 · Mark scheme

Question	Answers	Mark	AO/ Spec. Ref
05.3	**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	AO1
	No relevant content	0	
	Indicative content • trees over / in field • (which) reduce light for photosynthesis • (so) fewer daisies there • trees over / in field • (which) take water / nitrates / ions from the soil • (so) fewer daisies there • trampling on sports pitches • (will) kill plants • (so) fewer daisies there • competition from plants / grasses on field • (will) use up water / nitrates / ions / space • (so) fewer daisies there • gardener may water / fertilise / mow field • (which provides) more water / nitrates / ions • (so) more / fewer daises grow there • more insects / disease / animals in some areas • (may) eat / kill plants • (so) fewer daisies there • school buildings • (which) reduce light for photosynthesis • (so) fewer daisies near school • pollution / toxins from vehicles on roads • (which will) reduce growth • (so) fewer daisies near roads • wrong pH **or** lack of ions **or** poor drainage **or** poor / wet / dry soil in some areas • (which will) slow growth • (so) fewer daisies there Level 3 answers must refer to several factors in accurate detail		4.7.1.1 4.7.1.2 4.7.1.3 4.4.1.1
Total		**13**	

4.7.1.3 Biotic factors

Answer 02 · Mark scheme

June 2019 | 8464/B/2H | Original Q5



4.7.1.3 Biotic factors

Answer 03 · Mark scheme

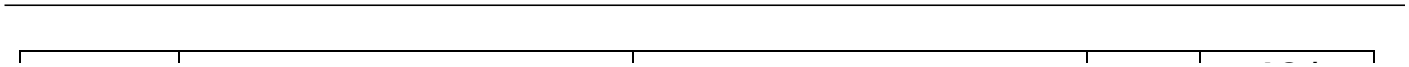
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	the variety of all the different <u>species</u> (of organisms) on Earth **or** the variety of all the different <u>species</u> (of organisms) in a habitat / area / ecosystem		1	AO1 4.7.3.1
03.2	any **one** from: • compost • burning **or** as a fuel	allow to improve soil (texture / drainage / quality) allow to grow food / crops / plants ignore farming unqualified ignore as fertiliser	1	AO1 4.7.3.3
03.3	decay / burning of peat releases carbon dioxide (into the atmosphere) which is increasing global warming	do **not** accept peat bogs release carbon dioxide into the atmosphere allow a description of global warming or consequences if no other mark awarded allow removal of a carbon sink / store for 1 mark	1 1	AO1 4.7.3.3 4.7.3.5

03.4	any **two** from: • takes minerals from the soil as crops are harvested / removed • leads to soil erosion • farmers have to use fertilisers which pollute water / streams / lakes • burning crop waste produces carbon dioxide • using large farm machinery causes soil compaction	ignore nutrients allow burning crop waste causes global warming allow using large farm machinery releases carbon dioxide	2	AO3 4.7.3.2 4.7.3.3 4.7.3.5 4.7.3.6
03.5	antibiotic passed into the environment in animal faeces / urine / sewage **or** antibiotic in animal faeces / urine / sewage flows into rivers		1	AO2
	bacteria in water / land become antibiotic resistant	allow named water or land pathogen such as typhoid / cholera / E coli	1	AO2
	some of these bacteria are human pathogens		1	AO3
	(so) cause (human) diseases which now cannot be cured because they are antibiotic resistant	If no other marks awarded allow 1 mark for mention of antibiotics in milk / meat being consumed by humans.	1	AO3 4.6.3.4 4.7.3.2
Total			**10**	

4.7.1.3 Biotic factors

Answer 03 · Mark scheme

November 2020 | 8464/B/2H | Original Q3



4.7.1.3 Biotic factors

Answer 04 · Mark scheme

June 2022 | 8464/B/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	both have a cell membrane both have cytoplasm		1 1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	any **one** from: • fever • abdominal / stomach cramps	ignore vomiting / sickness / diarrhoea ignore feel unwell unqualified ignore rashes allow high temperature allow sweating / chills	1	AO1 4.3.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	penicillin	allow phonetic spelling	1	AO2 4.3.1.9

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **one** from: • only a few bacteria killed so live bacteria continued to reproduce • time delay before antibiotic reached bacteria • time delay before antibiotic could kill bacteria	allow bacteria reproducing when course started allow takes time (for antibiotic) to travel through the body allow takes time (for antibiotic) to work	1	AO3 4.3.1.1 4.3.1.3 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	there were fewer toxins in the body than at day 0		1	AO2 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	to reduce / prevent resistant strains / bacteria developing **or** to reduce / prevent antibiotic resistance (in bacteria)	ignore references to bacteria becoming immune allow because they will get better without taking any antibiotics ignore body will fight the infection unqualified allow some infections are caused by viruses allow because they have been told not to by NHS / NICE	1	AO1 4.3.1.8

4.7.1.3 Biotic factors

Answer 04 · Mark scheme

June 2022 | 8464/B/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	B		1	AO2 4.2.2.3 4.3.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	D		1	AO2 4.2.2.3

Total Question 1		**9**

4.7.1.3 Biotic factors

Answer 05 · Mark scheme

June 2022 | 8464/B/2H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **one** from: • competition • herbivores • trampling / mowing • pollinators • pathogens	allow other plants / trees (growing in the field) allow named herbivore allow pests allow insects or named pollinator allow infection ignore disease unqualified	1	AO2 4.7.1.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	any **six** from: • mark out (grid) area in wet and in dry area • method for placing quadrat(s) • count / record number of buttercups (in the quadrat) • use at least 5 quadrats in each area • take soil moisture readings • use suitable equipment for readings, eg soil moisture meter • calculate the mean (in each area) • use the mean and area to calculate total number in wet area and total number in dry area **OR** any **six** from (6): • transect between wet area and dry area • place quadrat(s) regularly along transect • count / record number of buttercups (in the quadrat) • use at least 5 quadrats along transect • take soil moisture readings • use suitable equipment for readings, eg soil moisture meter • repeat transects • calculate the mean at each distance along the transects	allow mark out a transect in each of the two areas allow description of a method to place quadrat(s) randomly / systematically do **not** accept throwing quadrats randomly ignore percentage cover of buttercups allow (for each area) total number of buttercups divided by total area sampled, multiplied by total area for **2** marks allow description of a method to place quadrat(s) systematically	6	AO1 4.7.2.1 RPA7

Total Question 3		7

4.7.1.3 Biotic factors

Answer 06 · Mark scheme

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

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

4.7.1.3 Biotic factors

Answer 07 · Mark scheme

June 2025 | 8464/B/1H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	touch / contact (with contaminated surfaces / skin / blisters)	allow through droplets / air / coughs / sneezes ignore sexual intercourse	1	AO2 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(chickenpox) is caused by a virus	allow antibiotics (only) treat bacterial infections allow chickenpox is not caused by bacteria ignore antibiotic resistance	1	AO2 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	inactive / dead / weakened (named) pathogen	allow inactive / dead / weakened virus / bacteria / fungi / microorganism allow proteins / antigens (from the pathogen) allow the mRNA (from the pathogen)	1	AO1 4.3.1.7

4.7.1.3 Biotic factors

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(for) toxicity **or** check not poisonous / harmful	allow check for side-effects allow to check it is safe ignore to check it is not dangerous	1	AO1 4.3.1.9
	(for) efficacy **or** to see if it works		1	
	(for) dose **or** how much is needed		1	
		allow interaction with other drugs allow to find out when a booster vaccination would be needed allow to find out how long it offers protection against the pathogen for		

Question	Answers	Mark	AO / Spec. Ref.
02.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.2.2.3 4.3.1.6 4.3.1.7
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified, and stated simply but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content **how a vaccine works (primary):** • white blood cells stimulated / respond • (by) producing antibodies • (antibodies) are specific to microorganism / microbe / virus / chickenpox • (antibodies) bind with antigens • reference to memory cells **when chickenpox virus enters the body (secondary):** ○ virus / pathogen is destroyed faster / quickly ○ (because) production of correct antibodies ○ (because) antibodies are produced sooner ○ (because) rate of antibody production is faster ○ (because) more antibodies produced It is acceptable for students to refer to virus / chickenpox / microorganism / microbe for pathogen throughout For **Level 3** primary and secondary responses must be considered		

Total Question 2	**12**

4.7.1.3 Biotic factors

Answer 08 · Mark scheme

June 2025 | 8464/B/2H | Original Q5

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

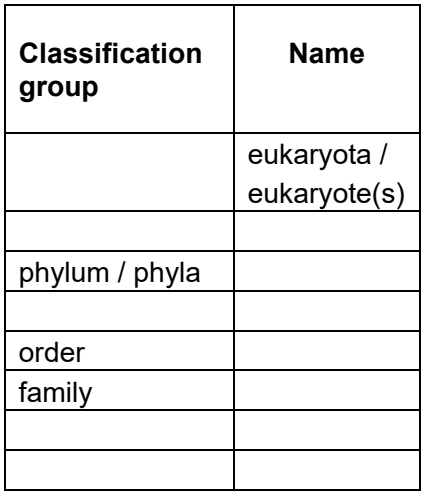
4.7.1.3 Biotic factors

Answer 08 · 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 • (only) soft parts decayed / eaten **or** bones were not decayed / eaten • bone(s) / remains replaced by minerals	do **not** accept plesiosaur (died and) is buried in rock(s) allow mineralisation of bones allow bone(s) left imprint in mud / sand / sediment (that then hardened to rock) ignore bones turned to stone / rock	2	AO1 4.6.3.2

Answer 08 · 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	

4.7.1.3 Biotic factors

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**

4.7.1.3 Biotic factors

Answer 01 · Examiner comments

June 2018 | 8464/B/2H | Original Q1

Question 1 (standard demand)

01.1 86% of students were able to identify two or three factors that were biotic or abiotic, with about 64% identifying all four correctly.

01.2 Most students noted that light increased as you moved away from the tree. However, a much lower number related light to photosynthesis and fewer still could link to glucose for growth, although some answered with 'providing food'. There were students who mixed up photosynthesis and respiration.

01.3 Many students identified a quadrat and most of these could spell it correctly. Much fewer identified the light meter, with solar panel and light dependent resistor (LDR) as the most common wrong answers. 'Lightometer' was seen but unless this was qualified as a mobile phone app it did not gain credit. Similarly a 'light sensor' was only correct if linked to a data logger.

01.4 Most students attempted a calculation, with 15% answering correctly. Some students were able to correctly calculate the area of one quadrat as 0.25 m^2 but then multiplied by either ten or five instead of the six sites sampled.

01.5 A wide variety of answers were seen suggesting that students understood that light intensity could change during the day. Provided the idea was clear credit was awarded.

01.6 The many students who just wrote 'repeat the investigation' did not gain credit. However 38% of students knew that this would only improve validity if it was in a different direction or for a different tree. Sampling every metre was also a correct common response.

01.7 74% of students identified 'daisy'. A number of students wrote more than one answer and so lost the mark under the list rule. Clover was a common incorrect answer, possibly because that was the species with the highest percentage cover at high light intensity rather than the species which **only** grew at high light intensity.

01.8 The first straightforward mark point for increasing light intensity showing an increased percentage cover of plants was stated by 62% of students although some incorrectly inferred that it was the percentage cover of plants causing the increased light intensity.

Only the most mathematically astute students were able to note that a maximum of 100% cover was seen from 175au of light for the second mark. A number of students did not read the question carefully enough and gave detailed descriptions of what was happening for each species instead.

4.7.1.3 Biotic factors

Answer 01 · Examiner comments June 2018 | 8464/B/2H | Original Q1

01.9 While 69% of students were able to identify a factor for one mark, often seen and credited within the reason section, very few were able to explain this in terms of the tree. Instead students gave very general reasons for why the factor was needed by plants. Many students wrote about the carbon dioxide level under a tree changing which is not the case.

Answer 02 · Examiner comments June 2019 | 8464/B/2H | Original Q5

Question 5 (standard, standard/high & high demand)

05.1 Most students were able to identify one way to improve the method given for the RPA of measuring a population of organisms; in this case, daisies in a school field. 57% of students gave both improvements correctly.

05.2 Most students made a good attempt at this tough multistep calculation. A third gained two marks for correctly calculating the area of the school field. A further 12% of students gained a further one mark, most usually for converting the incorrect answer they derived into standard form with two significant figures. 10% correctly calculated the result but failed to express it in the required format, while 7% calculated a totally correct answer.

05.3 This extended response question asking about factors which would affect the distribution of daisy plants on the school field was intended to be challenging. To give answers reaching Level 2 or 3 the student needed to include a high degree of accurate detail to explain each factor. Students who identified only factors, or who discussed only one factor, would be unlikely to get a mark awarded above Level 1. To gain a mark in Level 3 quite a lot of strong linking with accurate detail was needed for several factors and a clear understanding of how each one affected the distribution. It was not required to label each factor as biotic or abiotic but if the student chose to do so it needed to be correct.

11% of students gave enough accurate detail to be awarded five or six marks (Level 3). 57% of students gained three or four marks (Level 2) and 26% achieved one or two marks (Level 1). Very few students gained no credit or did not attempt a response. This question differentiated well throughout the ability range of students.

4.7.1.3 Biotic factors

Answer 04 · Examiner comments

June 2022 | 8464/B/1H | Original Q1

Question 1 (standard demand)

01.1 66% of students scored both marks for identifying the cell membrane and cytoplasm as structures that are found in both bacterial and animal cells.

01.2 One symptom of salmonella food poisoning was asked for, with students instructed not to refer to vomiting and diarrhoea. 60% of the students were awarded the mark, usually for stomach ache or fever. Many described fever as having a high temperature or sweating, which were allowed.

01.3 64% of students knew that penicillin was the first antibiotic developed. A wide range of phonetic spellings were accepted. The most common incorrect answers were the names of well-known painkillers.

01.4 Fewer than half of the students scored this mark. Most correct responses referred to a time delay before the antibiotics became effective, or started working. A few students said the bacteria would be reproducing or multiplying. There was some confusion with antibodies, and incorrect references to bacteria fighting the antibiotics, or antibiotics fighting bacteria.

01.5 Two-thirds of students knew that a child will start to feel better after taking antibiotics for a few days because there will be fewer toxins in the body. Most other students thought the child had become resistant to the bacteria.

01.6 31% of students scored the mark, usually for saying overuse of antibiotics could result in antibiotic resistance. Alternatively, they scored the mark for the idea that the person would get better without taking any antibiotics, which was allowed.

Quite a lot of students said the patient or the antibiotic would become resistant, which was incorrect. A common mistake was to confuse immunity with resistance.

Answer 04 · Examiner comments

June 2022 | 8464/B/1H | Original Q1

01.7 A third of students correctly identified the drawing of the white blood cell as the cell that produces antibodies. More than half of the students thought the red blood cell produced antibodies; potentially as a result of students being unfamiliar with drawings of blood components.

01.8 63% of students identified platelets as the part of the blood that starts the clotting process. Few selected plasma as their answer.

4.7.1.3 Biotic factors

Answer 05 · Examiner comments

June 2022 | 8464/B/2H | Original Q3

Question 3 (standard & standard/high demand)

03.1 Half the students could identify one biotic factor affecting the number of buttercups. Abiotic factors were frequently seen, such as light intensity and minerals in the soil.

03.2 The mark scheme allowed for two alternative valid methods to investigate if the amount of water in the soil affects the number of buttercups in the field. Transects were often referred to but not always correctly. Students who described a transect in the wet area and also a transect in the dry area were following the first method on the mark scheme. For the first method, references to marking a grid in each area were seen, and more frequently, for the second marking point, some reference to a method of placing quadrats such as a description of using a random number generator and coordinates. It was equally valid to describe a random method or a systematic method to place quadrats. However, throwing quadrats is not random or systematic and therefore was not accepted. Simply stating 'randomly place quadrats' was insufficient for this marking point because a method was required.

Many students gained the third marking point. Estimating percentage cover was insufficient.

Few students made an attempt to measure soil moisture readings or to describe how this could be achieved.

Clear descriptions of calculating a mean and using the total area correctly in calculations were seen.

The alternative method could also gain all six marks. Many of the marking points are the same for the two alternative methods. Care was required if students referred to calculating a mean from the results from a transect. Sometimes, students indicated they would use all the results along a transect to calculate a mean, which was incorrect for the eighth marking point.

Answer 06 · 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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4.7.1.3 Biotic factors

Answer 06 · 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 resitance
- From 0 – 4 months where warfain was given shows an increase of rats being resicant to warfan
- Showing how the 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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Answer 08 · Examiner comments

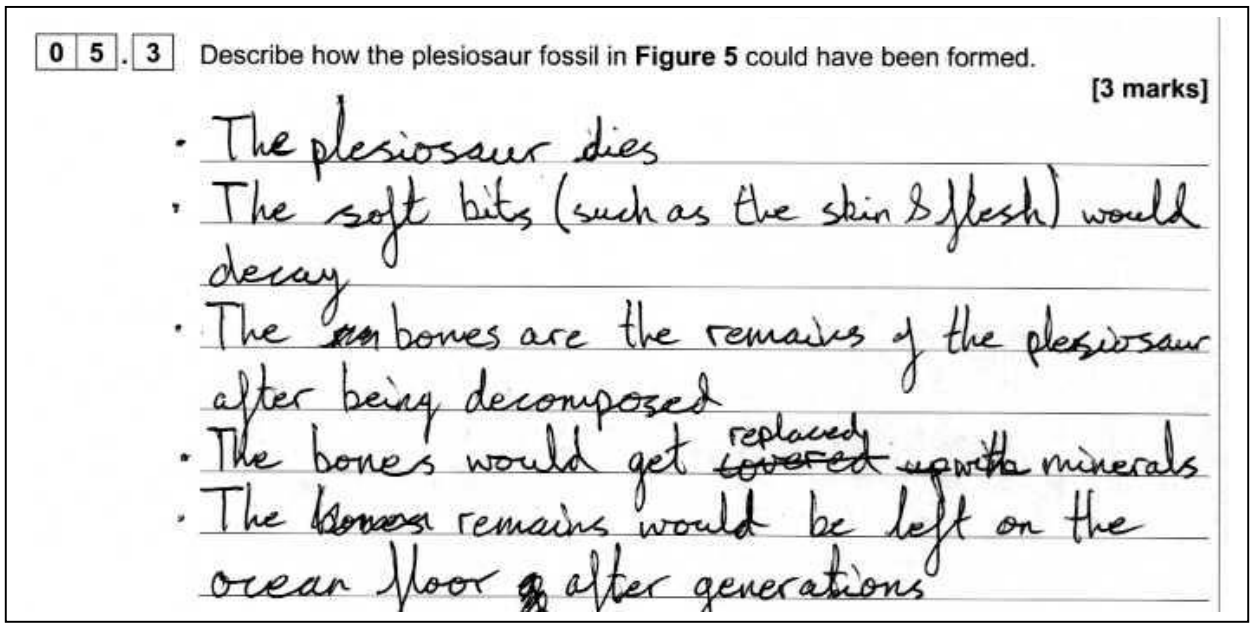
Question 5 (Standard and Standard/High demand)

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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Answer 08 · Examiner comments June 2025 | 8464/B/2H | Original Q5

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 Phillip 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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4.7.1.3 Biotic factors

GCSE

Combined Science: Trilogy

8464/B/1H Combined Science: Trilogy Biology Paper 1H

Report on the exam

Published: August 2025

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4.7.1.3 Biotic factors

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4.7.1.3 Biotic factors

Overview

This paper is one of the six examined components for Combined Science: Trilogy. All of these papers follow a similar structure and test the same assessment objectives.

This paper has 70 marks available to students and is made up of six questions.

- Approximately 40% of marks assess AO1; 40% of marks assess AO2; and 20% of marks assess AO3.
- Approximately 40% of marks target Standard demand, 40% of marks target Standard/High demand and 20% of marks target High demand.

Questions 1 and 2 on this paper and questions 5 and 6 on the Foundation Tier paper are common. These questions are identical and are targeted at Standard demand.

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/High demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade is based on their attainment across all six papers.

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4.7.1.3 Biotic factors

Summary of overall performance

Overall, students performed well on factual recall questions and straightforward mathematical calculations, whereas extended responses and the application of knowledge to unfamiliar contexts proved more challenging.

Strongest performance was observed in questions that tested basic recall or calculations. This was most noticeable in Questions **01.1**, **02.1** and **02.2**.
Students also performed well in the mathematical elements of the paper, particularly in **06.3** and **06.5**, where they demonstrated confidence in calculations involving standard form and percentages.

Moderate performance was seen in questions requiring straightforward application of knowledge, such as in **02.4**, and in **03.2**. Questions **05.2** and **06.1**, were also quite well answered by a significant proportion of students.

In contrast, a number of questions revealed significant difficulties for students, such as in **01.3**.
The extended response in **02.5** proved particularly challenging, as many students could describe the primary immune response but struggled to explain the secondary response in sufficient detail. Similarly, in **03.4** and **04.1**, students often gave imprecise answers which often lacked explanatory detail.

It is vital that students read all the information in each question and use it appropriately in their answers. Understanding the meaning of command words is particularly important. For example, ‘explain’ and ‘evaluate’ were often interpreted as ‘state’ or ‘describe’, leading to students missing out on marks. Question **06.6** was a notable example of this.

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Question 1 (Standard demand)

01.1 This question was generally well answered. A significant proportion of students (48%) achieved both marking points, demonstrating strong understanding of the topic. Many responses showed accurate labelling and good recall of the key blood vessels associated with the heart.

Where only one mark was awarded, this was most commonly for the correct identification of the vena cava.

01.2 61% of students gained the mark for this question.

01.3 This question was generally well answered, with most students recognising the involvement of respiration. However, many did not explain that more energy was required, and the misconception that energy is 'produced' rather than 'released' in the mitochondria was common.

Only a small proportion demonstrated understanding that the heart muscle needs to contract, with few using this precise term. Confusion between the processes of respiration and breathing was common.

Overall, 35% of students achieved two or more marks, while only 7% gained full marks. Most gained partial credit for identifying respiration but struggled to explain how energy is used by the heart.

01.4 This question was well answered, with 71% of students gaining at least one mark. Tiredness and chest pain were the most frequently identified symptoms.

Some responses repeated the same idea using different wording, for example 'heart attack' and 'blood clot'. Terms such as 'heart murmur' or 'palpitations' were credited as irregular heartbeat, while 'heartburn' was not.
Descriptions of increased breathing rate were often too vague, and few students mentioned pale skin.

01.5 This question was generally well answered, with over 80% of students gaining at least one mark. Many correctly identified infection or rejection as valid risks, while fewer mentioned the risk from anaesthetic.

Weaker responses often rephrased the question, giving vague statements such as 'there is a risk from surgery', which were not creditworthy. Some students speculated about long-term outcomes, for example 'the heart tissue not growing' or 'the patch being too small'. These were outside the scope of the question and not accepted.

Answers referring to bleeding had to make clear that it resulted from the operation and involved a significant loss of blood, with terms such as 'heavy blood loss' being credited. General references to 'risk of disease' were also not sufficient.

Descriptions such as the heart being punctured or stopping were credited as examples of damage to the heart, but unqualified terms like 'harming the heart' or 'death' were not.

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Question 2 (Standard demand)

02.1 This question was very well answered, with 95% of students correctly identifying touch or direct contact as a method of transmission. Many also referred accurately to coughing, sneezing, or droplets, which were credited.

Vague examples like hugging or playing together were not creditworthy, as they did not clearly imply skin-to-skin contact. In contrast, examples such as kissing, high fives, or transmission via contaminated surfaces like shared towels were accepted.

02.2 This question was very accessible, with many students correctly stating that antibiotics are used to treat bacterial infections.

A common misconception was the claim that chickenpox is not a virus, revealing a misunderstanding of the nature of the disease. References to 'it' were interpreted as referring to chickenpox and were credited where appropriate.

02.3 Many students correctly referred to dead pathogens, which was creditworthy. However, vague answers such as 'dead cells', 'dead disease', or 'dead chickenpox' were not accepted, as students needed to identify that it was the pathogen, not the disease itself, used in the vaccine.

Unqualified statements such as 'a small amount' were insufficient unless clearly linked to the dead pathogen or the antigen. Terms such as 'inert' or 'dormant' were accepted as synonymous with inactive when applied correctly to the pathogen.

02.4 This question was generally well answered, with 87% of students gaining at least two marks. Many demonstrated a clear understanding of the concepts being assessed.

Errors most often arose from repeating the same idea using different wording, for example stating that the drug was tested 'to check for toxicity' and 'to check for side effects'. These were treated as equivalent and not credited twice. References to allergic reactions were also accepted as side effects, and statements such as 'to check it doesn't kill the person' were credited as showing awareness of the ultimate risk.

Terms such as 'efficient' and 'effective' were accepted as equivalent to efficacy. However, references to 'reliability' or 'accuracy' were not sufficient, as they do not directly address whether the drug works as intended. Overall, this was an accessible question, though more precise language would have improved some responses.

02.5 This extended response question was assessed holistically. Many students demonstrated a clear understanding of the primary immune response, often describing in detail how white blood cells produce specific antibodies. These responses typically met the criteria for Level 2, with 50% of students achieving this level.

Fewer students were able to describe the secondary immune response in sufficient detail to reach Level 3, with only 10% achieving this. Stronger answers successfully linked features such as the faster production of antibodies and the role of memory cells in enabling a quicker, more effective response. High-level responses also referred to the production of complementary antibodies and explained how this led to a rapid destruction of pathogens. Statements such as antibodies being 'produced sooner' were creditworthy, while vague phrases such as pathogens being 'fought off quickly' were not.

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4.7.1.3 Biotic factors

The function of white blood cells was generally well understood, and many students correctly described antibody production. However, credit for specificity required clarity that the antibodies produced were complementary or specific to the pathogen or its antigens. Simply stating that antibodies were produced was insufficient.

Confusion between antigens and antibodies was common and often affected the accuracy of responses. Overall, while the primary response was well described by most students, a lack of detail about the secondary immune response prevented many from progressing beyond Level 2. This question highlighted that the secondary immune response remains an area of weakness for many.

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4.7.1.3 Biotic factors

0 2 . 5 Explain how a vaccine for chickenpox gives immunity against the disease.

You should refer to how the body responds to:

- the vaccine
- chickenpox pathogens that enter the body after vaccination.

[6 marks]

A Chickenpox Vaccine contains a dead or inert pathogen. This is then injected into the patients bloodstream. This causes the immune System to react to the new foreign pathogens. Lympho -cytes (White blood cells) ~~target~~ produce antibodies which are Specific to the antigens on the surface of the pathogen and then memory cells remember what antibodies to produce for the particular antigens of the bacteria. Thus, if you are actually injected you can produce antibodies quicker and kill the pathogens

Extra Space

This response was awarded 4 marks but had the potential to reach 6 with slightly more detail. The initial explanation of what a vaccine is was ignored, as this was assessed in a previous question.
The student correctly states that white blood cells produce antibodies, which satisfies the requirements for Level 2 and earns 3 marks. They further add that the antibodies are specific to the antigens—this additional piece of indicative content increases the mark within Level 2.

Credit is given for the mention of memory cells, and the student continues by stating that antibodies are produced more quickly upon infection. While this begins to reference the secondary response, it lacks a second linked idea, such as explaining that pathogens are destroyed more rapidly. Had this been included, the response could have progressed into Level 3, with up to 6 marks awarded.

This example reflects a common pattern seen on the Higher Tier, students providing accurate information but not developing it fully enough to access the Level 3 marks.

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Question 3 (High demand)

03.1 58% of students were awarded the mark for this question.

03.2 This question differentiated well between students of varying ability. Most were able to gain the first two marks by correctly selecting two distances from the graph that doubled and applying the inverse square law. A small number of students selected distances that did not double, such as 10 cm and 60 cm, which prevented them from achieving the calculation marks.

A few students used the incorrect formula 1/d rather than $1/d^2$, resulting in no credit. Others referred to the rate of oxygen production rather than calculating light intensity, which was also not credited. However, the majority used the correct formula and expressed their answers in an acceptable form.

Stronger answers correctly stated that light intensity 'decreases by a factor of four' or an equivalent phrase. Many, however, gave only vague statements such as 'light intensity decreases as distance increases', which were insufficient. A small number incorrectly stated that intensity 'reduced by 25%'.

03.3 This question was generally well answered, with 54% of students achieving at least one mark. Many correctly described that an increase in temperature leads to a higher rate of photosynthesis or faster oxygen production. Responses referring to the 'rate of bubble production' were credited, as the bubbles were identified as oxygen in the figure. However, answers that only mentioned an increase in oxygen volume or used vague terms such as 'rate of reaction' without linking this to photosynthesis were not sufficient.

Although many students described an 'increase of energy', It was often unclear what had more energy and vague statements about an energy increase for 'the plant' were not creditworthy. The idea of *more frequent* collisions was generally not well described. Responses that referred only to collisions, without further qualification did not gain credit.

Overall, most students gained at least one mark. However, only a minority demonstrated the particle-level understanding required to achieve full marks.

03.4 This question was challenging, with only 37% of students gaining at least one mark. References to other limiting factors, such as carbon dioxide, were not credited.

Many students correctly stated that high temperatures lead to less oxygen production, but only those who linked this to enzyme denaturation gained full marks. Responses that referred vaguely to cells or pondweed being denatured were not accepted.

Incorrect answers often suggested that oxygen production would increase or remain unchanged. Some students gave irrelevant points about experiment accuracy, which were not creditworthy.

Overall, while many achieved partial marks, few used precise biological terminology or explained the cause-and-effect relationship needed for full credit.

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Question 4 (Standard and High demand)

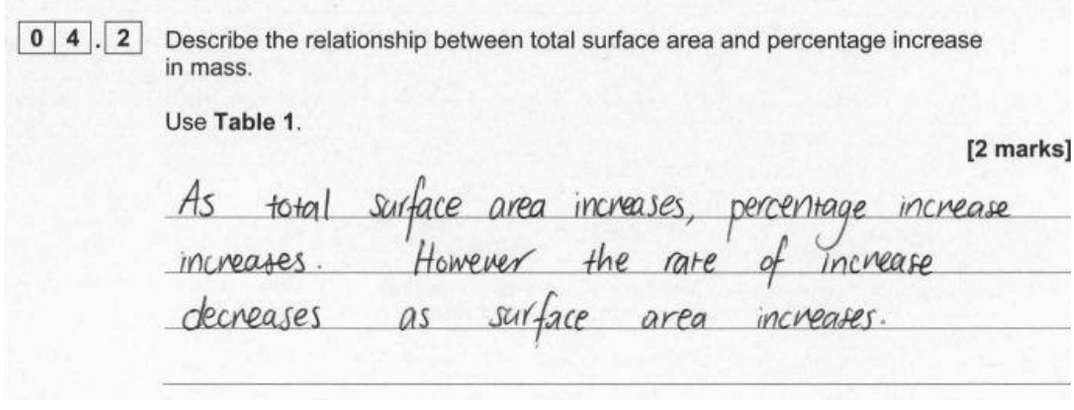
04.1 To gain credit, students needed to state that the potato pieces had different *starting* masses, making answers such as 'they have different mass', insufficient.

References to precision, accuracy, or comparability were not credited unless clearly linked to the variation in starting mass. Few students fully explained why using percentage change is more valid, with many giving vague responses such as 'more accurate' or 'more reliable'.

Some incorrectly attributed the use of percentage change to differences in surface area, which was not relevant. Others noted that it made results 'easier to compare', but did not go on to explain why.

04.2 This question was well answered, with 86% of students correctly identifying a positive correlation, stating that as surface area increases, the percentage increase in mass also increases.

A common error was the incorrect use of the term 'directly proportional', which was not credited as the relationship was not linear. Only 3% of students demonstrated higher-level understanding by noting that the rate of increase slowed, showing awareness of the diminishing trend in the data.


0 4 . 2 Describe the relationship between total surface area and percentage increase in mass.

Use **Table 1**.

[2 marks]

As total surface area increases, percentage increase increases. However the rate of increase decreases as surface area increases.

This is a rare response that was awarded 2 marks. The student successfully describes a decreasing rate, which meets the criteria for marking point 2. This level of detail and understanding was not commonly seen, as many students did not refer to the full pattern shown in the table.

04.3 To gain credit, students needed to state both the direction of water movement and name the process as osmosis. While most correctly identified osmosis, many omitted the direction of movement.

Explanations were credited if they described water moving from a high to low concentration of water, although this less precise wording often caused confusion. The preferred description was water moving from a dilute solution to a more concentrated solution across a partially permeable membrane. Statements referring to movement from low to high solute concentration were also accepted.

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4.7.1.3 Biotic factors

Confusion about concentration remained common, with many students not distinguishing between water and solute concentration. Although most could name osmosis, unclear explanations of the gradient and movement direction often prevented full marks.

0 4 . 3 Explain why the potato pieces increased in mass.

[2 marks]

Osmosis is the movement of water from a high concentration to a low concentration through a semi-permeable membrane. ~~The~~ Some of the distilled water moved into the potatoes through osmosis.

This response was awarded 1 mark for a correct description of the movement of water into the potato by osmosis.
However, a common misconception is evident in the explanation that 'water moves from a high concentration to a low concentration.' While this is frequently seen, it lacks precision. The addition of 'water' before both references to concentration would have been acceptable, though not ideal.
This error highlights a widespread misunderstanding of the principles of osmosis, particularly in relation to concentration terminology.

04.4 This question was particularly challenging, with only 4% of students gaining any marks. It required application of knowledge about osmosis in a broader context.

Few students recognised that all potato pieces would eventually reach the same percentage change in mass after 24 hours. Many incorrectly stated that the pieces would have the same mass, showing misunderstanding of what percentage change represents.

Credit was also given for identifying that it is the potato *cells*, not the whole pieces or the potato, that becomes turgid.

Common misconceptions included the belief that concentrations would equalise, and osmosis would stop, that percentage change would increase indefinitely, or that cells would burst. The role of the cell wall in preventing bursting was rarely acknowledged.

Overall, this question highlighted significant gaps in students' understanding of osmosis, particularly in distinguishing between plant tissues and plant cells.

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4.7.1.3 Biotic factors

04.5 This question was poorly answered, with only 8% of students meeting both criteria. Many responses lacked precision and failed to clearly describe how the method should be adapted. Few students stated that the independent variable should be different concentrations of salt solution. References to at least three concentrations and the use of units such as g/dm^3 clarified that solutions, not masses of salt, were being tested. Vague statements such as 'add some salt to water' were not credited. Many students also failed to recognise that surface area needed to be replaced as the independent variable, often attempting to include both variables in the same method.

For controlling surface area, responses needed to state that all potato pieces should have the same surface area and not just the 'same size' or 'same shape' which were too vague. Students could also gain credit by stating that the cylinders should not be cut further or should be cut into the same number of pieces, as this implied control of surface area. Very few students addressed this point at all.

Overall, most responses demonstrated confusion around the concept of concentration and lacked the clarity required to access the marks.

Describe how the student could change the method to investigate the effect of salt concentration on potato tissue.

[2 marks]

Cut 5 cylinders from one potato. Do not cut into different number of pices. Put each cylinder into different beaker containing solution of salt in distilled water with different concentrations: 0, 0.2, 0.4, 0.6, 0.8

This is a rare example of a 2-mark response. The student correctly refers to not cutting the pieces of potato, which demonstrates an understanding of the need to control the size and surface area of the samples. They also clearly state that different concentrations of salt solution were used, which shows an awareness of how to create the range of conditions needed to observe a pattern in mass change.

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4.7.1.3 Biotic factors

Question 5 (Standard and High demand)

05.1 49% of students gained 1 mark on this question. 34% gained full marks for this question.

05.2 This question proved challenging, with 63% of students failing to achieve the mark. While many correctly identified the palisade layer, a wide range of incorrect responses was seen.

Common errors included confusing the palisade tissue with the upper epidermis, spongy mesophyll, or simply writing 'mesophyll', which was too vague to credit. Other incorrect answers suggested other plant tissues and sub-cellular structures.

Overall, the question highlighted that while some students had a good grasp of leaf anatomy, many lacked precise knowledge of the location and function of palisade tissue.

05.3 This question was challenging, with 62% of students failing to achieve any marks. It required understanding of the adaptations of palisade mesophyll tissue and how these relate to its role in photosynthesis. While some students identified one appropriate adaptation or function, few provided the full explanation needed for both marks.

Many students correctly stated that the cells contain many chloroplasts or a large amount of chlorophyll. However, common errors included mentioning a 'large surface area', omitting the quantifier 'many', or failing to link the adaptation to its function. Responses such as 'contains chloroplasts for photosynthesis' were too vague, whereas answers specifying that the many chloroplasts absorb light for photosynthesis were awarded full credit.

Some students incorrectly described the position of the palisade cells at the top of the leaf or referred to unrelated processes such as water absorption or gas exchange. Confusion between palisade and spongy mesophyll tissues was also frequent.

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4.7.1.3 Biotic factors

0 5 . 3 Explain how tissue **A** is adapted to its function.

[2 marks]

has many chloroplasts and so many chlorophyll so photosynthesis can take place ~~at a higher~~

0 5 . 3 Explain how tissue **A** is adapted to its function.

[2 marks]

contains lots of chloroplast wich contains chlorophyll to absorb the light thats why its on the top side of the leaf as thats where there is the highest light intensity

Two examples of responses that were both limited to 1 mark.

In the first example, the student is awarded for correctly stating that the cell contains many chloroplasts. However, further credit is not gained, as the response only references photosynthesis and does not specifically mention the absorption of light—an essential part of that marking point.

In the second example, the student is again awarded marking point 1 for correctly identifying the presence of many chloroplasts. This time, the student does mention light absorption but does not go on to link this to the process of photosynthesis.

In both cases, the students demonstrated partial understanding but did not provide enough detail to access full marks. This pattern was common across responses, where students often gave either the function (photosynthesis) or the mechanism (light absorption), but not both.

05.4 This question was challenging, with many students demonstrating only partial understanding. While 77% gained at least one mark, only 26% achieved three or more. Few were able to provide a full, coherent sequence of the pathway of water.

Most students gained credit for stating that water enters the root hair cells from the soil. However, answers that referred only to ‘roots’ or incorrectly described the process as active transport were not credited.

Fewer students successfully described water moving up the xylem, as many omitted the direction of flow or confused the xylem with the phloem, sometimes incorrectly referring to translocation instead of transpiration.

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References to water moving to the leaves were rare, with many responses diverting into discussions of photosynthesis, which was not relevant to the mark scheme.

Only a small number of students mentioned stomata or described their role in water leaving the leaf. Evaporation or transpiration as the final stage of water loss was more commonly stated, although it had to be correctly located to gain credit.

Overall, while the early and final stages of the process were better understood, students often lacked the precision and sequencing needed for full marks. This question highlighted persistent misconceptions about water transport and the role of specific plant structures.

Question 6 (High demand)

06.1 61% of students gained the mark for this question.

06.2 This question required students to apply their knowledge of ciliated cells in a new context. To gain credit, answers needed to describe the movement caused by the cilia (e.g. push, sweep, waft, pass through) and correctly identify what was being moved (e.g. egg, ovum, fertilised egg, or embryo). Phrases such as 'pass the egg through' were accepted, and incorrect references to the egg's destination were ignored. References to sperm were not credited.

Many students struggled, often confusing the roles of cilia and mucus. A common error was stating that cilia trap bacteria or pathogens, a function associated with mucus in the respiratory system rather than the oviduct.

06.3 Students generally performed well on this question, with 47% achieving full marks. Most were able to recall and correctly rearrange the equation, demonstrating strong mathematical skills.

The most common error was incorrect conversion from millimetres to micrometres, which prevented many from gaining the conversion mark. Some students also substituted values incorrectly, leading to an incorrect final answer.

Overall, performance was good, and many students showed confidence with both standard form and the calculation process. Clear working remains important, as it allows credit to be given for correct steps even when the final answer is incorrect. Students should also cross out incorrect attempts to make their reasoning clear.

06.4 This question proved difficult for many students, as it required clear application of knowledge about oxygen transport and respiration.

Many recognised that anaemia reduces oxygen transport but often used vague phrasing such as 'less oxygen is taken to the body', which was not credited. To gain the mark, answers needed to specify that oxygen was not reaching cells, muscles, or another specific destination. Irrelevant organs, such as the liver, and absolute statements like '*no* oxygen is taken to the cells' were not accepted.

Fewer students successfully identified the shift to anaerobic respiration and the associated production of lactic acid. Responses that referred only to 'less energy' or 'less aerobic respiration' were insufficient, and mentioning anaerobic respiration without lactic acid was also insufficient.

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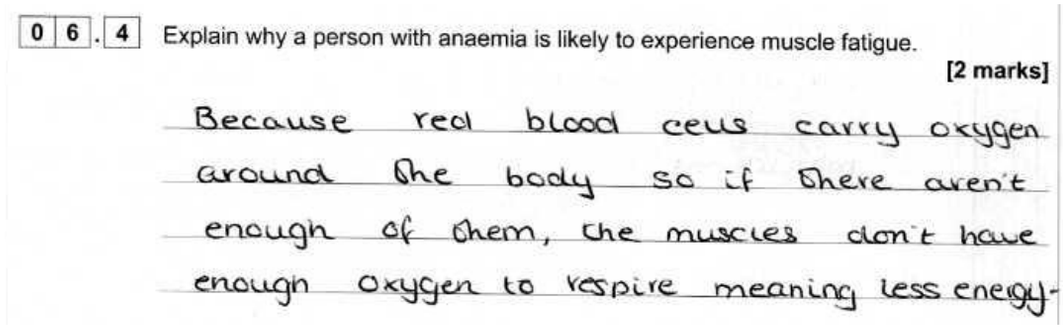
4.7.1.3 Biotic factors

Overall, while many students understood the initial effect of reduced oxygen transport, few linked this to the physiological consequences of anaerobic respiration, revealing gaps in applying respiration knowledge in unfamiliar contexts.

0 6 . 4 Explain why a person with anaemia is likely to experience muscle fatigue.

[2 marks]



This response was awarded 1 mark. The student correctly identifies that less oxygen reaches the muscles. A more general statement such as 'less oxygen to the body' would not have been sufficient at this level.
However, the student does not mention anaerobic respiration or the production of lactic acid, both of which were required to achieve further credit. This reflects a common issue where students recognise the reduction in oxygen delivery but do not link it to the consequences on respiration.

06.5 This question was generally well answered, with 67% of students gaining full marks. Many demonstrated strong mathematical skills and successfully applied standard form.

The most common errors were in the percentage calculation, which led to incorrect final answers despite correct method or structure. Magnitude errors, often caused by misplacing zeros, were also frequent.
Students who made calculation errors but correctly expressed their answer in standard form were often able to gain partial credit.

06.6 Most students (83%) accessed Level 1 by identifying relevant points, 47% reached Level 2, but only 1% achieved Level 3. The question highlighted weaknesses in data interpretation, comparative reasoning, and structuring evaluations.

Many students correctly identified advantages of stem cell-derived red blood cells, including longer shelf life, smaller sample requirements, and lower risk of infection. Some gained credit by framing these as disadvantages of whole blood donation. However, many answers simply re-stated information from the table without comparison or explanation.

Disadvantages of stem cells were rarely mentioned. While cost was often noted, few students developed this point or compared it effectively with the lower cost of whole blood donation. Misconceptions were common, particularly references to ethical concerns about embryonic stem cells, which were not relevant in this context. Few students recognised benefits such as reduced risk of rejection or potential advantages for patients with rare blood types.

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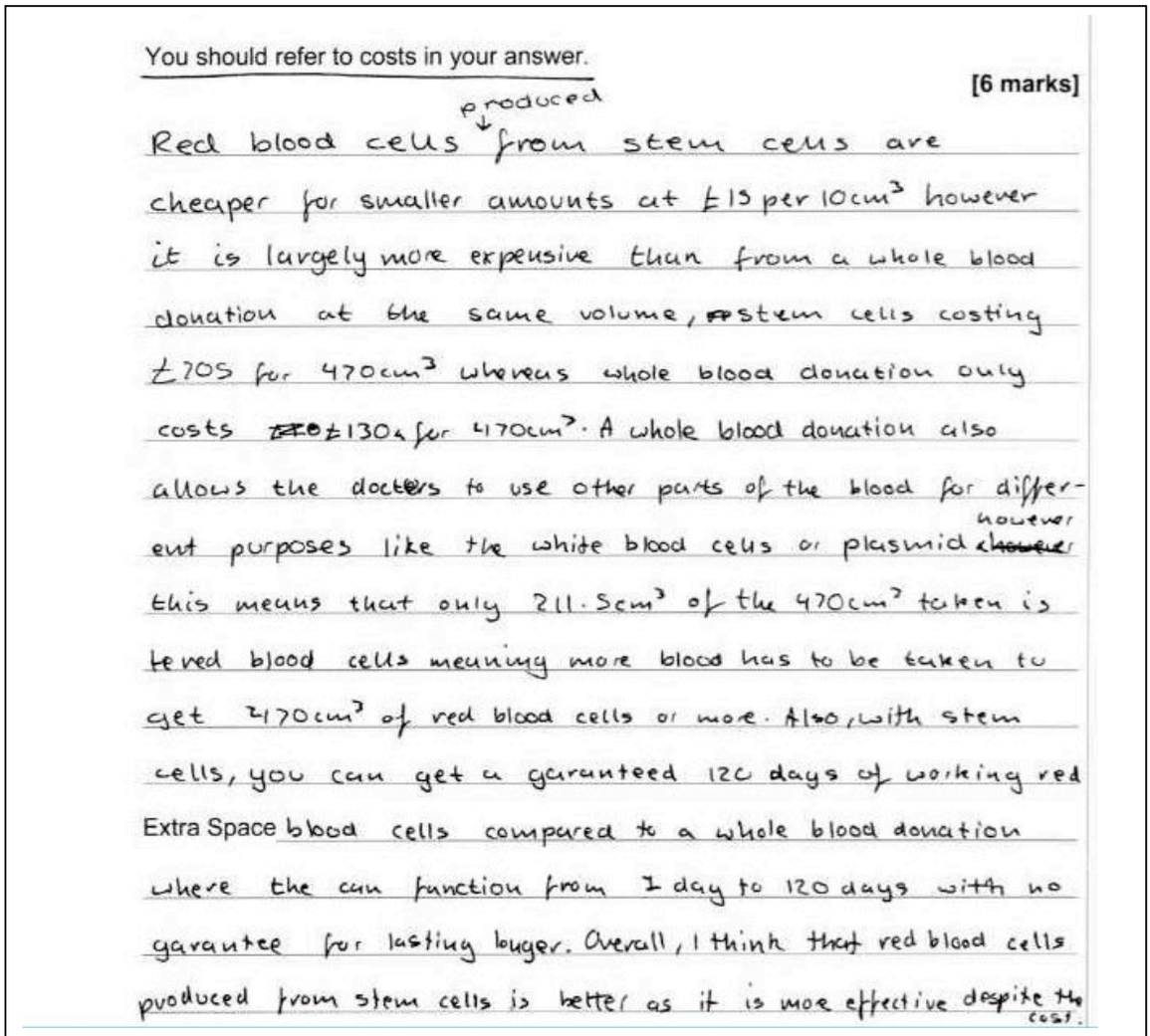
4.7.1.3 Biotic factors

Source appendix · Full source examiner report



You should refer to costs in your answer.

[6 marks]

Red blood cells produced from stem cells are cheaper for smaller amounts at £15 per 10cm³ however it is largely more expensive than from a whole blood donation at the same volume, ~~#~~stem cells costing £705 for 470cm³ whereas whole blood donation only costs ~~£0~~£130 for 470cm³. A whole blood donation also allows the doctors to use other parts of the blood for different purposes like the white blood cells or plasmid ~~however~~ however this means that only 211.5cm³ of the 470cm³ taken is red blood cells meaning more blood has to be taken to get 470cm³ of red blood cells or more. Also, with stem cells, you can get a garanteed 120 days of working red blood cells compared to a whole blood donation where the can function from 1 day to 120 days with no garantee for lasting longer. Overall, I think that red blood cells produced from stem cells is better as it is more effective despite the cost.

Extra Space

This is a rare example of a response that was awarded 5 marks.

The student correctly states that red blood cells produced from stem cells are more expensive and identifies the specific cost as £705, meeting two of the cost-related points.

They then note that whole blood donation includes other components, such as white blood cells, and despite the incorrect reference to plasma, this is accepted as being in line with the indicative content principles. The student also explains that these additional components can be used for different purposes. This was sufficient to award credit relating to the advantages of whole blood donation.

The response continues with an extended discussion about the lifespan of different types of blood cells. Although somewhat lengthy, the student eventually makes the point that red blood cells derived from stem cells last longer—earning credit for an advantage of stem cell blood.

In total, this response gained credit for cost-related points, advantages of whole blood donation, and an advantage of stem cell blood. Had the student included a further distinct advantage of stem cell blood, they would have been awarded the full 6 marks.

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4.7.1.3 Biotic factors

Cost evaluation was key to higher marks. Many students performed calculations correctly, allowing progression beyond Level 1, but errors occurred when comparing unequal volumes. Correct intermediary calculations were still credited.

Overall, while most students identified some valid points, only a very small proportion produced well-developed evaluations supported by data analysis.

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4.7.1.3 Biotic factors

Contact us

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