AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.7.1.4

Adaptations

Mark schemes and examiner comments

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

Using this booklet

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

Name: _____ **Date:** _____

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

4.7.1.4 Adaptations

Answer 01 · Mark scheme

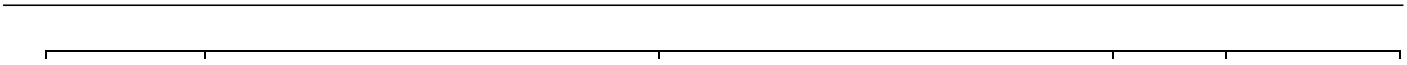
June 2018 | 8464/B/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	they survive in high temperatures they survive where it is acidic		1 1	AO2 4.7.1.4
03.2	C		1	AO3 4.7.1.4
03.3	because it has (high / optimum) activity at high temperature or 65 °C **and / or** low pH or pH 3 or high acidity	mark dependent on C correct for question **03.2** allow it is the only enzyme that is active between 55 °C and 75 °C **and / or** below pH4	 1	AO2 4.7.1.4
03.4	any **three** from: • based on DNA / chemical evidence (the three domains are) • (Archaea) –primitive / simple bacteria • Prokaryota / Bacteria – true / modern bacteria • Eukaryota – includes (protists, fungi,) plants and animals	 allow Eukaryota - includes organisms with cells having a nucleus if no other mark awarded allow for **1** mark mention of Archaea, Prokaryota / Bacteria and Eukaryota **or** three correct descriptions	3	AO1 4.6.4
03.5	(these microorganisms) live in extreme conditions	allow (most Archaea) are extremophiles	1	AO2 4.6.4
Total			8	

4.7.1.4 Adaptations

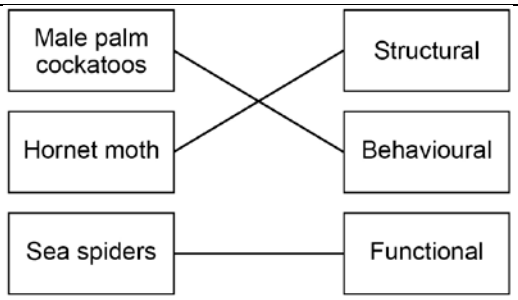
Answer 01 · Mark scheme

June 2018 | 8464/B/2H | Original Q3



4.7.1.4 Adaptations

Answer 02 · Mark scheme

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

4.7.1.4 Adaptations

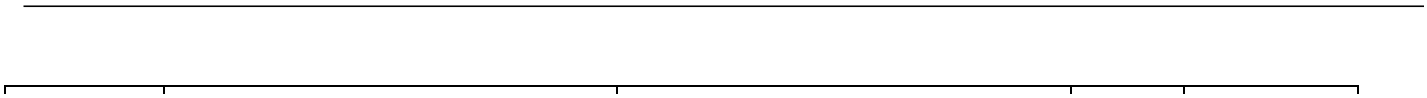
Answer 02 · Mark scheme

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

4.7.1.4 Adaptations

Answer 02 · Mark scheme

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



4.7.1.4 Adaptations

Answer 03 · Mark scheme November 2020 | 8464/B/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	amylase	allow phonetic spelling allow carbohydrase do **not** accept amylose	1	AO1 4.2.2.1
02.2	small intestine		1	AO1 4.2.1 4.2.2.1
02.3	any **one** from: • greater magnification • higher resolving power	allow can see (smaller) sub-cellular structures / parts allow can see more detail (inside cells) allow reference to 3-D images	1	AO1 4.1.1.5
02.4	capillary		1	AO2 4.2.2.1 4.2.2.2
02.5	$20 = \frac{\text{image length}}{0.8}$ image length = 0.8 x 20 image length = 16 (mm)		1 1 1	AO2 4.1.1.5 RPA 1
02.6	diffusion		1	AO3 4.1.3.1
02.7	active transport	allow active uptake	1	AO3 4.1.3.3

4.7.1.4 Adaptations

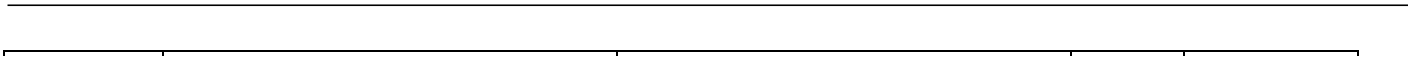
Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	any **one** from: • respiration • to form glycogen • to make amino acids / proteins	allow as an energy source do **not** accept to make / use / create / produce energy allow to make lipid / fat	1	AO1 4.4.2.1 4.4.2.3
02.9	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.		3–4	AO2 4.1.1.3 4.1.3.1 4.1.3.3 4.2.2.1
	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 • have (many) microvilli • (to) increase surface area • wall of villus only one cell thick **or** is thin • capillaries are close to surface • (so) short pathway • good blood supply • (to) transport food molecules away **or** to the body • (and) maintain a diffusion gradient • cells have many mitochondria • (where) respiration takes place • (where) energy is transferred • (as) active transport requires energy • energy is needed to absorb sugar / food / molecules For Level 2 must make links between structure and it's function			
Total			**14**	

4.7.1.4 Adaptations

Answer 03 · Mark scheme

November 2020 | 8464/B/1H | Original Q2



4.7.1.4 Adaptations

Answer 04 · Mark scheme

June 2023 | 8464/B/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	A		1	AO1 4.2.1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	has (large) air spaces (between cells) (so) gases can diffuse / move through the leaf to / from the photosynthetic / palisade / B layer	allow has (large) gaps (between cells) allow carbon dioxide **or** oxygen **or** water vapour for gases allow to / from the upper mesophyll if named gas given for mp 2 direction of movement must be correct if no other marks awarded allow **1** mark for cells have chloroplasts for photosynthesis	1 1 1	AO1 4.2.1 4.2.3.1

4.7.1.4 Adaptations

Answer 04 · Mark scheme

June 2023 | 8464/B/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3		reason must correctly match the structure		AO1 4.2.1
	composed of hollow tubes / cells	allow cells are empty allow no cytoplasm / nucleus / sub-cellular structures	1	4.2.3.1 4.2.3.2
	(so) no obstruction to water flow	allow (so) water flows easily if linked to hollow tubes allow to maintain the transpiration stream	1	
	OR			
	has lignin (1)	ignore has thick walls		
	(to) hold tubes open (1) **or** (to) strengthen the tubes	allow (to) keep water inside xylem allow (to) make tubes rigid		
	OR			
	no end walls (1)			
	(so) water flows easily (1) **or** (so) water flows continuously	must be linked to an adaptation allow (so) maintains a constant water flow allow to maintain the transpiration stream		

4.7.1.4 Adaptations

Answer 04 · Mark scheme

June 2023 | 8464/B/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	water enters (guard) cells by osmosis	allow water enters (guard) cells because the concentration of water is higher outside the cell than inside the cell	1	AO2
	cells swell and curve (to open the stoma)	allow cells become turgid and curve (to open the stoma) allow inner wall of (guard) cell is thicker / stronger **or** less flexible than outer wall so cells curve (to open stoma)	1	AO3 4.1.1.2 4.1.1.3 4.1.3.2 4.2.3.1 4.2.3.2

Total Question 4	**8**

4.7.1.4 Adaptations

Answer 05 · Mark scheme

June 2025 | 8464/B/1H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	carbon dioxide		1	AO1 4.4.2.1
	ethanol		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	palisade (mesophyll layer)	ignore reference to cells	1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		ignore name of tissue	1	AO1 4.2.3.1
	(cells / tissue) contain **many** chloroplasts	allow (cells) are closely packed together allow cells / tissue contain a lot of chlorophyll		
	(to) absorb more light for photosynthesis		1	
		allow for **2** marks (cells / tissue) contain **many** chloroplasts to absorb light for photosynthesis		

4.7.1.4 Adaptations

Answer 05 · Mark scheme

June 2025 | 8464/B/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(water absorbed from soil by osmosis / diffusion) into / through root hair (cells)		1	AO1
	(water) travels **up** through xylem (vessels) **or** (water) through xylem (vessels) to the leaf	do **not** accept water travels up through the phloem	1	AO1
	(water) moves into the spongy mesophyll / layer by diffusion / osmosis		1	AO2
	(water) lost through stomata		1	AO1
	(water) lost by evaporation / transpiration (to atmosphere)	do **not** accept translocation	1	AO1
		if no other mark awarded allow **1** mark for transpiration stream		4.2.3.2

Total Question 5	10

4.7.1.4 Adaptations

Answer 06 · 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

4.7.1.4 Adaptations

Answer 06 · Mark scheme

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

4.7.1.4 Adaptations

Answer 06 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	<table><tr><th>Classification group</th><th>Name</th></tr><tr><td></td><td>eukaryota / eukaryote(s)</td></tr><tr><td></td><td></td></tr><tr><td>phylum / phyla</td><td></td></tr><tr><td></td><td></td></tr><tr><td>order</td><td></td></tr><tr><td>family</td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	**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

4.7.1.4 Adaptations

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**

4.7.1.4 Adaptations

Answer 01 · Examiner comments

June 2018 | 8464/B/2H | Original Q3

Question 3 (standard & standard / high demand)

03.1 Students were able to relate extremophiles to harsh conditions with 39% of students identifying one of the conditions and 54% identifying both.

03.2 64% of students identified enzyme C as the enzyme from bacteria in the cave.

03.3 Those students who selected the incorrect enzyme in question **03.2** were unable to get any credit for their answer to this question. Some who correctly picked enzyme C then incorrectly wrote about microbes living or surviving in the conditions rather than referring to enzymes still being active in these conditions.

Other students appeared to misunderstand the graph itself and presumed that the enzymes themselves had high temperatures or were acidic rather than the activity being greatest in those conditions. The word optimum was rarely used.

Those students who got the correct answer (28%) usually referred to 'enzyme activity at high temperatures'. Whereas the students who wrote about pH did not mention that the conditions were of low pH or high acidity, simply referring to it being acidic.

03.4 There were a few excellent answers from students who had a real understanding of this new aspect of the specification. However, in general students struggled with this question, with 12% not attempting it at all. 3% of students achieved three marks.

Many students did not know what the domains were. Students often wrote answers about kingdoms and phyla rather than the three domains. And there were many answers that suggested the domains were a way of classifying organisms in the environment with many references to producers, consumers, habitats, communities and abiotic and biotic factors. Many students confused the three-domain system with the Linnaeus system of classification and described that instead.

Other students described the thee-domain system as referring to the conditions of an organism's environment, referencing the previous questions' use of pH and temperature. Some students also described food chains or predator prey relationships. Students were often able to achieve two out of the three marks for their descriptions of Eukaryotes and Prokaryotes. However, they often did not describe Archaea as 'simple' or 'primitive' bacteria, but simply as extremophiles.

Not many students received credit for marking point one as they usually just referenced classification based on characteristics rather than DNA or chemical evidence. The compensation mark was the marking point most often awarded.

4.7.1.4 Adaptations

Answer 01 · Examiner comments June 2018 | 8464/B/2H | Original Q3

03.5 24% of students answered this question correctly. Some did not recognise that the extreme conditions were the focus of the question and instead commented on the microorganism being found in the caves which had matching conditions to the graphs.

Common incorrect answers included that Archaea are primitive or old or that they survived in hot or dark or humid or acidic conditions without making reference to the fact that these conditions are extreme.

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

Question 4 (standard & standard/high demand)

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

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

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

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

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

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

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

4.7.1.4 Adaptations

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

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

Answer 04 · Examiner comments June 2023 | 8464/B/1H | Original Q4

Question 4

04.1 Three fifths of students correctly identified Tissue A as the epidermis. A quarter of students thought Tissue B, the palisade mesophyll, was the epidermis.

04.2 Half of the students scored at least 1 mark, usually for saying that the spongy mesophyll is adapted for its function by having air spaces. A description of these was allowed, such as gaps or air pockets. Only a fifth of students went on to explain the function of the air spaces, to score 2 marks. There was quite a lot of confusion regarding how water enters a plant, many thinking that it entered via the leaves. Some students thought the spongy mesophyll was a storage tissue. Quite a lot of students gained the compensation mark for saying the cells of the spongy mesophyll have chloroplasts for photosynthesis.

04.3 Fewer than a third of students scored any marks on this question. An adaptation of xylem had to be described in order to gain any marks. If a correct adaptation was given, the reason had to match the structure. Quite a lot of students talked about long tubes, which was insufficient. A reference to them being hollow or empty was needed. Some students gained 2 marks for saying the cells are strengthened with lignin. Others said the xylem cells did not have end walls, but only a few explained why this was useful.

04.4 Students struggled to answer this question which was set at the highest level of demand. Very few scored any marks. The most common responses referred to the stoma needing to open to either allow the transfer of gases for photosynthesis, or to allow the excess glucose to leave the leaf. Some said the glucose would be used in respiration to transfer energy to open the stoma. Few attempted to describe what caused the stoma to open.

Answer 06 · Examiner comments

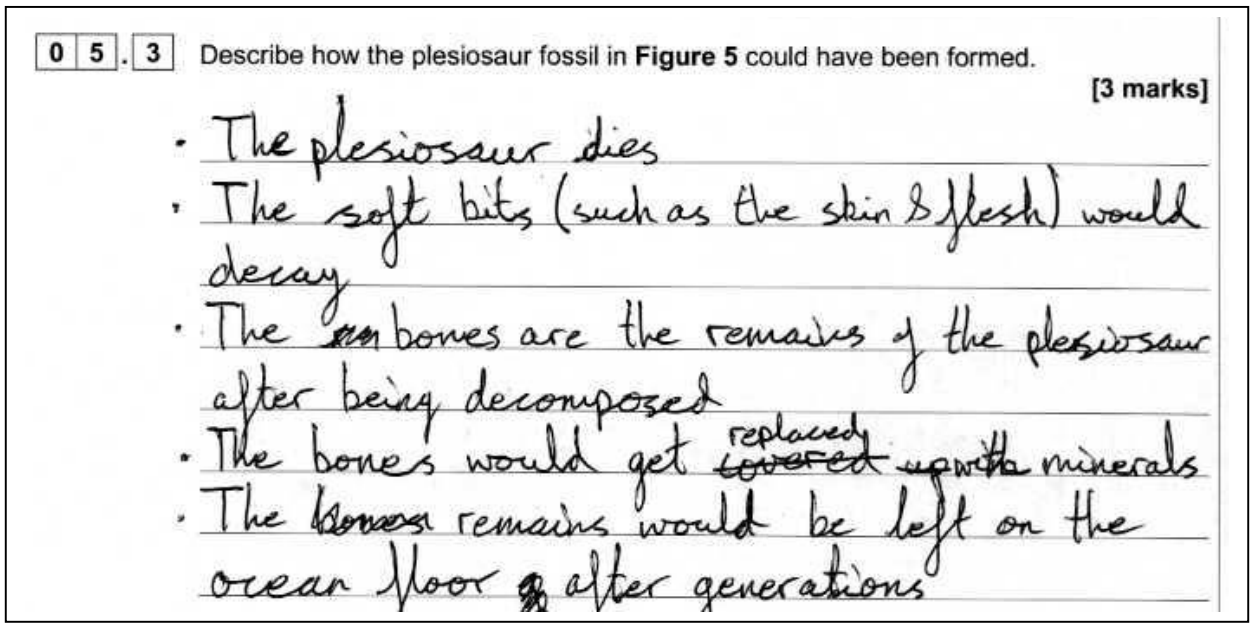
Question 5 (Standard and Standard/High demand)

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 ~~an~~ bones are the remains of the plesiosaur after being decomposed
- The bones would get ~~covered~~ replaced up 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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4.7.1.4 Adaptations

Answer 06 · 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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4.7.1.4 Adaptations

GCSE

Combined Science: Trilogy

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

Report on the exam

Published: August 2025

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4.7.1.4 Adaptations

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4.7.1.4 Adaptations

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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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)

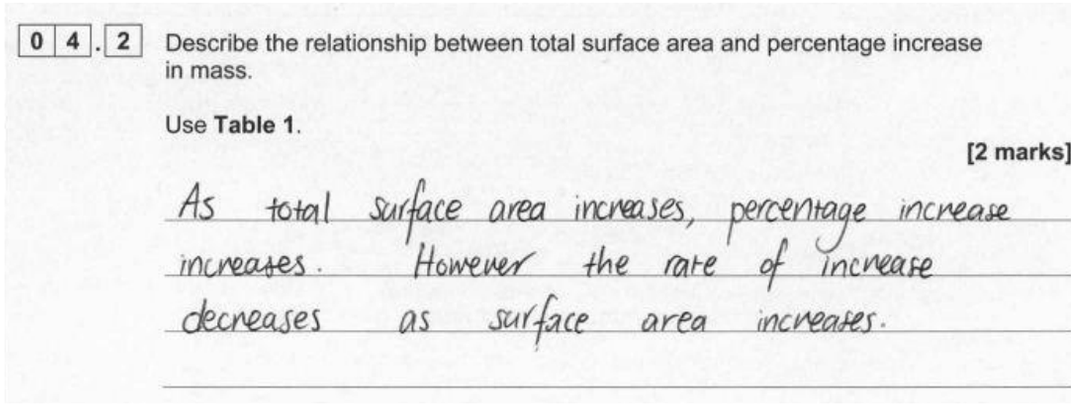
04.1 To gain credit, students needed to state that the potato pieces had different *starting* masses, making answers such as 'they have different mass', insufficient.

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.



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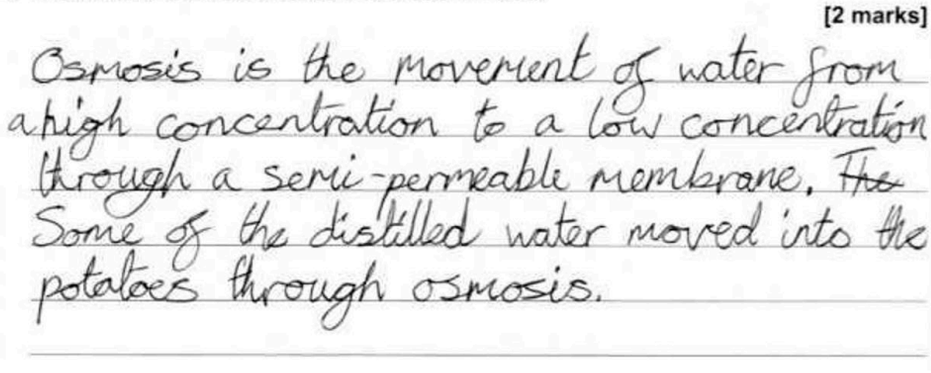
Confusion about concentration remained common, with many students not distinguishing between water and solute concentration. Although most could name osmosis, unclear explanations of the gradient and movement direction often prevented full marks.

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

[2 marks]



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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

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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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4.7.1.4 Adaptations

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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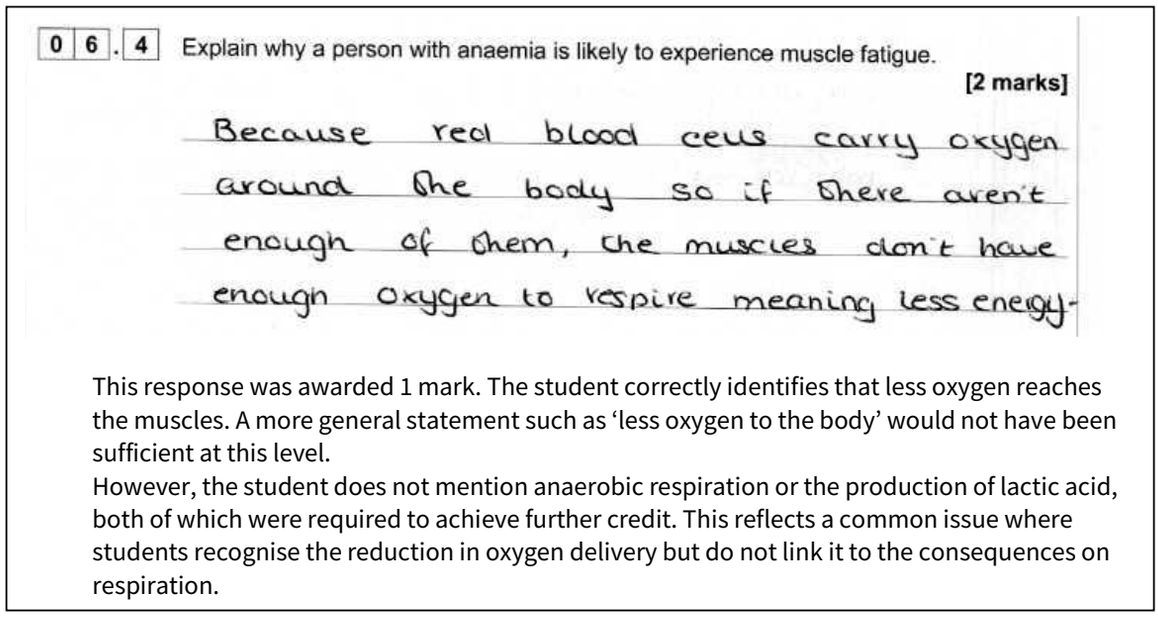
4.7.1.4 Adaptations

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]

Because red blood cells carry oxygen around the body so if there aren't enough of them, the muscles don't have enough oxygen to respire meaning less energy.

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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4.7.1.4 Adaptations

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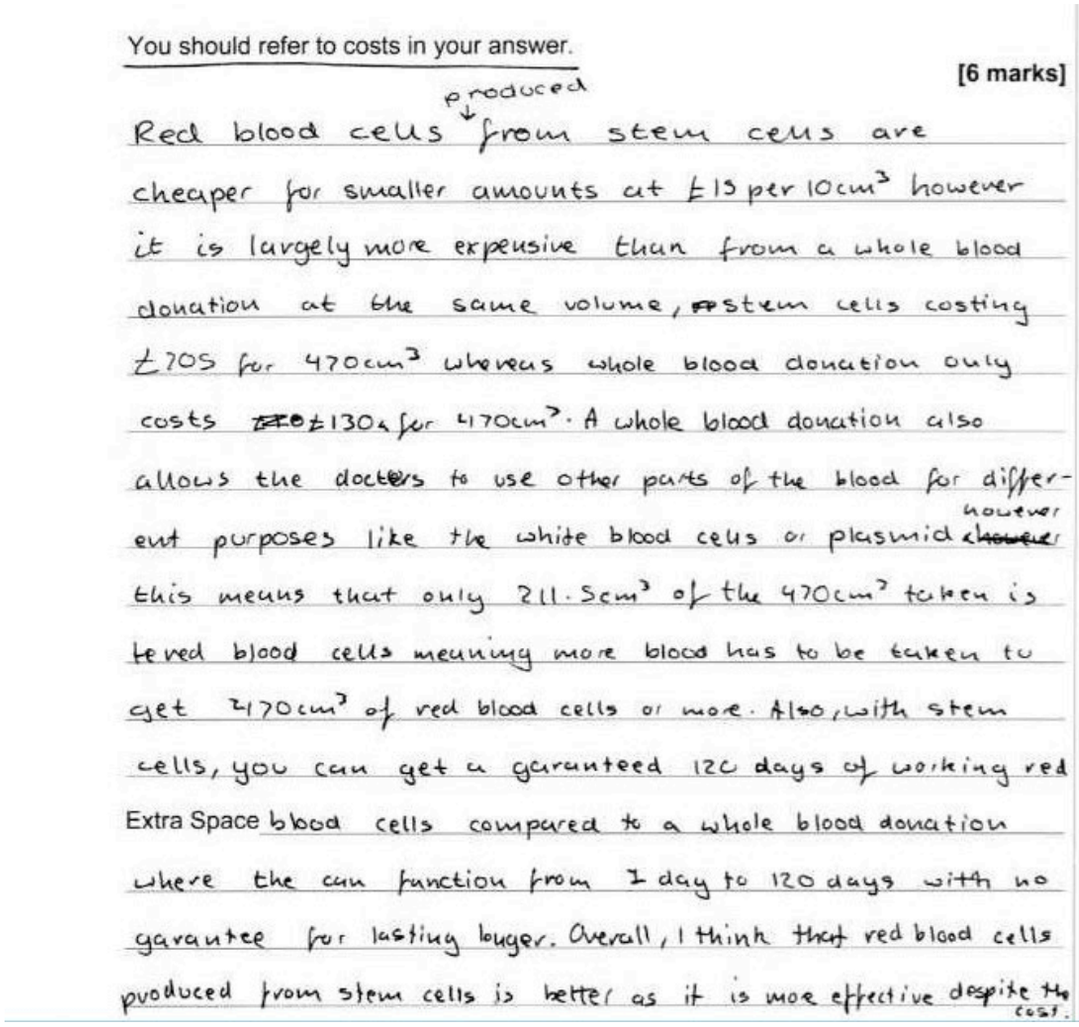

You should refer to costs in your answer.

[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, ~~F~~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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4.7.1.4 Adaptations

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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4.7.1.4 Adaptations

Contact us

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