AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.3.1.7

Vaccination

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**5**
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.

4.3.1.7 Vaccination

Answer 01 · Mark scheme

June 2018 | 8464/B/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **one** from: • not everyone would go to the doctor • sample will not always be sent for analysis • some cases not tested / diagnosed / confirmed	allow not all cases recorded allow only medically confirmed cases recorded ignore some cases are unknown allow idea that doctor may make a judgemental error or mis-diagnosis	1	AO2 4.3.1.2
05.2	$\frac{1939}{2030} \times 100$ 96 / 95.5	an answer of 96 / 95.5 scores **2** marks allow **1** mark only for 95 or other incorrect rounding allow for **1** mark: $\left(\frac{91}{2030} \times 100 =\right) 4.5\%$ allow **2** marks for correct rounding of 95.51724138 allow **1** mark for correct calculation using incorrect subtraction **only** if working shown	1 1	AO2 4.3.1.2
05.3	most people are **immune** so do **not become ill** (from infection) less chance of **non-immune** / **unvaccinated** individuals being exposed to pathogen / measles / virus	allow herd / community immunity so do not become ill (from infection) allow most people are immune so do not become infected ignore most people are immune so don't get / catch it reference to an organism is needed allow 'it' for the measles virus allow fewer people to pass it on to non-immune people	1 1	AO1 4.3.1.1 4.3.1.7

4.3.1.7 Vaccination

Answer 01 · Mark scheme

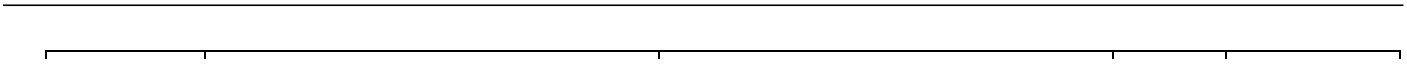
June 2018 | 8464/B/1H | Original Q5

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 3:** Relevant points (comparisons / reasons) are identified, given in detail and logically linked to form a clear account.	5–6	AO1
	Level 2: Relevant points (comparisons / reasons) are identified and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2
	No relevant content	0	
	Indicative content **differences (after exposure to measles virus):** • greater number / higher concentration of antibodies produced • quantitative statement, eg 9 times higher **or** 0.8 to 7.2 • antibodies produced sooner – idea of immediate response • antibodies produced quicker • antibodies stay (in higher concentration) for longer **explanation** • white blood cells / leucocytes / lymphocytes / B cells ignore phagocytes / macrophages • reference to previous exposure (of white blood cells) to pathogen / virus • (white blood cells) recognise pathogen / virus / antigen • memory cells • production of specific / correct antibodies		4.2.2.3 4.3.1.2 4.3.1.6 4.3.1.7
Total			**11**

4.3.1.7 Vaccination

Answer 01 · Mark scheme

June 2018 | 8464/B/1H | Original Q5



4.3.1.7 Vaccination

Answer 02 · Mark scheme

November 2020 | 8464/B/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	any **four** from: • bacterial cell is smaller (than a plant cell) • bacterial cell does **not** have chloroplasts (plant cell does) • bacterial cell does **not** have its DNA / genetic material inside a nucleus (plant cell does) • bacterial cell (may) have plasmids (plant cell does not) • bacterial cell does **not** have mitochondria (plant cell does) • cell wall in bacterial cells is **not** made of cellulose (cell wall in plant cells is) • bacterial cell does **not** have a large / permanent vacuole (plant cell does) • bacterial cell has smaller ribosomes (than plant cells)	allow converse statements 'it' refers to bacteria ignore chlorophyll allow bacterial cell does **not** have a nucleus (plant cell does) allow bacterial cell has DNA / genetic material in a ring / loop (plant cell does not) allow bacterial cell has DNA / genetic material free in cytoplasm do **not** accept idea that bacterial cells do not have ribosomes allow bacterial cell (may) have a flagellum (plant cells do not) allow bacterial cell (may) have a slime capsule (plant cell does not)	4	AO1 4.1.1.1 4.1.1.2

4.3.1.7 Vaccination

Answer 02 · Mark scheme

November 2020 | 8464/B/1H | Original Q4

04.2	any **four** from: • dead / inactive / weakened form of pathogen / bacterium / microorganism is introduced / injected • white blood cells stimulated to produce antibodies • reference to memory cells made or remain • on re-exposure specific / correct antibodies are made (very) quickly • bacteria / pathogens / microorganisms killed and do not produce a large enough population to cause the disease	allow introduce / inject antigen(s) from the pathogen allow dead / inactive / weakened form of *Gonorrhoea* (bacteria) introduced / injected do **not** accept inject Gonorrhoea disease do **not** accept incorrect white blood cell, eg phagocyte allow on re-exposure specific / correct antibodies are produced in large quantities allow bacteria / pathogens / microorganisms killed and do not produce a large enough population to produce toxins	4	AO1 4.3.1.7 AO2 4.3.1.1

4.3.1.7 Vaccination

Answer 02 · Mark scheme

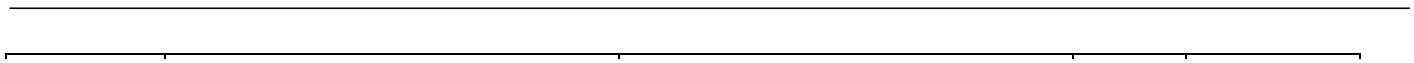
November 2020 | 8464/B/1H | Original Q4

04.3	fewer bacteria / pathogens in chicken / eggs / food (so) fewer bacteria are ingested (by humans) **or** fewer bacteria / pathogens ingested (by humans) (1) (so) fewer toxins produced (1)	ignore references to immunity unqualified allow fewer chickens / eggs will carry the bacteria / pathogens ignore chickens do not get disease / infected allow idea of fewer bacteria being passed on to humans in food allow idea of fewer bacteria being passed on to humans in food (1)	1 1	AO2 4.3.1.3 4.3.1.1
04.4	wash hands before preparing food wash hands after using the toilet	ignore wash hands unqualified allow good food hygiene allow clean areas where a person has been ill allow do not shake hands (with someone who has food poisoning)	1	AO1 4.3.1.1 4.3.1.3
04.5	warmer weather so bacteria reproduce / increase faster	ignore bacteria are killed at low temperatures allow food not cooked properly on barbeques	1	AO3 4.3.1.1 4.3.1.3
Total			**12**	

4.3.1.7 Vaccination

Answer 02 · Mark scheme

November 2020 | 8464/B/1H | Original Q4



4.3.1.7 Vaccination

Answer 03 · 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

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

4.3.1.7 Vaccination

Answer 03 · 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**

4.3.1.7 Vaccination

Answer 04 · Mark scheme

June 2024 | 8464/B/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	virus(es)		1	AO1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	any **two** from: • isolation (of people with measles) • cover your nose / mouth when you cough / sneeze • frequent handwashing / sanitiser	allow wear face coverings allow frequent cleaning of surfaces ignore PPE unqualified ignore public health education programmes unqualified ignore social distancing unqualified	2	AO2 4.3.1.1 4.3.1.2

4.3.1.7 Vaccination

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	any **four** from: • (vaccine / injection) contains dead / inactive (measles) pathogen / virus • white blood cells produce antibodies • the antibodies produced are specific / correct (for the measles virus / pathogen) • reference to memory cells made • on secondary exposure antibodies are produced faster	 allow vaccine / injection contains weakened / attenuated pathogen / virus allow vaccine / injection contains (measles) antigens ignore vaccine contains dead measles allow leucocytes / lymphocytes produce antibodies do **not** accept phagocytes produce antibodies allow description of memory cells allow on secondary exposure larger quantities of antibodies are produced ignore herd immunity ignore antitoxins if no other marks awarded allow **1** mark for antibodies are produced	4	AO1 4.3.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	viruses enter cells (so) cells are damaged / killed	allow viruses exist / reproduce inside cells allow viruses inject genetic material into cells allow cells burst open	1 1	AO1 4.3.1.1

4.3.1.7 Vaccination

Answer 04 · Mark scheme

June 2024 | 8464/B/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	to check the drugs are not toxic / poisonous	allow to check for side-effects allow to check the drugs are not harmful ignore dangerous	1	AO1 4.3.1.9
	to check efficacy **or** to see if the drugs work **or** check if the drugs treat the disease		1	
	to determine dosage **or** to find out how much is needed		1	
		allow to check interaction with other drugs		

Total Question 3	12

4.3.1.7 Vaccination

Answer 05 · 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

4.3.1.7 Vaccination

Answer 05 · 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		

4.3.1.7 Vaccination

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**

4.3.1.7 Vaccination

Answer 01 · Examiner comments

June 2018 | 8464/B/1H | Original Q5

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

05.1 76% of students achieved this mark. Common correct responses included not all cases of measles being recorded or diagnosed, or people not going to see the doctor. There were some confused ideas that deaths would not be recorded.

05.2 34% of students were awarded both marks. The most common error was in rounding the final answer, for example an answer of 95 gained one mark only.

Quite a lot of students used the alternative method given on the right hand side of the mark scheme. Many gave an answer of 4.5% for one mark. Only a few continued and subtracted this value from 100 to give the correct final answer.

05.3 This was a demanding question targeting the highest-attaining students. 8% of students achieved at least one mark. The question asked for an explanation of why vaccinating a large proportion of a population reduced the spread of the measles virus.

The first marking point required a reference to most people being immune and linking this to the fact that they would not become ill. Students usually missed this mark because they said they would not catch the virus, which is incorrect. Many were familiar with the term ‘herd immunity’, but few could clearly explain it.

The second marking point was for the idea that there would then be fewer people with the disease to pass the virus on to unvaccinated people. This mark did need a reference to the chance of an organism being passed on, disease was insufficient.

Many responses included correct biological facts, but they were not relevant to the question being asked. For example, many students gave a description of what a vaccine is, or described the immune response in general terms.

4.3.1.7 Vaccination

Answer 01 · Examiner comments June 2018 | 8464/B/1H | Original Q5

05.4 This was a 'level marked', 'extended response' question. The command word was 'Explain', so the main discriminator between the three different levels was the quality of linking ideas. Students were asked to explain the differences between antibody production after the injection of a vaccine and after exposure to the measles virus. Therefore comparisons between the two exposures and clear explanations in terms of the immune response were needed for level 3.

Students who only gave simple statements or a description of the graph, without comparisons or explanations, could only attain level 1. 53% of students gave a level 1 response.

Some students only gave comparisons. These could achieve three marks, if sufficient comparisons were made. The most common comparisons given were that more antibodies were produced at a faster rate after exposure. On their own these comparisons achieved two marks. If a correct quantitative statement was also given this was sufficient for three marks.

To achieve four marks explanations for the differences were required. 34% of students achieved three or more marks. Very few students gave a level 3 response, but this was targeted at grades 8–9.

Many responses showed a misunderstanding of antibodies, antigens, antitoxins and phagocytosis. Incorrect graph readings were often seen.

4.3.1.7 Vaccination

Answer 03 · 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 03 · 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.

4.3.1.7 Vaccination

Answer 04 · Examiner comments

June 2024 | 8464/B/1H | Original Q3

Question 3 (standard & standard/high demand)

03.1 62% got this question correct. Common incorrect answers were bacteria, mosquitos and pathogen.

03.2 Many students mixed up measles with malaria, with answers such as 'use a bed net' or 'drain swamps' seen frequently. A common mistake was missing out the idea of cells and being more generic with the use of the word 'body', which was not creditworthy. References to poor hygiene and handwashing alone were insufficient to gain credit but were seen very often. Students very often gave the same marking point twice, such as 'cover your face when sneezing' and 'wear a face mask', which only gained 1 mark.

The most common correct answer was 'isolation'; students who gained 2 marks often gave 'wearing a mask' as their second answer. Some students referred to sneezing into elbows which was synonymous with covering your mouth when sneezing.

03.3 Often students missed the first marking point by stating that the vaccine contains dead measles, which was insufficient at this level. Students also missed out on the final marking point by saying that the white blood cells respond rapidly but did not say that it was quick*er* at producing antibodies. The most awarded marks were for 'white blood cells make antibodies' and correct references to memory cells.

There was a lot of confusion with antibodies surrounding and engulfing pathogens which was seen several times. Many students confused the words antigen and antibody when talking about the specificity.

03.4 Most students were able to articulate that viruses entered cells and damaged them for 2 marks. Several students incorrectly stated that viruses released toxins, which damaged cells and in this case only 1 mark was awarded for the damage to cells. Many stated that viruses specifically infect white blood cells, which is incorrect.

03.5 For this question, many students gave answers that matched the same marking point ('check to see if it's harmful' and 'to see if there are side effects' are equivalent to 'check the drugs are not toxic'), which would only be credited with 1 mark. We are seeing an increase in students writing simple one-word answers (such as 'side-effects' or 'toxicity') that don't answer the question. Answering the question 'Why are clinical trials needed?' simply with 'side effects' doesn't tell the examiner if the student understands that the drug must be tested to see if it will give side effects or prevent them. It's not clear enough to answer the question and therefore not creditworthy.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

Answer 04 · Examiner comments June 2024 | 8464/B/1H | Original Q3

0 3 . 5 Drugs can help to reduce the symptoms of the norovirus infection.

New drugs must go through clinical trials before being licensed for use.

Give **three** reasons why clinical trials are needed. **[3 marks]**

1 To understand the side effects.

2 So you know the correct volume or concentration of the medicine to take.

3 to ensure it is safe for people with the infection.

This student gained 2 marks because responses 1 and 3 were repeats of the same marking point. The description of correct dosage is enough to be awarded a second mark.

4.3.1.7 Vaccination

GCSE

Combined Science: Trilogy

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

Report on the exam

Published: August 2025

AQA Education (AQA) is a registered charity (number 1073334) and a company limited by guarantee registered in England and Wales (number 3644723). Our registered address is AQA, Devas Street, Manchester M15 6EX.

4.3.1.7 Vaccination

Support and guidance from AQA

Our reports on the exams are part of a suite of support we offer to enhance your understanding of our assessments and your students' performance.

Mark ranges and award of grades

Grade boundaries and cumulative percentage grades are available on the results statistics page of our website.

Data Insights (replaces Enhanced Results Analysis)

Data Insights is our new powerful online platform designed to help schools analyse exam performance in detail. You can:

- View how your students' grades compare to previous years and to other AQA centres.
- Analyse average marks and grade distributions for specific subjects.
- Drill down into individual student performance across components, units, and assessment objectives.
- Use heatmaps to identify patterns in question performance, spot strengths and weaknesses, and inform teaching strategies.
- Download tailored reports to support post-results analysis and intervention planning.

For more information on Data Insights, log in through Centre Services.(Sign in to your AQA account).
Take a look at our Data Insights Video , quick reference guide or Data Insights user guide which have helpful insights on how to analyse your data.

Professional development

Attend one of our feedback courses where you can review example responses from students and commentaries from our examiners.

Enhance your understanding of GCSE science mark schemes and how to apply them with our eLearning courses.

AQA resources

We explain common misunderstandings and mistakes that students make when answering exam questions, and provide top tips on good exam technique in our Teaching Guide.
Enhance your understanding of vital aspects of the GCSE science assessments using our dedicated Teacher training (Focus on Success) packs.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

Contents

The below table is interactive. You can press the control button click on the title of the question to go directly to that page.

Contents	Page
Overview	4
Summary of overall performance	5
Question 1	6
Question 2	7
Question 3	10
Question 4	11
Question 5	14
Question 6	16

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

© 2024 AQA and its licensors. All rights reserved.

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.

© 2024 AQA and its licensors. All rights reserved.

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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

© 2024 AQA and its licensors. All rights reserved.

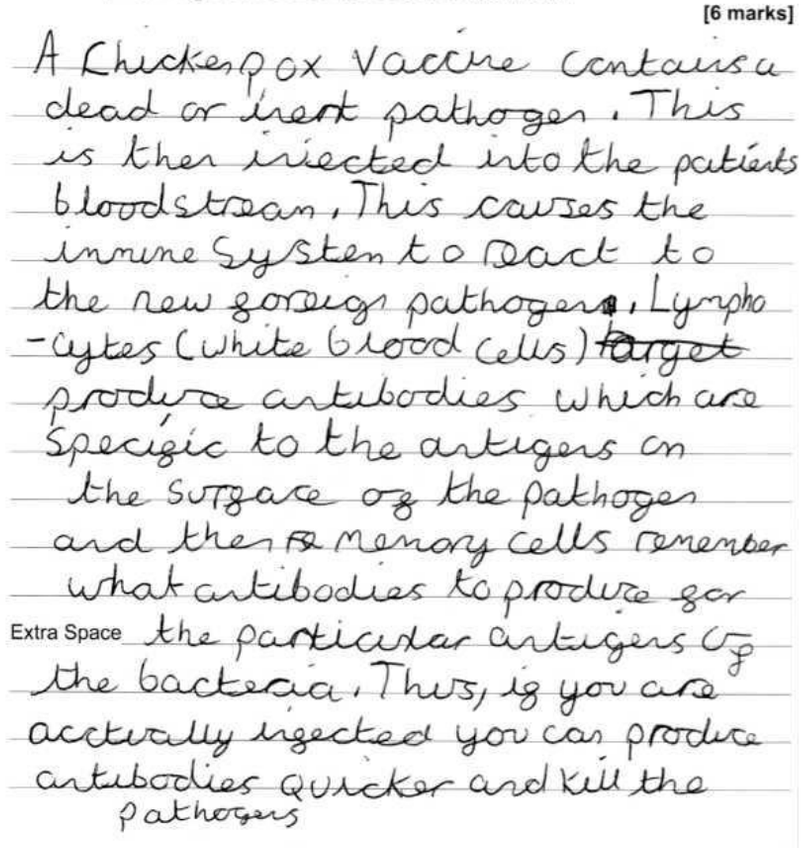
4.3.1.7 Vaccination

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]



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.

© 2024 AQA and its licensors. All rights reserved.

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.

© 2024 AQA and its licensors. All rights reserved.

Question 4 (Standard and High demand)

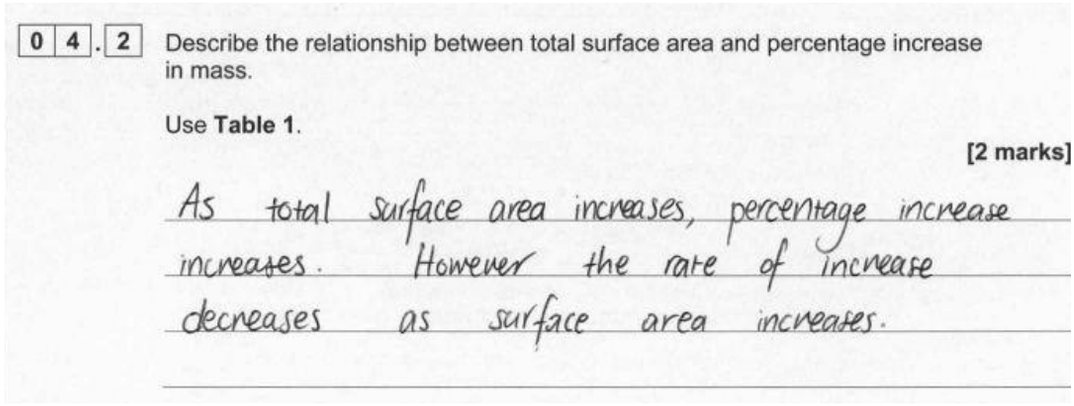
04.1 To gain credit, students needed to state that the potato pieces had different *starting* masses, making answers such as 'they have different mass', insufficient.

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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

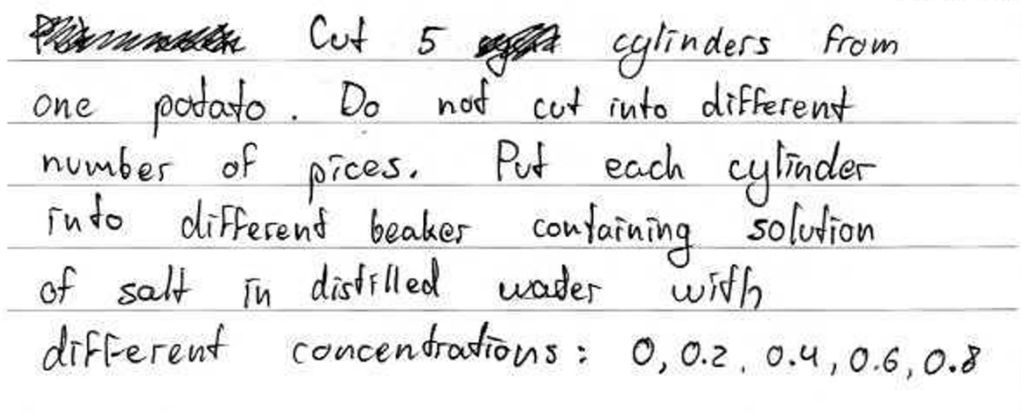
04.5 This question was poorly answered, with only 8% of students meeting both criteria. Many responses lacked precision and failed to clearly describe how the method should be adapted. Few students stated that the independent variable should be different concentrations of salt solution. References to 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]



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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

Source appendix · Full source examiner report

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.

© 2024 AQA and its licensors. All rights reserved.

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.

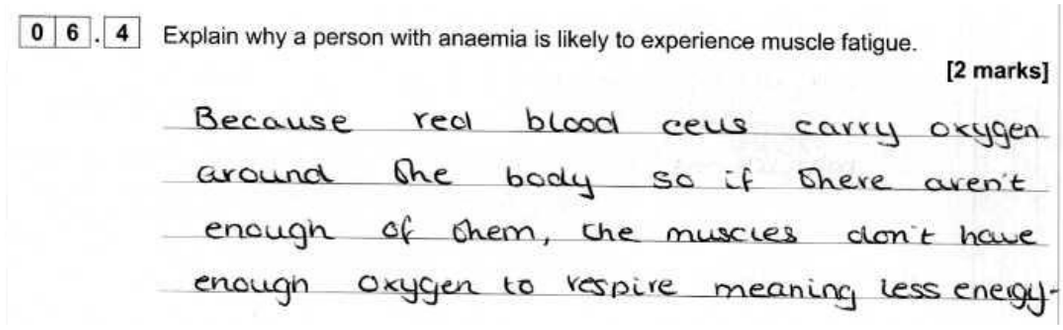
© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

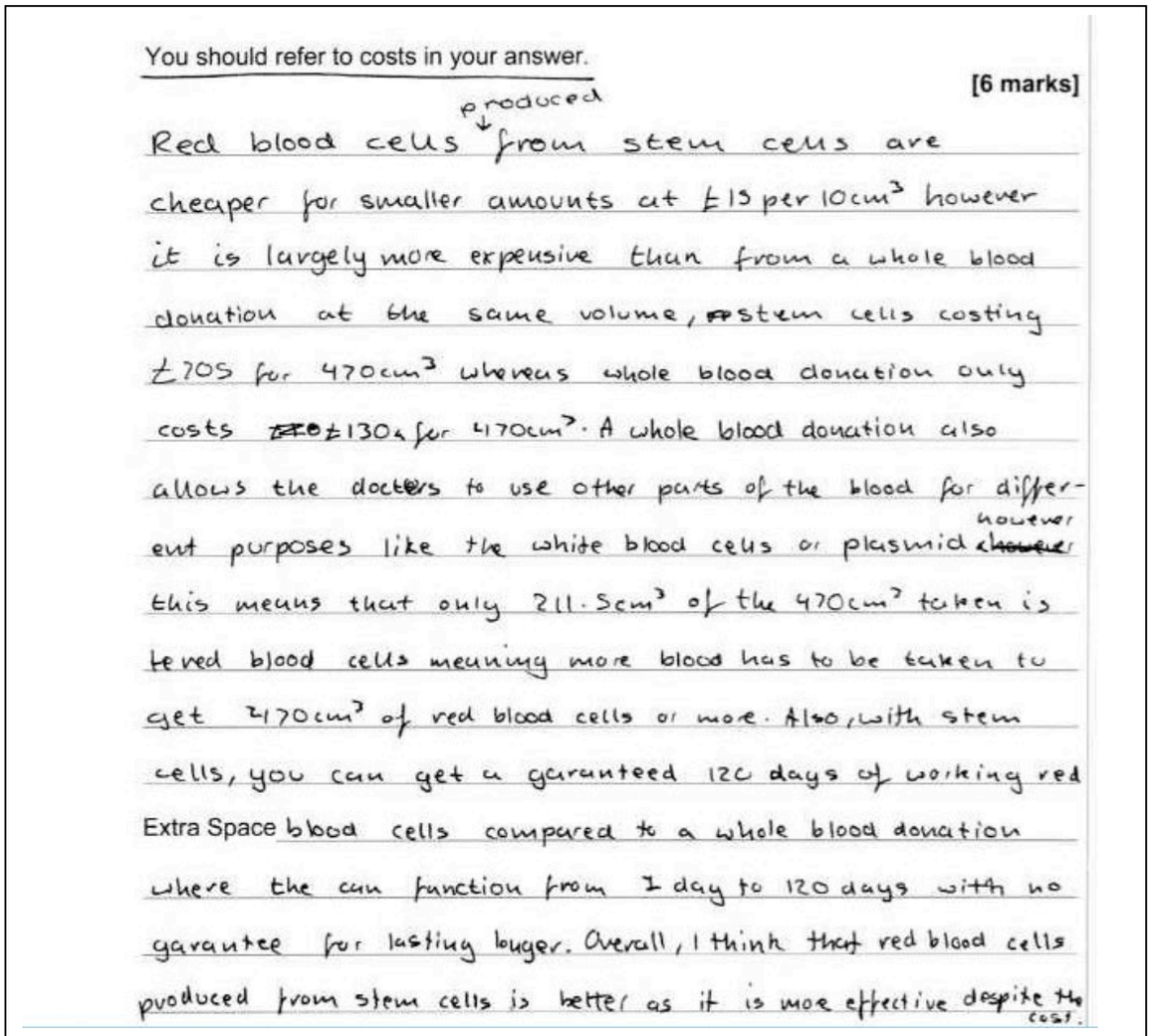
Many students correctly identified advantages of stem cell-derived red blood cells, including longer shelf life, smaller sample requirements, and lower risk of infection. Some gained credit by framing these as disadvantages of whole blood donation. However, many answers simply re-stated information from 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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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, ~~ff~~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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

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.

© 2024 AQA and its licensors. All rights reserved.

4.3.1.7 Vaccination

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

Tel: 01483 477756
Email: gcsescience@aqa.org.uk

aqa.org.uk

© 2024 AQA and its licensors. All rights reserved.