AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.7.1.2

Abiotic factors

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**4**
Available paper years	**2018–2025**

Using this booklet

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

Name: _____ **Date:** _____

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

4.7.1.2 Abiotic factors

Answer 01 · Mark scheme June 2018 | 8464/B/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	<table><tr><th>Factor</th><th>Biotic</th><th>Abiotic</th></tr><tr><td>Diseases</td><td>✓</td><td></td></tr><tr><td>Herbivores</td><td>✓</td><td></td></tr><tr><td>Temp</td><td></td><td>✓</td></tr><tr><td>Water</td><td></td><td>✓</td></tr></table>	allow **1** mark for 2 or 3 correct	2	AO1 4.7.1.3 4.7.1.2
06.2	(leaves block light near tree so) more light (as you move outwards)	allow low light intensity under tree ignore Sun	1	AO2 4.7.2.1
	for photosynthesis	allow less photosynthesis under the tree	1	AO1 4.7.2.1 4.4.1.1 4.4.1.3
	(which) produces (more) glucose / proteins (for growth)	ignore growth ignore food allow molecules, cell components or other correct substances instead of proteins if no other mark awarded allow less water / ions / minerals / nutrients under the tree	1	AO1 4.7.2.1 4.4.1.1 4.4.1.3
06.3		in this order		AO1 4.7.2.1
	quadrat	correct spelling only	1	
	light meter	allow lux meter allow light intensity meter allow light data logger	1	
06.4	1.5(0) (m^2)	allow 15 000 cm^2	1	AO2 4.7.2.1

4.7.1.2 Abiotic factors

Answer 01 · Mark scheme

June 2018 | 8464/B/2F | Original Q6

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

4.7.1.2 Abiotic factors

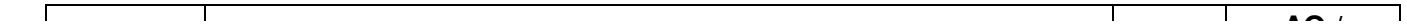
Answer 01 · Mark scheme

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

4.7.1.2 Abiotic factors

Answer 01 · Mark scheme

June 2018 | 8464/B/2F | Original Q6



4.7.1.2 Abiotic factors

Answer 02 · Mark scheme

June 2022 | 8464/B/2F | Original Q2

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 2:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 4.7.2.1 RPA 7
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • place quadrat randomly / systematically • description of how randomness is achieved **or** description of how systematic placement is achieved • count number of buttercups in quadrat • record number • repeat quadrat (in another location in the same wet soil area) • (repeat) at least 5 times • calculate a mean number of buttercups per quadrat • the area of the wet soil area is 100 m^2 • estimate the buttercup population using the area of the quadrat		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	an abiotic factor		1	AO2 4.7.1.2 RPA7

4.7.1.2 Abiotic factors

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	any **two** from: • light (intensity) • temperature • competition • herbivores / grazing • pollinators • trampling / mowing • wind (direction / strength) • soil pH **or** soil type • ions / minerals / nutrients in the soil • pathogens • herbicides	ignore rain / water / weather allow shade ignore sun allow other plants growing there allow pests **or** named pest allow insects or named pollinator allow named mineral allow infection ignore disease unqualified allow pesticides	2	AO2 4.7.1.2 4.7.1.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(the) dependent		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5 mark with 02.6	0.25 (m^2)		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6 mark with 02.5	8 ÷ 0.25 32 (buttercups per m^2)	allow ecf from question **02.5** allow 8 × 4	1 1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any **two** from: • repeat • same volume of water • same mass / volume of soil • more acidity / pH levels • same number of bean seeds • same spacing / depth of seeds • same species / variety / type of bean seeds • same size boxes • same light (intensity) • same temperature	allow same amount of water allow same amount of soil } if neither marking point awarded, allow put them in the same place eg greenhouse	2	AO3 4.7.1.2 RPA7

4.7.1.2 Abiotic factors

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	$\frac{11+12+11+17+19}{5}$ **or** $\frac{70}{5}$ 14 (cm)		1 1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	bean plants grow less well (in acid soil) **or** bean plants are shorter (in acid soil)	allow converse	1	AO3 4.7.1.2 RPA7

Total Question 2		16

4.7.1.2 Abiotic factors

Answer 03 · Mark scheme

June 2023 | 8464/B/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	line approximately perpendicular to river	allow on either side of river ignore length of line do **not** accept a line parallel to the river	1	AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	quadrat		1	AO1 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	6 / six	ignore calculation / range given if mean is clear	1	AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	increases		1	AO3 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	to know the uncertainty of the mean		1	AO3 4.7.2.1 RPA7

4.7.1.2 Abiotic factors

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	light intensity moisture levels		1 1	AO1 4.7.1.2 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	more / increased carbon dioxide (in air) **or** less carbon dioxide absorbed / used (by plants) (due to) less photosynthesis	 allow (due to) more decay / burning (of plants) allow **2** marks for less carbon dioxide used for photosynthesis if no other mark awarded allow **1** mark for carbon dioxide is used in photosynthesis	1 1	AO2 4.7.2.1 4.7.2.2 4.7.3.5

Total Question 3	9

4.7.1.2 Abiotic factors

Answer 04 · Mark scheme

June 2025 | 8464/B/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	quadrat		1	AO1 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	7 × 4 28 (%)	allow $\frac{7}{25}$ × 100 allow **1** mark for a correct calculation from an incorrect attempt at counting squares (in the range 5 to 10) covered by buttercups	1 1	AO3 AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	distance from the tree		1	AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	percentage cover is affected by number and size of individual plants		1	AO3 4.7.2.1 RPA7

4.7.1.2 Abiotic factors

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$\frac{12+8+4+12+4}{5}$ 8 (%)	allow $\frac{40}{5}$	1 1	AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	higher percentage cover 10 m from tree	allow ecf from question **03.5** with correct mathematical analysis of difference in incorrectly calculated mean allow converse if clearly referring to 1 m from tree **or** closer to the tree allow higher percentage cover further from tree allow more cover / buttercups further from tree allow cover is double further from tree allow twice as much / many further from tree	1	AO3 4.7.2.1 RPA7

4.7.1.2 Abiotic factors

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **two** from:		2	AO2 4.7.1.2 4.7.2.1 4.7.1.3 RPA7
	• light	allow shade **or** less / more light allow (tree) leaves drop and cover buttercups ignore Sun		
	• temperature			
	• water / moisture	allow rain		
	• type of soil			
	• pH (of soil)	allow acidity / alkalinity (of soil)		
	• minerals / ions	allow salts **or** named examples of ions, such as nitrate allow fertiliser(s) ignore nitrogen / nutrients		
	• oxygen in soil			
	• wind (strength / direction)			
	• herbicide	allow weedkiller		
	• competition from other plants			
	• herbivores / grazers (of buttercups)	allow animals / insects eat / damage buttercups		
	• (number of) pollinators			
	• time of year	allow season ignore time unqualified		
	• size of tree / roots / canopy			
	• disease / pathogen (of buttercups)			
		ignore (availability of) space ignore carbon dioxide ignore weather / climate		
		if no other mark awarded allow **1** mark for biotic **and** abiotic		

4.7.1.2 Abiotic factors

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	any **two** from: • repeat at more distances **or** at another distance (from the tree) • repeat at each distance more (than 5) times • repeat for other trees • measure other (named) factor(s)	allow specific distances, between 0 m and 10 m or beyond 10 m allow repeat (at each distance) more than 5 times allow repeat at 1 m and 10 m more (than 5) times allow repeat the (whole) investigation ignore repeat 5 times	2	AO3 4.7.2.1 RPA7

Total Question 3	12

4.7.1.2 Abiotic factors

Answer 02 · Examiner comments

June 2022 | 8464/B/2F | Original Q2

Question 2 (low & standard demand)

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

For Level 2 (3–4 marks) the method needed to include sufficient detail to collect a representative sample (a valid outcome), such a random or systematic placement of quadrats, counting or recording the number of buttercups in a quadrat and repeating. The highest scoring responses also included more detail, such as is shown in the indicative content section of the mark scheme.

Some students repeated the question, which is never given credit. Many students could give the idea of counting the number of buttercups in a quadrat, and understood the need for repeats. Fewer students described placing the quadrat randomly or systematically. Throwing quadrats is not random, therefore could not be credited as part of a response.

02.2 44% of students knew that water in the soil was an abiotic factor in this investigation.

02.3 41% of students could give two factors that might affect the number of buttercups growing on the school field. Students were reminded not to refer to water, but this was frequently seen, along with references to dry soil and rain which were ignored.

The most common correct answers related to light intensity, temperature and trampling.

02.4 43% of students could identify that the number of buttercups was the dependent variable.

02.5 71% of students could calculate the area of the quadrat.

02.6 29% of students could use their answer from **02.5** to calculate the number of buttercups per m^2.

02.7 10% of students could give two improvements the students could make to give more valid results. The most common answers related to using the same number of seeds in each box or repeating the investigation. Answers such as measure the soil, or measure the acid, were insufficient.

Answer 02 · Examiner comments June 2022 | 8464/B/2F | Original Q2

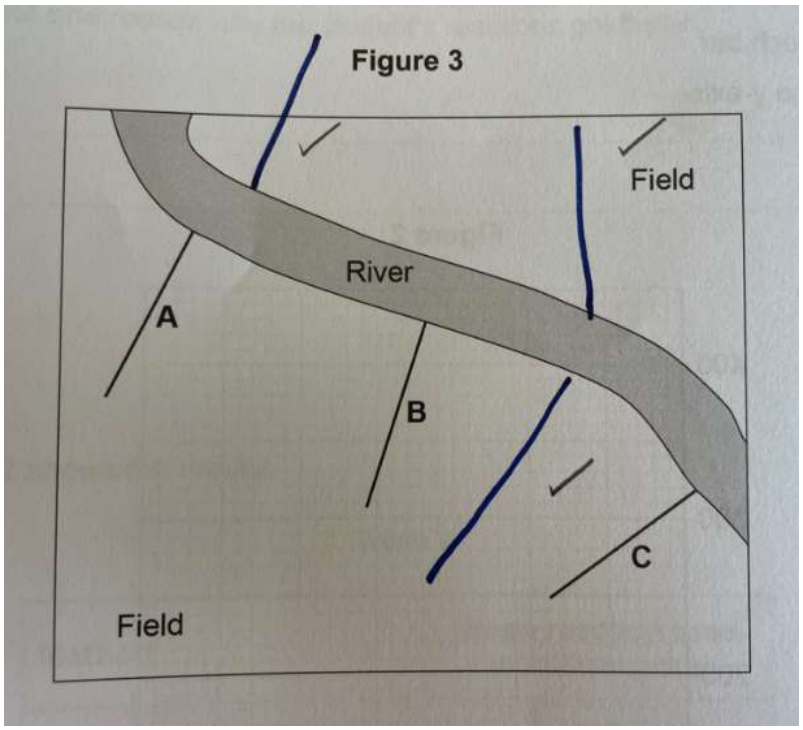
02.8 Most students could calculate the mean value. The most frequently seen incorrect answer indicated a potential issue with calculator use, such as 11+12+11+17+19÷5 = 54.8, where 19÷5 is occurring first, followed by the addition. Students should think about whether their answer to a calculation is sensible.

02.9 Students could describe the effect of acid soil on the growth of the bean plants in several ways and 60% of students were awarded this mark. Sometimes, responses were insufficiently detailed, such as acid soil affects the growth.

Answer 03 · Examiner comments June 2023 | 8464/B/2F | Original Q3

Question 3 (Low and Standard demand)

03.1 Many students could identify where to place a fourth transect for this investigation. Students could draw their transect either side of the river. Transects parallel to the river were incorrect. A significant number of students misunderstood the aim of the investigation and instead connected the existing three transects.



The three lines on the image above are examples that were acceptable for 'approximately perpendicular to river'. Note that we have ticked each line to indicate the lines have been drawn. The lines could be drawn by hand or with a ruler and could extend beyond the boundary of the image (as shown in the top left). Lines that extended well into, or across, the river were incorrect.

Answer 03 · Examiner comments

June 2023 | 8464/B/2F | Original Q3

03.2 The majority of students knew that a quadrat was required.

03.3 Most students could interpret the graph to state the correct mean. Some students attempted to calculate the mean of the mean at each distance, which was incorrect.

03.4 Due to the way the question was phrased, we assumed 'it' referred to the plant species. Many students could state that the mean number of plant species increased further from the river. This was expressed in a variety of ways. 'Wider range / diversity' or 'bigger / higher numbers' or 'bigger / higher mean' all gained the mark. A simpler response such as 'There are more' or 'We see more plants' was also sufficient for the mark.

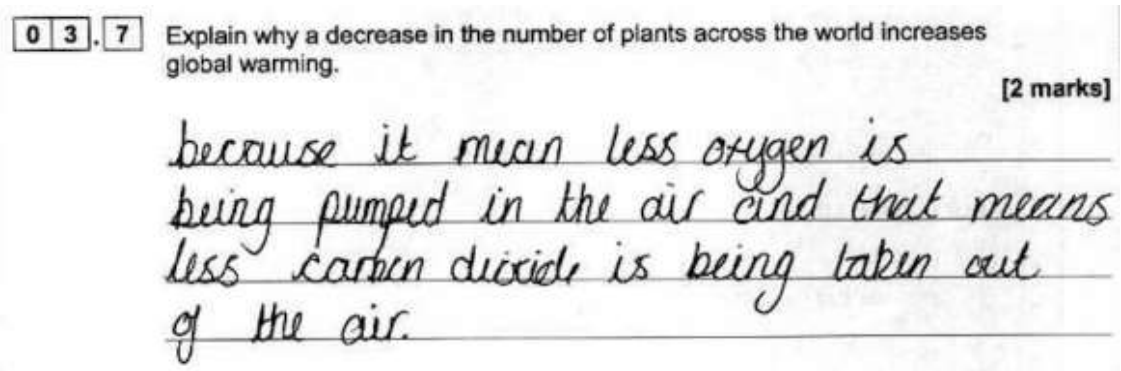
A significant number of students misunderstood the question and attempted to explain rather than describe the effect of moving away from the river.

03.5 40% of students could identify why it is useful to know the range of results.

03.6 50% of students could identify two abiotic factors from the list provided.

03.7 Some students could state that plants use carbon dioxide during photosynthesis. This was awarded 1 mark (in the absence of either marking point) but was insufficient to answer the question fully.

A common misconception was that global warming is linked to the oxygen concentration in the air. Incorrect references to ozone were also frequently seen. There were incorrect references to plants 'breathing' and respiration was sometimes stated as the process involved.


0 3 . 7 Explain why a decrease in the number of plants across the world increases global warming.

[2 marks]

because it mean less oxygen is being pumped in the air and that means less carbon dioxide is being taken out of the air.

Many students made an incorrect link between oxygen and global warming. Marking point 1 was awarded here but with no reference to photosynthesis, decay or burning marking point 2 could not be awarded.

Answer 04 · Examiner comments

June 2025 | 8464/B/2F | Original Q3

Question 3 (Low and Standard demand)

03.1 80% of students could identify the equipment as a quadrat.

03.2 Some students counted all squares containing some buttercup plants and therefore reached a number of 10 small squares. They could gain one mark with a correct calculation of the final answer of 40, but only if appropriate working was shown. It is possible that this error indicates a lack of practical experience of Required Practical Activity 7 and the wide range of ways that abundance and distribution of a species can be sampled.

03.3 Two thirds of students could identify the independent variable.

03.4 Just over half of students identified the advantage of calculating percentage cover instead of counting the number of buttercup plants in an area.

03.5 Most students could calculate the mean. When only one mark was awarded, for correct working, but the final answer was incorrect, it appears calculator skills are the issue, with students putting all the numbers into the calculator at once and therefore only dividing the final number by 5. For example, 12 + 8 + 4 + 12 + 4 ÷ 5 = 36.8.

03.6 Nearly two thirds of students could give one conclusion from the results. Some students did not answer the question, and instead gave a reason for the results, such as 'more sunlight further from the tree'.

03.7 Students most frequently referred to water or rain or light. Some students gave light and shade, which were the same marking point, therefore only gained one mark.

03.8 Students struggled to suggest improvements to the method. Most students who did gain a mark gave bullet point 1 on the mark scheme for the idea of varying the distances more. Responses suggesting changing the method to throwing quadrats were surprisingly common. As has been included in previous examiner reports, throwing quadrats is never an appropriate method.

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