AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.1.2

Abiotic factors

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**4**
Available paper years	**2010–2025**

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

March 2010 | BLY1BP | Original Q4 | Legacy

Four	**A**	spiral wrack	**3**
	B	bladder wrack	**2**
	C	serrated wrack	**4**
	D	kelp	**1**

4.7.1.2 Abiotic factors

Answer 02 · Mark scheme

June 2022 | 8461/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**abiotic** any **two** from: • water	 allow moisture / humidity / rain(fall) allow dryness	2	AO1 4.7.1.1 4.7.1.2 4.7.1.3
	• oxygen / air (in soil) • pH (of soil) • minerals / ions	ignore carbon dioxide allow acidity / alkalinity (of soil) allow salts allow named example of an ion ignore nutrients		
	• temperature • size of soil particles **or** texture / type of soil	 allow named example of soil type ignore space / toxins / weather		
	biotic any **two** from: • food	 allow amount of dead / decaying matter (in soil) ignore nutrients	2	
	• predators / consumers / carnivores	allow example – such as birds		
	• disease / pathogens / bacteria / fungi	allow microorganisms / microbes / parasites if **no** other marks awarded allow **2** marks for **four** factors in reverse categories		

Answer 02 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
09.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	AO2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content • same concentration of chemical / **X** applied to the soil • same volume / amount of chemical / **X** applied to the soil • same size of area sampled – eg 1 m^2 or 0.25 m^2 • use of a quadrat • same time between application and collecting worms • same time allowed for collecting worms after application • each sample area selected randomly • method of achieving randomness – eg random coordinates • (collect and) count worms in each of areas **A** and **B** • at least 5 repeats in each of areas **A** and **B** • calculate mean (per unit area) **or** total for each of areas **A** and **B** • compare means / totals for areas **A** and **B**		4.7.2.1 RPA9

Total Question 9		**10**

4.7.1.2 Abiotic factors

Answer 03 · Mark scheme

June 2023 | 8461/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	(30 m) tape measure quadrat	must be in this order	1 1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	choose locations at random		1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	area mean	must be in this order	1 1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	multiply mean by area	allow multiply 2 by 150 allow multiply total (of five quadrats) by a fifth of the area allow multiply 10 by 30	1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	count and record more samples		1	AO3 4.7.2.1 RPA9

4.7.1.2 Abiotic factors

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.6	any **one** from: • water / moisture • light • temperature • oxygen in the soil • wind • minerals / ions	 allow humidity allow rain allow drought ignore sun unqualified allow shade (by eg building) ignore oxygen unqualified allow named ions allow fertiliser / salts ignore carbon dioxide ignore nutrients ignore (soil) pH	1	AO2 4.7.1.2

Total Question 2	8

4.7.1.2 Abiotic factors

Answer 04 · Mark scheme

June 2025 | 8461/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	to remove all / the water	allow to make sure there is no water left allow to make sure the soil is (completely) dry ignore to remove water unqualified	1	AO3 4.7.1.2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$\frac{71}{252} \times 100$ 28.1(746…) 28 (%)	 allow student's incorrectly calculated percentage using mass data for 20 metres, rounded to nearest whole number	1 1 1	AO2 4.7.1.2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	as distance increases the percentage of water increases	allow positive correlation allow as one increases the other increases allow as one decreases the other decreases ignore directly proportional	1	AO3 4.7.1.2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	any **two** from: • repeat (at each distance) **and** calculate a mean • test at intermediate / further distances • test around more / different trees • test at different angles around the (same) tree	 allow repeat (at each distance) **and** remove / identify anomalies allow test more areas	2	AO3 4.7.1.2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	any **three** from: • light (intensity) • temperature • type of soil • pH (of soil) • minerals / ions (in soil) • wind (intensity / direction) • oxygen in soil	 if neither awarded allow shade for **1** mark ignore sun allow acidity / alkalinity (of soil) allow salts **or** named examples of ions, such as nitrate allow fertiliser ignore nitrogen / nutrients ignore (availability of) space ignore carbon dioxide	3	AO2 4.7.1.1 4.7.1.2 4.7.2.1 RPA9

Total Question 9	**10**

4.7.1.2 Abiotic factors

Answer 02 · Examiner comments

June 2022 | 8461/2F | Original Q9

Question 9

This was the second of three questions common to both the Foundation and Higher Tier papers. The topic was biotic and abiotic factors that affected the populations of earthworms in two habitats.

09.1 Only one in forty students were able to identify four relevant factors. The most commonly suggested were water, oxygen and temperature for abiotic factors and food and predation for biotic factors. Most students appeared to have little understanding of the distinction between the two types of factor and it was common to find at least some factors in the incorrect category. A significant proportion of weaker students appeared to have a poor understanding of what was required and copied out the four bullet points regarding features of earthworms into the four available spaces or sometimes decided on a couple of factors and wrote them in both sections to gain one or two marks.

09.2 While it was clear that a significant proportion of students had spent time completing fieldwork, there were also many who made no attempt at an answer. There were also students who appeared to misunderstand the question and gave often accounts of why the earthworm populations might be different in the different areas.

Some students included sufficient detail regarding control variables, randomising test areas, counting worms and how to deal with the results for both areas to gain access to Level 3. However some omitted vital components of this, in particular randomising the sampling areas or using chemical **X**, and could only gain a mark at Level 2. Those students who omitted reference to both areas were limited to Level 1.

A small but significant number of students determined the number of earthworms in the whole of the field and lawn and then compared these. This was not an appropriate comparison (and may have reflected practice at a related question from the November 2021 examination) as the question specifically referred to the number of worms per m^2.

A considerable minority of students suggested that throwing quadrats is a suitable way of achieving randomness, which is not only potentially dangerous but also is unlikely to achieve randomness and appropriate representation of the whole area.

Fewer than one in eight achieved level 3 although another third wrote answers worthy of level 2.

4.7.1.2 Abiotic factors

Answer 03 · Examiner comments — June 2023 | 8461/2F | Original Q2

Question 2

This question was about the use of quadrats for estimating the size of a population of buttercups on a lawn.

02.1 The selection from the word box of a 30 m tape measure for measuring the length and width of the lawn and a quadrat as the name of a 1 m × 1 m square frame was done successfully by almost three-quarters of students.

02.2 The sampling at random locations was selected as the appropriate method by a almost three-quarters of students.

02.3 The vast majority of students correctly selected the area of the lawn as the product of its length and width and the mean as a description of the total number of plants divided by the number of samples.

02.4 This question required students to describe how they could use the sampling data in Table 1 and the illustration of the lawn in Figure 2 to demonstrate that the population estimate was 300 buttercup plants. Students answered in various ways: multiplying the mean (per m^2) by the area, '2 × 150', or the total in 5 samples multiplied by a fifth of the area; all of which were correct. A not uncommon incorrect answer was to multiply the total in the 5 samples by the area. Just over one-quarter of students gave a correct answer.

02.5 Improving the accuracy of the estimate by counting and recording more samples was correctly selected by just under three-quarters of students.

02.6 Having been given soil pH as an example of an abiotic factor, most students were able to suggest another – 'light' and 'temperature' being the most common.

Answer 04 · Examiner comments — June 2025 | 8461/2F | Original Q9

Question 9 (Standard demand)

09.1
Students were given a method for an investigation into numbers of daisy plants growing in a field at different distances from the tree. A quarter of students knew that the steps were repeated to remove all the water, or to ensure all the water had evaporated. Common incorrect answers seen included 'to improve accuracy', 'to identify anomalies' and 'to remove excess water'.

09.2
Students were given data from an investigation into the number of daisy plants growing at different distances from a tree. They were asked to calculate a percentage and give their answer to the nearest whole number. This calculation was attempted by around 80% of students, with 20% being awarded the full 3 marks. Of those students that did not gain all 3 marks, those that showed their working out were able to gain one or two marks. Students should be encouraged to always show their working out for calculations.

4.7.1.2 Abiotic factors

Answer 04 · Examiner comments

09.3
A pleasing number of students was able to describe the effect of distance from the tree on the percentage of water in the soil – with almost 45% gaining credit. Students who simply stated 'it increased' did not gain credit as both reference to the distance and the percentage of water were required for the mark.

09.4
Students were asked to consider changes to the investigation that would increase the validity of the conclusion. Bullet point 1 was most commonly seen, although students stating simply to 'repeat it' without qualification could not be given credit at this level of demand. Around a third of students gained at least one mark for this question.

09.5
Around a third of students were able to suggest at least two abiotic factors that might have caused more daisy plants to grow further from the tree, with a further 7% of students gaining all three marks. The full range of possible correct responses outlined on the mark scheme were seen, with light being the most common. A few students negated a correct abiotic factor by suggesting the tree (biotic) was the cause – for example 'shade from the tree'.
Vague answers such as 'soil' or 'weather' did not gain credit, and despite being told in the question not to refer to water, a small number of students referred to rainfall, humidity or drought which again could not be credited.