AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.1.2

Abiotic factors

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**3**
Available paper years	**2021–2025**

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 November 2021 | 8461/2H | Original Q5

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>05.1</td><td>
<table>
<tr><th>Factor</th><th>Biotic</th><th>Abiotic</th></tr>
<tr><td>Nitrates in the soil</td><td></td><td>✓</td></tr>
<tr><td>Rabbits eating the plants</td><td>✓</td><td></td></tr>
<tr><td>Shading by a building</td><td></td><td>✓</td></tr>
<tr><td>Soil pH</td><td></td><td>✓</td></tr>
<tr><td>Temperature</td><td></td><td>✓</td></tr>
<tr><td>Trampling by people</td><td>✓</td><td></td></tr>
</table>
all 6 correct = 3 marks
4 or 5 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks
</td><td></td><td>3</td><td>AO1
4.7.1.2
4.7.1.3
4.4.1.2</td></tr>
<tr><td>05.2</td><td>(grid and) coordinates

to achieve randomness</td><td>

ignore throwing quadrat

allow random coordinates for 2 marks

if no other mark awarded allow random walk or description of random walk for 1 mark</td><td>1

1</td><td>AO1
4.7.2.1
RPA9</td></tr>
</table>

4.7.1.2 Abiotic factors

Answer 01 · Mark scheme

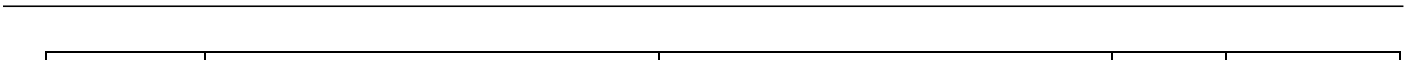
November 2021 | 8461/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	*(mean per m^2 =)* 24 **or** 6 × 4		1	AO2 4.7.2.1 RPA9
	(calculation of area of lawn =) (½ × 16 × 10) – (6 × 3) **or** 80 – 18		1	
	(area of lawn =) 62 m^2	allow correct calculation using total area (of triangle) – area of rectangle	1	
	(total number of daisies =) 24 × 62	allow correct calculation using an incorrectly calculated area of the lawn and / or mean	1	
	1488	allow answer based on incorrect area	1	
	(answer to 3 sig figs =) 1490	allow student's calculated answer rounded to 3 sig figs	1	
05.4	too few quadrats **or** quadrat too small	allow sample size too small	1	AO3 4.7.2.1 RPA9
	sample may not be representative of the lawn	allow quadrats may not have been placed randomly	1	
Total			**13**	

4.7.1.2 Abiotic factors

Answer 01 · Mark scheme

November 2021 | 8461/2H | Original Q5



4.7.1.2 Abiotic factors

Answer 02 · Mark scheme

June 2022 | 8461/2H | Original Q2

Question 2

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

Question	Answers	Mark	AO / Spec. Ref.
02.2	**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 2		**10**

4.7.1.2 Abiotic factors

Answer 03 · Mark scheme

June 2025 | 8461/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	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.
02.2	$\frac{71}{252} \times 100$ 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.
02.3	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.
02.4	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.
02.5	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 2	10

4.7.1.2 Abiotic factors

Answer 01 · Examiner comments November 2021 | 8461/2H | Original Q5

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

This question related to Required Practical Activity 9 and was about determination of the size of a daisy population on a lawn. There was much confusion about biotic and abiotic factors that might affect the growth of daisy plants on the lawn and, although three-quarters assigned at least two of the given factors correctly, fewer than half got all six correct.

In **05.2**, around half the students knew that sampling of the daisies should be at random but very few were able to describe adequately how this might be achieved, ie the use of random coordinates. References to 'throwing' the quadrat were not rewarded.

05.3 was a 6-mark extended calculation of the daisy population on a triangular shaped lawn with a rectangular paved area cut into it. This examined mathematics skill 5c and students were therefore expected to know how to calculate the area of a triangle and a rectangle. However, some thought that the Pythagoras theorem was appropriate for calculating the area of a triangle. Some calculations were very difficult to follow and students should be encouraged to make their reasoning clear; others gave highly improbable answers, eg a total population on the lawn being less than the mean for one quadrat. There was the anticipated error in calculating the area of a 50 cm × 50 cm quadrat, with incorrect answers including 25 m^2. Many students attempted to convert all measurements to centimetres rather than metres and the excessive number of zeros often caused transfer errors from one line of working to the next; or they thought there were 100 cm^2 in 1 m^2 rather than 10 000. Some calculations did not include the given mean of 6 plants per quadrat. Thus, around an eighth of students were completely successful, scoring all 6 marks, and almost two-thirds scored less than half-marks.

Answer 01 · Examiner comments November 2021 | 8461/2H | Original Q5

Most students scored one of the two marks available in **05.4**, for pointing out that the use of just 10 quadrats may not have been sufficient. Hardly any students could go on to elaborate on this to state, for example, that this may not have been a representative sample or that it would not have allowed for an uneven distribution of the daisies, or that the 10 quadrat positions may not have been sufficiently random.

4.7.1.2 Abiotic factors

Answer 02 · Examiner comments

June 2022 | 8461/2H | Original Q2

Question 2

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.

02.1 It was evident that many students did not understand the difference between the two types of factors, with fewer than half scoring full marks for suggesting two abiotic and two biotic factors that could affect the size of an earthworm population. Appropriate answers for abiotic factors included water, oxygen, pH and temperature and, for biotic factors, food availability, predators and pathogens.

02.2 This was a 6-mark extended response question on planning an investigation to compare the number of earthworms per m^2 in two areas: a grass lawn and a farmer's field. Most students answered this very well, with almost a half scoring full marks. Answers typically included the use of the given chemical **X** to bring the worms to the surface, the use of a quadrat (sometimes of stated dimensions) placed randomly, with a suitable method for selection of random coordinates, counting the worms, repeating the procedure a large number of times, calculation of a mean and a comparison between the two areas. Points less frequently given included standardisation of the concentration and volume of the chemical, waiting a standard amount of time for the worms to come to the surface and collecting for a standard time period. Inappropriate points included the use of a transect or attempts at randomisation by throwing the quadrat.

Answer 03 · Examiner comments

June 2025 | 8461/2H | Original Q2

Question 2 (Standard demand)

02.1
Students were given a method for an investigation into numbers of daisy plants growing in a field at different distances from the tree. Three quarters 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'.

02.2
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 over 95% of students, with a pleasing 80% being awarded the full 3 marks. Of the 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.

02.3
A pleasing number of students were able to describe the effect of distance from the tree on the percentage of water in the soil – with almost 90% gaining credit. Students that simply stated 'it increased' did not gain credit as reference to both the distance and the percentage of water were required for the mark.

02.4
Students were asked to consider changes to the investigation that would increase the validity of the student's conclusion. Bullet point 1 was most commonly seen, although students stating simply to 'repeat it' without further qualification could not be given credit at this level of demand. Around 75% of students gained at least one mark for this question.

02.5
Around a quarter of students were able to suggest three abiotic factors that might have caused more daisy plants to grow further from the tree, with a further half of students gaining two of the available 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.