AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.7.3.6

Maintaining biodiversity

Mark schemes and examiner comments

Tier	**Higher**
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.

4.7.3.6 Maintaining biodiversity

Answer 01 · Mark scheme June 2018 | 8464/B/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(the scientists)			
	chose / used (traditional varieties of) rice plants with short stems and rice plants with large grains **or** chose rice plants with short stems and large grains.		1	AO2 4.6.2.3
	(cross) bred the rice plants	allow cross pollinated the rice plants	1	AO1 4.6.2.3
	(from the offspring) chose the plants with best / desired characteristics **or** chose plants with short(est) stems and big(gest) grains		1	AO1 4.6.2.3
	bred repeatedly until all plants had desired characteristics **or** bred repeatedly until they bred true **or** bred repeatedly until they produced IR8		1	AO1 4.6.2.3

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Answer 01 · Mark scheme

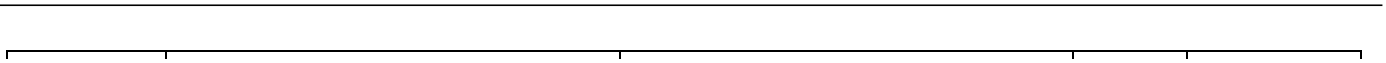
June 2018 | 8464/B/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	agree (**max 3** marks) • resistance to disease / pests / pathogens so higher yield • resistant to herbicides so less competition for (sun)light / water / minerals / ions (from weeds) • larger / more grains per plant or higher yield so more food for people or more income for farmers • better nutritional content (vitamins / protein / low GI index) so will improve health disagree (**max 3** marks) • may affect wild plants (if genes transfer) so making them herbicide resistant • use of herbicides may reduce biodiversity because other plants are killed • traditional varieties no longer grown so reduction in biodiversity • may affect health of people who eat the rice because not enough research done yet	each reason must be explained to gain credit allow improved survival in harsh conditions so can be grown in wider area allow (GM) seeds are expensive for farmers because they have to buy new seeds every year **or** because farmers have to buy specific herbicide if no explanations allow **1** mark for one agree reason **and** one disagree reason	4	AO3 4.6.2.4
Total			**8**	

4.7.3.6 Maintaining biodiversity

Answer 01 · Mark scheme

June 2018 | 8464/B/2H | Original Q5



4.7.3.6 Maintaining biodiversity

Answer 02 · Mark scheme

November 2020 | 8464/B/2H | Original Q3

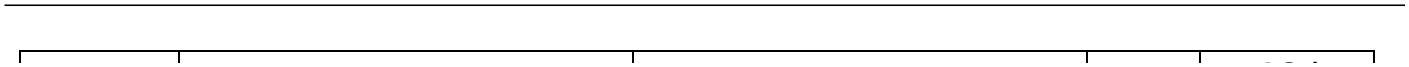
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	the variety of all the different <u>species</u> (of organisms) on Earth **or** the variety of all the different <u>species</u> (of organisms) in a habitat / area / ecosystem		1	AO1 4.7.3.1
03.2	any **one** from: • compost • burning **or** as a fuel	allow to improve soil (texture / drainage / quality) allow to grow food / crops / plants ignore farming unqualified ignore as fertiliser	1	AO1 4.7.3.3
03.3	decay / burning of peat releases carbon dioxide (into the atmosphere) which is increasing global warming	do **not** accept peat bogs release carbon dioxide into the atmosphere allow a description of global warming or consequences if no other mark awarded allow removal of a carbon sink / store for 1 mark	1 1	AO1 4.7.3.3 4.7.3.5

03.4	any **two** from: • takes minerals from the soil as crops are harvested / removed • leads to soil erosion • farmers have to use fertilisers which pollute water / streams / lakes • burning crop waste produces carbon dioxide • using large farm machinery causes soil compaction	ignore nutrients allow burning crop waste causes global warming allow using large farm machinery releases carbon dioxide	2	AO3 4.7.3.2 4.7.3.3 4.7.3.5 4.7.3.6
03.5	antibiotic passed into the environment in animal faeces / urine / sewage **or** antibiotic in animal faeces / urine / sewage flows into rivers		1	AO2
	bacteria in water / land become antibiotic resistant	allow named water or land pathogen such as typhoid / cholera / E coli	1	AO2
	some of these bacteria are human pathogens		1	AO3
	(so) cause (human) diseases which now cannot be cured because they are antibiotic resistant	If no other marks awarded allow 1 mark for mention of antibiotics in milk / meat being consumed by humans.	1	AO3 4.6.3.4 4.7.3.2
Total			**10**	

4.7.3.6 Maintaining biodiversity

Answer 02 · Mark scheme

November 2020 | 8464/B/2H | Original Q3



4.7.3.6 Maintaining biodiversity

Answer 03 · Mark scheme

November 2021 | 8464/B/2H | Original Q2

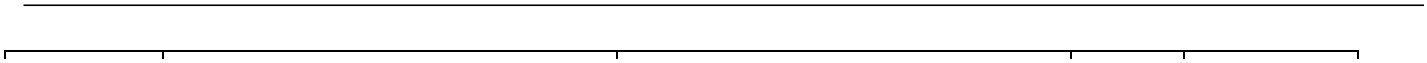
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	increases (from 2005) to 690 million **or** increases to 2008 decreases (from 2008) to 630 million	allow peak in 2008 allow peak at 690 million if no other mark awarded, allow overall increase from 470 million **or** overall increase to 630 million **or** (overall) increase of 160 million **or** increases to 690 and decreases to 630 (without units) for **1** mark	1 1	AO2 4.7.3.1 4.7.3.6
02.2	$\frac{690(\text{million}) - 460(\text{million})}{690(\text{million})} \times 100$ 33.3 (%) 33 (%)	allow $\frac{230(\text{million})}{690(\text{million})} \times 100$ ignore number of decimal places allow calculated value from incorrect graph readings allow calculated answer correctly given to 2 significant figures	1 1 1	AO2 4.7.3.1 4.7.3.6
02.3	compost burning **or** as a fuel	allow improving soil (texture / drainage / quality) ignore farming unqualified ignore as fertiliser	1 1	AO1 4.7.3.3

02.4	any **two** from: • reduce pollution • plant trees • breeding programmes (for endangered species) • rewilding / regeneration of habitats / hedgerows / meadows • (reintroducing) wider field margins • plant a variety of crops • reduce use of pesticide / herbicide / insecticide	ignore references to carbon dioxide, greenhouse gases or global warming allow reduce named example of pollution, eg smoke **or** acidic gases **or** sewage **or** fertiliser allow reduce toxic waste dumping allow afforestation allow reforestation ignore reduce / stop deforestation allow planting wild flower seeds allow reduce monoculture ignore recycling ignore protect / conserve habitat(s) / areas	2	AO1 4.7.3.1 4.7.3.2 4.7.3.4 4.7.3.6
Total			**9**	

4.7.3.6 Maintaining biodiversity

Answer 03 · Mark scheme

November 2021 | 8464/B/2H | Original Q2



Answer 04 · Mark scheme

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	herbicide is added / sprayed (on soil / land / field / crop / maize)		1	AO1
	(so) weeds killed **and** (GM) maize / crop not killed	allow (so) unwanted plants killed **and** (GM) maize / crop not killed allow **only** the weeds are killed	1	AO2
	(so) (GM) maize / crop has less competition for light / water / minerals / ions / space	allow (so) (GM) maize / crop has more light / water / minerals / ions / space ignore reference to nutrients ignore (GM) maize / crop has less competition unqualified	1	AO2
	(so more) photosynthesis to produce glucose which produces protein / cellulose / starch / fat (for growth)	allow (so more) photosynthesis to produce glucose which produces amino acids (for growth)	1	AO2 4.4.1.1 4.6.2.4 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	use of herbicide kills weeds / wildflowers / plants (that are not the crop)	allow increased use of herbicide / weedkiller ignore (more) use of pesticides ignore herbicide kills animals / insects	1	AO3 4.6.2.4 4.7.3.1
	(causes) fewer weeds **or** fewer other plants therefore less food for animals / insects	allow fewer wildflowers therefore less food for animals / insects allow less variety of food therefore lower number of species of animals / insects allow fewer weeds / wildflowers **or** fewer other plants therefore more competition for food	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	crops / plants may be insect / bee pollinated insects may be predators of (crop) pests	allow for pollination allow a description eg insects eat crop pests allow bees may be predators of (crop) pests	1 1	AO2 4.7.1.1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	provides source of food / shelter (for insects / bees / pollinators)	allow protection / hiding from predators	1	AO2 4.7.3.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(as oxygen level increases decay increases due to aerobic) respiration of microorganisms (which) releases carbon dioxide causing global warming	allow (aerobic) respiration of bacteria / fungi / decomposers allow (which) releases carbon dioxide which is a greenhouse gas allow (which) releases carbon dioxide causing the greenhouse effect ignore (which) releases carbon dioxide causing climate change	1 1	AO2 AO1 4.7.3.3 4.7.3.5 4.7.2.2 4.4.2.1

Total Question 4	11

4.7.3.6 Maintaining biodiversity

Answer 01 · Examiner comments

June 2018 | 8464/B/2H | Original Q5

Question 5 (standard / high & high demand)

05.1 The basic principle behind selective breeding was understood by a good number of students with 49% credited with at least one mark. However, they missed marks by not being precise enough in relating their answer to the particular context of this question. Many referred to ‘a bigger yield’ or the general ‘desired characteristics’ instead of short stems and large grains.

The question was often misread as a genetic modification (GM) question. Students who followed this route seldom achieved any marks. There were a lot of answers in terms of GM, cutting out enzymes, injecting genes, asexual reproduction and cloning. A large number wrote about breeding the plants together using asexual reproduction and generally showed little understanding of how asexual and sexual reproduction are different. Often these students would go on to talk about transfer of pollen being a part of the asexual process.

Marking points two and three were most often given. However, some students went on to incorrectly describe breeding as adding pollen to seeds. The most common error for marking point three was to breed all the offspring together rather than choosing the ones with short stems and large rice grains. If students answered a generic question instead of this one about IR8 rice they were still able to achieve a maximum of three marks.

In marking point four many students demonstrated an understanding of continuing to breed, but only a minority obtained the mark by also referring to an end point. ‘Bred true’ was not seen but ‘until IR8 is produced’ or ‘until all plants have this characteristic’ was noted. 3% of students achieved all four marks.

05.2 This high demand question was not well answered due to lack of biological detail in explanations. 4% of students achieved two or more marks. A great many students only provided half of any mark point. The compensation mark was awarded a few times, but was often missed because the 'for' response gave only the explanation, not the reason. Many students did not give explanations. Answers only listing statements or explanations tended to be weak suggesting that students were not as strong with regards to the issues surrounding GM.

A typical answer gaining no marks was ‘agree as can provide enough food to feed the population so less people are starving in India but disagree because it uses chemicals’.

Many students made references to unnatural, going against nature, against god, dangerous due to the use of chemicals, against religion, unethical, scientists playing god or the idea that an embryo is a potential life which is killed. Other ideas put forward which did not gain credit were rice producing methane which affects global warming, inbreeding causing diseases to spread so if one plant gets it they all will die and vague references to biodiversity.

‘Superweeds’ were mentioned occasionally, which if correctly described with reference to transfer of herbicide resistant genes a mark was achieved. Those students who referred to the concern about the effect on people’s health rarely gained the mark because they did not talk about ‘not enough research having been done yet’.

4.7.3.6 Maintaining biodiversity

Answer 03 · Examiner comments

November 2021 | 8464/B/2H | Original Q2

Question 2 (standard demand)

Generally, students could interpret the graph and describe the trends between 2008 and 2011 in terms of years, such as 'it increases to 2008'. However, fewer could correctly extract relevant data, such as the money spent in millions of pounds in 2008 or 2011. References to trends beyond 2011 were ignored. Some students tried to give economic or levels of concern reasons for the trends which did not answer the question. When 'describe' is used as a command word the answer does not require an explanation.

In **02.2** students were given the equation and asked to calculate the percentage change. Some students could not read the appropriate figures from the graph. The most common error was not giving the answer to two significant figures. This is prompted in the question and on the answer line. There were indications that some students are confused between decimal places and significant figures.

Knowledge of uses of peat was very weak, with most students not being able to give one use of peat taken from peat bogs. The most common correct answer related to peat in compost. Misconceptions of the term biodiversity were frequently seen in **02.4**, with answers referring to diversity in the human population or vague answers relating to recycling or climate change that would not directly increase biodiversity. Suggestions that would maintain, or decrease the rate of biodiversity decline, such as 'stop hunting' may maintain, but not increase biodiversity, and therefore were considered to be insufficient at this level.

Answer 04 · Examiner comments

June 2025 | 8464/B/2H | Original Q4

Question 4 (Standard/high and High demand)

04.1 Many students understood the term 'resistant'. However, it was clear that some students did not understand the term 'herbicide'. Some students confused herbicides with herbivores. Misconceptions surrounding herbicides were evident in statements such as 'herbicides can no longer eat the crops' and 'GM crops that are herbicide resistant cannot be eaten by herbivores' and some students confused herbicides with pesticides. Very few students were awarded marking point 1 as they often overlooked the idea that herbicide would be applied (to the crops).

For marking point 2, many students were seen to write that 'GM crops are less likely to be killed by herbicides' but did not then go on to state that the other plants / weeds would be killed. Many students incorrectly believed that maize and GM maize are grown simultaneously in the same field by the same farmer. This demonstrates a fundamental misunderstanding of how GM crops are used. Students need to be careful in their use of the word 'affected' as this was too vague for this marking point. For example, 'weeds are affected'.

Where students described the idea of competition in marking point 3, most were able to name a factor that would be competed for. However, it was very rare to see marking point 4.

Accounts of the steps involved in the process of producing GM plants were not relevant in this question but were seen in answers. In these instances, the students filled the answer space with their description before concluding with a short statement such as GM crops won't be killed. A small number of students went down the route of describing selective breeding instead of answering the question.

0 4 . 1 Maize is a crop plant.

A variety of maize has been genetically modified (GM) to be resistant to a herbicide.

Explain how growing GM herbicide-resistant maize can produce a larger yield than growing non-GM maize.

[4 marks]

as the genetically modified (GM) maize is resistant to a herbicide, it means that the maize can be sprayed by the herbicide, causing no damage to the plant but making it so no insects or bugs that will damage the maize, so more maize survives and will continue to produce a larger yei yield than growing non-GM maize.

This student gains marking point 1 but then continues to incorrectly describe function of the herbicide with a common misconception, so only marking point 1 was awarded.

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4.7.3.6 Maintaining biodiversity

Answer 04 · Examiner comments June 2025 | 8464/B/2H | Original Q4

04.2 This question asked students how growing GM crops decreases the biodiversity of animals. Some students made no reference to animals in their answers at all. Either they did not read the question properly or did not understand what they were being asked. A commonly seen insufficient response was 'the GM crops are genetically identical' and some students wrote about monoculture.

Many students failed to use the word herbicide correctly in this answer and as in question **04.1**, a lack of understanding of the word herbicide proved problematic. It was common for students to state that animals would not be able to eat the GM herbicide resistant crop after herbicide had been applied or that if animals ate the crop they would die. A frequently seen insufficient idea was that growing GM crops would take up more land leaving less habitat space for animals. The most frequent marking point here was marking point 2 with the idea of fewer other plants meaning less food for animals.

04.3 Very few students were awarded 2 marks for this question. Some students did not understand the term yield in the question. The most commonly awarded mark was for marking point 1, for the idea of insects as pollinators. However, there were a lot of misconceptions surrounding pollen and pollination. Commonly seen misconceptions regarding pollination included:

- bees making pollen or being a source of pollen
- bees collecting pollen for nectar
- pollination being where seeds get stuck to a bee's body
- pollen being needed by crops for photosynthesis / respiration
- the idea that bees themselves fertilise the plants, rather than facilitating pollination as a step leading to fertilisation.

Where insufficient attempts at marking point 2 was seen, some students were not clear about insects eating or destroying pests, instead suggesting insects simply deter or scare crop pests.

The idea of insects dying and decomposing and therefore providing minerals for the crops was insufficient. Some students repeated information from the question, giving answers such as 'insects increase crop yields'.

04.4 The most common correct answer for this question was 'hedgerows provide places for insects to reproduce / breed'. 'Hedgerows provide a source of food' or 'hedgerows provide a source of shelter' were also commonly seen correct answers.

The most common insufficient response was 'more hedgerows provide more habitats / places to live' as this was repeating the information given. Students must take care not to simply repeat information given to them in the question stem. Many students made vague references to increased biodiversity without linking this to the context of the question or wrote about the hedgerow providing 'ideal living conditions' for the insects without specifying what those conditions are.

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4.7.3.6 Maintaining biodiversity

Answer 04 · Examiner comments June 2025 | 8464/B/2H | Original Q4

04.5 This was a challenging question for many students as they failed to link microorganisms with respiration, instead writing answers implying the peat itself respired. It also appeared to be quite challenging to keep to the topic of the question, instead students frequently mentioned combustion rather than decay. There was a lot of repetition from the wording of the question, which didn't gain any marks. Very few students attained both marks available on this question, with marking point 1 rarely seen. Students who gained 1 mark, commonly gained the mark for stating that the released carbon dioxide is a greenhouse gas or that the release of carbon dioxide leads to global warming. Some students had the correct idea for marking point 2 but wrote the symbol for carbon dioxide incorrectly (e.g. 'CO2' or 'Co2', or with the 2 written superscript to the letters) and so were not awarded the mark. Refer to page 4 of the mark scheme for guidance on the use of formulae.

Most of the students achieving marking point 2 had not made the link to the source of the carbon dioxide being decomposers or respiration, with many stating that oxygen reacted with the peat to form carbon dioxide. There were not many students who could link the idea to increase oxygen enabling the microbes to respire, which produces carbon dioxide. Of the students who were not awarded marking point 2 it was frequently because the students identified that carbon dioxide would be released but did not go on to state the effect of this or simply reiterated the phrasing from the question stem (i.e. that carbon dioxide causes climate change). Several students made irrelevant references to methane or the ozone layer or stated that the process of cutting the peat released stored carbon dioxide. Another common error was stating that carbon is released into the atmosphere as opposed to carbon dioxide.

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