AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.6.2.4

Genetic engineering

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**2**
Available paper years	**2022–2024**

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.

4.6.2.4 Genetic engineering

Answer 01 · Mark scheme

June 2022 | 8464/B/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	larger yields		1	AO1 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	GM crops will harm wildlife		1	AO1 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	gene(s)	allow allele(s)	1	AO1 4.6.1.3 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	protein		1	AO1 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	an allele that is only expressed if two copies are present		1	AO1 4.6.1.4

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Answer 01 · Mark scheme

June 2022 | 8464/B/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	heterozygous		1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 mark with 1.8	offspring genotypes correctly derived hh circled Woman: H, h Man: H, h HH, Hh Hh, hh	allow **1** mark for 1 or 2 correct genotypes	2 1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8 mark with 01.7	25%	probability must match derivations (hh) in question **01.7**	1	AO3 4.6.1.4

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Answer 01 · Mark scheme

June 2022 | 8464/B/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any **one** from: • it might harm the embryo / baby / mother • it might cause a miscarriage • they do not want to make a choice about having an abortion • it is against their religious beliefs	ignore cost ignore harmful / dangerous unqualified allow against their religion	1	AO3 4.6.1.4 4.6.1.5

Total Question 1		**11**

4.6.2.4 Genetic engineering

Answer 02 · Mark scheme

June 2024 | 8464/B/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	domain		1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	offspring are genetically identical		1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	a gamete contains half of the number of chromosomes		1	AO1 4.6.1.1 4.6.1.2

4.6.2.4 Genetic engineering

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any **one** from: • similar / same structure / characteristics / phenotype (as potatoes)	allow named similar structure / characteristics such as same shape / leaves / flowers / taste allow studied with microscopes ignore 'look the same / similar' unqualified	1	AO1 4.6.4
	• similar DNA / genes	allow DNA analysis allow analysis of genetic material allow similar genetic material ignore genetic information do **not** accept same DNA / genes		
	• similar / same biochemistry			
	• same first part of binomial (name)	allow same first part of Latin / scientific name		

Answer 02 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
06.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content allow reference to named crop throughout **effects of climate change** • climate change will change weather patterns / trends • climate change causes flooding **or** drought **or** temperature change • farming land decreased by sea level rise / flooding / desertification • current crops cannot grow / survive (in changing conditions) **benefits of GM** ○ GM may allow crops to grow in wider range of conditions ○ GM may allow crops to be resistant to wider range of pests / diseases ○ GM may allow crops to be stored for longer ○ GM may increase crop yield **or** increase growth rate ○ to feed the increasing human population ○ useful if less area available for farming ○ larger human population needs more land for housing **other relevant content** ▪ variation amongst current crops reduced by asexual reproduction **or** selective breeding ▪ rate of evolution (by natural selection) may be slower than rate of climate change For **Level 3**, answers must explain effect(s) of climate change **and** benefit(s) of GM with logical link.		4.6.2.4 4.7.3.2 4.7.3.5 4.7.3.6

Total Question 6	**10**

4.6.2.4 Genetic engineering

Answer 01 · Examiner comments June 2022 | 8464/B/2F | Original Q1

Question 1 (low demand)

01.1 72% of students could identify larger yields as a useful characteristic that crops are genetically modified for.

01.2 Around half of students could identify a concern about GM crops.

01.3 40% of students could name ‘gene’ or ‘allele’ as a piece of DNA that codes for a characteristic. Frequently seen incorrect answers were chromosome, genome and phenotype.

01.4 Just over half of students knew that protein was made using the DNA code.

01.5 50% of students knew the definition of a recessive allele.

01.6 52% of students could identify that heterozygous was the appropriate term.

01.7 A quarter of students could correctly derive the three missing possible genotypes of the child and draw a ring around hh. Many students could derive the genotypes, but did not draw a ring, or circled Hh or HH.

Answer 01 · Examiner comments June 2022 | 8464/B/2F | Original Q1

01.8 The probability selected here needed to match the proportion of hh in their response to **01.7**. Half of students achieved this.

01.9 Many students gave the first marking point, for the idea that there may be harm to the embryo. Some responses were too vague, such as ‘religion’ unqualified. ‘They might not want to know’ was considered insufficient. Despite the question context relating to cystic fibrosis, many students only referred to screening identifying the gender of the embryo. Some misconceptions were seen, such as embryo screening causing cancer and incorrect references to radiation were common.

4.6.2.4 Genetic engineering

Answer 02 · Examiner comments

June 2024 | 8464/B/2F | Original Q6

Question 6 (standard demand)

06.1 30% of students could select that the classification group 'Eukaryota' is a domain.

06.2 50% of students knew that asexual reproduction produces genetically identical offspring.

06.3 Just over 50% of students knew that a gamete contains half the number of chromosomes compared to the other cells in a potato plant.

06.4 Most students could describe how a new plant species could be identified as being in the same genus as potatoes. DNA analysis or similar characteristics were the most common correct answers.

Misconceptions were seen, such as the idea that the species would have identical DNA. On the Foundation tier, some answers were much too vague, such as 'by testing'.

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Answer 02 · Examiner comments June 2024 | 8464/B/2F | Original Q6

06.5 Few students appeared to follow the direction of the question, beyond stating that GM crops can be made to grow even if the climate changes. Some students were aware of food insecurity as a result of climate change, and this could be given credit for the idea that current crops will not be able to grow/survive.

Few students made links between climate change and the possible benefits of GM crops. Lists of possible benefits of GM with no link to climate were limited to Level 1. Some students made very good attempts at this question and a few recognised some of the effects of climate change and were able to link these to the idea that current crops would struggle to grow in these conditions. This was an attempt at a logical link and achieved a Level 2 mark.

Some students further developed this idea, and clearly had a grasp of the question being asked, as they then went on to describe how GM would enable crops (or potatoes) to survive the conditions that climate change brings. They could further strengthen their account with suggestions that more crops could be grown or crops could be grown faster. These responses were detailed and logically linked accounts and were therefore Level 3 responses.

Some students wrongly gave explanations of causes of climate change.

0 6 . 5 Scientists have collected and stored seeds from species in the same genus as potatoes.

In the future, these seeds may be used for genetic modification of potato plants.

Genetically modified potato plants could help supply food to the human population as the climate changes.

Explain why genetic modification of crop plants may be important for the human population to survive climate change.

[6 marks]

the genetically modified plants can photosynthesise ~~more~~ better leading to more Oxygen in the ~~plant~~ planet as the plants are reducing the Carbon Dioxide amount

Genetically Modified plants can grow faster, so providing more food to the population

Genetically Modified plants can thrive better without the needs that any other plant need.

In the second paragraph, this student has given the idea that GM crops may grow faster and therefore provide more yield. This is indicated on the mark scheme as one idea for a benefit of GM crops in this context. There is no attempt to link this idea with effects of climate change, therefore the response is within Level 1 and 1 mark was awarded.

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Answer 02 · Examiner comments June 2024 | 8464/B/2F | Original Q6

Contact us

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