AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.6.1.3

DNA and the genome

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**3**
Available paper years	**2019–2020**

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.

4.6.1.3 DNA and the genome

Answer 01 · Mark scheme

June 2019 | 8464/B/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	vectors are used to insert genes into cells vectors are usually plasmids or viruses		1 1	AO1 4.6.2.4
03.2	wheat not affected by spraying / herbicide (so) wheat gets more light / water / nitrates / ions / minerals (so) more photosynthesis / glucose / proteins (for more yield)	allow only weeds affected / killed by spraying / herbicide allow less competition for light / water / nitrates / ions / minerals ignore nutrients ignore carbon dioxide ignore space idea of more needed at least once for mp 2 and 3	1 1 1	AO1 AO2 4.6.2.4 4.7.1.1 4.4.1.1
03.3	any **two** from: • production of human insulin / medicines • crops resistant to diseases / pests • crops resistant to frost • crops resistant to drought • crops / foods with added nutrients • plants / crops with more / bigger fruits **or** higher yield • crops with improved taste • crops with improved shelf life	allow examples such as potatoes resistant to blight allow examples such as golden rice with vitamin A gene allow examples such as larger tomatoes	2	AO1 4.6.2.4

4.6.1.3 DNA and the genome

Answer 01 · Mark scheme

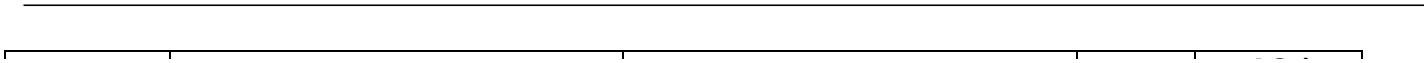
June 2019 | 8464/B/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	identify genes linked to (certain) disease so can lead to better prevention / treatment of that disease **or** identify genes causing inherited disorders (1) so may prevent children being born with the disorder by using IVF **or** gene therapy (1) **or** tracing human migration patterns from the past **or** evolution of humans (1) so to better understand the ancient history of humans (1)	allow correctly named diseases such as cancer / diabetes	1 1	AO1 AO2 4.6.1.3
Total			**9**	

4.6.1.3 DNA and the genome

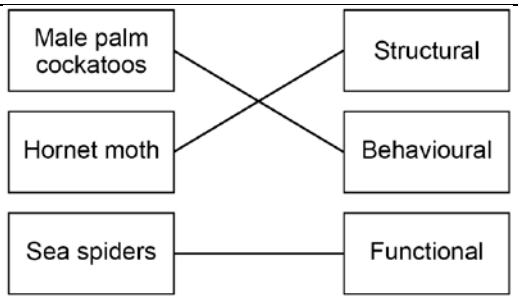
Answer 01 · Mark scheme

June 2019 | 8464/B/2H | Original Q3



4.6.1.3 DNA and the genome

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec.
04.1	 all correct for **2** marks allow **1** mark for one or two correct line(s) additional lines from a box on the left negates the mark for that box		2	AO2 4.7.1.4
04.2	any **four** from: • growing on other plants means support to absorb more light (for photosynthesis) • bright colours attract pollinators **or** bright colours attract insects to transfer pollen • large quantities of pollen (increases the likelihood of pollen transfer) and so more seeds / reproduction • tiny / light seeds will travel long distances to grow in new areas • many seeds mean many new plants so will out-compete other species	allow to obtain water / minerals / ions / glucose from the other plant ignore nutrients allow fertilisation for transfer of pollen allow tiny / light seeds will travel away from competitors allow many seeds so more (orchids) will survive	4	AO2 4.7.1.4 4.7.1.1 4.4.1.1

4.6.1.3 DNA and the genome

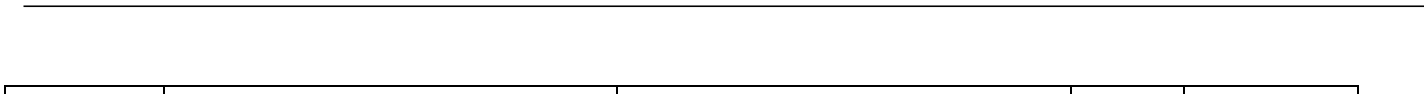
Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	any **four** from: • mutations for purple flower (in ancestral species) • isolation **or** change in environment e.g. area had more insects • (plants with purple flowers) survive and breed • (plants with purple flowers) pass on allele / gene / DNA / mutation • until they were so different they could no longer interbreed (with the ancestral species)	allow genetic variation gives purple flowers allow purple orchid more suited to a new environment allow genetic material for allele allow breed successfully for interbreed	4	AO2 4.7.1.4 4.7.1.1 4.4.1.1
04.4	species **D** because it has the lowest number of amino acids different (in the sequence) **or** because it has the lowest number of differences in the sequence **or** only one / sixth amino acid is different	must be an attempt at an explanation to gain this mark allow because it has the highest number of amino acids which are the same (in the sequence) allow because it has only one difference in the sequence allow only the glycine / gly has been changed to tyrosine / tyr	1 1	AO3 4.6.4 4.6.1.3 4.6.1.4
Total			**12**	

4.6.1.3 DNA and the genome

Answer 02 · Mark scheme

June 2019 | 8464/B/2H | Original Q4



4.6.1.3 DNA and the genome

Answer 03 · Mark scheme

November 2020 | 8464/B/2H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1	AO2 4.6.1.3
01.2	any **one** from: • 2 strands / chains that are twisted / coiled / spiralled • double helix • (long) polymer	allow cross links between 2 strands / chains allow reference to nucleotides or sugars, phosphates and bases	1	AO1 4.6.1.3
01.3	amino acids protein	in this order only allow polypeptide	1 1	AO1 4.6.1.3
01.4	all the genetic material (of an organism)	allow DNA / genes for genetic material ignore chromosomes	1	AO1 4.6.1.3
01.5	tracing how aboriginal people spread across Australia		1	AO2 4.6.1.3
01.6	variation	ignore genetic/environmental	1	AO1 4.6.2.1

4.6.1.3 DNA and the genome

01.7	stronger / larger (shell) (so) more likely to (survive and) breed **or** (so) more likely to (survive and) pass on genes **OR** (better) camouflaged (1) (so) less likely to be eaten and will breed more (1)		1 1	AO2 4.6.2.2
Total			**9**	

4.6.1.3 DNA and the genome

Answer 03 · Mark scheme

November 2020 | 8464/B/2H | Original Q1

Answer 01 · Examiner comments

June 2019 | 8464/B/2H | Original Q3

Question 3 (standard, standard/high & high demand)

03.1 Half of the students gave one correct statement about vectors, usually that they were used to insert genes into an organism. A further 23% also knew that vectors were usually plasmids or viruses.

03.2 Students were asked to explain why a herbicide resistant variety of wheat will give a higher yield than a non-herbicide resistant variety. The first marking point was the one most commonly awarded, for the idea that when a herbicide is applied, it will not affect or kill the resistant wheat. However, very few students went on gain any further marks and to fully answer the question, failing to give the consequence of the weeds being killed and the resistant wheat not killed. 40% of students gained the first mark, with 1% gaining more.

Many students do not appear to understand what a herbicide is, with some stating that herbicides eat the wheat and so herbicide resistant varieties don't get eaten. Clear indications of pests or diseases resulted in zero marks. Others simply stated that non-herbicide resistant varieties do get killed by herbicides, but this on its own was insufficient to gain a mark. Students should be reminded to avoid vague terms such as 'nutrients', as this was ignored in the second marking point. There was some misuse of the term 'immune' when answering this question.

03.3 Some students gave excellent descriptions of examples of genetic engineering in use today, which they may well have found out when researching uses of genetic engineering. 'Golden rice with added nutrients' was a common correct answer, as was 'crops with higher yields' or 'disease resistant crops'. However, many students are still giving answers which are too vague to gain credit, such as 'GM crops' or 'disease resistance'. Crops may be resistant to certain pests but are never resistant to pesticides.

There appeared to be some confusion between selective breeding and genetic engineering from some students. Additionally, some students referred to designer babies, IVF and embryo screening, all of which were incorrect answers. Some students were confused between genetic engineering and gene therapy and described replacing defective genes, which did not gain credit. Novelties such as 'glow in the dark' animals and the many instances of natural genetic mutations such as featherless chickens, seedless fruits and

Answer 01 · Examiner comments

white sunflowers were not acceptable. Half of the students were able to correctly give one or two examples.

03.4 Students found this question challenging, with a significant number of them describing the designer baby idea which did not gain credit. Some thought that by mapping the human genome we would be able to more easily predict if a child would be born with a genetic disorder, which again was not correct. There were also lots of vague statements such as 'help cure diseases' which were insufficient.

A few students did appreciate the importance of understanding the human genome for use in tracing human migration patterns from the past. A number also realised that if a gene could be identified as causing an inherited disorder this would lead to being able to offer parents embryo screening or maybe gene therapy in the future.

16% of students correctly gave a use and only a minority of students were able to follow this up with an explanation of how it could help in the future.

4.6.1.3 DNA and the genome

Answer 02 · Examiner comments

June 2019 | 8464/B/2H | Original Q4

Question 4 (standard & standard/high demand)

04.1 Almost all students gained credit for knowing at least one correct adaptation and 78% gained two marks for all correct links.

04.2 This question provided a large range of responses with over half giving one or two correct explanations of the adaptations of orchid plants. The most common was that brightly coloured flowers would attract insects or bees for pollination, but some did not gain the mark as they just stated 'to attract bees' without explaining how this would help the orchid plant. Some students thought the bright colours might be a warning to 'predators'.

Growing attached to other plants could be linked to obtaining more (sun)light or to the symbiotic idea of obtaining water, minerals or glucose, but the vague idea of 'nutrients' is insufficient at this level. Large quantities of pollen needed to be linked to increased reproduction or seeds to gain a mark, and not to attracting insects, so was less often awarded.

A number of students linked the light seeds to wind dispersal but needed to take this further than just 'to spread' and link it to growing in new areas or further away. Thousands of seeds needed to be linked to the idea of a large population able to withstand competition or not face extinction. 12% of students gained three or four marks.

04.3 In the last series most students did not understand selective breeding, but possibly due to emphasis this year by teachers on this topic, many now tried to apply the selective breeding process to this question which is essentially about natural selection and speciation.

Fewer than a quarter of students gained one mark usually for identifying that the purple flower was the result of a (random) mutation. As previously, any indication that the plant 'mutated' itself resulted in this mark not being awarded. The other mark often seen was for the idea that the plant with a purple flower survived and bred.

12% of students were able to continue the process and gain two to four marks. Many missed marks at this stage by referring to asexual reproduction. The final marking point regarding speciation was very rarely seen.

Answer 02 · Examiner comments

June 2019 | 8464/B/2H | Original Q4

04.4 73% of students correctly identified species D as being most like the ancestral species. Those that did not, usually gave species A as it had the same colour flower. 31% of students were able to give a precise reason related to the fact that 9 of the 10 amino acids in the sequence were the same or that there was only one difference in the sequence. Describing this as 'the nearest' or 'most similar' was insufficient.