AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.6.2.3

Selective breeding

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**2**
Available paper years	**2018–2023**

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.

4.6.2.3 Selective breeding

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

4.6.2.3 Selective breeding

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**	

4.6.2.3 Selective breeding

Answer 01 · Mark scheme

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

4.6.2.3 Selective breeding

Answer 02 · Mark scheme

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Oncorhynchus	ignore capitals ignore italics do **not** accept *Oncorhynchus keta*	1	AO2 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	eukaryota	allow eukaryote	1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	select fish that have / get least / less / no (attachment of) sea lice **and** breed (selected fish) together	ignore with desired genes	1	AO2
	select offspring that have least sea lice **and** breed (selected offspring) together	allow select offspring with desired characteristic **and** breed together	1	AO1
	repeat over many generations until all offspring have no sea lice (attached)	do **not** accept idea of repeating with the same parents	1	AO2 4.6.2.3

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	sea lice will not be feeding on salmon (skin / blood)	allow skin less likely to be damaged / infected	1	AO3 4.6.2.3
	(so) salmon grow larger / faster	allow (so) salmon lose less energy allow no / less need for pesticides / insecticides allow (so) not off-putting (to consumers / buyers) allow (so) more (likely to be) sold allow salmon with sea lice cannot be sold	1	
	(so) salmon can be sold for more money	allow more profit allow no need to remove lice	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	all fish genetically similar	allow all fish have many / mostly same genes ignore inbreeding unqualified do **not** accept fish are clones do **not** accept fish are genetically identical	1	AO1 4.6.2.3
	(therefore) all may have (same) inherited disorder / defect **or** (therefore) prone / susceptible to same disease **or** (therefore) lack of variation to survive future environmental change		1	

Total Question 4	**10**

4.6.2.3 Selective breeding

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’.

4.6.2.3 Selective breeding

Answer 02 · Examiner comments

Question 4 (Standard, Standard/high and High demand)

04.1 Some students gave the binomial, which was incorrect.

A large number of students were giving incorrect names including the domain / Linnaean classification system (eg Archaea, Eukaryote, Family) or other classification groups (eg Animalia, Vertebrates, Mammal, Fish, Amphibian, Insect).

04.2 Students found it challenging to name the correct domain.

Common incorrect responses were archaea, prokaryotes, bacteria, insect, kingdom and animals. Some students gave the species or genus name. Many students gave classification groups again (ie Animalia, Mammal, Fish, Amphibian, Insect, Fungus). Some students named roles in a food web such as consumer, prey, predator, tertiary consumer. Some students named the domain as the water/sea/ocean.

4.6.2.3 Selective breeding

Answer 02 · Examiner comments

June 2023 | 8464/B/2H | Original Q4

04.3 There were many responses that were too vague to score marks. In most cases, these repeated the question. References to selecting and breeding fish with the gene were common, and not creditworthy alone.

Some students implied that the parents were being bred repeatedly, rather than the next generation. Few students could describe when the selective breeding would be finished.

Some misconceptions were seen regarding genetic modification.

0 4 . 3 Some salmon have genes that result in fewer sea lice attaching to the skin.

Describe how fish farmers can selectively breed salmon that sea lice **cannot** attach to.

[3 marks]

They can catch the salmon that fewer sea lice attach to. They then bread the fish and breed the offspring until they produce salmon that sea lice cannot attach to.

This response gains marking point 1. It is then unclear that the offspring are being selected before breeding so no further marks were given.

04.4 Generally, students could state some advantage to salmon farmers, but few could give a full explanation.

Responses relating to the fish being 'healthier', 'fresher' or 'higher quality' were insufficient.

04.5 Students found this question challenging. When asked to explain the disadvantage of selective breeding, many students gave responses that could apply to any population (whether selectively bred or not), such as 'may get diseases' or 'may pass on inherited disorders). These were insufficient.

Some students ignored the 'Do not refer to cost or time in your answer' statement in the question and referred to how long selective breeding takes.

For marking point 1 some students incorrectly stated that genes / DNA / gene pool would be the same in all the salmon. So, 'smaller gene pool' / 'similar DNA' were equivalent to the marking point but 'same gene pool' / 'same DNA' did not gain credit.

There were different ways that students could be awarded marking point 2. In option 1 (marking point 2), the idea of an inherited disorder / defect was important, and it needed to be clear that this is across the whole population. Answers of 'all get the same disease' did not gain credit as they miss the idea of it being an inherited condition. An answer of 'one parent can pass on a genetic disorder' would not gain credit as it does not imply all the salmon having it and could apply with or without selective breeding.

4.6.2.3 Selective breeding

Answer 02 · Examiner comments June 2023 | 8464/B/2H | Original Q4

In option 2 (marking point 2), we were looking for the idea is that all salmon would be ‘prone / susceptible to’ ‘the same / a particular’ disease. So, ‘all likely to get the same diseases’ or ‘fish are likely to die from the same disease’ would be equivalent.

Very few students went the option 3 (marking point 2) route, to explain how there would be a lack of variation to survive future environmental change.

Evidence of misconceptions was common, such as the suggestion that salmon are prone to developing genetic diseases. This was stated in terms that suggested genetic diseases are communicable or develop later in life.

References to ethics suggested that students are confused between selective breeding with genetic modification. Some responses referred to the unethical nature of killing fish or sea lice being a disadvantage (despite the whole point of salmon farming being to kill salmon for food). References to mutations implied that some students view any mutation as harmful or negative. Many students gave references to sea lice evolving or becoming extinct. Some misconceptions were seen around selective breeding involving chemicals, resulting in fish not being organic.