AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.2.4

Genetic engineering

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**18**
Available paper years	**2007–2024**

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 January 2007 | BLY1F | Original Q4 | Legacy

Question 4

	answers	extra information	mark
(a)	antibodies antitoxins antibiotics		1 1 1
(b)	any **two** from: • measles • mumps • rubella / German measles		2
(c)	less / low / no chance of getting named / all condition(s) if vaccinated quantitative figure(s) e.g. 5 times less likely to get convulsions	must be comparative	1 1
(d)	enzymes genes		1 1
total			9

4.6.2.4 Genetic engineering

Answer 02 · Mark scheme

March 2007 | BLY1B | Original Q5 | Legacy

Five	**A**	cell	**1**
	B	chromosome	**4**
	C	enzymes	**2**
	D	gene	**3**

4.6.2.4 Genetic engineering

Answer 03 · Mark scheme

January 2008 | BLY1F | Original Q5 | Legacy

Question 5

	answers	extra information	mark
(a)	genes chromosomes		1 1
(b)(i)	higher yield less use of pesticides		1 1
(b)(ii)	any **two** from: • uncertain about effects on health • fewer bees • might breed with wild plant • seeds only from one manufacturer		2
total			6

4.6.2.4 Genetic engineering

Answer 03 · Mark scheme

January 2008 | BLY1F | Original Q5 | Legacy

BLY1F

Answer 04 · Mark scheme

March 2008 | BLY1BP | Original Q9 | Legacy

Nine	**3**	**2**	**4**	**3**

4.6.2.4 Genetic engineering

Answer 05 · Mark scheme

January 2009 | BLY1F | Original Q4 | Legacy

question	answers	extra information	mark
4(a)	protection / defence from predators / from being attacked / from being eaten	ignore insulation **or** rolls into a ball ignore camouflage	1 1
4(b)	looks like snake / looks scary deters predators **or** has large eyes to spot predator **or** camouflage **or** warning colouration from predator or prey	allow **two** separate adaptations for **2** marks	1 1
4(c)(i)	natural selection		1
4(c)(ii)	Darwin		1
4(c)(iii)	simple life forms		1
4(d)	believe that God created all organisms **or** humans there from the beginning		1
Total			**8**

4.6.2.4 Genetic engineering

Answer 05 · Mark scheme

January 2009 | BLY1F | Original Q4 | Legacy

Biology BLY1F - AQA GCSE Mark Scheme 2009 January Series

COMPONENT NUMBER: BLY1F

COMPONENT NAME: Science B / Biology

STATUS: Final

DATE: January 2009

Answer 06 · Mark scheme

March 2009 | BLY1BP | Original Q4 | Legacy

Four	**A**	insulin is produced by genetically engineered bacteria	**3**
	B	diabetics inject insulin to control diabetes	**4**
	C	the insulin gene is 'cut out' using enzymes	**1**
	D	the insulin gene is transferred into a bacterium	**2**

Answer 07 · Mark scheme

June 2009 | BLY1BP | Original Q9 | Legacy

Nine	**2**	**2**	**1**	**3**

4.6.2.4 Genetic engineering

Answer 08 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	sexual		1
4(b)	chromosome		1
4(c)(i)	any **two** from: • genetic-engineering can produce fast-growing food animals • genetic engineering can be used to clone animals in danger of extinction • using GM animals can reduce the number of animals used in medical research	ignore answers that do not relate to list	2
4(c)(ii)	GM animals might escape and breed with wild animals animals have the right to be free from genetic modification	ignore answers that do not relate to list	1 1
Total			**6**

4.6.2.4 Genetic engineering

Answer 08 · Mark scheme January 2010 | BLY1F | Original Q4 | Legacy

BLY1F

Question5

Answer 09 · Mark scheme June 2010 | BLY1BP | Original Q9 | Legacy

No matching mark scheme was available in the supplied archive for this question.

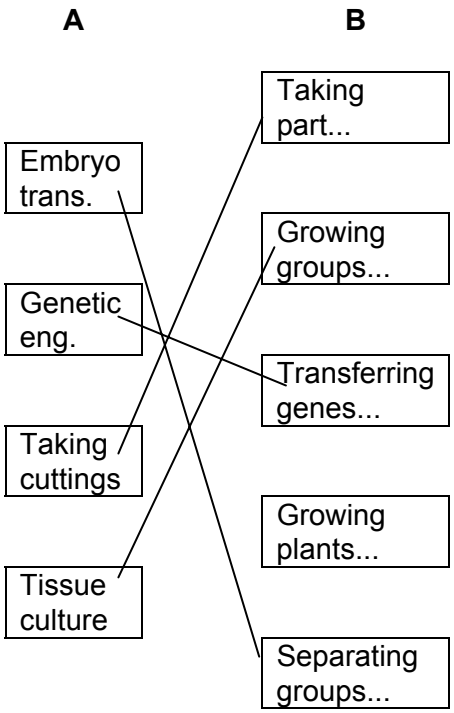
Answer 10 · Mark scheme November 2010 | BLY1BP | Original Q8 | Legacy

Eight	**2**	**3**	**2**	**4**

4.6.2.4 Genetic engineering

Answer 11 · Mark scheme

Question 4

question	answers	extra information	mark
4		**1** mark for each correct line mark each line from left hand box two lines from left hand box cancels mark for that box	4
Total			**4**

4.6.2.4 Genetic engineering

Answer 11 · Mark scheme

January 2011 | BLY1F | Original Q4 | Legacy

BLY1F

Answer 12 · Mark scheme

March 2011 | BLY1BP | Original Q9 | Legacy

Nine	**3**	**4**	**3**	**2**

Answer 13 · Mark scheme

June 2011 | BLY1BP | Original Q9 | Legacy

Nine	**2**	**4**	**3**	**4**

Answer 14 · Mark scheme

November 2011 | BLY1BP | Original Q9 | Legacy

Nine	**4**	**3**	**2**	**1**

4.6.2.4 Genetic engineering

Answer 15 · Mark scheme

June 2012 | BL1FP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6 (a)	insects don't eat / damage crop	allow idea of insects carrying plant disease	1
6 (b)(i)	60		1
6 (b)(ii)	lower (yield) by 8 (arbitrary units)	accept 'higher' if answer clearly refers to wheat with transferred gene allow yield is only 52 **or** goes down to 52 accept ecf from (b)(i) for **2** marks	1 1
6 (b)(iii)	grow / use wheat without insect poison (gene) higher yield (in fields)	 accept bigger crop / more wheat ignore grows better	1 1
6 (c)	 (concerned about) effect on populations of (wild) flowers / insects effect of eating GM crops on human health	ignore unnatural / unethical / against religion unqualified accept specific examples given ignore harms the environment allow harmful to humans if eaten	 1 1
Total			8

4.6.2.4 Genetic engineering

Answer 15 · Mark scheme

June 2012 | BL1FP | Original Q6 | Legacy

BL1FP

4.6.2.4 Genetic engineering

Answer 16 · Mark scheme

June 2013 | BL1FP | Original Q6 | Legacy

Question 6

question	answers	extra information	Mark
6(a)	sexual reproduction		1
6(b)(i)	genes		1
6(b)(ii)	gametes		1
6(c)(i)	any **two** from: • more meat (per cow) • more milk each day • can be milked for more time after giving birth / greater proportion of time	answers must be comparative ignore bigger unqualified accept '(produce) more milk', for **1** mark, if neither more milk each day nor can be milked for more time after giving birth are given	2
6(c)(ii)	(milk contains) more protein less time before having a calf when no milk produced	answers must be comparative	1 1
6(d)(i)	genes from one organism are transferred to a different organism		1
6(d)(ii)	(possible) harm to babies' long term health	allow don't know long-term / side effects (on baby) accept idea that there may be other things in (genetically engineered) cow's milk that might harm babies' health e.g. bacteria ignore ethical / religious arguments	1
Total			9

4.6.2.4 Genetic engineering

Answer 17 · Mark scheme

November 2020 | 8461/2F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	$\frac{6.0}{1.6}$ 3.75	allow a range of 5.9 to 6.1 for 6.0 do **not** accept if a unit is given if no other marks awarded, allow a correct answer using a value of 5.8 or 6.2 for **1** mark	1 1	AO2 4.7.3.2
09.2	$\frac{2.5 - 1.6}{50}$ 0.018 (billion per year)	allow $\frac{0.9}{50}$	1 1	AO2 4.7.3.2
09.3 view with Figure 12	suitable extrapolation line on Figure **2** reading taken at 2050 from student's line	allow straight extrapolation allow a tolerance of ± ½ small square allow **1** mark for 10 billion if no extrapolation drawn	1 1	AO2 4.7.3.2
09.4	fewer fish caught **or** limit the number of fish caught (remaining fish) can reproduce	allow a method of doing this, eg increase mesh size **or** do not catch young fish allow more fish (survive to) reproduce	1 1	AO1 4.7.5.1 4.7.5.3

4.6.2.4 Genetic engineering

Answer 17 · Mark scheme

November 2020 | 8461/2F | Original Q9

Question	Answers	Mark	AO / Spec. Ref.
09.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4-6	AO1 4.7.3.1 4.7.3.2 4.7.3.3 4.7.3.4 4.7.3.6 4.7.3.5 4.7.5.1 4.7.5.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content **human land use** • increasing population requires more food • crops / livestock for food • farming crops for biofuels • peat use as compost • peat use as fuel • increased use of pesticide / insecticide / herbicide / fertilisers • use of free-range / organic methods increases land use (for same yield) **link to biodiversity** • deforestation • monocultures • loss of hedgerows to make fields larger • loss of habitat • consequence of loss of habitat eg (change in) migration • fertiliser run off polluting water • use of pesticide / insecticide / herbicide reduces insects / plants which damages food chains • more soil erosion **link to atmospheric pollution** • more carbon dioxide (from farm animals / machinery) • more methane (from cows) • climate change **or** global warming • example of impact on biodiversity • acid rain • desertification Answers referring to only land use or only biodiversity are level 1		

4.6.2.4 Genetic engineering

Answer 17 · Mark scheme

November 2020 | 8461/2F | Original Q9

09.6	golden rice has improved nutritional value		1	AO1 4.7.5.4
09.7	any **one** from: • gene may contaminate / enter other breeds / species • reduction / extinction of population of wild / traditional rice • reduction / extinction of population of flowers / insects • high cost of seeds • may have too much vitamin A (in diet)	ignore references to religious beliefs allow decrease in biodiversity allow decrease in gene pool allow may harm (human) health allow may cause side effects (on humans) ignore may harm humans unqualified	1	AO3 4.6.2.4
Total			**16**	

4.6.2.4 Genetic engineering

Answer 18 · Mark scheme

June 2024 | 8461/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.1	gene (for antigen)	allow DNA / allele for antigen ignore DNA / allele unqualified	1	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.2	(pure) antigen(s)		1	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.3	the viruses may cause an infection		1	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.4	any **three** from: • (sun) light • water • ions / minerals / salts • oxygen in the soil • space	ignore sun allow moisture / rain allow a named example allow **two** named ions for **2** marks ignore nutrients / food ignore carbon dioxide	3	AO1 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.5	crop plants grow better **or** crop plants have higher yield	ignore reference to competition	1	AO2 4.6.2.4 4.7.5.4 4.7.3.1

4.6.2.4 Genetic engineering

Answer 18 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.6	any **one** from: • may kill / harm / poison **other** plants • may pollute streams / rivers / soil • may kill / harm / poison humans / animals	ignore it is poisonous unqualified allow may alter taste of (GM) maize allow may reduce biodiversity ignore reference to cost	1	AO2 4.6.2.4 4.7.3.1 4.7.3.6

Total Question 3	8

4.6.2.4 Genetic engineering

Answer 17 · Examiner comments

November 2020 | 8461/2F | Original Q9

Question 9 (standard demand)

The question was about human population increase and the problem of provision of sufficient food. For the calculation in **09.2**, both of the values required were given in the information, so it was not necessary to determine figures from the graph. Despite this, many students did attempt to, often incorrectly. For those who did show the correct numbers in their calculations, a large proportion used them incorrectly, often adding them and very few did the necessary calculation of dividing the difference by 50. Some just left the value at '0.9' and a significant number divided this by 5, rather than by 50. Others calculated the mean of the two given values rather than the mean annual increase.

In **09.3** most students attempted to draw some sort of extrapolation on the graph; however, this was often not linked to the trend shown by the line, rising a little, then plateauing or even taking a downturn. Students could still gain the second mark for reading the correct value from their own line. Often this was not done accurately, particularly by students who continued their extrapolation beyond 2050 and read off the final population value. It was clear that students who simply read the scale, and gave answers such as '10' had not considered the implication that their answer of a human population of only 10, rather than 10 billion, is unlikely.

Of the more successful students in **09.4** these showed some understanding of the term 'quota' and described limiting fishing in one way or another. However, this was as far as some got as they omitted the idea that the remaining fish would be able to reproduce, in order to maintain stocks. Lower-attaining students often suggested that a quota referred to the amount of fish that people could buy or eat. In **09.5** many students did not link the need for more farmland to an increasing population needing more food. References to the use of chemicals to enhance growth were only given very occasionally. In terms of reduced biodiversity, hardly any students went beyond 'cutting down trees' and habitat loss. Few students referred to methane production but these rarely went any further. Whilst many students filled up the available space, most of these simply repeated the same vague points in order to do so.

4.6.2.4 Genetic engineering

Answer 17 · Examiner comments

November 2020 | 8461/2F | Original Q9

Concluding Remarks

Particular problems which occurred quite frequently included:

- confusion of certain terms, eg mitosis / meiosis, reabsorption / filtration / excretion
- paying insufficient attention to information provided in the stem of a question in order to guide a reasoned response, avoid misconceptions and the inclusion of irrelevant information
- repeating, rather than using, information given in the question, for which no marks are available
- careless reading of the question resulting in an inappropriate answer, or not following instructions in multiple-choice items, such as to tick the correct number of boxes
- careless reading of data from a graph
- omitting numbers when a question asks for the use of data
- missing a question when no answer lines were provided and the answer needed to be in a table or a Punnett square
- poor handwriting, for example with numerals – especially the distinction between the numbers 1 and 2
- not checking whether the answer to a calculation is sensible – for example, in converting units over an appropriate order of magnitude, such as the conversion of nanometres to metres.

4.6.2.4 Genetic engineering

Answer 17 · Examiner comments

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.6.2.4 Genetic engineering

Answer 18 · Examiner comments

June 2024 | 8461/2F | Original Q3

Question 3 (low demand)

03.1 A third of students gained this mark.

03.2 Over half of students correctly identified the antigen as the part of the virus made by the yeast cell. The most common incorrect answer seen was 'nucleus' or 'gene'.

03.3 Two thirds of students knew a danger of this vaccine was that it may cause an infection.

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Answer 18 · Examiner comments

June 2024 | 8461/2F | Original Q3

03.4 10% of students did not score any marks on this question. The most common answers were sunlight and water, although minerals and space were also seen frequently. Some students gave oxygen as an answer but missed out on the mark when they didn't specify that the oxygen being competed for is that in the soil. The most frequent uncreditworthy answers were sun unqualified, food, nutrients, soil and carbon dioxide.

03.5 Less than 10% of students gained this mark. The vast majority of answers stated that the glyphosate kills the weeds but not the maize, or that this reduces competition without giving the consequence of this in terms of growth/yield.

03.6 A number of incorrect answers were given for this question, with just over 20% gaining the mark. Many students referred to the maize being killed, despite being told it was resistant and there were many vague comments about other organisms, or the environment being affected – which did not gain credit.