OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

B6.2 FEEDING THE HUMAN RACE

SCORE	PERCENTAGE
/111	%

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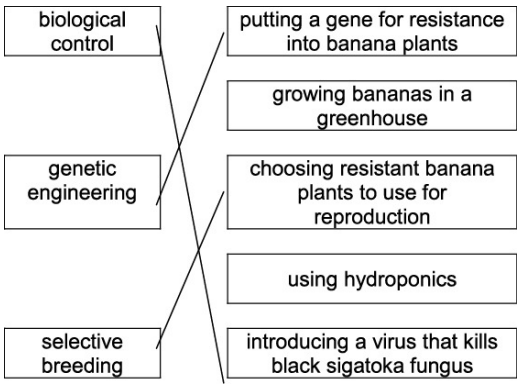
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Question			Answer/Indicative content	Marks	Guidance
1			A	1	
			Total	**1**	
2	a			3	
	b	i	Block C was used so the scientists could see if the sticking agent alone killed the fungus (1)	1	
		i	Block D was used so the scientists could compare the action of the other treatments with no treatment / as a control (1)	1	
		ii	fungicide and sticking agent were the best at killing fungus (1)	1	
		ii	fungicide on its own still killed the fungus (but less than with sticking agent) (1)	1	
		ii	sticking agent does kill the fungus (but less than fungicide) (1)	1	
			Total	**8**	
3		i	use of random numbers (1)	1	
		ii	40.4 (2)	2	**allow** correct mean ie 9.0 (1)
		iii	moderate pollution (1)	1	**allow** ECF from (d) (ii)
		iii	only just above low / closer to low than high (1)	1	
		iv	identify the species of lichens present in their sample (1)	1	**allow** reference to bushy / crusty
		iv	find out how sensitive to pollution these lichens are (1)	1	
		iv	if the lichens are mostly pollution sensitive species = low pollution levels (1)	1	**allow** ora

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Question			Answer/Indicative content	Marks	Guidance
			Total	8	
4			D	1	
			Total	1	
5			A	1	
			Total	1	
6		i	use of random numbers (1)	1	
		ii	40.4 (2)	2	**allow** correct mean i.e. 9.0
		iii	moderate diversity (1)	1	**allow** ECF from (d) (ii)
		iii	only just above low / closer to low than high (1)	1	
		iv	identify the species of lichens present in their sample (1)	1	**allow** reference to bushy / crusty
		iv	find out how sensitive to pollution these lichens are (1)	1	
		iv	if the lichens are mostly polution sensitive species = low pollution levels (1)	1	**allow** ora
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
7	a	i	kills the fungus (that is killing the bananas) so protects / increases the crop / yield (1)	1	
		ii	choose the most resistant individual / banana (1)	1	
		ii	allow it to reproduce (1)	1	
		ii	repeat this process over many generations (1)	1	
	b		some growth (1)	1	
			grows well (1)	1	
	c	i	**A** (1)	1	
		ii	Show that it will be able to grow in less area (all calculations greater than 86.4) (1)	1	
	d		protesters in Europe think that genetic engineering is ethically wrong / not safe (1)	1	
			people in Africa need the food as less is available (1)	1	
			Total	**10**	
8	a		It takes a long time for mutations to occur. ☐ Moving genes between plants is difficult. ☐ The plants have to be selected over many generations. ✓	1	More than one answer =0
	b		some people may not want to buy / eat GM plants (1) there are concerns about their safety / some people do not think that GM is ethically right (1)	2	**allow** some people are against GM **allow** some people prefer to buy non-GM **allow** environmental concerns **allow** may cause allergies / side effects / be harmful **ignore** 'playing God'
			Total	**3**	

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Question			Answer/Indicative content	Marks	Guidance
9	a		the plants lack genetic variation (1) all susceptible to the same disease / any disease / environmental change might wipe them all out (1)	2	**allow** decreased gene pool / genetically identical **allow** all the strawberries will be ready at the same time (1)
	b		some people may not want to buy / eat GM plants (1) there are concerns about their safety / some people do not think that GM is ethically right (1)	2	**allow** some people are against GM **allow** some people prefer to buy non-GM **allow** environmental concerns **allow** may cause allergies / side-effects / be harmful **ignore** 'playing God'
			Total	**4**	
10			idea that they agree as provides more food / more crops / higher yield(1) idea that they disagree as pesticides maybe harmful (to humans or the environment) (1)	2	**ignore** references to taste / harmful to crops
			Total	**2**	

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Question			Answer/Indicative content	Marks	Guidance
11	a		**advantage** (better) control of mineral levels / control of disease (1) **disadvantage** lack of support for plant / idea that (inorganic) fertilisers need to be added (1)	2	**allow answers linked to example in question** e.g. can be grown in shade away from intense heat (1) **allow** reduces competition (1) **ignore** references to increased yield **ignore** no soil needed **ignore** nutrients / fertilisers **allow** uses fertilisers (1) **ignore** minerals added **ignore** reference to pollution / pesticides **ignore** references to cost unqualified **but allow** expensive to buy / set up / run (1)
	b		**Any two from:** UK can afford to grow (more expensive) organic crops / Africa needs food grown cheaply (1) in Africa crops **more** likely to fail / in UK crops **less** likely to fail (1) high(er) demand for food in Africa (due to increased population) (1) idea that in Africa it is important to control the amount of water / UK control of water not as important(1) poor soil (conditions) in Africa / UK has better soil (condition) (1)	2	**allow** in UK we can afford to import food / ora (1) **allow** may get famines in Africa (1) **ignore just** 'crops grow better in UK' **ignore** plants in Africa die **allow** there is a shortage of food in Africa (1) **allow** more people to feed in Africa / less people to feed in UK(1) **ignore** just Africa has a higher population **ignore** just drought in Africa **allow** soil in UK more fertile / ora (1) **allow** barren soil in Africa (1) **ignore** dry soil
			Total	4	
12			A ✓	1 (AO1.2)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
13			A ✓	1 (AO1.1)	
			Total	1	
14			D ✓	1 (AO1.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
15		i	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Provides a detailed explanation drawing conclusions why GM plants would make more biomass available to humans. Links photosynthesis to agricultural food chains and function of insecticides. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Provides an explanation why GM plants would make more biomass available to humans. Links photosynthesis **or** function of insecticides to agricultural food chains. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Provides a basic explanation why GM plants would make more biomass available to humans. This could include ideas about photosynthesis **or** function of insecticide **or** agricultural food chains. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.	6 (AO 3 × 1.1) (AO 2 × 2.1) (AO 1 × 3.2b)	**AO1.1 Demonstrates knowledge of insecticides and photosynthesis.** • Insecticides will kill insect pests • Less leaves will be eaten/pests eat less leaves • Leaves are the site of photosynthesis • Less pests of the GM plant **AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass** • **More** photosynthesis • **More** light absorption for photosynthesis • **More** chlorophyll / chloroplasts for photosynthesis • **More** food/glucose/biomass made by photosynthesis **AO3.2b Draw conclusions linking photosynthesis to food chains** • More plant growth/food/biomass for cattle • More biomass passes through the agricultural food chain • Cattle receive more energy for growth • Then cattle will grow more, therefore more food for humans <u>Examiner's Comments</u> In this Level of Response question, examiners were looking for a detailed conclusion linking photosynthesis to food chains. This should link both photosynthesis and function of pesticides to agricultural food chains. This differentiated well over the whole ability range of the candidates. Exemplar 7 shows a Level 3 answer which gained 6 marks. Exemplar 7

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Question			Answer/Indicative content	Marks	Guidance
					L3 Genetically modified plants that make insecticide are resistant to insects and repell them. This prevents biomass being lost this way and results in more biomass being available for cattle consumption which means more food for them which means more cattle are reared resulting in more food being available for humans in the form of meat or dairy. If less leaves are eaten by insects then there are more leaves available for photosynthesis as there is more surface area. A greater rate in photosynthesis means that the plants will grow stronger and faster which is more efficient for the farmers which means more food for the cattle at a lower cost
		ii	any two from: concern that they may be harmful to humans if eaten ✓ plants may escape into the wild ✓ useful /pollinating insects might be harmed ✓ disrupt food chains ✓ ethically wrong ✓	2 (AO 2 × 2.1)	ALLOW harmful effects not discovered to humans IGNORE dangerous ALLOW resistance / resistance gene could get into other plants IGNORE harmful to insects/pests ALLOW harm the environment /reduce biodiversity ALLOW morally / religiously wrong IGNORE playing God / not natural / disrupt nature IGNORE may not taste good IGNORE reduced gene pool / genetic variation / susceptible to the same disease <u>Examiner's Comments</u> The most common credited mark was that it was ethically wrong. A lot of responses focused on it not being natural, which was a non-credit worthy answer.
			Total	8	
16			C ✓	1 (AO1.2)	
			Total	1	
17			A ✓	1 (AO1.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
18		i	mRNA carries the code for proteins ✓ more protein will be made ✓	2 (AO 2 × 2.1)	ALLOW protein will be made faster Examiner's Comments This question assessed AO2.1. Many candidates were able to link mRNA to either more or faster protein synthesis, but very few referred to the term 'code' to link mRNA and protein synthesis.
		ii	First check answer on answer line If answer = 40 award 2 marks $\frac{20 \times 200}{100}$ ✓ = 40 ✓	2 (AO 2 × 2.2)	Examiner's Comments Candidates found this AO2.2 mathematics skills question quite challenging. 240 was a common incorrect response. Candidates need to have more practice at similar questions using percentages to develop their mathematical skills in this area.

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Question			Answer/Indicative content	Marks	Guidance
		iii	new method uses the plants **own** genes ✓ concern that plants with the insecticide/gene might be harmful to humans / might impact on food chains / might kill useful insects ✓	2 (AO 2.2) (AO3.2a)	ALLOW might have side-effects IGNORE ideas about cultural or religious or ethical objections or that it is playing God Examiner's Comments This question assesses both AO2 and AO3. Candidates were most likely to score a mark for the AO3 marking point, but it was rare for them to gain the AO2 mark. Many candidates described the effect of the gene on the plant, not consumers, or did not pick up on the possible problems of the insecticide itself. There were several responses written about the concern about genetic modification not being a natural process. This is an idea that mark schemes are unlikely to credit, preferring instead to focus on the effects of GM food on all consumers. Candidates also frequently missed out writing about the plants own genes and just focused on the AO3 marking point of the bacterial gene so missed the AO2 marking point. It was common for candidates to write about general dangers of bacteria and infections and not specifically the gene.
			Total	6	
19			B	1 (AO 1.2)	Examiner's Comments This question assessed knowledge and understanding of biological control. Main incorrect response chosen by the majority of candidates was D, confusing pesticide with biological control in stopping the spread of the prickly pear cactus.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
20	a		B, (C), E, D, (A) ✓✓	2 (AO 1.1)	ALLOW 1 mark for B selected in first box Examiner's Comments The question required the candidates to have knowledge and understanding of the process of selective breeding. The majority of lower ability candidates did gain at least one mark here.
	b		cow B x bull B ✓ cow makes creamy milk ✓ bull?s mother produced high yield of milk ✓ Cow B / Bull B not aggressive ✓	4 (AO 3.2a) (AO 3.1b x3)	If wrong cow or bull chosen = No marks IGNORE cow C has creamy milk IGNORE bull A?s mother produced high yield Examiner's Comments The question required the candidates to analyse information from the table to evaluate and make judgements. The majority of candidates gained full marks here, with a select few identifying the wrong cow and bull to selectively breed.
	c	i	yield of milk has gone up and number of cows has decreased ✓	1 (AO 3.1a)	IGNORE negative correlation Examiner's Comments Many candidates could successfully analyse the graph and describe the relationship between number of cows and yield of milk. Lower ability candidates described the wrong relationship by incorrectly identifying that as the yield of milk increases so does the number of cows.

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Question			Answer/Indicative content	Marks	Guidance
		ii	**Any two from:** (cows' milk yield has increased) due to selective breeding ✓ (cows' milk yield has increased) due to intensive farming ✓ need less cows to produce the same amount of milk ✓	2 (AO 3.2)	**ALLOW** improved medications / hormone injections / better quality food supply ✓ <u>Examiner's Comments</u> The question required candidates to analyse the relationship in the graph and draw conclusions, which challenged candidates. Few gained full marks here and didn't appreciate the impact of intensive farming on the increase yield of milk. The most common marking point given was due to selective breeding.
			Total	9	

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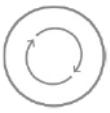
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Question			Answer/Indicative content	Marks	Guidance
21	a		the population is increasing ✓	1 (AO 1.1)	ALLOW more births than deaths Examiner's Comments This question which tested the candidate's knowledge and understanding was well answered with the majority of candidates gaining the mark.
	b	i	move genes ✓ from one organism to another ✓	2 (AO 1.1)	ALLOW modifying/alter the genome IGNORE alter genes Examiner's Comments Candidates found this question which tested their knowledge and understanding challenging. Most candidates just repeated the question that genetics/genes are modified and did not score.
		ii	Any two from: disease resistance ✓ frost resistance ✓ pest resistance ✓ taste ✓ drought resistance ✓ vaccines ✓ colour ✓ flavour ✓	2 (AO 1.2)	IGNORE yield /size of fruit✓ Examiner's Comments A lot of candidates did not read this question properly. They referred to features which were linked to yield, which was already stated in the stem of the question, such as crop size or repeated crop yield. The most common awarded marking points were colour/taste/disease resistance.

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Question			Answer/Indicative content	Marks	Guidance
		iii	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 48 (%) award 2 marks 96? or 0.48 ✓ =48 (%) ✓	2 (AO 2.2) (AO 1.2)	ALLOW correct conversion of the fraction of the people with a negative opinion into a percentage <u>Examiner's Comments</u> The majority of higher ability candidates and over half of all candidates could correctly calculate the percentage in the survey that had a negative opinion. A small number of candidates picked up the error carried forward mark for the mathematical element to correctly calculate a percentage, even if the response was wrong.  AfL It is important for all candidates to show full working out, as a significant number displayed no working out. Showing full working out gives candidates a chance of scoring the error carried forward mark, even if the final answer is incorrect.
			Total	7	
22			B	1 (AO 1.1)	<u>Examiner's Comments</u> This AO1.1 question testing recall of mechanisms of energy losses in food chains, showed a clear area of misconception. In general, candidates chose either B or a significant number frequently put C and did not score.  Misconception Many candidates are unaware of the distinction between egestion and excretion.
			Total	1	

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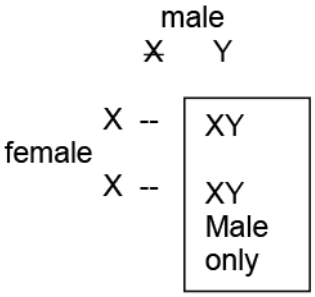
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Question			Answer/Indicative content	Marks	Guidance
23		i	kills the spores / fungus ✓	1 (AO 2.1)	**ALLOW** kills/burns/eradicates the (barley) powdery mildew Examiner's Comments Many candidates did not score on this AO2.1 question because of the lack of reference to the specific organisms in the question. A common mistake is to give generic responses using terms like disease and infection. Rather unexpected, but throughout this question about a fungus a lot of candidates referred to bacteria and viruses.
		ii	the spores left by the fungus growing on the barley cannot infect wheat / the fungus does not grow on wheat / wheat is not a host for the fungus✓ (after two years) there will be less spores/fungus population / the spores/fungus will die✓	2 (AO 2.1)	AW barley powdery mildew for fungus AW pathogen for fungus ALLOW wheat resistant to barley powdery mildew Examiner's Comments This AO2.1 question was approached more like a recall question by many candidates. A substantial number described crop rotation ideas about depletion/replacement of nutrients. Again, many candidates wrote about killing infections or diseases rather than spores or fungi.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
24		i	(DNA) ligase ✓	1 (AO 1.1)	Examiner's Comments Although many candidates did score on this AO1.1 question, the most common error was to refer to restriction enzymes. A significant minority gave lipase as their answer.
		ii	males are XY ✓ so only male rats will be born / ORA ✓ the population will contain an imbalance of sexes / (too many males and) not enough females/no females to mate/reproduce with ✓	3 (AO 1.1) (AO 2.1 x2)	**ALLOW** female is XX **DO NOT ALLOW** males are YY **ALLOW** genetic diagram for 2 marks  Examiner's Comments Higher ability candidates scored well on this AO1.1 and AO2.1 question. Several candidates thought the space for a diagram required them to illustrate how genetic engineering was carried out, rather than showing what would happen in a cross without an X sperm. Many candidates unfortunately replaced the X sperm with a Y, saying males were now YY. Also, there was evidence of a few candidates still mixing up the chromosomes and incorrectly recalling the male as XX and female as XY and others who had correctly done a Punnett square but did not annotate the genotypes. Lower ability candidates showed little understanding about sex-determination or the difference between a gene and a chromosome.
			Total	4	

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Question			Answer/Indicative content	Marks	Guidance
25			D ✓	1 (AO2.1)	
			Total	**1**	
26			B ✓	1 (AO1.1)	
			Total	**1**	
27		i	genetic engineering / genetic modification ✓	1 (AO1.1)	**ALLOW** GM / Gene Therapy
		ii	worried about possible side effects / ethically / morally / religiously wrong ✓	1 (AO3.2a)	**IGNORE** playing God / not natural
			Total	**2**	
28			B ✓	1 (AO1.1)	
			Total	**1**	
29			C ✓	1 (AO1.1)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
30		i	**Any four from:** plasmid used to insert the gene ✓ restriction enzyme to cut open the plasmid / for removing the gene ✓ ligase enzyme to insert the gene / join ends of gene and plasmid ✓ correct reference to sticky ends ✓ correct reference to selection using antibiotic markers ✓	4 (AO4 x 1.1)	enzyme and role must be correct link
		ii	idea (this method) does not use mice / ORA ✓ people may think original method is cruel / unethical / killing mice ✓	2 (AO2.1)	**ALLOW** does not use animals **IGNORE** references to religion/playing god etc.
		iii	to repeat the work / make sure it is reproducible ✓ to make sure it worked / was safe ✓	2 (AO2 x 1.1)	**ALLOW** make sure work was valid **ALLOW** check for errors/mistakes **ALLOW** was correct **ALLOW** was reliable **ALLOW** was ethical **ALLOW** make sure work was original / authentic **ALLOW** recognise significance of work ALLOW to improve quality of report/published work
			Total	**8**	
31			**Any three from:** biological control ✓ nematodes will eat cutworms ✓ less cutworms ✓ less stevia eaten ✓ increase the yield ✓	3 (AO3 x 2.1)	 **ALLOW** predators of the cutworms added **ALLOW** more crop
			Total	**3**	

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