


Mark scheme – Feeding the Human Race

Question	Answer/Indicative content	Marks	Guidance
1	D ✓	1 (AO2.1)	
	Total	1	
2	B ✓	1 (AO1.1)	
	Total	1	
3	B	1 (AO1.2)	<u>Examiner's Comments</u> 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	
4	A	1	
	Total	1	
5	A ✓	1 (AO1.2)	
	Total	1	
6	A ✓	1 (AO1.1)	
	Total	1	
7	D ✓	1 (AO1.1)	
	Total	1	
8	D	1	
	Total	1	
9	A	1	
	Total	1	
10	the population is increasing ✓	1 (AO1.1)	ALLOW more births than deaths <u>Examiner's Comments</u>

					This question which tested the candidate's knowledge and understanding was well answered with the majority of candidates gaining the mark.
			Total	1	
1	1	a	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	
	b	i	A (1)	1	
		ii	Show that it will be able to grow in less area (all calculations greater than 86.4) (1)	1	
	c		some growth (1)	1	
			grows well (1)	1	
			Total	6	
1	2				ALLOW 1 mark for B selected in first box
			B, (C), E, D, (A) ✓✓	2 (AO 1.1)	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.
			Total	2	
1	3	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	
1	4	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.
		ii	Any two from: (cows' milk yield has increased) due to selective breeding ✓	2 (AO 3.2)	

			(cows' milk yield has increased) due to intensive farming ✓ need less cows to produce the same amount of milk ✓		ALLOW improved medications / hormone injections / better quality food supply ✓ Examiner's Comments 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	3	
1 5				3	
			Total	3	
1 6			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	
1 7			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.
			Total	4	

18	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	
		Total	4	
19	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	5	
20	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.
	ii	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 48 (%) award 2 marks 96? or 0.48 ✓	2 (AO 2.2) (AO 1.2)	ALLOW correct conversion of the fraction of the people with a negative opinion into a percentage

		=48 (%) ✓		<p><u>Examiner's Comments</u></p> <p>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.</p>  <p>AfL</p> <p>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.</p>
		Total	6	
2 1	i	use of random numbers (1)	1	
	ii	40.4 (2)	2	allow correct mean ie 9.0 (1)
	ii	moderate pollution (1)	1	allow ECF from (d) (ii)
	i	only just above low / closer to low than high (1)	1	
	i	identify the species of lichens present in their sample (1)	1	allow reference to bushy / crusty
	i	find out how sensitive to pollution these lichens are (1)	1	
	i	if the lichens are mostly pollution sensitive species = low pollution levels (1)	1	allow ora
		Total	8	
2 2	i	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>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. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p>	<p>6 (AO 3 × 1.1)</p> <p>(AO 2 × 2.1)</p>	<p>AO1.1 Demonstrates knowledge of insecticides and photosynthesis.</p> <ul style="list-style-type: none"> • 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 <p>AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass</p> <ul style="list-style-type: none"> • More photosynthesis • More light absorption for photosynthesis • More chlorophyll / chloroplasts for photosynthesis • More food/glucose/biomass made by photosynthesis

	<p>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. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>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. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks No response or no response worthy of credit.</p>	<p>(AO 1 × 3.2b)</p>	<p>AO3.2b Draw conclusions linking photosynthesis to food chains</p> <ul style="list-style-type: none"> • 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 <p><u>Examiner's Comments</u></p> <p>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.</p> <p>Exemplar 7</p> <p>L3 <i>Genetically modified plants that make insects resistant to insects and repel them. This prevents being lost this way and results in more biomass being available for cattle consumption which means more food for which means more cattle are reared resulting in food being available for humans in the form of milk/dairy. If less leaves are eaten by insects then more leaves available for photosynthesis as the surface area. A greater rate in photosynthesis the plants will grow stronger and faster which is for the farmer which means more food for the cattle</i></p>
ii	<p>any two from:</p> <p>concern that they may be harmful to humans if eaten ✓</p> <p>plants may escape into the wild ✓</p> <p>useful /pollinating insects might be harmed ✓</p> <p>disrupt food chains ✓</p> <p>ethically wrong ✓</p>	<p>2 (AO 2 × 2.1)</p>	<p>ALLOW harmful effects not discovered to humans IGNORE dangerous</p> <p>ALLOW resistance / resistance gene could get into other plants</p> <p>IGNORE harmful to insects/pests</p> <p>ALLOW harm the environment /reduce biodiversity</p> <p>ALLOW morally / religiously wrong IGNORE playing God / not natural / disrupt nature</p> <p>IGNORE may not taste good IGNORE reduced gene pool / genetic variation / susceptible to the same disease</p> <p><u>Examiner's Comments</u></p>

					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	