

Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		Growing crops with their roots in water ✓	1 (AO 1.1)	<u>Examiner's Comments</u> This was answered correctly by around half of all candidates. There didn't appear to be a common distractor. Where there was an incorrect response, it was evenly spread between the other options.
	b		Suitable scale ✓ Axes labelled ✓ Bars correctly drawn ✓	3 (3 x AO 2.2)	<u>Examiner's Comments</u> Approximately half of all candidates gained full marks on this question. A few candidates chose an incorrect scale, which then made it harder for them to gain the mark for drawing the bars correctly. A few candidates forgot to label the y-axis.
	c		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) Identifies and explains a reason why people may be short of food AND Compares the information between Haiti and USA recognising the difference between percentage and the actual number of people. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Identifies and explains reasons why people may be short of food OR Compares the information between Haiti and USA recognising the difference between percentage and the actual number of people. <i>There is a line of reasoning presented</i>	6 (2 x AO 1.1) (2 x AO 2.1) (2 x AO 3.2a)	AO1.1 Demonstrates knowledge and understanding of scientific ideas to give reasons why people might be short of food. - Increasing populations - New pests and pathogens - Changes to the environment / weather - Conditions might not be right - Costs of agricultural inputs e.g., fertilisers, feed stuffs, pesticides, irrigation systems, equipment - Land availability AO2.1 Applies knowledge and understanding to explain why people might be short of food - Increasing population means there is less food to go round - New pests and pathogens will result in lower yields of crops - Changes to the environment / weather might reduce crop yields

		<i>with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Identifies a reason why people may be short of food with a limited explanation OR Makes a basic comparison between Haiti and USA <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 mark <i>No response or no response worthy of credit.</i>	- Costs of agricultural inputs may be too high for farmers to afford AO3.2a Analyses information to compare food security between Haiti and USA. - A much larger percentage (almost half) in Haiti do not have enough food compared to USA - The population in USA is much higher than Haiti - More people in USA do not have enough food - The impact on Haiti is more significant as it affects a larger proportion of the population <u>Examiner's Comments</u> For candidates to achieve Level 3 on this question, they had to make sure they answered both parts of the question. Candidates achieving Level 2 provided detailed responses on either one or the other aspects of the question. A considerable number of candidates were able to compare both the numbers of people and the percentage of people in each country. Less successful responses tended just to mention that the USA has a larger population than Haiti, or that Haiti might not have the right conditions for growing food. Exemplar 1 <i>People may be low on food for biological reasons such as drought because the very low amount of rainfall would significantly reduce crop growth therefore meaning less food will be harvested. This would also mean there would be limited food for animals who would be killed for food. In Haiti, the population of 11.5m is lower than the USA at 331.9m. However the percentage of people who do not get enough food is higher in Haiti by 45%. This could be due to the country being less developed and also experiencing more extreme climates.</i> This shows an example of a candidate who scored 6 marks on this question. The candidate has identified and
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					explained a biological reason why people may be short of food: 'drought because the very low amount of rainfall (AO1) would significantly reduce crop growth (AO2)'. They have also identified the difference in population number (AO3) and have calculated that 'the percentage of people who do not get food is higher in Haiti by 45%' (AO3), fully meeting the Level 3 criteria on the mark scheme.
			Total	10	
2			Pesticides kill pests/insects ✓ The pests/insects may become resistant ✓	2 (2 x AO 3.1a)	ALLOW idea that may deter them from using pesticide ALLOW may choose alternative named methods / alternative pesticide/ become organic farmers <u>Examiner's Comments</u> This question proved to be found quite tricky by candidates. Where candidates had recognised that it was natural selection in the previous question, they generally gained at least 1 mark on this question, recognising that some of the insects became resistant to the pesticide, and/or that the farmers would need to find an alternative pesticide. When an incorrect response was selected in Question 17 (b), then candidates often went down the wrong path with their responses to this question.
			Total	2	
3			C	1 (AO 1.1)	<u>Examiner's Comments</u> This was answered correctly by the majority of candidates.
			Total	1	

4	a		✓✓	2 (2 xAO 1.1) IGNORE no soil use hydroponics line Three correct = 2 marks One or two correct = 1 mark DO NOT ALLOW more than 1 line from/to each box <u>Examiner's Comments</u> The majority of candidates answered this well.
	b	i	220 ✓	1 (AO 2.1) <u>Examiner's Comments</u> The majority of candidates read the data off the graph correctly.
		ii	36% ✓	1 (AO 2.1) <u>Examiner's Comments</u> The majority of candidates read the correct data off the graph and were able to perform the necessary calculation.
	c	i	Chinook salmon have a gene that makes them grow fast/desired gene ✓ Gene/DNA is taken out of chinook salmon and transferred to Atlantic salmon ✓ Makes Atlantic salmon grow faster (so greater mass) ✓	3 (3 xAO 2.1) Gene/DNA for rapid growth is taken out of chinook salmon and transferred to Atlantic salmon = 2 marks <u>Examiner's Comments</u> This question proved challenging. A significant number of responses referred to selective breeding rather than genetic engineering, even though the question mentioned genetic engineering. Other candidates provided hybrid responses that mixed up the processes of genetic engineering and selective breeding. Exemplar 2 <i>TO increase the mass, the scientist should find a fish that is like salmon with a high mass and either breed them together or take the DNA/DNA (reproductive cell and sperm) from the fish with a high mass and fertilise the egg salmon eggs with this. Therefore, the offspring will have a higher mass. Then they should breed the offspring with the desired characteristics together again and repeat this again for many generations.</i> Exemplar 2 shows a response where

					the candidate has confused the processes of genetic engineering and selective breeding and were unable to be credited any marks. Other hybrid responses were seen, where the candidate had mixed up elements of both processes within their response.
		ii	Any two from: GE salmon might outcompete wild salmon ✓ GE salmon might breed with wild salmon ✓ Wild salmon might decrease in numbers/become extinct ✓	2 (2 xAO 3.2a)	<u>Examiner's Comments</u> The most common incorrect responses were the idea that they would spread disease to the fish in the sea, or that it would make the fish in the sea unfit for human consumption. Where a mark was gained, it was usually for the idea that they might breed with the wild fish.
			Total	9	
5	a		Gene ✓ Mutation ✓	2 (AO 2 x 1.1)	<u>Examiner's Comments</u> The majority of candidates answered this question correctly. Candidates that scored 1 mark on this question tended to get the mark for mutation.
	b		Selective breeding ✓	1 (AO 1.1)	ALLOW artificial selection <u>Examiner's Comments</u> There was considerable confusion between selective breeding and genetic engineering in these responses.
	c	i	West ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Approximately half of all candidates answered this correctly.
		ii	A lower ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Half of all candidates answered this correctly.
		iii	Because there are fewer birds to eat the sorghum / so less bitter sorghum needed ✓	1 (AO 3.2b)	ALLOW less bitter sorghum needed as less likely to get eaten <u>Examiner's Comments</u> Candidates who were credited a mark showed the link between there being fewer birds, so less sorghum would get eaten. Other candidates showed

					confusion and talked about it 'tasting less bitter, so the farmers could sell more crops'.
			Total	6	
6		i	All points correctly plotted ✓ ✓	2 (2 xAO 2.2)	3 points correct = 1 mark ALLOW +/- half a square DO NOT ALLOW a bar graph <u>Examiner's Comments</u> The majority of candidates were able to correctly plot all 4 points. Where only 1 mark was scored, it was due to the first point being plotted incorrectly.
		ii	Line of best fit ✓	1 (AO 2.2)	ALLOW ECF from incorrect points plotted IGNORE extrapolations <u>Examiner's Comments</u> The majority of candidates were able to draw a suitable line of best fit. Where candidates didn't score this mark it was generally for the following reasons: they did not use a ruler, their line was too thick, or they had multiple lines.
		iii	A figure in range of 1.55-1.7 ✓	1 (AO 2.2)	ALLOW ECF figure from candidate's graph <u>Examiner's Comments</u> More than half of all candidates were able to use their line of best fit to make a prediction.
		iv	Any two from: Less chance of mutations ✓ Less likely to get cancer/tumours ✓ Cancer/tumours can spread / be lethal ✓	2 (2 xAO 1.1)	ALLOW uncontrolled growth causes cancer/tumours ALLOW malignant <u>Examiner's Comments</u> This question was one of the more challenging questions for the majority of candidates, with candidates not making the link between uncontrolled

					cell growth and tumours/cancer. Most candidates who were credited marks tended to only gain 1 mark on this question, for stating that mole rats were less likely to get mutations, or less likely to get cancer.
			Total	6	
7			Level 3 (5–6 marks) Provides an explanation of how each control method works AND Provides an evaluation of each method <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Provides an explanation of a control method AND Provides an evaluation of a method OR Provides an explanation how each control method works OR Provides an evaluation of each method <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Provides an explanation of a control method OR Provides an evaluation of a method. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks No response or no response worthy of credit	6 (3 × AO 1.2) (3 × AO3.2a)	AO1.2 Demonstrate knowledge and understanding of the methods of control for the disease. Digging/burning the plants will destroy/kill the virus/infection / prevent the insects from feeding on the infected tulips - Spraying fields with insecticide will kill the insects - Insects cannot spread infection AO3.2a Analyse information to make judgements on the methods of control. Digging up and burning advantages: - Only kill the infected bulbs - Does not involve paying for insecticide - Will not cause bioaccumulation by insecticide - Will not kill harmless/useful insects • Digging up and burning disadvantages: - Will not stop further spread by insects - Time consuming / may have to pay for labour - Contribute to greenhouse effect / global warming / CO₂ produced / harmful gasses / pollution - Less tulips/crop - Detection of disease maybe too late • Insecticide advantages:

					- Faster method - Less labour/ time investment Does not contribute to greenhouse effect / global warming / CO₂ production - don't destroy the crops • Insecticide disadvantages: - Repeat application - Cost involved - Cause bioaccumulation - Kill useful/harmless insects - Disrupt food chains/webs - Reduce biodiversity - Promote insecticide resistance <u>Examiner's Comments</u> The Level of Response question had a high level of no responses, whereby if those candidates had attempted the question could have gained some marks. Those candidates who attempted to answer mainly produced Level 1 and Level 2 answers and very few were able to explain how each method would control the disease plus discuss the advantages and disadvantages of each method. A number of candidates got confused that pesticides would kill the infection not the insects and harm the tulips. Exemplar 1 <i>If they dig up and burn any tulips as soon as they show signs of infection this can cause pollution into environment and could potentially damage other tulips around the surrounding area. However, an advantage of this is the infection will be killed.</i> <i>A disadvantage of spraying their fields with insecticides is it could also kill the tulips, as well preventing the infection from spreading.</i> Exemplar 1 shows a Level 2, 4 marks response where the candidate has correctly identified how digging up and burning the tulips would control the disease by killing the infection with a correct evaluation of a method, by
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					causing pollution. They did not identify how insecticides would reduce the spread of infection and incorrectly stated that tulips would be killed.
			Total	6	
8		i	(Use living organism/fungus) to kill a pest/caterpillars ✓	1 (AO 1.1)	ALLOW using natural predator/natural parasites to kill pests/caterpillar <u>Examiner's Comments</u> This question was one of the most challenging for the candidates whereby they did not know what a biological control was. Therefore it had a high no response from the candidates or provided a guess.  Assessment for learning Centres could make sure that candidates are aware of biological control in controlling pest numbers.
		ii	1000 (times) ✓	1 (AO 1.2)	ALLOW 1×10^3 / thousand <u>Examiner's Comments</u> Roughly half of all candidates could calculate that spores were x1000 more concentrated sprayed on the soil than the tops of trees. Most answers which did not gain the mark subtracted 100 from 100 000.
		iii	Any three from: Kills more caterpillars than water/control ✓ (Concentration used on the soil) contain more spores (than tree tops) ✓ Lasts longer (than tree tops) ✓ Not much difference between caterpillars killed for soil and trees ✓	3 (AO 3.1a) (AO 3.1a) (AO 3.2a)	ALLOW kills more caterpillars when sprayed on tree tops and soil IGNORE quote numbers unless qualified ALLOW higher concentration (of spores) ALLOW (soil) lasts many years but tree tops only a few months IGNORE lasts many years <u>Examiner's Comments</u> This question proved challenging for the candidates. It was testing the ability to interpret and analyse

					information from tables. It had a fairly high no response from candidates but those who attempted and gained a mark were able to identify that the fungal spores last longer/contained more when sprayed on the soil. Most candidates were not able to identify that using spores killed more caterpillars than the water/control. Candidates who did not gain any marks were not comparative with their answers between spores sprayed on the tops of the tree and the soil. Exemplar 2 <i>Some may think spraying on top is better than in soil as it kills the caterpillars however this will only last a few months and they are not as concentrated as on spraying on soil. Spraying on soil lasts for many years since worms eat it. therefore it is better as it lasts longer. therefore in the long run it will kill more. On soil it also more concentrated than on the top of trees. Evolving fungi spores are an effective way as they will mean time what water does. water may kill the caterpillars significantly sooner.</i> Exemplar 2 gained full marks for correctly identifying spores kills more caterpillars than the control/water and spraying on the soil last longer and has a higher concentration.
			Total	5	
9	a		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 (2 × AO 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 reduce gene pool / genetic variation / susceptible to the same disease <u>Examiner's Comments</u> Very few candidates gained full marks

					for this question on concerns of genetic modification crops. The most given mark was for ethically wrong. Most common incorrect answers were unnatural or talking about costs from the previous question.  Assessment for learning Benefits and consequences of genetic engineering is a common assessed topic and centres could benefit using past papers as a useful revision tool.
	b		Idea cost of pesticide is less ✓ Cost of growing GM (wheat) is lower / cost saving 18 (euros per hectare) ✓	2 (2 × AO 3.1b)	ASSUME taking about GM crops if not stated IGNORE less pesticide IGNORE more profitable/sell/production of wheat ALLOW costs 210 (euros per hectare) rather than 228 DO NOT ALLOW government costs/seeds cost less <u>Examiner's Comments</u> A significant number of candidates scored a mark here correctly identifying that the pesticide cost is lower for GM crops. Candidates who did not gain any marks on this question mixed up the cost to produce the crops for the farmer with selling costs and profits.
	c		DNA ✓	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates did not correctly identify DNA is inserted into wheat cells to genetically modify it. This tested their knowledge and understanding of genetic engineering and incorrect answers ranged from all the other alternative answers.
			Total	5	
10			B ✓	1 (AO 2.1)	<u>Examiner's Comments</u>

					This question was the most accessible questions in the multiple choice Section A, with most candidates correctly answering B by correctly retrieving information from the table for the best two types of strawberries the farmer would use to selective breed to produce a high yield and as early as possible in the year.
			Total	1	