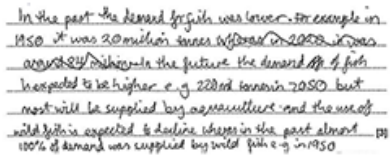
Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1		i	Non-coding DNA ✓ Transcription✓ Ribosomes ✓ Translation ✓	4 (4 x AO 1.1)	**Examiner's Comments** This gap fill question all candidates attempted and the majority scored either three or four marks. Only a small number were not given any marks here. The most common given marks were for transcription and translation identified correctly. The most common error candidates made was stating that genes can be switched on by coding DNA instead of non-coding DNA.
		ii	(Genetic engineering) introduce a gene from another organism ORA ✓	1 (AO 1.1)	**AW** adding/transfer/insert for introduce **IGNORE** change/replace genes/DNA from another organism **ALLOW** only uses gene from one organism **Examiner's Comments** This question proved the most challenging to the candidates assessing their knowledge and understanding of genetic engineering. Most candidates were not able to describe the process of genetic engineering. Vague references to vectors and various enzymes were answered. Where candidates did identify moving a gene, they did not clearly identify that the gene was from another species. Common responses included genetic engineering swaps/replaces a gene. **Misconception** There has been a knowledge gap identified and most candidates did not know that in genetic engineering genes are introduced from one organism to another. Misconceptions

					included, swapping genes / replacing genes and part of selective breeding. Revisiting key ideas throughout the GCSE course would help remove and eliminate these misconceptions.
			Total	**5**	
2			**B**	1 (AO 2.1)	**Examiner's Comments** This was the highest scoring question in this section with nearly all candidates able to correctly convert a percentage into numbers and understand standard form.
			Total	**1**	
3			**D**	1 (AO 1.1)	
			Total	**1**	
4	a		**Any three from:** (Chemical first produced) by a mutation ✓ (Idea these seeds/plants) less likely/not eaten by birds/people / **ORA** ✓ These seeds are more likely to survive and reproduce / ORA ✓ Pass on allele/gene (for making the chemical) / **ORA** ✓	3 (AO 1.1) (2 xAO 2.1)	If selective breeding described award no marks **ALLOW** these seeds/plants are better adapted (by less being eaten) **ORA** **AW** produce offspring for reproduction **ALLOW** pass on advantageous allele/gene ORA **IGNORE** pass on traits/characteristics **Examiner's Comments** This question assessed the application of knowledge and understanding of natural selection. The question was a good discriminator between candidates at different grades and over half of candidates gained 2 or full marks. Most responses provided evidence that the candidates could identify it was natural selection and they could explain how the sorghum evolved to produce the bitter taste.
	b		**Any two from:** (Select/choose plants/organisms) with	2 (2 xAO 1.1)	If genetic engineering/cloning described award no marks **DO NOT ALLOW** (select)

			less bitter chemical/show desired characteristics ✓ Breed these (plants/organisms together) ✓ Select/choose (offspring) with less bitter chemical/ desired characteristic and repeat the process ✓		seeds/sorghum with no bitter chemical **ALLOW** cross breed/pollinated (together) **Examiner's Comments** Over half of all candidates gained full marks here, demonstrating knowledge and understanding of selective breeding.
	c		In areas where there are many birds there are higher levels of the bitter chemical / **ORA** ✓ (More bitter chemical) less likely to be eaten by the birds / **ORA** ✓	2 (AO 3.1a) (AO 3.1b)	**IGNORE** sorghum evolves to not be eaten If no worthy answer allow birds have evolved to no longer taste the bitter chemical **Examiner's Comments** This question required candidates to analyse information to draw conclusions. This proved challenging and most responses did not gain maximum marks. The most common given marking point was correctly identifying the trend from the graph, however less than half of all responses gained this mark. Many responses did not explain that sorghum that had higher levels of the bitter chemical were grown in areas with higher numbers of birds to prevent it being eaten. **Assessment for learning** Centres could provide more opportunities for candidates to analyse information and draw conclusions. These AO3 skills are accessed in the exam and make up 20%.
			Total	**7**	

5	a		Wrasse feed/eat/kill parasites (that would feed/eat the salmon) ✓ More food / energy is available (for the salmon for growth) ✓	2 (2 xAO 2.1)	**ALLOW** wrasse are a predator of the parasite **ALLOW** wrasse may prevent the salmon developing diseases / wrasse are a cleaner species **DO NOT ALLOW** salmon eating wrasse **Examiner's Comments** This question required candidates to apply their knowledge of biological control to salmon and wrasse. Half of all candidates were given a mark for understanding that the wrasse would feed on the parasites. Most unsuccessful responses stated that the wrasse take the parasites away from the salmon but not in any detail how. Many responses did not gain full marks for linking how fewer parasites would increase the food/energy available to the salmon. A number of candidates incorrectly stated that the wrasse provided food for the salmon directly, with the salmon eating them.
	b		**Any three from:** (Total) demand/supply for fish is increasing ✓ Has increased from 20 to 220 million tonnes ✓ Earlier (total) demand is mainly supplied by wild fish ✓ From 1990 supply from aquaculture begins to increase ✓ Demand/supply for wild fish has decreased since 2000 ✓ Demand/supply by aquaculture is predicted to become greater than demand/supply for wild fish ✓ (Demand/supply by aquaculture is predicted to become greater than	3 (3 xAO 2.1)	**ALLOW** demand/supply for fish was lower in the past **ALLOW** increased by 200 million tonnes **ALLOW** earlier demand/supply by wild increased and aquaculture remains the same **DO NOT ALLOW** earlier demand/supply is increasing at a similar rate both wild and aquaculture **ALLOW** range between 1980-2010 **ALLOW** range between 1996-2010 **Examiner's Comments** Very few candidates did not gain a mark here but less than a third gained maximum marks. The question required skills in application of information provided in the graph. The most successful responses understood that the demand/supply for fish increased over the years and

			demand/supply for wild fish) will happen between 2020 and 2030 ✓		could correctly identify the correct years when demand/supply for aquaculture increased and wild fish decreased. Most unsuccessful scoring marks were for the correct identification that demand/supply from aquaculture overtakes wild fish and that wild fish was the main source of salmon supplied earlier. **Assessment for learning** Centres could provide more opportunities for candidates to apply and extract information from graphs. Responses demonstrated confusion that both aquaculture and wild fish supplied 20 million tonnes in 1950 when in fact it was 20 million tonnes by wild fish alone and that earlier they both increased at the same rate which is not the case. Wild fish supply increased while aquaculture remained the same, very low. Some responses also stated that aquaculture is predicted to supply 220 million tonnes by 2050 which is also incorrect, it is 140 million tonnes and 80 million supplied by wild fish. Exemplar 3  In the past the demand for fish was lower. For example in 1950 it was 20 million tonnes whereas in 2020 it was approx 84 million. In the future the demand for fish is expected to be higher e.g. 220m tonnes in 2050 but most will be supplied by aquaculture and the use of wild fish is expected to decline sharply in the past almost 100% of demand was supplied by wild fish e.g. in 1950 Exemplar 3 gained maximum marks. The candidate correctly identified that the demand/supply for fish has increased (by ORA), they extracted the data that it increases from 20-220 million tonnes and that earlier supply/demand came mainly from wild fish.
	c	i	Restriction (endonuclease) ✓	1 (AO 1.1)	**IGNORE** restricting/restrictive **Examiner's Comments**

					Over half of candidates correctly identified that a restriction enzyme is the cutting enzyme involved in genetic engineering. This had the highest omit in the paper with candidates not answering this question. **Assessment for learning** Centres could provide more opportunities for candidates to learn the names of the enzymes involved in genetic engineering as it has been highlighted as a knowledge gap in the number of unsuccessful responses seen.
		ii	(DNA) Ligase ✓	1 (AO 1.1)	**DO NOT ALLOW** lipase **Examiner's Comments** Over half of candidates correctly identified that ligase enzyme is the joining enzyme involved in genetic engineering. This had the highest omission rate in the paper with candidates not answering this question. **Assessment for learning** Centres could provide more opportunities for candidates to learn the names of the enzymes involved in genetic engineering as it has been highlighted as a knowledge gap in the number of unsuccessful responses.
		iii	The gene will switch on the growth hormone gene ✓ Growth hormone will be made continuously ✓	2 (2 xAO 2.1)	**ALLOW** growth hormone produced throughout the year If no marks awarded allow (gene inserted) will allow salmon to grow throughout the year for one mark

					Examiner's Comments Over half of all candidates gained a mark when applying their knowledge and understanding of genetic engineering. Very few responses gained maximum marks and the most successful given mark came from knowing the salmon would grow throughout the year (with gene inserted).
		iv	**First check the answer on answer line** **If answer to 2 significant figures is correct for accepted range award 3 marks** $\frac{(13.0 - 7.3)}{7.3} \times 100$ ✓ **OR** $\frac{(5.7)}{7.3} \times 100$ ✓ **PLUS** 78.08 (%) ✓ 78 (%) ✓	3 (AO 2.2) (AO 1.2) (AO 2.2)	**ALLOW** mm instead of cm units **ALLOW** range 12.9-13.1cm for genetically engineered salmon **ALLOW** range 7.2-7.4cm for non-genetically engineered salmon **ALLOW** any correct rounding of 78.082191 8 **ALLOW** correct answer from accepted range measured **ALLOW ECF** for incorrect measurements by correct equation **ALLOW** one mark for an incorrect answer if it is clearly shown that it has been correctly rounded to 2 significant figures **Examiner's Comments** This question was a good differentiator between candidates at different grades. Candidates had to correctly measure the non-genetically engineered and genetically engineered salmon and calculate the percentage increase then further process the answer to 2.s.f. There was a good spread of marks given with many candidates scoring maximum marks. The least successful responses did not apply the correct calculation for percentage increase and did not correctly give the answer to 2.d.p.

			Total	**12**	
6			**B**	1 (AO 1.1)	**Examiner's Comments** This was one of the most accessible questions on the multiple choice Section A, with most candidates correctly answering B on why antibiotic markers are used in genetic engineering.
			Total	**1**	
7		i	Biological ✓	1 (AO 1.1)	**Examiner's Comments** On this AO1.1 recall question only the higher ability candidates scored. A whole range of incorrect answers were given included pesticides, fungicides, spore control, pest control and artificial. It was also the most frequently omitted question as candidates either knew the term 'biological' or did not.
		ii	2 ✓	1 (AO 1.2)	**Examiner's Comments** A good number of candidates could calculate 2 orders of magnitude higher from 1×10^6 and 1×10^8. The most common incorrect answers were 10^2 and 100.
			Total	**2**	
8			C ✓	1 (AO 2.2)	
			Total	**1**	
9			B ✓	1 (AO 1.1)	**Examiner's Comments** Many candidates answered this AO1.1 question well, choosing B. All the other letters were seen in the responses, most commonly D.
			Total	**1**	