

Gene Projects - Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	<p>A description that makes reference to four of the following:</p> <ul style="list-style-type: none"> • restriction endonuclease used to { cut plasmid / isolate gene } (1) • forming sticky ends (1) • ligase enzymes used to add isolated gene to plasmid (1) • (ligase) forms phosphodiester bonds (between nucleotides) (1) • recombinant { DNA / plasmid } produced (1) 	<p>ALLOW 'endonuclease' or 'restriction enzyme'</p> <p>ALLOW 'sticky ends' in context of the DNA or plasmid being cut by enzymes if restriction enzymes not specified</p> <p>ALLOW integrase for ligase</p>	(4)

Q2.

Question number	Answer
	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p><u>Indicative content:</u></p> <p><u>Benefits</u></p> <p>Described:</p> <ul style="list-style-type: none">• crops have increased yield due to pest control or resistance to disease• reduced need to use pesticides• crops can be grown in a wider range of conditions, e.g. harsh conditions, drought etc <p>Discussed:</p> <ul style="list-style-type: none">• hybridisation could allow crop plants to have genes for tolerance to harsh conditions from genome D• crops have higher nutrient content, or produce a greater range of useful chemicals e.g. pharmaceutical products• genetic modification can be beneficial if crops are resistant to herbicides - crops can be sprayed with herbicide without { being harmed / causing reduction in yield } <p><u>Risks</u></p> <p>Hybridisation:</p> <ul style="list-style-type: none">• hybridisation can lead to pest species which have ability to grow in wide range of conditions• hybridisation could allow genes for tolerance to harsh conditions from genome D to enter pest species <p>GM:</p> <ul style="list-style-type: none">• genetic modification may result in genes entering pest species, making control difficult or into food chains• GM can introduce antibiotic resistant genes to other species <p>Selective breeding</p> <ul style="list-style-type: none">• selective breeding reduces { genetic diversity / size of gene pool }, or causes genetic drift• leading to loss of useful alleles / reducing the ability of the crops to adapt to environmental change

Level	Mark	Descriptor	Additional Guidance
0	0	No awardable content	
1	1-2	Limited scientific judgement made with a focus on one side of the argument only. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.	Only considered one benefit or one risk without further explanation beyond a brief description.
2	3-4	A scientific judgement is made through the application of relevant evidence to both sides of the argument. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.	Considers at least one risk and one benefit with some discussion.
3	5-6	A scientific judgement is made, which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.	Benefits generally described and specific risks discussed. Conclusions described for each of the three methods – hybrids, GM and selective breeding.

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: <ul style="list-style-type: none"> changing a base results in a change in the triplet code this changes the codon(s) in the mRNA resulting in a different { amino acid / amino acid sequence } (in the primary structure) 	ALLOW deletion / substitution / insertion / frameshift. ALLOW illustration of change in triplet code e.g. ATT to ATG ALLOW introducing a stop codon / terminating translation	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • sequence the genome of people with MPS1 • sequence the genome of a number of people without the condition • compare the base sequences to identify mutations found only in individuals with the condition 	ALLOW comparison of base sequences of people with MPS1 and people without MPS1	(3)

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(i)	<p>A description that makes reference to the following:</p> <ul style="list-style-type: none"> • gene is a length of DNA that codes for a { polypeptide / protein } (1) • genome is a complete set of { DNA / introns and exons } (1) 		(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(ii)	ligase / integrase		(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(iii)	plasmid / virus		(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(iv)	<p>A description that makes reference to the following:</p> <ul style="list-style-type: none"> • transcription of DNA to mRNA (1) • { translation of mRNA / protein synthesis } on ribosomes (1) 		(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • no prothrombin activated so thrombin not produced (1) • thrombin needed to convert fibrinogen to fibrin (1) • fibrin needed to trap { platelets / blood cells } to form the (blood) clot (1) 		(3)

Q5.

Question Number	Answer	Mark
(a)	<ol style="list-style-type: none"> 1. reference to {restriction enzyme / endonuclease} ; 2. to cut gene out of animal DNA ; 3. idea of amplification using DNA polymerase (in PCR) ; 4. (enzymes) open plasmid ; 5. (same endonuclease) to produce 'sticky ends' /description / at selected base sequence ; 6. H bonds formed between bases at 'sticky ends' ; 7. ligase ; 8. to join gene to plasmid / eq ; 9. reference to {phosphodiester / eq} bond ; 	(5)

Question Number	Answer	Mark
(b)	<ol style="list-style-type: none"> 1. (small) {circle /eq} of DNA ; 2. containing bacterial (survival) genes and {protein / animal} gene ; 3. marker gene / description given ; 	(2)

Question Number	Answer	Mark
(c)	<ol style="list-style-type: none"> 1. idea of easier to manage growth e.g. do not need sterile conditions ; 2. idea that it is safer (than bacteria) ; 3. idea of more protein can be made /eq ; 4. bacteria may not have correct amino acids to make protein / eq ; 5. idea that it could produce edible drugs ; 6. idea that plants have introns/bacteria do not so gene does not need modifying ; 7. idea that it is cheaper ; 	(2)

Question Number	Answer	Mark
(d)	<ol style="list-style-type: none"> 1. idea of gene transfer to other {species / eq} ; 2. idea of consequence of transfer e.g. resistance to pesticide / antibiotics, superweeds ; 3. idea of possible harmful effects from genes e.g. biochemical changes to substances that could act as allergens, long term effects of consuming ; 4. idea that benefit focused on developed countries / converse ; 5. idea of risk related to use of viral vectors ; 6. idea of effect on organic farmers ; 	(2)