WJEC (Eduqas) Biology A-level

Topic 2.7: Application and Reproduction of Genetics

Questions by Topic - Mark Scheme

1.

	Question			Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1				**Indicative content** **Sequence and data:** • the order of <u>nucleotides/bases</u> in the DNA • Sanger sequencing • descriptions of methods used • data/information would give {loci/sequences} of individual genes • coding for specific amino acid/proteins • descriptions of introns and exons (correct context) **100 000 Genomes Project:** • Next Generation Sequencing/NGS • locate genes responsible for {rare genetic disorder/cancers}/mutated sequences • by comparing genomes of sufferers with {normal genome/large number of individuals} • Predisposition to disease/{diagnosis/ understanding causes} of diseases • developing treatments/gene therapy. • Use in prenatal diagnosis **Benefits and ethics:** • Sharon would find out if the drug would give her liver damage/benefit is matching drugs to genetic make up of patient/personalised medication • ethical dilemma is over <u>rights of access</u> to genomic information • {Misuse of genetic information} by Employers/insurers • Wider implications on family health • {Anxiety/distress} caused by knowledge • Social discrimination/OWTTE						
				7-9 marks Indicative content of this level must address all three parts: *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level addresses at least two parts. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content addresses at least one part. *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
				Question 1 total	4	5	0	9	0	0

2.

	Question		Marking details	Marks Available
2	(a)	(i)	AATT and TTAA;	1
		(ii)	they have unpaired bases / they have exposed bases / they are single stranded DNA sections;	1
		(iii)	EcoR1;	1
	(b)	(i)	{Ring of / circle of / loop of} DNA (found in bacteria); Accept {additional / extra} DNA qualified	1
		(ii)	so that the cut ends (of the fragment and the plasmid) are <u>complementary</u>;	1
		(iii)	Ligase;	1
	(c)		• Introns are {non-coding / blocks of repeated nucleotides} /exons code (for proteins); • so there is more variability / more unique to individual / {number of times that the blocks are repeated varies/ {STRs / VNTRs} vary / ORA for exons;	2
	(d)		Same position **and** thickness of bands;	1
	(e)	(i)	{Makes multiple copies / amplifies} DNA; NOT replicates unqualified	1
		(ii)	<u>DNA</u> polymerase; (DNA) <u>replication</u>;	2
			Question 2 Total	**[12]**

3.

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	GGC GTA ATT CCC		1		1		
		(ii)	different nucleotide sequence at each end/one primer for each strand of DNA (1).			1	1		
		(iii)	Enables {specific/the gene} to be {amplified/to be copied/to be replicated} (1)			1	1		
		(iv)	Does not matter how {many cycles in PCR/initial quantity/number of copies made}(1) Ratio will be same (1)			2	2		

4.

Question			Marking details	Marks Available
4	(a)		Restriction {endonuclease/ enzymes} used to cut (out the desired gene); The <u>same</u> {endonuclease/ enzyme} is used to open the plasmids; Producing {complementary/ corresponding} 'sticky ends'; Ligase is used to {join/ splice/ attach/ adhere/ anneal} gene into plasmid;	1
	(b)	(i)	'Roundup' will not kill crop but it will kill {other plants / weeds}; Reducing competition in the field; Allowing increased yield;	3
		(ii)	There will be increased use of herbicide; a reduction in biodiversity/ may lead to {herbicide resistant weeds/ superweeds} bioaccumulation in food chain; OR <u>Dispersal of pollen</u> from crops engineered for herbicide resistance to {wild relatives/ weeds}; may lead to {herbicide resistant weeds/ superweeds}; OR <u>Dispersal of pollen</u> from crops engineered for herbicide resistance to other crops; May contaminate organic crops; OR (GM crop) produces a new protein; Unknown effects of <u>eating</u> new protein;	Max 2
			Question 5 Total	**[9]**

5.

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		Any 3 from: {Restriction (endonuclease) enzyme/ named enzyme e.g. EcoR1} used to cut out {gene/ DNA} (1) Sticky ends/ or description of (1) <u>Same</u> restriction enzyme used to open DNA in {vector/ plasmid/ virus/ *Camelina*} (1) Ligase used to {insert / anneal / splice} gene into {vector/ plasmid/ viral/ *Camelina*}(1)	3			3		
	(b)		Less wild fish will be harvested (to feed farmed fish)			1	1		

6.

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		• Double stranded {not single/ RNA is single stranded}/ double helix vs {not double helix/ single stranded} • deoxyribose not ribose • thymine not uracil Accept letters • Longer molecule **2 marks for 3 correct** **1 mark for 2 correct**	2			2		
	(b)		It cuts DNA/ or description (1) Ignore reference to RNA At a specific (base) <u>sequence</u>(1)	2			2		
	(c)		Any **three** (×1) from: • Make guide RNA (with complementary sequence) of {target gene/ fertility gene} (1) • Insert {CRISPR/ Cas9} into {eggs/ cells} (1) NOT mosquitoes alone • and incubate/allow to {grow/mature} (1) • remove the gene that {makes them fertile/ affects meiosis} (1)		3		3		
	(d)		• Reference to reduced fertility in mosquitoes (1) • Less mosquitoes = less malaria (1) • Any **one** (×1) from Reference to right of humans to make another species extinct / Effect on {removal from food chain/ ecosystems/ biodiversity} Unknown effects of GM mosquitoes in the environment (1)		2	1	3		
			Question 6 total	**4**	**5**	**1**	**10**	**0**	**0**

7.

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				• **Extract** mRNA from the bacterium (which is synthesising the proteins). • Use **reverse transcriptase** to synthesise a {single strand of DNA/ cDNA} using the mRNA (as a template). • Use **DNA polymerase** to produce double stranded DNA. • **Sticky ends** are added to the end of each DNA strand of the DNA. • The DNA is copied many times using the **PCR.** • Plasmids from bacteria are isolated • **Restriction {endonuclease/ enzymes}** is used to open the plasmid (at a specific point) • producing **sticky ends complementary** to the DNA. • **DNA ligase** is used to bind the DNA into the plasmid. • **Antibiotic resistance genes / markers/ LacZ** are used to select bacteria containing the recombinant plasmids. Concerns: • dispersal of pollen from engineered crops to wild relatives/ contamination of organic crops • unknown effects of eating new protein which is toxic to insects/ health concerns from eating GM crop • a reduction in biodiversity e.g. beneficial insects killed/ affect on food chains • Could result in resistance to protein in insects/ selection pressure						
				7-9 marks Indicative content of this level is… Detailed explanation of all three areas in the indicative content. *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Detailed explanation of 2 areas of the indicative content, or partial description of 3 areas. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is… Good explanation of one area of the indicative content or partial description of 2/3 areas. *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
				Question7 total	7	2		9	0	0