Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)(i)	D (proteins, nucleic acids, starch)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)(ii)	C (lactose)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)(iii)	D (mRNA)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
1(b)	An explanation that makes reference to the following: • (a mutation results in) a different sequence of amino acids (1) • therefore different R groups / side chains (1) • resulting in changes to { ionic / hydrogen bonding / disulphide bridges } (1) • change in shape of active site causing a change in enzyme activity (1)		**(4)**

(Total for Question 1 = 7 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)(i)	C (nucleic acid and protein)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)(ii)	B (human immunodeficiency virus)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(b)	A description that makes reference to the following: **Latency:** • virus genetic material inserted into host cell and integrated into host DNA (1) • viral DNA replicated each time the host cell replicates (1) **Lytic cycle:** • virus genetic material inserted into host cell and synthesis of viral particles by host cell (1) • lysis of host cell (1)		**(4)**

(Total for Question 2 = 6 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)	An explanation that makes reference to the following: • overall net filtration pressure is 3.2 (1) • so fluid will be forced from the glomerulus into the Bowman's capsule (1)	<u>Example of calculation</u> 9.2 − 2.0 = 7.2 7.2 − 4.0 = 3.2 =3.2	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)	An explanation that makes reference to the following: • active transport of chloride ions out of ascending limb of loop of Henle (1) • causes a decrease in water potential of the medulla (1) • ascending limb impermeable to water (1) • therefore water reabsorbed from the descending limb by osmosis (1)		**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(c)	D (increased secretion of ADH and increased permeability of the collecting duct)		**(1)**

(Total for Question 3 = 7 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)	A (fertile offspring)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)	An explanation that makes reference to five of the following: • geographical isolation between Fuerteventura and mainland birds (1) • birds exposed to different selection pressures (1) • variation between individuals (1) • therefore increased survival / reproduction of individuals with advantageous { alleles / genes } (1) • increasing frequency of (these) alleles (1) • reproductive isolation / allopatric speciation (1)		**(5)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(c)	An explanation that makes reference to the following: • captive-breeding programmes to increase numbers (1) • ensure outbreeding to maintain genetic diversity (1) • to re-introduce (genetically diverse) birds into a suitable habitat (1)		**(3)**

(Total for Question 4 = 9 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)(i)	A (P)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)(ii)	An explanation that makes reference to the following: • (no P wave on trace) sinoatrial node / SAN not functioning (1) • causing lack of electrical activity in the atria (1) • failing to pass electrical signal to the atrioventricular node (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)(iii)	• normal ECG trace rate is 60 beats per minute and person with Sick Sinus Syndrome rate is 50 beats per minute (1) • so difference 10 beats per minute (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)(iv)	An explanation that makes reference to the following: • sinoatrial node is not working causing a slower heart beat rate (1) • causing lack of oxygen to { brain / muscles } (1)		**(2)**

(Total for Question 5 = 8 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)(i)	C (*Paramecium* is a eukaryote and the bacterium is a prokaryote)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)(ii)	An explanation that makes reference to the following: • pond water has greater water potential than the cytoplasm therefore water enters by osmosis (1) • *Paramecium* has { only cell membrane / has no cell wall } (1) • so would burst if water not removed (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)(i)	An explanation that makes reference to the following: • locust has a smaller surface area to volume ratio than *Paramecium* (1) • therefore has { tracheae / tracheoles } to provide greater surface area (for gas exchange / diffusion) (1)	Allow converse statements	**(2)**

Question Number	Indicative content	
6(b)(ii)	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. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • in human exhaled air abdominal pumping movements rise, but since exhaled air is warmer / more moist, contains more carbon dioxide and less oxygen than atmospheric air no conclusion can be reached from this result • in the presence of pure oxygen the number of abdominal pumping movements is lower than when in atmospheric air • in the presence of pure carbon dioxide the number of abdominal pumping movements is higher than when in atmospheric air • in atmospheric air there is some residual effect of previous gas exposure	
Level	Mark	Descriptor
	0	No awardable content
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

(Total for Question 6 = 12 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)	An explanation that makes reference to four of the following: • colonisation by pioneer species (1) • which contribute dead organic matter to form soil (1) • therefore creating suitable conditions for other species to establish (1) • leading to { succession / a sequence of changes } in {a community / organisms / species / plants} (1) • the final { stage / sere / community } is { self-sustaining / stable } (1)	Allow lichens	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(i)	An explanation that makes reference to the following: • *Euphorbia regis-jubiae* is a producer therefore provides { food / energy } for other organisms (herbivores / primary consumers / decomposers) (1) • { presence of roots / organic material } holds soil structure together / increases nutrients (1) • therefore it provides { shelter / (micro) habitat } for other organisms to establish themselves (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(ii)	An explanation that makes reference to the following: • high light intensity promotes growth due to increased photosynthesis / high temperature promotes growth due to rapid rates of reaction (1) • however lack of { rainfall / water } limits { photosynthesis / transpiration } rate (1) • however { wind / high temperature } increases { transpiration rate / water loss } (1) • however wind results in soil erosion therefore poor soil quality (1)	Accept converse statements	**(4)**

(Total for Question 7 = 11 marks)

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>8(a)</td><td>
A genetic diagram that makes reference to the following:

• parent genotype HhPp x HhPp (1)

<table>
<tr><th>Gametes</th><th>HP</th><th>Hp</th><th>hP</th><th>hp</th></tr>
<tr><td>HP</td><td>HHPP
hairy
purple</td><td>HHPp
hairy
purple</td><td>HhPP
hairy
purple</td><td>HhPp
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purple</td></tr>
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purple</td><td>Hhpp
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green</td></tr>
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purple</td><td>hhPP
smooth
purple</td><td>hhPp
smooth
purple</td></tr>
<tr><td>hp</td><td>HhPp
hairy
purple</td><td>Hhpp
hairy
green</td><td>hhPp
smooth
purple</td><td>hhpp
smooth
green</td></tr>
</table>
• gametes formed all correct (1)
• genotypes all correct (1)
• phenotypes and ratios correct (1)
</td><td></td><td>(4)</td></tr>
</table>

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(i)	An answer that makes reference to the following: • calculation difference (1) • calculation of percentage (1)	Example of calculation difference = 14 - 5 = 9 kg (9 ÷ 5) x 100 = 180 % Correct answer with no working gains full marks	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(ii)	there is no difference between GM and non-GM potato yields	ALLOW no significant difference	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(iii)	An answer that makes reference to the following: • use Student's t-test to calculate the value of t (2) • correct answer (1)	Example of calculation $2.9^2 \div 6 = 1.4017$ and $2.1^2 \div 6 = 0.735$ $\sqrt{}$ (1.4017 + 0.735) = 1.462 (12.0 – 5.0) ÷ 1.462 = t = 4.788 = 4.79 Correct answer with no working gains full marks	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(iv)	An answer that makes reference to the following: • $p < 0.05$ (1) • difference is not due to chance (1) • so GM potatoes have significantly greater yield than non-GM (1)	Allow ECF for incorrect value of t Allow 0.005	**(3)**

(Total for Question 8 = 13 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
9(a)	An answer that makes reference to the following: • calculation of frequency of homozygous recessives *f*(tt) (1) • calculation of q (1) • calculation of p (1) • calculation of *f*(TT) and *f*(Tt) (1)	<u>Example of calculation</u> Allow ECF for incorrect values 100-64% = 36% = **0.36** q = $\sqrt{0.36}$ = **0.6** p = 1 − 0.6 = **0.4** p^2 = 0.4^2 = **0.16** 2pq = 2 x 0.4 x 0.6 = **0.48**	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)(i)	A description that makes reference to any two of the following: • population is large (1) • mating is random (1) • mutation is rare (1) • migration does not alter allele frequency / does not happen / the population is isolated (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)(ii)	An answer that makes reference to the following: • founder effect (1) • population bottleneck (1) • genetic drift / result of chance (1)		**(3)**

(Total for Question 9 = 9 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
10(a)	An explanation that makes reference to the following: • to prevent growth of { bacteria / fungi } which would produce amylase (1) • to prevent { bacteria / fungi } from decomposing the seeds (1)		**(2)**

Question Number	Indicative content	
10(b)	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. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • seed half with embryo does have amylase activity • seed half without embryo has no amylase activity • seed half without embryo and with the gibberellin does have amylase activity • this suggests gibberellin is needed for amylase { synthesis / activity } • selectively permeable membrane shows that the active agent / gibberellins is a small molecule • amylase is not diffusing through the membrane	
Level	**Mark**	**Descriptor**
	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented. Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure.
3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.

(Total for Question 10 = 8 marks)