

Question	Marking guidelines	Mark	Comments
1(a)	All the fish/all the species/all the populations/all the organisms;	1	Must indicate all/every species. Reject answers that suggest other fish/organisms might be present.
1(b)(i)	<ol style="list-style-type: none"> <li>Capture sample, mark and release;</li> <li>Appropriate method of marking suggested / method of marking does not harm fish;</li> <li>Take second sample and count marked organisms;</li> <li> <math display="block">\text{Population} = \frac{\text{No in sample}_1 \times \text{No in sample}_2}{\text{Number marked in sample}_2};</math> </li> </ol>	3 max	<ol style="list-style-type: none"> <li>E.g. Cutting a fin/attaching a tag/paint/marker.</li> <li>May be awarded from equation if not given here.</li> <li>Accept any valid alternative to equation or answer expressed as a ratio.</li> </ol>
1(b)(ii)	One suitable reason; E.g. population increases/changes (between first and second sample)	1	Accept other valid answers, which must, however, relate to breeding/only works if population constant.
1(c)	<ol style="list-style-type: none"> <li>With different mouth eats different food / has different way of feeding / specific mouth shape for specific food;</li> <li>Competition between species/interspecific competition is reduced;</li> </ol>	2	<ol style="list-style-type: none"> <li>Catches more food and gas exchange are neutral</li> <li>Reject intraspecific</li> </ol>

**Question 2: N/A**

Question	Marking guidelines	Mark	Comments
3(a)	1. Transect/lay line/tape measure (from one side of the dune to the other); 2. Place quadrats at regular intervals along the line; 3. Count plants/percentage cover/abundance scale (in quadrats) <b>OR</b> Count plants and record where they touch line/transect;	3 max	1&2. Reject random in context of placing transect/quadrats 2. Accept references to stratified sampling/different seral stages 3. Accept abundance scale
3(b)	1. Stabilises sand / stops sand shifting; 2. Forms/improves soil / makes conditions less hostile;	2	2. Allow credit for example of making conditions less hostile such as: Adds nutrients Improves water retention

Question	Marking guidelines	Mark	Comments
4(a)(i)	Non-living/physical/chemical factor/non biological;	1	Do not accept named factor unless general answer given.
4(a)(ii)	Accept an abiotic factor that may limit photosynthesis/growth; E.g. Water Named soil factor Light Carbon dioxide Incline/aspect Wind/wind speed	1	Reject altitude/height  Not "soil" / "weather"  Accept Oxygen
4(b)	<ol style="list-style-type: none"> <li>Correct explanation for differences between day and night e.g. photosynthesis only during the daytime / no photosynthesis/only respiration at night;</li> <li>Net carbon dioxide uptake during the day/in light <b>OR</b> No carbon dioxide taken up at night/in dark / carbon dioxide released at night/in dark;</li> <li>At ground level <u>more</u> respiration / in leaves <u>more</u> photosynthesis;</li> <li>Carbon dioxide produced at ground level/carbon dioxide taken up in leaves;</li> </ol>	4	Principles <b>Comparing day and night/light and dark</b> <ol style="list-style-type: none"> <li>Explanation in terms of photosynthesis/respiration</li> <li>Effect on carbon dioxide production/uptake</li> </ol> <b>Comparing leaves with ground level</b> <ol style="list-style-type: none"> <li>Explanation in terms of photosynthesis/respiration</li> <li>Effect on carbon dioxide production/uptake</li> </ol> 2 and 4 must relate to why the change occurs
4(c)	<ol style="list-style-type: none"> <li>Variation in original colonisers / mutations took place;</li> <li>Some better (adapted for) survival (in mountains);</li> <li>Greater reproductive success;</li> <li><u>Allele</u> frequencies change;</li> </ol>	3 max	<ol style="list-style-type: none"> <li>Allow "advantage so able to survive"</li> <li>Reject gene/genotype</li> </ol>

Question	Marking guidelines	Mark	Comments
5(a)(i)	1. Animal 2 / 5 has hair but offspring do not; 2. So 2 / 5 parents must be heterozygous/carriers; <b>OR</b> 3. 4/7/8 are hairless but parents have hair; 4. So 2 / 5 must be heterozygous/carriers;	2	Accept parents as alternative to animals 2 and 5 1 + 3: Allow reference to children/offspring for animals 7 + 8 Ignore reference to individuals 1 and 6
5(a)(ii)	Hairless males have fathers with hair / 4 is hairless but 1 is hairy / 7 and/or 8 are hairless but 6 is hairy / only males are hairless;	1	Ignore references to other individuals Ignore reference to genotypes Allow credit for candidate who states that evidence is not conclusive/pedigree possible with autosomal character;
5(b)	1. Parental genotypes $X^H X^h$ and $X^H Y$ Gametes $X^H X^h X^H Y$ ; 2. Genotypes of offspring $X^H X^H, X^H Y, X^H X^h, X^h Y$ ; 3. Phenotypes of offspring female with hair male with hair male hairless; 4. 0.25 / $\frac{1}{4}$ / 1 in 4 / 25%;	4	Accept any letter for gene but capital letter must represent dominant allele. 1. Both parental genotypes and gametes must be correct 2. Allow for offspring genotypes correctly derived from <u>gametes</u> given by candidate; 3. Allow phenotypes correctly derived from offspring genotype Allow $H \equiv X^H, h \equiv X^h$ 4. Ignore 1:3 in context of correct probability Reject 1:4

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Question	Marking Guidelines	Marks	Notes
6(a)(i)	Two marks for correct answer of 4;; One mark for calculation involving $0.2 \times 0.2$ or 0.04;	2	
6(a)(ii)	0.2/ the frequency remains the same ;	1	Reject if wrong frequency is quoted
6(b)(i)	1. There is a <u>probability</u> of 5%/0.05; 2. That difference in frequencies / difference in results are due to <u>chance</u> ;	2	Accept 95% probability changes in frequencies not different as a result of chance
6(b)(ii)	1. Directional; 2. The recessive allele confers disadvantage/ the dominant allele confers advantage/more likely to survive / reproduce;	2	Assume "it" to refer to the recessive allele 2. References to selection do not gain credit as the term is in the question. Allow reference to phenotype / enzyme functionality (instead of allele) when describing advantage/disadvantage.

Question	Marking Guidelines	Marks	Notes
7(a)	<ol style="list-style-type: none"> <li>Breeding less successful;</li> <li>Feathers in poor condition;</li> <li>Less energy for breeding/reproduction/ stated aspect of reproduction;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>Reject cannot breed.</li> <li>Ignore "wings damaged"</li> </ol>
7(b)(i)	<ol style="list-style-type: none"> <li>Avoids bias;</li> <li>Data representative/choice of nest not influencing results;</li> <li>Allows use of statistical tests/named statistical test;</li> </ol>	2 max	
7(b)(ii)	<p>Accept general statements or statements based on data that make the required points.</p> <ol style="list-style-type: none"> <li>Correct statement about range of 0 – 15;</li> <li>Correct statement about 0;</li> <li>Correct statement about 170;</li> <li>Correct statement about gap between 15 and 170;</li> </ol>	3 max	<ol style="list-style-type: none"> <li>e.g. No pattern/no correlation between 0 and 15</li> <li>e.g. Birds with no feather mites did not have (the) high(est) breeding success / 86%</li> <li>e.g. Highest number of feather mites linked to lowest breeding success</li> <li>e.g. No data between 15 and 170</li> </ol>
7(c)(i)	There is no correlation between the number of feather mites and breeding success /the number of feather mites does not affect breeding success;	1	<p>These specific variables must be stated.</p> <p>Reject difference between feather mite and breeding success.</p>
7(c)(ii)	Breeding success decreases as feather mites increases/ negative correlation between feather mites and breeding success ;	1	Accept reproductive or breeding success

7(d)(i)	<ol style="list-style-type: none"> <li>1. The larger the size of the oil gland the larger the number of feather mites;</li> <li>2. Positive correlation;</li> <li>3. (Wide) scatter of points / points not on line;</li> </ol>	2max	<ol style="list-style-type: none"> <li>3. Accept any answer that conveys the idea of a wide spread. Ignore any reference to anomalies</li> </ol>
7(d)(ii)	<p>No mark for effect on reliability, marks are for explanation.</p> <ol style="list-style-type: none"> <li>1. Oil gland size/number of mites could vary;</li> <li>2. At different times of the day/due to preening;</li> </ol>	2	<p>Ignore responses that state oil gland affects numbers of mites</p> <p>Allow preening affects mite numbers/size of oil gland;</p>
7(e)	<ol style="list-style-type: none"> <li>1. Improve health of birds/reduces disease/reduces harm;</li> <li>2. Healthier birds may find more food for young/do not pass on disease/ have greater specified aspect of breeding success;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>1. Ignore death of birds</li> <li>2. specified aspect can include longer breeding life</li> </ol>



Question	Marking Guidelines	Marks	Notes
8(a)	<ol style="list-style-type: none"> <li>1. Saprobionts/saprophytes;</li> <li>2. Digest/break down proteins/DNA/nitrogen-containing substances;</li> <li>3. Extracellular digestion/release of enzymes;</li> <li>4. Ammonia/ammonium produced;</li> <li>5. Ammonia converted to nitrite to nitrate/ammonia to nitrate;</li> <li>6. Nitrifying (bacteria)/ nitrification;</li> <li>7. Oxidation;</li> </ol>	5 max	<p>Ignore all references to other parts of the nitrogen cycle</p> <ol style="list-style-type: none"> <li>1. Accept saprotrophs. Allow this mark if saprobionts linked to fungi.</li> <li>2. Ignore "nitrogen in plants" Ignore enzymes excreted</li> <li>6. Accept <i>Nitrosomonas/Nitrobacter</i></li> </ol>
8(b)	<ol style="list-style-type: none"> <li>1. Carbon dioxide concentration increases;</li> </ol> <p><b>Clearing</b></p> <ol style="list-style-type: none"> <li>2. No/Less vegetation so no/less photosynthesis / photosynthetic organisms;</li> <li>3. No/Less carbon dioxide removed (from the atmosphere);</li> </ol> <p><b>Burning</b></p> <ol style="list-style-type: none"> <li>4. Burning/combustion releases / produces carbon dioxide;</li> </ol>	4	<p>Ignore correct references to respiration or animals</p> <p>For mark points 2 and 3 idea of 'no/less' must be stated not just implied.</p> <ol style="list-style-type: none"> <li>3. Must not include 'by respiration'</li> <li>4. Do not credit references to burning fossil fuels. Only give credit for combustion increases carbon dioxide if mark point 1 has not been given.</li> </ol>

8(c)	<ol style="list-style-type: none"><li>1. Carbon dioxide combines with ribulose biphosphate/RuBP;</li><li>2. Produces two molecules of glycerate (3-)phosphate/GP;</li><li>3. Reduced to triose phosphate/TP;</li><li>4. Using reduced NADP;</li><li>5. Using energy from ATP;</li><li>6. Triose phosphate converted to other organic substances/ named organic substances/ribulose biphosphate;</li><li>7. In light independent reaction/Calvin cycle;</li></ol>	6 max	<ol style="list-style-type: none"><li>3. Accept add hydrogen for reduced</li><li>4. Accept alternatives such as NADPH for reduced NADP/GALP for TP/ribulose biphosphate</li></ol>
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Question	Marking Guidelines	Marks	Notes																				
9(a)(i)	1. Parents are heterozygous; 2. Kittens receive white allele from parents /black cat;	1 max	1. Accept carriers/carries white allele																				
9(a)(ii)	1 :1;	1	Answer must be expressed as a ratio that could be reduced to 1 : 1																				
9(b)(i)	Black, Chocolate, Black;	1	All three correct for the mark																				
9(b)(ii)	<table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 25%;">Parental phenotypes</td> <td style="width: 25%;">Chocolate male</td> <td style="width: 35%;">Black female</td> </tr> <tr> <td>1. Parental genotypes</td> <td><math>bb^i</math></td> <td></td> <td><math>Bb^i</math>;</td> </tr> <tr> <td>2. Parental gametes</td> <td><math>b</math> <math>b^i</math></td> <td></td> <td><math>B</math> <math>b^i</math>;</td> </tr> <tr> <td>3. Offspring genotypes</td> <td><math>Bb, Bb^i</math></td> <td><math>bb^i</math></td> <td><math>b^i b^i</math>;</td> </tr> <tr> <td>Offspring phenotypes</td> <td>Black</td> <td>Chocolate</td> <td>cinnamon</td> </tr> </table>		Parental phenotypes	Chocolate male	Black female	1. Parental genotypes	$bb^i$		$Bb^i$ ;	2. Parental gametes	$b$ $b^i$		$B$ $b^i$ ;	3. Offspring genotypes	$Bb, Bb^i$	$bb^i$	$b^i b^i$ ;	Offspring phenotypes	Black	Chocolate	cinnamon	<p>1</p> <p>1</p> <p>1</p>	<p>1. Both genotypes needed for the mark.</p> <p>2. Allow credit if gametes are correctly derived from candidate's incorrect parental genotypes.</p> <p>3. Genotype(s) must be with correct phenotype Allow credit if symbols other than B/b/b<sup>i</sup> have been used correctly.</p> <p>Ignore genetic diagrams unless clearly annotated</p>
	Parental phenotypes	Chocolate male	Black female																				
1. Parental genotypes	$bb^i$		$Bb^i$ ;																				
2. Parental gametes	$b$ $b^i$		$B$ $b^i$ ;																				
3. Offspring genotypes	$Bb, Bb^i$	$bb^i$	$b^i b^i$ ;																				
Offspring phenotypes	Black	Chocolate	cinnamon																				

9(b)(iii)	<ol style="list-style-type: none"><li>1. Offspring ratios are a probability/not fixed/arise by chance/</li><li>2. gametes may not be produced in equal numbers/</li><li>3. fertilisation/fusion of gametes is random/</li><li>4. small sample;</li></ol>	1	
9(b)(iv)	<ol style="list-style-type: none"><li>1. Possible if parents homozygous/ bb;</li><li>2. Don't know genotype of chocolate cat / chocolate cat could be homo- or heterozygous / chocolate cat could be bb or bb<sup>i</sup> ;</li><li>3. Two chocolate cats could give cinnamon kittens;</li></ol>	2 max	

**Additional notes on marking Question 10**

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay are those corresponding to the appropriate descriptors. Candidates may gain credit for any information providing that it is biologically accurate, relevant and of a depth in keeping with an A-level course of study. Material used in the essay does not have to be taken from the specification, although it is likely that it will be. In fact, extra credit is given for those who show evidence of a greater breadth of study.

These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally come from each of the areas specified if maximum credit is to be awarded. Where the content is drawn from two areas, two marks should be awarded and where it is taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

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**Essay A      Using DNA in science and technology**

Section

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**DNA and classification**

- 2.2      Structure of DNA
  - 2.3      Differences in DNA lead to genetic diversity
  - 2.9      Comparison of DNA base sequences  
          DNA hybridisation
- 

**Genetic engineering and making useful substances**

- 1.3      Plasmids
  - 5.8      The use of recombinant DNA to produce transformed organisms that benefit humans
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**Other uses of DNA**

- 2.5      Cell cycle and treatment of cancer
  - 5.8      Gene therapy;  
          Medical diagnosis and the treatment of human disease;  
          The use of DNA probes to screen patients for clinically important genes;
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**Essay B**     **A cycle is a biological pathway or process in which the end product of one cycle becomes the starting point for the next. Write an essay about cycles in biology.**

Section

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**Ecological cycles**

- 4.6     Nutrient cycles  
          Carbon cycle  
          Nitrogen cycle
- 

**Biochemical cycles**

- 1.2     Enzyme action  
 4.2     Synthesis of ATP from ADP  
 4.3     Light-independent reaction  
 4.4     The Krebs cycle
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**Physiological and genetic cycles**

- 1.4     The mechanism of breathing  
 1.5     The cardiac cycle  
 2.5     The cell cycle  
 5.3     Muscle contraction  
 5.5     Oestrous cycle
-