

Biodiversity and Natural Resources -2

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also

Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A

level Biology Students of other Boards

Topic: Biodiversity and Natural Resources -2

Type: Mark Scheme

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful



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Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to <ul style="list-style-type: none">• (counting) the number of different species (1)• (counting) number of individual per species (1)	ALLOW measure species richness ALLOW determined population sizes	(2)



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Question Number	Answer	Additional guidance	Mark
(ii)	<p>An answer that makes reference to</p> <ul style="list-style-type: none">• appropriate calculation e.g. percentage of world {plants / vertebrates / total} found in Madagascar <p>or</p> <p>percentage of {plants / vertebrate } in Madagascar that are endemic to Madagascar e.g.</p> <p>or</p> <p>percentage of world {plant / vertebrates / total} endemic to Madagascar</p> <p>or</p> <p>density of {plant / vertebrates / total} on {Madagascar / Earth}</p> <ul style="list-style-type: none">• species density of {animals / plants} in Madagascar is higher than for the Earth• many of the species found in Madagascar are not found anywhere else	<p>4% of plants, 3.6% of vertebrates or 4% of the combined total</p> <p>80.9% plants 78.1% of vertebrates endemic</p> <p>3.2% of plants, 2.8% of vertebrates or 3.2% of the combined total</p> <p>ALLOW a large number of species relative to the area</p>	(3)



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Q2.

Question Number	Answer	Mark
(a)	A bacteria and fungi	(1)

Question Number	Answer	Mark
(b)(i)	A none	(1)

Question Number	Answer	Mark
(b)(ii)	D validity	(1)

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	<ol style="list-style-type: none">1.2. ref to hydrolysis ;3. by {enzymes / cellulase} / eq ;4. produced by microorganisms / eq ;5. into(β) glucose ;6. uptake of glucose into microorganisms / eq ;7. idea that glucose is used in {respiration / fermentation} ;8. releasing carbon dioxide into the atmosphere / eq ;9. idea that some of glucose (solution) soaks into ground ;		(4)



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Question Number	Answer	Additional Guidance	Mark
(b)(iv)	<ol style="list-style-type: none">1. to make investigation valid ;2. idea that {temperature / heat energy} affects {rate of enzyme reactions / enzyme activity / rate of decomposition} ;3. increase in {heat / kinetic} energy results in more {collisions / energetic collision / enzyme-substrate complexes / eq} ;4. idea that high temperature results in enzyme {denaturing / becoming denatured} ;5. (so) decomposition would stop / eq ;	4. ACCEPT bacteria killed / eq	(4)

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Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An answer that makes reference to two of the following:</p> <ul style="list-style-type: none">• increase in cross sectional area with testosterone (and not with placebo)• greatest increase with testosterone and exercise• significant difference for {testosterone plus exercise / group D } as the SDs (for start and after 10 weeks) do not overlap	ALLOW increase in size (of triceps muscle)	(2)



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Question Number	Answer	Mark
(ii)	<p>D - show that testosterone has an effect</p> <p><i>The only correct answer is D</i></p> <p>A is incorrect because a placebo does not make measurements more accurate</p> <p>B is incorrect because placebos do not make data more reproducible</p> <p>C is incorrect because the placebo does not show that exercise has an effect</p>	(1)

Q4.

Question number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">(species) found only in one particular location (1)		<p>Choose an item.</p> <p>(1)</p>

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Q5.

Question Number	Answer	Additional guidance	Mark
(i)	<ul style="list-style-type: none">• correct calculation of loss of area from 2010 to 2012 (1)• correct calculation of rate with relevant units (1)	<p><u>Example of calculation</u></p> $1160 - 700 = 460$ $(460 \div 2) \times 1000$ $= 230\,000 \text{ Ha yr}^{-1}$ <p>ALLOW Ha per year</p> <p>Correct answer without working gains full marks ALLOW ECF(1) eg $1160 - 680 = 240\,000 \text{ Ha yr}^{-1}$ (1) $1160 - 690 = 235\,000 \text{ Ha yr}^{-1}$ (1) $1160 - 710 = 225\,000 \text{ Ha yr}^{-1}$ (1) $1160 - 720 = 240\,000 \text{ Ha yr}^{-1}$ (1) 220 000 to 240 000 Ha yr⁻¹ with no working gains 1 mark</p>	(2)

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Question number	Answer	Mark
*(ii)	<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>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.</p> <p>Indicative content</p> <p>Basic information</p> <ul style="list-style-type: none">• captive breeding will increase population size• deforestation is reducing the habitat• captive animals will be protected from hunters <p>Evidence of linkages</p> <ul style="list-style-type: none">• orangutan numbers are declining and captive breeding will increase population size• as loss of habitat is a major reason for the decline, animals should be released into areas of forest in protected areas• more of the forest needs to be protected to reduce the rate at which habitat is being lost• captive bred animals show behaviour that may make them unable to compete in the wild• loss of habitat would lead to increased competition due to reduced food availability <p>Evidence of sustained scientific reasoning</p> <ul style="list-style-type: none">• it is important to restrict passage of disease from humans to the wild population by minimising contact and releasing animals away from wild populations• if deforestation is not reduced – or protected areas increased – there will not be enough habitat left in which to release captive-bred orangutans• judgement on relative importance of captive breeding and habitat protection taking into account rate of deforestation and loss of suitable habitat• releasing animals if there is insufficient habitat could lead to an increased vulnerability to predation and poaching	(6)



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Level 0	Marks	No awardable content	
Level 1	1-2	<p>Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified.</p> <p>A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.</p>	<p>Captive breeding will increase numbers of orangutans</p> <p>Habitat loss is increasing</p>
Level 2	3-4	<p>A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified.</p> <p>A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.</p>	<p>Discussion of benefits of both captive breeding and habitat protection.</p> <p>Separate discussions of habitat loss and captive breeding.</p> <p>Linkages made for each aspect but not compared.</p>
Level 3	5-6	<p>A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information.</p> <p>A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.</p>	<p>Conclusion that without habitat protection, captive breeding is limited as there is less suitable habitat in which to release the animals</p> <p>Comparative evaluation of the benefits of habitat protection and captive breeding.</p> <p>Reference made to the data.</p>



Q6.

Question Number	Answer	Additional Guidance	Mark
	<p>A description that makes reference to the following:</p> <ul style="list-style-type: none">• two GALP used to produce a glucose molecule• (glucose molecules are) joined together by glycosidic bonds to form starch• by condensation reactions• producing amylose and amylopectin	<p>ALLOW triose phosphate instead of GALP</p> <p>ALLOW maltose / polysaccharide</p>	<p>(4)</p>

Q7.

Question Number	Answer	Additional guidance	Mark
	<p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none">• cut a {strip / ring} of aorta (1)• record thickness of the piece of aorta (1)• hang masses on the (strip / ring) until aorta splits (1)• tensile strength determined by dividing force by cross sectional area (1)	<p>ALLOW 'take a section of aorta'</p> <p>ALLOW repeats with same dimensions, e.g. length and { width / thickness}</p> <p>ALLOW 'breaks' or 'snaps' for 'splits'</p> <p>ALLOW 'weights' for 'masses'</p>	<p>(3)</p>



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Q8.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none">• description of production of agar plates with bacteria (1)• description of method used to add plant extract to plates (1)• extracts used separately and in combination (1)• incubate for at 37°C for an appropriate period of time (1)• measure and compare the sizes of zones of inhibition (1)	<p>ALLOW plates { inoculated / seeded} with bacteria, production of bacterial lawn or streak plates</p> <p>e.g. on filter paper discs or in wells</p> <p>ALLOW time from 24 to 72h and a temperature from 35-38°C</p> <p>e.g. diameter or area</p> <p>ALLOW comparative statements such as the larger the area, the more effective the antimicrobial properties</p>	<p>(4)</p>



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Q9.

Question number	Answer	Additional guidance	Mark
(i)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• the frequency of the different shell patterns in different habitats is an example of adaptation (1)• provides camouflage (appropriate to the habitat) (1)• reducing predation (in different habitats) / providing protection from predators (1)• therefore increasing the chance of (surviving to) reproduce (1)	<p>ALLOW other reasonable suggestions e.g. temperature regulation</p> <p>IGNORE increasing survival rate</p>	(3)

Question number	Answer	Additional guidance	Mark
(ii)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">• use a statistical test such as the (Student) t-test (1)• if the test value is greater than the {critical / table} value at $p=0.05$ the difference is significant (1)	<p>ALLOW using a critical value of $p = 0.05$ and a suitable number of degrees of freedom</p>	(2)



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Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	A answer that makes reference to the following: <ul style="list-style-type: none">the area inhabited by a particular { species / organism } (1)		(1)

Question Number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to the following: <ul style="list-style-type: none">biodiversity {measured / compared} using a diversity index (1)species richness (assessed) (1)genetic diversity of {populations / species} (1)presence of any {endemic / rare} species (1)	ALLOW count the number of different species in an area ALLOW endangered species / species at risk of extinction	(4)

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Q11.

Question Number	Answer	Additional Guidance	Mark
	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none">• pieces of rope of same length and {width / diameter } (1)• (stored at) a range of temperatures above and below 18°C (1)• humidity at 60% / ropes stored for same period of time (1)• {masses / force / weights} applied until rope breaks (1)• calculate change in tensile strength (1)		(4)

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Q12.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to the following</p> <ul style="list-style-type: none">• North American population is more genetically diverse (therefore more likely to adapt) (1)• (more different alleles) therefore more likely to have an allele that gives advantage (1)• the individuals with an advantageous allele are more likely to survive and breed (1)• the frequency of that allele will increase (1)		Expert (4)



Q13.

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Question Number	Answer	Additional guidance	Mark
	<ul style="list-style-type: none">• found only in one geographical location(1)	ALLOW one area of the world	(1)



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Q14.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	<p>A description that makes reference to the following:</p> <ul style="list-style-type: none">• utilitarian argument, better to test on animals than on humans (1)• the benefits to humans must outweigh harm done to other animals (1)		(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none">• to determine safe dose (1)• to determine side effects (1)• to determine how the drug is metabolised (1)		(2)



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Q15.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none">percentage germination decreases as length of time stored increases (for both varieties) (1)correct calculation of decrease for both varieties (1){ little change / 1 or 2 % } in percentage germination when stored for up to 48 hours for both varieties (1)greatest decrease in percentage germination occurred { later for P than Q / from 72 hours for P and from 48 hours for Q } (1)	<p>ALLOW correct reference to negative correlation</p> <p>e.g. (from 0 to 120 hours) 40% decrease for P and a 36% decrease for Q</p>	(3)



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Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none">• allowed a comparison between { the two varieties / stored seeds and seeds that had not been stored }(1)• to see the effect of seeds being stored at { 80% humidity / 42°C } (1)• data showed that the percentage germination success was { high / not 100% } in the control seeds (1)	<p>ALLOW wheat seeds were viable or suitable for this investigation</p>	(2)

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Q16.

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



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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.



Q17.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to five of the following:</p> <ul style="list-style-type: none">• as a result of a mutation (1)• (cyanobacteria) produce proteins containing the amino acid cysteine (1)• (cysteine rich proteins) produce {heat stable enzymes / proteins resistant to unfolding} (1)• other adaptations such as {enzymes with large hydrophobic cores / simpler protein folds / amino acids that do not bond to metal ions } (1)• high temperatures act as a selection pressure (1)• allowing them to {survive / replicate} and pass advantageous allele to next generation (1)	<p>ALLOW 'pass alleles for heat tolerance to next generation'</p>	<p>(5)</p>



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Q18.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• <i>Aedes aegypti</i> mosquito occupies its own niche (1)• if this species is eliminated the niche it occupied will become vacant (1)• other species (of mosquito) may evolve to occupy the niche (1)• these species may carry the virus (1)	<p>ALLOW each species</p> <p>ALLOW other organisms / insects</p> <p>ALLOW <i>Aedes aegypti</i> is a vector / is not the disease causing organism</p>	<p>Choose an item.</p> <p>(3)</p>

Q19.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to</p> <ul style="list-style-type: none">• determine the sequence of amino acids (for trypsin)• determine the number of {differences / similarities} in sequences (of amino acids) between species• the greater the number of differences the less closely related the species are	<p>ALLOW differences and similarities in primary structure</p> <p>ALLOW more similarities more closely related</p> <p>ALLOW greater difference in sequence longer the time from a common ancestor</p>	<p>(3)</p>



Q20.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none">• mutation leads to { variation within the population of grass snakes / (snakes with) different colour or markings } (1)• (natural selection led to) those snakes which were better camouflaged surviving to reproduce (1)• (therefore) giving rise to two populations with differing allele frequency (1)• (as the result of natural selection) the two populations became reproductively isolated (1)• sympatric speciation (in the context of new species developing in the same habitat) (1)	<p>ALLOW separate gene pools develop or a change in allele frequency</p> <p>ALLOW can no longer breed with each other</p>	<p>(4)</p>

Q21.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none">• {control / placebo} (1)• to allow a comparison with {A and B / the other groups} (1)		<p>(2)</p>



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Q22.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• { warm conditions / water / glucose / amino acids / ideal pH } available <p>Plus 2 of the following:</p> <ul style="list-style-type: none">• suitable { temperature / pH } for bacterial enzymes (1)• glucose used for { respiration / energy }• amino acids used for growth	<p>ALLOW 37°C</p> <p>ALLOW optimum</p>	<p>(3)</p>

Q23.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none">• drugs not delivered to { other / healthy } tissues (1)• overall dosage needed is less (1)	<p>ALLOW drug does not { affect / reach } other tissues, drug not delivered to the whole body ALLOW converse</p> <p>ALLOW { higher concentration / more of the drug } delivered to area where needed</p>	<p>(2)</p>



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Q24.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to two of the following points:</p> <ul style="list-style-type: none">• there is an odd number of chromosomes (1)• therefore it does not have homologous pairs of chromosomes (1)• therefore meiosis cannot take place / meiosis requires chromosome pairs (1)	<p>ALLOW uneven number</p> <p>ALLOW non-homologous chromosomes</p>	(2)

Q25.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• presence of different stimuli (1)• (therefore resulting in) different genes being { activated / deactivated / transcribed / expressed } (1)• so different proteins are made (1)• proteins produced determine { structure / function } of cells (1)	<p>e.g. transcription factors, chemical stimulus</p> <p>ALLOW different genes are switched {on / off}</p> <p>ALLOW 'tissues' for 'cells'</p>	(3)



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Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• xylem identified as { hollow / thick-walled / lacking cytoplasm } / stain used to identify { xylem tissue / lignin } (1)• sizes of cells measured using { eye piece graticule / stage micrometer } (1)• {length / width} of cells from both areas measured / several measurements made and then the means compared (1)• correct calculation by dividing image size by magnification (1)	<p>e.g. stained with toluidine blue, safranin or phloroglucinol</p>	(3)

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Q26.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	A		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following: <ul style="list-style-type: none">• mosquitoes are geographically isolated in the tunnels (1)• random genetic mutations cause variation in the population which allows some individuals to feed on rats, mice and humans (1)• these individuals {will be selected for / are more likely to survive and reproduce} (1)• the proportion of individuals in the population with this mutation will change over time (1)• over many generations these populations become genetically distinct from the above ground population (1)		(5)

Q27.

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Question Number	Answer	Additional Guidance	Mark
(i)	<ul style="list-style-type: none">• amylopectin contains alpha glucose and cellulose contains beta glucose (1)	ALLOW { α / a } glucose and { β / b } glucose OR H and OH have been reversed on carbon 1	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	<ul style="list-style-type: none">• hydrogen / H (bond)		(1)



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Q28.

Question Number	Answer	Mark
(i)	<p>The only correct answer is D <i>there is no significant difference in allele richness between the two populations.</i></p> <p>A is not correct because it should not state that allele richness in Finland is higher B is not correct because it should not state that allele richness in the USA is higher C is not correct because the null hypothesis does not concern genetic diversity</p>	Computer (1)

Question Number	Answer	Additional guidance	Mark
(ii)	<ul style="list-style-type: none"> correct completion of table (1) correct substitution into the equation (1) correct calculation of chi- squared value (1) 	<p>5 / 25 / 2.78 1 / 1 / 0.25</p> <p>16.50 / 16.5</p> <p>Correct answer with no working gains full marks ALLOW ecf for 2 marks</p> <p>16.49 if 2.77, if 2.8 16.52, 16.42 if 2.7 in the table</p>	Expert (3)



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Question Number	Answer	Additional guidance	Mark
(iii)	<p>An answer that makes reference to three of the following</p> <ul style="list-style-type: none">• {little / no} effect of small founder population on allele richness (1)• degrees of freedom value is 9 / critical value is 16.919 (1)• therefore stated chi-squared value is below the critical value (16.919) (1)• therefore { there is no significant difference in allele richness between the two populations/ null hypothesis can be accepted} at 0.05 probability (1)	<p>ALLOW converse answer for a stated chi-squared value above the cv if incorrectly calculated</p> <p>ALLOW there is a significant difference at 0.10 probability</p>	Expert (3)

Q29.

EXAM PAPERS PRACTICE

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to the following</p> <ul style="list-style-type: none">• Hardy-Weinberg equation stated (1)• correct calculation of frequency of homozygous recessive individuals (1)• correct calculation of frequency of dominant and recessive alleles (1)	<p>Example of calculation</p> $p^2 + 2pq + q^2 = 1.0$ $q^2 = 102 \div 200 = 0.51$ <p>Dominant allele = 0.29 Recessive allele = 0.71</p> <p>Correct answer with no workings gains full marks</p>	(3)



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Q30.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none">• mate {males and females / individuals} from different populations (1)• if they do not produce fertile offspring the parents are different species (1)	<p>ALLOW converse argument</p> <p>ALLOW they cannot breed together to produce fertile offspring gets both marks</p>	<p>Choose an item.</p> <p>(2)</p>



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