PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 3: CLASSIFICATION AND BIODIVERSITY

NATURAL SELECTION

SCORE	PERCENTAGE
/157	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	1. idea that bacteria are resistant to fewer {antibiotics / antibiotic combinations} (in 2006 than 2007) ; 2. in both years there are resistant strains to {streptomycin / INH + rifampicin + ethambutol / INH } ; 3. idea that there are resistant strains to INH + rifampicin in 2006 but not in 2007 ; 4. idea that there are resistant strains to {ethambutol / rifampicin} in 2007 but not in 2006 ;	**ACCEPT** clear abbreviations to the names of the antibiotics throughout **1 ACCEPT** a description e.g. new resistances, resistant to 4 in 2006 and 5 in 2007 **3 ACCEPT** idea that {resistance decreased to zero / no longer resistant} **4 ACCEPT** idea of resistance developing **NB** development of new resistances to {ethambutol / rifampicin} = Mp 1 and 4	**(3)**

Question Number	Answer	Additional Guidance	Mark
(ii)	1. bacteria have a mutation in {DNA / gene / eq } ; 2. idea that the {presence / usage of} {antibiotic (INH) / INH} acts as a selection pressure ; 3. idea that the allele (for resistance) is passed on ; 4. idea that bacteria {divide by asexual reproduction / divide by binary fission / produce clones / eq} ; 5. idea of increasing the allele frequency ;	**3 NOT** gene **4 ACCEPT** divide by mitosis / conjugation / transduction / transformation / eq	

Question Number	Answer	Additional Guidance	Mark
	6. idea that the more resistant bacteria there are, the more likely new strains will acquire the (resistance) gene ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
(iii)	1. reference to codes of {practice / conduct / eq } ; 2. idea that appropriate {antibiotics / named example} should be given to patients ; 3. idea of {educating patients about taking antibiotics / taking the full course of antibiotics ; 4. credit another appropriate procedure e.g. hand washing, screening ;	**1 ACCEPT** named policy /code **NB** Mp5 is for named practice **2 ACCEPT** not giving antibiotics if not necessary / not using antibiotics for prophylactic treatment / using narrow spectrum antibiotics / rotate antibiotic use	**(2)**

Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • HIV mutates (1) • resistance to one drug but not to {all / others} (1)		**(2)**

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to four of the following: • sample taken from the female genital tract (1) • bacteria grown on {selective / indicator} media (1) • bacteria grown on media containing different types of antibiotics (1) • use of {antibodies / DNA profiling} (1) • using {Gram staining / cell shape / colony shape / colony colour} (1)		(4)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • because they grow on the skin cells preventing pathogenic bacteria from doing so (1) • because they use the glycogen so less {glucose / energy / glycogen} available for the pathogenic bacteria (1) • because they produce lactic acid which inhibits the growth of pathogenic bacteria (1) • because the low pH denatures the enzymes of the pathogenic bacteria (1)	**ACCEPT** below optimum pH	(3)

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	• Y calculated (1) • body condition index calculated to 2 dps (1)	Example of calculation: $Y = 0.73 \times 86.4 - 34.5 = 28.572$ $26.4 \div 28.572 = 0.92$ ecf from calculation of Y	(2)

Question Number	Indicative content
*(ii)	Answers will be credited according to candidates' 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. <u>Indicative content</u> • decrease in body mass (D) • therefore decrease in condition index (D / E) • because less nutritious plant material available (E) • decrease in organic matter in stomach (D) • because less plant material available (E) • increase in mineral ion content (D) • because more foraging for roots (E) • and therefore soil is consumed (E) • less water in faeces (D) • as plant material does not contain as much water (E)

	• therefore wombat had to conserve water (E) • 2 months after drought measurements start returning back to normal (D) • as quality and quantity of plant material increases (E) **Level 1 :** 1 mark = 1 description (1 D) 2 marks = 2 descriptions (2 D) or 1 description and 1 explanation (D + E) **Level 2 :** 3 marks = 3 descriptions that include what happens after rain (3D + D) or 2 descriptions and 1 explanations (2D +1E) 4 marks = 2 descriptions and 2 explanations (2D +2E) **Level 3 :** 5 marks = 3 descriptions and 3 explanations (3D +3E) 6 marks = 4 descriptions and 4 explanations that include an explanation of why mineral content in stomach is higher (4D + 4E)

Level	Marks	
0	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.

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	• deduce expected values (1) • calculation of Chi squared (1)	Example of calculation C: $(42 - 20)^2 \div 20 = 24.2$ and M: $(6 - 10)^2 \div 10 = 1.6$ and S: $(12 - 30)^2 \div 30 = 10.8$ Chi squared value = 36.6 Correct answer gains full marks, with no working shown **ACCEPT** one mark in working for expected values of 20, 10 and 30 or 37.2	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following: • reject {null hypothesis / H_0} significant difference between observed and expected results (1) • because calculated value is greater than the critical value at {p = 0.05 / p = 0.01} / because calculated value is greater than 5.991 / 9.210 (1) • uses 2 degrees of freedom / 5.991 / 9.210 (1) • concludes mice show preference for corner squares (1)	**ACCEPT** converse for all Mps if answer in (i) produces a calculated value less than 5.991	**(4)**

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	• total blood volume in one seal (1)	Example of calculation: 400 x 207 = 82800 cm^3 **Accept** calculation of total haemoglobin per cm^3 kg^{-1} blood: 207 × 216 = 44712 **Accept** calculation of concentration of haemoglobin in one seal: 216 × 400 = 86400	
	• conversion of g dm^{-3} to g cm^{-3} (1)	216 ÷ 1000 = 0.216 g cm^{-3}	
	• total mass of haemoglobin (concentration of haemoglobin x volume of blood in a seal) (1)	0.216 x 82800 = 17885 g Correct answer with no working gains full marks **Accept** for two marks a correct answer with no units / wrong units **Accept** for three marks: 17884.8 g / 17880 g / 17890 g / 17900/ 18000 g / 17.8848 kg / 17.885 kg / 17.89 kg / 17.9 kg / 18 kg	**(3)**

Question Number	Indicative content
(ii) *	Answers will be credited according to candidates' 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. <u>A: Depth and diving</u>: • positive correlation between maximum depth and maximum time holding breath • weak positive correlation between mass of animal and depth • weak correlation between maximum time holding breath and mass of mammal • because diving deeper requires larger oxygen storage as can't breathe underwater • aerobic respiration requires oxygen to release energy <u>B: Blood and muscle:</u> • positive correlation between volume of oxygen in body and maximum depth • positive correlation between concentration of haemoglobin in blood and maximum depth • no correlation between oxygen stored in muscle and maximum depth • all the mammals must possess myoglobin acting as an oxygen store in muscle • bottlenose dolphin and harbour seal have more oxygen stored in lungs / Weddell seal and Northern elephant seal have less oxygen stored in lungs • oxygen stored in lungs results in more buoyancy so deeper diving mammals have less stored in lungs • combined effect of high blood volume and haemoglobin concentration results in very high blood oxygen storage • more oxygen stored in blood so higher haemoglobin concentration and blood volume in animals that dive deeper • all have similar proportions of oxygen stored in muscle <u>Quantitative analysis</u> • Q1: quoting of data to support explanation • Q2: manipulation of data to support explanation, for example, determining total haemoglobin concentrations in mammals.

Level	Marks	
0	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context. **Level 1: Description of some patterns from at least one of A or B**
2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. The discussion shows some linkages and lines of scientific reasoning with some structure. **Level 2: Description of patterns with explanation from at least one of A or B**
3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured. **Level 3: Detailed description and explanation of patterns from both A and B with quantitative analysis (Q)**

Q7.

Question Number	Correct Answer	Additional guidance	Mark
(a)	An explanation that makes reference to the following: • Tasmanian wolf and Dunnart more closely related (1) • because there are fewer base differences between Dunnart and the Tasmanian wolf than between the grey wolf and Tasmanian wolf (1)	For answers relating to grey wolf and Dunnart Base differences quantified {only 2 differences between Tasmanian wolf and Dunnart but 5 between grey wolf and Dunnart, and 7 between grey wolf and Tasmanian wolf}	**(2)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following: • placental mammal/grey wolf has more successful reproduction than marsupial mammal/ Tasmanian wolf (1) • because young are born more {developed/mature}marsupial offspring very small so less likely to survive (1) • therefore grey wolves outcompete Tasmanian wolves unless Tasmanian wolves are geographically isolated (1)		**(3)**

Q8.

Question Number	Indicative content
*	Answers will be credited according to candidate's deployment of knowledge and understanding of 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. • with increasing snow depth, there is higher survival of grey owls / fewer brown owls survive / more grey owls D • snow depth has decreased over time D • the percentage of brown owls has increased over time / percentage of grey owls has decreased D For • with less snow, more ground is visible / uncovered / more twigs and trees visible E • with less snow, grey owls more obvious (to predators / prey) / less camouflaged E • with less snow, natural selection would favour brown owls / more brown (advantageous) alleles passed on / fewer grey alleles passed on / brown owls outcompete grey owls E • enhanced greenhouse effect due to carbon dioxide emissions reflecting radiation back / absorbing radiation (causing melting) E Against • no direct measure of greenhouse gas / temperature / fossil fuel emissions A • graphs show correlations not causal links A • data for owl survival with snow depth is scattered / gaps in data / weak correlation A • data for mean snow depth has many outliers / anomalies / not all points are around line / data is scattered A • other factors (named factors) could be affecting the owl population A • reduced snow may not be due to greenhouse gas release A

	• data for owl survival with snow depth is scattered / gaps in data / weak correlation A • data for mean snow depth has many outliers / anomalies / not all points are around line / data is scattered A • other factors (named factors) could be affecting the owl population A • reduced snow may not be due to greenhouse gas release A

Level 0	Marks	No awardable content
Level 1	1-2 (1-3)	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made . **1 mark : any 1 from D, E, A** **2 marks : any 2 from D, E, A**
Level 2	3-4 (4-6)	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made. **D and, E OR A** **3 marks : at least 3 points. Any combination of D, plus E, or A** **4 marks : at least 4 points. Any combination of D, plus E, or A**
Level 3	5-6 (7-9)	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. **D, E, AND A** **5 marks : at least 5 points. Must have combination of D, E, and A** **6 marks : at least 6 points. Must have combination of D, E, and A**

Q9.

Question Number	Acceptable Answer	Additional Guidance	Mark
	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)**

Q10.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An answer that makes reference to the following: Evaluation • judgment clearly stated and supported by an argument (1) AND at least one from each argument for 4 marks		
	For • antibiotic H is the most effective therefore spraying might help to reduce food poisoning (1) • which could prevent wider spread of infection or contamination of other products (1) Against • bacteria may be inside the chicken so unaffected by spraying (1) • possibility of promoting antibiotic resistance / effects on gut flora of consumers (1) • experimental results may not be {valid due to molecular size and diffusion / reliable due to lack of replicates} (1) • experiment used harmless strain of *Campylobacter* so results may not apply to { pathogenic strain / other bacteria that also cause food poisoning } (1)		**(5)**

Q11.

Question Number	Acceptable Answer	Additional guidance	Mark
	An answer that makes reference to the following: • mutation rates in bacteria are very high because bacteria divide frequently (1) • resistant bacteria have a selective advantage (1) • rapid asexual reproduction causes large numbers of antibiotic-resistant bacteria (1) • therefore there is a need for new antibiotics that bacteria are not resistant to (1) • this is a slow process because research and testing takes time (1)		**(5)**

Q12.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • {random / chance} mutations (1) • produce {proteins / enzymes} that make the drug ineffective (1) • therefore resistant organisms pass on allele (1) • drug is the selection pressure (1)	**DO NOT ACCEPT** if mutation caused by drug **DO NOT ACCEPT** pass on mutation / gene	**(3)**

Q13.

Question Number	Correct Answer	Additional guidance	Mark
(a)	*Staphylococcus* spp.		**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following: • the number of living bacteria does not increase (1) • because cell division is prevented (1)	Accept more sophisticated answers that give details of how cell division is prevented	**(2)**

Question Number	Indicative content
***(c)**	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. Candidates are expected to reach a decision/conclusion on whether the development of bacterial resistance is so serious and rapid that antibiotics will become ineffective in the treatment of the majority of bacterial infections. • Prior use of antibiotics increases the percentage of resistant bacteria, supported by quantitative data • Prior use of the named antibiotic has the greatest effect, supported by quantitative data • Increasing use of antibiotics increases selection pressures so more resistant strains • Shows understanding that resistance mechanisms are inherited by sexual means and lateral gene transfer, e.g. via plasmids and this means they can spread rapidly and in some cases across species • Bacteria have high reproduction rates and mutations more likely within a short time • Understands current methods used to limit increase in resistant strains such as strict controls on antibiotic prescribing, problems of ensuring patients complete course of treatment when symptoms disappear, limit use of antibiotics in animal husbandry etc. • Comments on difficulties of developing new drugs • Methods of preventing spread of resistant strains especially hospital infection • Movement of humans means that transfer of resistant strains will spread to new hosts more easily

Level	Mark	Descriptor
	0	No rewardable material
Level 1	1-3	Provides little or no reference to a range of scientific ideas, processes, techniques and procedures. Scientific argument may be attempted, but fails to link biological concepts and/or ideas in order to support decision/conclusion. Limited attempt to address the question.
Level 2	4-6	Scientific reasoning occasionally supported through the linkage of a range of scientific ideas, processes, techniques and procedures. Scientific argument is partially developed. Attempts to synthesise and integrate relevant knowledge with linkages to biological concepts and/or ideas, leading to a notional scientific argument or decision/conclusion based on evidence.
Level 3	7-9	Scientific reasoning supported throughout by sustained linkage of a range of scientific ideas, processes, techniques or procedures. Scientific argument is well developed and logical. Demonstrating throughout the skills of synthesising and integrating relevant knowledge with consistent linkages to biological concepts and/or ideas, leading to nuanced and balanced scientific argument or decision/conclusion based on evidence.

Q14.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • { selective pressure against / loss of } sickle cell alleles due to effects of sickle cell anaemia (1) • heterozygote advantage due to protection against malaria increases { HbS frequency / number of heterozygotes } (1) • heterozygote advantage increases with increased prevalence of malaria (1) • HbS frequency depends on whether malaria or sickle cell disease represents a greater risk to survival (1)		**(4)**

Q15.

Question Number	Answer	Additional Guidance	Mark
(i)	A calculation that makes reference to: • correct calculation to find q (1) • correct calculation to find p (1) • correct calculation to find 2pq and number of mosquitoes (1)	q = 0.899... **Allow** any dpp = 0.101... **Allow** any dp **Allow** ecf for mp2 and mp3 1183 = three marks Correct answer with no working gainsfull marks	3

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of thefollowing: • The frequency of the resistance allele increased in 2015 (1) • because the (resistant) acetylcholinesterase enzyme is not affected by the pesticide / enzymestill works (1) • acetylcholine is still broken down in synapses (1) • the mosquitoes survive and breed (1) • the resistance allele carries a cost as it is reducedwhen no pesticide is used / after 2015 (1)	**Allow** Number of resistant mosquitoesincreases in 2015 **Allow** converse **Allow** converse **Allow** converse **Allow** resistant mosquitoes are at a selective advantage **Allow** lost by genetic drift / non- resistant mosquitoes out compete resistant ones after pesticide use stops **Allow** no selective pressure to retain the resistant allele	4

Q16.

Question Number	Answer	Mark
	An answer that makes reference to three of the following: • use more mice as one mouse might behave as an anomaly / mice behave differently (1) • control {temperature / light} because it affects preference (1) • control {sex / age / species} as they affect behaviour (1) • clean before using other mice so scent removed (1)	(3)

Q17.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to five of the following:		(5)
	• 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)		

Q18.

Question Number	Answer	Additional Guidance	Mark
(i)	D sympatric speciation A is incorrect because allopatric speciation requiresgeographical separation B is incorrect because genetic speciation is the wrongterm C is incorrect because stabilising selection is the wrongterm		1
(ii)	*An answer that makes reference to:* • have not seen if they can breed and produce fertile offspring with modern mosquitoes (1)		1
(iii)	*An answer that makes reference to:* • peer review / published in journals / conferences(1)		1
(iv)	• Phylum and class (1) • Prisoculex and burmanicus (1)		2

Q19.

Question Number	Correct Answer	Additional guidance	Mark
(a)	An explanation that makes reference to the following: • the shaded leaves have a larger surface area to mass ratio and are therefore bigger and thinner than leaves in the sun (1) • bigger allows more {chloroplasts / chlorophyll} for absorption of light (1) • thinner allows shorter diffusion path for entry of carbon dioxide (1)		**(3)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to five of the following: • growing nettles in {pots / eq} to ensure soil pH / {mineral/ named mineral} content in pots is the same (1) • {measure / control} the {light intensity / duration} for both treatments to ensure light intensities are different (1) • watering regime is the same in both treatments to ensure same potential for leaf growth (1) • use {groups of pots / measure more leaves} so that data collected is reliable (1) • use genetically identical nettles in each treatment as some genes may affect growth (1) • make sure that all pathogens / consumers are prevented from access as they can reduce growth (1)		**(5)**

Q20.

Question Number	Answer	Additional guidance	Mark
(a)(i)	1. reference to {polymerase chain reaction / PCR} ; 2. polymerase (enzyme) {added / eq }; 3. idea of need for primers and nucleotides ; 4. {90-98} (°C) → {50-65} (°C) → {70-75} (°C) ; 5. idea that cycle needs to be repeated {several times / to make several copies of DNA / eq};	**1. Accept** as a ref to PCR machine	**(4)**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	(DNA) {profiling / fingerprinting / (gel) electrophoresis} ;	**Ignore** Southern blotting, PCR **Accept** DNA profile / DNA fingerprint	**(1)**

Question Number	Answer	Additional guidance	Mark
(b)	1. idea of work appearing in a (Scientific) journal or being presented at a conference ; 2. idea that validity or reliability is considered ; 3. by other scientists / ref to peer review ;	**1. Accept** publishing a paper, scientific meeting	**(2)**

Question Number	Answer	Additional guidance	Mark
(c)(i)	1. reference to different {conditions / environments /eq} (in each region) ; 2. idea of different selection pressures ; 3. idea of {restricted gene flow / separate gene pools} ; 4. reference to reproductive isolation;	**1. Accept** appropriate named factor e.g. temperature **3. Ignore** different allele frequency	**(2)**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	1. idea of different {alleles/ gene pool} ; 2. idea that this leads to {new / different} phenotypes ; 3. idea of new {allele / gene} can be {advantage / disadvantage} ; 4. reference to (advantageous) {(mutated) gene / (new) allele} passed onto offspring ;	**1. Ignore** allele frequency **2. Accept** traits / characteristics / features	**(2)**

Q21.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: • each pigment will absorb different wavelengths (of light) (1) • each pigment will absorb different amounts of light at eachwavelength (1) • action spectrum is different because the seaweeds are absorbingdifferent wavelengths of light (1) • the rate of photosynthesis will therefore be different at each wavelength(1)	**ACCEPT** each pigment will reflect different wavelength (of light) description of which colour light is {reflected / absorbed}	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • green seaweeds found in shallow water as they {cannot absorb thegreen light / can absorb the red light} (1) • {brown / red} seaweeds can absorb {green / blue / other} wavelengths of light so are positioned further down as thesewavelengths can penetrate further (1) • seaweeds positioned so that they can absorb light for {photosynthesis / light-dependent reactions / photolysis} (1) • seaweeds positioned to avoid competition with the other types of seaweed (1)	**ALLOW** plants for seaweeds	(3)

Q22.

Question Number	Answer	Additional Guidance	Mark
	An explanation that includes four of the following: • collection acts as a selection pressure (1) • (random) mutation (in gene) for pigment / colour (1) • greyish brown plants are less likely to be {collected / found} as harder to see (1) • more likely to reproduce, passing on new **allele** (1) • **allele** frequency increases (1)	Accept collection of plants results in natural selection Accept genetic variation for colour exists (in population) Accept greyish brown plants {better camouflaged / blend in} so not picked piece together Accept converse Accept more likely to pass on allele to offspring Accept converse Accept allele increases in gene pool Accept converse	**Exp (4)**

Q23.

Question Number	Answer	Additional Guidance	Mark
(a)(i)	1. (successful interbreeding) produces offspring; 2. (same species produce) fertile (offspring); 3. credit reason why offspring of different species might be infertile ;	**Accept** converse throughout **Ignore** viable eg genetic incompatibility, different number of chromosomes, poor quality gametes , low number of gametes	**(3)**

Question Number	Answer	Additional Guidance	Mark
(a)(ii)	1. reference to reproductive isolation ; 2. different breeding times; 3. do not recognise {courtship displays / songs / eq} ; 4. physically incompatible eg genitalia ;		**(3)**
Question Number	**Answer**	**Additional Guidance**	**Mark**
(b)	1. idea that the two species share the same habitat ; 2. idea that the two species experience the same environmental conditions ; 3. (therefore) the same selection pressures ; 4. idea that they are both well-adapted (to their environment) ; 5. idea that no mutations have happened that {improve / change} their {phenotypes / survival}; 6. {no / few} changes in allele frequency / gene pool is stable ; 7. idea that there has been very little change in environment (over the years) ;	**Accept** similar **NB** this needs to be in the context of both species being subjected to the same selection pressures **Accept** similar	**(3)**

Q24.

Question Number	Answer	Additional Guidance	Mark
(a)	idea of organisms that breed to produce fertile offspring ;	**Ignore** reproductively isolated **Ignore** viable	(1)

Question Number	Answer	Additional Guidance	Mark
(b)	1. idea of geographical isolation ; 2. idea of different {environmental conditions / habitats / eq} ; 3. reference to different selection pressures ; 4. idea that mutation resulted in {adaptation / increased survival} ; 5. idea of {decrease in gene flow / different alleles} ; 6. ref to reproductive isolation ; 7. credit suitable example e.g. different songs, incompatible genitals ;		(4)

Question Number	Answer	Additional Guidance	Mark
(c)	1. idea of descending from common ancestor ; 2. idea of living in similar habitats ; 3. idea of similar (environmental) {conditions / factors} ; 4. idea of similar selection pressures ; 5. idea that both well-adapted ; 6. idea that mutations have not changed appearance ; 7. idea of similar gene pool ;	**Accept** same for similar throughout **2. Accept** place / environment / area	(3)

Q25.

Question Number	Answer	Additional guidance	Mark
(a)	1. reference to increase in {metabolic rate / enzyme activity / eq} as temperature rises ; 2. reference to increase in {kinetic / eq} energy of molecules (as temperature rises) / eq ; 3. reference to increase in {enzyme-substrate complexes / energy of collisions / eq} (as temperature rises) ; 4. idea of {inactivation at lower temperatures/ denaturation at higher temperatures} of enzymes ; 5. idea that temperature affects {differentiation / growth /division / eq} ;	**1. Accept** converse argument for mp 1 – 3 **2. Accept** movement **4.Accept** the idea that enzyme-substrate complexes cannot be made if denaturing	**(3)**

Question Number	Answer	Additional guidance	Mark
(b)	1. idea that temperature affects {survival / development / growth / metabolism / cell division / eq} ; 2. idea that enzymes affect {development / growth / metabolism / cell division/ eq} ; 3. idea that temperature affects enzymes ; 4. idea that different frogs have different enzymes ;		**(2)**

Question Number	Answer	Additional guidance	Mark
(c)	*sylvatica*, *pipiens*, *palustris*, *clamitans* ; ;	if order correct but reversed = 1 mark	**(2)**

Question Number	Answer	Additional guidance	Mark
(d)	1. idea that different species are reproductively isolated ; 2. idea of different breeding {times / seasons / eq} ; 3. idea of different {breeding / courtship / eq} {behaviour / rituals / displays / colour / songs / croaks / eq} ; 4. idea that population at {northerly / southerly} limit of range may not develop (to adulthood) ; 5. idea that breeding between different species results in infertile offspring ;	**3. Accept** idea of incompatible {genitalia / gametes}	**(3)**

Question Number	Answer	Additional guidance	Mark
(e)	1. idea that global warming will increase the temperature (at the latitudes) ; 2. idea that temperatures (at these latitudes) may become too high for any of the species ; 3. idea that new temperature may be above the maximum to complete development or above the upper lethal limit ; 4. idea that species move {north / to cooler regions / eq} ; 5. ref to change in {food source / predators / competition / eq} ;	**2.Accept** become extinct	**(3)**