PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 3: CLASSIFICATION AND BIODIVERSITY

CLASSIFICATION

SCORE	PERCENTAGE
/70	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	• total number of dolphin's gene families and number of shared gene families **(1)** • percentage of gene families shared **(1)**	Example of calculation 12 678 and 11 189 = 88.26 / 88.3 / 88 **Accept** ecf if one value incorrect	**(2)**

Q2.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • because of the {differences in / hypervariable regions} (in each individual's DNA) (1) • so produce fragments of different lengths (1) **OR** • different {fragments / lengths} of DNA are separated out (1)	**ACCEPT** unique DNA **ACCEPT** each individual has different abundance ofdifferent sized DNA (fragments) **OR** **ACCEPT** fragments therefore move through gel at different rates / smaller fragments move {further /faster} / converse for larger	(2)

Q3.

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)**

Q4.

Question Number	Correct Answer	Additional guidance	Mark
(a)	both species look alike and are active at night (1)	morphologically and behaviourally similar	**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	A description that makes reference to the following: • sample of {cells / DNA} (1) • DNA polymerase chain reaction (1) • procedure repeated several times (1) • temperature requirements (1)	e.g. 55 °C, 72 °C, 95 °C	**(4)**

Question Number	Correct Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following points: • increases biodiversity / index of diversity increases (1) • as the value for {N / numerator} increases in the index of diversity (1)	Accept justification consistent with formula Correct answer gains full marks	**(2)**

Q5.

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

Q6.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An experimental method that makes reference to five of the following steps: • use of experts to identify and collect many samples of rhinoceros dung from all areas of the park (1) • DNA extracted from rhinoceros cells and amplified using PCR (1) • use of { restriction endonucleases / appropriate primers } to obtain short tandem repeat sequences from DNA (1) • use of gel electrophoresis to separate DNA fragments (1) • description of method used to visualise fragments (1) • each different pattern of bands represents one individual rhinoceros (1)	e.g. radioactive probe / fluorescent probe / Southern blotting / UV light / autoradiography / X- rays	

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • no dung found from some rhinoceros, so they were not counted (1) • closely related individuals have similar DNA profiles, so they may not be distinguished as separate individuals (1)		**(2)**

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to two of the following: • {DNA / fragments} {are negatively charged / have a phosphate group} (1) • therefore the {DNA / fragments} move {when a potential difference is applied / towards the positive electrode} (1) • {smaller / lighter} fragments move further / {larger / heavier} fragments move shorter distance (1)	ACCEPT current / charge / voltage / electric field towards (positive) anode ACCEPT small fragments faster / larger fragments slower	

Question Number	Answer	Additional Guidance	Mark
(ii)	7 / 7.0 / 8 / 8.0 / 9 / 9.0 (kb)		

Q8.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • dolphins and (minke) whales are the most closely-related as they evolved from the same {species / (recent) common ancestor} **(1)** • the common ancestor of dolphins and minke whales evolved from the same common ancestor as cows **(1)** • pigs are the most distantly-related because they were the {first / earliest} animals to diverge **(1)** • the more closely-related the animals are the {more similar their DNA will be / fewer mutations} **(1)**	**Accept** an account that talks about branching points or speciation **Accept** because their (shared) common ancestor is furthest away **Accept** converse	**(3)**

Q9.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that includes four of the following: • obtain DNA (from the two types of plants) (1) • {use of restriction enzymes to cut DNA into fragments / use of PCR to amplify DNA} (1) • {DNA / fragments} (loaded) on (agarose) gel with {current passed through / voltage or potential difference applied} (1) • fragments of DNA are separated (1) • {same / similar} (banding) pattern suggests they are the same species (1)	Accept movement of (negatively charged) DNA moves to positive electrode Accept description / diagram of banding pattern Accept shorter fragments travel further Accept converse	**Exp (4)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that includes two of the following: • (if leaf is green it contains) chlorophyll / photosynthetic pigments (1) • so more {light / more wavelengths of light} absorbed for photosynthesis (1) • so more glucose produced for growth (1) OR • (if flower is brightly coloured) it attracts {pollinators / insects} (1) • so (more likely to) reproduce successfully (1) • to produce seeds / pass trait on (1)	 Accept more light / wavelengths of light leads to higher rate of photosynthesis Accept more GALP / TP / GP for growth Accept so increased genetic variation (as less self- pollination) Accept asexual reproduction (through bulb) still possible if pollination does not occur	**Exp (2)**

Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	*Rhithrogena*	DO NOT ACCEPT *Rhithrogena germanica*	**(1)**

Question Number	Answer	Mark
(ii)	**The only correct answer is B** ***A*** *is not correct because Animalia is the kingdom* ***C*** *is not correct because Heptageniidae is the family* ***D*** *is not correct because Insecta is the class*	**(1)**

Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	• *Anopheles*	**DO NOT ACCEPT** *Anopheles gambiae*	(1)CL

Question Number	Answer	Mark
(ii)	**The only correct answer is C Order** ***A** is incorrect because organisms in orders are sub-divided into families* ***B** is incorrect because organisms in families are sub-divided into a genus* ***D** is incorrect because organisms in phylum are sub-divided into classes*	(1)

Question Number	Answer	Mark
(iii)	**The only correct answer is B** *Plasmodium falciparum* *A is incorrect because Anopheles gambiae is the vector and not the pathogen* ***C** is incorrect because Puccinia graminis causes stem rust* ***D** is incorrect because Salmonella enterica causes food poisoning*	(1)

Q12.

Question Number	Answer	Additional Guidance	Mark
(i)	• calculation of q (1) • calculation of p (1) • calculation of number of heterozygotes (1)	Correct answer: 516 **Accept** answers with range of 517 and 528 with incorrect rounding for two marks Correct answer gains full marks **Accept** ECF for mp3 for 2pq x 2500	3

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • only Tibetans and Denisovans have the allele (1) • so (the presence of the allele) suggests that Denisovans and Tibetans must have interbred (1) • and produced fertile offspring (1)	**Accept** Allele is present in Tibetans and Denisovans	2

Q13.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • because dolphins and killer whales are separate species so should not be able to interbreed to produce fertile {offspring / hybrids} **(1)** • but {Kekaimalu / the offspring from the mating of the whale and dolphin} was fertile **(1)**	**Accept** separate species are not able to interbreed to produce fertile offspring **Accept** but Kekaimalu {reproduced / produced offspring}	**(2)**

Q14.

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

Q15.

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)**

Q16.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • because they want to validate their results (1) • by other members of the scientific community {checking / repeating / discussing / criticising} their work (1)	**ACCEPT** peer review to check …	(2)

Q17.

Question Number	Answer	Additional Guidance	Mark
	Eukarya / Eukaryota / Eukaryotes / Eukaryotae	**DO NOT ACCEPT** Animalia eukaryotes	**(1)**

Q18.

Question Number	Answer	Additional Guidance	Mark
	organisms that interbreed to produce fertile offspring	**ACCEPT** mate / reproduce	**(1)**

Q19.

Question Number	Answer	Mark
	The only correct answer is C ***A*** *is not correct because order goes between class and family* ***B*** *is not correct because order goes between class and family* ***D*** *is not correct because order goes between class and family*	**(1)**

Q20.

Question Number	Answer	Additional Guidance	Mark
	The only correct answer is A **B** is incorrect because *Plasmodium* is the genus name not the species name **C** is incorrect because *Plasmodium* causes malaria not *Puccinia* **D** is incorrect because *Plasmodium* causes malaria not *Puccinia*		(1) COMP