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General Certificate of Education

Biology 1411

BIOL4 Populations and Environment

Mark Scheme

2010 examination - January series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Question	Part	Marking Guidance	Mark	Comments
1	(a)	Small surface area to volume ratio / more fat; Lose less heat (to the environment) / for insulation; When they are sitting on eggs;	2 max	
1	(b)(i)	The further north/higher the latitude, the higher the percentage (of white snow geese);	1	
1	(b)(ii)	Snow lying longer/melts slower further north/at greater latitudes; White geese better camouflaged (further north); Predation linked to survival/reproductive success;	3	**Q** In order to gain the last marking point, candidates must explain how survival or reproductive success is affected.
1	(c)	Snow melts earlier/snow melts further north / less snow; White geese decreasing as less well camouflaged/at disadvantage/blue geese increasing as better camouflaged/at an advantage;	2	
1	(d)(i)	Stabilising;	1	Do not accept stable
1	(d)(ii)	Few geese survive at the extremes/most survive from the middle of the range;	1	

Question	Part	Marking Guidance	Mark	Comments
2	(a)	Extracellular digestion / releases enzymes; Starch to monosaccharides /glucose/sugars/smaller molecules ; Respire product of digestion; Produce carbon dioxide from respiration;	2 max	
2	(b)	Correct answer of 40;; Incorrect answer showing clearly that a difference in mass has been divided by time;	2	
2	(c)	Lower as plants contain a lower proportion of nitrogen/higher proportion of carbon/ higher C:N ratio; Nitrogen found (mainly) in protein/amino acids / nitrogen used to make protein;	2	

2	(d)	Investigation refers to a single species and other species might not respond in the same way; Investigation carried out in greenhouse where conditions controlled; Accept any other valid answers relating to how an increase in carbon dioxide concentration might increase caterpillar damage, e.g.: Caterpillars may eat more to compensate (for low nitrogen/ protein); Increased temperature (resulting from higher carbon dioxide concentration will increase rate of growth /reduce generation time; Other organisms interfere with results;	2 max	Remember question concerns caterpillar damage

Question	Part	Marking Guidance	Mark	Comments
3	(a)	All organisms of one species in a habitat/area/place/at one time;	1	Accept group
3	(b)(i)	From curve **C**; Find age as a percentage of a maximum/find value when 5000/50% still alive; (Use to) calculate as a percentage of 95/ Answer = 85 years;	3	**Q** This question tests quality of written communication. Marks may be awarded for calculating the answer but this must be supported by adequate explanation making the points listed. If curve A or B are given, figures for last mark point are A 8 B 50 All three +/- 2
3	(b)(ii)	More disease/poor food supplies/poor sanitation/poor medical care; High death rate among the young/in childhood / curve drops steeply at first/in first 40;	2	Overcrowding not enough Ignore ref to years or percentage

Question	Part	Marking Guidance	Mark	Comments
4	(a)(i)	Method of positioning quadrats, E.g. Find direction and distance from specified point/ find coordinates on a grid / split area into squares; Method of generating random numbers; E.g. From calculator/telephone directory/numbers drawn from a hat;	2	Last point represents minimum answer **Q** Do not credit any method that relies on throwing a quadrat
4	(a)(ii)	Calculate running mean/description of running mean; When enough quadrats, this shows little change/levels out (if plotted as a graph); Enough to carry out a statistical test; A large number to make sure results are reliable; Need to make sure work can be carried out in the time available;	2 max	Ignore terms that are not incorrect Regards large numbers as 10/10% +
4	(b)	Coppice different parts of the wood at different times; As data show many daffodils flowering 4/5 years after coppicing;	2	**Q** Second point needs specific reference to the graph, numbers and time after coppicing. Accept any correct answer that does this.
4	(c)	<u>Positive</u> correlation between rainfall and flowering/the higher the rainfall, the more daffodil flowers; <u>Negative</u> correlation/the higher the temperature the fewer daffodils in flower; All statistically significant so not likely to be/not due to chance;	2 max	

Question	Part	Marking Guidance	Mark	Comments
5	(a)	Krebs cycle/link reaction/pyruvate to acetylcoenzyme A;	1	**Q** Accept valid alternative for any of these steps.
5	(b)	(Respiratory reactions controlled by) enzymes; Rate decreases as less kinetic energy/fewer collisions (between substrate and active site) fewer E-S complexes formed;	2	
5	(c)	Requires hydrogen/electrons / is reduction; Hydrogens from reduced NAD/reduced NAD reduces (pyruvic acid) / reduced NAD oxidised;	2	Information may be on diagram
5	(d)	Respiring anaerobically; (Anaerobic respiration/respiration with nitrogen) less efficient/produces less ATP; More anaerobic respiration/ more glucose/substrate must be respired to produce same amount of ATP (so more carbon dioxide produced);	3	

Question	Part	Marking Guidance	Mark	Comments
6	(a)	Vegetation consists mainly of low growing species/herbs/annuals/ no/few tress; Species **X** has high rate of photosynthesis at high light intensity; Species **X** grow fastest at high rate of photosynthesis / at high light intensities; Will outcompete other species **Y**/**Z**;	3max	 Do not credit Species **X** is first tree
6	(b)	Produces shade/reduces light intensity; Species **Z** grows best/photosynthesis best/ in low light intensity / Species **Z** does not grow well / low rate of photosynthesis in high light intensity;	2	 Accept answers in terms of CO_2 absorption

Question	Part	Marking Guidance	Mark	Comments
7	(a)(i)	Will work in all weather conditions/hairs will stick to it even if shrew/animal is wet/ withstand rain;	1	
7	(a)(ii)	So shrews come into contact with glue;	1	
7	(b)	Avoids bias/allows statistical tests to be carried out;	1	Allow description
7	(c)(i)	Increases the reliability of the measurements; If measurements are repeatable, differences less likely to be due to measurement/personal error/ anomalies unlikely;	2	Accept advantages of repeatable results. E.g. identifying anomalies/remove errors
7	(c)(ii)	Plot graph/scatter diagram of one set of results against the other; Expect to see points lying close to line / Line should slope upwards/show positive correlation; OR Plot measurement against hair number; Look for overlying / corresponding points;	2	**Q** To gain first marking point, candidates must say what has been plotted. If what is being plotted is not clear, second point cannot be awarded.
7	(d)(i)	One mark for a valid explanation based on individual shrews entering more than one hair tube / many hairs from same shrew/ shrews enter without leaving hair;	1	
7	(d)(ii)	Rules out differences due to changes in population / changes in environmental conditions; That could be produced by births/deaths/migration/specific example of environmental conditions affects results;	2	

7	(e)	(A statistical test) determines the probability of results being due to chance; Enables null hypothesis/description of null hypothesis to be accepted/rejected; Determines whether correlation/result is significant;	2 max	
7	(f)(i)	(Curve/line of best fit shows) positive correlation/ description of positive correlation;	1	
7	(f)(ii)	Curve/line of best fit (almost) parallel to x-axis/horizontal / level/ no correlation / index is independent of number of shrews; Hair tubes with positive results when no shrews trapped; Small size of shrews means shrews may not trigger traps;	2 max	

Question	Part	Marking Guidance	Mark	Comments
8	(a)	1 Light (energy) excites/raises energy level of electrons in chlorophyll; 2 Electrons pass down electron transfer chain; 3 (Electrons) reduce carriers/passage involves redox reactions; 4 Electron transfer chain / role of chain associated with chloroplast membranes / in thylakoids / grana; 5 Energy released / carriers at decreasing energy levels; 6 ATP generated from ADP and phosphate/P_i / phosphorylation of ATP;	5 max	**Q** Accept any reasonable alternative for electron transfer chain. Example such as chemiosmosis;
8	(b)	1 Some light energy fails to strike/is reflected/not of appropriate wavelength; 2 Efficiency of photosynthesis in plants is low/approximately 2% efficient; 3 Respiratory loss / excretion / faeces / not eaten; 4 Loss as heat; 5 Efficiency of transfer to consumers greater than transfer to producers/approximately 10%; 6 Efficiency lower in older animals/herbivores/ primary consumers/warm blooded animals/homoiotherms; 7 Carnivores use more of their food than herbivores;	6 max	**Q** Accept figures below 5%. Accept figures over 5% but below 10% if clearly related to maximum efficiency.

8	(c)	1	Slaughtered when still growing/before maturity/while young so more energy transferred to biomass/tissue/production;	4 max	**Q** The principle here is one mark for identifying a relevant point and offering an explanation. Accept other equivalent answers.
		2	Fed on concentrate /controlled diet /controlled conditions/so higher proportion of (digested) food absorbed/lower proportion lost in faeces / valid reason for addition;		
		3	Movement restricted so less respiratory loss / less energy used;		
		4	Kept inside/heating/shelter / confined so less heat loss / no predators;		
		5	Genetically selected for high productivity;		