General Certificate of Education
June 2010

Biology BIOL4

Populations and environment

Final

Mark Scheme

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Although specific marks are not awarded in this unit, marks awarded will take into account the quality of written communication. Credit will only be awarded where candidates have presented information clearly and coherently and used the specialist vocabulary indicated in the mark scheme for this unit. Specific references to quality of written communication are given in the comments column.

Question	Marking guidance	Mark	Comments
1 (a)	Ammonia/ammonium/NH_3/NH_4^+;	1	
1 (b)	Will have similar shape/tertiary structure (as substrate) / complementary shape (to active site); Fit/bind with active site / forms enzyme-substrate complex;	2	Neutral: same shape as substrate Reject: same shape as active site
1 (c) (i)	Provides ATP for the reaction/nitrogen fixation/reduction of nitrogen/formation of ammonia; Enzyme/nitrogenase produced quicker/<u>more</u> enzyme produced; Uses/removes oxygen (so nitrogenase works);	2 max	Accept: ATP or energy Ignore references to temperature Use of oxygen must be in the correct context
1 (c) (ii)	ATP used for/needed for nitrogen fixation/reduction of nitrogen/formation of ammonia/production of enzyme/nitrogenase; (So less ATP) available for growth/protein synthesis/production of new cells/production of biomass;	2	Accept: ATP or energy Accept: converse for those without fertiliser

Question	Marking guidance	Mark	Comments
2 (a)	Two marks for correct answer of 59/60;; One mark for incorrect answer clearly derived from figures of 18, 28 and 38;	2	Ignore: any figures after decimal point.
2 (b)(i)	Population changes; As young birds leave nest/join population;	2	Reject: population decreases Reject first point if (young) birds are leaving population/migrating
2 (b) (ii)	(Would be likely to) catch all birds (again) in second sample / sample sizes are the same; Birds (in territories and) not mixing with population; Only estimates number of birds in territories sampled / territory sample not representative (of population);	2 max	Neutral: references to breeding Accept: idea of the population is divided
2 (c)	(Recording) DNA / base sequence is like marking (animal)/wouldn't need to mark; (Finding identical/same base sequence) would show animal has been caught/recorded before;	2	

Question	Marking guidance	Mark	Comments
3 (a)	The frequency/proportion of <u>alleles</u> (of a particular gene); Will stay constant from one generation to the next/over generations / no genetic change over time; Providing no mutation/no selection/population large/population genetically isolated/mating at random/no migration;	3	The three principles for marking are: What feature What happens to it Providing . . . Accept: genotype/explanation of genotype Accept: alternative wording, e.g. there is no gene flow/genetic drift for genetically isolated.
3 (b)	White/deaf cats unlikely to survive/selected against; Will not pass on allele (for deafness/white fur) (to next generation)/will reduce frequency of allele;	2	Accept: alternative wording, e.g. have a disadvantageous phenotype Neutral: will not breed
3 (c)	In Paris/London frequencies (of these alleles) add up to more than 1;	1	Can be shown by correct figures to be more than 1 e.g. 0.71 + 0.78 = 1.49 Accept: more than100%
3 (d)	Two marks for correct answer of 44(.22);; One mark for incorrect answer in which p/frequency of H determined as 0.67 and q/frequency of h as 0.33 ***OR*** Answer given as 0.44(22);	2	

Question	Marking guidance	Mark	Comments
4 (a)	F – E – R/ F – (E + R);	1	Accept: F– (R + E) / F– R– E
4 (b) (i)	Increase because fed concentrates/food with high nutritive value/food with high digestibility/food with little waste/because less egested;	1	
4 (b) (ii)	Decrease because movement restricted/heat loss reduced;	1	Accept: less movement/less muscle contraction Ignore references to keeping warm
4 (c) (i)	0.98 : 1 / 98 : 100;	1	Answer must be this way round and expressed in its simplest terms Reject: 0.98
4 (c) (ii)	Mammals maintain (body) temperature/have high (body) temperature;	1	Accept: mammals are endotherms /warm-blooded Accept: converse for insects
4 (d)	(Results show) positive correlation/positive correlation described; Most/higher values close to line / curve shows good agreement; Lower values less close to line/less correlation; (Generally) predicted values are higher / actual values lower;	3 max	Reject: reference to line/curve of best fit Ignore reference to anomalies Reference to ‘predicted’ or ‘actual’ required

Question	Marking guidance	Mark	Comments
5 (a)	(Increase in) dead organisms/humus/decomposition; Leading to (increase in) nitrification/ammonia to nitrate/activity of nitrifying bacteria; Nitrogen fixation;	2max	Accept: pioneer species for plants
5 (b) (i)	Bare soil temperatures fluctuate; More bare soil, early/at start of succession/when few plants;	2	Reject: environmental temperature Accept: converse
5 (b) (ii)	Plant will grow/survive in the shade/when overshadowed (by taller plants)/when receiving less light;	1	Effect on plant with reason for effect Ignore reference to competition
5 (c)	(Grassland consists of) small/annual plants; Will be replaced by/outcompeted by woody plants; So these (woody plants) must be removed/have growth checked/grazed;	2 max	Must be in the context of grassland Need idea of replaced not just an increase in percentage cover

Question	Marking guidance	Mark	Comments
6 (a)	Electrons transferred down electron transport chain; Provide energy to take protons/H^+ into space between membranes; Protons/H^+ pass back, through membrane/into matrix/through ATPase; Energy used to combine ADP and phosphate/to produce ATP;	3 max	Accept: alternatives for electron transport chain.
6 (b) (i)	Prevent damage to mitochondria caused by water/osmosis/differences in water potential;	1	Accept: other terms that imply damage e.g. shrink/burst
6 (b) (ii)	Glucose is used/broken down during glycolysis; Breakdown of glucose/glycolysis in cytoplasm/not in mitochondria; Glucose cannot cross mitochondrial membrane/does not enter mitochondria;	2 max	Accept: 'glucose is converted to pyruvate' for description of breakdown Accept: only pyruvate can
6 (b) (iii)	Terminal/final acceptor (in electron transport chain) / used to make water;	1	Could be shown by symbols

Question	Marking guidance	Mark	Comments
7 (a) (i)	Fewest people at site R as mean is lowest; Standard deviations do not overlap so significant/not due to chance;	2	Accept use of mean values to show 2.2 is the lowest Accept use of values/description of standard deviation even in wording 'standard deviation' is not used
7 (a) (ii)	There was a probability of less than 0.05/ 5 in a hundred/5%; That the difference was due to chance;	2	In the context of less than Accept converse: probability of more than 95% Look for idea of difference (between sites)
7 (b) (i)	(Would not be reliable as) number of species is still increasing;	1	Accept: has not reached peak/maximum or if shown by values
7 (b) (ii)	Idea of curve has flattened/no more species found so no benefit/no point/takes unnecessary time/takes unnecessary effort / can get same results with fewer quadrats;	1	Basic idea is of minimising effort. If values used reward idea rather than accuracy of numbers
7 (c)	Combustion/ would burn/cause loss of substances (other than water)/named substance/cause loss of dry mass;;	1	Accept: only want water to be lost Ignore: reference to decomposition
7 (d)	Seaweeds/plants are producers/lower/first trophic level / animals are consumers/higher trophic level/feed on seaweeds; Loss of energy between trophic levels; As a result of respiration/ as heat;	2 max	Accept relevant position in food chain as trophic level Accept: energy transfer is inefficient Accept: description of trophic levels Accept: not all seaweed/eaten
7 (e) (i)	The site/site U with most people/34.6 has the largest ratio/3.24; (Large value of ratio due to) large biomass ÷ small number / large size ÷ small number/biomass greater than abundance;	2	Accept: as number of people increases, ratio increases Explanation of seaweed ratio

7 (e) (ii)	1. Fewer larger animals/more smaller animals where more people/more disturbance; 2. 0.09 linked to 34.6/appropriate link between row 4 and row 1;: 3. Larger animals affected by human activity; 4. Smaller animals are young animals; 5. Fewer species of seaweed (with disturbance); 6. (So) fewer niches /habitats (for large animals);	4 max	Principle Use of data Accept: converse Accept: converse Accept if shown by figures Accept idea of disturbance/damage to niche/habitat

Question	Marking guidance	Mark	Comments
8 (a)	1. High concentration of carbon dioxide linked with night/darkness; 2. No photosynthesis in dark/night / light required for photosynthesis/light-dependent reaction; 3. (In dark) <u>plants</u> (and other organisms) respire; 4. In light net uptake of carbon dioxide by plants/plants use more carbon dioxide than they produce/ rate of photosynthesis greater than rate of respiration; 5. Decrease in carbon dioxide concentration with height; 6. At ground level fewer leaves/less photosynthesising tissue/more animals/less light;	5 max	Accept: converse of low in day Ignore references to rate of photosynthesis in day/night Accept day = light Must be a reference to plants or <u>all</u> organisms Do not allow converse for this point Accept description of compensation point Accept: converse of increase closer to ground
8 (b)	1. Carbon dioxide combines with ribulose bisphosphate/RuBP; 2. To produce two molecules of glycerate 3-phosphate/GP; 3. Reduced to triose phosphate/TP; 4. Requires reduced NADP; 5. Energy from ATP;	5	This mark scheme is based on specification content. Accept alternate names such as NADPH Credit relevant diagrams Accept: description of ‘reduced’

8 (c)	1. Microorganisms are saprobionts/saprophytes; 2. Secrete enzymes (onto dead tissue) / extracellular digestion; 3. Absorb products of digestion/smaller molecules/named relevant substance; 4. Respiration (by microorganisms) produces carbon dioxide; 5. Carbon dioxide taken into leaves; 6. Through stomata;	5 max	Accept saprophytes although not strictly correct. Accept: description of absorption