Version 1.0



General Certificate of Education (A-level)
June 2012

Biology BIOL4

(Specification 2410)

Unit 4: Populations and Environment

Post-Standardisation

Mark Scheme

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Question	Marking Guidelines	Mark	Comments
1(a)	Crabgrass;	1	Reject: grass or grassland Reject: crabgrass if another organism is also included
1(b)	1. Species/plants/animals change the environment/conditions/add humus/nutrients etc.; 2. Less hostile (habitat); 3. Species/plants better competitors;	2 max	Accept 'they' for species/plants in mark points 1 and 3 Allow 'more hospitable' or equivalent for mark point 2
1(c)	(Only) plants which can photosynthesise with less light (remain);	1	Accept converse but do not award mark for idea that plants cannot photosynthesise and die because there is no light Answers must be in context of being or not being able to photosynthesise with less light

Question	Marking Guidelines	Mark	Comments
2(a)	Is always expressed/shown (in the phenotype);	1	Reject 'is always present' without further qualification
2(b)	C^BC^B, C^BC^P and C^BC^Y; Or C^BC^B, C^PC^B and C^YC^B;	1	All three are required for the mark Accept C^BC^B, C^BC^P, C^BC^Y, C^YC^B and C^PC^B Accept BB, BP and BY or BB, BP, BY, YB and PB
2(c)	1. Two genotypes (as parents) shown as C^P C^Y Or Two sets of gametes shown as C^P and C^Y; 2. Genotypes of offspring shown as C^P C^Y, C^P C^P and C^Y C^Y; 3. Above genotypes of offspring correctly linked to phenotypes i.e. pink and yellow;	3	Award **one mark maximum** for candidates who have misread the question and complete a correct genetic cross between a pink snail, C^PC^Y and a yellow snail, C^YC^Y to give pink and yellow offspring Accept ratio (or equivalent) of 3 pink: 1 yellow for mark point 3
2(d)	1. Correct answer of 42%;;; = 3 marks 2. q^2 = 0.49/49% ***OR*** q = 0.7/70%; 3. Shows understanding that 2pq = heterozygotes / carriers / shows answer is derived from 2pq;	3	Answer of 0.42 = 2 marks Award **one mark maximum** for answer of 49.9/49.98/50% or 0.49/0.5 Award **one mark maximum** for answer of 40.8/41% or 0.41 Accept: b^2 = 0.49/49% or b = 0.7/70% for mark point 2

Question	Marking Guidelines	Mark	Comments
3(a)	All/group of species / all/group of populations / all the organisms;	1	Accept equivalent terms for group. Answers which only refer to organisms must have idea of **all** the organisms not just a group of organisms Reject answers which include 'environment' or abiotic factors as part of the definition
3(b)(i)	7.2 – 8.4 (metres);	1	Accept answer of 1.2
3(b)(ii)	1. Food / prey / oxygen; 2. Less/no competition;	2	Do not accept 'resource' for mark point 1 unless this is qualified as food/prey/oxygen Reference to light and CO_2 as a resource negates mark point 2 Ignore intraspecific/interspecific for mark point 2
3(c)	1. Increase in depth linked to decrease in temperature / decrease in depth linked to increase in temperature; 2. Correlation/relationship between temperature and fish distribution does not indicate a causal effect; 3. Overlap in ranges / different fish/species occupy same depth; 4. Other abiotic/biotic/named factor involved;	3 max	Accept increase or decrease in temperature is related to 'higher depth' or 'lower depth due to ambiguity of these terms Ignore any reference to correlation unless it is clearly in context of temperature and fish distribution Temperature does not determine fish distribution is not sufficient for idea of causal effect Reject: 'casual' for mark point 2 Reject 'other factors' for mark point 4 unless further qualified

Question	Marking Guidelines	Mark	Comments
4(a)	Ribulose bisphosphate/RuBP;	1	Accept Ribulose biphosphate or Ribulose diphosphate Accept phonetic spellings Accept any variation in upper or lower case for RuBP
4(b)	ATP and reduced NADP are produced in grana/thylakoids/ present in A/both tubes;	1	Must be reduced NADP but accept any alternative which show hydrogen attached to NADP Must be reduced NADP not reduced NAD
4(c)	1. 4 000; 2. Light-dependent reaction does not occur /ATP and reduced NADP are not produced;	2	Accept 'same as in (tube) C', but not 'same' on its own Accept converse for mark point 2
4(d)	1. (Less) GP converted to TP; 2. (Less) TP converted to RuBP;	2	GP = glycerate 3-phosphate TP = triose phosphate but abbreviations are sufficient Accept GALP as TP
4(e)	1. No/less ATP / ATP produced (during electron transport); 2. No/less reduced NADP / reduced NADP produced (during electron transport);	2	Must be reduced NADP but accept any alternative which shows hydrogen attached to NADP

Question	Marking Guidelines	Mark	Comments
5(a)	1. Specific (to one pest); 2. Only needs one application/ reproduces; 3. Keeps population low; 4. Pests do not develop resistance; 5. Does not leave chemical in environment/on crop / no bioaccumulation; 6. Can be used in organic farming;	2 max	Ignore reference to leaching or eutrophication Reference to immunity disqualifies mark point 4
5(b)	1. Increases, rapid decrease, constant/level/fluctuates; 2. Accept any one of increases at 3/4 weeks / increases to 8 weeks / peaks at 8 weeks / levels at 10 weeks;	2	Allow equivalent terms for description of the three main changes described in mark point 1 Ignore any reference to initial decrease Allow steep decrease as equivalent to rapid decrease in mark point 1 but reject large/significant decrease unless further qualified Accept any one of following for mark point 2 Increases to any value between 8 and 9% / peaks at any value between 8 and 9% / decreases to any % below 2%
5(c)	1. Decrease number of pests / (two-spotted) mite / decrease in % (of leaves occupied); 2. Remains at low numbers / remains below 2%;	2	Accept any % below 2% for mark point 2

5(d)	1. Cost of treatment/biological control; 2. Takes (a long) time to act; 3. Pest/two-spotted mite is not completely removed; 4. May become a pest/damage/eat crop;	2 max	
5(e)	1. Pesticide kills predatory mites / other predators / two-spotted mites are <u>resistant</u>; 2. Two-spotted mite reproduces;	2	Accept breed/multiply for mark point 2

Question	Marking Guidelines	Mark	Comments
6(a)	1. Affects <u>enzymes</u>; 2. Affects respiration; <u>Or</u> 3. Affects volume/pressure of gases; 4. Affects readings;	2 max	'respiration involves enzymes' = two marks Ignore reference to controlling a variable Mark point 4 can only be awarded if mark point 3 has been credited
6(b)(i)	1. <u>Oxygen</u> taken up/used (by seeds); 2. <u>Carbon dioxide</u> (given out) is absorbed by solution/potassium hydroxide; 3. Decrease in volume / pressure (inside flask);	3	Reject air is taken up for mark point 1 Reference to vacuum negates mark point 3
6(b)(ii)	4;	1	
6(c)	1. Remains the same; 2. No oxygen uptake/used;	2	Any reference to 'carbon dioxide **not** being produced' disqualifies mark point 2

Question	Marking Guidelines	Mark	Comments
7(a)	1. Is widely/commonly used; 2. Provides a standard/benchmark/reference; 3. Produces large amount of carbon dioxide; 4. Is a decreasing resource / could be replaced by biofuel;	2 max	Allow a variety of descriptors for marking point 2 e.g. 'provides a base line', 'produces known amount of carbon dioxide' Mark point 2, do not accept 'for comparison' on its own as 'comparison' is in stem of question Ignore reference to a control
7(b)	1. Independent / no bias / trustworthy; 2. Non-profit making; 3. (Focused on) effect on environment/climate;	2 max	
7(c)(i)	1. Most/3 biofuels show reduction in CO_2/negative % change in CO_2; 2. (But) soy-based biodiesel is positive/ shows an increase in CO_2; 3. CO_2 is a greenhouse gas; 4. Global warming (affected); 5. Other 'greenhouse gases'/ methane/nitrous oxide/water vapour etc. (affect climate);	4 max	Allow reference to figures for mark points 1 and 2 Must show that so-based biodiesel is positive or increases rather than simply 'it doesn't decrease'
7(c)(ii)	1. CO_2 taken up in <u>photosynthesis</u>; 2. More taken up than produced (when it is used); 3. Less CO_2 produced than petrol;	2 max	

7(d)	1. (These microorganisms) don't have (cellulose-digesting) enzymes; 2. (Cellulose) is a polysaccharide/polymer/long (molecule/chain); 3. (Cellulose) is insoluble / glucose/product of digestion is soluble; 4. Broken down into glucose/monomers /monosaccharides; 5. Sugars/glucose used in glycolysis / glucose can be converted to pyruvate; 6. Produces more ethanol/fuel produces ethanol/fuel quicker;	3 max	Accept 'don't make enough of these enzymes' for mark point 1 Accept' large' for mark point 2 Ignore (alpha) glucose for mark point 4. Do not accept sugars for mark point 4 Accept 'speeds up process' for mark point 6
7(e)	1. Removes species / fewer species / growth of single crop / single plant species / monoculture; 2. Removes habitats / fewer habitats/niches /only one habitat; 3. Removes variety of food sources / fewer food sources / only one food source;	2 max	Deforestation or removal of hedges on its own should not be credited

Question	Marking Guidelines	Mark	Comments
8(a)	1. Fertilisers/minerals/named ion (added to soil); 2. Role of named nutrient or element e.g. nitrate/nitrogen for proteins / phosphate/phosphorus for ATP/DNA; 3. Pesticides/biological control prevents damage/consumption of crop; 4. Pesticides/weed killers /herbicides/weeding remove competition; 5. Selective breeding / genetic modification (of crops); 6. Glass/greenhouses enhance temp/CO_2/ light; 7. Ploughing aerates soil/improves drainage; 8. Ploughing/aeration allows nitrification/decreases denitrification; 9. Benefit of crop rotation in terms of soil nutrients/fertility/pest reduction; 10. Irrigation/watering to remove limiting factor; 11. Protection of crops from birds/pests/frost by covers/netting etc.;	5 max	Accept any named examples of natural fertilisers for mark point 1 e.g. manure, bone meal etc. Ignore named elements Accept fertilisers/minerals/ named nutrient/element removes limiting factor for mark point 2 Accept any type of pesticide e.g. fungicides for mark point 3 Accept seeding method reduces competition for mark point 4 Accept idea of choosing particular variety of crop for mark point 5 Allow rotivation, harrowing, hoeing as alternatives terms for ploughing in mark points 7 and 8 Accept addition of organic material (mark point 1) improves soil structure/drainage or effect of lime on pH for mark point 7 Accept activity/number of nitrifying bacteria increased / denitrifying bacteria decreased in mark point 8. Ignore nitrogen fixation

8(b)	1. Protein/amino acids/DNA into ammonium compounds / ammonia; 2. By saprobionts; 3. Ammonium/ammonia into nitrite; 4. Nitrite into nitrate; 5. By nitrifying bacteria/microorganisms; 6. Nitrogen to ammonia/ammonium; 7. By nitrogen-fixing bacteria/microorganisms in soil;	5 max	Accept any named nitrogen containing compound e.g. urea for mark point 1 Accept saprophytes for mark point 2 Accept marks for conversion i.e. mark points 1, 3, 4 and 6 even if incorrect type of bacteria named as being involved However, reject marks for type of bacteria i.e. mark points 2, 5 and 7 if linked to incorrect process e.g. nitrite converted to nitrate by saprobionts Award one mark for ammonia/ammonium into nitrate if neither mark point 3 or 4 awarded Ignore reference to nitrogen-fixing bacteria in root nodules. If not specified, assume nitrogen-fixing bacteria are in the soil
8(c)	1. Variation/variety in pest population; 2. Due to mutation; 3. Allele for resistance; 4. Reference to selection; 5. Pests with resistance (survive and) breed / differential reproductive success; 6. Increase in frequency of allele;	5 max	Reference to ‘immune’ negates mark point 3 or 5 but not both Ignore ‘vertical gene transmission’ Must be increase in frequency of allele for mark point 6 do not credit answers which only refer to ‘change’