



**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)	<ol style="list-style-type: none"> 1. Species/plants/animals change the environment/conditions/add humus/nutrients etc.; 2. Less hostile (habitat); 3. Species/plants better competitors; 	2 max	<p>Accept 'they' for species/plants in mark points 1 and 3</p> <p>Allow 'more hospitable' or equivalent for mark point 2</p>
1(c)	(Only) plants which can photosynthesise with less light (remain);	1	<p>Accept converse but do not award mark for idea that plants cannot photosynthesise and die because there is no light</p> <p>Answers must be in context of being or not being able to photosynthesise with less light</p>

Question	Marking Guidelines	Mark	Comments
2(a)	Is always expressed/shown (in the phenotype);	1	Reject 'is always present' without further qualification
2(b)	$C^B C^B$, $C^B C^P$ and $C^B C^Y$; <u>Or</u> $C^B C^B$, $C^P C^B$ and $C^Y C^B$;	1	All three are required for the mark Accept $C^B C^B$, $C^B C^P$, $C^B C^Y$, $C^Y C^B$ and $C^P C^B$ Accept BB, BP and BY <u>or</u> BB, BP, BY, YB and PB
2(c)	1. Two genotypes (as parents) shown as $C^P C^Y$ <u>Or</u> 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, $C^P C^Y$ and a yellow snail, $C^Y C^Y$ 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	<p>Accept equivalent terms for group.</p> <p>Answers which only refer to organisms must have idea of all the organisms not just a group of organisms</p> <p>Reject answers which include 'environment' or abiotic factors as part of the definition</p>
3(b)(i)	7.2 – 8.4 (metres);	1	Accept answer of 1.2
3(b)(ii)	<ol style="list-style-type: none"> 1. Food / prey / oxygen; 2. Less/no competition; 	2	<p>Do not accept 'resource' for mark point 1 unless this is qualified as food/prey/oxygen</p> <p>Reference to light and CO₂ as a resource negates mark point 2</p> <p>Ignore intraspecific/interspecific for mark point 2</p>
3(c)	<ol style="list-style-type: none"> 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	<p>Accept increase or decrease in temperature is related to 'higher depth' or 'lower depth' due to ambiguity of these terms</p> <p>Ignore any reference to correlation unless it is clearly in context of temperature and fish distribution</p> <p>Temperature does not determine fish distribution is not sufficient for idea of causal effect</p> <p>Reject: 'casual' for mark point 2</p> <p>Reject 'other factors' for mark point 4 unless further qualified</p>

Question	Marking Guidelines	Mark	Comments
4(a)	Ribulose biphosphate/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)	<ol style="list-style-type: none"> 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	<p>Ignore reference to leaching or eutrophication</p> <p>Reference to immunity disqualifies mark point 4</p>
5(b)	<ol style="list-style-type: none"> 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	<p>Allow equivalent terms for description of the three main changes described in mark point 1</p> <p>Ignore any reference to initial decrease</p> <p>Allow steep decrease as equivalent to rapid decrease in mark point 1 but reject large/significant decrease unless further qualified</p> <p>Accept any one of following for mark point 2</p> <p>Increases to any value between 8 and 9% / peaks at any value between 8 and 9% / decreases to any % below 2%</p>
5(c)	<ol style="list-style-type: none"> 1. Decrease number of pests / (two-spotted) mite / decrease in % (of leaves occupied); 2. Remains at low numbers / remains below 2%; 	2	<p>Accept any % below 2% for mark point 2</p>

5(d)	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 1. Affects <u>enzymes</u>; 2. Affects respiration; <p style="text-align: center;"><u>Or</u></p> <ol style="list-style-type: none"> 3. Affects volume/pressure of gases; 4. Affects readings; 	2 max	<p>'respiration involves enzymes' = two marks</p> <p>Ignore reference to controlling a variable</p> <p>Mark point 4 can only be awarded if mark point 3 has been credited</p>
6(b)(i)	<ol style="list-style-type: none"> 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	<p>Reject air is taken up for mark point 1</p> <p>Reference to vacuum negates mark point 3</p>
6(b)(ii)	4;	1	
6(c)	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 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	<p>Allow a variety of descriptors for marking point 2 e.g. 'provides a base line', 'produces known amount of carbon dioxide'</p> <p>Mark point 2, do not accept 'for comparison' on its own as 'comparison' is in stem of question</p> <p>Ignore reference to a control</p>
7(b)	<ol style="list-style-type: none"> 1. Independent / no bias / trustworthy; 2. Non-profit making; 3. (Focused on) effect on environment/climate; 	2 max	
7(c)(i)	<ol style="list-style-type: none"> 1. Most/3 biofuels show reduction in CO₂/negative % change in CO₂; 2. (But) soy-based biodiesel is positive/ shows an increase in CO₂; 3. CO₂ is a greenhouse gas; 4. Global warming (affected); 5. Other 'greenhouse gases'/ methane/nitrous oxide/water vapour etc. (affect climate); 	4 max	<p>Allow reference to figures for mark points 1 and 2</p> <p>Must show that so-based biodiesel is positive or increases rather than simply 'it doesn't decrease'</p>
7(c)(ii)	<ol style="list-style-type: none"> 1. CO₂ taken up in <u>photosynthesis</u>; 2. More taken up than produced (when it is used); 3. Less CO₂ produced than petrol; 	2 max	

<p>7(d)</p>	<ol style="list-style-type: none"> 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; 	<p>3 max</p>	<p>Accept 'don't make enough of these enzymes' for mark point 1</p> <p>Accept 'large' for mark point 2</p> <p>Ignore (alpha) glucose for mark point 4. Do not accept sugars for mark point 4</p> <p>Accept 'speeds up process' for mark point 6</p>
<p>7(e)</p>	<ol style="list-style-type: none"> 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; 	<p>2 max</p>	<p>Deforestation or removal of hedges on its own should not be credited</p>

Question	Marking Guidelines	Mark	Comments
8(a)	<ol style="list-style-type: none"> 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/CO₂/ 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	<p>Accept any named examples of natural fertilisers for mark point 1 e.g. manure, bone meal etc. Ignore named elements</p> <p>Accept fertilisers/minerals/named nutrient/element removes limiting factor for mark point 2</p> <p>Accept any type of pesticide e.g. fungicides for mark point 3</p> <p>Accept seeding method reduces competition for mark point 4</p> <p>Accept idea of choosing particular variety of crop for mark point 5</p> <p>Allow rotivation, harrowing, hoeing as alternatives terms for ploughing in mark points 7 and 8</p> <p>Accept addition of organic material (mark point 1) improves soil structure/drainage or effect of lime on pH for mark point 7</p> <p>Accept activity/number of nitrifying bacteria increased / denitrifying bacteria decreased in mark point 8. Ignore nitrogen fixation</p>

<p>8(b)</p>	<ol style="list-style-type: none"> 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; 	<p>5 max</p>	<p>Accept any named nitrogen containing compound e.g. urea for mark point 1</p> <p>Accept saprophytes for mark point 2</p> <p>Accept marks for conversion i.e. mark points 1, 3, 4 and 6 even if incorrect type of bacteria named as being involved</p> <p>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</p> <p>Award one mark for ammonia/ammonium into nitrate if neither mark point 3 or 4 awarded</p> <p>Ignore reference to nitrogen-fixing bacteria in root nodules. If not specified, assume nitrogen-fixing bacteria are in the soil</p>
<p>8(c)</p>	<ol style="list-style-type: none"> 1. <u>Variation/variety</u> in pest population; 2. Due to mutation; 3. <u>Allele</u> for resistance; 4. Reference to selection; 5. Pests with resistance (survive and) breed / differential reproductive success; 6. Increase in frequency of allele; 	<p>5 max</p>	<p>Reference to 'immune' negates mark point 3 or 5 but not both</p> <p>Ignore 'vertical gene transmission'</p> <p>Must be increase in frequency of allele for mark point 6 do not credit answers which only refer to 'change'</p>