



**General Certificate of Education (A-level)
June 2013**

Biology

BIOL4

(Specification 2410)

Unit 4: Populations and Environment

Final

Mark Scheme

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Question	Marking Guidelines	Mark	Comments
1(a)	Birth <u>rate</u> and death <u>rate</u> = 2 marks;; OR 1. Change in population / births and deaths / population at start and end; 2. In a given time;	2	Neutral: any reference to per or times by a number eg per 1000 / × 100 Neutral: ignore any reference to immigration and emigration unless context is incorrect
1(b)	1. High birth rate / high proportion/percentage/number of young/children; 2. High death rate / low proportion/percentage/number of elderly/older people/low life expectancy;	2	1 and 2. Both points must be clearly stated. Do not award other mark by implication 1 and 2. Accept appropriate use of percentage/number as alternatives 1. Accept: 'wide base' or any equivalent description of high proportion/number of young children 2. Accept: 'narrow at top' or any equivalent description of low proportion of older people 2. Accept high death rate in context of any age group

Question	Marking Guidelines	Mark	Comments
2(a)	<i>Ulva lactuca</i> ;	1	Reject: <i>Ulva</i> on its own Accept: <i>lactuca</i> on its own Accept: Incorrect spelling
2(b)(i)	Difficult/too many/too many to count / individual organisms not identifiable / too small to identify / grows in clumps;	1	Neutral: easier/quicker/representative/more accurate, unless qualified
2(b)(ii)	Any described feature of concrete eg texture / flat / composition chemicals / nutrients etc;	1	Neutral: not natural / man made / are different, without further qualification
2(c)	<ol style="list-style-type: none"> 1. Pioneer species/<i>Ulva</i> increases then decreases; 2. Principle of a species changing the conditions / a species makes the conditions less hostile; 3. New/named species better competitor / previous/named/pioneer species outcompeted; 4. <i>G. coulteri</i>/<i>Gelidium</i> increases <u>and</u> other/named species decreases; 	4	<p>1 and 4. Growth/reproduces = increases. Dies = decrease</p> <p>2. Accept description of change in conditions eg soil/humus forms, nutrients increased</p> <p>Pioneer species grows, dies and forms humus = 2 marks</p> <p><i>G. coulteri</i>/<i>Gelidium</i> outcompetes other/named species = 2 marks</p>

Question	Marking Guidelines	Mark	Comments
3(a)	1. Expression / appearance / characteristic due to genetic constitution/genotype/allele(s); 2. (Expression / appearance / characteristic) due to environment;	2	1 Accept: named characteristic 1 Accept: homozygous / heterozygous / genes / DNA 1 Neutral: chromosomes
3(b)(i)	1. 3 and 4 and 9/11/affected offspring; 2. Both 3 and 4 are carriers/heterozygous; OR If dominant at least one of 3 and 4 would be affected;	2	1 Accept: 9/11 and their parents 1 Accept: unaffected parents have affected children 2 Accept: if 3 and 4 are unaffected all their children will be unaffected
3(b)(ii)	1. 11 is affected, 3 is not; 2. 3/father of 11 does not have a recessive allele on his X chromosome/ X^t ; OR (If on X) 11/affected female would not receive the recessive allele on X chromosome/ X^t from 3/father; OR (If on X) 3/father (of 11) would pass on the dominant allele on his X chromosome/ X^T ;	2	1 Accept: 3/unaffected father/parents produce an affected daughter 1 Accept: 3 and 4 would only produce unaffected females 2 Answers must be in context of alleles Reject: recessive/dominant chromosomes
3(c)(i)	Answer in range of 5.8 - 6.2% = 3 marks;; If incorrect answer, then 2 max of following points 1. $q^2/p^2/tt = 0.001$ or 1 divided by 1000; 2. $p/q/T = 0.968 - 0.97$; 3. Understanding that heterozygous = $2pq$;	3 max	Answers in range of 0.058 - 0.062 = 2 marks 3. This can be shown mathematically ie $2 \times$ two different numbers 3. Accept: answer provided attempts to calculate $2pq$

3(c)(ii)	Affected individuals (usually) do not reproduce/die during childhood/do not pass on allele/genetic screening;	1	
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Question	Marking Guidelines	Mark	Comments																
4(a)	<table border="1" data-bbox="347 353 879 707"> <thead> <tr> <th></th> <th>Glycolysis</th> <th>Link reaction</th> <th>Krebs Cycle</th> </tr> </thead> <tbody> <tr> <td>Occurs in mitochondria</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Carbon dioxide produced</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>NAD is reduced</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table> <p>Mark horizontally</p>		Glycolysis	Link reaction	Krebs Cycle	Occurs in mitochondria		√	√	Carbon dioxide produced		√	√	NAD is reduced	√	√	√	3	
	Glycolysis	Link reaction	Krebs Cycle																
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4(b)(i)	<ol style="list-style-type: none"> 1. Glucose is used/broken down during glycolysis/in cytoplasm; 2. Glucose cannot cross mitochondrial <u>membrane(s)</u> / pyruvate can cross mitochondrial <u>membrane(s)</u>; 	2	<ol style="list-style-type: none"> 1 Accept: glucose to pyruvate or glucose not converted to pyruvate for one mark 																
4(b)(ii)	<ol style="list-style-type: none"> 1. Is a competitive inhibitor / attaches to active site; 2. Reduces/prevents enzyme-substrate/E-S complex forming; 	2	<ol style="list-style-type: none"> 1 Accept: inhibitor/malonate attaches to active site to form an enzyme-substrate complex 2 Accept: substrate/succinate cannot bind to enzyme 2 Accept mark point 2, but not mp1 in context of non-competitive inhibition 																
4(b)(iii)	<ol style="list-style-type: none"> 1. Krebs cycle inhibited; 2. NAD/Coenzyme/FAD not/less reduced; 3. Hydrogens not passed to ETC; 4. Oxygen used as final/terminal (electron) acceptor; 	2 max	<ol style="list-style-type: none"> 4 Accept: oxygen combines with electrons <u>and</u> protons/hydrogen ions without reference to final acceptor <p>Neutral: oxygen is used in the Krebs cycle</p>																

Question	Marking Guidelines	Mark	Comments
5(a)(i)	So it/CO ₂ is not a <u>limiting</u> factor (on growth/photosynthesis);	1	Accept: CO ₂ is a <u>limiting</u> factor
5(a)(ii)	So any difference is due to <u>iron</u> (deficiency);	1	Accept: <u>iron</u> is the variable
5(a)(iii)	Amount of triose phosphate/TP will be similar/same/low (at start);	1	Accept: to allow triose phosphate to stabilise / become constant Reject: so all triose phosphate is used up Reject: so no triose phosphate
5(b)	<ol style="list-style-type: none"> 1. (Less) ATP produced; 2. (Less) reduced NADP produced; 3. ATP/reduced NADP produced during light-dependent reaction; 4. (Less) GP to triose phosphate/TP; 	4	Accept: alternatives for reduced NADP ie NADP with hydrogen/s attached
5(c)	<ol style="list-style-type: none"> 1. Less triose phosphate converted to RuBP; 2. CO₂ combines with RuBP; 	2	Accept: less triose phosphate so less RuBP

Question	Marking guidelines	Mark	Comments
6(a)	<ol style="list-style-type: none"> 1. No interbreeding / gene pools are separate / <u>geographic(al)</u> isolation; 2. Mutation; 3. Different selection pressures / different foods/niches/habitats; 4. Adapted organisms survive and breed / differential reproductive success; 5. Change/increase in allele frequency/frequencies; 	5	<p>Accept: all marks if answer written in context of producing increased diversity of plants</p> <ol style="list-style-type: none"> 1 Do not award this mark in context of new species being formed and then not interbreeding 1 Accept reproductive isolation as an alternative to no interbreeding 2 Accept: genetic variation 3 Accept: different environment / biotic/abiotic conditions or <u>named</u> condition 3 Neutral: different climates
6(b)	<p>Similar/same environmental/abiotic/biotic factors / similar/same selection pressures / no isolation / gene flow can occur (within a species);</p>	1	<p>Accept: same environment</p>

Question	Marking Guidelines	Mark	Comments
7(a)(i)	Reliable / representative / for statistical tests;	1	Accept: identify anomalies Neutral: accurate/valid/bias
7(a)(ii)	<ol style="list-style-type: none"> Find coordinates (on a grid) / split area into squares / number the sites; Method of generating/finding random numbers eg calculator/computer/random number generator/random numbers table; 	2	<ol style="list-style-type: none"> Ignore references to tape measures, metre rulers etc Accept: numbers out of a hat / use of dice
7(a)(iii)	<ol style="list-style-type: none"> Breeding (of lizards); Food source/prey; Predator; Variation in malarial infection; Temperature variation; Availability of water eg drought/'rainy season' 	2 max	Neutral: weather / climate / hurricanes / hibernation / migration / emigration / immigration
7(b)	<ol style="list-style-type: none"> Number in sample varies; Allow a (valid) comparison; 	2	
7(c)	<ol style="list-style-type: none"> (Overall) <u>positive correlation</u> (for either/both species); Reference to (site) 5 / 300 metres; Limited results for <i>A.wattsii</i> / small sample/number/percentage infected for <i>A.wattsii</i>; 	2 max	Neutral: only one study / no repeats
7(d)(i)	<ol style="list-style-type: none"> Fewer <i>A.wattsii</i> infected / more <i>A.gingivinus</i> infected; Higher number of <i>A.wattsii</i> present when higher percentage/number of <i>A.gingivinus</i> infected; No <i>A.wattsii</i> present when <i>A.gingivinus</i> has zero infection; 	2 max	

7(d)(ii)	<ol style="list-style-type: none"> 1. Reduced immunity / increased susceptibility to disease; 2. Reduced oxygen transport/uptake/respiration / reduced activity/movement; 	2	<ol style="list-style-type: none"> 1. Accept: idea that energy/ resources are used to combat malaria
7(d)(iii)	<ol style="list-style-type: none"> 1. There is a <u>probability</u> of less than 1% / 0.01; 2. That result(s)/correlation/it is due to chance; <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> 3. There is a <u>probability</u> of more than 99%/0.99; 4. That result(s)/correlation/it is not due to chance; 	2	<ol style="list-style-type: none"> 1. Reject: probability is/equal to 1%/0.01; 1. Reject 0.01%/5%/0.05/0.05% 2. Allow correct interpretation using above (incorrect) figures eg there is a probability of less than 5% that the results are due to chance =1 mark <p>Note: there is a probability of more than 5% that the results are due to chance =0 marks</p> <ol style="list-style-type: none"> 3. Reject: probability is/equal to 99%/0.99; 3. Reject 0.99%/95%/0.95/0.95 % 4. Allow correct interpretation of above figures ie 0.99%/95%/0.95/0.95 % but reject if less than

Question	Marking Guidelines	Mark	Comments
8(a)	<p>(Biological Agents)</p> <ol style="list-style-type: none"> 1. Only needs one application/ reproduces; 2. Specific; 3. Keeps/maintains low population; 4. Pests do not develop resistance; 5. Can use less chemicals / reduces chemical residues / no bioaccumulation; <p>(Chemical pesticides)</p> <ol style="list-style-type: none"> 6. Acts quickly; 7. Can apply to specific area; 8. Kills all/most/greater variety of pests; 	6 max	<p>Assume advantages are in context of correct type of control (chemical or biological) unless stated otherwise</p> <p>4. Reject reference to immunity</p>
8(b)	<ol style="list-style-type: none"> 1. Growth of algae/surface plants/algal bloom blocks light; 2. Reduced/no photosynthesis so (submerged) plants die; 3. <u>Saprobiotic</u> (microorganisms/bacteria); 4. Aerobically respire / use oxygen in respiration; 5. Less oxygen for fish to respire / aerobic organisms die; 	5	<p>3. Accept: Saprobiont/saprophyte/ saprotroph</p> <p>3. Neutral: decomposer</p>

<p>8(c)</p>	<ol style="list-style-type: none"> 1. Slaughtered when still growing/before maturity/while young so more energy transferred to biomass/tissue; 2. Fed on concentrate /controlled diet / so higher proportion of food absorbed/digested/assimilated / used for biomass/tissue / lower proportion lost in faeces; 3. Movement restricted so less heat/energy/respiratory loss; 4. Heating/Kept warm/ inside so less heat/energy/respiratory loss/maintain body temperature; 5. Genetically selected / selective breeding (for high productivity); 	<p>4 max</p>	<p>Q 1-4 The principle here is one mark for identifying a relevant point <u>and</u> offering an explanation</p> <ol style="list-style-type: none"> 2. Accept: named diets for controlled diet, eg high protein diet 2. Neutral: loss in excretion 2. Neutral: for growth <p>Neutral: reference to predators</p>
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