

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

Biology

BIOL4

(Specification 2410)

Unit 4: Populations and Environment

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from: aqa.org.uk

Copyright © 2013 AQA and its licensors. All rights reserved.

Copyright

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the school/college.

Set and published by the Assessment and Qualifications Alliance.

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. coulterii</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. coulterii</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 <u>and</u> 4 <u>and</u> 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	
----------	---	---	--

Question	Marking Guidelines	Mark	Comments																
4(a)	<table border="1" data-bbox="347 353 880 707"> <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																
Occurs in mitochondria		√	√																
Carbon dioxide produced		√	√																
NAD is reduced	√	√	√																
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	

<p>7(d)(ii)</p>	<ol style="list-style-type: none"> 1. Reduced immunity / increased susceptibility to disease; 2. Reduced oxygen transport/uptake/respiration / reduced activity/movement; 	<p>2</p>	<ol style="list-style-type: none"> 1. Accept: idea that energy/ resources are used to combat malaria
<p>7(d)(iii)</p>	<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; 	<p>2</p>	<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>
-------------	--	--------------	---