



**General Certificate of Education
June 2010**

Biology

BIOL4

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting 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 to download from the AQA Website: www.aqa.org.uk

Copyright © 2010 AQA and its licensors. All rights reserved.

COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres 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 centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

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/ $\text{NH}_3/\text{NH}_4^+$; | 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) | <p>The frequency/proportion of <u>alleles</u> (of a particular gene);</p> <p>Will stay constant from one generation to the next/over generations / no genetic change over time;</p> <p>Providing no mutation/no selection/population large/population genetically isolated/mating at random/no migration;</p> | 3 | <p>The three principles for marking are: What feature What happens to it Providing . . .</p> <p>Accept: genotype/explanation of genotype</p> <p>Accept: alternative wording, e.g. there is no gene flow/genetic drift for genetically isolated.</p> |
| 3 (b) | <p>White/deaf cats unlikely to survive/selected against;</p> <p>Will not pass on allele (for deafness/white fur) (to next generation)/will reduce frequency of allele;</p> | 2 | <p>Accept: alternative wording, e.g. have a disadvantageous phenotype</p> <p>Neutral: will not breed</p> |
| 3 (c) | In Paris/London frequencies (of these alleles) add up to more than 1; | 1 | <p>Can be shown by correct figures to be more than 1 e.g. $0.71 + 0.78 = 1.49$</p> <p>Accept: more than 100%</p> |
| 3 (d) | <p>Two marks for correct answer of 44(.22);;</p> <p>One mark for incorrect answer in which p/frequency of H determined as 0.67 and q/frequency of h as 0.33</p> <p>OR</p> <p>Answer given as 0.44(22);</p> | 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) | <p>Electrons transferred down electron transport chain;</p> <p>Provide energy to take protons/H⁺ into space between membranes;</p> <p>Protons/H⁺ pass back, through membrane/into matrix/through ATPase;</p> <p>Energy used to combine ADP and phosphate/to produce ATP;</p> | 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) | <p>Glucose is used/broken down during <u>glycolysis</u>;</p> <p>Breakdown of glucose/glycolysis in cytoplasm/not in mitochondria;</p> <p>Glucose cannot cross mitochondrial membrane/does not enter mitochondria;</p> | 2 max | <p>Accept: 'glucose is converted to pyruvate' for description of breakdown</p> <p>Accept: only pyruvate can</p> |
| 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 <u>dry</u> mass;; | 1 | Accept: <u>only</u> 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) | <ol style="list-style-type: none">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 | <p>Principle</p> <p>Use of data</p> <p>Accept: converse</p> <p>Accept: converse</p> <p>Accept if shown by figures</p> <p>Accept idea of disturbance/damage to niche/habitat</p> |
|------------|--|-------|---|

| Question | Marking guidance | Mark | Comments |
|----------|---|-------|--|
| 8 (a) | <ol style="list-style-type: none"> 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 | <p>Accept: converse of low in day</p> <p>Ignore references to rate of photosynthesis in day/night Accept day = light Must be a reference to plants or <u>all</u> organisms</p> <p>Do not allow converse for this point Accept description of compensation point</p> <p>Accept: converse of increase closer to ground</p> |
| 8 (b) | <ol style="list-style-type: none"> 1. Carbon dioxide combines with ribulose biphosphate/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 | <p>This mark scheme is based on specification content. Accept alternate names such as NADPH</p> <p>Credit relevant diagrams</p> <p>Accept: description of 'reduced'</p> |

| | | | |
|-------|--|-------|---|
| 8 (c) | <ol style="list-style-type: none">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 | <p>Accept saprophytes although not strictly correct.</p> <p>Accept: description of absorption</p> |
|-------|--|-------|---|