



# Mark Scheme (Results)

June 2011

GCE Biology (6BI04) Paper 01  
The Natural Environment and  
Species Survival

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June 2011

Publications Code UA027479

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## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

### Quality of Written Communication

- Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

## GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
Eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

### Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

### Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous  
e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not  
e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not  
e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not  
e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not
- candidates must make their meaning clear to the examiner to gain the mark.
- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark - irrelevant material should be ignored

Question Number	Answer	Mark
1(a)(i)	C ;	(1)

Question Number	Answer	Mark
1(a)(ii)	A ;	(1)

Question Number	Answer	Mark
1(a)(iii)	D ;	(1)

Question Number	Answer	Mark
1(b)(i)	<ol style="list-style-type: none"><li>1. reference to graph ;</li><li>2. line (graph) / eq ;</li><li>3. {Y / vertical} and {X / horizontal} axes correctly described. e.g. mass versus time / rate versus temperature ;</li><li>4. idea of using same scale for axes (for both plants) ;</li><li>5. idea of plotting each {temperature / species (plant)} separately ;</li></ol>	(3)

Question Number	Answer	Mark
1(b)(ii)	<ol style="list-style-type: none"> <li>1. idea of controlling a variable ;</li> <li>2. reference to {optimum / suitable / eq} temperature (for germination) ;</li> <li>3. idea of using {viable / live / eq} seedlings OR making sure that seeds {germinate / eq} ;</li> <li>4. reference to validity of the investigation ;</li> </ol>	(2)

Question Number	Answer	Mark
1(b)(iii)	<ol style="list-style-type: none"> <li>1. sea plantain / <i>Plantago maritima</i> / <i>Plantago</i> ;</li> </ol> <p>Any three from:</p> <ol style="list-style-type: none"> <li>2. idea of different latitudes have different (mean) temperatures ;</li> <li>3. {sea plantain / <i>Plantago maritima</i> / <i>Plantago</i>} grows {better / eq} at all (three) temperatures / eq ;</li> <li>4. {bog sedge / <i>Kobresia simpliciuscula</i> / <i>Kobresia</i>} does not grow very well at {lower temperatures / 10°C and 14°C} / eq ;</li> <li>5. credit appropriate comparative manipulated figures ;</li> </ol>	(4)

Question Number	Answer	Mark
2(a)(i)	<ol style="list-style-type: none"> <li>1. reference to {metabolism / named example / eq} {stops / is slow / eq} ;</li> </ol> <p>(below 0°C)</p> <ol style="list-style-type: none"> <li>2. enzymes are inactive / cells disrupted / eq ;</li> </ol> <ol style="list-style-type: none"> <li>3. reference to cause of {inactivity / cell disruption} e.g. water freezes, lower kinetic energy ;</li> </ol> <p>(above 40°C)</p> <ol style="list-style-type: none"> <li>4. enzymes {denature / change 3D shape / eq} ;</li> <li>5. reference to consequences of denaturation e.g. fewer enzyme-substrate complexes possible, change in active site, change in bonding ;</li> </ol>	(2)

Question Number	Answer	Mark
2(a)(ii)	<ol style="list-style-type: none"> <li>1. (carbon dioxide and / or methane) are greenhouse gases / eq ;</li> <li>2. which {absorb / trap / eq} {heat / infra red / IR / long wave} (radiation) / eq ;</li> <li>3. {reflected / (re)radiated} from the Earth's surface / eq ;</li> <li>4. prevent {heat / infra red / IR / long wave / eq} (radiation) escaping ;</li> <li>5. idea of temperatures maintained higher (than they would be) ;</li> </ol>	(3)

Question Number	Answer	Mark															
2(a)(iii)	<table border="1"><thead><tr><th data-bbox="371 297 692 398">Technique</th><th data-bbox="692 297 914 398">Could provide evidence</th><th data-bbox="914 297 1171 398">Would not provide evidence</th></tr></thead><tbody><tr><td data-bbox="371 398 692 470">Amniocentesis</td><td data-bbox="692 398 914 470"></td><td data-bbox="914 398 1171 470">✓</td></tr><tr><td data-bbox="371 470 692 539">Dendrochronology</td><td data-bbox="692 470 914 539">✓</td><td data-bbox="914 470 1171 539"></td></tr><tr><td data-bbox="371 539 692 640">Peat-bog pollen analysis</td><td data-bbox="692 539 914 640">✓</td><td data-bbox="914 539 1171 640"></td></tr><tr><td data-bbox="371 640 692 741">Potassium-argon dating</td><td data-bbox="692 640 914 741"></td><td data-bbox="914 640 1171 741">✓</td></tr></tbody></table>	Technique	Could provide evidence	Would not provide evidence	Amniocentesis		✓	Dendrochronology	✓		Peat-bog pollen analysis	✓		Potassium-argon dating		✓	(2)
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Dendrochronology	✓																
Peat-bog pollen analysis	✓																
Potassium-argon dating		✓															



Question Number	Answer	Mark
* 2(b) QWC	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> <li>1. carbon dioxide produced {by using / in production of / eq} fossil fuels / eq ;</li> <li>2. no (direct) evidence that increased carbon dioxide leads to global warming / eq ;</li> <li>3. reference to carbon dioxide released from {other processes / named process} ;</li> <li>4. idea of removal of {carbon sinks / named example / eq} (also) leads to increase in carbon dioxide ;</li> <li>5. stated example of any other greenhouse gas released from another source e.g. CFC, water vapour, methane ;</li> <li>6. description of source e.g. ruminant animals, paddy fields, melting ice, clearance of peat land ;</li> <li>7. idea of natural {cycles / events / phenomena / eq} may be involved (in global warming) e.g. solar, volcanoes ;</li> <li>8. idea of evidence from past is being used ;</li> <li>9. idea of {(past evidence) is not in indicator of future events / limitations of (climatic) models} ;</li> <li>10. idea that scientists may be biased ;</li> <li>11. description of bias e.g. employed by {company / country} with vested interest, self promotion ;</li> <li>12. specific example of problem with / disadvantage of} alternative source of energy ;</li> </ol>	(6)

Question Number	Answer	Mark
3(a)	B ;	(1)

Question Number	Answer	Mark
3(b)	D ;	(1)

Question Number	Answer	Mark
*3(c) QWC	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <p>succession described:</p> <ol style="list-style-type: none"> <li>1. reference to lichens and mosses as <u>pioneer</u> community ;</li> <li>2. able to grow in {little / no} soil / eq ;</li> <li>3. (that) breaks up (rock) fragments / forms {thin / shallow / eq} soil;</li> <li>4. reference to {plants / eq} with {small / short / eq} roots ;</li> <li>5. (able to) grow in {thin / shallow / eq} soil / eq ;</li> <li>6. idea that changes in soil structure enable {trees / shrubs} to grow / eq ;</li> </ol> <p>general points:</p> <ol style="list-style-type: none"> <li>7. reference to soil able to {hold / retain / contain / eq} {water / minerals} ;</li> <li>8. as plants {lose leaves / die / decay / eq} ;</li> <li>9. reference to {organic matter / humus / eq} {increases / released / eq} ;</li> <li>10. reference to competition effects ;</li> </ol>	(5)

Question Number	Answer	Mark
3 (d)	<p>1. climax (community) ;</p> <p>Any three from:</p> <p>2. includes (both) animals and plants / has many species / has high biodiversity / eq ;</p> <p>3. reference to {interaction / eq} between species / eq ;</p> <p>4. idea of balanced equilibrium of species ;</p> <p>5. reference to {dominant / codominant} (plant or animal) species ;</p> <p>6. reference to stable if no {change to environment / human influence} ;</p>	(4)

Question Number	Answer	Mark
4(a)	<ol style="list-style-type: none"><li>1. fibrous - long / linear / straight (chains), globular - compact / spherical / eq ;</li><li>2. globular are folded and fibrous are not / eq ;</li><li>3. globular are soluble and fibrous are not / eq ;</li><li>4. fibrous -involved in {structural / eq} and globular are not ;</li><li>5. globular - involved in {catalysis / metabolism / eq} and fibrous are not ;</li></ol>	(2)

Question Number	Answer	Mark
4(b)(i)	C ;	(1)

Question Number	Answer	Mark
4(b)(ii)	<p>Any two from:</p> <ol style="list-style-type: none"><li>1. physical damage / eq ;</li><li>2. immersion in water / eq ;</li><li>3. (external) temperature / eq ;</li><li>4. burning / eq ;</li><li>5. electrocution / eq ;</li><li>6. reference to {clothing / eq} ;</li><li>7. wind / air movements / eq ;</li></ol>	(2)

Question Number	Answer	Mark
4(c)	<ol style="list-style-type: none"><li>1. reference to not {all / both / eq} muscles {contract / relax / reach (full) rigor / eq} at same {time / rate / eq} ;</li><li>2. idea of jaw muscle contracting before leg muscle / eq ;</li><li>3. idea of jaw muscle reaches {full contraction / rigor} before leg muscle / eq ;</li><li>4. jaw starts contraction {0.5 / 0.8 / 0.9} hours before leg OR jaw reaches (full) rigor 2.5 hours before leg ;</li><li>5. reference to {full contraction / rigor} in muscle does not last very long ;</li><li>6. idea of leg is still contracting while jaw is relaxing / eq ;</li></ol>	(4)

Question Number	Answer	Mark
5(a)(i)	<ol style="list-style-type: none"> <li>1. {competition / eq} for nutrients ;</li> <li>2. {competition / eq} for space ;</li> <li>3. {secretion / eq} {chemicals / substances / lysozyme / eq} OR affects {pH / eq} ;</li> <li>4. {stimulation / eq} of (skin) immune system / eq ;</li> </ol>	(2)

Question Number	Answer	Mark
5(a)(ii)	A ;	(1)

Question Number	Answer	Mark
5(b)	<ol style="list-style-type: none"> <li>1. idea that influenza may allow development of other diseases e.g. opportunistic infections ;</li> <li>2. antibiotics will {kill / inhibit growth of / eq} bacteria ;</li> </ol>	(2)

Question Number	Answer	Mark
5(c)(i)	<p>correct answer 37.2 / 37.17 / 37 (%) gains 2 marks</p> <ol style="list-style-type: none"> <li>1. <math>(226 - 142) / 84</math> ;</li> <li>2. <math>\div 226</math> to give 37.2 / 37.17 / 37 (%) ;</li> </ol>	(2)

Question Number	Answer	Mark
5(c)(ii)	<ol style="list-style-type: none"><li>1. yes ;</li><li>2. idea that if current rate continues / eq ;</li><li>3. idea of achieving lower than the target / eq;</li><li>4. credit use of supporting figures ;</li></ol>	(3)

Question Number	Answer	Mark
5(c)(iii)	<ol style="list-style-type: none"><li>1. reference to some bacteria {can resist / are resistant to} antibiotics ;</li><li>2. idea of {resistance being genetic / can be passed on} ;</li><li>3. reference to MRSA / other named example ;</li></ol>	(2)

Question Number	Answer	Mark
6(a)(i)	C ;	(1)

Question Number	Answer	Mark
6(a)(ii)	D;	(1)

Question Number	Answer	Mark
6(a)(iii)	D ;	(1)

Question Number	Answer	Mark
6(b)(i)	<ol style="list-style-type: none"><li>1. humans more closely related to chimp (than to orang utan and gorilla) / eq ;</li><li>2. reference to humans and chimps more closely related to orang utan than gorilla ;</li><li>3. reference to similarity of sequence indicates closeness of ancestral relationship / eq ;</li><li>4. human and chimp sequence identical / eq ;</li><li>5. orang utan has one difference, gorilla has two differences / eq ;</li><li>6. reference to {number 19 for orang utan / number 9 and 19 for gorilla} different ;</li></ol>	(4)



Question Number	Answer	Mark
6(b)(ii)	<ol style="list-style-type: none"><li>1. reference to similarity (of DNA) indicates closeness of relationship ;</li><li>2. because genes are sections of DNA / eq ;</li><li>3. genes are the codes for protein / eq ;</li></ol>	(2)

Question Number	Answer	Mark
6(b)(iii)	<ol style="list-style-type: none"><li>1. reference to source of DNA sample, e.g. blood, saliva, semen ;</li><li>2. reference to small samples of DNA can be amplified by PCR ;</li><li>3. reference to use of (restriction / eq) enzymes to {break / eq} DNA ;</li><li>4. reference to use of {electro potential / potential difference / eq} ;</li><li>5. reference to {treatment / staining / eq} ;</li><li>6. show up as {bands / bars / eq} ;</li><li>7. reference to the {number of bands / eq} that match indicates similarity of the DNA ;</li></ol>	(3)

Question Number	Answer	Mark
7(a)(i)	<ol style="list-style-type: none"> <li>drawing mark - recognisable {granum / grana} with clear stacks (of thylakoids / eq) shown / eq;</li> <li>label mark - {granum / grana / thylakoids} labelled / eq ;</li> </ol>	(2)

Question Number	Answer	Mark									
7(a)(ii)	<table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>Electrons in chlorophyll are excited as light energy is absorbed</td> <td>✓</td> <td></td> </tr> <tr> <td>The energy absorbed by chlorophyll is used to generate ADP and NADP</td> <td></td> <td>✓</td> </tr> </tbody> </table> <p>1 mark each correct row ; ;</p>	Statement	True	False	Electrons in chlorophyll are excited as light energy is absorbed	✓		The energy absorbed by chlorophyll is used to generate ADP and NADP		✓	(2)
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7(a)(iii)	<ol style="list-style-type: none"> <li>reference to energy from light ;</li> <li>reference to photolysis ;</li> <li>of water ;</li> </ol>	(2)

Question Number	Answer	Mark															
7(b)(i)	<table border="1"> <thead> <tr> <th data-bbox="421 295 715 360">Position on shore</th> <th data-bbox="715 295 948 360"><i>Ulva lactuca</i></th> <th data-bbox="948 295 1209 360"><i>Schizymenia dubyi</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="421 360 715 434">Top of the shore</td> <td data-bbox="715 360 948 434" style="text-align: center;">✓</td> <td data-bbox="948 360 1209 434"></td> </tr> <tr> <td data-bbox="421 434 715 508">Middle of the shore</td> <td data-bbox="715 434 948 508"></td> <td data-bbox="948 434 1209 508"></td> </tr> <tr> <td data-bbox="421 508 715 607">Lower down the shore</td> <td data-bbox="715 508 948 607"></td> <td data-bbox="948 508 1209 607"></td> </tr> <tr> <td data-bbox="421 607 715 678">All regions</td> <td data-bbox="715 607 948 678"></td> <td data-bbox="948 607 1209 678" style="text-align: center;">✓</td> </tr> </tbody> </table>	Position on shore	<i>Ulva lactuca</i>	<i>Schizymenia dubyi</i>	Top of the shore	✓		Middle of the shore			Lower down the shore			All regions		✓	
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Question Number	Answer	Mark
7(b)(ii)	<p>general points:</p> <ol style="list-style-type: none"><li>1. idea of (rate of) growth is linked to (rate of) photosynthesis ;</li><li>2. idea of top of the shore is shallower water where most wavelengths are available / lower shore is deeper water where only green (and blue) available ;</li><li>3. idea that red weeds {reflect / do not absorb} red light OR green weeds {reflect / do not absorb} green light ;</li></ol> <p><i>Ulva lactuca</i> / green seaweed:</p> <ol style="list-style-type: none"><li>4. high(est) rates in {red / blue} light / eq / {very low / lowest} in green light ;</li><li>5. would grow well if {all / (blue and) red} light available ;</li></ol> <p><i>Schizymenia dubyi</i> / red seaweed:</p> <ol style="list-style-type: none"><li>6. high(est) rate in green light / eq ;</li><li>7. can grow where only green light available / any light available / eq ;</li></ol>	(4)

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8(a)	<table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>HIV infects b-lymphocytes in the human immune system</td> <td></td> <td>✓</td> </tr> <tr> <td>The genetic material in HIV is a form of RNA</td> <td>✓</td> <td></td> </tr> <tr> <td>The enzyme, reverse transcriptase, is used by HIV</td> <td>✓</td> <td></td> </tr> </tbody> </table> <p>1 mark each correct row ;;;</p>	Statement	True	False	HIV infects b-lymphocytes in the human immune system		✓	The genetic material in HIV is a form of RNA	✓		The enzyme, reverse transcriptase, is used by HIV	✓		(3)
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Question Number	Answer	Mark
8(b)(i)	<ol style="list-style-type: none"> <li>1. change in the {nucleotides / bases} / eq ;</li> <li>2. in {RNA / DNA} / eq ;</li> <li>3. which leads to change in the {sequence / eq} of amino acids in (primary structure of) a {polypeptide / protein} / eq ;</li> </ol>	(2)

Question Number	Answer	Mark
8(b)(ii)	<ol style="list-style-type: none"><li>1. idea that HIV has {many / variety of / new / eq} {strains / types / antigens / protein coats / eq} (in infected person) ;</li><li>2. some strains {are / become} resistant to {an individual / a specific / a particular / eq} drug / eq ;</li><li>3. these would survive if (only one drug used) / eq ;</li><li>4. {mixture of drugs / eq } has more chance of getting rid of {all / more} (strains / types / eq) / eq ;</li><li>5. reference to drugs used together because of mutation ;</li><li>6. reference to rapid rate of mutation ;</li><li>7. reference to rapid rate of {multiplication / eq} of virus ;</li></ol>	(4)

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