

Mark Scheme (Results)

Summer 2014

GCE Biology (6BI04)
Paper 01R

Unit 4: Natural environment

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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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
 - ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
 - iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.

() means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.

ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

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.

Question Number	Answer	Mark
1(a)(i)	C reduced NADP	(1) COMP

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. ADP / adenosine diphosphate ; 2. PO_4^{3-} / phosphate ;	ACCEPT either way round 2. ACCEPT Pi / inorganic P	(2) GRAD

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	1. molecule Q is {oxygen / O_2 }; 2. made from water / H_2O ; 3. idea of {photolysis / light splitting the water molecule / eq} ; 4. into {O / (atom of) oxygen} (and H^+ and electrons) ; 5. idea that two water molecules are needed to form one molecule of oxygen ; 6. in chloroplast ;	1. reject O , $1/2 \text{O}_2$ 4. ACCEPT $\text{H}_2\text{O} \rightarrow 1/2 \text{O}_2 + 2\text{H}^+$	(4) EXP

Question Number	Answer	Mark
1(b)(i)	A granum	(1) COMP

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. (image length) 76 / 76.5 / 77 (mm) / eq ; 2. image length / 0.007 ; 3. (76) 10857.14286 / eq (76.5) 10928.57143 / eq (77) 11000 / eq	2. CE applies 3. CE applies	(3) EXP

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	1. idea of compartmentalisation (from cytoplasm); 2. thylakoid (membranes) are site of {light-dependent reaction / photophosphorylation / chemiosmosis} ; 3. credit named molecules {within / on / eq} membrane ; of idea of { / eq } in (thylakoid) membranes ; 4. idea that (thylakoid) membranes provide a space for accumulation of H ⁺ ; 5. stroma is site of {light-independent reaction / Calvin cycle / carcon fixation} ; 6. reference to {RuBP / RUBISCO / eq} ;	1. ACCEPT description of separation 3. e.g. chlorophyll / carotenoids / photosystems / electron carrier proteins / ATP synthetase / NADP reductase	(3) EXP

Question Number	Answer	Additional Guidance	Mark
2(a)	<ol style="list-style-type: none"> 1. proteins consist of amino acids joined together by peptide bonds; 2. credit reference to named bonds (between R groups) involved in holding { 3D structure / eq} ; 3. carbohydrates consist of { monosaccharides / glucoses / eq} ; 4. reference to glycosidic { bonds / eq} between (adjacent) { glucose / eq} molecules ; 		(3) EXP

Question Number	Answer	Additional Guidance	Mark
2(b)	<ol style="list-style-type: none"> 1. idea that the drugs could { bind to / alter shape of} { glycoproteins / gp120} ; 2. idea that drugs bind to { receptors / antigens} on membrane / eq ; 3. called CD4 (antigen / molecules) ; 4. preventing virus attaching to T (helper / CD4⁺) cells / eq ; 		(3) EXP

Question Number	Answer	Additional Guidance	Mark
*2(c)	<ol style="list-style-type: none"> 1. reference to reverse transcriptase ; 2. idea of formation of (viral) DNA ; 3. from (viral) RNA ; 4. reference to integrase ; 5. idea of integration of (viral) DNA into (host) DNA ; 6. idea that {T helper cells / eq} would be {destroyed / killed / burst / eq} (by virus particles leaving cell) ; 7. idea that more T (helper) cells would become infected ; 	<p>QWC focussing on clarity of expression</p> <ol style="list-style-type: none"> 2. reject idea that RNA is {turned into / converted into} DNA 5. ACCEPT idea of {latency / formation of provirus / eq} 	(5) EXP

Question Number	Answer		Mark
3(a)	<ol style="list-style-type: none"> 1. {scientific / peer reviewed} {papers / journals / magazines / article} ; 2. (scientific) {conferences / lecture / forums} ; 3. media reports ; 	<ol style="list-style-type: none"> 3. e.g. TV, radio. newspaper ' internet 	(2) GRAD

Question Number	Answer	Additional Guidance	Mark
*3(b)(i)	<p>1. idea of using <i>proteomics</i> (to study protein);</p> <p>Any 5 from :</p> <p>2. idea of using DNA {<i>profiling / fingerprinting</i>} (to study DNA) ;</p> <p>3. idea of obtaining {<i>tissue / cell</i>} sample from tomcod ;</p> <p>4. multiple copies of DNA made / eq ;</p> <p>5. using {PCR / <i>polymerase chain reaction</i>} ;</p> <p>6. ref to <i>restriction</i> {<i>enzymes / endonucleases</i>} to produce DNA {<i>fragments / eq</i>} ;</p> <p>7. reference to (<i>gel</i>) <i>electrophoresis</i> ;</p> <p>8. idea of {loading / eq} the DNA onto the { / <i>named gel</i>} ;</p> <p>9. idea that an {<i>electric current / charge</i>} is applied ;</p> <p>10. reference to use of {<i>dye / fluorescent staining / UV light / Southern blotting / gene probes / radioactive labelling / eq</i>} ;</p>	<p>QWC focussing on spelling</p> <p>4. IGNORE refs to amplification, large amounts</p> <p>8. e.g. <i>agarose, agar</i></p> <p>9. ACCEPT apply <i>potential difference</i></p>	<p>(6) EXP</p>

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	1. same number of chromosomes ; 2. idea that the mutation affected the sequence of DNA ; OR 3. idea that (all / most of) the {bands / eq} are the same (size / position / width) ; 4. idea that only {a small region of DNA / the AHR2 gene} is affected ;	1. ACCEPT both contain AHR2 gene	(2) EXP

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	1. a protein with a different {structure / amino acids / function} / eq ; 2. idea that the mutation will affect the DNA ;	1. ACCEPT two AAs missing 2. e.g. two codons missing	(2) EXP

Question Number	Answer	Additional Guidance	Mark
4(a)	<ol style="list-style-type: none"> 1. prevents viruses attaching to {uninfected / eq} host cells / eq ; 2. by binding to receptors / eq ; 3. (therefore) preventing virus from entering cell / eq ; 4. (therefore) viruses cannot replicate and infect more cells / eq ; 		(2) EXP

Question Number	Answer	Additional Guidance	Mark
4(b)	<ol style="list-style-type: none"> 1. idea that macrophages present antigen to T {helper / CD4} cells ; 2. idea that T helper cells are needed to activate {T killer / B} cells ; 3. idea of B cell acting as an antigen-presenting cell (to self) ; 4. idea that B cells {result in / eq} plasma cells that {produce / eq} antibody ; 5. idea of infected (host) cell presenting antigen to T killer cells ; 6. idea that T killer cells destroy infected host cells / eq ; 	<ol style="list-style-type: none"> 1. ACCEPT dendritic cells / Langerhans cells IGNORE Phagocytes 6. ACCEPT APC if referring to infected host cell 	(4) EXP

Question Number	Answer	Additional Guidance	Mark
4(c)	<ol style="list-style-type: none"> 1. idea that a mutation has occurred (in the nucleic acid) ; 2. idea of a change in {antigens / protein} (on the virus surface) ; 3. idea that a secondary immune response will not be possible ; 4. idea that memory cells will not recognise the (new) antigen ; 5. idea that another (primary) immune response needed e.g. (new) antigen needs to be presented ; 		(3) EXP

Question Number	Answer	Mark
5(a)	B 2	(1) COMP

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	<ol style="list-style-type: none"> 1. (only) contain hydrogen, carbon and oxygen ; 2. reference to fatty acids and glycerol {joined by / eq} ester{bonds / eq} ; 3. idea of saturated and unsaturated (fatty acids / 		(2) GRAD

	lipids);		
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Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	<ol style="list-style-type: none"> 1. uses less fertiliser / eq ; 2. idea of not using more pesticides / eq ; 3. idea that greenhouse gas emissions are not that different ; 4. credit manipulation of figures to support marking point 3 ; 	<p>1. & 2. IGNORE comparisons between the different crops</p> <p>3. ACCEPT less than corn but more than sugar cane</p>	(3)EXP

Question Number	Answer	Additional Guidance	Mark
5(b)(iii)	<ol style="list-style-type: none"> 1. credit three correctly named ions ; 2. nitrates for {protein / amino acids / nucleic acids / named nucleic acid} ; 3. proteins used for growth ; 4. calcium ions for {other nutrients uptake / promotes cell elongation / strengthen cell walls / enzyme function / protection against heat stress / protection against diseases / eq} ; 5. magnesium ions for chlorophyll production ; 6. for photosynthesis ; 	<p>1. e.g. nitrates, calcium ions, magnesium ions, sulphates, potassium ions, phosphates</p> <p>ACCEPT</p> <p>Sulphates for amino acids</p> <p>Potassium ions for stomata function</p>	(4)EXP

Question Number	Answer	Additional Guidance	Mark
6(a)	idea of a series of changes (that occur to the composition of species in the community) of organisms (present in an area) over a period of time ;		(1) GRAD

Question Number	Answer	Additional Guidance	Mark
6(b)	<p>Five years before:</p> <ol style="list-style-type: none"> 1. idea that there are more { algae / lichens / mosses } present ; 2. because these are { simpler organisms / early colonisers / pioneer species / eq } ; 3. less <i>H. pebloides</i> present / eq ; 4. because recently colonised area / eq ; <p style="text-align: right;">max 3 marks</p> <p>Five years after:</p> <ol style="list-style-type: none"> 5. more <i>H. pebloides</i> present / eq ; 6. because had a longer period of time to become established / eq ; 7. idea that { grasses / ferns / small shrubs / eq } present ; 8. because these are { higher organisms / next group of colonisers } / eq <p>OR</p> <p>idea of improvement in soil structure ;</p> <p style="text-align: right;">max 3 marks</p>	<ol style="list-style-type: none"> 1. ACCEPT no large plants 2. ACCEPT because only bare rock / don't need soil? 7. ACCEPT large plants 	(4) EXP

Question Number	Answer	Additional Guidance	Mark
6(c) (i)	<ol style="list-style-type: none"> 1. idea of measuring off two areas of the same size ; 2. use of a { quadrat / eq } ; 3. use of random { coordinates / sampling / eq } ; 4. method of generating random coordinates ; 5. description of estimate of abundance e.g. number of plants, percentage cover 6. indication that several sample sites used ; 7. appropriate method of recording quantitative data ; 	7. e.g. tally chart, table, graph	(4)EXP

Question Number	Answer	Additional Guidance	Mark
6(c) (ii)	<ol style="list-style-type: none"> 1. idea of { using a moisture probe / drying out soil samples / eq } ; 2. idea of testing soil around plants ; <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> 3. idea of using rain gauge / eq ; 4. idea of collecting water over a period of time ; 		(2)GRAD

Question Number	Answer	Additional Guidance	Mark
6(d)	<ol style="list-style-type: none">1. idea that birds brought seeds with them ;2. idea of bird droppings ;3. adding nutrients to soil / eq ;4. (therefore) supporting growth of {more / different} plants ;5. idea that faeces will help maintain soil structure ;		(2)EXP

Question Number	Answer	Mark
7(a)	A active artificial	(1)COMP

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	<ol style="list-style-type: none"> 1. antibodies appear (in blood) {immediately / on day 0 / eq} in group B but {on day 4 / after 3 days} in group A ; 2. antibodies reach higher levels in group B / eq ; 3. credit comparative manipulated data ; 		(2)EXP

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	<ol style="list-style-type: none"> 1. antibodies present from the first vaccination / eq ; 2. idea of a secondary immune response ; 3. memory cells already present / eq ; 4. due to first vaccination / eq ; 5. memory cells mean that {antibodies produced immediately} / eq ; 6. on exposure to (same) antigen / eq ; 		(3)EXP

Question Number	Answer	Additional Guidance	Mark
7(c)	1. idea that the virus will be destroyed quicker ; 2. {more / wider range of} memory cells present ; 3. so {higher levels / faster production} of antibodies ;		(2)EXP

Question Number	Answer	Additional Guidance	Mark
7(d)	<p>Comparisons of groups A and B</p> 1. not very reliable as sample size is small / eq ; 2. data for first 15 days after vaccination are reliable as error bars do not overlap ; 3. data for 30 and 60 days not reliable as error bars overlap ;		
	<p>Comparisons within either of the groups</p> 4. there may be no change in the first fifteen days ;		(3)EXP

Question Number	Answer	Mark
8(a)	A bacteria and fungi	(1)COMP

Question Number	Answer	Mark
8(b)(i)	A none	(1)COMP

Question Number	Answer	Mark
8(b)(ii)	D validity	(1)COMP

Question Number	Answer	Additional Guidance	Mark
8(b)(iii)	<ol style="list-style-type: none"> 1. ref to hydrolysis ; 2. by {enzymes / cellulase} / eq ; 3. produced by microorganisms / eq ; 4. into(β) glucose ; 5. uptake of glucose into microorganisms / eq ; 6. idea that glucose is used in {respiration / fermentation} ; 7. releasing carbon dioxide into the atmosphere / eq ; 8. idea that some of glucose (solution) soaks into ground ; 		(4)EXP

Question Number	Answer	Additional Guidance	Mark
8(b)(iv)	<ol style="list-style-type: none"> 1. to make investigation valid ; 2. idea that {temperature / heat energy} affects {rate of enzyme reactions / enzyme activity / rate of decomposition} ; 3. increase in {heat / kinetic} energy results in more {collisions / energetic collision / enzyme-substrate complexes / eq} ; 4. idea that high temperature results in enzyme {denaturing / becoming denatured} ; 5. (so) decomposition would stop / eq ; 	4. ACCEPT bacteria killed / eq	(4)EXP

Ofqual




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