



Mark Scheme (Results)

Summer 2014

IAL Biology (WBI04)
Paper 01

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	Additional guidance	Mark
1(a)	<ol style="list-style-type: none"> 1. (GALP formed) in the Calvin cycle ; 2. carbon fixation / carbon dioxide {reacting with / binding to / eq} RuBP ; 3. to form {GP / glycerate 3-phosphate / eq} / eq ; 4. reference to RUBISCO as an {enzyme / catalyst} (in carbon fixation) ; 5. formation of {GALP / glyceraldehyde 3-phosphate / eq} from GP / eq ; 6. using ATP AND {reduced NADP / NADPH} (in conversion to GALP) ; 	<p>ACCEPT triose phosphate for GALP</p> <p>2. ACCEPT formation of 6C intermediate from RuBP</p> <p>4. ACCEPT catalyses ACCEPT ribulose biphosphate carboxylase</p> <p>5. ACCEPT reduced to NB award formation of GALP from reaction between carbon dioxide and RuBP if mp 3 not awarded</p>	(4)

Question Number	Answer	Additional guidance	Mark
1(b)	<ol style="list-style-type: none"> 1. DNA is {a polynucleotide / made of many nucleotides} ; 2. idea that (mono)nucleotides (in a strand) are joined by {phosphodiester bonds / eq} ; 3. idea that strands are anti-parallel to each other ; 4. hydrogen bonds between complementary bases (holding strands together) ; 5. idea of double helix ; 	<ol style="list-style-type: none"> 2. ACCEPT joined by bonds between pentose and phosphate 4. ACCEPT between adenine and thymine, cytosine and guanine (A and T, G and C) 5. e.g. 2 strands twisted together 	(4)

Question Number	Answer	Additional guidance	Mark
1(c)	<ol style="list-style-type: none"> 1. GALP {converted / eq} to glucose ; 2. {conversion of glucose / eq} to deoxyribose (sugar) ; 3. {glucose used in / eq} respiration ; 4. credit use of ATP (from respiration) in a named process ; 5. idea that GALP is used in synthesis of bases / eq ; 6. idea of use of nitrates (and GALP) in synthesis of (DNA){bases / named (DNA) base} ; 7. idea of synthesis of AAs for enzymes (involved in DNA synthesis) ; 	<ol style="list-style-type: none"> 1. ACCEPT hexose IGNORE sugar 2. ACCEPT sucrose ACCEPT GALP to deoxyribose if mp 1 not awarded 4. e.g. active transport, DNA synthesis ; 5. ACCEPT named base 	(3)

Question Number	Answer	Mark
2(a)(i)	C reliable	(1)

Question Number	Answer	Mark
2(a)(ii)	D valid	(1)


Question Number	Answer	Additional guidance	Mark
2(b)(i)	<ol style="list-style-type: none"> 1. idea that the diameter of the Sitka spruce was similar to the silver fir ; 2. idea that the seedlings were the tallest ; 3. idea that the most seedlings survived ; 	NB 'they' implies Sitka spruce throughout 1. ACCEPT only 0.04 smaller IGNORE second highest	(3)

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	<ol style="list-style-type: none"> 1. {competition for / lack of} space; 2. {competition for / lack of / too much} water (in soil) ; 3. {competition for / lack of} {mineral (ions) / named mineral ion} ; 4. idea that the soil is the wrong pH ; 5. {parasites / disease / eq} ; 6. idea of being eaten e.g. grazing, herbivores ; 7. {wrong / unsuitable} temperature / eq ; 8. idea that they have a slower growth rate ; 	<ol style="list-style-type: none"> 2. IGNORE rainfall 3. IGNORE food / nutrients 4. ACCEPT not the optimum pH 6. NOT predators 7. ACCEPT not the optimum temperature, too high, too low 	(2)

Question Number	Answer	Additional guidance	Mark
2(c)	1. idea of {planting seeds / measuring parameter of seedlings} ; 2. idea of growing seedlings for a set period of time ; 3. idea of measuring seedlings at end of growth period ; 4. {range of / 5 stated} light intensities used / eq ; 5. idea of {using several seedlings / repeats} ; 6. idea of calculating the mean ; 7. credit appropriate named control variable ;	1. ACCEPT appropriate measurement e.g. % germination, diameter, height, mass IGNORE age, dry mass, dry biomass 3. IGNORE dry mass, dry biomass 5. ACCEPT at least 3 6. ACCEPT average 7. e.g. temperature, pH, soil , CO ₂ concentration, minerals , water availability, same seed source, age	(4)

Question Number	Answer	Mark
3(a)	A dendrochronology	(1)

Question Number	Answer	Additional guidance	Mark
3(b)	To prevent {decomposition / infection / loss of sap / loss of water / eq} ;	ACCEPT prevent entry of insects / pathogens / animals / organisms / parasites	(1)

Question Number	Answer	Additional guidance	Mark
3(c) (i)		This bar can be indicated by shading, just a line, an M written inside, circled that does not include the whole of a bar on either side	(1)

Question Number	Answer	Mark
3(c) (ii)	B 30	(1)

Question Number	Answer	Additional guidance	Mark
3(d)	1. idea that an increase in temperature increases { ring thickness / (tree ring) growth } ; 2. enzymes work faster (with higher temperature) / eq ; 3. photosynthesis is faster (with higher temperature) / eq ; 4. idea that more {material / eq} laid down in the tree trunks ; 5. idea that above a certain temperature rate of {enzyme activity / photosynthesis / biomass production / NPP / eq } decreases ; 6. idea that at higher temperatures {enzymes denature / tree dies / lack of water / eq} ; 7. idea of a longer growing season ;	1. NOT increase number of rings 4. e.g. biomass , organic compounds 6. NOT start to denature	(4)

Question Number	Answer	Additional guidance	Mark
3(e)	<ol style="list-style-type: none">1. idea that tree ring growth and global warming is a correlation ;2. reference to no {proof / evidence} of causation ;3. idea that there are other (environmental) {factors / named factor / eq} that affect growth (besides temperature) ;	<ol style="list-style-type: none">2. ACCEPT no {evidence / proof} that global warming affects tree growth3. e.g. water availability / disease / pH	(3)

Question Number	Answer	Additional guidance	Mark
*4(a)	<p>(QWC - spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. reference to { bacteria / fungi} ; 2. idea that enzymes are involved (in decomposition) ; 3. idea that enzymes are secreted (onto organic matter) ; 4. credit appropriate named enzyme ; 5. credit named organic molecule ; 6. decomposition produces { monomers / appropriate named monomer} ; 7. credit appropriate named bond that is broken ; 8. that {are soluble / dissolve} ; 9. idea that some (soluble) molecules are {taken up / used / eq} by microorganisms ; 	<p>QWC emphasis on clarity of expression</p> <ol style="list-style-type: none"> 3. ACCEPT extracellular digestion / saprophytes 4. e.g. hydrolases, protease 5. e.g. protein, lipid, polysaccharide ; 6. e.g. amino acids 7. e.g. peptide bond 9. IGNORE idea of microorganisms feeding ACCEPT soak into the ground 	(6)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	<ol style="list-style-type: none"> 1. idea that pH affects {enzymes / proteins} ; 2. idea that the shape of active site is altered due to ionisation of the R groups ; 3. credit an appropriate process in the bacteria that would be affected ; 4. idea that pH may affect {cell wall structure / membrane structure / nutrient availability / eq} ; 	<ol style="list-style-type: none"> 1. ACCEPT denatured NOT killed 3. e.g. respiration, metabolism IGNORE growth 	(3)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	<ol style="list-style-type: none"> 1. idea that the pH of vinegar is not in the pH range for these bacteria ; 2. idea that vinegar will {denature the enzymes / kill the bacteria / bacteria cannot replicate / eq} ; 3. (therefore) decomposition will not take place / eq ; 	<ol style="list-style-type: none"> 2. ACCEPT bacteria cannot survive in the vinegar 3. ACCEPT food will not spoil IGNORE preservation 	(2)

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	<ol style="list-style-type: none"> idea that the pH of apple vinegar is within the pH range of four of the bacteria ; <i>Lactobacillus</i>, <i>Acetobacter</i>, <i>Salmonella</i> , and <i>Escherichia</i> could {survive / replicate} (on the food) ; idea that there will be decomposition ; 	<ol style="list-style-type: none"> ACCEPT the pH is above the lowest limit for four of them ACCEPT all survive except <i>Bacillus</i> IGNORE growth 	(2)

Question Number	Answer	Additional guidance	Mark
5(a)	<ol style="list-style-type: none"> bacterial cell does not have a {nucleus / nuclear envelope / eq}, patient's cell does / eq ; bacterial cell has circular DNA, patient's cell has {linear DNA / chromosomes} / eq ; bacterial cell has no {(membrane bound) organelles / named example}, patient's cell does / eq ; bacterial cell has {small / 70S} ribosomes, patient's cell has {large / 80S} ribosomes ; bacterial cell has a (peptidoglycan / murein) cell wall, patient's cell does not have a cell wall / eq ; 	<p>Clear comparison needed do not piece together</p> <ol style="list-style-type: none"> ACCEPT nuclear membrane ACCEPT loop ACCEPT for bacteria: pili / slime capsule / plasmids / mesosomes but not in patient For patient: Golgi, mitochondria, RER, ER, lysosomes but not in bacteria IGNORE flagellum NOT cellulose cell wall 	(2)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	1. idea that it is held on with tape (but not completely sealed) ; 2. idea that it must be sealed to prevent lid from falling off AND contamination occurring ; OR to prevent growth of anaerobic bacteria / eq ;	1. ACCEPT from a clear diagram	(2)

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	1. stated temperature of {25°C to 33 °C} ; 2. warm enough for bacteria (type 1 and 2) to {grow / reproduce / eq} ; 3. idea of {preventing / reducing / eq} growth of (human) pathogenic bacteria / eq ;	3. ACCEPT harmful not the optimum temperature for pathogenic bacteria	(3)

Question Number	Answer	Additional guidance	Mark
5(b)(iii)	1. idea that P has no effect on either type of bacteria ; 2. idea that Q has no effect on type 1 bacteria but {kills / inhibits the growth of} type 2 ; 3. idea that R has no effect on type 1 bacteria but {kills / inhibits the growth of / eq} type 2 ;	N.B. Piece responses together IGNORE references to zone of inhibition, clear zones NOT either Q or R having a greater effect than P 2 and 3 IGNORE no effect on one but affects the other	(3)

Question Number	Answer	Additional guidance	Mark
5(b)(iv)	<p>1. idea of {measuring the diameter / using graph paper to work out area} of the clear zones / eq ;</p> <p>2. idea of taking several measurements and calculating a mean</p> <p>OR</p> <p>description of how area obtained ;</p> <p>3. idea of {subtracting / dividing } the results ;</p>	<p>1. ACCEPT length, radius IGNORE size</p> <p>2. e.g. counting squares</p> <p>3. IGNORE 'calculate the difference' as in stem of question</p>	(3)

Question Number	Answer	Additional guidance	Mark
6(a)	1. reference to {role / eq} in non-specific response ; 2. idea of destroying bacterial cell walls / eq ; 3. idea that it helps prevent infection ;	2. IGNORE {destroying / killing} bacteria, stops cell wall synthesis, weakens 3. IGNORE prevents entry	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	1. soluble / eq ; 2. hydrophilic (outer surface) / eq ;	2. ACCEPT charged R groups on outside	(2)

Question Number	Answer	Mark
6(b)(ii)	D 390 ;	(1)

Question Number	Answer	Additional guidance	Mark
*6(b)(iii)	<p>(QWC - spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. reference to <i>transcription</i> ; 2. idea of DNA {unwinding / unzipping / eq} in the region of the <i>gene</i> coding for <i>lysozyme</i> ; 3. idea that (<i>RNA</i>) (<i>mono</i>)<i>nucleotides</i> {line up against / attach to} <i>complementary bases</i> (on the DNA) ; 4. on the {<i>template / antisense</i>} <i>strand</i> ; 5. idea of formation of {<i>phosphodiester bonds / eq</i>} (between adjacent mononucleotides) ; 6. reference to {<i>post transcriptional modification/ RNA splicing</i>} ; 7. reference <i>spliceosome</i> ; 8. credit details of post transcriptional modification ; 	<p>QWC emphasis on spelling</p> <ol style="list-style-type: none"> 1. ACCEPT <i>transcribed</i> <p>8. e.g. removal of <i>introns</i> , <i>exons</i>, <i>capping</i></p>	(6)

Question Number	Answer	Mark
7(a)(i)	D natural passive	(1)

Question Number	Answer	Mark
7(a)(ii)	B artificial passive	(1)

Question Number	Answer	Mark
7(a)(iii)	C natural active	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(i)	<ol style="list-style-type: none"> 1. FPV does not have an envelope but HIV does / eq ; 2. FPV has DNA but HIV has RNA / eq ; 3. FPV does not have {reverse transcriptase / integrase} but HIV does / eq ; 4. FPV does not have gp 120 molecules but HIV does / eq ; 	Do not piece together	(2)

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	<p>idea that {enzymes / DNA polymerase} is needed to synthesise the viral DNA</p> <p>OR</p> <p>DNA is needed to make new virus particles ;</p>	ACCEPT each new particle needs to contain DNA	(1)

Question Number	Answer	Additional guidance	Mark																								
7(c)(i)	<p>1. (7 weeks =) 49 days / nearly 50 days / 2^{-5} / $2^{-4.9}$ / $\frac{1}{2}^{4.9}$ / $\frac{1}{2}^5$;</p> <p>2. $1/32$ / {3 / 3.1 / 3.13 / 3.125} %;</p>	<p>Two marks for correct answer</p> <p>2. ACCEPT</p> <table border="1" data-bbox="1032 983 1906 1121"> <tbody> <tr> <td>0.03</td> <td>0.031</td> <td>0.0313</td> <td>0.03125</td> <td></td> <td></td> </tr> <tr> <td>3.4</td> <td>3.44</td> <td>3.438</td> <td>3.4375</td> <td></td> <td></td> </tr> <tr> <td>0.03</td> <td>0.034</td> <td>0.0344</td> <td>0.03438</td> <td>0.034375</td> <td></td> </tr> <tr> <td>0.03</td> <td>0.033</td> <td>0.0335</td> <td>0.03349</td> <td>0.033493</td> <td>0.0334929</td> </tr> </tbody> </table>	0.03	0.031	0.0313	0.03125			3.4	3.44	3.438	3.4375			0.03	0.034	0.0344	0.03438	0.034375		0.03	0.033	0.0335	0.03349	0.033493	0.0334929	(2)
0.03	0.031	0.0313	0.03125																								
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0.03	0.033	0.0335	0.03349	0.033493	0.0334929																						

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	<p>1. reference to natural passive immunity ;</p> <p>2. idea that {there are no antibodies left / level of antibodies become too low} to give protection ;</p> <p>3. because they have been {broken down / excreted (by the kidneys) /eq} ;</p> <p>4. idea that the (specific / primary / humoral / CMI) immune response has not occurred ;</p> <p>5. no (T helper / T killer / B) memory cells made / eq ;</p> <p>6. idea that kitten cannot produce antibody (immediately)to FPV on (first) infection</p> <p>7. idea that {agglutination / opsonisation / eq} will no longer occur ;</p> <p>OR</p> <p>idea that phagocytosis will {be reduced / not enhanced} ;</p>	<p>4. ACCEPT idea of not activating {T helper / T killer / B cells}</p>	(4)

Question Number	Answer	Additional guidance	Mark
8(a)	<ol style="list-style-type: none"> 1. there is {variation / eq} in {organisms / eq} ; 2. idea that certain {characteristics / adaptations} will help the organisms survive ; 3. idea of (advantageous) alleles passed onto offspring / eq ; 4. resulting (eventually) in a change in allele frequency / eq ; 	4. ACCEPT change in gene pool, new gene pool	(3)

Question Number	Answer	Additional guidance	Mark
8(b)(i)	<ol style="list-style-type: none"> 1. idea of feathers indicate health ; 2. idea that they are a warning to predators ; 3. idea of feathers being important in attracting a female ; 4. (those with best feathers) more likely to {reproduce / mating / eq} ; 5. alleles for colourful feathers will be passed on (to offspring) / eq ; 	4. IGNORE reference to can mate or reproduce	(2)

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	idea of { seen by predators / hunted (for their feathers) / restricted movement / a lot of energy is used to produce them / eq} ;		(1)

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	<ol style="list-style-type: none"> 1. idea that feathers are not important in attracting a mate ; 2. idea that they provide camouflage (from predators) ; 3. (camouflage necessary) so that she can {incubate her eggs / bring up the young birds} / eq ; 4. idea that energy being diverted away (from feather production) towards {producing / looking after} the offspring ; 5. idea that movement is not restricted ; 		(2)

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