



Pearson

# **Mark Scheme (Results)**

Summer 2017

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

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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.

Question Number	Answer	Additional guidance	Mark
<b>1(a)</b>	<p>1. chloroplast only :</p> <p>grana, thylakoid (membrane / lumen), stroma, (inter granal) lamellae, starch {grains / granules};</p> <p>2. both chloroplasts and mitochondria :</p> <p>(double) membrane, ribosomes,;</p> <p>3. mitochondria only :</p> <p>matrix, stalked particles, {cristae / folded inner membrane} ;</p>	<p><b>NB TWO structures needed for each mark</b></p> <p>2 Ignore cytoplasm Accept (loop) DNA</p> <p>3 Ignore mesosomes</p>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)(i)</b>	<p>1. one glycerol and three fatty acids ;</p> <p>2. reference to ester bonds (between fatty acids and glycerol);</p> <p>3. idea that (triglycerides /fatty acids / hydrocarbon chains) may be saturated or unsaturated ;</p>	<p>3 Accept description of presence and absence of double carbon carbon bonds</p>	<b>(3)</b>

Question Number	Answer	Mark
<b>1(b)(ii)</b>	<p><b>1(b)(ii). The only correct answer is A - condensation</b></p> <p><i>B is not correct because hydrolysis breaks bonds</i></p> <p><i>C is not correct because this is not an oxidation reaction</i></p> <p><i>D is not correct because this is not a reduction reaction</i></p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)(iii)</b>	<p>1. use of reduced NADP produced by light-dependent reaction;</p> <p>2. use of ATP produced by light-dependent reaction;</p> <p>3.( light-independent reaction produces) {GALP / trioses} used in synthesis of {FAs / glycerol / triglyceride} ;</p> <p>4. {GALP / trioses} converted to amino acids used to synthesise {proteins / enzymes} / eq ;</p> <p>5. idea of enzymes used in synthesis of triglycerides ;</p>	3 Accept GALP to glucose to glycerol	<b>(4)</b>

Question Number	Answer	Additional guidance	Mark
<b>2(a)</b>	1. idea of suitable temperature for the bacteria to {grow / multiply / eq} ; 2. idea of preventing the growth of (human) pathogens ;	Do not accept optimum temperature	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>2(b)</b>	1. idea that Petri dish 1 plate opened with bacteria already on the agar ; 2. the risk of contamination (of the investigator) / eq ;		<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>2(c)</b>	1. <b>P</b> is bacteriostatic as the bacteria in Petri dish 1 were still present but prevented from growth in Petri dish 2 / eq ; 2. <b>Q</b> is bactericidal as bacteria did not grow in {either Petri dish}/ eq ; 3. {antibiotic R is not effective / bacteria are resistant to <b>R</b> } as they grew in both Petri dishes / eq ;	Accept references to the presence or absence of clear zones as an eq for bacterial growth throughout	<b>(3)</b>

Question Number	Answer	Mark
<b>3(a)</b>	<p><b>3(a). The only correct answer is C – role of a species in an ecosystem</b></p> <p><i>A is not correct because niche is about role not distribution and abundance</i></p> <p><i>B is not correct because niche is about role not location</i></p> <p><i>D is not correct because niche is about role not trophic level</i></p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(b)</b>	<ol style="list-style-type: none"> <li>1. idea of testing water samples and {noting down observing / eq} (the different) species present ;</li> <li>2. idea of using an (oxygen) probe / chemical testing kit ;</li> <li>3. idea that the lowest level of oxygen with species present is minimum level tolerated ;</li> <li>4. idea that all other {variables / named variable} must be {controlled / monitored / eq} ;</li> </ol>	Accept appropriate lab based experiment that includes all species being added to each concentration and survival looked for	<b>(3)</b>

Question Number	Answer	Mark
<b>3(c)(i)</b>	<p><b>3(c)(i). The only correct answer is C – species richness</b></p> <p><i>A is not correct because endemism describes organisms found in a specific area</i></p> <p><i>B is not correct because genetic diversity describes the genetic variation of a species</i></p> <p><i>D is not correct because taxonomy concerns classification</i></p>	<b>(1)</b>

Question Number	Answer	Mark
<b>3(c)(ii)</b>	<p><b>3(c)(ii). The only correct answer is C – mayfly nymph</b></p> <p><b>A</b> is not correct because blood worm are found in polluted areas where the oxygen content will be low to avoid competition</p> <p><b>B</b> is not correct because freshwater shrimp can tolerate low pollution levels and will therefore not be in unpolluted areas to avoid competition</p> <p><b>D</b> is not correct because tubifex worms are found in polluted areas where the oxygen content will be low to avoid competition</p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(c)(iii)</b>	<ol style="list-style-type: none"> <li>1. idea that species adapted to {low oxygen levels / polluted water} will avoid competition ;</li> <li>2. for {space / food / substratum / eq} ;</li> <li>3. idea that there will be predators of some of the species ;</li> <li>4. idea that the polluted water provided other {nutrients / food / eq} required by these species ;</li> </ol>	1 Accept converse	<b>(3)</b>



Question Number	Answer	Mark
<b>3(c)(iv)</b>	<p><b>3(c)(iv). The only correct answer is D – tubifex worm</b></p> <p><b>A</b> is not correct because caddis fly need relatively high levels of oxygen so cannot survive in polluted water</p> <p><b>B</b> is not correct because hoglouse need relatively high levels of oxygen so cannot survive in polluted water</p> <p><b>C</b> is not correct because stone fly nymph need high levels of oxygen so cannot survive in polluted water</p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(d)(i)</b>	idea that the {tube / syphon / eq} will absorb oxygen from the {air / above the water} ;	<p>Accept tail / flagellum</p> <p>Accept haemoglobin has a high affinity for oxygen / metabolism is very low /adapted to respire anaerobically</p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3 (d)(ii)</b>	<p>1. anatomical / structural / physical ;</p> <p>2. because it has the {tube / syphon / eq} ;</p> <p><b>OR</b></p> <p>3. behavioural ;</p> <p>4. because it has to be close to the surface of the water / eq ;</p>	2 Accept tail / flagellum	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>4(a)(i)</b>	1. (75% of 6100 =) 4575 (squirrels) ;		<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>4(a)(ii)</b>	1. (Total number of alleles in black squirrels = $6100 \times 2 =$ ) 12200 ;  2. ( $4575 \div 12200 =$ ) 0.375 / 0.38 / 0.4;	Correct answer only gains full marks CE to be applied from 4(a)(i)  CE from mp 1 e.g. $4575 \div 6100 = 0.75$ Accept 37.5 %	<b>(2)</b>



Question Number	Answer	Additional guidance	Mark
*5(a)(i)	<p><b>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</b></p> <ol style="list-style-type: none"> <li>1. idea that {vaccine / antigens / attenuated virus / eq } needs to be injected into person ;</li> <li>2. to stimulate the (primary) immune response / eq ;</li> <li>3. idea that macrophages present the antigen (in the vaccine) to T helper cells ;</li> <li>4. idea that T helper cells release cytokines to stimulate {B cells / T killer cells} ;</li> <li>5. resulting in formation of memory (T / B) cells ;</li> <li>6. idea that memory cells remain in the body ;</li> <li>7. idea that these memory cells are activated on infection (with the virus) ;</li> <li>8. idea that the resulting immune response will be faster ;</li> </ol>	<p>Emphasis is on logical sequence</p> <p>1 Do not accept killing virus</p> <p>8 e.g. idea of {faster / more} antibody produced (by plasma cells), idea of (macrophages) destroying virus before it has chance to replicate, idea that T killer cells would be able to destroy host-infected cells sooner</p>	<p><b>(6)</b></p>

Question Number	Answer	Mark
<b>5(a)(ii)</b>	<p><b>5(a)(ii). The only correct answer is A – artificial active</b></p> <p><i>B is not correct because a vaccine contains antigen and therefore stimulates an immune response</i></p> <p><i>C is not correct because a vaccine is not natural</i></p> <p><i>D is not correct because a vaccine contains antigen and therefore stimulates an immune response and is not natural</i></p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>5(a)(iii)</b>	<ol style="list-style-type: none"> <li>1. tested on animals ;</li> <li>2. tested on (small number of) healthy individuals ;</li> <li>3. tested on small number of people who are likely to come in contact with Zika ;</li> <li>4. idea of (then) testing on a small number of pregnant women (to check for side effects in the baby) ;</li> <li>5. idea that it is unlikely that phase III will be carried out first</li> </ol>	<p>1 Accept cells, tissues</p> <p>3 Accept women before they got pregnant Do not accept people infected with the disease</p> <p>4 Accept testing on pregnant animals</p>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>5(b)</b>	<ol style="list-style-type: none"> <li>1. idea of analysing the structure of { RNA / protein / genetic material } from all three viruses ;</li> <li>2. to determine the sequence of {bases in the RNA / amino acids in the protein} ;</li> <li>3. reference to use of phylogenics ;</li> <li>4. use of gel electrophoresis to analyse {RNA / proteins / eq} of the three viruses ;</li> <li>5. idea of closely-related viruses will have similar {protein / RNA} ;</li> </ol>	<p>NB penalise reference to DNA only once</p> <p>3 Accept proteomics</p> <p>4 Accept DNA made using RNA as a template</p>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(a)</b>	1. idea that they can reduce the number of {(foreign) bacteria / fungi / yeast / pathogen} in the wound ; 2. by competing with them for {space / nutrients /eq} ;	1 Accept prevent colonisation by {(foreign) bacteria / fungi / yeast / pathogen} Do not accept virus	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(b)(i)</b>	1. red / swollen ; 2. because of {increased blood flow to the area / histamine release /eq} ;	1 Ignore painful or hot 2 Accept vasodilation	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(b)(ii)</b>	1. idea that it results in skin cells to {cover / close / repair / eq } wound ; 2. produce identical cells so that the (new) skin carries out the same { function / appearance / eq } ;	1 Accept replace the damaged cells	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(b)(iii)</b>	1. idea of long (poly)peptide chains ; 2. {little / no} tertiary structure / {hydrogen bonds / cross links} between (poly)peptide chains ; 3. idea of repeating amino acid sequences ;	1 Ignore long proteins 2 Accept mainly secondary structure	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(c)(i)</b>	<ol style="list-style-type: none"> <li>1. idea that <i>E. coli</i> and <i>Pseudomonas</i> are found in all the ulcers ;</li> <li>2. idea that <i>Pseudomonas</i> is the most common bacteria found in ulcers ;</li> <li>3. idea that the presence of <i>S. aureus</i> depends on the type of ulcer ;</li> </ol>	<p>1 piece together</p> <p>3 Accept e.g. of ulcers it does not contaminate, not found in all ulcers</p>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(c)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea that doctors cannot know which type of bacteria has caused the ulcer ;</li> <li>2. therefore {do not know which antibiotic will be effective / may prescribe the wrong antibiotic} ;</li> <li>3. idea that a {wrong prescription of / broad spectrum} antibiotic can result in the increase in antibiotic resistance ;</li> </ol>	<p>1 Accept idea that ulcers are caused by a number of different types of bacteria</p> <p>2 Accept problem of prescribing only one antibiotic</p> <p>3 Ignore unnecessary prescription Do not accept immune</p>	<b>(2)</b>



Question Number	Answer	Additional guidance	Mark
<b>7(a)</b>	1. increase in {mean / average} temperature ; 2. of the earth's {surface / atmosphere} ;		<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>7(b)(i)</b>	1. idea that there is a correlation because when rainfall increases tree ring width increases 2. idea that in some years rainfall increases but tree ring width decreases , so not a perfect correlation ;	1 Accept idea that the peaks or troughs coincide / pattern of rainfall and tree ring width is similar	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>7(b)(ii)</b>	1. use of water in { photolysis / light-dependent reaction } ; 2. credit a named molecule made by the plant and how it contributes to growth ; 3. credit use of water in transport of { sucrose / (mineral) ions } ; 4. credit named mineral ion and how it is related to growth ; 5. idea that the increase in tree ring growth results from an increase in {number / size} of xylem ;	2 e.g. glucose for energy, cellulose for new cells 3 Accept sugars, minerals, named mineral Ignore nutrients 4 e.g. nitrates used to make protein	<b>(3)</b>

Question Number	Answer	Mark
<b>7(c)(i)</b>	<p><b>7(c)(i). The only correct answer is D - <math>\text{kJ cm}^{-2} \text{ yr}^{-1}</math></b></p> <p><b>A</b> is not correct because an area is measured in <math>\text{cm}^2</math> and it is per year</p> <p><b>B</b> is not correct because an area is measured in <math>\text{cm}^2</math></p> <p><b>C</b> is not correct because it is per year</p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>7(c)(ii)</b>	<ol style="list-style-type: none"> <li>idea that GPP is the { organic matter / eq } produced as a result of photosynthesis ;</li> <li>idea that NPP is the { biomass / energy available for the next trophic level / eq } remaining after respiration ;</li> </ol>	<ol style="list-style-type: none"> <li>Accept energy converted</li> <li>Accept NPP is the biomass and <math>\text{NPP} = \text{GPP} - \text{R}</math></li> </ol>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>7(c)(iii)</b>	<ol style="list-style-type: none"> <li>idea that there are different species of tree ;</li> <li>idea of genetic difference between the trees ;</li> <li>idea that other parts of trees are growing not just tree rings ;</li> <li>idea that another named abiotic variable involved ;</li> <li>idea that a named biotic variable;</li> </ol>	<ol style="list-style-type: none"> <li>Accept number or size of leaves</li> <li>e.g. temperature</li> <li>e.g. disease, herbivores involved, competition</li> </ol>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>*8(a)</b>	<p><b>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</b></p> <ol style="list-style-type: none"> <li>idea that { bacteria / fungi / microorganisms } decompose (plant) material ;</li> <li>reference to (release of) { enzymes / named enzyme } ;</li> <li>reference to hydrolysis of {bonds / named bond} ;</li> <li>credit example of plant molecule that is digested</li> </ol> <p>OR</p> <p>credit example of named product of digestion ;</p> <ol style="list-style-type: none"> <li>idea that some of the products are absorbed by the decomposers ;</li> <li>credit use of products by the decomposer ;</li> <li>idea that {carbon dioxide / methane / eq} is released (by the decomposers) ;</li> </ol>	<p><b>Emphasis is on clarity of expression</b></p> <ol style="list-style-type: none"> <li>Accept other named organism e.g. worm Ignore decomposers</li> <li>e.g. starch, cellulose, protein</li> <li>Accept bacteria feed on these products</li> <li>e.g. used in respiration</li> </ol>	<b>(6)</b>

Question Number	Answer	Additional guidance	Mark
<b>8(b)(i)</b>	<ol style="list-style-type: none"> <li>increase (in first 4 days) due to heat (energy) released by {respiration / metabolism} of decomposers / eq ;</li> <li>decrease in temperature (after 4 days) due to { denaturation of enzymes / decrease in numbers of decomposers / decrease in substrate / eq } ;</li> </ol>	<ol style="list-style-type: none"> <li>Do not accept enzymes start to denature</li> </ol>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>8(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea that decomposition would be faster;</li> <li>2. as enzymes will work faster ;</li> <li>3. idea that this would occur as long as the temperature was above ambient temperature ;</li> <li>4. and below the optimum temperature of the enzymes ;</li> <li>5. idea that {(core) temperature drop / algor mortis} would be slower ;</li> <li>6. idea that {putrefaction / liquefaction } would be faster ;</li> <li>7. idea that {maggots will hatch sooner / insect activity will be increased / eq } ;</li> </ol>		<b>(5)</b>