



Mark Scheme (Results)

October 2018

Pearson Edexcel International Advanced Level Biology (WBI05)

Paper 01

Energy, Exercise and Coordination

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October 2018

Publications Code WBI05\_01\_1810\_MS\*

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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.

## 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)	<p><b>The only correct answer is D – Schwann cell</b></p> <p><i>A is not correct because myelin is produced by the Schwann cell.</i></p> <p><i>B is not correct because myelin is produced by the Schwann cell.</i></p> <p><i>C is not correct because myelin is produced by the Schwann cell.</i></p>	(1)

Question Number	Answer	Mark
1 (b) (i)	<p><b>The only correct answer is B – an electrical insulator</b></p> <p><i>A is not correct because myelin does not act as an electrical conductor.</i></p> <p><i>C is not correct because myelin is impermeable to potassium ions.</i></p> <p><i>D is not correct because myelin is impermeable to sodium ions.</i></p>	(1)

Question Number	Answer	Mark
1 (b) (ii)	<p><b>The only correct answer is A – axon</b></p> <p><i>B is not correct because myelin surrounds the axon.</i></p> <p><i>C is not correct because myelin surrounds the axon.</i></p> <p><i>D is not correct because myelin surrounds the axon.</i></p>	(1)

Question Number	Answer	Additional Guidance	Mark
<b>1 (c) (i)</b>	<ol style="list-style-type: none"> <li>1. 5.7 and 2.7 ;</li> <li>2. difference divided by the smaller value ;</li> <li>3. 111 / 111.1 ;</li> </ol>	<p><b>MP1 ALLOW</b> 5.6 to 5.8 and 2.7 to 2.8</p> <p><b>MP3 ALLOW</b> ECF if they divide by larger value</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>1 (c) (ii)</b>	<ol style="list-style-type: none"> <li>1. as diameter of neurone increases speed of conduction increases for both ;</li> <li>2. above 1 <math>\mu\text{m}</math> myelinated neurones have a faster speed of conduction than non-myelinated neurones / below 1 <math>\mu\text{m}</math> non-myelinated neurones have a faster speed of conduction ;</li> <li>3. the diameter has a greater effect on the speed of conduction of a myelinated neurone / eq ;</li> <li>4. in myelinated neurones linear relationship but not linear in non-myelinated neurone ;</li> </ol>	<p><b>MP3 ALLOW</b> gradient is steeper in myelinated neurones</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>1 (c) (iii)</b>	<ol style="list-style-type: none"> <li>1. idea that myelin sheath insulates the axon ;</li> <li>2. there are breaks in the myelin sheath of myelinated fibres / nodes of Ranvier ;</li> <li>3. action potentials occur at the nodes only / eq ;</li> <li>4. nerve impulses jumping from node to node / saltatory conduction ;</li> <li>5. in non-myelinated fibres action potential has to be generated all along the axon ;</li> </ol>	<p><b>MP3 and 5 ALLOW</b> depolarisation</p> <p><b>MP4 ALLOW</b> action potential / depolarisation jumps from node to node</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
2(a)	1. $90 \text{ (mm)} \div 50\,000$ ; 2. $1.8 \times 10^{-3} \text{ mm}$ ;	<b>ALLOW</b> 91 / 9 / 9.1	(2)

Question Number	Answer	Mark
2(b)(i)	<p><b>The only correct answer is D</b></p> <p><i>A is not correct because D shows a sarcomere</i></p> <p><i>B is not correct because D shows a sarcomere</i></p> <p><i>C is not correct because D shows a sarcomere</i></p>	(1)

Question Number	Answer	Mark
2(b)(ii)	<p><b>The correct answer is A</b></p> <p><i>B is not correct because it contains myosin and actin</i></p> <p><i>C is not correct because it contains regions with both actin and myosin</i></p> <p><i>D is not correct because it contains regions with both actin and myosin</i></p>	(1)



Question Number	Answer	Mark		
2(b)(iii)	<p><b>The correct answer is B -</b> <table border="1" data-bbox="846 292 1464 347"> <tr> <td data-bbox="846 292 1167 347">decreases</td> <td data-bbox="1171 292 1464 347">stays the same</td> </tr> </table></p> <p><i>A is not correct because part B stays the same</i></p> <p><i>C is not correct because part A decreases and part B stays the same</i></p> <p><i>D is not correct because part D decreases</i></p>	decreases	stays the same	<b>(1)</b>
decreases	stays the same			

Question Number	Answer Additional Guidance	Mark
2(c)	<p><b>The correct answer is A – few mitochondria and few capillaries</b></p> <p><i>B is not correct because fast twitch fibres have few capillaries</i></p> <p><i>C is not correct because fast twitch fibres have few mitochondria</i></p> <p><i>D is not correct because fast twitch fibres have few mitochondria and few capillaries</i></p>	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(d)</b>	<ol style="list-style-type: none"><li>1. calcium ions {are released from sarcoplasmic reticulum / enter the sarcoplasm } ;</li><li>2. calcium ions bind to troponin ;</li><li>3. (change in shape of troponin) moves tropomyosin away from myosin binding site ;</li><li>4. allowing myosin (heads) to attach to actin ;</li><li>5. (contraction as) actin is pulled past the myosin / reference to sliding filament theory ;</li></ol>	<b>MP3 ALLOW</b> this exposes the myosin binding site	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(a)(i)</b>	<ol style="list-style-type: none"> <li>1. as age increases (median) FEV<sub>1</sub> decreases ;</li> <li>2. at lower altitudes (median) FEV<sub>1</sub> is lower ;</li> </ol>	<p><b>ACCEPT</b> converse statements</p> <p><b>MP1 ALLOW</b> negative correlation</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(a)(ii)</b>	<ol style="list-style-type: none"> <li>1. { lungs / alveoli } lose their { elasticity / elastic tissue } ;</li> <li>2. weaker {breathing muscles / diaphragm / intercostal muscles } ;</li> <li>3. idea of respiratory disease ;</li> <li>4. idea of fewer alveoli ;</li> </ol>	<p><b>MP3 ALLOW</b> description of environmental factor e.g. more smoking damage</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(a)(iii)</b>	<ol style="list-style-type: none"> <li>1. less oxygen available / eq ;</li> <li>2. need to breathe more forcefully / eq ;</li> <li>3. stronger breathing muscles / eq ;</li> <li>4. larger lung capacity / eq ;</li> </ol>	<p><b>MP1 ALLOW</b> lower concentration of oxygen</p> <p><b>MP4 ALLOW</b> more air needs to be breathed in / breathed out / larger tidal volume / larger vital capacity</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(b)</b>	<ol style="list-style-type: none"> <li>1. (collect traces) from each group of Andean males and North American males ;</li> <li>2. (for each individual) count the number of breaths / eq ;</li> <li>3. divide by the time taken (to find the rate) ;</li> <li>4. find the middle value (for each group) ;</li> </ol>	<p><b>MP1 ALLOW</b> collect enough result to find the median</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>4(a)</b>	<ol style="list-style-type: none"> <li>1. exposure to pesticide increases the risk of developing Parkinsons / eq ;</li> <li>2. the more pesticides an individual is exposed to the greater the risk of developing Parkinsons / eq ;</li> <li>3. correct manipulation of data to support MP1 or 2 ;</li> </ol>	<p>e.g. (relative) risk for P, Q and R exposed group is 2.1 greater than control group</p> <p><b>IGNORE</b> simple descriptions of the data</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
4 (b) (i)	<ol style="list-style-type: none"> <li>1. idea that pesticides are {absorbed through skin / inhaled} ;</li> <li>2. idea that blood carries pesticides to the brain ;</li> <li>3. pesticide kills the dopamine secreting neurones in the (mid) brain ;</li> <li>4. {inhibits release / reduces production} of dopamine ;</li> <li>5. {binds to / blocks} post synaptic receptors for dopamine</li> <li>6. idea of effect on motor pathway ;</li> </ol>	<p><b>MP3 ACCEPT</b> basal ganglia / substantia nigra</p> <p><b>MP4 ALLOW</b> no dopamine production / not enough dopamine in the synaptic cleft</p> <p><b>MP6</b> e.g. stops impulses reaching muscle cells / reduces action potentials in motor neurones</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>4(b)(ii)</b>	<p>1. reference to <b>L dopa</b> ;</p> <p>2. idea that L dopa can cross the blood brain barrier ;</p> <p>3. L dopa is converted to dopamine in the brain / eq ;</p> <p>4. dopamine binds to receptors on the post-synaptic membrane ;</p> <p>OR</p> <p>1. use an enzyme inhibitor ;</p> <p>2. reference to {<b>monoamineoxidase B / MAOB</b>} ;</p> <p>3. to prevent the breakdown of dopamine</p> <p>4. dopamine binds to receptors on the post-synaptic membrane ;</p> <p>OR</p> <p>1. reference to <b>dopamine agonist</b> ;</p> <p>2. idea that dopamine agonist can cross the blood brain barrier ;</p> <p>3. (dopamine agonist) binds to receptors on the post-synaptic membrane ;</p>	<p><b>MP2 ALLOW</b> diffuse from blood into brain</p> <p><b>MP4 ALLOW</b> idea of effect on motor pathway</p> <p><b>MP2 ALLOW</b> named MAOB e.g. selegline</p> <p><b>MP4 ALLOW</b> idea of effect on motor pathway</p> <p><b>MP3 ALLOW</b> idea of effect on motor pathway</p>	<b>(3)</b>

Question Number	Answer	Mark
5(a)	<p><b>The only correct answer is B – homeostasis</b></p> <p><i>A is not correct because chemiosmosis is movement of ions across a partially permeable membrane down their electrochemical gradient</i></p> <p><i>C is not correct because phototropism is the orientation of an organism in response to light</i></p> <p><i>D is not correct because respiration is the process by which living organisms produce energy</i></p>	<p><b>(1)</b></p>



Question Number	Answer	Additional Guidance	Mark
*5(b)(i)	<ol style="list-style-type: none"> <li>1. core temperature falls ;</li> <li>2. receptors in hypothalamus detect the change ;</li> <li>3. idea of an increase in { shivering / metabolic activity } ;</li> <li>4. increasing heat production ;</li> <li>5. once (core body) temperature increases {shivering stops / metabolic activity reduces} ;</li> <li>6. body hair insulates ;</li> <li>7. curling up reduces surface area (to volume ratio) reducing heat loss ;</li> </ol>	<p><b>QWC emphasis on clarity of expression</b></p> <p><b>MP1 IGNORE</b> body / skin temperature</p> <p><b>MP5 ACCEPT</b> negative feedback</p> <p><b>MP6 ALLOW</b> description of hair erector muscles standing hairs up to create insulation layer</p>	<b>(5)</b>

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	<ol style="list-style-type: none"> <li>1. body mass will decrease ;</li> <li>2. fat { broken down / used as a respiratory substrate / provides energy for shivering / eq } ;</li> </ol>	<p><b>ALLOW</b> muscle / protein</p>	<b>(2)</b>

Question Number	Answer	Mark
5(c)(i)	<p>The only correct answer is D - <input type="text" value="increases"/> <input type="text" value="increases"/></p> <p><i>A is not correct because</i>  <i>B is not correct because</i>  <i>C is not correct because</i></p>	(1)

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	<ol style="list-style-type: none"> <li>1. count number of bears (living near paths) ;</li> <li>2. introduce humans (on paths) ;</li> <li>3. idea of controlling level of disturbance (by humans on paths) ;</li> <li>4. count number of bears that remain (near ) after disturbance ;</li> <li>5. idea of repeating disturbance at regular time intervals ;</li> <li>6. habituation has occurred when the number of bears (around the paths) stops decreasing after human use of paths ;</li> </ol>	<p><b>MP4 ALLOW</b> other reasonable methods of assessing response of bears</p> <p><b>MP6 ALLOW</b> other reasonable methods of demonstrating habituation</p>	(4)

Question Number	Answer	Additional Guidance	Mark
<b>6(a)(i)</b>	<ol style="list-style-type: none"> <li>1. the lower the concentration of oxygen the more EPO (that is synthesised) / eq ;</li> <li>2. the longer the time the more EPO (that is synthesised) / eq ;</li> </ol>	<b>ALLOW</b> converse statements	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>6(a)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea that low oxygen concentration triggers second messenger systems ;</li> <li>2. reference to <b>transcription factors</b> ;</li> <li>3. transcription factor binds to (the promotor region of) the EPO gene ;</li> <li>4. more (EPO mRNA) transcription ;</li> <li>5. increased (EPO) protein synthesis / eq } ;</li> </ol>	<p><b>MP1 ALLOW</b> an example of a second messenger e.g. cAMP / protein kinases</p> <p><b>MP3 ALLOW</b> EPO DNA</p>	<b>(4)</b>

Question Number	Answer	Additional Guidance	Mark
<b>6(b)</b>	<ol style="list-style-type: none"> <li>1. isolate the EPO gene (from human cells) / eq ;</li> <li>2. using restriction enzymes / eq ;</li> <li>3. insert the EPO gene into a vector / eq ;</li> <li>4. example of a vector ;</li> <li>5. insert { vector / gene } into udder of a sheep / eq ;</li> <li>6. idea of modifying several (udder) cells ;</li> </ol>	<p><b>MP4</b> e.g. plasmid / virus / bacteria</p> <p><b>MP5 ALLOW</b> insert {vector / gene} into breast cells / milk protein genes</p>	<b>(4)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(a)</b>	<ol style="list-style-type: none"> <li>1. they have a {suppressed / weakened} immune system ;</li> <li>2. identify particular aspect of immune system that could be suppressed ;</li> <li>3. idea of close contact (with others with viral infections) ;</li> </ol>	<p><b>MP2</b> e.g. produce fewer T killer cells / less antibody to virus</p> <p><b>MP3 ALLOW</b> more opportunities for injuries</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(b)</b>	<ol style="list-style-type: none"><li>1. (boosters) contain the same antigens as the (original) vaccine ;</li><li>2. (boosters) { stimulate more / maintain number of } memory cells ;</li><li>3. (boosters) stimulate production of antibodies (specific for the pathogen by plasma cells) ;</li><li>4. when infected (with the pathogen) there is a rapid immune response / eq ;</li><li>5. eliminates the pathogen before it can infect and damage the heart cells ;</li></ol>	<p><b>MP1 ALLOW</b> an inactive form of the virus</p> <p><b>MP5 ALLOW</b> idea that infection is less severe</p>	<p style="text-align: right;"><b>(3)</b></p>

Question Number	Answer	Additional Guidance	Mark
<b>7(c)</b>	<ol style="list-style-type: none"> <li>1. work as a neurotransmitter ;</li> <li>2. binding to serotonin receptors / eq ;</li> <li>3. reference to {<b>synapses / post synaptic membrane</b>} ;</li> <li>4. in the pleasure centres of the brain / eq ;</li> </ol>	<p><b>MP2 ALLOW</b> stimulate the release of serotonin / production of serotonin / prevents the re-uptake of serotonin</p> <p><b>MP3 ALLOW</b> synaptic cleft</p> <p><b>MP4 ALLOW</b> nucleus accumbens</p> <p><b>MP4 IGNORE</b> other named parts of the brain</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(d)</b>	<ol style="list-style-type: none"> <li>1. cardiac muscle is weaker (in unfit heart) ;</li> <li>2. stroke volume is smaller / eq ;</li> <li>3. needs to beat faster to maintain cardiac output / eq ;</li> <li>4. to ensure a supply of oxygen to tissues ;</li> </ol>	<p><b>ALLOW</b> converse statements</p> <p><b>MP4 ALLOW</b> muscles need oxygen for aerobic respiration</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
7(e)	<ol style="list-style-type: none"> <li>1. cells forming the SAN are myogenic ;</li> <li>2. SAN receives impulses from the {cardiovascular centre / medulla } ;</li> <li>3. sympathetic nerves stimulate the SAN / parasympathetic nerves inhibit the SAN ;</li> <li>4. idea that waves of depolarisation from the (SAN) initiate contraction of the {atria / heart} ;</li> <li>5. pressure changes cause a pulse / eq ;</li> </ol>	<p><b>MP1 ALLOW</b> cells of SAN have an intrinsic rhythmicity / SAN act as the (primary) pacemaker</p> <p><b>MP4 ALLOW</b> passes an (electrical) impulse to AVN</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
7(f)	<ol style="list-style-type: none"> <li>1. (some) ion channels open and allow the movement of ions ;</li> <li>2. the membrane potential becomes less negative ;</li> <li>3. reference to <b>threshold potential</b> ;</li> <li>4. causes (more) ion channels to open (depolarising the cell membrane) ;</li> </ol>	<p><b>MP1 and 4 ALLOW</b> calcium ions / sodium ions / potassium ions</p> <p><b>MP2 ALLOW</b> membrane becomes more positive / inner membrane becomes positive</p> <p><b>MP4 ALLOW</b> calcium ions / sodium ions</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
7(g)	<ol style="list-style-type: none"> <li>1. genes code for membrane protein channels ;</li> <li>2. exercise is an environmental factor ;</li> <li>3. idea that exercise does not change the number of genes ;</li> <li>4. exercise can affect ion channel {gene expression / transcription / mRNA production / synthesis} ;</li> <li>5. by { increasing / decreasing / changing } the activity of transcription factors ;</li> </ol>	<p><b>MP4 ALLOW</b> less activation of genes / less ion channel protein made / genes switched off</p>	<p><b>(3)</b></p>



Question Number	Answer	Additional Guidance	Mark
*7(h)	<ol style="list-style-type: none"> <li>1. ribosomes on the rough endoplasmic reticulum translate (beta-1-adrenergic receptor) mRNA ;</li> <li>2. polypeptide chains are released into the endoplasmic reticulum ;</li> <li>3. transported to the Golgi apparatus ;</li> <li>4. { sugars added / carbohydrate added / glycosylation takes place } in the Golgi apparatus ;</li> <li>5. the glycoprotein is packaged into vesicles / eq ;</li> <li>6. vesicles fuse with the cell membrane ;</li> <li>7. idea of inserting the beta-1-adrenergic receptor into the (cell) membrane ;</li> </ol>	<p><b>QWC emphasis is for logical sequence</b></p> <p><b>MP1 ALLOW</b> description of translation that includes role of ribosomes on rER</p> <p><b>MP2 ALLOW</b> primary structure enters the ER</p> <p><b>MP3 ALLOW</b> Golgi body</p> <p><b>MP4 ALLOW</b> protein is converted into a glycoprotein in the Golgi</p> <p><b>MP4 IGNORE</b> glycogen added</p> <p><b>MP5 ALLOW</b> vesicles with (beta-1-adrenergic receptor) in their membrane leave the Golgi / glycoproteins leave the Golgi in vesicles</p>	(5)

Question Number	Answer	Additional Guidance	Mark
7(i)	1. distance between peaks will increase / peaks will be less frequent / eq ;	<p><b>ALLOW</b> any named peak (P, Q, R, S, T)</p> <p><b>ALLOW</b> increase in length of interval between any pair of letter P, Q, R, S and T</p> <p><b>ACCEPT</b> correct annotated diagram</p> <p><b>ALLOW</b> shorten the QT interval (in some) ;</p> <p><b>IGNORE</b> fewer peaks</p> <p><b>IGNORE</b> descriptions of heart beats or pulse</p>	(1)

Question Number	Answer	Additional Guidance	Mark
7(j)	<p>1. adrenalin is absorbed into the blood stream / eq ;</p> <p>2. causes (smooth) muscle in blood vessels to contract ;</p> <p>3. resulting in reduced blood flow ;</p>	<p><b>MP2 ALLOW</b> causes vasoconstriction</p> <p><b>MP2 IGNORE</b> causes capillaries to constrict / blood vessels contract</p>	(2)

Question Number	Answer	Additional Guidance	Mark
<b>7(k)</b>	<ol style="list-style-type: none"> <li>1. atropine inhibits nerve impulses in the parasympathetic system ;</li> <li>2. the sympathetic system still functions ;</li> <li>3. this causes contraction of the radial muscles ;</li> <li>4. circular muscles {are not stimulated / relax} ;</li> </ol>	<p><b>MP1 ALLOW</b> stops / inhibits parasympathetic system</p> <p><b>MP3 IGNORE</b> retinal / radical muscles</p>	<b>(3)</b>

