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## **Mark Scheme (Results)**

January 2017

Pearson Edexcel  
International Advanced Subsidiary Level  
in Biology (WBI05)  
Paper 01 Energy, Exercise and  
Coordination

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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)	The only correct answer is A B is incorrect because intermembrane space is where protons accumulate C is incorrect because matrix is overall structure where reactions take place D is incorrect because outer mitochondrial membrane acts as a transport structure	(1)

Question Number	Answer	Mark
1(a)(ii)	The only correct answer is C A is incorrect because eukaryotic organelles have both nucleic acids-DNA and RNA B is incorrect because eukaryotic organelles have both nucleic acids-DNA and RNA D is incorrect because eukaryotic organelles have both nucleic acids-DNA and RNA	(1)

Question Number	Answer	Mark
1(a)(iii)	The only correct answer is C A is incorrect because cristae is involved in oxidative phosphorylation B is incorrect because protons accumulate here D is incorrect because contains enzymes involved in ATP synthesis	(1)

Question Number	Answer	Mark
1(a)(iv)	The only correct answer is B A is incorrect because used the incorrect calculation C is incorrect because used the incorrect calculation D is incorrect because used the incorrect calculation	(1)

Question Number	Answer	Mark
1(a)(v)	The only correct answer is C A is incorrect because has no visible ribosomes on surface B is incorrect because has no visible ribosomes on surface D is incorrect because has no visible ribosomes on surface	(1)

Question Number	Answer	Additional guidance	Mark
1(b)	1. idea of no / reduced chemiosmosis / electron transport chain / oxidative phosphorylation ; 2. less production of { reduced NAD / NADH } ; 3. idea of less active transport of hydrogen ions ; 4. fewer { H <sup>+</sup> / hydrogen ions / protons } in intermembrane space ; 5. lower/less steep { concentration / electrochemical / proton / H <sup>+</sup> } gradient ; 6. less diffusion of { H <sup>+</sup> / hydrogen ions / protons } ; 7. reference to { stalked particles / ATP synthase } ; 8. the production of ATP will be reduced / eq ;	ACCEPT 'no' in place of 'less' or 'reduced'  MP1 ACCEPT 'ETC' for electron transport chain  MP2 ACCEPT reduced FAD/FADH  MP3 ACCEPT a description of active transport          MP7 ACCEPT ATPase or ATP synthetase	Exp          (5)

Question Number	Answer	Additional guidance	Mark
2(a)	<p>1. fMRI scan shows activity of { auditory cortex / brain } / eq ;</p> <p>2. fMRI measures uptake of oxygen ;</p> <p>3. idea that active area of brain gets more { blood / oxygen / oxygenated blood / uses oxygen } ;</p> <p>4. idea that { oxyhaemoglobin / deoxyhaemoglobin } involved ;</p> <p>5. more active area appears { light / white / bright / coloured / eq } ;</p> <p>6. idea that if habituation occurs then brain activity falls with repeated stimulus ;</p>	<p>MP3 ACCEPT converse MP3 and 4. <b>"Active area has more oxyhaem/less deoxyhaem"</b> gets MP3 AND MP4</p> <p>MP5 ACCEPT converse</p> <p>MP6 ACCEPT converse</p>	Exp (5)

Question Number	Answer	Mark
2(b)	<p>The only correct answer is C</p> <p>A is incorrect because calcium channels not found here</p> <p>B is incorrect because calcium channels not found here</p> <p>D is incorrect because habituation involves a decrease in response</p>	(1)



Question Number	Answer	Additional guidance	Mark
3(a)	1. sodium ions moved out ( of axon ) AND potassium ions move into ( axon ) ; 2. reference to pump / active transport ; 3. reference to ATP / energy ; 4. potassium ions diffuse out (down concentration gradient) ; 5. sodium ions cannot diffuse back into axon ;	MPs 1 and 2. <b>"sodium ions are pumped out and potassium ions are pumped in" gains both MP1 and MP2</b> MP2 ACCEPT sodium - potassium pump  MP5 ACCEPT 'sodium channels are closed'	Exp (3)

Question Number	Answer	Additional guidance	Mark
3(b)	1. idea that an increase in temperature will reduce the duration ; 2. credit correct manipulation of data ; 3. reference to overlapping of { range / standard error / standard deviation } ; 4. idea that as temp increases { range / SD / SE decreases } ;	MP2 e.g. 1.6 ms	Exp (2)

Question Number	Answer	Additional guidance	Mark
3(c)	1. { binds to / blocks / eq } sodium (ion) channels ; 2. no sodium ions diffuse in / eq ; 3. no depolarisation ; 4. no { action potential / impulse / electrical activity } in (motor) neurones ; 5. reduced muscle contraction ;		Exp (4)

Question Number	Answer	Additional guidance	Mark
4(a)	<ol style="list-style-type: none"> <li>1. DNA { strands separate / unwinds / unzips / hydrogen bonds broken / eq } ;</li> <li>2. (mono)nucleotides line up against their complementary bases ;</li> <li>3. on the template strand (of DNA) ;</li> <li>4. phosphodiester bonds form (between adjacent (mono)nucleotides) ;</li> <li>5. reference to correctly named enzyme ;</li> <li>6. reference to mRNA (produced) ;</li> </ol>	<p>MP2 ACCEPT named bases e.g. A-U or A-T and G-C</p> <p>MP3 ACCEPT antisense strand</p> <p>MP5 e.g. RNA polymerase or DNA helicase DO NOT ACCEPT DNA ligase</p>	<p>Exp</p> <p>(4)</p>

Question Number	Answer	Additional guidance	Mark
4(b)	<ol style="list-style-type: none"> <li>1. slows speed of impulse ;</li> <li>2. idea that impulse { cannot jump from node to node / no saltatory conduction } ;</li> </ol>		<p>Exp</p> <p>(2)</p>

Question Number	Answer	Additional guidance	Mark						
4(c)	<table border="1"> <thead> <tr> <th>Symptom</th> <th>Part of brain affected</th> </tr> </thead> <tbody> <tr> <td>loss of vision</td> <td>visual cortex / occipital lobe / cerebral hemisphere / cerebral cortex / cerebrum ;</td> </tr> <tr> <td>difficulty in walking</td> <td>cerebellum / cerebrum / motor cortex;</td> </tr> </tbody> </table>	Symptom	Part of brain affected	loss of vision	visual cortex / occipital lobe / cerebral hemisphere / cerebral cortex / cerebrum ;	difficulty in walking	cerebellum / cerebrum / motor cortex;		Grad (2)
Symptom	Part of brain affected								
loss of vision	visual cortex / occipital lobe / cerebral hemisphere / cerebral cortex / cerebrum ;								
difficulty in walking	cerebellum / cerebrum / motor cortex;								

Question Number	Answer	Additional guidance	Mark
4(d)	<p>1. both parents are { heterozygous / carriers } ;</p> <p>2. child inherits one recessive allele from { each parent / both parents } OR child is homozygous recessive ;</p>	<p>ACCEPT genetic diagram or Punnet square for both MP1 and MP2</p> <p>MP1 DO NOT ACCEPT 'may be'</p> <p>MP2 DO NOT ACCEPT 'gene'</p>	Exp (2)

Question Number	Answer	Additional guidance	Mark
5(a)	<ol style="list-style-type: none"><li>1. after exercise is least reliable because standard deviation is largest ;</li><li>2. anomalous results included in calculation of mean ;</li><li>3. not reliable because { small sample size / only 6 tested / eq } ;</li><li>4. idea of not reliable because no information about the 6 people ;</li><li>5. reliable because investigation was repeated ;</li><li>6. reliable because the ranges do not overlap ;</li></ol>	MP1 ACCEPT converse  MP4 information must be qualified e.g. level of fitness / age / gender / health	Exp  (2)

Question Number	Answer	Additional guidance	Mark
*5(b)	<p>QWC -Spelling of technical terms must be correct and answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> <li>1. less able to hold breath after exercise compared to deep breathing ;</li> <li>2. exercise increases CO<sub>2</sub> ;</li> <li>1. deep breathing reduces CO<sub>2</sub> ;</li> <li>4. reference to change in { pH / formation of carbonic acid / formation of hydrogen ions } ;</li> <li>5. reference to chemoreceptors ;</li> <li>6. reference to { medulla / ventilation centre / carotid body / aortic body } ;</li> <li>7. reference to impulses ;</li> <li>8. contraction of { diaphragm / intercostal muscles } ;</li> </ol>	<p>QWC-emphasis is for clarity of expression</p> <p>MP1 ACCEPT converse</p> <p>MP2 IGNORE fall in O<sub>2</sub></p> <p>MP4 change correctly related to either exercise or deep breathing</p>	<p>Exp</p> <p>(6)</p>

Question Number	Answer	Mark
5 (c) (i)	<p>The only correct answer is C</p> <p>A is incorrect because is a miscalculation</p> <p>B is incorrect because is a miscalculation</p> <p>D is incorrect because is a miscalculation</p>	(1)

Question Number	Answer	Additional Guidance	Mark
5(c) (ii)	<ol style="list-style-type: none"> <li>1. the volume exhaled by non-smokers is higher than the volume exhaled by smokers ;</li> <li>2. credit comparative use of data ;</li> <li>3. idea that non-smokers breathe out faster than smokers ;</li> <li>4. non-smokers level out sooner / graph plateaus earlier than smokers / eq ;</li> </ol>	<p>MP1 ACCEPT '<b>FEV1</b> is higher for non-<b>smokers</b>'</p> <p>ACCEPT converse for all MPs</p>	<p>Exp</p> <p>(3)</p>

Total 12 marks

Question Number	Answer	Additional guidance	Mark
6(a)	1. gene for pyrethrin synthesis { removed / eq } from flowers ; 2. (using) restriction enzyme / endonuclease ; 3. use of vector / named vector ; 4. use of (DNA) ligase (for joining gene to plasmid) ; 5. idea of culturing yeast cells (to produce pyrethrin) ;	MP1 ACCEPT 'DNA' for ' <b>gene</b> '  MP3 e.g. virus, liposome, plasmid	Exp  (4)

Question Number	Answer	Additional guidance	Mark
6(b)	1. idea that (protein) channels are different ; 2. idea that pyrethrin cannot bind ; 3. idea of metabolised in mammals ; 4. idea of dilution in mammals ;		Exp  (2)

Question Number	Answer	Additional guidance	Mark
6(c)	1. circular muscles contract ; 2. radial muscles relax ;		Grad  (2)



Question Number	Answer	Additional guidance	Mark
6(d)	<ol style="list-style-type: none"> <li>1. idea that increasing concentration kills more flies ;</li> <li>2. more of species A killed (at a lower concentration) than species B in pyrethrin ;</li> <li>3. more species B killed (at a lower concentration) than species A in organochlorine ;</li> <li>4. { 100% / all killed } at { lower concentration / 4.4 } in pyrethrin / at { higher concentration / 5.2 } with organochlorine ;</li> </ol>	<p>ACCEPT converse for MPs 2 and 3</p> <p>MP4 ACCEPT + or - 0.1</p>	Exp (3)

Question Number	Answer	Additional guidance	Mark
6(e)	<ol style="list-style-type: none"> <li>1. idea of { less / slower / poor / stunted / inhibited / eq } growth ;</li> <li>2. { less / no } { cell elongation / phototropism } ;</li> </ol>		Exp (2)

Total 13 marks

Question Number	Answer	Additional guidance	Mark
7(a)	1. idea of not introducing (new) pathogens / eq ; 2. risk of { disease / infection / named example } ; 3. idea of the blood being a complete match ; 4. no { immune response / rejection / transfusion reaction } ;		Exp (2)

Question Number	Answer	Additional guidance	Mark
7(b)	1. one person tested / no repeats ; 2. idea that performance also depends on muscle fibre type ; 3. type of training is unspecified ; 4. idea that { other factors / named factor } not controlled ;	MP4 e.g. diet, gender, drug use	Exp (3)

Question Number	Answer	Additional guidance	Mark
7(c)	1. aerobic respiration used to supply ATP ; 2. ATP needed for muscle contraction ; 3. oxygen used as { electron / hydrogen (ion) / proton } acceptor ; 4. ATP synthesis / phosphorylation of ADP occurs / ADP combines with P <sub>i</sub> ; 5. less anaerobic respiration so less lactate ; 6. lactate lowers pH and affects { enzymes / contraction } ; 7. less lactate means exercise can continue for longer ;		Exp  (5)

Question Number	Answer	Additional guidance	Mark
7(d)	1. leads to { atherosclerosis / endothelial damage / inflammatory response / plaque formation } ; 2. reference to { blood clotting / blockage of arteries } ; 3. idea that this leads to { heart attack / stroke / CVD / CHD / eq } ;		Exp  (2)

Question Number	Answer	Additional guidance	Mark
7(e)	1. idea of a placebo ; 2. idea of dosage being { safe / effective / eq } ; 3. idea of double blind trials ; 4. idea of large sample size ; 5. athletes standardised for { event / age / gender / eq } ; 6. trials repeated / eq ; 7. use of statistics (to test significance) ;		Exp (5)

Question Number	Answer	Additional guidance	Mark
7(f)	1. idea that ACTH is transported in blood ; 2. idea of binding to receptor (on cell membrane) ; 3. activation of enzymes / production of second messenger (in cell) ; 4. idea of { transcription factors / gene activation } ; 5. resulting in the synthesis of { testosterone / androgens } ;	MP3 ACCEPT adenylyl cyclase, kinase, cAMP	Exp max (3)

Question Number	Answer	Additional guidance	Mark
7(g)	idea that { two substances / IGF-1 and HGH } work together to { improve / enhance / eq } an effect ;		Grad (1)

Question Number	Answer	Additional guidance	Mark
7(h)	<ol style="list-style-type: none"> <li>1. { virus / HIV } in T helper cells (introduced into recipient) ;</li> <li>2. idea that HIV will burst out of these T helper cells ;</li> <li>3. and infect the T helper cells of the recipient ;</li> <li>4. reduce numbers of T helper cells / destroys T helper cells ;</li> <li>5. resulting in the development of { AIDS / infection / eq } ;</li> </ol>	MP5 ALLOW named infection e.g. pneumonia	Exp  (3)

Question Number	Answer	Additional guidance	Mark
*7(i)	<p>QWC - Spelling of technical terms must be correct and answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> <li>1. idea that neurotransmitter { remains / increases in concentration / accumulates } in synapse ;</li> <li>2. neurotransmitter binds to receptors ;</li> <li>3. on postsynaptic { membrane / neurone } ;</li> <li>4. sodium (ion) channels open ;</li> <li>5. sodium ions enter postsynaptic neurone ;</li> <li>6. reference to depolarisation ;</li> <li>7. idea that { impulses / action potentials } { continue / increase in frequency } ;</li> <li>8. increase in mental alertness ;</li> </ol>	<p>QWC emphasis is for logical sequence</p> <p>MP1 DO NOT ACCEPT 'stops reuptake'</p>	<p>Exp</p> <p>(6)</p>

Total 30 marks

