



# Mark Scheme (Results)

Summer 2014

IAL Biology WBI05  
Unit 5: 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
<b>1(a)(i)</b>	D ; tendons	<b>1</b>

Question Number	Answer	Mark
<b>1(a)(ii)</b>	D ; 3:1	<b>1</b>

Question Number	Answer	Mark
<b>1(a)(iii)</b>	A ; few mitochondria and few capillaries	<b>1</b>

Question Number	Answer	Mark
<b>1(a)(iv)</b>	B ; three	<b>1</b>

Question Number	Answer	Mark
<b>1(a)(v)</b>	C ; P and Q	<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)</b>	<ol style="list-style-type: none"><li>1. radial muscles (of iris) contract ;</li><li>2. circular muscles (of iris) relax ;</li><li>3. pupil { increases / widens / dilates / eq } ;</li></ol>		<b>Max 3</b>

Question Number	Answer	Additional guidance	Mark
<b>2(a)</b>	<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"> <li>1. idea of {several / lots / many / eq} {male and female} rats ;</li> <li>2. idea that rats are same age / same mass / same species / same health / same pretreatment / eq ;</li> <li>3. idea of measuring change in {volume / height / level / distance moved / eq} of coloured water ;</li> <li>4. left for set stated time ;</li> <li>5. description of how rate is obtained e.g. {volume / height / distance moved / eq} ÷ time / per minute ;</li> <li>6. carbon dioxide absorber named e.g. sodium hydroxide, potassium hydroxide, soda lime ;</li> <li>7. idea of syringe used to reset coloured water (for repeats) ;</li> <li>8. idea of controlling temperature e.g. use of waterbath ;</li> </ol>	<p>QWC emphasis is clarity of expression (penalise once)</p> <ol style="list-style-type: none"> <li>1. ACCEPT same male and female rat used more than once, calculation of mean for male and female rats</li> <li>6. ACCEPT chemical formula</li> </ol>	<b>Max 6</b>

Question Number	Answer	Additional guidance	Mark
<b>2(b)</b>	1. cannot {measure volume of oxygen used / rate of respiration / uptake of oxygen} / {no} movement of coloured water / eq ;  2. because volume of oxygen used = volume of carbon dioxide produced / {no} change in {volume / pressure} ;	1. IGNORE amount	<b>Max 2</b>



Question Number	Answer	Mark
<b>3(a)</b>	D ; medulla oblongata	<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>3(b)(i)</b>	cerebral hemisphere / cerebrum / frontal lobe / frontal cortex / forebrain / temporal lobe / eq ;		<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>3(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. reference to better resolution ;</li> <li>2. idea of more detail seen e.g. smaller parts seen, finer detail ;</li> <li>3. no use of X rays ;</li> <li>4. idea of safer e.g. less risk of cell damage, mutation ;</li> <li>5. therefore can use more often / eq ;</li> </ol>	<p>ACCEPT appropriate converse comment ACCEPT Mps even if fMRI used</p> <p>2. greater detail / clearer picture / sharper image</p> <p>4. ACCEPT less harmful, less dangerous, use on pregnant women</p>	<b>Max 3</b>

Question Number	Answer	Additional guidance	Mark
<b>3(c)</b>	1. caffeine {binds / blocks / eq} ; 2. {channel / reuptake} proteins ; 3. reference to presynaptic {membrane / knob / eq} ;	2. NOT sodium channels / receptors	<b>Max 3</b>

Question Number	Answer		Mark
<b>3(d)(i)</b>	neither patients nor {doctors / scientists / eq} know which treatment the patients were given / eq ;	ACCEPT administrator	<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>3(d)(ii)</b>	<p>1. idea that SSRI works best ;</p> <p>2. placebo works faster than SJW / SJW and placebo effect {wear off / level / end at 12 / same final score / fall then rise / eq} ;</p> <p>3. credit comparative manipulation of figures to support Mp1 ;</p>	<p>1. ACCEPT e.g. St. John's wort and placebo less effective, St John's wort and placebo work but not as well SSRI ;</p> <p>3. e.g. for SSRI HRSD score decrease 6 units more than SJW</p>	<b>Max 2</b>

Question Number	Answer	Additional guidance	Mark
<b>3(d)(iii)</b>	<p>1. idea of more patients e.g. increase sample size, large number of patients, repeat the trial / eq ;</p> <p>2. idea of use of statistical analysis ;</p> <p>3. (sample selection) same age / gender / ethnicity / lifestyle / health / eq ;</p> <p>4. idea of extending time of trial e.g. beyond 8 weeks ;</p>	<p>3. IGNORE randomised unqualified</p>	<b>2</b>

Question Number	Answer	Additional guidance	Mark
<b>4(a)(i)</b>	Correct answer gains TWO marks  36 x 128 OR 4608 ;  4.608 / 4.6 / 4.61 ;		<b>2</b>

Question Number	Answer	Additional guidance	Mark
<b>4(a)(ii)</b>	1. idea that lower resting heart rate means more potential to reach maximum heart rate ;  2. idea that higher {stroke volume / cardiac output} means more {blood / oxygen / glucose} delivered ;  3. aerobic respiration / less anaerobic respiration / less lactate produced / eq ;	3. ACCEPT less oxygen debt	<b>2</b>

Question Number	Answer	Additional guidance	Mark
<b>4(a)(iii)</b>	<ol style="list-style-type: none"><li>1. idea of increased oxygen supply ;</li><li>2. oxygen is { electron / hydrogen (ion) / proton } acceptor / eq ;</li><li>3. to form water / eq ;</li><li>4. idea of increased glucose supply ;</li><li>5. idea of reduced coenzyme produced e.g. reduced NAD, reduced FAD ;</li><li>6. electron transport chain eg. idea of electrons passed along carriers ;</li><li>7. idea of proton gradient produced e.g. hydrogen ions moved to intermembrane space ;</li><li>8. idea of phosphorylation of ADP e.g. ADP combines with P(i) ;</li></ol>	<ol style="list-style-type: none"><li>5. ACCEPT any origin of reduced NAD / reduced FAD</li><li>7. ACCEPT electrochemical gradient / concentration gradient / chemiosmosis</li><li>8. ACCEPT equation</li></ol>	<b>Max 5</b>

Question Number	Answer	Additional guidance	Mark
<p><b>4(b)</b></p>	<ol style="list-style-type: none"> <li>1. idea that for high risk an increase in exercise reduces incidence of type 2 diabetes ;</li> <li>2. idea that for low risk an increase in exercise has no effect on incidence of type 2 diabetes ;</li> <li>3. reference to correlation in correct context of Mp1 or Mp2 ;</li> <li>4. idea that a causal relationship is { shown by the high risk group and level of exercise / not shown by the low risk group and level of exercise } ;</li> <li>5. idea that other factors may cause type 2 diabetes e.g. genes, obesity, diet, age, ethnicity ;</li> </ol>	<p>ACCEPT high risk = family history low risk = no family history</p> <p>negative correlation between high risk increase in exercise and incidence of type 2 diabetes = 2</p>	<p>Max 4</p>

Question Number	Answer	Additional guidance	Mark
<b>5(a)</b>	idea that {cell body / centron} in middle / eq ;	ACCEPT dendrites at both ends	<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>5(b)</b>	<p>1. it increases with increasing axon diameter / eq ;</p> <p>2. at 1 <math>\mu\text{m}</math> the conduction velocity is the same ;</p> <p>3. idea of greater change in velocity with myelinated neurones / eq ;</p> <p>4. correct manipulation of comparative figures ;</p>	<p>ALLOW converse for Mp1, Mp2 and Mp3</p> <p>4. e.g. at 5 <math>\mu\text{m}</math> velocity is 5 times faster with myelinated increase with myelinated is 22.8 <math>\text{ms}^{-1}</math> and 2.8 <math>\text{ms}^{-1}</math> in unmyelinated</p>	<b>Max 3</b>

Question Number	Answer	Additional guidance	Mark
<b>5(c)</b>	1. idea that Schwann cells cover the axon ; 2. idea that {myelin / Schwann cells} provide insulation ; 3. {action potential / depolarisation / eq} at nodes of Ranvier / eq ; 4. idea that local currents occur over a longer distance ; 5. reference to saltatory conduction / eq ; 6. impulse jumps from node to node / eq ;	3. IGNORE converse  6. NOT action potential	<b>Max 5</b>



Question Number	Answer	Additional guidance	Mark
<b>5(d)</b>	1. acetylcholine {not broken down / remains / eq} ; 2. acetylcholine {binds / eq} to receptor ; 3. in post-synaptic membrane ; 4. action potential described e.g. sodium ions move into post-synaptic neurone, depolarisation of post-synaptic membrane / excitatory post-synaptic potential ; 5. idea that {action potentials / impulses / transmission} {increase / continue / eq} ;	ACCEPT ACh 1. ACCEPT accumulates  4. ACCEPT opening of voltage gated channels, sodium ion channels  5. ACCEPT increase frequency of action potentials	<b>Max 3</b>

Question Number	Answer	Mark
<b>6(a)(i)</b>	A ; less than 9 hours of light ;	<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>6 (a) (ii)</b>	1. reference to photoreceptors; 2. {light / red light} converts $P_R$ to $P_{FR}$ / {dark / far red} converts $P_{FR}$ to $P_R$ ; 3. flower when $P_{FR}$ in low concentration / flower when $P_R$ in high concentration / eq ; 4. reference to plant growth substances ;	1. ACCEPT phytochrome  3. ACCEPT these plants are short day plants  4. ACCEPT produce florigen, named PGS	<b>Max 3</b>

Question Number	Answer	Mark
<b>6 (b) (i)</b>	B ; IAA	1

Question Number	Answer	Mark
<b>6 (b) (ii)</b>	C ; moves away from the illuminated side	1

Question Number	Answer	Additional guidance	Mark
<b>7(a)(i)</b>	1. (breathlessness is) due to {lack of oxygen / increased carbon dioxide} in blood ; 2. reference to reduced {surface area / surface area to volume} ; 3. reference to reduced diffusion ; 4. idea of {reduced airflow / eq} due to {more mucus / narrowing of airways / eq} ;	IGNORE less gas exchange    4. ACCEPT scarring, inflammation, thickening	<b>Max 3</b>

Question Number	Answer	Additional guidance	Mark
<b>7(a)(ii)</b>	idea that there is no recoil e.g. difficult to exhale, lungs remain inflated ;	ACCEPT lungs struggle to deflate, lungs cannot contract IGNORE difficult to inhale	<b>1</b>

Question Number	Answer	Additional guidance	Mark
<b>7(a)(iii)</b>	<p>1. idea that there is more oxygen in blood / eq ;</p> <p>2. detected by {chemoreceptors / carotid body / aortic body};</p> <p>OR</p> <p>idea that {medulla / ventilation centre / respiratory centre} stimulated ;</p> <p>3. to reduce (ventilation) rate ;</p>		<b>Max 2</b>

Question Number	Answer	Additional guidance	Mark
<b>7(b)</b>	<p>Correct answer gains TWO marks</p> <p>1. 12 million / 12,000,000 / <math>12 \times 10^6</math> (smoke) ;</p> <p>2. (25% of 12 million is) 3 million ;</p>		<b>2</b>

Question Number	Answer	Additional guidance	Mark
<b>7(c)</b>	1. idea that nature means {genetic / inherited / eq} origin ; 2. A1AT deficiency ; 3. idea that nurture means {environmental / lifestyle / behaviour / eq} origin ; 4. smoking / dust / air pollution / eq ;		<b>Max 3</b>

Question Number	Answer	Additional guidance	Mark
<b>7(d)(i)</b>	different {base / nucleotide} {sequence / order} ;	ACCEPT {codons / triplets} different, bases {deleted / added / replaced / substituted} IGNORE different mutations / different A1AT production	<b>1</b>

Question Number	Answer	Additional guidance	Mark									
<p><b>7(d)(ii)</b></p>	<table border="1" data-bbox="430 338 925 665"> <tbody> <tr> <td></td> <td>M</td> <td>S</td> </tr> <tr> <td>M</td> <td>MM</td> <td>MS</td> </tr> <tr> <td>Z</td> <td>MZ</td> <td>ZS</td> </tr> </tbody> </table> <p data-bbox="430 703 1106 810">                     1. all four genotypes of the possible children ;                      2. (probability) 75% / 0.75 / <math>\frac{3}{4}</math> / eq ;                 </p>		M	S	M	MM	MS	Z	MZ	ZS	<p data-bbox="1406 306 1892 371">ACCEPT if letters are in different order</p> <p data-bbox="1406 770 1659 836">2. ACCEPT 3 in 4 IGNORE ratios</p>	<p data-bbox="1937 735 1962 767"><b>2</b></p>
	M	S										
M	MM	MS										
Z	MZ	ZS										

Question Number	Answer	Additional guidance	Mark
<b>*7(e)</b>	<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"> <li>reference to (human) {gene / DNA / allele} for A1AT ;</li> <li>reference to use of restriction enzyme ;</li> <li>gene inserted into {fertilised egg / zygote} of sheep ;</li> <li>use of {vector / plasmid / virus / liposome / (micro)injection / microprojectile} ;</li> <li>use of promoter gene (to ensure expression) / eq ;</li> <li>idea of embryo (develops) in {uterus / womb} ;</li> <li>idea of use of {surrogate / adult (female) sheep} ;</li> </ol>	<p>QWC emphasis is logical sequence (penalise once)</p> <ol style="list-style-type: none"> <li>ACCEPT endonuclease</li> <li>ACCEPT gene gun, electroporation</li> <li>ACCEPT foster mother</li> </ol>	<b>Max 5</b>

Question Number	Answer	Additional guidance	Mark
<b>7(f)</b>	<ol style="list-style-type: none"> <li>FEV<sub>1</sub> will be lower / eq ;</li> <li>due to {inflammation / mucus build up / narrowed airways / reduced elasticity} ;</li> </ol>	<ol style="list-style-type: none"> <li>ACCEPT converse</li> <li>ACCEPT obstructed / blocked</li> </ol>	<b>2</b>

Question Number	Answer	Additional guidance	Mark
<b>7(g)</b>	<ol style="list-style-type: none"><li>1. site of action is the muscles (in the airways) ;</li><li>2. which {relax / do not contract} ;</li><li>3. causing airways to {open / dilate / eq} ;</li><li>4. resulting in more air entering alveoli ;</li></ol>		<b>Max 3</b>

Question Number	Answer	Additional guidance	Mark
<b>7(h)</b>	<ol style="list-style-type: none"><li>1. bronchodilators have been ineffective / eq ;</li><li>2. theophylline {has side effects / increases heart rate / increases headaches} ;</li><li>3. idea of need to be monitored / eq ;</li><li>4. idea of more expensive ;</li></ol>	<ol style="list-style-type: none"><li>3. more time consuming / inconvenient</li></ol>	<b>Max 2</b>



Question Number	Answer	Additional guidance	Mark
<b>7(i)</b>	<ol style="list-style-type: none"><li>1. use of {attenuated / weakened / inactive / harmless / eq} {bacteria / <i>Pneumococcus</i> / pathogen} ;</li><li>2. reference to antigen presenting cells ;</li><li>3. activation of T helper cells / reference to cytokines ;</li><li>4. reference to B effector cells / activation of T killer cells ;</li><li>5. (differentiation into) plasma cells that secrete antibody / eq ;</li><li>6. reference to memory cells ;</li><li>7. idea that antibody production is {sooner / faster / greater} ;</li></ol>	<ol style="list-style-type: none"><li>1. IGNORE microbe</li>        <li>5. ACCEPT produce</li></ol>	<b>Max 4</b>



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