

# Mark Scheme (Results)

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International Advanced Level  
Biology (WBI05) Paper 01

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 judgment 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

Question Number	Answer	Mark
1(a)(i)	C ;	(1)
Question Number	Answer	Mark
1(a)(ii)	B decreases ;	(1)
Question Number	Answer	Mark
1(a)(iii)	C ;	(1)
Question Number	Answer	Mark
1(a)(iv)	A calcium ;	(1)
Question Number	Answer	Mark
1(a)(v)	A actin ;	(1)
Question Number	Answer	Mark
1(a)(vi)	B more myoglobin than fast twitch fibres ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	1. (tendons) attach muscle to bone / eq ; 2. do not stretch when muscle contracts / all force transferred to bone / eq ; 3. so { bone / skeleton } is moved / eq ;	IGNORE unqualified ref to energy wasted ACCEPT converse for Mp 2, 3	(3)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	1. reference to {protein / hormone / eq} ; 2. regulates / switch on / activates / binds to promoter region / eq ; 3. a gene / allele / mRNA synthesis / eq ;	2. ACCEPT allows RNA polymerase to bind 3. IGNORE transcription	(2)

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	1. reference to {restriction enzyme / named e.g.} ; 2. idea that gene is removed from DNA ; 3. idea of a vector is needed e.g. virus used / (micro) pipette injection, gene gun, microprojectile, liposome, plasmid ; 4. idea that gene incorporated into { DNA /genome} of zebrafish ; 5. credit named enzyme used to incorporate gene e.g. ligase ;	1. IGNORE endonuclease alone 3. IGNORE bacteria	(3)

Question Number	Answer	Additional Guidance	Mark
2(b)	idea of effect on native populations of zebrafish e.g. transfer of added gene, competition, reduction of population ;	ACCEPT effect on predators	(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	idea that {GM fish / fish with gene for red protein} less likely to survive at lower temperature ;		(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	<p>1. idea of difference between the{ mean / lowest} temperatures of the two types is small ;</p> <p>2. Idea that the SD shows an overlap ;</p> <p>3. credit manipulation of figures e.g. difference in means is 1.1°C</p> <p>OR</p> <p>SD based on using non-GM 4.0 to 6.6 °C and green 5.1 to 7.7°C ;</p>	<p>1.ACCEPT similar, close</p> <p>ACCEPT that some of the greens can survive 0.2°C below the mean for non-GM</p>	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)	<ol style="list-style-type: none"><li>1. idea that it shows {waves / heart rate / heart rhythm} ;</li><li>2. idea that these are waves of electrical activity in the {heart / skin} ;</li><li>3. over a period of time / during cardiac cycle / eq ;</li></ol>	2.ACCEPT PQRST waves	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)	<ol style="list-style-type: none"><li>1. idea that one breath is peak to peak or trough to trough ;</li><li>2. idea of count the number of peaks or troughs in a set time ;</li><li>3. number per minute / eq ;</li><li>4. idea of repetition to obtain a mean or improve reliability ;</li></ol>		(3)

Question Number	Answer	Additional Guidance	Mark
*3(c)(i)	<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. concentration of carbon dioxide in the {alveoli / lungs / eq} is higher / eq ;</li> <li>2. concentration of carbon dioxide in the blood is higher / eq ;</li> <li>3. idea of pH of blood falls (due to increased CO<sub>2</sub>) ;</li> <li>4. (CO<sub>2</sub> / pH levels in blood) detected by chemoreceptors ;</li> <li>5. in {carotid body / carotid artery / aortic body / aorta} ;</li> <li>6. reference to {ventilation / respiratory} centre ;</li> <li>7. idea of control is in medulla ;</li> <li>8. sends{ more / eq} impulses along {neurones / nerves} ;</li> <li>9. to intercostals muscles / diaphragm ;</li> </ol>	QWC emphasis is logical sequence	<b>(5)</b>

Question Number	Answer	Additional Guidance	Mark
3 (c) (ii)	<ol style="list-style-type: none"><li>1. (inhaled) air has a lower CO<sub>2</sub> ;</li><li>2. idea that the CO<sub>2</sub> concentration in blood is higher than in the {alveoli / lungs / eq} ;</li><li>3. (so) CO<sub>2</sub> moving {down concentration gradient / out of blood} / eq ;</li><li>4. CO<sub>2</sub> lost (to atmosphere) through {exhaling / breathing / ventilation / eq} ;</li></ol>		<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	idea that kittens visual system is similar to humans OR {less / un} ethical to use human babies ;	ACCEPT visual cortex / vision development / brain	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	idea of reducing genetic variation ;	ACCEPT similar genes / similar genotype	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. rhodopsin {splits / bleaches / breakdown / eq} ;  2. into opsin and (trans-)retinal ;  3. idea of a change in shape of retinal / <i>cis</i> -retinal into <i>trans</i> -retinal ;	3.ACCEPT retinol	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	<ol style="list-style-type: none"> <li>1. (lack of stimulus/light in right eye meant that){ fewer impulses / less firing / eq} to {visual cortex / target cells / ocular columns / eq} ;</li> <li>2. less neurotransmitter released / eq ;</li> <li>3. synapses {weakened / lost / destroyed / inactive / eq} ;</li> <li>4. neurones for right eye lost / eq ;</li> <li>5. idea that neurones for left eye develop ;</li> <li>6. {cell / ocular} columns {smaller for right eye / larger for left eye} ;</li> </ol>		(3)

Question Number	Answer	Additional Guidance	Mark
4(c)	<p>one from:</p> <p>will feel pain / cruel / animals have rights / not given their consent / causes {damage / harm / blindness / stress} / eq ;</p>		(1)

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	B - 70 mV ;		(1)

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	1. idea that pd changes from negative to positive ; 2. by 100 mV ;	1.ACCEPT becomes positive, changes from -70 to +30 mV	(2)

Question Number	Answer	Additional Guidance	Mark
5(a)(iii)	1. idea that permeability of membrane to Na <sup>+</sup> increases ; 2. Na <sup>+</sup> {channels / gates} open ; 3. detail of channels e.g. {voltage-gated / voltage-dependent} channels, activation gate opened ; 4. Na <sup>+</sup> move into neurone ; 5. through diffusion / down the {concentration/eq} gradient ; 6. stimulates more Na <sup>+</sup> channels to open / ref to positive feedback ; 7. idea that pd is positive because of excess {Na <sup>+</sup> / eq} inside neurone ;	ACCEPT Sodium ions NOT Sodium but penalise once only	(5)

Question Number	Answer	Additional Guidance	Mark
5(b)	1. idea that (second stimulus) is occurring during the action potential ; 2. idea that (the neurone) has not reached the resting potential ; 3. idea that sodium ion channels closed ;	1.ACCEPT during (absolute) refractory period	(2)

Question Number	Answer	Additional Guidance	Mark
6 (a)	1. idea that it comes from pre-synaptic neurone e.g. from vesicles that bind to pre-synaptic membrane ;  2. it diffuses { across the synaptic gap / eq } ;  3. idea that it { affects / eq } post-synaptic{ neurone / membrane } ;	3.ACCEPT receptors, depolarises , initiate action potential, effect on Na{ ions / channels }	(2)

Question Number	Answer	Additional Guidance	Mark
6(b)	1. idea that serotonin not reabsorbed OR SSRI binds to reuptake proteins ;  2. reference to{ synapse / synaptic cleft } ;  3. idea that there is a high level of serotonin ;  4. idea that serotonin continues to have an effect e.g. serotonin continues to bind to receptors in post-synaptic membrane ;	1.ACCEPT remains, stays    3.ACCEPT level stays high, builds up	(2)

Question Number	Answer	Additional Guidance	Mark
6(c)(i)	1. idea that mean degree of muscle contraction decreases ; 2. idea that Calcium ion channels are less responsive ; 3. in {sensory / eq} neurone ; 4. idea that fewer $\text{Ca}^{2+}$ taken up ; 5. idea that less neurotransmitter released ; 6. idea of fewer impulses in motor neurone or to muscle ;	5.ACCEPT fewer vesicles move to presynaptic membrane / neurotransmitter depleted	(3)

Question Number	Answer	Additional Guidance	Mark
6(c)(ii)	1. reference to different volume(s) used ; 2. idea that muscle contraction is measured for each number of times the volume was repeated ; 3. idea of same type of sound ; 4. idea of control of one other abiotic variable e.g other noise , temperature, rest period, interval between trials ; 5. idea of control of volunteers e.g. same age, gender, hearing ability ;		(4)

Question Number	Answer	Additional Guidance	Mark
*7(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"> <li>1. idea that the fuel is from metabolic processes eg from glycolysis , from pyruvate ;</li> <li>2. 2 carbon compound ;</li> <li>3. idea that this is added to a 4 carbon compound to form a 6 carbon compound ;</li> <li>4. idea that carbon dioxide released during Krebs cycle ;</li> <li>5. {hydrogens / protons / eq} removed ;</li> <li>6. attached to NAD / used to reduce NAD / formation of NADH;</li> <li>7. ref to reduction of FAD / formation of FADH<sub>2</sub> ;</li> <li>8. reference to formation of ATP ;</li> <li>9. idea of regeneration of the 4 carbon compound ;</li> <li>10.idea that oxygen used in formation of water ;</li> </ol>	<p>QWC emphasis clarity of written expression ACCEPT Mps when they can be clearly identified from a diagram but if a diagram only then penalise by 1 mark</p> <ol style="list-style-type: none"> <li>2.ACCEPT acetyl coenzyme A / acetyl coA</li> <li>3.ACCEPT oxaloacetic acid citrate / citric acid</li> </ol>	<b>(6)</b>

Question Number	Answer	Additional Guidance	Mark
7(b)	1. double membrane bound / nuclear envelope ; 2. ref to nuclear pores ; 3. presence of one or more nucleoli ; 4. idea of contains genetic material ;	ACCEPT Mps from clear labelled diagram  4.ACCEPT DNA, chromosomes, chromatin	(3)

Question Number	Answer	Additional Guidance	Mark
7(c)	1. idea that structure of DNA is changed OR {spontaneous / random} change in {gene / DNA} ;  2. {sequence / number / eq} of {bases / codons /eq} changed ;	2.ACCEPT addition, deletion etc as eq to number / sequence	(2)

Question Number	Answer	Additional Guidance	Mark
7(d)	$723\,913 \div 40\,000 / (1 \div 40\,000) \times 723\,913 ;$ 18 ;	Correct answer gains both marks  IGNORE 18.1	(2)

Question Number	Answer	Additional Guidance	Mark
7(e)	1. more glucose in (pancreatic) cells / eq ; 2. more {respiration / Krebs cycle / oxidative phosphorylation} in mitochondria / eq ; 3. more ATP {produced / present / eq} ; 4. ATP level detected ;	2.NOT mitochondria respire glucose	(3)

Question Number	Answer	Additional Guidance	Mark
7(f)	1. idea of injection procedure carried out ; 2. idea that study done with eggs with no {intervention / cytoplasm / mitochondria} added OR an inert substance added / extract from bad egg added ;	2.ACCEPT no transfer to infertile eggs/ bad eggs no extract from donor eggs/good eggs no ooplasmic transfer	(2)



Question Number	Answer	Additional Guidance	Mark
7(h) (ii)	idea that some embryos may be selected rather than others ;	ACCEPT against abortion , right to life, destroying life , rights of embryo, rights of disabled, spare embryos, designer babies, eugenics	(1)

Question Number	Answer	Additional Guidance	Mark
7(i)	1. tropical / eq ;  2. as produce less heat / eq ;  3. more ATP produced / eq ;  4. idea that ATP available for muscle contraction ;		(3)

Question Number	Answer	Additional Guidance	Mark
7(j)	1. idea that mitochondrial {DNA /genes} mutate rapidly  OR  idea of interbreeding is less successful e.g. reduced viability of offspring, offspring {die early / lack energy / develop slowly / less fertile / have incompatible mitochondria} ;  2. leading to {reproductive isolation / no interbreeding} ;	IGNORE evolve	(2)

