Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCE
in Biology (6BI05) 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.

Question Number	Answer	Mark
1(a)(i)	A ; cerebrum	(1)

Question Number	Answer	Mark
1(a)(ii)	C ; hypothalamus	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	<table><tr><th>Stage</th><th>Voltage-gated K^+ channel open</th><th>Voltage-gated K^+ channel closed</th><th>Voltage-gated Na^+ channel closed</th></tr><tr><td>Depolarisation</td><td></td><td>✓</td><td></td></tr><tr><td>Repolarisation</td><td>✓</td><td></td><td>✓</td></tr></table>	**3 columns correct = 2 marks** **2 columns correct = 1 mark**	(2)

Question Number	Answer	Mark
1(b)(ii)	A ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	In sensory neurone: 1. dendron longer; 2. dendron myelinated ; 3. axon shorter ; 4. {cell body / eq} {not at the end / towards the middle / to the side / eq } ; 5. reference to no {motor end plate / eq} ;	ALLOW converse for motor neurone 4. **ACCEPT** centron / nucleus for cell body	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(a)	1. idea that initiates electrical activity over atria ;	1. **ACCEPT** initiates impulse / initiates depolarisaton	
	2. causes atria to contract / eq ;	2. **ACCEPT** systole for contract	
	3. {forcing / eq} the (oxygenated) blood into the left ventricle / eq ;		
	4. electrical activity from SAN {received by AVN / travels through {bundle of His / Purkyne fibres / eq }} ;	4. **ACCEPT** Purkinje for Purkyne	
	5. causing left ventricle to contract (forcing blood into aorta) / eq ;	5. **ACCEPT** systole for contract **NOT** left and right	**(4)**

Question Number	Answer	Additional Guidance	Mark
*2(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. increase in *respiration* rate in *muscle* cells ; 2. more {CO_2/*carbonic* acid/eq} in blood ; 3. more {*lactate* / *lactic acid*} in blood / eq ; 4. idea that *chemoreceptors* in *medulla* stimulated ; 5. ref to *cardiovascular* control centre in *medulla* ; 6. ref to *autonomic nervous system* /*sympathetic nerve* ; 7. more *impulses* from {*medulla* / *cardiovascular* control centre} to SAN OR along neurones to SAN ; 8. More {*noradrenaline / norepinephrine*} released onto SAN ; 9. SAN (excitation) rate increased / eq ; 10. (causing an) increased {heart rate / eq} / eq ; 11. Comment on other mechanism e.g. presence of adrenaline, stretch receptor role ;	**QWC emphasis is on spelling** 2 OR 3 **ACCEPT** reduced blood pH 4. **ACCEPT** in *aorta, carotid* 6. **ACCEPT** *accelerator* nerve 10. **ACCEPT** beats per min for heart rate	**(6)**

Question Number	Answer	Additional Guidance	Mark
2(c) (i)	Correct answer with units gains 2 marks 1 beat = 0.81 sec / 60 ÷ 74 / eq ; 8.1 seconds ;	**ACCEPT** 8.11 seconds	**(2)**

Question Number	Answer	Mark
2(c) (ii)	mV / millivolts / eq ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)	1. idea that there was no bias ; 2. idea of contributes to validity ; 3. idea of hot object desensitises ; OR idea of thermoreceptors not harmed /overstimulated / habituated due to high temp ;	**1. ACCEPT** sequence of procedure has no effect/to see if positive then negative gives a different outcome to negative then positive	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. conclusion is valid / eq ; 2. (because mean feelings) scores similar for both / eq ; 3. idea that difference between positive and negative (mean feelings) scores are similar ; 4. comment on SD as a measure of variation from the mean / eq ; 5. SD similar for physical and emotional when experience is positive / eq ; 6. Idea of overlap for {positive / negative} ; 7. figures used to support Mp6 e.g. for positive minimum is 4.0 for physical and maximum is 4.6 for emotional ;	**1 ACCEPT** conclusion is supported NB for negative the positive minimum for physical is 1.3 and maximum is 2.1 for emotional	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	1. fMRI ; and any two from: 2. (fMRI) operates in real time / eq ; 3. as experience will be short lived / eq ; 4. Active areas will {light up / be coloured / eq} (on the image) / eq ; 5. high resolution (as areas involved may be small) / eq ; 6. Safer / eq ;	 **2 ACCEPT** live images, 4 images per second **4. ACCEPT** idea of active areas require more oxygen/oxygenated blood 5 **ACCEPT** more pixels, image is more detailed **6. ACCEPT** ref. to not using X rays, etc	**(3)**

Question Number	Answer	Mark
3(c)(ii)	D ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
4 (a)	1. idea that opsin uncouples from the (rod cell) cell surface membrane ; 2. trans retinal {converts / eq} to cis retinal ; 3. rhodopsin is (re)formed / eq ; 4. from opsin and retinal ; 5. idea that this results in dark adaptation ; 6. permeability of the cell surface membrane to Na^+ increases / eq ; 7. hyperpolarisation of cell decreases / eq ; 8. (more) neurotransmitter is released / eq ;	**NB IGNORE *references to bipolar neurone responses*** **IGNORE** reference to retinol **6. ACCEPT** Na^+ {enters /channels unblocked / channels open} **7. ACCEPT** (partial) depolarisation / reduced potential difference **8. ACCEPT** glutamate for neurotransmitter	**(5)**

Question Number	Answer	Additional Guidance	Mark
4 (b)(i)	1. mean peak voltage increases as light intensity increases up to 9 AU / eq ; 2. idea of {non linear increase / increase decreases} ; 3. no further increase in change in mean peak voltage as light intensity increases from 9AU / eq ;	**IGNORE** speed references **2. ACCEPT** greatest change is mean peak voltage is when light intensity increases from 1 to 3	**(2)**

Question Number	Answer		Mark
4 (b)(ii)	*As light intensity increases up to 9AU* 1. idea that the greater the light intensity, the less {neurotransmitter/eq} there is binding to the neurone present ; 2. idea that inhibition removed e.g. (more) Na^+ channels open, (more) Na^+ diffuses into neurone ; 3. so peak voltage of depolarisation becomes more positive / eq ; *At high light intensities (from 9AU) :* 4. idea of no {neurotransmitter/eq} binding ; 5. sufficient Na^+ enters / eq ; 6. so action potential achieved ;	**NB ACCEPT** glutamate for neurotransmitter **ACCEPT** converse for decreasing light intensity **3 ACCEPT** increasing depolarisation **5 ACCEPT** threshold potential achieved	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(c)	1. idea of rats have rights ; 2. rats made {blind/ eq } ; 3. 15 samples may not be sufficient for a reliable investigation / eq ; 4. idea that rat retina may not behave like human retina (so investigation has no (potential) medical application) ;	1. **ACCEPT** lack of consent given 2. **ACCEPT** harmed, causes pain, requires killing rats 4. **ACCEPT** tissue culture available	**(2)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(a) (i)</td><td>
<table>
<tr><th>Investigation</th><th>Type of respiration</th><th>Potassium hydroxide solution absent or present</th><th>Coloured liquid moved to the left</th><th>Coloured liquid moved to the right</th><th>Coloured liquid did not move</th></tr>
<tr><td>1</td><td>Anaerobic</td><td>Absent</td><td>☒</td><td>☒</td><td>☒</td></tr>
<tr><td>2</td><td>Aerobic</td><td>Absent</td><td>☒</td><td>☒</td><td>☒ ;</td></tr>
<tr><td>3</td><td>Aerobic</td><td>Present</td><td>☒ ;</td><td>☒</td><td>☒</td></tr>
</table>
</td><td></td><td>(2)</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(a)(ii)</td><td>1. (as anaerobic) no O_2 absorbed / eq ;

2. no CO_2 produced / eq ;

3. so no change in {volume/pressure} (so liquid does not move) ;

4. since for each 6C glucose respired, 2x3C lactate formed / eq ;</td><td>1. ACCEPT No oxygen used</td><td>(3)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(a)(iii)	1. (reduced NAD from glycolysis) enters mitochondria/ moves through outer mitochondrial membrane / eq ; 2. moves to inner membrane of mitochondrion / eq ; 3. becomes {oxidised /NAD / NAD^+} ; 4. as {electrons / eq} transferred to {electron transport chain / eq} / eq ; 5. fate of hydrogen ions described e.g. pumped into membrane space ; 6. (NAD) returns to {Krebs cycle/ matrix / eq} ;	**2. ACCEPT** crista for inner mitochondrial membrane **6. ACCEPT** cytoplasm, glycolysis	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(b)	1. same mass of each tissue / eq ; 2. idea of time being recorded for {a set distance travelled by coloured liquid OR distance coloured liquid travelled in a set time} ;	**1. IGNORE** amount	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(a)	1. RBC will {carry/supply oxygen} ; 2. idea that low number of mitochondria present in fast twitch ; 3. so additional oxygen may have limited additional effect / eq ; 4. poor {blood supply / capillary network} in fast twitch muscle so little additional {oxygen / RBC / eq} received / eq ; 5. (in fast twitch) respiration is (primarily) anaerobic / eq ; 6. short {time duration of race/distance travelled} means minimal additional blood supplied to muscles in timeframe ;	ACCEPT converse for slow twitch muscle **4. ACCEPT** low numbers of RBC in fast twitch so extra will have minimal additional effect **6. ACCEPT** no need for oxygen because of short {time duration of race/distance travelled}	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)	1. idea of not being fair ; 2. idea of being a poor role model for youngsters ; 3. health risk to athletes / eq ; 4. cost to {NHS / medical services / eq} of health implications / eq ;	**3. ACCEPT** raised blood clotting risk, harmful side effects	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. protein coat / eq ; 2. no {cytoplasm / cell surface membrane present / eq } ; 3. contains { viral genetic material / eq } ; 4. very small / smaller than a bacterium / size stated ; 5. response to antivirals / eq ;	**1. ACCEPT** capsid **2. ACCEPT** no ribosomes, no organelles	**(2)**

Question Number	Answer	Additional Guidance	Mark
*7(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. identify a gene that {provokes an effective immune response / codes for {antigen / eq} / inhibits *T. gondii* entering {brain/muscle} cells} ; 2. gene removed using a {restriction enzyme / endonuclease} ; 3. {same / this / eq} restriction enzyme used to open {*T. gondii* genome / eq} / eq ; 4. sticky ends {formed / eq } ; 5. ligase used to bind gene / eq ; 6. by forming phosphodiester bonds / eq ; 7. idea of method of introducing gene into pathogen ; 8. idea that gene needs to be expressed e.g. protein synthesised ; 9. idea of this protein in provoking an immune response ; 10. detail of immune response ;	QWC with emphasis on clarity of expression 3. **NOT** plasmid cut open 7. **IGNORE** plasmid 8. **ACCEPT** synthesises antigen	**(6)**

Question Number	Answer	Additional Guidance	Mark
7(c)	1. idea that it binds to wasp venom so it {is removed from / can no longer bind to} receptor ; 2. idea that breaks down wasp venom so it leaves receptor ; 3. idea that wasp venom binds more readily to it than to the receptor ; 4. idea of the nature of the compound e.g. enzyme ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
7(d)	1. idea that mass of ants and mass other insects compared ; 2. in a measured area / reference to quadrat ; 3. samples taken from other habitats / eq ; 4. reference to extrapolate to world scale ;		**(3)**

Question Number	Answer	Additional guidance	Mark
7(e)	1. reference to transcription factors ; 2. bind to promoter region / form a transcription initiation complex / eq ; 3. RNA polymerase can bind /eq ; 4. mRNA made ; 5. idea of translation occurring ; 6. at ribosomes / on the RER / in the cytoplasm ; 7. idea of function of product e.g. inhibits normal ant behaviour / stimulates abnormal ant behaviour / description of abnormal behaviour given ; 8. idea of product affecting nervous system ;	2. **ACCEPT** gene switched on 5. **ACCEPT** protein/polypeptide produced	**(5)**

Question Number	Answer	Additional Guidance	Mark
7(f)	1. {sequence of bases / eq} on DNA that codes for a {polypeptide/protein/eq} ; 2. that regulates circadian rhythms / description given ;	2**. ACCEPT** idea that gene is activated at certain times of the day such as near noon	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(g)	1. (signals are) {calcium ions / Ca^{2+}} ; 2. less (Ca^{2+}) binding to troponin so less tropomyosin {displaced / eq} ; 3. so less myosin binding sites exposed (on actin) / less myosin binds (to actin) ; 4. so there is a lack of muscle use / eq ; 5. idea that muscle atrophy means muscle (mass) reduction	5. **ACCEPT** muscle wastage for muscle reduction	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(h)	1. idea of unsuccessful breeding programme e.g.(fungi) unable to breed together / eq ; 2. could not produce sexually viable offspring / eq ; 3. they had {few (homologous) features in common / morphological differences / different chromosome number / eq} ; 4. { DNA / eq } compared ; 5. Use of electrophoresis ; 6. {banding / eq } did not match / eq;	1. **ACCEPT** cannot interbreed 4. **ACCEPT** DNA hybridisation, molecular phylogeny, proteomics 5. **ACCEPT** DNA profiling 6. **ACCEPT** converse	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(i)	1. contains xylem / eq ; 2. idea that it is strong enough (to support the ant/fungus) ; 3. leaf supplies {a nutrient/named nutrient/water} to fungus ; 4. idea of enables effective spreading of fungal spores e.g. enables dispersal, effective reproduction ;		**(2)**