

Topic 7 Biology

Booklet 2 of 3

Revision Questions

**Cardiac & Pulmonary
Systems &
Thermoregulation**

MARK SCHEME

Question Number	Correct Answer	Mark
4(a)	<ol style="list-style-type: none"> 1. {initiates / eq} heartbeat / eq ; 2. (starts) wave of excitation / depolarisation ; 3. {determines / eq} heart rate ; 	max (2)

Question Number	Correct Answer	Mark
4(b)	<ol style="list-style-type: none"> 1. {increased / eq} impulses to SAN / eq ; 2. (via) sympathetic {nervous system / eq } ; 3. stimulates more frequent depolarisation in SAN / eq ; 4. increases {heart rate / cardiac output} /eq ; 	max (2)

June 2010

Question Number	Correct Answer	Mark
*4(c)	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. changes {electrical activity / <i>depolarisation</i>} of heart / eq ; 2. peak is reversed / eq ; 3. idea that peak is earlier than expected ; 4. no change in pressure in <i>pulmonary artery</i> ; 5. (because) little blood in <i>ventricles</i> ; 6. missed normal wave after E / longer gap before next wave / eq ; 7. missed (effective) <i>contraction</i> after E ; 8. early <i>depolarisation</i> leaves <i>ventricle</i> insensitive ; 9. idea that the wave of <i>depolarisation</i> is prevented ; 10. reference to <i>refractory</i> period / eq ; 	max (5)

June 2010

Question Number	Correct Answer	Mark
4(d)	<ol style="list-style-type: none"> 1. idea that (absolutists) say drugs should not be used at any time ; 2. should not allow athletes to be pressured into using drugs ; 3. risk to health / eq ; 4. gain unfair advantage / eq ; 5. other harmful substances banned / eq ; 6. burden on care services / eq ; 7. idea that (relativists) say that drugs could be used under some circumstances ; 8. idea that they could be used for medication ; 9. drugs (in the body) can be difficult to legislate for / eq ; 	<p>max (2)</p>

June 2010

Question Number	Answer	Mark
6(a)	<ol style="list-style-type: none"> 1. idea that stimulation generated from within (muscle) e.g. no external stimulation ; 2. idea of brings about depolarisation ; 	(2)

Question Number	Answer	Mark
*6(b) QWC	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. reference to {<i>Sinoatrial node / SAN</i>} ; 2. initiates <i>depolarisation</i> / eq ; 3. passes through (wall of) <i>atria</i> / eq ; 4. causes <i>atrial</i> {<i>systole</i> / eq} ; 5. AVN conducts to <i>ventricles</i> / eq ; 6. reference to {<i>Purkyne</i> fibres / bundle of <i>His</i>} ; 7. ventricular {<i>systole</i> / eq} follows (from apex) / eq ; 8. atrioventricular valves closed (and prevent flow to atria) ; 9. <i>semilunar</i> valves opened by pressure / eq ; 10. blood forced into <i>arteries</i> / eq ; 11. changed pressure in {<i>diastole</i> / eq} closes <i>semilunar</i> valves ; 	max (6)

Question Number	Answer	Mark
3(a)(i)	1. breath identified ; 2. reference to time (for one / several peaks) ; 3. ref method for tidal volume e.g. height from peak to trough on trace ; 4. reference to calibration for volume ;	(3)

Question Number	Answer	Mark
3(a)(ii)	breathing rate x tidal volume / eq ;	(1)

Question Number	Answer	Mark
3(b)(i)	stroke volume / strength of (cardiac) muscle contraction / blood viscosity / size {atria/ventricles/chambers} / adrenaline / eq ;	(1)

June 2011

Question Number	Answer	Mark
3(b)(ii)	<ol style="list-style-type: none"> 1. there is little difference in ventilation rate / does not increase as much / eq ; 2. oxygen uptake increases / eq ; 3. credit use of manipulated figures ; 	(3)

Question Number	Answer	Mark
3(b)(iii)	<ol style="list-style-type: none"> 1. idea that there is more blood passing through (lungs) / eq ; 2. oxygen diffuses into blood / eq ; 3. {diffusion/eq} gradient being maintained / eq ; 4. oxygen (diffuses) in faster / eq ; 	(3)

Question Number	Answer	Mark
3(b)(iv)	<ol style="list-style-type: none"> 1. increased heart rate (from 50-100) {increases oxygen uptake / increases ventilation rate less} / eq ; 2. idea that heart rate has a greater effect on oxygen uptake than on ventilation rate ; 	(2)

Question Number	Answer	Mark
6(a)	<ol style="list-style-type: none"> 1. more {muscle contraction / respiration} / eq ; 2. idea that heat energy released ; 3. idea that more heat produced than lost ; 	(2)

Question Number	Answer	Mark
6(b)	<ol style="list-style-type: none"> 1. ref to {detection of temperature change / temperature receptors} ; 2. reference hypothalamus ; 3. more sweating / eq ; 4. loss of heat due to evaporation (of water) / eq ; 5. vasodilation (of arterioles) / eq ; 6. loss of radiant heat / eq ; 7. heat gained equal heat lost / eq ; 8. reference negative feedback ; 9. behavioural heat loss mechanism described / eq ; 	(5)

Question Number	Answer	Mark
6(c)	<ol style="list-style-type: none"> 1. idea of dehydration ; 2. no longer sweating / eq ; 3. cooling mechanisms failing / eq ; 4. heat production greater than heat loss / eq ; 5. increase of pace / eq ; 	(2)

Question Number	Answer	Mark
*4 (a)	<p>Take into account quality of written communication when awarding the following points.</p> <ol style="list-style-type: none"> 1. idea of calibration for volume ; 2. idea of calibration for time ; 3. description of how to calculate tidal volume (from trace) / eq ; 4. idea that one peak = one breath ; 5. reference to breathing rate is number of peaks per minute ; 6. idea of standardised group of males and females e.g. same age, non-smokers ; 7. idea that traces taken at rest ; 8. reference to replicates ; 9. description of how to calculate the mean from the trace ; 	(6)

Question Number	Answer	Mark
4 (b)(i)	<ol style="list-style-type: none"> 1. PEF increases (from 15) to when they are in their 30s and then decreases ; 2. reaches a peak at age {30 to 34} for women / eq ; 3. reaches a peak at age {36 to 39} for men / eq ; 4. idea that PEF falls below value at 15 (later on in life) ; 5. manipulation of figures to illustrate the points above ; 	(4)

Question Number	Answer	Mark
4 (b)(ii)	weakening of muscles / loss of elasticity of lungs ;	(1)

Question Number	Answer	Mark
4 (b)(iii)	1. he is more than 30% below / must be less than $400 \text{ dm}^3 \text{ min}^{-1}$ / he is {37 to 39 %} below / eq ; 2. therefore his asthma is not under control ;	(2)

Question Number	Answer	Mark
4 (b)(iv)	height ;	(1)

Question Number	Answer	Mark
4(a)	<ol style="list-style-type: none"> 1. heart rate increases / eq ; 2. {stroke volume / eq} increases / eq ; 3. {SAN /eq} activity increases / ; 4. AVN time delay decreases / eq ; 5. idea that more blood returning (to the heart) causes {heart / muscle} to stretch ; 6. idea that ventricles contract with greater force ; 	(4)

Question Number	Answer	Mark																		
4(b) (i)		(2)																		
	<table><tr><th>Approximate value for</th><th>0.1 dm³</th><th>0.5 dm³</th><th>6 dm³ min⁻¹</th><th>6 breaths min⁻¹</th><th>12 breaths min⁻¹</th></tr><tr><td>Resting breathing rate</td><td></td><td></td><td></td><td></td><td><input checked="" type="checkbox"/></td></tr><tr><td>Resting tidal volume</td><td></td><td><input checked="" type="checkbox"/></td><td></td><td></td><td></td></tr></table>		Approximate value for	0.1 dm ³	0.5 dm ³	6 dm ³ min ⁻¹	6 breaths min ⁻¹	12 breaths min ⁻¹	Resting breathing rate					<input checked="" type="checkbox"/>	Resting tidal volume		<input checked="" type="checkbox"/>			
	Approximate value for		0.1 dm ³	0.5 dm ³	6 dm ³ min ⁻¹	6 breaths min ⁻¹	12 breaths min ⁻¹													
	Resting breathing rate						<input checked="" type="checkbox"/>													
Resting tidal volume		<input checked="" type="checkbox"/>																		

Question Number	Answer	Mark
4(b)(ii)	<ol style="list-style-type: none"> 1. more {peaks / eq} in the same time / higher frequency / distance between (consecutive) peaks would decrease ; 2. idea of distance from peak to trough would increase ; 	(2)

Question Number	Answer	Mark
4(c)	<p>Any two from the following:</p> <ol style="list-style-type: none"> 1. how often they play 2. age 3. body size / BMI / eq 4. gender / eq 5. fitness level / eq 6. health status / eq 7. lifestyle e.g. smoker or swimmer ; ; 	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)	1. idea that (some) have less myoglobin present ; 2. less blood / fewer red blood cells / less haemoglobin ; 3. as fewer capillaries present / eq ; 4. idea that respiration is (mainly) anaerobic ;		(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	negative feedback ;	ACCEPT -ve feedback, biofeedback is negative	(1)

Question Number	Answer	Additional Guidance	Mark
*3(b)(ii)	<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"> 1. Idea that low pH is due to acid in the blood ; 2. <i>lactate</i> taken to <i>liver</i> / eq ; 3. reference to oxygen debt / EPOC ; 4. used to convert <i>lactate</i> back to <i>pyruvate</i> ; 5. with production of <i>reduced</i> NAD / eq ; 6. {<i>lactate</i> / <i>pyruvate</i>} converted to <i>glucose</i> / <i>glycogen</i> ; 7. <i>pyruvate</i> into <i>mitochondria</i> ; 8. idea of <i>chemoreceptors</i> detecting change in pH ; 9. idea of response e.g. increased { nerve impulse rate from <i>medulla</i> / breathing rate / heart rate } ; 10.(dissolved) CO₂ from blood (<i>diffuses</i>) into <i>alveoli</i> / eq ; 	<p>QWC emphasis is spelling</p> <p>ACCEPT <i>lactic</i> acid for <i>lactate</i> throughout and <i>pyruvic</i> acid for <i>pyruvate</i></p> <p>1. Accept for acid: <i>lactic acid/lactate</i>/(dissolved) CO₂</p> <p>5. ACCEPT NADH₂ and NADH + H⁺</p> <p>7. ACCEPT <i>lactate</i>, <i>matrix</i> as equivalent to mitochondria</p>	(5)

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	<ol style="list-style-type: none"> 1. reference to arterioles ; 2. muscles contracting to restrict diameter / eq (in shunts) ; 3. muscles relaxing to increase diameter / eq (of arterioles) ; 4. to redirect blood {away from deeper arterioles / into surface arterioles} / eq ; 5. to increase blood flow { into capillaries / towards surface } / eq ; 6. (so more heat lost) through radiation ; 	<p>IGNORE ref to relaxation of hair erector muscles</p> <p>2. ACCEPT vasoconstriction</p> <p>3. ACCEPT muscles relax to dilate arteriole ;</p> <p>3. ACCEPT vasodilation</p> <p>4. ACCEPT shunt vessels</p> <p>5. More blood enters = to increase blood flow</p>	(4)

Question Number	Answer	Additional Guidance	Mark
2(a)	1. idea that initiates electrical activity over atria ; 2. causes atria to contract / eq ; 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 }} ; 5. causing left ventricle to contract (forcing blood into aorta) / eq ;	1. ACCEPT initiates impulse / initiates depolarisaton 2. ACCEPT systole for contract 4. ACCEPT Purkinje for Purkyne 5. ACCEPT systole for contract NOT left and right	(4)

Question Number	Answer	Additional Guidance	Mark
*2(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"> 1. increase in <i>respiration</i> rate in <i>muscle</i> cells ; 2. more {CO₂/carbonic acid/eq} in blood ; 3. more {lactate / lactic acid} in blood / eq ; 4. idea that <i>chemoreceptors</i> in <i>medulla</i> stimulated ; 5. ref to <i>cardiovascular</i> control centre in <i>medulla</i> ; 6. ref to <i>autonomic nervous system</i> /<i>sympathetic nerve</i> ; 7. more <i>impulses</i> from {<i>medulla</i> / <i>cardiovascular</i> control centre} to SAN OR along neurones to SAN ; 8. More {<i>noradrenaline</i> / <i>norepinephrine</i>} 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 ; 	<p>QWC emphasis is on spelling</p> <p>2 OR 3 ACCEPT reduced blood pH</p> <p>4. ACCEPT in <i>aorta</i>, <i>carotid</i></p> <p>6. ACCEPT <i>accelerator</i> nerve</p> <p>10. ACCEPT beats per min for heart rate</p>	(6)

Question Number	Answer	Additional Guidance	Mark
2(c) (i)	Correct answer with units gains 2 marks 1 beat = $0.81 \text{ sec} / 60 \div 74 / \text{eq}$; 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)	<ol style="list-style-type: none"> 1. idea that stimulation generated from within (muscle) ; 2. idea that this results in depolarisation ; 		(2)

Question Number	Answer	Additional Guidance	Mark
3(b)	<ol style="list-style-type: none"> 1. idea that it shows electrical activity of the heart ; 2. idea of how to identify {one heart beat / time for one heart beat} ; 3. count the number of { these / peaks / eq } in a {set time / stated time} or how long from one set of electrical activity to the next ; 4. description of how to obtain heart rate e.g. beats divided by time ; 	ACCEPT for 2: from one {P wave / QRS complex / T wave } to the next	(3)

Question Number	Answer	Additional Guidance	Mark
3(c)	<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"> 1. the concentration of carbon dioxide in the <i>alveoli</i> is higher / eq ; 2. the concentration of carbon dioxide in the blood is higher / pH of blood is lower / eq ; 3. detected by <i>chemoreceptors</i> in {<i>medulla</i> / <i>carotid artery</i> / <i>aorta</i> } ; 4. reference to {<i>cardiovascular</i> / <i>cardiac</i>} control centre in <i>medulla</i> ; 5. reference to <i>autonomic</i> nervous system / <i>sympathetic</i> nerve ; 6. more impulses to <i>SAN</i> / eq ; 7. { <i>noradrenalin(e)</i> / <i>norepinephrine</i> } released onto <i>SAN</i> ; 8. <i>SAN</i> (excitation) rate increased / eq ; 9. heart rate will increase / eq ; 	<p>QWC Emphasis is on spelling of technical terms</p> <p>1 ACCEPT {diffusion / concentration} gradient increased</p>	(5)

Question	Answer	Additional Guidance	Mark
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Question Number	Answer	Additional Guidance	Mark
5(a)	1. panting causes heat loss / eq ; 2. because water evaporates from { mouth / tongue } / eq ; 3. idea of using heat energy from blood ; 4. panting increases air movement (over the tongue / through the mouth) / eq ; 5. increased air movement increases the rate of evaporation / eq ;	2. ACCEPT saliva evaporates 3. <u>ACCEPT</u> heat energy lost through radiation from blood (capillaries in tongue)	(4) (4)

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	hypothalamus ;		(1)

Question Number	Answer	Additional Guidance	Mark
*5(b)(ii)	<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"> 1. idea that there is a normal temperature for the blood ; 2. thermoreceptors detect change in temperature ; 3. (thermoreceptors send) nerve impulses to TC / eq ; 4. (if the blood temperature increases the TC) sends out nerve impulses to increase panting / eq ; 5. blood temperature falls (due to panting) / eq ; 6. once normal blood temperature is reached, the impulses (from the TC) cease / eq ; 7. panting stops / eq ; 8. reference to homeostasis ; 	<p>QWC emphasis is clarity of expression</p> <p>3. ACCEPT hypothalamus</p> <p>4. ACCEPT impulses to ventilation centre</p>	<p>(5)</p>

Question Number	Answer	Additional Guidance	Mark
5(c)	1. panting involves muscle contraction / eq ; 2. muscle contraction requires respiration / eq ; 3. {muscle contraction / respiration} releases heat energy / eq ;		{2} (2)

Total for Question 5 = 12 MARKS