

Question Number	Answer	Acceptable answers	Mark
<b>1(a)</b>	<p>A comparison including two of the following:</p> <p>both increase (1)</p> <p>oxygen uptake increases more when running / less when walking (from 6 to 10 km per hr) (1)</p> <p>from 6 to 8 km per hour running has a higher oxygen uptake (1)</p> <p>at 8 km per hour both running and walking have the same oxygen uptake (1)</p> <p>from 8 to 10 km walking has a higher oxygen uptake (1)</p>	<p>accept from 6 to 10 km per hour running increase by <math>13 \pm 1</math> and walking increase by <math>22 \pm 1</math></p> <p>accept quoted figures <math>\pm 1</math> eg at 6 running uses 2 (<math>\text{cm}^3/\text{kg}/\text{min}</math>) more than walking accept any speed between 6 and 7.9 (km per hr )</p> <p>ignore lines cross at 8</p> <p>accept quoted figures <math>\pm 1</math> eg at 9 running uses 6 (<math>\text{cm}^3/\text{kg}/\text{min}</math>) less than walking accept any speed between 8.1 and 10</p>	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(i)</b>	(oxygen + glucose $\rightarrow$ ) water + carbon dioxide	<p>both water and carbon dioxide are required in either order.</p> <p>Accept <math>\text{H}_2\text{O} + \text{CO}_2</math></p> <p>Ignore: energy</p> <p>reject wrong symbols eg <math>\text{H}_2\text{O}</math> or <math>\text{H}^2\text{O}</math></p>	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(ii)</b>	<p>an explanation linking two of the following:</p> <p>muscles <b>contract</b> more / faster (1)</p> <p>more (aerobic) respiration (1)</p> <p>(so) more energy ( is needed from aerobic respiration) (1)</p>	<p><b>'More' only has to be stated</b> once for MP 2 and 3 more respiration for energy is carried out = 2 marks.</p> <p>Reject produce / make energy</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(iii)</b>	<b>B</b> statement 2 only		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)(i)</b>	<p><math>24 \div 0.12</math> (1)</p> <p>= 200 (beats per minute)</p>	two marks for correct bald answer	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)(ii)</b>	<p>more blood per minute / faster blood flow (1)</p> <p>more oxygen / glucose (transported to muscle cells) (1)</p>	<b>'more' only has to be stated once</b> blood flows faster carrying oxygen /glucose = 2 marks.	<b>(2)</b>

Total for Question 1 = 11 marks

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(i)</b>	<ul style="list-style-type: none"> <li>• (heart rate = )198 to 200 (1)</li> <li>• (0.18 x 198 to 200 = ) 35.6 to 36 (1)</li> </ul>	2 marks for correct bald answer ecf	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(ii)</b>	B - 12.8 mmol dm <sup>-3</sup>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(iii)</b>	D - the concentration of lactic acid is not dependent on heart rate		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(iv)</b>	<p>Any three from the following:</p> <ul style="list-style-type: none"> <li>• lactic acid increases / <b>more</b> lactic acid produced (as exercise increases) (1)</li> <li>• using more energy /muscles working / contracting harder / faster (1)</li> <li>• <u>aerobic</u> respiration at its maximum (rate) (1)</li> <li>• as oxygen not supplied fast enough / muscles not getting enough oxygen (1)</li> <li>• <u>anaerobic</u> respiration occurs (producing lactic acid) (1)</li> </ul>	<p>Accept stops Ignore breathing</p> <p>Accept body Accept not enough oxygen /oxygenated blood</p>	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(b)</b>	Any three from the following: <ul style="list-style-type: none"> <li>• (concentration of lactic acid) decreases (1)</li> <li>• lactic acid broken down(1)</li> <li>• using oxygen / oxidised(1)</li> <li>• into carbon dioxide and water (1)</li> <li>• ref to oxygen debt / EPOC (1)</li> </ul>	Accept amount  Accept if written in a word or formula equation for MP3 and MP4	<b>(3)</b>

**(Total for question 2 = 10 marks)**

Question number	Answer	Mark
<b>3(a)</b>	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): <ul style="list-style-type: none"> <li>• same temperature to act as control (1)</li> <li>• to provide the optimum temperature for enzyme action in the peas (1)</li> </ul>	<b>(2)</b>

Question number	Answer	Additional guidance	Mark																
<b>3(b)(i)</b>	<ul style="list-style-type: none"> <li>headed table with units (1)</li> <li>accurately completed table (1)</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>O<sub>2</sub> used /ml at 10 mins</td> <td>0.8</td> <td>0.1</td> <td>0.0</td> </tr> <tr> <td>O<sub>2</sub> used /ml at 20 mins</td> <td>1.6</td> <td>0.1</td> <td>0.0</td> </tr> <tr> <td>O<sub>2</sub> used /ml at 30 mins</td> <td>2.4</td> <td>0.1</td> <td>0.0</td> </tr> </tbody> </table>		A	B	C	O <sub>2</sub> used /ml at 10 mins	0.8	0.1	0.0	O <sub>2</sub> used /ml at 20 mins	1.6	0.1	0.0	O <sub>2</sub> used /ml at 30 mins	2.4	0.1	0.0	<p>negative values do not need to be shown if table heading states oxygen used/lost</p> <p>accept time in row 1 as an alternative</p>	<b>(2)</b>
	A	B	C																
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Question number	Answer	Additional guidance	Mark
<b>3(b)(ii)</b>	$2.4 \div (30 \times 60)$ (1) $= 0.0013$ (ml/second) (1)	<p>accept <math>1.6 \div (20 \times 60)</math></p> <p>accept <math>0.8 \div (10 \times 60)</math></p> <p>award full marks for correct numerical answer without working</p> <p>maximum one mark if no unit conversion</p>	<b>(2)</b>

Question number	Answer	Mark
<b>3(b)(iii)</b>	<p>An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):</p> <ul style="list-style-type: none"> <li>the peas in respirometer A are germinating so using up oxygen (1)</li> <li>during the process of respiration to release energy for growth (1)</li> </ul>	<b>(2)</b>

Question number	Answer	Additional guidance	Mark
<b>3(c)</b>	<p>Any one improvement from:</p> <ul style="list-style-type: none"> <li>soda lime (1)</li> <li>cotton wool soaked with potassium hydroxide (1)</li> </ul>	<p>accept other relevant chemical that would remove carbon dioxide</p>	<b>(1)</b>

**(Total for question 3 = 9 marks)**