

Question Number	Answer	Acceptable answers	Mark
1(a)	<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 13 ± 1 and walking increase by 22 ± 1</p> <p>accept quoted figures ± 1 eg at 6 running uses 2 ($\text{cm}^3/\text{kg}/\text{min}$) 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 ± 1 eg at 9 running uses 6 ($\text{cm}^3/\text{kg}/\text{min}$) less than walking accept any speed between 8.1 and 10</p>	(3)

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	(oxygen + glucose \rightarrow) water + carbon dioxide	<p>both water and carbon dioxide are required in either order.</p> <p>Accept $\text{H}_2\text{O} + \text{CO}_2$</p> <p>Ignore: energy</p> <p>reject wrong symbols eg H_2O or H^2O</p>	(1)

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

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

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

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

Total for Question 1 = 11 marks

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

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	B - 12.8 mmol dm ⁻³		(1)

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

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

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

(Total for question 2 = 10 marks)

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

Question number	Answer	Additional guidance	Mark																
3(b)(i)	<ul style="list-style-type: none"> headed table with units (1) accurately completed table (1) <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>O₂ used /ml at 10 mins</td> <td>0.8</td> <td>0.1</td> <td>0.0</td> </tr> <tr> <td>O₂ used /ml at 20 mins</td> <td>1.6</td> <td>0.1</td> <td>0.0</td> </tr> <tr> <td>O₂ 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 ₂ used /ml at 10 mins	0.8	0.1	0.0	O ₂ used /ml at 20 mins	1.6	0.1	0.0	O ₂ 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>	(2)
	A	B	C																
O ₂ used /ml at 10 mins	0.8	0.1	0.0																
O ₂ used /ml at 20 mins	1.6	0.1	0.0																
O ₂ used /ml at 30 mins	2.4	0.1	0.0																

Question number	Answer	Additional guidance	Mark
3(b)(ii)	$2.4 \div (30 \times 60)$ (1) $= 0.0013$ (ml/second) (1)	<p>accept $1.6 \div (20 \times 60)$</p> <p>accept $0.8 \div (10 \times 60)$</p> <p>award full marks for correct numerical answer without working</p> <p>maximum one mark if no unit conversion</p>	(2)

Question number	Answer	Mark
3(b)(iii)	<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"> the peas in respirometer A are germinating so using up oxygen (1) during the process of respiration to release energy for growth (1) 	(2)

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

(Total for question 3 = 9 marks)