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

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	(oxygen + glucose →) water + carbon dioxide	both water and carbon dioxide are required in either order. Accept H_2O + CO_2 Ignore: energy reject wrong symbols eg H2O or H^2O	**(1)**

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

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

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	24 ÷ 0.12 (1) = 200 (beats per minute)	two marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	more blood per minute / faster blood flow (1) more oxygen / glucose (transported to muscle cells) (1)	'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)	• (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)	Any three from the following: • 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)	Accept stops Ignore breathing Accept body Accept not enough oxygen /oxygenated blood	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)	Any three from the following: • (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)	Accept amount Accept if written in a word or formula equation for MP3 and MP4	**(3)**

(Total for question 2 = 10 marks)

Question number	**Answer**	**Mark**
3(a)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • same temperature to act as control (1) • to provide the optimum temperature for enzyme action in the peas (1)	**(2)**

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>3(b)(i)</td><td>• headed table with units (1)

• accurately completed table (1)

<table><tr><td></td><td>A</td><td>B</td><td>C</td></tr><tr><td>O_2 used /ml at 10 mins</td><td>0.8</td><td>0.1</td><td>0.0</td></tr><tr><td>O_2 used /ml at 20 mins</td><td>1.6</td><td>0.1</td><td>0.0</td></tr><tr><td>O_2 used /ml at 30 mins</td><td>2.4</td><td>0.1</td><td>0.0</td></tr></table></td><td>negative values do not need to be shown if table heading states oxygen used/lost

accept time in row 1 as an alternative</td><td>(2)</td></tr>
</table>

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

Question number	Answer	Mark
3(b)(iii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • 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)	Any one improvement from: 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)