

Question	Answers	Extra information	Mark	AO / Specification reference
<b>01.1</b>	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> 6H <sub>2</sub> O	answers must be given in the correct order	1 1	AO1 4.4.2.1
<b>01.2</b>	any <b>three</b> from: <ul style="list-style-type: none"> <li>more energy is transferred to the environment</li> <li>when new bonds are made (in products)</li> <li>than is taken in</li> <li>to break bonds (in reactants)</li> <li>this makes the environment slightly warmer</li> </ul>		3	AO1 4.4.2.1
<b>01.3</b>	muscle cells are more active / require more energy more mitochondria means more energy is released energy is needed for the muscle cells to contract	allow converse arguments for first 2 marking points if answer written about fat cells	1 1 1	AO2 4.1.1.2 4.4.2.1
<b>01.4</b>	during active transport / movement of mineral ions against their concentration gradient into the root chemical reactions to build amino acids / larger molecules	accept any other appropriate use of energy	1 1	AO1 4.1.3.3 4.4.2.1
<b>02.1</b>	to absorb carbon dioxide		1	AO2 4.4.2.1

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02.2	any <b>six</b> from: <ul style="list-style-type: none"> <li>• write down the start position of the air bubble</li> <li>• leave earthworms to respire for a set period of time</li> <li>• as they take in oxygen, the bubble will move</li> <li>• carbon dioxide will be removed by the soda lime so volume of gas in test tube will decrease</li> <li>• at end of the time period, write down the position of the bubble</li> <li>• calculate the distance moved by the bubble in a set time</li> <li>• repeat the experiment at this temperature</li> <li>• place in a water bath of a different temperature and allow time to acclimate</li> <li>• repeat whole experiment at four (or more) different temperatures</li> <li>• experiment can be reset between repeats by opening the tap and letting gas back into the test tube</li> </ul>	accept alternative measurement suggested – measure the time taken for a bubble to move a certain distance	6	AO2 4.4.2.1
02.3	return the earthworms to their natural environment as soon as possible / do not subject worms to very high temperatures / handle worms carefully	accept any other appropriate suggestion related to the earth worms' welfare	1	AO3 4.4.2.1

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<b>02.4</b>	rate of respiration = gradient of line		1	AO2
	rate of respiration @ 20 °C = 5.5 mm/min, and @ 10 °C = 2.5 mm/min	allow 1 mark for 6 mm/min <u>or</u> 3 mm/min	1	4.4.2.1
	rate @ 20 °C is 2.2× higher		1	Ms 4a, 4d
		allow 1 mark for difference = 3 mm/min	2	
<b>02.5</b>	line of gradient > line for 20 °C		1	AO3 x1
	respiration is an enzyme-controlled reaction		1	AO2 x2
	the higher the temperature, the more substrate-enzyme collisions so the reaction occurs faster		1	
<b>03.1</b>	glucose →		1	AO1
	ethanol <u>and</u> carbon dioxide		1	4.4.2.1
<b>03.2</b>	yellow		1	AO2 4.4.2.1
<b>03.3</b>	to prevent oxygen contacting the yeast / to ensure the yeast respire anaerobically		1	AO2 4.4.2.1
<b>03.4</b>	place the equipment in water baths of (at least five) different temperatures		1	AO2 4.4.2.1
	allow time for the yeast to acclimatise		1	
	allow yeast to respire for fixed period of time		1	
	determine the rate of respiration using the indicator colour scale		1	

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03.5	attach a gas syringe to the open tube measure the volume of gas given off in a set period of time	accept use inverted liquid-filled test tube award 2 marks for measure the time it takes for a certain volume of gas to be given off	1 1 1	AO3 4.4.2.1
04.1	220 mg/dm <sup>3</sup>		1	AO2 4.4.2.2 Ms 4a
04.2	any <b>two</b> from: <ul style="list-style-type: none"> <li>exercise was vigorous so cells respired anaerobically</li> <li>oxygen not supplied to cells fast enough</li> <li>glucose is not completely broken down / incomplete oxidation of glucose (causing lactic acid to be produced)</li> </ul>		2	AO2 4.4.2.2
04.3	rate = $\frac{900 - 220}{10}$ rate = 68 mg/dm <sup>3</sup> per minute		1 1	AO2 4.4.2.2 Ms 1c

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<b>04.4</b>	any <b>six</b> from: <ul style="list-style-type: none"> <li>concentration of lactic acid in the bloodstream decreases</li> <li>lactic acid is being broken down</li> <li>the blood transports the lactic acid into the liver</li> <li>lactic acid is first converted back to glucose</li> <li>(then the glucose is converted) into carbon dioxide and oxygen</li> <li>by aerobic respiration</li> <li>this requires extra oxygen</li> <li>the amount of oxygen required is known as known as the oxygen debt</li> </ul>		6	AO1 4.4.2.2
<b>05.1</b>	to transfer energy to the cells / provide cells with energy to use in chemical reactions (needed to maintain life)		1 1	AO1 4.4.2.1
<b>05.2</b>	no yes no ethanol		1 1 1 1	AO1 4.4.2.1
<b>05.3</b>	anaerobic respiration in yeast produced ethanol used in alcohol production / named alcoholic product anaerobic respiration in yeast produces carbon dioxide used to make bread rise		1 1 1 1	AO1 4.4.2.1

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06.1	D		1	AO2 4.4.2.1
06.2	carbon dioxide and water		1	AO1 4.4.2.1
06.3	any <b>two</b> from: <ul style="list-style-type: none"> <li>more energy is released</li> <li>no lactic acid is made</li> <li>build-up of lactic acid can cause muscle fatigue</li> </ul>		2	AO1 4.4.2.1
07.1	any <b>four</b> from: <ul style="list-style-type: none"> <li>glucose concentration has decreased</li> <li>glucose is broken down in respiration / is a reactant of respiration (aerobic and anaerobic)</li> <li>lactic acid concentration has increased / has been produced</li> <li>lactic acid is produced from the incomplete break down of glucose</li> <li>so anaerobic respiration took place</li> </ul>		4	AO2 4.4.2.1 4.4.2.2
07.2	800% increase	award 1 mark for $\frac{18-2}{2}$	2	AO2 4.4.2.1 4.4.2.2 MS 1c

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<b>07.3</b>	any <b>six</b> from: <ul style="list-style-type: none"> <li>● heart rate increased:</li> <li>● to speed up the rate at which blood is moved around the body</li> <li>● so more oxygen is transferred to cells / carbon dioxide removed</li> <li>● maintains a high concentration gradient for the diffusion of gases between blood and cells / blood and lungs</li> <li>● to provide additional oxygen for respiration</li> <li>● breathing rate increased:</li> <li>● more oxygen diffuses into blood / carbon dioxide diffuses into the lungs</li> <li>● to bind to red blood cells</li> <li>● to provide additional oxygen for respiration</li> </ul>		6	AO1 4.4.2.2
<b>08.1</b>	sum of all the reactions which take place inside a cell / organism		1	AO1 4.4.2.3
<b>08.2</b>	respiration releases the energy needed for reactions to occur  respiration required to maintain body temperature  so enzyme-controlled reactions occur efficiently		1  1  1	AO1 4.4.2.3

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08.3	fatty acids glycerol		1 1	AO1 4.4.2.3
08.4	any <b>two</b> from: <ul style="list-style-type: none"> <li>• both storage molecules for energy</li> <li>• converted back into glucose</li> <li>• when energy is needed</li> </ul>		2	AO1 4.4.2.3
09.1	any <b>four</b> from: <ul style="list-style-type: none"> <li>• sprinters require lots of energy very rapidly</li> <li>• they will respire anaerobically</li> <li>• but there will not be time for lactic acid to build up and cause muscle fatigue (before race completed)</li> <li>• marathon runners need their muscles to work effectively over a much longer duration</li> <li>• if rate of oxygen usage &gt; rate of oxygen uptake, lactic acid will be produced</li> <li>• if lactic acid builds up, muscles will no longer contract</li> </ul>		4	AO2 4.4.2.2



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<b>09.2</b>	less oxygen is available at high altitudes (which stimulates red blood cell production)		1	AO2 4.4.2.2
	when athlete performs at lower altitudes their bodies are able to carry more oxygen		1	
	therefore, rate of respiration increases		1	
	so the activity / rate of energy release can be maintained for a longer period (without respiring anaerobically)		1	
<b>09.3</b>	additional blood in athlete's body means additional red blood cells		1	AO2 4.2.2.3 4.4.2.2
	oxygen-carrying capacity of blood increased		1	
	so athlete respire aerobically for longer		1	
<b>10.1</b>	6O <sub>2</sub> 6H <sub>2</sub> O	answers must be in the correct order	1	AO1 4.4.2.1
<b>10.2</b>	anaerobic respiration is not as efficient as aerobic respiration		1	AO1 4.4.2.1
	less energy is released per glucose molecule		1	
	glucose is not broken down completely		1	
	lactic acid is produced which causes muscle fatigue		1	

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10.3	any <b>four</b> from: <ul style="list-style-type: none"> <li>lactic acid produced during anaerobic respiration has to be converted back into glucose</li> <li>this requires oxygen</li> <li>the volume of oxygen needed for this process is the oxygen debt</li> <li>heart rate and breathing rate stay high</li> <li>to supply extra oxygen to (muscle) cells until all lactic acid is removed and oxygen debt is paid</li> </ul>	ignore references to heat loss	4	AO2 4.4.2.1 4.4.2.2
11.1	ethanol: break down / soften cell walls / cell membranes washed: to remove the chlorophyll as chlorophyll / the green colour can mask the observed colour change		1  1 1	AO2 4.4.1.1
11.2	boil ethanol by placing in a beaker of boiling water so ethanol is not close to a naked flame / because ethanol is highly flammable <b>or</b> wash hands after using iodine iodine is an irritant		1 1  <b>or</b> 1 1	AO2 4.4.1.1

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11.3	any <b>four</b> from: <ul style="list-style-type: none"> <li>• green areas turn blue / black</li> <li>• so starch is present in these areas</li> <li>• produced through process of photosynthesis</li> <li>• white areas remain yellow / orange / iodine does not change colour</li> <li>• as no starch is present</li> <li>• green parts contain chlorophyll / white parts do not contain chlorophyll</li> </ul>		4	AO2 4.4.1.1
11.4	any <b>six</b> from: <ul style="list-style-type: none"> <li>• carbon dioxide diffuses into plant from the air</li> <li>• through the stomata</li> <li>• water absorbed / diffused / moves by osmosis</li> <li>• from soil into root cells</li> <li>• light absorbed by chlorophyll / chloroplasts</li> <li>• water and carbon dioxide are chemically joined / react during photosynthesis</li> <li>• to produce glucose</li> <li>• glucose molecules join together to make starch</li> <li>• using energy from respiration</li> </ul>		6	AO1 4.2.3.2 4.4.1.1 4.4.1.3