Mark scheme

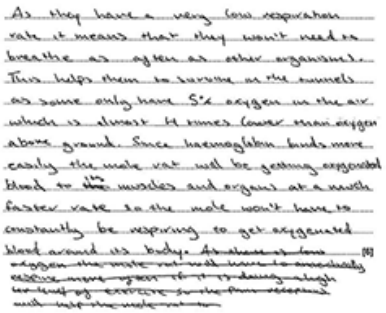
Question			Answer/Indicative content	Marks	Guidance
1			Forms two named colours from red / orange / yellow / green ✓ Correct reference to which colour indicates highest concentration of glucose ✓ Use of a colorimeter/colour chart for comparison / compare colour to known concentrations ✓	3 (3 x AO 1.2)	Orange-red is one colour **ALLOW** the idea that the amount of precipitate can be used to indicate glucose concentration **Examiner's Comments** Candidates were expected to apply their knowledge of the results of the Benedict's test for glucose to suggest a way of using it to give a semi-quantitative measure of glucose concentration. Many candidates realised that there was a range of colour changes from blue to green to orange and red and could relate these to different glucose concentrations. The highest scoring candidates also suggested a way of judging these colours, such as the use of colour charts.
			Total	**3**	
2			Auxin ✓ Ethene ✓ Gibberellins ✓ Auxin ✓	4 (4 x AO 1.1)	**ALLOW** Gibberellins **ALLOW** Cytokinins **Examiner's Comments** Some of the lower scoring candidates confused plant hormones with human hormones but there were many fully correct answers to this question. Spellings of gibberellins varied considerably but credit was given if the attempt was phonetically close.
			Total	**4**	

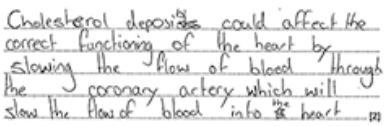
3	a		**First check the answer on the answer line** **If answer = 11 400 award 4 marks** Measures the line as 3.2cm/32mm ✓ Converts 32mm to 32000 µm OR 2.8µm converted to 0.0028mm ✓ 32 000 ÷ 2.8 = 11 428.57 OR 32 ÷ 0.0028 = 11 428.57 ✓ = 11 400 (3 s.f.) ✓	4 (3 x AO 2.2) (AO 1.2)	**ALLOW** answers in range 31 to 33mm **ECF** if line incorrectly measured **ECF** if line incorrectly measured or incorrect/no conversion **ALLOW** 1 mark for clear evidence of incorrect answer correctly rounded to 3 significant figures **ALLOW** full marks for correct answers calculations based on diameters in the range 31 to 33mm eg: **Examiner's Comments** This calculation consisted of four main steps: • the correct measurement of the yeast cell • the conversion from millimetres or centimetres to micrometres • the calculation of the magnification • the adjustment of the answer to 3 significant figures. Candidates may have made a mistake in one of these steps but were still given credit if the other steps were completed correctly. A range of sizes of the yeast cell from 31 mm to 33 mm was allowed.

Diameter	31	31.5	32.5	33
Conversion	31000	31500	32500	33000
Calculation answer	11071	11250	11607	11785
Answer to 3 sig figs	11100	11300	11600	11800

					The most common error seen in responses was an incorrect conversion of the measurement to micrometres.
	b		Carbon dioxide ✓	1 (AO 1.1)	**ALLOW** CO_2 **Examiner's Comments** Most candidates correctly stated carbon dioxide but a small number gave ethanol as the answer.
			Total	**5**	
4			C	1 (AO 1.2)	**Examiner's Comments** Although the majority of responses were correct, some candidates thought that DNA contained amino acids, rather than coding for them, and so chose option B as their response.
			Total	**1**	
5			**Any two from:** Respiration is a universal chemical process ✓ Plants need (to produce) ATP ✓ Named example of ATP/energy use in plants ✓	2 (2 xAO 2.1)	**ALLOW all organisms need to respire** **ALLOW** plant cells have mitochondria which are the site of respiration. E.g., active transport / protein synthesis / cell division / translocation / photosynthesis **IGNORE** growth unqualified **Examiner's Comments** There was considerable confusion between photosynthesis and respiration in these responses. However, there were correct references to ATP production and processes such as active transport.
			Total	**2**	
6			**B**	1 (AO 2.1)	
			Total	**1**	

7			**D**	1 (AO 1.1)	
			Total	**1**	
8			**Level 3 (5–6 marks)** Gives a detailed explanation how each of the features allows the mole rats to survive in the tunnels. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Partially explains how the features allow the mole rats to survive in the tunnels. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Gives a limited explanation of how a feature allows the mole rats to survive in the tunnels. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 mark** *No response or no response worthy of credit*	6 (3 xAO 1.1) (3 x AO 2.1)	**AO1.1 Demonstrates knowledge and understanding of scientific ideas to describe the features.** • oxygen required for aerobic respiration • haemoglobin in red blood cells transports oxygen to tissues • lactic acid produced during anaerobic respiration **AO2.2 Applies knowledge and understanding to explain how the features allow the rats to survive.** • (a low respiration rate) will reduce the need for oxygen • (haemoglobin that binds oxygen more easily) will allow the oxygen to be picked up at the lungs from the low concentration in the air • (haemoglobin that binds oxygen more easily) more oxygen will be carried to the tissues/cells • less oxygen so anaerobic respiration is more likely • increased production of lactic acid • (lack of pain receptors) will prevent the lactic acid from causing pain and/or reducing movement **<u>Examiner's Comments</u>** The Level of Response extended writing question proved to be a good discriminator. There was a full range of responses over the 6 marks. The most successful responses were able to explain the benefits of a low respiration rate with the tunnels only having 5% oxygen, haemoglobin binding to oxygen more easily with more oxygen delivered to muscle cells to carry out respiration and few pain receptors would be able to tolerate

					high levels of lactic acid from anaerobic respiration better. The least successful responses just copied out the information provided in the question or only addressed few pain receptors being able to tolerate lactic acid from anaerobic respiration. The responses that did not achieve Level 3 were not specific about the role of haemoglobin in the delivery of oxygen to tissue/cells. Exemplar 2  Exemplar 2 gained Level 1, 2 marks as the candidate gave a limited explanation of how a feature allows the mole rat to survive in the tunnels. They incorrectly stated that having a low respiration rate meant they could breathe less instead of requiring less oxygen for aerobic respiration. They correctly identified oxygen binding with haemoglobin more easily means faster delivery of oxygen to muscles. They crossed out the part addressing pain receptors and acid.
			Total	**6**	
9			**Any two from:** Reduces blood flow to the heart muscle/cells ✓ Less oxygen/glucose delivered to the heart muscle/cells ✓ Heart (muscle) respires less ✓ Heart (muscle) does not contract properly ✓	2 (2 × AO2.1)	**IGNORE** Reduces blood flow to the heart **IGNORE** Less oxygen/glucose delivered to the heart **<u>Examiner's Comments</u>** The main issue here was candidates did not differentiate between the blood supply to the cardiac muscle being blocked or the blood supply to the whole heart. This is seen in this

					exemplar which did not score. Exemplar 3  Exemplar 3 was not given any marks for this response.
			Total	**2**	
10	a	i	**Any two from:** A process occurring in all cells/in mitochondria ✓ Breakdown/use of glucose to release/transfer/provide energy ✓ Producing ATP ✓	2 (2 × AO1.1)	**DO NOT ALLOW** produces energy **IGNORE** reference to the use of oxygen **ALLOW** energy stored as ATP Second or third marking points can be awarded from an equation if it shows energy or ATP **Examiner's Comments** There was some confusion here between the processes of cellular respiration and that of breathing. Some candidates also incorrectly referred to energy being created by the process.
		ii	Ratio = 0.9 ✓ Glucose and protein ✓	2 (1 × AO1.2) (1 × AO3.1)	Need to have the correct ratio to score the second marking point **ALLOW** glucose, protein, and lipid **ALLOW** glucose and lipid **Examiner's Comments** The majority of candidates correctly manipulated the data, produced a correct ratio and then interpreted it.
	b	i	Use/add Benedict's (reagent) ✓ Heat ✓	2 (2 × AO1.2)	**IGNORE** references to colour changes **Examiner's Comments** There was some confusion over this basic biochemical test. A number of candidates gave the correct reagent but did not mention the need to heat it. Others gave incorrect reagents such as Iodine solution.

		ii	Idea that less colour change/less red colour/less precipitate indicates less glucose present ✓	1 (1 × AO2.2)	**ALLOW** idea that small amount of glucose only produces a green colour **ALLOW** idea of the use of a colour scale to judge how much glucose is present **ALLOW** reverse argument **IGNORE** reference to time taken to change colour **IGNORE** see how dark/light the indicator becomes unless qualified by colours **Examiner's Comments** The most common error here was to suggest timing how long the Benedict's solution takes to change colour rather than looking for the degree of colour change. The more successful answers listed the range of colours from blue, to green and through to red.
			Total	**7**	