

Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		Auxin ✓ Ethene ✓ Gibberellins ✓ Auxin ✓	4 (4 x AO 1.1)	ALLOW Gibberellins ALLOW Cytokinins <u>Examiner's Comments</u> 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.
	b		When the apical bud is cut off, there is no/less auxin and the lateral buds grow ✓ When the apical bud is cut off, but auxin is added, the lateral buds do not grow ✓	2 (2 x AO 3.2a)	<u>Examiner's Comments</u> Some candidates scored both marks here by correctly linking the presence or absence of the apical bud and auxin to the extent of growth of the lateral buds. Marks were often lost by confusion between the apical buds and the lateral buds or by omitting the presence or absence of auxin from the explanations.
			Total	6	
2			A	1 (AO 1.1)	
			Total	1	
3			Stem cells can differentiate/become specialised into (red) blood cells ✓ (As they are from another person) they would not have the defective allele/disorder / will have functioning/normal haemoglobin ✓	2 (2 xAO 3.1)	IGNORE they will have normal red blood cells <u>Examiner's Comments</u> The two aspects to this response were

					the ability of stem cells to differentiate into red blood cells and the fact that the donor would not have the mutation. Some answers focused on one of these two aspects but the higher scoring scripts contained references to both.									
			Total	2										
4	a		<table><tr><th>Error</th><th>Random error</th><th>Systematic error</th></tr><tr><td>Excess fluid was left on some aubergine pieces which will affect the mass.</td><td>✓</td><td></td></tr><tr><td>The scale used to weigh the aubergine pieces was not calibrated correctly.</td><td></td><td>✓</td></tr></table>	Error	Random error	Systematic error	Excess fluid was left on some aubergine pieces which will affect the mass.	✓		The scale used to weigh the aubergine pieces was not calibrated correctly.		✓	1 (AO 3.2a)	<u>Examiner's Comments</u> The difference between random errors and systematic errors is covered in the Working Scientifically section of the specification. Although it has not been tested many times on these papers, the question was well answered by most candidates.
Error	Random error	Systematic error												
Excess fluid was left on some aubergine pieces which will affect the mass.	✓													
The scale used to weigh the aubergine pieces was not calibrated correctly.		✓												
	b		The skin is not permeable / Water could not move through the skin ✓	1 (AO 2.2)	DO NOT ALLOW the skin would prevent movement of the solution/solute ALLOW the skin would inhibit osmosis <u>Examiner's Comments</u> Many candidates appreciated that the aubergine skin is impermeable and this would prevent osmosis from occurring. Some responses then went on to state that the solution, rather than water, would not be able to pass through. This error meant that candidates did not score the mark.									
	c		First check the answer in table / on answer line If answer = (-) 34.0% award 3 marks (5.3 -3.5 =) 1.8 ✓ (1.8÷ 5.3 =) 0.3396... ✓ 0.3396 x100 = (-) 34.0% ✓	3 (3 xAO 1.2)	Mark answer on answer line first ALLOW -1.8 ALLOW -0.3396.... ALLOW 33.9 / 34 for 2 marks ALLOW one mark for an incorrect answer if it is clearly shown that it has been correctly rounded to three significant figures.									

					<u>Examiner's Comments</u> The majority of candidates scored full marks. The two most common errors here were as follows. Some candidates could not calculate the percentage change as they divided 3.5 by 5.3. Other candidates could calculate the percentage but then made rounding errors.
	d		This is where the line intercepts the x axis / This (is the concentration of solution that) produces no change in mass ✓	1 (AO 3.2a)	<u>Examiner's Comments</u> This was correctly answered by most candidates.
	e		Include other concentrations/wider range/smaller intervals of solution ✓ Idea that these should be in the region around 0.46 (mol/dm ³) ✓	2 (2 xAO 3.3b)	IGNORE just repeat readings <u>Examiner's Comments</u> A number of candidates correctly stated that including intermediate concentrations in the experiment would improve accuracy. Only the higher scoring papers included reference to these concentrations being focused in the crucial area of 0.4 to 0.6 mol/dm ³ .
			Total	8	
5			Hydrogen ions cannot build up in the space/cannot become concentrated, as the outer membrane is missing ✓ Therefore, they cannot diffuse back in(to the mitochondria) ✓	2 (2 xAO 3.2a)	<u>Examiner's Comments</u> Although this question covered a high-level concept, candidates were provided with plenty of information in the question. Many interpreted this information correctly and gave good responses.
			Total	2	
6			A	1 (AO 2.1)	<u>Examiner's Comments</u> The most common incorrect response was B.
			Total	1	
7			D	1 (AO 2.2)	ALLOW 512
			Total	1	
8			A	1 (AO 2.1)	

			Total	1	
9			(Slowing down the cell cycle) will slow down cell division/mitosis / less likely to divide uncontrollably OR Cancer is caused by rapidly dividing cells/mitosis ✓ AND Prevent tumours ✓	2 (2 xAO 1.1)	AW cell replication/multiplication for cell division IGNORE reproduction IGNORE stops/prevents cell division/mitosis/cells dividing uncontrollably IGNORE any process slowing down that occur during interphase ALLOW cancer cells carry out uncontrolled cell division/multiply quickly IGNORE tumour cells IGNORE cancer growing IGNORE tumours spread slowly <u>Examiner's Comments</u> This question required candidates to demonstrate their knowledge and understanding of mitosis and cancer. Most correct responses gained the marking point linking slowing down the cell cycle will protect the mole rat developing cancer. Fewer successful responses also identified that this would prevent tumours developing. The most common non-scoring response given was about cancer not spreading and chance of mutation would reduce during DNA replication.
			Total	2	
10			C	1 (AO 1.1)	
			Total	1	
11			Killing the plasma cells stops production of amyloid/ Protein/killing the plasma cells stops blood vessels being blocked (from the pancreas and thyroid gland) ✓ Stem cells can differentiate into new plasma cells/stem cells can be used to replace the plasma cells ✓	2 (AO 2 × 2.1)	IGNORE stops amyloidosis IGNORE the new plasma cells cannot make the amyloid/protein <u>Examiner's Comments</u> Many candidates, even higher ability candidates found this AO2.1 question challenging. Candidates had not recognised the two bullet points as a

					direction on how to structure their answer. Many answers referred to killing amyloid, forming new blood plasma, and making new cells. Candidates that scored 1 mark were able to link killing plasma cells to the stopping of the production of the amyloid protein. Many candidates appreciated that stem cells could differentiate into new cells, but it was rare to see 'differentiate into plasma cells' for the second marking point.
			Total	2	
12			Level 3 (5-6 marks) Describes the general role of stem cells AND Describes the development of red blood cells as specialised cells AND Explains the change in RNA concentration or the loss of the nucleus <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3-4 marks) Describes the general role of stem cells and describes the development of red blood cells as specialised cells OR Describes the development of red blood cells as specialised cells and explains the change in RNA concentration or the loss of the nucleus OR Describes the general role of stem cells and explains the change in RNA concentration or the loss of the nucleus <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1-2 marks) Describes the general role of stem	6 (2 × AO1.1) (3 × AO2.1) (1 × AO3.2b)	AO1 Demonstrate knowledge and understanding of scientific ideas of the general role of stem cells. - Stem cells are undifferentiated cells/are able to differentiate to form different cells - Stem cells become specialised for specific functions/become specialised cells AO2 Apply knowledge and understanding of scientific ideas to the development of the red blood cell from a stem cell to a cell that contains the protein haemoglobin. - Red blood cells (are specialised cells as they) - do not have a nucleus - contain haemoglobin - Haemoglobin is made by protein synthesis/by using RNA AO3 Analyse information from the graph to explain changes that occur to RNA and the loss of the nucleus - Amount of RNA falls due to the loss/decrease in size of the nucleus - The cell loses the nucleus to give room for large amounts of

			cells OR Describes the development of red blood cells as specialised cells OR Explains the change in RNA concentration or the loss of the nucleus <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>		haemoglobin that have been produced <u>Examiner's Comments</u> This was the level of response question on this paper. To obtain Level 3, candidates had to discuss the importance of stem cells in forming specialised cells. They then had to explain how red blood cells become specialised by losing the nucleus in order to allow more room for haemoglobin. A common misconception in some answers was the idea that the fall in mRNA in the cell made more room for haemoglobin. Also, there was confusion concerning the loss of the nucleus. Many candidates correctly referred to the increase of space for haemoglobin but others said that this would increase the surface area to volume ratio of the cell.
			Total	6	
13			Water potential of cytoplasm/cells is low/is reduced ✓ Water moves into guard cells by osmosis ✓ Guard cells have an unevenly thickened wall ✓ Guard cells bend to open the stoma ✓	4 (1 × AO2.1) (1 × AO1.1) (1 × AO2.1) (1 × AO1.1)	ALLOW the cells are hypertonic/more concentrated Must be clear that water is not entering the guard cells through the stoma DO NOT ALLOW water and ions enter by osmosis ALLOW reverse argument for each marking point if answer refers to stomata closing <u>Examiner's Comments</u> The mechanism for stomatal opening has been examined before but it still proves to be problematic for candidates. Many simply repeated the information that was provided in the question and did not explain how an increase in turgidity of the guard cells causes the stoma to open.

			Total	4	
14		i	Any two from: Sample size is very small / only two patients were tested ✓ Idea that the experiment showed an improvement not a cure ✓ (Only 1 year later,) eyesight could deteriorate in subsequent years ✓ Have not tested it on dry AMD / may not work on all forms of blindness / only one form of blindness was tested ✓	2 (2 × AO3.1a)	ALLOW reference to possible long term side effects <u>Examiner's Comments</u> There were a number of acceptable answers here, but the most popular reference was to the fact that the claim stated a cure, but the information only stated that an improvement had been seen.
		ii	Test more people / See if it cures dry AMD / See if it is safe/has side effects / See if it lasts long term / Determine the cost / Determine the availability of the stem cells ✓	1 (1 × AO3.1a)	IGNORE reference to age IGNORE reference to the damage increasing ALLOW possible named side effect <u>Examiner's Comments</u> As a suggest question, there are a range of acceptable factors that could be given marks. Refences to possible side effects was the most common correct answer.
			Total	3	
15			B ✓	1 (AO 2.1)	<u>Examiner's Comments</u> The majority of candidates answered correctly. A small proportion of candidates answered incorrectly by choosing option C, even though this region of the graph does not show any increase in DNA content.
			Total	1	
16			B ✓	1 (AO1.1)	<u>Examiner's Comments</u> This question proved to be challenging with many candidates choosing option D, even though in this response the movement of chromosomes does not appear after DNA replication, and there are two stages involving DNA replication.

			Total	1	
17			C ✓	1 (AO1.1)	<u>Examiner's Comments</u> The majority of candidates answered this correctly. A small but significant number of candidates incorrectly chose option B as the answer, presumably confusing which cells are haploid and which are diploid.
			Total	1	