

Separate Science (Biology) Unit 1 Cell Biology – Mark scheme

Foundation

Question number	Description	Marks	Page number
4.1.1 Cell structure			
3	(4.2.1 – size of structures, naming an organ, identifying a tissue) (4.1.3 – root hair cell adaptation to function) Using a microscope, eyepiece power calculation	11	4
4.1.2 Cell division			
1	Interpreting cell cycle pie chart, calculation from cell cycle pie chart, identifying dividing cells from diagram, tick boxes	9	6
2	Cell cycle tick boxes, calculation from cell cycle pie chart,	9	7
5	Cell cycle stage recall and tick boxes, describing advantages and disadvantages of therapeutic cloning	8	8
4.1.3 Transport in cells			
2	Calculating, surface are, volume and surface area:volume of a cube, recall on gas exchange in the lungs, adaptations of the lungs for gas exchange.	9	10
2	Diffusion recall box tick, identifying adaptation for diffusion from axolotl diagram, sentence completing on stem cells (4.2.2 – respiratory system structure)	11	11
3	Interpretation of osmosis experiment results, osmosis gap fill, describing how roots are adapted for water absorption	9	12
4	Naming parts of plant cell, transport in cells box ticking, explanation linked to diagram of partially permeable cell membrane, giving control variables for osmosis practical method.	14	14
6	Interpreting oxygen absorption table, surface area to volume ratio for absorption. (4.7.2 – earthworms aiding decay, 4.6.1 reproduction)	10	16
7	Explaining how to calculate rate of water uptake in potato chip, suggesting control variable, predicting results for different temperatures of the experiment.	8	18

Common content

Question number	Description	Marks	Page number
4.1.1 Cell structure			
1	Cell structure box matching, describing adjustments to microscope to improve on given image diagrams, calculating magnification of a diagram	9	19
1	Function of nucleus, naming cell without nucleus, drawing and labelling an animal cell, calculating magnification, advantage of electron microscope over light microscope	10	22

Higher

Question number	Description	Marks	Page number
4.1.1 Cell structure			
5	Calculating real length of an image, describing how to use a microscope,	8	
4.1.2 Cell division			
6	Stem cells recall, converting pictograms to grams, calculation from cell cycle pie chart, describing three stages of cell cycle, advantages and disadvantages of therapeutic cloning	14	24
4.1.3 Transport in cells			
4	Explaining, including calculations, why multicellular organisms cannot absorb nutrients needed through outer surface,	5	28
4	Plotting results from osmosis experiment, using graph to determine concentration of sugar solution inside plant cell, explaining results for osmosis experiment	11	29
4	Reasons for results being anomalous, calculating a percentage change, explain results from osmosis experiment, explaining improvements to osmosis experiment method, explaining how calcium ions moves from egg shell to egg cytoplasm.	12	31

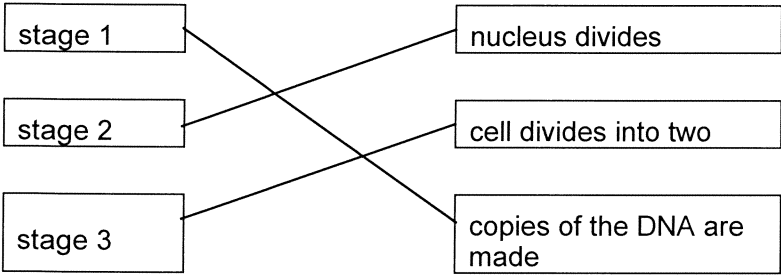
5	Describing results from a table, explaining how results from a table show how nitrates ions are absorbed (4.4.1 describing how nitrate ions are used for plant growth)	10	33
5	Interpreting and explaining a diagram for active transport, explain results from osmosis experiment, suggesting and explaining sugar concentration in plant cells from results, describing improvement to osmosis experiment method.	12	35
6	(4.2.2 food test for glucose) Explaining why diabetics cause body cells to lose more water, describing how the small intestine is adapted for absorption	12	37
9	Box matching for size of cells, describing how sa:vol changes as length of cell increases, explaining why animals need transport systems, explaining rate of active transport dependent on oxygen concentration on cells.	13	39

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nucleus cell tissue organ	all in correct order allow 1 mark for each consecutive pair of structures	3	AO2 4.1.1.1 4.1.1.2 4.2.1
03.2	any one from: <ul style="list-style-type: none"> • bladder • brain • heart • (small or large) intestine • kidney • liver • lung • pancreas • skin • stomach 	allow any organ found in an animal ignore blood	1	AO1 4.2.1
03.3	phloem		1	AO1 4.2.3.1
03.4	large surface area (so) it can absorb (a lot of) water / minerals / (mineral) ions	allow long allow 1 mark for (many) mitochondria allow for 2 marks (many) mitochondria for active transport	1 1	AO1 4.1.1.3 4.2.3.2
03.5	any one from: <ul style="list-style-type: none"> • biggest / widest field of view • easier to focus 		1	AO3 4.1.1.2
03.6	to avoid damage to lens / slide	ignore references to focussing	1	AO3 4.1.1.2

03.7	(×)5		1	AO2 4.1.1.2
03.8	any one from: (root hair cells) <ul style="list-style-type: none"> • are not exposed to light • do not photosynthesise 	allow are underground	1	AO2 4.1.1.2 4.1.1.3 4.2.3.2 4.4.1.1
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	nucleus		1	AO1 4.1.2.1
01.2	gene(s)	allow allele(s)	1	AO1 4.6.1.4
01.3	copying of chromosomes		1	AO2 4.1.2.2
01.4	mitochondria		1	AO1 4.1.1.2
01.5	60 – 45 or 120 – 105 15 (minutes)	an answer of 15 (minutes) scores 2 marks	1	AO2 4.1.2.2
			1	
01.6	C		1	AO2 4.1.2.2
01.7	8		1	AO2 4.1.2.2
01.8	to repair tissues		1	AO1 4.1.2.2
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	mitochondria		1	AO1 4.1.3.4
	ribosomes		1	
02.2	to repair the muscles		1	AO1 4.1.3.4
02.3	$\frac{5}{100} \times 21$	an answer of 1.05 hours scores 2 marks	1	AO2 4.1.3.4
	1.05 (hours)	allow $\frac{1}{20} \times 21$ allow for 2 marks 1 hour 3 minutes or 1:03 (hours)	1	
02.4	$\frac{7}{20} \times 100$	an answer of 35 (%) scores 2 marks	1	AO2 4.1.3.4
	35 (%)	allow 5×7	1	
02.5	78		1	AO2 4.1.3.5
02.6	fertilisation		1	AO1 4.1.3.5
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	 <p>allow 1 mark for 1 or 2 correct</p> <p>credit can be given where students have matched the boxes correctly, for example numbering the boxes</p>		2	AO1 4.1.2.2
05.2	6 picograms		1	AO2 4.1.2.2
05.3	meristem cells in plants can differentiate throughout the life of the plant		1	AO1 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	any two from: <ul style="list-style-type: none"> • may cure / treat diseases or cure medical conditions or produce replacement cells / tissues / organs • cells unlikely to be rejected by patient • cells / tissues of any type can be produced • many cells produced • cells produced could be used for research • would reduce waiting time for transplants 	ignore references to cost ignore all reference to producing babies / IVF allow example eg diabetes / paralysis allow cells can be stored for future use ignore used in medical treatments ignore patient makes / grows cells / tissues / organs ignore same genetic information ignore differentiated into most types of cells	2	AO3 4.1.2.3 4.1.1.4 4.6.2.4
05.5	any two from: <ul style="list-style-type: none"> • (potential) life is killed / destroyed • shortage of donors / eggs • egg donation / collection has risks • do not yet know risks / side effects of the procedure on the patient • may transfer (viral) infection • poor success rate 	ignore references to cost ignore unethical unqualified ignore reference to religion / beliefs allow embryo is killed ignore embryo is destroyed ignore embryo is a life / becomes a baby ignore long term effects are not well understood allow may cause tumours / cancer allow in terms of viable egg / embryo / cell / tissue / organ production	2	AO3 4.1.2.3 4.1.1.4 4.6.2.4
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	diffusion		1	AO1/1 4.1.3.1
02.2	(SA of one face = 2×2) =4 (Total SA = 4×6) = 24 (Volume = $2 \times 2 \times 2$) =8 (SA:volume ratio =) 24:8 or 3:1	ignore units allow correct calculation using their calculated SA of 1 face x 6 ratio must be consistent with their figures	1 1 1 1	AO2 4.1.3.1
02.3	red (blood) cell(s)	allow erythrocyte(s)	1	AO1 4.2.2.3
02.4	carbon dioxide	name takes precedence allow CO ₂ ignore CO ² / CO2 ignore water (vapour)	1	AO2 4.2.2.2 4.2.2.3 4.4.2.1
02.5	any two from: <ul style="list-style-type: none"> • wall of alveolus (only) one cell thick • wall of capillary (only) one cell thick • cells of alveolus / capillary wall are flattened / thin • good blood supply • (well) ventilated 	ignore large surface area ignore many alveoli ignore moist lining if none of these mentioned allow 1 mark for idea of short distance between (air in) alveolus and blood	2	AO1 4.1.3.1 4.2.2.2
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the movement of particles from a high concentration to a low concentration		1	4.1.3.1 AO1
02.2	(gills) have (many) projections (for) large(r) surface / area or (gills) are on the outside of the body (1) for good access to water (1)	allow description of projections allow have lots of / five gills	1 1	4.1.3.1 AO2
02.3	differentiation		1	4.1.2.3 AO1
02.4	mitosis	do not accept meiosis	1	4.1.2.2 AO1
02.5	hair		1	4.1.2.2 4.1.2.3 AO1
02.6	axolotls are cheap to feed axolotls are easy to breed		1 1	4.1.2.3 AO3
02.7	D		1	4.2.2.2 AO1
02.8	trachea	allow windpipe allow cartilage (ring)	1	4.2.2.2 AO1
02.9	pulmonary artery		1	4.2.2.2 AO1
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any one from: <ul style="list-style-type: none"> water on potato would increase mass to control amount of water on potato 	allow so only the mass of the potato is measured allow to remove water from outside of potato allow liquid / solution / sugar solution for water allow so you get the correct (starting) mass of the potato do not accept so that all the pieces of potato weighed the same	1	AO3 4.1.3.2
03.2	increase in mass increase in length	extra ticks negate marks	1 1	AO2 4.1.3.2
03.3	osmosis into lower	in this order only allow diffusion allow inside do not accept through allow low / more dilute / dilute	1 1 1	AO1 4.1.3.2 AO2 4.1.3.2 AO2 4.1.3.2
03.4	any one from: <ul style="list-style-type: none"> the concentration (of sugar solution) in the cells is 0.4 (mol/dm³) the concentration (of sugar solution) in the cells is the same as the solution (in the tube) 	allow reference to potato instead of cells	1	AO3 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	any two from: <ul style="list-style-type: none"> • has (root) hairs • large surface / area • (root) hairs extend into soil • (root) hairs have thin walls 	ignore references to active transport and mineral uptake allow root hair cells allow wide surface area allow (root) hairs are long / widespread	2	AO1 4.1.1.3 4.1.3.1 4.1.3.2
Total			9	

Question 4

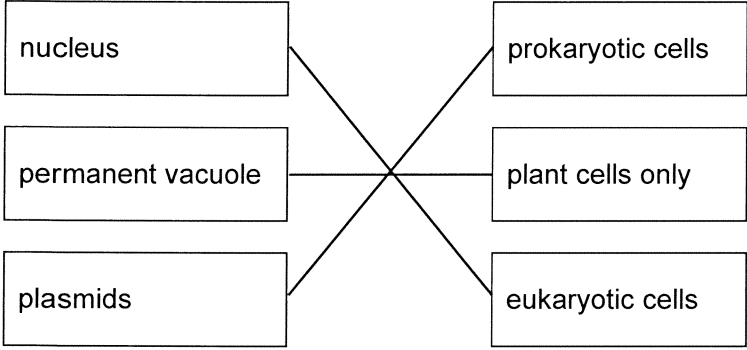
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	nucleus	in any order allow phonetic spelling	1	4.1.3.2 AO3
	chloroplast	ignore chlorophyll	1	AO2
	(permanent) vacuole	ignore cell sap allow starch grains / granules	1	AO2
04.2	any one from: <ul style="list-style-type: none"> (for) strength / support (to) maintain the structure / shape of cell 	allow to stop the cell bursting allow (for) protection against mechanical damage	1	4.1.3.2 AO1
04.3	allows some substances through		1	4.1.3.3 AO1
04.4	by osmosis		1	4.1.3.3 AO1
04.5	by active transport		1	4.1.3.3 AO3
04.6	(substance C is) too big		1	4.1.3.3 AO3
	to pass through the membrane / holes / gaps	ignore it cannot pass / get through unqualified allow 2 marks for: the gaps are too small for substance C to pass through	1	

04.7	<p>any three from:</p> <ul style="list-style-type: none"> • (cubes cut from) same potato • (starting) volume / size (of potato) • temperature (of sugar solution) • volume of (sugar) solution • use potato with no skin on • time (in solution) 	<p>allow (same) variety / type of potato</p> <p>allow (starting) length</p> <p>allow amount of (sugar) solution allow idea of potato being fully submerged in the (sugar) solution</p> <p>allow 1 hour (in solution) / how long you leave it for (in solution)</p> <p>ignore dry the potato</p>	3	4.1.3.3 AO3
04.8	vernier callipers		1	4.1.3.3 AO1
04.9	the potato cube will stay the same size		1	4.1.3.3 AO2
Total			14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	diffusion		1	AO2 4.1.3.1
06.2	A		1	AO2 4.1.3.1
06.3	B		1	AO3 4.1.3.1
06.4	(earthworm) can absorb more oxygen (in a given time) or increases / more gas exchange	allow get / obtain / take in more oxygen ignore easier absorption of oxygen ignore references to food	1	AO2 4.1.3.1
06.5	lipase		1	AO1 4.2.2.1
06.6	more oxygen (in soil with earthworms) (for) more (aerobic) respiration (of) bacteria / fungi / microorganisms / microbes / decomposers	reference to more is only needed once for the first two marking points allow earthworms bring oxygen to soil do not accept anaerobic respiration	1 1 1	AO2 4.4.2.1 4.7.2.2
06.7	fertilisation	ignore sexual reproduction	1	AO1 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	asexual (reproduction)	allow cloning	1	AO2 4.6.1.1
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	measure the mass / length of the chip at the start	ignore references to blotting the potato chips	1	AO2 4.1.3.3
	measure the mass / length of the chip at the end	if neither mark awarded allow 1 mark for measure the increase in length / mass	1	
	divide the change in mass / length by time taken		1	
07.2	use cork borer	allow a description allow a potato chip cutter	1	AO3 4.1.3.3
07.3	(rate) would be higher / faster	ignore more diffusion / osmosis	1	AO3 4.1.3.3
	(as) surface area (for diffusion / osmosis) is greater		1	AO2 4.1.3.3
07.4	(as temperature increases the) rate (of osmosis) would increase	ignore more water taken in	1	AO3 4.1.3.3
	as (water) molecules / particles have more energy to move (faster) or as (water) molecules / particles have more kinetic energy	allow (water) molecules / particles move faster	1	
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.			
01.1	 <p>allow 1 mark for one or two correct links</p>		2	AO1 4.1.1.1 4.1.1.2			
01.2	<table border="1" data-bbox="333 898 900 965"> <tr> <td data-bbox="333 898 517 965">vacuole</td> <td data-bbox="517 898 700 965">ribosome</td> <td data-bbox="700 898 900 965">cell wall</td> </tr> </table> <p>tick box takes precedence if no tick is given, look at both the figure and the circling of words in the table if writing is seen on the figure and in the table both must be correct</p>	vacuole	ribosome	cell wall		1	AO1 4.1.1.2
vacuole	ribosome	cell wall					
01.3	turn the (fine focusing) knob until the cells are in focus	<p>allow focus it</p> <p>do not accept increase magnification</p> <p>ignore decrease magnification ignore clear ignore references to resolution / illumination ignore zoom in / out</p>	1	AO2 4.1.1.2			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(rotate the) nosepiece / objective lens	allow change the (objective / eyepiece) lens	1	AO2 4.1.1.2
	to a higher power (lens)	allow (to) increase the magnification a comparator is required ignore change / adjust the magnification allow stronger or more powerful lens ignore references to resolution / illumination unqualified ignore zoom in / out ignore references to an electron microscope	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	conversion of units: (112 mm →) 112 000 (μm) or (280 μm →) 0.28 (mm) (magnification =) $\frac{112}{0.28}$ or (magnification =) $\frac{112\ 000}{280}$ 400 (×)	an answer of 400 (×) scores 3 marks allow 1 mark for no conversion of units 112 / 280 or incorrect value from step 1 correctly substituted do not accept if units are given if no other mark scored allow 1 mark for: magnification = $\frac{\text{size of image}}{\text{size of real object}}$ a triangle with words or letters in is insufficient, as the correct rearrangement is needed	1 1 1	AO2 4.1.1.2
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	controls the (activities of the) cell	allow contains genetic information / genes / DNA / chromosomes do not accept brain do not accept controls substances entering / leaving the cell	1	4.1.1.2 AO1
01.2	red blood cell / RBC or bacteria / prokaryote or xylem (cell)	allow erythrocyte ignore blood cell unqualified ignore platelets allow named examples of bacteria do not accept virus	1	4.2.2.3 4.1.1.1 AO1
01.3	cell shape is similar to cell in Figure 1 and nucleus present any two features correctly identified and labelled: <ul style="list-style-type: none"> • nucleus • (cell) membrane • cytoplasm • mitochondria / mitochondrion • ribosome(s) 	ignore shading do not accept a cell wall drawn allow cell wall if drawn and correctly labelled do not accept other plant sub-cellular structures	1 1	4.1.1.2 AO2 8.2.1 AO1
01.4	any one from: <ul style="list-style-type: none"> • (cellulose cell) wall • chloroplast • (permanent) vacuole 	ignore chlorophyll allow starch grain	1	4.1.1.2 AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	<p>24 (mm) or 2.4 (cm)</p> <p>$\frac{24}{0.06}$</p> <p>or</p> <p>$\frac{2.4}{0.06}$</p> <p>(\times) 400</p>	<p>an answer of (\times) 400 scores 3 marks</p> <p>an answer of (\times) 40 scores 2 marks</p> <p>allow in range 23 to 25 (mm) or in range 2.3 to 2.5 (cm)</p> <p>allow correct calculation from their measurement of X to Y in the range 2.3 cm to 3.5 cm or 23 mm to 35 mm</p> <p>allow correct magnification derived from their measurement in mm</p> <p>ignore rounding errors</p>	<p>1</p> <p>1</p> <p>1</p>	<p>4.1.1.5 AO2</p>
01.6	<p>high(er) magnification</p> <p>high(er) resolution or high(er) resolving power</p>	<p>ignore bigger / zoom</p> <p>allow see more detail</p> <p>if neither mark awarded allow 1 mark for see smaller objects or see smaller sub-cellular structures</p> <p>allow 3D image</p>	<p>1</p> <p>1</p>	<p>4.1.1.5 AO1</p>
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$50 = \frac{43}{\text{size of real object}}$	an answer of 860 (μm) scores 4 marks	1	AO1 3×AO2 4.1.1.5
	(size of real object =) $\frac{43}{50}$		1	
	(size of real object =) 0.86 (mm)		1	
	(size of real object =) 860 (μm)	allow correct conversion of their calculated value	1	
		if no other marks awarded allow 1 mark for magnification = $\frac{\text{size of image}}{\text{size of real object}}$		

Question	Answers	Mark	AO / Spec. Ref.
05.2	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.1.1.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	AO1
	No relevant content	0	
	Indicative content <ul style="list-style-type: none"> • place slide on stage • use lowest power / $\times 4$ objective lens (initially) • adjust mirror or switch light on so light passes through slide • move stage as close to lens as possible • slide must not touch lens • turn focussing knob so slide moves away from lens • turn focussing knob until image comes into focus • use fine focus to get clear image • change objective lens to $\times 10$ • $\times 5$ eyepiece and $\times 10$ objective lenses (gives total magnification of $\times 50$) • refocus slide using focussing knob For Level 2 reference to how to focus the slide / cells and achieve magnification of $\times 50$ is required		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	<p>stage 1 cell growth or increase in number of organelles</p> <p><u>DNA</u> replicates or two copies of each chromosome form</p> <p>stage 2 / mitosis one set of chromosomes moves to each end of cell</p> <p>nucleus divides</p> <p>stage 3 cytoplasm / cell membrane divides to form two (genetically) identical cells</p>	<p>max 4 if correct sequence but no reference to stage numbers</p> <p>max 4 marks if no stage numbers given ignore names of phases</p> <p>marks can be awarded for labelled diagrams</p> <p>allow increase in named organelle eg ribosomes / mitochondria</p> <p>allow DNA duplicates / doubles ignore genetic information replicates if this statement given as part of stage 2 allow max 4 marks</p> <p>allow chromosomes separate or are pulled apart</p> <p>allow nucleus splits into two</p> <p>allow cytokinesis</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO1 4.1.2.1 4.1.2.2</p>

<p>06.6</p>	<p>any two from:</p> <p>advantages:</p> <ul style="list-style-type: none"> • may be used to cure / treat (current / future) diseases or cure medical conditions or produce replacement cells / tissues / organs • cells / tissues of any type could be produced • cells unlikely to be rejected by the patient • many cells produced • cells produced could be used for research • would reduce waiting time for organ transplants <p>any two from:</p> <p>disadvantages:</p> <ul style="list-style-type: none"> • potential life is killed / destroyed • shortage of donors / eggs • egg donation / collection has risks • do not yet know risks /side effects of the procedure on the patient • may transfer (viral) infection • poor success rate to produce viable eggs / embryo 	<p>ignore references to cost</p> <p>allow example eg diabetes / paralysis</p> <p>ignore used for medical treatments</p> <p>allow cells differentiate into many types</p> <p>ignore identical cells are produced unqualified</p> <p>ignore references to cost</p> <p>ignore unethical unqualified</p> <p>ignore references to religion / beliefs</p> <p>allow embryo is destroyed</p> <p>ignore cells destroyed or wasted</p> <p>allow may cause tumours / cancer</p>	<p>2</p> <p>2</p>	<p>AO1 AO3 4.1.2.3 4.1.1.4 4.6.2.4</p>
<p>Total</p>			<p>14</p>	

04.6		a ratio of 30 000:1 for X and 0.55:1 for Y scores 3 marks		4.1.3.1
	(SA: vol ratio of X =) $2.4 \times 10^{-7} : 8 \times 10^{-12}$ or 0.000 000 24 : 0.000 000 000 008	if no other calculation marks awarded allow 1 mark for calculation of SA for X and Y or calculation of volume for X and Y or calculation of SA and volume for one or both cubes if not given as a ratio	1	AO2
	(SA: vol ratio of Y =) 726:1331		1	AO2
	conversion to same scale: 30 000:1 and 0.55:1		1	AO2
	(so) diffusion distance is longer in multicellular organism or (so) volume supplied by each unit of surface area is greater in multicellular organism	allow converse allow converse allow idea that some cells will have no surfaces exposed to outside in multicellular organism	1	AO1
	(so) diffusion rate per unit volume is slower in a multicellular organism	allow converse	1	AO2
Total			17	

Question	Answers	Extra information	Mark	AO / Spec. Ref.												
04.1	to control for the starting mass (of the pieces of carrot)	allow because the pieces of carrot were not all the same mass at the start do not accept were not all the same size do not accept as a control variable	1	AO3 4.1.3.2												
04.2	suitable scale and label for y-axis all points plotted correctly line of best fit	allow 5 or 6 per 2 cm do not accept 5 per 1 cm allow $\pm \frac{1}{2}$ a square allow 1 mark for 4 correct points <table border="1"> <thead> <tr> <th>conc. ...</th> <th>percentage (%) change...</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>+ 24</td> </tr> <tr> <td>0.2</td> <td>+ 12</td> </tr> <tr> <td>0.4</td> <td>+ 1</td> </tr> <tr> <td>0.6</td> <td>- 8</td> </tr> <tr> <td>0.8</td> <td>- 15</td> </tr> </tbody> </table>	conc. ...	percentage (%) change...	0.0	+ 24	0.2	+ 12	0.4	+ 1	0.6	- 8	0.8	- 15	1 2 1	AO2 4.1.3.2
conc. ...	percentage (%) change...															
0.0	+ 24															
0.2	+ 12															
0.4	+ 1															
0.6	- 8															
0.8	- 15															
04.3	value from student's line of best fit	allow $\pm \frac{1}{2}$ a square	1	AO3 4.1.3.2												

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	mass decreased		1	AO2 4.1.3.2
	(due to) loss of water by osmosis	ignore diffusion	1	AO1 4.1.3.2
	through a partially / selectively / semi permeable membrane		1	AO1 4.1.3.2
	(as) concentration of sugar solution is greater than concentration of sugar (solution) inside cells / carrot or (as) the concentration of water is less outside the cells / carrot than the concentration inside the cells / carrot	a clear reference to concentration of water or concentration of sugar is required for the fourth mark allow (as) concentration of sugar solution inside cells / carrot is lower than the concentration of sugar solution (in the tube or around the carrot) allow answers in terms of dilute and concentrated solutions	1	AO2 4.1.3.2
04.5	the (partially permeable / cell) membrane was damaged	allow idea that cell membrane is no longer intact or is more permeable / leaky allow the membrane is denatured ignore cells are dead	1	AO3 4.1.3.2
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(yes, because) the mass change (of egg 4) is much lower than the others	allow because it / egg 4 has gained (over) 50% less mass than the others allow it / egg 4 has gained 1.5 g and the others have all gained more than 3 g (unit required)	1	AO3 4.1.3.2
04.2	$\frac{75.7 - 72.4}{72.4} \times 100$ 4.6 (%)	an answer of 4.6 / 4.56 / 4.558 scores 2 marks or equivalent allow 4.558 / 4.56 (%) allow any correct rounding of 4.558011049723757	1 1	AO2 4.1.3.2
04.3	(mass increased because) water entered by osmosis from a dilute solution in the beaker to a more concentrated solution in the egg (cell) through a partially permeable membrane	allow from an area of high water concentration in the beaker to an area of low water concentration in the egg (cell) allow ref to water potential allow ref to 'strong' and 'weak' solutions ignore along / across concentration gradient do not accept 'amount' in place of concentration allow semi-permeable / selectively permeable membrane	1 1 1	AO2 4.1.3.2 AO2 4.1.3.2 AO1 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	use five (or more) different concentrations of salt / sugar solution (in beakers)	allow any number of concentrations provided it is more than four	1	AO3 4.1.3.2
	(by) plotting percentage change (in mass / volume) on / using a graph		1	
	determine the concentration where the curve / line crosses the zero percentage change (in mass / volume)		1	
04.5	(ions are moved) from an area of low concentration to high concentration	allow against the concentration gradient allow in terms of solution do not accept molecules	1	AO2 4.1.3.3
	(by) active transport		1	
	(which) requires using energy	do not accept idea of energy being created	1	AO1 4.1.3.3
Total			12	

05.3	any three from: <ul style="list-style-type: none"> • (rate) fastest in the first 0.5 hours • (rate gradually) decreases after first 0.5 hours or (rate gradually) decreases throughout the investigation • rate is constant between 1.0 and 2.0 hours or rate is constant between 2.0 and 3.5 hours • (rate) becomes zero between 3.0 and 3.5 hours 	allow 'it' for rate allow fastest rate is 120 units per hour (at start) allow mean rate over 3.5 hours is 37.14 units per hour allow (rate) is zero after 3.5 hours	3	AO3 4.1.3.3 4.2.3.2
05.4	more nitrate ions are absorbed in the presence of oxygen (which suggests) they are absorbed by active transport / uptake which requires energy from respiration some nitrate ions absorbed by diffusion or some nitrate ions absorbed (by active transport / uptake) requiring energy from anaerobic respiration or some nitrate ions absorbed by active transport / uptake using oxygen already dissolved in the solution	allow nitrate ions absorbed faster in the presence of oxygen do not accept energy produced / created / made	1 1 1 1	AO3 AO2 AO1 AO2 4.1.3.3 4.2.3.2

05.5	nitrate ions are used with glucose		1	AO1 4.4.1.3 4.4.2.3
	to form amino acids		1	
	(which are) used to synthesise proteins (needed for growth)		1	
Total			18	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	mineral / nitrate ion	allow nitrates allow potassium / magnesium / sodium ion do not accept nitrogen	1	4.1.3.3 AO3
	(because) it is more concentrated inside the cell	allow converse	1	AO3
	(so) it is moving against / up the concentration gradient or (so must) be moving by active transport / uptake	ignore moving along concentration gradient allow from low concentration to high concentration	1	AO2
05.2	cell contents are more concentrated than the 0.2 (mol/dm ³) solution	allow more dilute solution outside the cell allow higher concentration of water outside of the cells	1	4.1.3.3 AO3
	(therefore) water moves into the cells by osmosis	allow water moves into the cells by diffusion do not accept active transport	1	AO2
	the cells on the inner edge swell with water	allow cells on the inner edge become turgid allow cells on the inner edge absorb water and expand	1	AO3
	(but) the cells on the outer edge absorb less / no water so the stem curls	allow cells on outer edge absorb water at a slower rate allow cells on outer edge cannot expand and therefore the stem curls	1	AO3
05.3	between 0.2 and 0.4 (mol/dm ³)	allow answer in the range 0.21 to 0.39 (mol/dm ³)	1	4.1.3.3 AO3

05.4	<p>at 0.2 (mol/dm³) plant cells are absorbing water and at 0.4 (mol/dm³) they are losing water</p> <p>(so) same concentration is when there is no (net) gain or loss of water or (so) same concentration is when the stem is the same shape as the original</p>	<p>allow ecf from question 05.3</p>	<p>1</p> <p>1</p>	<p>4.1.3.3 AO2</p>
05.5	<p>measure the mass before and after to work out mass gain / loss</p> <p>plot percentage gain / loss on graph and see where the line intercepts 0% change</p>	<p>allow calculate change in mass</p> <p>allow repeat using different concentrations until percentage change in mass is zero</p>	<p>1</p> <p>1</p>	<p>4.1.3.3 AO3</p> <p>AO3</p>
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	plasma		1	4.2.2.3 AO1
06.2	Benedict's (reagent / solution)	allow Fehling's (reagent / solution)	1	4.2.2.1 AO1
06.3	add chemical / Benedict's (reagent to urine) and boil / heat positive result – (colour changes from blue to brick) red	allow ecf from question 06.2 allow any temperature above 65 °C ignore water bath unqualified allow orange / yellow / green / brown if no other mark awarded, allow 1 mark for reference to glucose testing stick / strip	1 1	4.2.2.1 AO1
06.4	the blood is more concentrated or less dilute (than the solution in the cells) (so) water moves out of cells by osmosis water moves through a partially permeable membrane	allow the solution in the cells is less concentrated or more dilute than the blood allow correct references to water concentration or water potential or hypotonic / hypertonic ignore reference to amount of water or glucose allow (so) water moves into the blood by osmosis allow semi-permeable / selectively permeable membrane	1 1 1	4.1.3.2 AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	projections / folds / villi provide a large surface area	ignore small intestine has a large surface area do not allow cilia	1	4.1.3.1 4.1.3.3 4.2.2.1 4.1.1.2 AO1
	walls of projections / folds / villi / capillaries are thin / one cell thick for shorter absorption / diffusion distance		1	AO2
	(small intestine is) very long, increasing time (for absorption)		1	AO1
	good / efficient blood supply to maintain concentration gradient	allow many capillaries to maintain concentration gradient	1	AO2
	cells have many mitochondria for (aerobic) respiration for active transport or cells have many mitochondria for energy release for active transport	do not accept anaerobic do not accept producing energy	1	
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.														
09.1	<table border="0"> <thead> <tr> <th data-bbox="323 383 464 405">Structure</th> <th data-bbox="592 383 743 405">Approximate radius</th> </tr> </thead> <tbody> <tr> <td data-bbox="323 443 464 495">a bacterial cell</td> <td data-bbox="611 443 724 472">1×10^{-14} m</td> </tr> <tr> <td data-bbox="323 539 464 591">a large molecule</td> <td data-bbox="611 495 724 524">5×10^{-10} m</td> </tr> <tr> <td data-bbox="323 636 464 687">an animal cell</td> <td data-bbox="611 539 724 568">1×10^{-10} m</td> </tr> <tr> <td data-bbox="323 732 464 784">an atom</td> <td data-bbox="611 607 724 636">1×10^{-6} m</td> </tr> <tr> <td></td> <td data-bbox="611 680 724 710">2×10^{-5} m</td> </tr> <tr> <td></td> <td data-bbox="611 754 724 784">3×10^{-9} m</td> </tr> </tbody> </table>	Structure	Approximate radius	a bacterial cell	1×10^{-14} m	a large molecule	5×10^{-10} m	an animal cell	1×10^{-10} m	an atom	1×10^{-6} m		2×10^{-5} m		3×10^{-9} m		1 1 1 1	AO2 AO2 AO2 AO1 4.1.2.2 4.1.3.2
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09.2	1.5:0.125 and 6:1 converted to same scale for example 12:1 and 6:1 or 6:0.5 and 6:1 as the length of the side of the cube increases the surface area to volume ratio decreases	allow 1.5:0.125 and 1.5:0.25 or allow 1.5:0.125 and 0.75:0.125 allow size for length of side allow converse	1 1 1	AO2 4.2.1.2														

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	animal has a small(er) surface area to volume ratio (than a bacterium)	allow converse	1	AO1 4.2.1.2
	(so) diffusion distance is larger in animals or volume to be supplied (with gas) by each unit of surface area is greater	allow converse	1	AO2 4.2.1.2
	(therefore) diffusion would not supply enough oxygen for the volume / size or diffusion would not remove enough carbon dioxide for the volume / size or diffusion rate per unit volume is slower	allow converse	1	AO2 4.2.1.2
09.4	active transport requires <u>energy</u> because (sugar molecule) movement is from low concentration (outside cell) to high concentration (inside cell)	allow active transport requires <u>energy</u> because (sugar molecule) movement is against / up concentration gradient	1	AO1 4.1.3.3
	(this) energy is transferred by <u>respiration</u> which requires oxygen		1	AO3 4.1.3.3
	(and a) higher concentration of oxygen allows a faster (rate of) respiration (or energy transfer)		1	AO3 4.1.3.3
Total			13	