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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9700 BIOLOGY

9700/31 Paper 31 (Advanced Practical 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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International Examinations

Question		Expected Answers		Marks	Additional Guidance
1 (a) (i) Prepare the space below to record all your results.					
PDO	recording 2	all cells drawn AND	(heading top or to left) **W**, **X**, **Y**, AND **Z**; **Ignore** P	[1]	If **W**, **X**, **Y**, **Z** NOT given. **Allow** concentration.
		(heading top or to right) time;		[1]	**Ignore** units. **Reject** units in table.
MMO	collection 3	times recorded for samples **W**, **X**, **Y** and **Z**;		[1]	**Ignore** wrong recording 1:20 etc. **Ignore P**.
		time at **W**/5.00 quicker/less than time for **Z**/0.25;		[1]	**Reject** if 1.24 etc. unless have made it clear this is minutes and seconds 1 minute 24 seconds.
		time for **P** between 0.25/**Z** and 1.00/**Y**; **Allow** same as **Z** or **Y**.		[1]	**Allow 1.24 etc.** as long as figures between **Z** and **Y**.
MMO	decisions 1	whole number of seconds recorded (units must be clear somewhere);		[1]	
(ii) Use your results to estimate the concentration of sugar in P.					
MMO	decisions 2	is **W** or **X** or **Y** or **Z** OR is between **W** and **X** or **X** and **Y** or **Y** and **Z** correct from results **Allow candidate P result** equal to or more than **W** or equal to or less than **Z** OR units g 100 cm^{-3} or g/100 cm^3;		[1]	**If no reading for P** then can only award correct units. **Reject** g/100 cm^{-3} **Ignore** incorrect units.
		is 5.00 or 2.50 or 1.00 or 0.25; OR (P) is between 5.00 and 2.50 or 2.50 and 1.00 or 1.00 and 0.25;		[1]	**Do not allow any estimate between two values.**

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Question		Expected Answers			Marks	Additional Guidance
(b) State degree of uncertainty in using the small syringe to measure the volumes.						
ACE	interpretation 1	+/– AND	half volume given AND	units/cm^3/ml/cc;	[1]	
(c) (i) Identify a significant source of error in estimating the sugar concentration of P.						
ACE	interpretation 1	determination of colour change; **Ignore** timing.			[max 1]	**Reject** temperature of water-bath. **Reject** correcting an error e.g. use a colorimeter.
		P between two concentrations/not enough concentrations;				**Allow P** not tested for other sugars.
(ii) Suggest how you would improve the investigation.						
ACE	improvements 3	more/different/wider range concentrations;			[1]	
		three examples of concentrations/serial dilution;;			[2]	**Ignore** units.
		white card to show colour change;			[1]	**Reject** colorimeter/colour chart.
		(repeat/replicate) more than once/many/more times/twice/thrice;			[1]	**Reject** repeat/repeat again/repeat(s) experiment.
		mean/average;			[1]	
		test **P** before hydrolysing;			[1]	
		have equal or excess volume of Benedict's;			[max 3]	

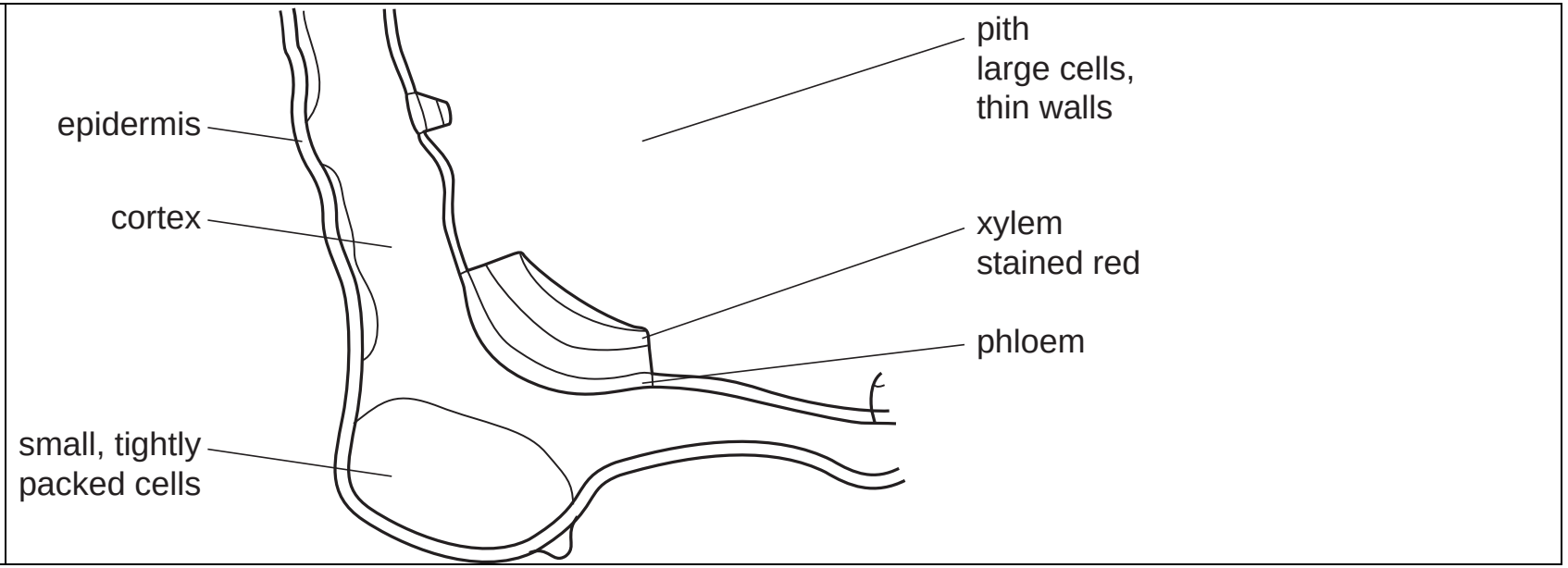
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Question		Expected Answers	Marks	Additional Guidance
(d) Suggest one reason why the concentration of sugar in the phloem is not always the same.				
ACE	**conclusion 1**	different part of plant/near source or sink/position in phloem;		
		different plant;		
		different time day/year or different season;		
		higher temperature;		
		different student so different timing to colour change;		**Reject any other errors** e.g. ref. to volumes.
		AVP; aphids feeding ref to osmosis/water relations needs link to sugars ref to damage to plant	[max 1]	
		Total	**[14]**	

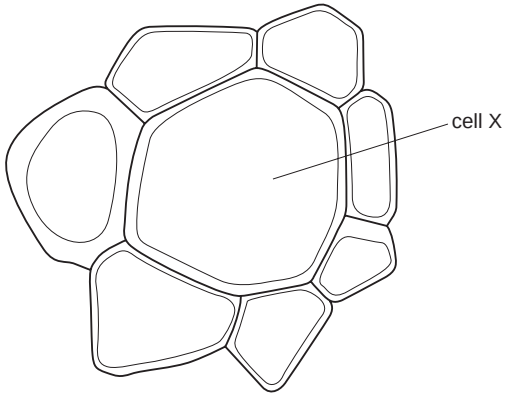
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Question Fig 2.1		Expected Answers							Marks	Additional Guidance
2 (a) Draw a large, labelled plan diagram of the part of the stem shown in fig. 2.1. Add TWO annotations to describe the visible appearance of two tissues.										
PDO	layout 1	clear, sharp, unbroken lines AND	no shading AND	longer than 6 cm from centre of drawn corner in both directions;					[1]	
MMO	collection 2	no cells AND	only correct quarter drawn;						[1]	
		epidermis as two lines maximum 3 mm at the corner OR corner region of collenchyma drawn; Must be a discrete area.							[1]	
PDO	recording 1	corner vascular bundle outer and inner edges both curved towards corner	AND smaller V.B. OR half on right side;						[1]	
MMO	decision 2	any one correct label/epidermis/trichome/cortex/vascular bundle/xylem/phloem/ pith;							[1]	
		Annotations based on	xylem	phloem	cortex	pith	epidermis	collenchyma	[max 1]	Must be two different tissues. Allow for any correct description of visible feature. **Ignore** functions.
		colour walls	red/pink	green						
		colour/lumen	white/ hollow							
		size cells Allow tightly packed			large	large	small/ thin	small		
							2 layers	compact		
		shape of tissue/cells			angular/pentagon/ AW		square			
		walls	thick		thin	thin		thick		

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pith
large cells,
thin walls
epidermis
cortex
xylem
stained red
phloem
small, tightly
packed cells

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Question Fig. 2.2		Expected Answers			Marks	Additional Guidance
(b) Make a large drawing of cell X and all the cells that are touching it. Label cell X on your drawing.						
PDO	layout 1	clear, sharp, AND unbroken lines **Ignore** additional cells beyond cell **X** plus surrounding cells	no shading AND	cell **X** largest internal dimension is more than 3cm;	[1]	
MMO	collection 2	labelled **correct** cell **X**;			[1]	**Ignore** any additional cells and organelles or textbook drawings. 
		drawn all cells (complete) surrounding (cell **X**); **Ignore** incorrect labelling of **X**/no label and number of cells, must have cells all round cell **X** but ignore additional cells/textbook additions.			[1]	
PDO	recording 1	(cell **X**) three adjoining straight walls; **Ignore** incorrect labelling of cell **X**.			[1]	
MMO	decision 2	(must have at least minimum 4 adjacent cells) all cells drawn must have side walls touching; **Reject** if cell wall boundaries are not clear.			[1]	
		cell between 6 o'clock and 9 o'clock has longer side attached to cell **X** than opposite wall; OR anomaly on right separated as line from adjacent cells;			[1]	
		Total			**[12]**	

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Question		Expected Answers	Marks	Additional Guidance
3 (a) (i) Prepare the space below and record your observations.				
MMO	**collection 1**	records observations of cells/yeast/AW grains/bubbles/spots for **A1** and **A2** and **A3**; **Allow** stained/blue unstained white/colourless/clear **Ignore** solution/liquid **Reject** molecules	[1]	**Allow** drawings under headings. **Ignore** other colours than blue or /white/colourless.
MMO	**decision 1**	(boiled yeast/**A1**) (mostly) blue/stained/no white (white) AND (yeast in glucose/**A3**) (mostly) white/unstained (blue) AND (yeast in salt/**A2**) white/unstained//white and blue/blue;	[1]	**A1** boiled **A2** high concentration salt **A3** in glucose/living
(ii) Explain the appearance of the yeast cells in A1 (boiled) and A3 (living)				
ACE	**interpretation 1**	(boiled yeast/**A1** blue/stained cells) cells dead/no activity/denatured enzymes/AW AND (yeast in glucose/**A3** white/unstained) living cells/example e.g. budding/respiration/enzymes active; ECF from results.	[1] AND	**Reject** yeast denatured.
(b) (i) Complete Table 3.1 by calculating the missing value for the mean activity of yeast. Show all the steps in your calculation.				
PDO	**display 2**	shows 177+180+168 and divided by 3; 177/3 180/3 168/3 then adding up;	[1]	
		then by 3 again; ECF from point 1, allow answer from point 1 divided by 3 or 9.	[1]	177+180+168 divides by 9;; 177+180+168 = 525/9 = 175/3 = (58);;

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Question		Expected Answers			Marks	Additional Guidance
(ii) Plot a graph of these data shown in Table 3.1.						
PDO	layout 4	**O**	x-axis concentration/conc/ %/percentage **AND**	y-axis <u>bubbles</u> min^{-1} or /min;	[1]	
		S	scale as 1.0 to 2 cm (allow no 0) and 20 to 2 cm; ECF from wrong O – must use more than half grid for both *x* and *y* axis with sensible scale 20 to 2cm and y 2 to 2 cm.		[1]	Allow 10 on origin on y but must be labelled.
		P	plotting crosses or dot in circle ONLY **AND** plots correct;		[1]	**Do not credit blobs in or out of circles.** **Credit x s in circles.**
		L	ruled/straight line to all points; Smooth curve through all points.		[1]	**Do not credit if any extrapolation beyond 0 or 5.0**

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Question		Expected Answers		Marks	Additional Guidance
(iii) Describe the results shown in your graph.					
ACE	interpretations 2	increases/most bubbles to 1.5%;		[1]	
		decreases/AW;		[1]	
(iv) From your graph estimate the mean activity of yeast in a 2.0% sodium chloride solution.					
ACE	interpretaton 1	correct reading from graph at 2.0%	AND bubbles per minute/min^{-1};	[1]	Whole number of bubbles only.
(v) Explain the difference in the activity between					
ACE	conclusion 2	**(0.0% to 1.5%) sodium chloride solution**	(Salt) increase enzyme activity /AW	[1]	**Allow** ref. increase in process e.g. active transport.
		(3.0 to 5.0%) sodium chloride solution	(Salt) inhibits/denatures enzymes OR causes water to move out of cells/ osmosis/dehydration/dessication of cells/plasmolysed;	[1]	**Reject** yeast denatured/killed/dies. Enzyme killed. Enzyme doesn't work.
		Total		**[14]**	

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9700 BIOLOGY

9700/32 Paper 32 (Advanced Practical 2), maximum raw mark 40

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Question		Expected Answers			Marks	Additional Guidance
1 (a) (i) Suggest what happens to the concentrations of starch and glucose after the starch suspension has been eaten.						
MMO	**decisions 2**		(starch)	(glucose/reducing sugar)		
		(stomach)	stays same/no change;		[1]	
		(mouth) AND (small intestine)	less/decreases, AND no/little/less/decreases AND	some/little/increases all/lots/more/increases;	[1]	
(ii) Prepare the space below and record: the tests you used, the quantities of the samples and reagents and your results.						
PDO	**recording 2**	all cells drawn AND	sample/**S1**, **S2**, **S3**, **S4** as heading for top or left column ;		[1]	**Mark both of separate results tables for mark points 1 and 2.**
		observations/colour/result/s ; **Check heading where colours recorded and credit this heading.**			[1]	
MMO	**collection 3**	**all** samples tested for starch AND **Ignore actual colours**	**S2** (iodine) blue/black AND **Reject** purple.	(with Benedict's) blue/no test done; **Reject** colourless	[1]	
		S4 (Benedict's only) (brick) red ;			[1]	
		S1 and S3 (Benedict's) either same colour or both colours, less than S4;			[1]	
MMO	**decisions 2**	same volume for each sample AND	same or excess volume for Benedict's;		[1]	**Reject** if just amounts or drops.
		(Benedict's) heats to more than 80° C /boils AND	same time 10 minutes or less ;		[1]	

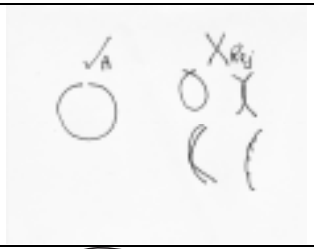
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Question		Expected Answers		Marks	Additional Guidance
(iii) Using the information provided and your results, complete Table 1.1 below to identify the samples.					
ACE	interpretation 3	sample	sample identified	[max 3]	
		starch about to be eaten	**S2**;		
		mouth	**S1** and/or **S3** ;		
		stomach	**S1** and/or **S3** ;		
		small intestine	**S4**;		
(iv) Explain your answer to (a) (iii).					
ACE	conclusions 3	hydrolysis/ed, used in correct context;		[1]	In correct context
		(starch eaten or **S2**/sample identified) no (hydrolysis/breakdown)/only contains starch/no glucose/ description of results;		[max 2]	**Allow** results only for starch eaten.
		(stomach or sample identified)idea of **no**/(enzyme action/ breakdown) OR (mouth or sample identified) **little** (enzyme action/breakdown);			
		(small intestine or **S4**/sample identified) more/increased/most (enzyme action/breakdown);			
(b) Suggest how the student could modify this investigation to obtain quantitative measurements of the glucose concentration.					
ACE	improvements 3	use known/range of concentrations of glucose;		[1]	
		serial dilution/description of dilutions/examples of 3 concentrations;		[1]	
		use colorimeter/colour chart/mass of precipitate/time for colour to change/diastix/glucose test strip;		[1]	**Reject** calorimeter'
		draw graph/calibration curve;		[1]	
		compare unknowns/samples to standards/AW;		[max 3]	

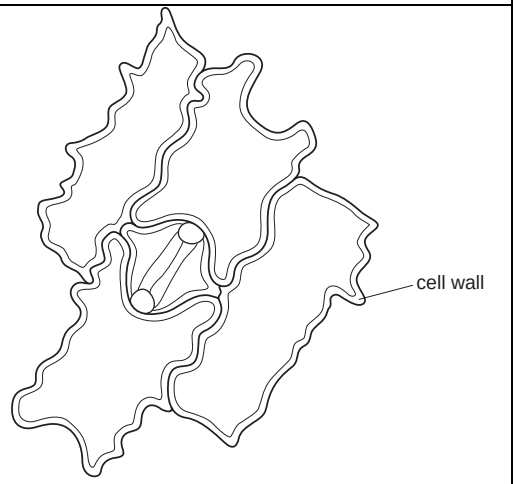
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Question		Expected Answers			Marks	Additional Guidance
(c) (i) Plot a graph of these data shown in Table 1.2.						
PDO	layout 4	**O**	x-axis conc/concentration, g dm^{-3} **Reject** g/dm^{-3} **Allow** g/dm^{3}	**AND** y-axis time, seconds/secs/s ;	[1]	
		S	scale as 5 to 2 cm (allow no 0) or 5 at origin and 20 to 2 cm allow 10 at origin;		[1]	If **O** is incorrect, allow suitable scale more than half grid on both axes.
		P	plotting crosses or dot in circle ONLY **AND** plots correct; No cross larger than X or o. If plot additional point with same symbol used to show calculation/gradient then reject plotting.		[1]	**Do not credit** blobs in or out of circles. **Credit** x s in circles.
		L	ruled/straight line to 3 points; **Allow** point to point if not plotted correctly.		[1]	**Allow** extrapolation to 0 within 3 mm. **Reject** if origin not 0,0. **Do not credit** if any extrapolation beyond 30 or beyond y-axis.
(ii) Use your graph to find the rate of hydrolysis by finding the gradient of the line.						
MMO	collection 1	shows how on graph ;			[1]	
ACE	interpretation 1	correct answer (from their correctly plotted graph); **Allow** any answer between 0.3500 and 0.4255 **Reject** as fraction **OR** 2.350 and 2.900/allow 2 with a fraction;			[1]	**Allow** 1 to 4 significant figures. If graph incorrectly plotted then check readings and calculation.
		Total			**[24]**	

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Question Fig 2.1		Expected Answers			Marks	Additional Guidance
2 (a) Draw a large plan diagram of the section shown in Fig. 2.1.						
PDO	**layout 1**	clear, sharp, AND unbroken lines	no shading AND	larger than the diagonal across 6 cm grid from apex of drawing	[1]	
MMO	**collection 1**	no cells AND	only whole section drawn; **Reject** if draw more than whole section labelled.		[1]	
PDO	**recording 1**	inner layer shown by two/three lines closer together than next line ;			[1]	
MMO	**decision 1**	drawn 3 large folds as shown in pmg All three folds larger than any of others.	**OR** bulge on side approx. half way between apex and edge ;		[1]	

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Question Fig. 2.2		Expected Answers			Marks	Additional Guidance
(b) (i) Make a large, labelled drawing to show TWO guard cells and the COMPLETE cells that surround them. Do not draw more than 6 cells. Show on Fig. 2.2 the cells you have drawn.						
PDO	layout 1	clear, sharp, AND unbroken lines	no shading AND	does not fit inside the 6 cm grid;	[1]	
MMO	collection 1	shows on Fig 2.2 at least 2 cells AND	2 guard cells only AND	up to 4 complete cells drawn;	[1]	
	1	length of surrounding cell more than width;			[1]	
MMO	decision 1	outline of (surrounding cells) wavy/not straight	AND no air spaces between adjacent cells;		[1]	
	1	cell wall labelled correctly; **Reject** if ultrastructure labelled.			[1]	
(ii) Calculate the actual length in micrometres of one of the guard cells. Show all the steps in your calculation.						
PDO	display 2	(length in <u>mm</u> (5 to 32) × $1000/10^3$; OR (length in <u>cm</u> (0.5 to 3.2) × $10000/10^4$; **Reject** any metre conversions and measurements outside the range given.			[1]	
		divided by 400; Must show division by 400.			[1]	
		Total			**[11]**	

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Question		Expected Answers		Marks	Additional Guidance
3 (a) Prepare the space below and record all your observations.					
PDO	**recording 1**	table/divided space into four with lines and clearly leaf/L stained/LI **AND** unstained/L **AND** potato/P stained/PI **AND** unstained/P;		[1]	
MMO	**collection 1**	(leaf cells/L) at least TWO different types of cells observed; **Allow** drawn or named from epidermal cells/palisade cells/mesophyll cells/xylem vessels/cells/ guard cells.		[1]	
MMO	**decision 1**	(potato cells/P) black/starch AND granules/grains/sacs/AW (when stained with iodine) AND in cells; **Reject** blue/black cells		[1]	
(b) Explain your observations.					
ACE	**interpretation 2**	(iodine) stains/shows starch;		[1]	
		(iodine)no effect/little/less starch in LI/leaf;	(potato) contains more starch;	[1]	**Allow** any comparative statement.
		Total		**[5]**	

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1 (a) (i) Complete table to show how you will carry out the tests on each solution.									
MMO	**decisions 4**	(Starch) iodine AND (reducing sugar) Benedict's AND (protein) Biuret or sodium/Na/potassium/K/hydroxide/OH <u>and</u> copper sulfate;						[1]	
		same volume/quoted volume for solution AND		same/quoted volume or excess volume for Benedict's;				[1]	**Reject** amounts or drops.
		(Benedict's) heats to at least 80^{o} C/ boils AND		same time 10 minutes or less ; **Reject** less than 1 minute				[1]	**Must have units**
		(starch)		(reducing sugar)		(protein)		[1]	**Reject** no change/colourless/negative/positive
		orange to yellow brown	blue/black **Reject** purple	blue to	orange/brown/ red	blue to	violet/ lilac/ purple mauve; **Reject** pink		

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Question		Expected Answers		Marks	Additional Guidance
(ii) Prepare the space below and record your observations of the tests on all the solutions.					
PDO	recording 3	all cells drawn AND **Allow** three tables samples in separate cells and different tests in different cells. **Allow** repeats tests.	sample/**S1**, **S2**, **S3**, **S4**, **S5** as heading for top row or left column ;	[1]	**If more than one table** for points 1 and 2 **all** tables must be correct.
		(heading for top row or left) observations/colour/result/s ;		[1]	
		observations for all solutions and all tests (15 readings);		[1]	
MMO	collection 3	(starch) **S3** blue/black;		[1]	**Reject** positives/negatives/ticks/ crosses for points 4,5 and 6
		(reducing sugar) **S2** any positive colour more than **S3**;		[1]	**Reject** no colour change
		(protein) **S2** and **S5 only** positive i.e. violet/lilac/mauve/purple;		[1]	**S1**, **S3** and **S4** NOT purple
(iii) Use your observations to state the two solutions that should be mixed in equal volumes to provide the correct mixture to feed the young mammal.					
ACE	conclusion 1	**(S)3 and (S)5;**		[1]	

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Question		Expected Answers			Marks	Additional Guidance
(b) (i) Plot these data shown in Table 1.1.						
PDO	layout 4	**O**	x-axis time (/) min AND	y-axis number/no. (of) individuals;	[1]	**Reject** min^{-1}
		S	scale for **chart** x-axis times evenly spaced and uses more than half grid and 2 to 2 cm y-axis	scale for **line** 5 mins to 2 cm and 2 to 2 cm on y;	[1]	**If incorrect O** then must use half or more of grid with sensible scale.
			blocks even width **AND** correctly plotted for day 1; No more than half a square above value	plotting crosses or dot in circle ONLY **AND** plots correct for day 1; No cross larger than X dot must fit inside o on any one point.	[1]	**Do not credit** blobs in or out of circles or a dot and cross in circle. **Credit** xs in circles.
		L	thickness of lines **AND** blocks for day 1 and 2 together **AND** shading/writing and key;	thickness of lines **AND** for both graphs ruled/straight lines joined point to point OR curve through points **AND** labelled/key; No extrapolation either end.	[1]	**Do not credit** if plot blocks as two separate groups. **Allow** if blocks for different times are touching If space between pairs this must be the same.
(ii) Describe the patterns in the results.						
ACE	interpretation 3	(in context of no. of individuals) increases then decreases/AW; peak then drops			[1]	
		(use of data) any quote of data using time with no. of individuals;			[1]	
		comparison between day 1 and day 2 day 2 digestion earlier or faster or day 1 slower/AW time less day 2/time more day 1/AW ;			[1]	

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Question		Expected Answers	Marks	Additional Guidance
(iii) Suggest a reason for the difference between the results for day 1 and day 2.				
ACE	conclusions 1	(mammals) just eaten/different food eaten/different time of day/concentration of enzyme different/health/ (method used) volume of saliva/pH/AW temperature different **Allow** in any context or no context.	[1]	
(iv) Suggest how you might control the variables in this investigation to compare a different species of mammal with the mammal studied.				
ACE	improvements 3	(mammals) same age/healthy/sex/mass/weight/AW;	[1]	**Reject** size
		(treatment/environment) (food) eaten/fed/diet same/time after meal the same live in same conditions/environment/example of variable temperature;	[1] [1]	
		(method) same volume/example of volume of saliva; same number/25 or same volume/5 cm^3 starch or same concentration/1% starch; temperature in water-bath/pH using buffer;	[max 2]	**Reject** amounts
		Total	**[22]**	

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Question		Expected Answers	Marks	Additional Guidance
2 (a) (i) Draw a large low-power plan diagram of the midrib of the leaf as shown in the shaded area in Fig. 2.1. Label upper surface and one vascular bundle.				
PDO	layout 1	clear, sharp, AND unbroken lines **Allow** 3 or fewer entire drawing. no shading AND shape of section as shown in fig. 2.1 does **not** fit inside grid; **Ignore** additional lamina drawn.	[1]	
MMO	collection 2	no cells drawn AND **Ignore** trichomes definite bulge at bottom of midrib;	[1]	
		region of cells at tip of bulge OR any triangular shape from upper epidermis towards vascular bundle;	[1]	
MMO	decisions 2	complete vascular bundle in lower half of midrib;	[1]	
		(in correct context of midrib) upper surface/epidermis AND vascular bundle labelled;	[1]	**Ignore** cuticle
(ii) Describe one visible adaptation of this leaf and suggest a possible advantage to the plant.				
MMO	decision 1	selects observable feature/curling/rolled/trichomes/hairs/no stomata on upper surface/stomata only on lower/sunken stomata/cuticle; **Allow** lots of/densely packed chloroplasts/palisade cells;	[1]	
ACE	conclusion 1	suggests an appropriate advantage reduces, less AND water loss/evaporation/transpiration; **Allow** traps water/absorbs water/reduces air movement	[1]	

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Question		Expected Answers			Marks	Additional Guidance
(iii) Find the ratio of the thickness of the midrib compared to the thickness of the lamina.						
MMO	**collection 1**	shows midrib measurement larger than lamina;			[1]	**Reject** any units mm/other units anywhere than eyepiece graticule units.
PDO	**display 2**	ratio larger number on left to or **:** smaller number; **Allow** as fraction of larger number over smaller number;			[1]	
		final answer whole numbers only;			[1]	
(b) (i) Make a large, high-power drawing of a group of three cells from the upper epidermis and the cells touching them.						
PDO	**layout 1**	clear, sharp unbroken lines AND	no shading in epidermal cells only AND	whole group does not fit in 6 cm grid;	[1]	
MMO	**collection 2**	**only three** epidermal cells drawn as a chain AND	no spaces/gaps between adjacent cells;		[1]	
		thinnest (epidermal) cell equal or less than half depth of longest cell in layer below;			[1]	
MMO	**decision 1**	label cell wall correctly;			[1]	

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<table>
<tr><th colspan="2">Question</th><th colspan="3">Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td colspan="7">(ii) Prepare the space below so that it is suitable for you to record the observable differences between the upper and lower epidermis of the leaf.</td></tr>
<tr><td>PDO</td><td>recording 1</td><td>organise as a table/
venn diagram/
ruled connected boxes</td><td>headed
upper and lower</td><td>no similarities recorded;</td><td>[1]</td><td><u>upper</u> <u>lower</u> OR venn circles labelled, overlap

empty</td></tr>
<tr><td>ACE</td><td>interpretation 3</td><td colspan="3">
<table>
<tr><th>feature</th><th>(upper)</th><th>(lower)</th></tr>
<tr><td>surface</td><td>smooth/flat/even/regular</td><td>rough/bumpy/ irregular;</td></tr>
<tr><td>cell shape</td><td>regular/flattened/ rectangular</td><td>irregular/angular/ pointed;</td></tr>
<tr><td>cell wall</td><td>thick</td><td>thin;</td></tr>
<tr><td>cell/epidermis size</td><td>large/thick</td><td>small/thin;</td></tr>
<tr><td>number
packing</td><td>few
dense/tight</td><td>lots
short/loosely;</td></tr>
<tr><td>trichome/hairs

Reject
spikes/thorns</td><td>none/few</td><td>has/some/lots;</td></tr>
<tr><td>stomata/sunken/ openings/gaps/ pores</td><td>none/absent/no

Reject less</td><td>has/present;</td></tr>
<tr><td>cuticle</td><td>present/thick</td><td>none/thin;</td></tr>
</table>
</td><td>[max 3]</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Total</td><td>[18]</td><td></td></tr>
</table>

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