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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/31 Paper 31 (Advanced Practical Skills 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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Question		Expected Answers		Marks	Additional Guidance
1 (a) (i) Prepare the space below and record your results.					**[6]**
PDO recording 2	1.	table with all cells drawn	**AND** heading (top or left) surface area/cm^2 or length/mm;	[1]	
	2.	**Reject** • if units in body of table • t or T • additional columns details of method			
		(heading) time with units;		[1]	
MMO collection 2	3.	collects data as times for all four pieces of potato;		[1]	
	4.	(A) recorded time different from other pieces;		[1]	
MMO decisions 2	5.	**Reject** units must be clear so 1.2 or 1:2 must have min and s or secs			
		records all times correctly as whole seconds or minutes with seconds; UNITS must be clear somewhere		[1]	
	6.	replicate recorded;		[1]	

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(ii) Identify *two* significant sources of error in your investigation. [2]

ACE interpretation MAX 2

	Reject temperature			
	Cause of error	Error		
	(dependent)			
1.	timing /dropping/distance long pieces of potato	not accurate/delayed/different;		
2.	ora shorter pieces	different height to top there is shorter distance to surface longer distance to surface;		
3.	(pieces of) potato	stick to sides/bottom of tube don't sink to bottom;	[max 1]	
	(standardised variables)			
4.	potato or position in potato or age or storage	not same different/variety old;		
5.	water left on potato	not same/different;		
6.	(test)-tubes	not same size/height;		
7.	hydrogen peroxide	concentration changes/decreases evaporates/degenerates/breaksdown;	[max 1]	
	(independent variable)			
8.	lengths/size/surface areas/volumes	not same different vary;	[max 1]	max 2 overall

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(iii) Suggest how you would make *three* improvements to this investigation. [3]

ACE improvements Max 3

1.	same potato or position in same age or storage or fresh use micrometer/cork borer/vernier callipers;	[1]	
2.	use same volume/mass/volume ratio more surface areas/sizes;	[1]	
3.	use a wider container or smaller potato use deeper container use tubes of same size clamp tubes in vertical position;	[1]	
4.	method to dry the potato lid to cover hydrogen peroxide;	[1]	
5.	(collect oxygen) use a gas syringe or water displacement/oxygen sensor;	[1]	
6.	replicate/repeat;	[1]	max 3

(b) (i) Three of the values in table 1.1 are anomalous. Draw a circle around each of these values. [1]

MMO decision 1

all three figures circled;

pH	time to displace 10 cm^3 of water/s					
	trial 1	trial 2	trial 3	trial 4	trial 5	mean
5	17	14	16	14	15	15
6	8	5	15	6	5	6
7	2	10	3	3	4	3
8	8	6	6	17	7	7
9	20	16	17	16	16	17

[1]

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(ii) Complete table 1.1. by calculating the missing value.					**[1]**
ACE interpretation 1	7; **Allow** 9.			[1]	
(iii) Plot a graph of the data shown in Table 1.1.					**[4]**
PDO layout 4	O	*x*-axis pH	**Reject** t	[1]	Must have units
			AND *y*-axis time/s or seconds;		
	S	**Reject** awkward scale			Must use more than half grid in *x* and *y*.
		scale as each pH to 2 cm	AND 5 seconds to 2 cm;	[1]	
	P	**Reject** plotting if scale is awkward if only dots/blobs or blobs in circles **Allow** cross in circle	intersection of cross must be clear to show plot. NO cross must touch the line for the next square.	[1]	
		correct plotting using crosses/dots in circle only;			
	L	straight line through points; error carried forward if scale or plotting incorrect	quality – no thicker than on grid, not feathery for the complete line. joining plots – • <u>ruled lines plot to plot</u> • <u>curve through all plots</u> extrapolation • <u>not beyond *x*- or *y*-axis</u>	[1]	**Reject** if any extrapolation

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(iv) Explain the relationship between pH and the enzyme catalase shown in the data. [3]

ACE conclusion 3

(in correct context of pH and activity (below 7/acid or above 7/ alkali) effect on) structure of protein/enzyme/active site or bonds		changed/altered/destroyed/no longer complementary broken;	[1]
(below 7 or above 7) **do not accept** collision(s)/react fewer ECSs (enzyme substrate complexes) or less/no substrate can bind/combine/attach fit into enzyme/active site;			[1]
(below 7/above 7) (enzymes) denatured;			[1]

[Total: 20]

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2 Make a large, high-power drawing to show the details of five of the structures specialised for gas exchange (alveoli). The walls of one alveolus must be touching the walls of at least two other alveoli. Label where gas exchange takes place. [5]

PDO layout 1	1.	**Reject** if drawn over the print of question			[1]	
		Reject • thick lines • feathery lines • 2 'tails' or overlaps or gaps	**AND** no shading	**AND** use most of the space provided;		
		clear, sharp, unbroken continuous lines				
MMO collection 2	2.	five structures drawn	**AND** at least 3 structures touching;		[1]	
	3.	at least three alveoli different shapes/sizes	**AND** thickness of one wall irregular;		[1]	
MMO decisions 2	4.	(walls with) at least 2 cells drawn	**AND** at least one nucleus drawn;		[1]	
	5.	**Reject** • if any label is biologically incorrect e.g. cell wall. • label within drawn area • into centre of alveolus correct label with label line to wall of alveolus;			[1]	

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(b) (i) Draw a large plan diagram of the bronchiole shown in Fig. 2.1. Label the lumen. [5]

PDO layout 1	1.	**Reject** if drawn over the print of question				
		Reject • thick lines – than grid • feathery lines • 3 'tails' or overlaps or gaps	**AND** no shading	**AND** use most of space provided;	[1]	
		clear, sharp, unbroken lines				
MMO collection 2	2.	no cells drawn	**AND** width of base of fold greater than width of tip of fold;		[1]	
	3.	13 to 15 folds in lumen;			[1]	
MMO decisions 2	4.	shows indentation;			[1]	
	5.	**Reject** • if any label is biologically incorrect e.g. cell wall. • label within drawn area correct label with label line to lumen;			[1]	

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(ii) Calculate the ratio of the mean thickness of the outer layer of the bronchiole compared to the mean thickness of the wall of the blood vessel shown in Fig. 2.1. [4]

MMO collection 2	**Reject** If lines not shown on both bronchiole and blood vessel		[1]	
	shows one measurement on each of bronchiole and blood vessel;			
	Reject If no units If not both same units If metres or converted to metres or micrometres or standard form		[1]	
	(one bronchiole measured) to nearest 0.5 mm	**AND** mm;		
MMO decisions 2	shows mean adds measurements	**AND** shows division by number of measurements;	[1]	
	Reject • If given as decimal :1 • If smaller to larger number • If include units answer is larger whole number to smaller whole number or leaves as fraction;		[1]	**Either** must be to lowest common denominator

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(iii) Prepare the space below so that it is suitable for you to compare the observable features of the bronchiole and blood vessel in the photomicrograph Fig. 2.1. [6]

PDO recording 2

organise as a table/ Venn diagram/ ruled boxes	**AND** headed <u>bronchiole</u> and <u>blood vessel</u>	**AND** differences opposite each other;	[1]	<u>bronchiole</u> | <u>blood vessel</u>
heading for similarities/similarity/compare (with contrast)/same;			[1]	

MMO decision 1

attempted one similarity ;		[1]	

ACE interpretation 3

Do not accept
- tick and cross without a key
- diagrams
- 3-D description
- incorrect biological terms e.g. endodermis

		bronchiole	blood vessel
	similarity		
S max 1	lumen	smooth muscle	epithelium
	feature		
D1	lumen shape	irregular/lobed/folded	smooth/oval/not folded;
D2	lumen size	small(er)	larg(er);
D3	folds	many/present	none/absent;
D4	no. of layers	more/2	less/1;
D5	outer/muscle layer/wall	thick(er)/wid(er)	thinn(er)/narrow(er);
D6	overall shape	circular/round	oval/squashed circle;

[max 3]

If no organisation if in same sentence or following sentences.

[Total: 20]

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9700/33 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

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Question		Expected Answers		Additional guidance
1 (a) (i)		**Decide on the concentrations of copper sulfate solution you will use in your investigation.**		**[3]**
MMO decisions 3	[1]	any 4 or more (volumes/concentrations);		
	[1]	(highest concentration) 0.3 to 0.15;		
	[1]	any three consecutive concentrations (including 0 if present) with two intervals • the same • or serial dilution by half • or serial dilution by ten;		
	(ii)	**State which variable you will need to control when preparing the plant tissue samples.**		**[1]**
MMO decision 1	[1]	length or surface area or size or dimensions or volume; **Allow** methylene blue		
	(iii)	**Describe how you will control this variable and prepare the samples of plant tissue.**		**[2]**
MMO decisions 2	[1]	(control) measure cut (methylene) rinsing/washing	the same any example of length 3 cm or less/size; excess	
	[1]	(prepare samples) use of scalpel/knife or ruler; (methylene blue) water		

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	(iv)	**Prepare the space below and record your observations.**		**[5]**
PDO recording 2	[1]	**Reject** • if units for % in body of table • other units e.g. mol dm^{-3}		
		table with all cells drawn	**AND** heading (top or left) percentage conc(entration);	
	[1]	**Reject** • if headings/columns for method/volumes/time 5 mins or size/lengths		
		(heading) colour or observations or description;		
MMO collection 2	[1]	(records clear separate observations/colours) after/during 5 min/before mixing	**AND** after mixing (after/at 5 min);	
	[1]	difference in the strength of colour between the first and last test-tube observations;		Key e.g. + = colour
MMO decision 1	[1]	5 or more concentrations or observation for water or replicate recorded;		
	(v)	**Suggest how copper sulfate solution affects plant cell membranes.**		**[1]**
ACE conclusion 1	[1]	In correct context of increasing or just copper sulfate Idea of damages or destroys	 it or ((cell) membrane(s)) phospholipid(s) fluid mosaic (model/structure)	
		or makes more	(fully) permeable	
		denatures	protein	
		(increases copper sulfate) } increases (decreases copper sulfate) } decreases	fluidity permeability	
		(increases copper sulfate) } decreases (decreases copper sulfate) } increases	selective permeability;	

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(vi) Identify three significant sources of error in your investigation. **[3]**

ACE interpretation MAX 3

Reject
temperature pH
evaporation
any errors which affect all test-tubes equally

	Cause of error	Error
	(dependent)	
[1]	qualitative;	
	colour/colour change/observations	difficult judging
[1]		seeing;
[1]		qualitative;
[1]	mixing	more difficult to judge colour/colours the same;
	(standardised variables) potato or position in potato or age	not same different/variety
[1]	or storage	old;
[1]	lengths/size/surface areas/volumes **Allow** mass	not same;
	staining/washing/handling/forceps	not same loses stain damages potatoes
[1]		ends not stained or middle more stain;
[1]	potato/samples (into test-tubes)	time not same/delayed time/not at same time;

max 3

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	(vii)	**Suggest how you would make *three* improvements to this investigation.**	**[3]**
ACE improvements MAX 3	[1]	same potato or position in same age or storage or fresh use micrometer/cork borer/vernier callipers/ruler with smaller divisions;	
	[1]	leave in methylene blue longer/stronger concentration/more than 5 minutes idea of wash more;	
	[1]	more/wider/narrower/different/examples range of concentrations or use burette or graduated pipette or smaller syringe or with smaller divisions;	
	[1]	stagger start or do individually or use more stop clocks or use help;	
	[1]	colorimeter or datalogger with light sensor; **Reject** calorimeter	
	[1]	repeat or replicate;	max 3
		[Total: 18]	

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<table>
<tr><td colspan="6">2 (a) (i) Draw a large plan diagram of a quarter of the specimen as shown in Fig. 2.1. Label the endodermis and cortex. [5]</td></tr>
<tr><td rowspan="2">PDO layout 1</td><td rowspan="2">[1]</td><td colspan="3">Reject
• if drawn over the print of question</td><td rowspan="2"></td></tr>
<tr><td>Reject
• thick lines-than grid
• feathery lines
• 3 'tails' or overlaps or gaps

clear, sharp, unbroken lines</td><td>AND
no shading</td><td>AND
uses most of space provided;</td></tr>
<tr><td rowspan="3">MMO collection 3</td><td>[1]</td><td>no additional cells drawn</td><td colspan="2">AND (epidermis shows)
only the correct quarter;</td><td rowspan="3"></td></tr>
<tr><td>[1]</td><td colspan="3">epidermis drawn with two lines 3 mm or closer for most of length;</td></tr>
<tr><td>[1]</td><td colspan="3">innermost line is wavy/undulating line;</td></tr>
<tr><td rowspan="2">MMO decision 1</td><td rowspan="2">[1]</td><td colspan="3">Reject
• if any label is biologically incorrect e.g. regions belonging to other organs or animals.
• label within drawn area</td><td rowspan="2"></td></tr>
<tr><td colspan="3">correct label with label lines to cortex and endodermis ;</td></tr>
</table>

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(ii) Make a high-power drawing of one large xylem vessel and the single layer of cells touching a quarter of the vessel's circumference. Labels are not required. [5]

PDO layout 1	[1]	**Reject** • if drawn over the print of question			
		Reject • thick lines – than on grid • feathery lines • 4 'tails' or overlaps or gaps if double lines for all cells • 1 if single line for any cell	**AND** no shading	**AND** uses most of space provided;	
		clear, sharp, unbroken lines			
MMO collection 3	[1]	one xylem vessel drawn **Ignore** band inside	**AND** only single layer of surrounding cells ;		
	[1]	**Reject** if layer of cells all round xylem vessel If xylem vessel not circular/polygonal			
		(surrounding cells) (single layer) three to eight cells in a layer only; **Allow** not touching.			
	[1]	**Reject** any spaces if single line for cell walls. any gaps between cell walls – floating cells			
		(all cells including xylem vessel) no enclosed spaces more than 1mm between adjacent double cell walls;			
PDO recording 1	[1]	cell walls drawn as double lines with middle lamella between three adjacent cells from surrounding cells;			

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(b) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on K1 and that in Fig. 2.2. [4]

PDO recording 1	[1]	organise as a table/Venn diagram/ruled boxes		**AND** headed K1 and Fig 2.2	**AND** first difference opposite each other;	K1 | Fig 2.2
ACE interpretation 3						**Ignore** • tick and cross without a key • ref. to non-observable features • 3D shapes
			feature	K1	Fig.2.2	
	[1]	1	epidermis	hairs/trichomes **Ignore** root	no hairs/trichomes;	
	[1]			thick(er) or more/2 layers	thin(ner) or few(er);	
	[1]	2	cortex	yes/present/more	no(one)absent/less;	
	[1]	3	endodermis	yes/present	no(one)/absent;	
	[1]	4	pericycle	yes/present	no(one)/absent;	
	[1]	5	vascular bundles xylem	ring/centre/no(one)/absent/ fewer	scattered/AW/towards edge/yes/present/more;	
	[1]	6	thickened cells/ sclerenchyma **Allow** collenchymas bundle sheath/AW	either way round for present/absent/under epidermis;		
	[1]			no(one)/absent	yes/present;	
	[1]	7	pith pith/centre cells	yes/present	no(one)/absent;	
	[1]			rounded	angular/pentagonal/AW;	
	[1] [1]	8	air spaces/lenticels stomata	yes/present no(one)/absent	no(one)/absent; yes/present;	max 3

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(c) (i) Plot a chart of the data shown in Table 2.1. [4]
MAX 2 for O and S if line graph drawn

PDO layout 4

O [1]	*x*-axis content(s)	**AND** *y*-axis conc(entration in) phloem or sieve tube/element (/) $\mu g\ cm^{-3}$;	Must have units
S [1]	scale as even widths to 2 cm	**Reject** scale on *y*-axis any other than 20 to 2 cm. AND *y*-axis <u>20 to 2 cm</u>;	
P [1]	**Reject** if *y*-axis scale is awkward if bars arranged differently from order of table if horizontal lines are too thick – 1mm/half square or not clear **Allow** bars if scale 20 to 2 cm. even if not 0 25 to 2 cm correct plotting of each bar;	horizontal top line must be clear, sharp and ruled to show plot line must be on horizontal line for sucrose line must be between two lines for all other contents	
L [1]	each bar separate if vertical lines only then must be at least 1 cm apart.	**AND** quality – vertical lines no thicker than on grid, not feathery for the complete line; bars – • <u>ruled lines **Reject** irregular thickness</u> • labelled clearly with contents – any clear labels e.g. chemical formulae NH_4, Ca, Mg, Na or mixture – underneath, must be directly below correct bar or inside bar or shaded with key.	**Reject** solid shading If line shading outside a bar

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	(ii) Calculate the percentage difference between the concentration of calcium ions in the xylem vessels and the concentration of calcium ions in the phloem sieve tube elements.			**[2]**
PDO display 2	[1]	shows subtraction (190 – 85) divided by 190 multiplied by 100; (190/190 – 85/190) × 100 or (1 – 85/190) × 100		
	[1]	**Reject** if no working **Allow** any answer less than 100 to no more than 3 significant figures 1 decimal place	**AND** percentage/%;	
	(d) Suggest why there is 120 µg cm^{-3} of sucrose in the phloem sieve tube elements.			**[2]**
ACE conclusions MAX 2	[1]	(phloem sieve tube elements) (sucrose) transported leaf(ves)/allow type of leaf cell/source to roots/other tissues/sink(s);		
	[1]	(detail) load(ed) (in source) or (transported by) mass flow/bulk transport/translocation (sucrose) too large to move out of phloem or sieve tubes or xylem walls impermeable;		
			[Total: 22]	

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1 (a) (i)		**Show clearly on Fig.1.1 what you would expect the contents of the test-tube to look like after 10 minutes. You will gain marks for clear labels. [2]**		
ACE conclusions 2	[1]	line drawn level with half way mark	AND more yeast drawn towards bottom of tube or another line to show a separate region;	
	[1]	one label or description;		
	(ii)	**State the time intervals you will use and what you will use the graph paper scale to measure. [2]**		
MMO decisions 2	[1]	uses 10 minutes	**AND** at least three times (including 10) even time intervals between consecutive three;	
		Or one/two/two and a half minutes or two mins 30s intervals; **Reject** if does not divide into 10 e.g. 3 minutes		
	[1]	measures or describes measuring e.g. (use graph paper) to find distance/length	**AND** description of what is measured; e.g. from halfway mark to top of sediment or bottom of tube to top of sediment/or from Fig. 1.1/AW;	
	(iii)	**…decide on the volume of Y and the volume of each buffer solution to use. Describe all the steps you used to work out the volume. [1]** **State the volume of Y and the volume of each buffer solution to use. [1]**		
MMO decisions 2	[1]	describes all following steps • takes into account to (half-way) line • takes into account 1 cm^3 calcium chloride/C • divides by half;		**Allow** • to 0.1 cm^3
	[1]	volume of Y <u>equal</u> to volume of buffer AND cm^3 / ml on both;		

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Question		Expected Answers		Additional guidance
(iv)		**Prepare the space below and record your observations.**		**[5]**
PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) pH;	
	[1]	**Reject** • if units anywhere else except headings • t or T		
		(headings) time min(utes)	**AND** length/depth/height/AW with mm or cm;	
MMO collection 2	[1]	different results/observations for different pH minimum 2 pH;		
	[1]	recorded to 1 mm or 0.1 cm only;		**Reject** if no units/if mixed units **Allow as error carried forward** whole or 0.5 units on graph paper
MMO decision 1	[1]	repeats recorded;		
(v)		**Use your results to state the effect of pH on the yeast suspension.**		**[1]**
ACE conclusion 1	[1]	(yeast settles) more / higher rate of • at some pH • or correct example of pH with results;		**Reject** activity

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Question		Expected Answers		Additional guidance
(vi)		**Identify *one* significant source of error in this experiment.**		**[1]**
ACE interpretation max 1	[1] or [1] [1]	cause of error (dependent variable) boundary/ top of layers or bubbles on surface or graph paper and test-tube (standardised variables) test-tubes sizes/ mixing/adding/readings	error idea of finding measuring seeing determining judging; lining up; not constant not same/different/vary cannot be done at same time;	max 1
(vi)		**State the degree of uncertainty of using the graph paper scale as a measure.**		**[1]**
ACE interpretation 1	[1]	+/– 2 mm;		**Reject** % error **Allow** +/– 0.2 cm or +/– whole or 1 graph paper unit

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Question		Expected Answers	Additional guidance
(vii)	**Suggest how you could make this investigation as accurate as possible … as reliable as possible**		**[3]**
ACE improvements max 3	C control of any relevant variable; [1] [1]	(for volumes) use measuring cylinder/burette/graduated pipettes or tubes or smaller (divisions)syringes Or hold tube vertical in retort stand/attach graph paper to tubes;	**Allow** for either accuracy or reliable
	A1 improving measurements to get a true value [1]	use ruler/graph paper, with smaller divisions/vernier calipers or colorimeter or collect and dry sediment or larger/more volumes so heights larger;	
	A2 [1]	set up each pH separately/stagger timing/longer time;	
	A3 [1]	more buffer solutions or examples of extra buffer/pH;	
	R1 improve method to get repeat data [1]	repeat or replicate;	
	R2 [1]	weigh out (initial) mass of yeast ;	max 3

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Question		Expected Answers		Additional guidance
(b) (i)		**Plot a graph of the data shown in Table 1.1.**		**[4]**
PDO layout 4	O [1]	*x*-axis calcium chloride/$CaCl_{(2)}$ conc(entration)(/) <u>m mol</u>	**Reject** t/T **AND** *y*-axis time (/) min;	Must have units
	S [1]	**Reject** if awkward scale 0.25 to 2 cm scale as 0.2 to 2 cm	**AND** 20 to 2 cm;	error carried forward if incorrect O then must use more than half provided grid in *x* and *y*
	P [1]	**Reject** • plotting if scale is awkward unless 0.25 • if only blobs/dots/blobs in circles. correct plotting using crosses/dots in circle only;	intersection of cross must be clear to show plot.	
	L [1]	straight line through points; error carried forward if scale or plotting incorrect	quality – no thicker than on grid, not feathery for the complete line. joining plots – • <u>ruled lines plot to plot</u> extrapolation • not beyond *x*- or *y*-axis Ignore • if in context of data correct to go to 0,0 must be within 2 mm of 0 • if not correct in context of data then no extrapolation at either end of data.	**Reject** if any extrapolation beyond 0 or 1.0.
(ii)		**State the concentration of calcium chloride required for the yeast to sediment out at 40 minutes.**		**[1]**
MMO collection 1	[1]	correct reading of concentration to no more than 2 significant figures;		

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Question		Expected Answers			Additional guidance
				[Total: 22]	
2 (a) (i)		Select a large vascular bundle and draw a large plan diagram of the vascular bundle. Label the xylem tissue.			[5]
PDO layout 1	[1]	**Reject** if drawn over print of question			
		Reject thick lines • feathery lines • 4 'tails' or overlaps or gaps	**AND** no shading	**AND** uses most of the space provided;	
		clear, sharp, unbroken lines			
MMO collection 3	[1]	no cells drawn	**AND** draws only one vascular bundle;		
	[1]	(vascular bundle) shows an outline which encloses vascular bundle tissues;			
	[1]	(in one vascular bundle) wider at one end than the other (tapered) Or at least three regions shown;			
MMO decision 1	[1]	**Reject** • if any label is biologically incorrect e.g. regions belonging to other organs or animals. • label within drawn area			
		correct label with label line xylem to region middle to tapered end;			

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Question		Expected Answers			Additional guidance
(ii) Make a high-power drawing of one trichome, with at least three cells, and one epidermal cell on each side touching the base of the trichome. Label the trichome. [5]					
PDO layout 1	[1]	**Reject** if drawn over print of question			
		Reject • thick lines – than on grid • feathery lines • 5 'tails' or overlaps or gaps if double cell walls	**AND** no shading	**AND** uses most of the space provided;	
		clear, sharp, unbroken lines in cell outlines			
MMO collection 2	[1]	5, 6 or 7 cells;			
	[1]	cells drawn as a touching group	**AND** cell walls as double lines with middle lamella in 3 adjacent (epidermal) cells;		
MMO decisions 2	[1]	(cell or tip of trichome or broken) pointed or rounded Or (in trichome) one larger cell or large base cell;			
	[1]	**Reject** • if any label is biologically incorrect e.g. labels belonging to other organs or animals. • label within drawn area			
		correct label with label line to trichome;			

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Question		Expected Answers	Additional guidance
(b) (i)		**Calculate the ratio of the diameter of the vascular tissue labelled X to the total diameter of the plant organ labelled Y. [3]**	
PDO recording 1	[1]	(measurements to same degree of precision) whole mm or 0.5 mm;	**Allow** 0.1 cm or 0.15 cm
PDO display 2	[1]	shows larger figure to or: smaller figure or larger figure divided by smaller figure;	
	[1]	rounds to correct ratio e.g. 125:69 or leaves as fraction e.g. 125/69;	**Reject** if include units in answer **Reject** 1.86:1

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Question		Expected Answers			Additional guidance
(ii)		**Prepare the space below so that it suitable for you to describe the observable differences between M1 and Fig. 2.1.**			**[5]**
PDO recording 1	[1]	organise as a table or Venn diagram or ruled connected boxes	headed M1 and Fig. 2.1	differences opposite each other;	M1 | Fig. 2.1
ACE interpretation 4		**Reject** tick and cross without a key –			if no organisation then mark points only if in same sentence or following sentences. **Allow** differences even if not opposite each other. **Allow** difference on one side if e.g. use more or –er.
		feature	M1	Fig. 2.1	
	[1]	shape	irregular/wavy/uneven/ starshape/swellings	oval/circular; Ignore regular	
	[1]	pith/hollow space/empty/ lumen/cavity **Ignore** vacuole	present/yes	absent/no;	
	[1]	vascular tissue/bundle/ xylem	bundles/around edge/ scattered	stele/in centre;	
	[1]	number of vascular bundles/ tissue/xylem	(vascular bundles) more/(xylem)less	(vascular bundles) less/(xylem)lots/more;	
	[1]	thickened layer/stained layer/collenchyma/AW	present	absent;	
	[1]	outer epidermis	thick	thin;	
	[1]		continuous/smooth	rubbing off/flaky/AW;	
	[1]	trichomes/hairs	present/yes/some/more **Allow** less	absent/no/none/fewer; **Allow** more	
	[1]	trichome shape	hair-like/pointed	irregular;	max 4
				[Total: 18]	

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/35 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

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UNIVERSITY of CAMBRIDGE International Examinations

Question		Expected Answers			Additional guidance
1 (a) (i)		**Decide which other concentrations of ascorbic acid to make and complete Table 1.2, including the concentrations from Table 1.1.** **[3]**			
MMO decisions 3	[1]	0.1% and 0.08%	**AND** any two other concentrations	**AND** all in ascending or descending order;	
	[1]	for two other concentrations correct volumes to make 20 cm^3		**AND** correct %;	
	[1]	any three consecutive concentrations with two even intervals the same e.g. 0.08, 0.06, 0.04 or serial dilution by half;			
	(ii)	**Prepare the space below to show the concentration of ascorbic acid and record your results including samples X and Y.** **[6]**			
PDO recording 3		**Reject** • if units for % in the body of table			
	[1]	table with all cells drawn	**AND** heading (top or left) percentage conc(entration);		
		Reject • if units for volume /drops in body of table • if any additional headings for method e.g. volume of ascorbic acid			.
	[1]	(heading) volume/vol cm^3;			
	[1]	volumes recorded to 2 decimal places;			
MMO collection 3	[1]	volume or drops decrease from highest concentration to next highest;			
	[1]	**Reject** if records less than 3 concentrations result for **Y** (water/0%) records lowest volume;			
	[1]	replicate recorded;			

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(iii) Plot a graph of the results. **[4]**

PDO layout 4	O [1]	*x*-axis percentage conc(entration)	**Reject** v **AND** *y*-axis vol(ume) cm^3;	Must have units
	S [1]	**Reject** if awkward scale scale as 0.02% to 2 cm	**AND** sensible volume to 2 cm and uses more than half grid;	
	P [1]	**Reject** plotting if scale awkward if only blobs/dots/blobs in circles if extra plot for **X** value correct plotting using crosses/dots in circle only;	intersection of cross must be clear to show plot.	
	L [1]	straight line through points; error carried forward if scale or plotting incorrect	quality – no thicker than on grid, not feathery for the complete line. joining plots – • ruled lines plot to plot • line of best fit two plots plus even plots (+1) either side or even plots either side • curve through all plots	line of best fit must end either at the horizontal line or the vertical line for each of the end plots i.e. highest and lowest concentration **Reject** if any extrapolation

(iv) Use your graph to estimate the ascorbic acid concentration of sample X. Show clearly on your graph how you obtained the ascorbic acid concentration. **[3]**

MMO collection 1	[1]	shows clearly on graph result for **X** e.g. as single line from volume for **X** or as extra plot;		
ACE interpretation 2	[1]	correct reading of ascorbic acid concentration	**AND** answer to no more than 4 decimal places or three significant figures if 4 decimal places last figure must be 5 (or 0);	
	[1]	%;		

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(v) Identify *two* significant sources of error when finding the concentration of ascorbic acid in sample X. [2]

ACE interpretation max 2

	cause of error	error	
	(dependent variables)	idea of	
[1]	drops stick to sides	volume/number of drops/not counted/not	
	too many drops	included/too high/not accurate	
		too many at once/end-point missed	
[1]	volume for **Y**	too small	
	colour change or same colour	judging	
		determining	
		seeing	
		when;;	
	(standardised variables)		
[1]	drop size/different pressure on syringe/syringe sticking/	not same/vary/different;	
[1]	mixing		
[1]	iodine evaporating/exposed to light		
	(independent variable)		
[1]	(ascorbic acid) evaporates or mixes with air	changes concentration/reacts;	
[1]	concentrations	more/wider/narrower/different needed;	max 2

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	(vi) Suggest how you would make *three* improvements to this investigation.		**[3]**
ACE improvements max 3	[1]	more/wider/narrower/different/examples range of concentrations (ascorbic acid) use graduated pipette or smaller/more divisions/calibration syringe/burette;	
	[1]	device/described for making drops/burette/titrate;	
	[1]	(to identify the end-point) use colorimeter or have a standard colour to compare to or use white tile/paper;	
	[1]	put drops in nearer to mixture or use a smaller test-tube/container or use a wider/larger test-tube/beaker/AW;	
	[1]	replicate/repeat/take more readings (each concentration);	max 3
		[Total: 21]	

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Question		Expected Answers			Additional guidance
2 (a) (i)		**Draw a large plan diagram of the sector shown in Fig. 2.1 to include the outline of two vascular bundles. No details of the internal tissues of the vascular bundles are required. [5]**			
PDO layout 1		**Reject** • if drawn over the print of question			
	[1]	**Reject** • thick lines • feathery lines • 3 'tails' or overlaps or gaps clear, sharp, unbroken lines	**AND** no shading	**AND** uses most of the space provided;	
MMO collection 2	[1]	no cells drawn	**AND** only two vascular bundles drawn in outline only;		
	[1]	rounded/pointed end;			
MMO decisions 2	[1]	longest vascular bundle is less than half width at widest point of section;			
		Reject • if any label is biologically incorrect e.g. cell wall or regions belonging to other organs or animals. • additional label(s) within drawn area			
	[1]	correct label C (can be within drawn area) to tissue below upper or lower epidermis;			

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Question		Expected Answers			Additional guidance
(ii)		**Using high-power, draw a large plan diagram to show one large vascular bundle in detail. Label the phloem.**			**[5]**
PDO layout 1	[1]	**Reject** • if drawn over the print of question			
		Reject • thick lines • feathery lines • 4 'tails' or overlaps or gaps	**AND** no shading	**AND** uses most of space provided;	
		clear, sharp, unbroken lines			
PDO recording 1	[1]	(details of) two regions separated from each other and from each cap;			
MMO collection 1	[1]	no cells	two caps withdrawn;		
MMO decisions 2	[1]	proportion of longest length of one cap is equal to or more than half the longest length between the caps;			
	[1]	**Reject** • if any label is biologically incorrect e.g. regions belonging to other organs or animals. • label within drawn area			
		correct label with label line to phloem;			

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Question		Expected Answers		Additional guidance
(b) Calculate the ratio of the thickness of the layer labelled B compared to the total thickness of the layer labelled A as shown in Fig. 2.2.				**[3]**
MMO collection 1	[1]	**Reject** • if no units • metres.		
		two measurements of A one between 17 to 19 mm and one between 12 to 14 mm or one combined measurement between 28 and 33 mm	**AND** one measurement between 38 to 40 mm;	
PDO display 2	[1]	shows larger figure to smaller figure;		**Reject** if converts to other units (than mm or cm) or standard form
	[1]	(needs working) answer rounded to correct ratio e.g. 39 : 29;		**Reject** if put units

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<table>
<tr><th colspan="2">Question</th><th>Expected Answers</th><th>Additional guidance</th></tr>
<tr><td colspan="4">(c) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on slide L1 and in Fig. 2.2. [3]</td></tr>
<tr><td>MMO decision 1</td><td>[1]</td><td>only observable differences;</td><td></td></tr>
<tr><td>ACE interpretation max 2</td><td>[1]
[1]
[1]
[1]
[1]
[1]
[1]
[1]
[1]</td><td>Ignore
• tick and cross without a key
• ref.to non-observable features
• 3 D shapes
<table><tr><th>feature</th><th>L1</th><th>Fig. 2.2</th></tr><tr><td>vascular bundles
number
arrangement
relative sizes</td><td>
lots/more
chain
different sizes or large and small</td><td>
few/one/two
centre
same sizes;</td></tr><tr><td>caps shape
cap</td><td>semicircles /AW</td><td>not semicircles or one end only;</td></tr><tr><td></td><td>yes/present</td><td>no/none/absent;</td></tr><tr><td>stomata numbers</td><td>none/not visible or few(er)</td><td>yes/more;</td></tr><tr><td>position</td><td>top/bottom/one side</td><td>all round/sides;</td></tr><tr><td>sunken</td><td>no/none/absent</td><td>yes/present;</td></tr><tr><td>leaf shape</td><td>tapered/pointed/elongated</td><td>semicircle/rounded;</td></tr><tr><td>surface Reject regular</td><td>irregular/rough</td><td>smooth;</td></tr><tr><td>extra ring/inner layer/allow endodermis</td><td>no/none/absent</td><td>yes/present;</td></tr></table></td><td>max 2</td></tr>
</table>

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Question		Expected Answers		Additional guidance
(d) Describe how the observable features of Fig.2.2 support the conclusion that this is a leaf from a plant growing in a dry habitat. [3]				
ACE conclusion MAX 3	[1]	sunken stomata or rolled/rounded	to reduce the <u>diffusion</u> of water/decreases diffusion gradient;	
	[1]	thick cuticle or thickened epidermis	to prevent or reduce <u>evaporation</u> of water;	
	[1]	no spongy mesophyll layer or no air spaces	to prevent <u>evaporation</u> from cell walls;	
	[1]	rounder shape or rolled or fewer stomata smaller surface area to volume ratio	to increase humidity/decreases diffusion gradient;	
	[1]	(in context of any of above) reduces <u>transpiration</u> (rate);		max 3
			[Total: 19]	

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/36 Paper 32 (Advanced Practical Skills 2), maximum raw mark 40

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Question		Expected Answers			Additional guidance
1 (a) (i)		**Decide on the temperatures you plan to use in the range (between) 25°C to 45°C. Record the temperatures you have chosen in the space below. [2]**			
MMO decisions 2	[1]	at least 5 temperatures;			
	[1]	one temp. 25°C to 29°C	**AND** one temp 40°C to 45°C	**AND** any three with two even intervals 3 or more degrees;	
	(ii)	**Prepare the space below and record your results. [4]**			
PDO recording 2	[1]	**Reject** • if any units in body of table • only t			
		table with all cells drawn	**AND** heading (top or left) temperature °C;		Must have units
	[1]	**Reject** • if units in body of table • if headings for volumes or stages (heading) time with units;			
MMO collection 2	[1]	temperatures recorded highest to lowest	**AND** first set of times recorded in whole seconds;		
	[1]	time at the lowest temperature is greater than the next temperature;			**Allow** • only if 3 or more results
	(iii)	**From your results, state the temperature at which the activity of the enzyme is lowest. [1]**			
ACE interpretation 1	[1]	temperature with longest time	AND with units, °C;		

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(iv) Identify *two* significant sources of error in this investigation. [2]

ACE interpretation max 2		cause of error	error	
	[1]	(dependent) stage 3 or end-point clots stick small clots coagulation milk drains back slowly	idea of seeing determining judging when;	
	[1]	(standardised variables) rotation or angle;	AND idea of not constant/different not same timing delayed;	
	[1]	shaking or mixing or E/enzyme starts to react;		
	[1]	E/enzyme temperature; (as milk)/AW		
	[1]	(independent variable) temperature or test-tube removed from water-bath	idea of not constant/not maintained decreasing cools down;	Max 2

(v) Describe a suitable control for this investigation. [1]
Reject if give two.

ACE improvement 1	[1]	boil enzyme;	

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(vi) Suggest how you could make this investigation as reliable as possible. **[1]**

ACE improvements MAX 1	C control of any relevant variable [1]	equilibrate milk and enzyme to temp. separately then mix Or use thermostatically controlled water bath Or keep tube in water bath during rotation;		max 1
	R1 improve method to get repeat data [1]	repeat	**AND** calculate or find mean/average;	

(b) (i) Three of the values in Table 1.1 are anomalous. Draw a circle around each of these values. **[1]**

(ii) Complete the Table 1.1 by calculating the missing value. **[1]**

MMO decisions 1 ACE interpretation 1	[1]	circles around <u>8.2, 4.9, 1.1;</u>	
	[1]	<u>8.8</u> **<u>Allow 8.7</u>**	

	activity of milk clotting enzyme / arbitrary units					
pH of milk	trial 1	trial 2	trial 3	trial 4	trial 5	mean
6.02	8.8	8.7	8.9	8.2	8.7	8.8 8.7
6.22	6.8	6.8	6.8	6.7	6.9	6.8
6.40	4.9	4.3	4.4	4.3	4.4	4.4
6.64	1.1	1.0	1.0	0.9	1.0	1.0
6.70	0.7	0.6	1.1	0.5	0.7	0.6

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(iii) Plot a graph of the data shown in Table 1.1. **[4]**

PDO layout 4

O [1]	*x*-axis pH	**AND** *y*-axis activity (/) arbitrary units or au;	Must have units
S [1]	**Reject** if awkward scale		error carried forward if incorrect O then scale *x*-axis 2 to 2 cm and *y*-axis 0.2 to 2 cm. must use more than half grid in *x* and *y*.
	scale as 0.2 to 2 cm Origin must be labelled as 6 or 6.02	**AND** 2 to 2 cm;	
P [1]	**Reject** plotting if scale is awkward if only dots/blobs or blobs in circles	intersection of cross must be clear to show plot.	
	correct plotting using crosses/dots in circle only;		
L [1]	straight line through points; error carried forward if scale or plotting incorrect 6.02 8.8 or 8.7 or ecf 6.22 6.8 6.40 4.4 6.64 1.0 6.70 0.6	quality – not thick, not feathery for the complete line. joining plots – • ruled lines plot to plot • line of best fit • curve through all plots	

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(iv) Explain the relationship between pH and the enzyme shown in the data. [3]

ACE conclusions 3	[1]	(in correct context of pH and effect on activity) structure of protein or substrate or enzyme or active site or bonds	 changed/altered/destroyed/no longer complementary broken;	
	[1]	(in correct context of increase in pH and decrease activity) so fewer enzyme-substrate complexes (ESCs) or less/no substrate can bind/combine/attach/fit into OR (in context of decrease in pH and increase in activity) more ESCs or more substrate binds/attaches;		
	[1]	(in correct context of effect of pH on enzyme i.e. when pH higher/nearer 7/less acidic/more alkaline) <u>denatured/denaturation</u>;		
			[Total: 20]	

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Question		Expected Answers			Additional guidance
2 (a) (i)		**Draw a large plan diagram showing the features of the wall of the organ. Label the position of the lumen.**			**[4]**
PDO layout 1	[1]	**Reject** if drawn over print of question			
		Reject • thick lines • feathery lines • one 'tail' or overlap or gap clear, sharp, unbroken lines	**AND** no shading	**AND** uses most of space provided;	
MMO collection 2	[1]	**Reject** if drawn two walls			
		no cells drawn	**AND** three layers drawn include any circles as only one layer;		
	[1]	**Reject** if only two layers drawn innermost layer is wider than outermost layer at same point;			
MMO decisions 1	[1]	**Reject** • if any label is biologically incorrect e.g. regions belonging to other organs or plants. • label within drawn area – e.g. between two walls correct label with label line to or in lumen on inside;			

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(ii) Annotate (make notes with label lines) your diagram to show one difference between the outside layers and the inside layers. [1]

MMO decision max 1

Reject
- if written over lines of the diagram drawing.
- if written underneath, unless have labelled on diagram

Allow 'er' for one label

	outermost	innermost	
thickness **Reject** cell wall	thin)ner)	think(er);	[1]
texture	smooth	rough;	[1]
cells/nuclei	Not clear/densely packed/ visible	Clear/less densely packed/(air) spaces/lots	[1]
Colours/staining of	Pink/red/grey/lighter/more	Purple/darker/less;	[1]

max 1

(b) (i) Actual diameter of the nucleus in the cell labelled Y is 7.8 µm. Use this information to calculate the actual diameter of the largest nucleolus in cell Y. [4]

MMO collection 2	[1]	correct measurement of <u>one</u> nucleus, 11 to 15 mm;		**Reject** if no units
	[1]	correct measurement of <u>one</u> nucleolus, 2 to 4.5 mm;		**Reject** if no units
PDO display 2	[1]	(mean) adds three measurements	**AND** shows division by 3;	
	[1]	answer to no more than 2 significant figures, (1 decimal place) between 1.1 and 6.4;		**Reject** standard form

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(ii) Suggest how you would make the measurement of each nucleolus more accurate. **[1]**

ACE improvement 1	[1]	different dimensions/diameters or use vernier callipers or (eyepiece) graticule or increase magnification or high power (of microscope) or enlarging or increase resolution;	

(iii) Make a large drawing of the cell labelled X with three complete cells touching cell X. **[5]**

PDO layout 1	[1]	**Reject** if drawn over print of question			
		Reject • thick lines • feathery lines • 2 'tails' or overlaps or gaps	**AND** no shading	**AND** uses most of space provided;	
		clear, sharp, unbroken lines			
MMO collection 2	[1]	only cell **X** and three correct complete touching cells;			
	[1]	nucleus with at least two distinct nucleoli (other than cell **X**);			
MMO decisions 2	[1]	chromosomes drawn as two areas (no details of chromosomes shown);			
	[1]	blue region/spindle around chromosomes drawn in cell **X**;			

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(iv) Prepare the space below so that it suitable for you to compare the cells labelled X and Y. [5]

PDO recording 2

[1] organise as a table or Venn diagram or ruled connected boxes | headed (cell) X and (cell) Y | differences opposite each other;

[1] heading for similarities/similarity/compare (with contrast)/same;

X | Y

MMO decision 1

[1] has at least one correct similarity, cytoplasm or cell/plasma membrane or shape;

ACE interpretation max 2

Reject tick and cross without a key

	feature	(cell) X	(cell) Y
[1] 1	nucleus/nuclear membrane	absent/none/not clear	present/clear;
[1] 2	nucleoli	absent/none/	present/clear;
[1] 3	cytoplasm	less/not granular	more/granular;
[1] 4	spindle fibres	present/visible	absent/none/not visible;
[1] 5	chromosomes/chromatid(s)	present/visible	not visible;
[1] 6	cytoskeleton	absent/not clear	present/clear/visible;
[1] 7	cell size	small(er)	larg(er);
Similarities			

if no organisation then mark points only if in same sentence or following sentences.

Allow two ticks for both present i.e. for cytoplasm and shape.

Allow differences even if not opposite each other.

Allow difference on one side if e.g. use more or –er.

max 2

[Total: 20]

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