UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2008 question paper

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.

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UNIVERSITY of CAMBRIDGE
International Examinations

Skill	*Total marks*	*Breakdown of marks*		*Question 1*	*Question 2*
Manipulation, measurement and observation	16 marks	Successful collection of data and observations	8 marks	2	6
		Nature of measurements or observations	8 marks	5	3
Presentation of data and observations	12 marks	Recording data and observations	4 marks	2	2
		Display of calculation and reasoning	2 marks	1	1
		Data layout	6 marks	3	3
Analysis, conclusions and evaluation	12 marks	Interpretation of data or observations and identifying sources of error	6 marks	3	3
		Drawing conclusions	3 marks	2	1
		Suggesting improvements	3 marks	3	0

MMO = Manipulation, measurement and observation
Collection = successful collection of data and observations
Decisions = decisions relating to measurements or observations

PDO = Presentation of data and observations
Recording = recording data and observations
Display = display of calculation and reasoning
Layout = data layout

ACE = Analysis, conclusions and evaluation
Interpretation = interpretation of data or observations and identifying sources of error
Conclusions = drawing conclusions
Improvements = suggesting improvements

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Question	Sections	Learning outcomes	Indicative material	mark
1 (a) (i)	MMO collection	Use their apparatus to collect an appropriate quantity of ..observations including subtle differences in colour.	all starch/iodine tests, negative/no colour change/orange/red; S2, violet/purple/mauve;	2
	MMO decisions	Sufficient distinct observations are made to identify the dissolved substances in a solution.	S1, glucose, S2, protein, S3, carbohydrate/sucrose/non-reducing sugar; (all correct)	1
	PDO recording	Present …observations in a single table of results. Include in table of results columns for raw data and for deductions. Use column headings that …conform to accepted scientific conventions.	single table drawn with all cells ruled; (1st/top) solution, colour changes/tests shown, conclusions/identification shown;	2
(ii)	MMO decisions	Qualitative observations consistent with materials supplied. Identify the dissolved substances in a solution.	idea of blue/negative test with Benedicts; therefore not glucose; boil with acid/HCl, neutralise with sodium bicarbonate, repeat benedict's test;	3
(iii)	ACE interpretation	Describe the patterns and trends shown by tables.	correct estimate with colour change from their results, with units;	1
(iv)	ACE interpretation	Identify the most significant sources of error in an experiment.	two from difficult to judge colour/may be between colours; volumes used different from those used for table; volume of Benedicts may have been different; heating time/temperature may have been different	2 max

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(v)	ACE improvements	Suggest modifications to an experimental arrangement that will improve the accuracy of the experiment or the accuracy of the observations that can be made, including the use of new methods or strategies to investigate the question.	S1 use same volume/example of volume as for known glucose; add same/excess volume of Benedicts to S1 and known glucose; heat/boil for same length of time; repeat all measurements; use more known concentrations of glucose; e.g. of accurate use of equipment/buretter/graduated pipette;	3 max
1 (b) (i)	PDO display	Use correct number of significant figures for calculated quantities.	30;	1
(ii)	MMO decisions	Replicate readings or observations as necessary.	anomalous/does not fit trend/pattern/described;	1
(iii)	PDO layout	Select which variables to plot and plot appropriately on clearly labelled *x*- and *y*-axes. Choose scales for the graph axes that allow the graph to be read easily, such as 1, 2 or 5 units to a 20mm square. Make the best use of the space available, using over half of the length and width of the grid. Plot all points to an appropriate accuracy. Follow IOB recommendations for putting lines on graphs.	O percentage concentration of starch on *x*-axis, and mean transmission of light/arbitrary units on *y*-axis ; S scale, more than half grid(*x* and *y*) used for plotted area; P all points correctly plotted with crosses/dots (in circles), points joined with ruled lines/curve through all points;	3
(c)	ACE conclusion	Draw conclusion from an experiment…considering whether the experimental data supports a given hypothesis ..making further predicitions.	idea that data does not (totally)support the hypothesis; as concentration of starch suspension increases the transmission of light changes slower/less after 1.5/2.0%;	1 1
			Total	**21**

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2 (a) (i)	MMO collection	Follow instruction given in the form of written instructions or diagrams. Use their apparatus to collect an appropriate quantity of data.	half drawn, no cells drawn, no shading;	
	PDO layout	Make drawings large, unshaded. Use fine, clear unbroken lines showing clear outlines of structures.	(half) larger than 9 cm width and fine clear, unbroken lines; vascular bundles correctly placed; proportions correct;	4
(ii)	MMO collection	Follow instruction given in the form of written instructions or diagrams. Make measurements using …graticules.	number of epg divisions across trichome correct; correct answer and units for calculation;	2
	PDO recording	Record raw readings of quantities to same degree of precision.	whole numbers of epg divisions;	1
	PDO display	Show working in calculations, key steps in working.	(epg divisions/no. of stage divisions) x epg divisions for trichome;	1
(iii)	ACE interpretation	Identify the most significant sources of error in an experiment.	parallax/not knowing where base is;	1
(iv)	ACE conclusion	Draw conclusions from interpretations of observations.	traps water/reduces evaporation;	1
(b)	MMO collection	Follow instruction given in the form of written instructions.	8–12 cells drawn;	1
	MMO decisions	Qualitative observations consistent with materials supplied. Show all structures that can be seen in a defined part of the specimen.	shape of cells as on slide; cell walls drawn; 2 correct labels;;	3 max

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(c)	MMO collection	Use their apparatus to collect an appropriate quantity of data or observations, including subtle differences in colour or other properties of materials.	hairs/no hairs; rolled leaf/not rolled; circular/semicircular; vascular bundles separate/vascular bundles in middle; more vascular bundles/fewer vascular bundles;	2 + 1 (3) max
	ACE interpretation	Describe and summarise key points of a set of observations.	comparative statements opposite each other;	1 max
	PDO recording	Make and record sufficient accurate measurements and observations.	organised as a table/venn diagram/ruled connected boxes, correctly headed;	1
			Total	**19**
			Paper Total	**40**

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2008 question paper

9700 BIOLOGY

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

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		data layout	6 marks	3	3
Analysis, conclusions and evaluation	12 marks	interpretation of data or observations and identifying sources of error	6 marks	3	3
		drawing conclusions	3 marks	2	1
		suggesting improvements	3 marks	3	0

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Improvements = suggesting improvements

ecf = error carried forward

AW = alternative wording

ora = or reverse argument

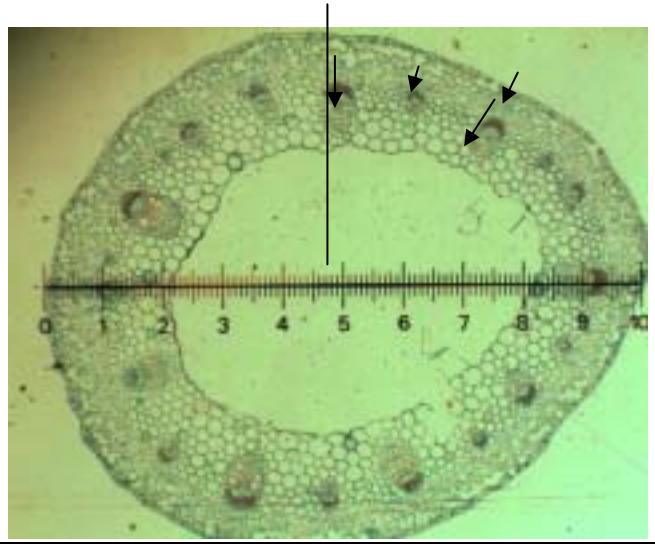
Q	Expected Answers	Additional Guidance		Marks
1 (a)	**How solutions made, concentration, measurements and observations.**	2 PDO display, 2 MMO collection, 1 MMO decision		**[5]**
	1 single table, all cells drawn; 2 column headings: concentration/mol dm^{-3} to left/across top, any one of length/mm/change in length/mm/volume cm^3 or ml; 3 in table changes shown, 0.6, gets smaller/–ve, water, gets no change/longer/+ve; 4 volume kept the same; 5 at least two of 0.4/0.3/0.2/0.15;	*Mark first table, ignore other tables/further writing. No outer boundary needed.* *M or molar or mole(s)/l or per litre. Allow strength. No units in table. Must have units.* *Read from final length results in table.* *Allow if not shown in table.* *Mark for volumes anywhere.* *allow 0.48/0.42/0.36/0.24/0.18/ 0.12/0.06*	*Check Supervisor's report for their results but mark according to mark scheme.* *Reject point 3 if heading units different from those recorded.*	
(b)	**Estimate the concentration of sucrose in X1.**	ACE interpretation		**[1]**
	correct concentration from results, mol/dm^3 or mol dm^{-3};	*Match any one correct. Or allow between correct values but no made up estimate and must have units M or molar or mole(s)/l or per litre*		

(c)	**Describe and explain the results from all the solutions that you made.**	3 MMO decisions		**[3]**
	concentration from results table, correct increase/decrease/no change in length; correct ref to direction of water movement, correct ref to water potential gradient; by <u>osmosis</u>;	*Ignore **X1**. Allow for their results even if wrong. Allow general statement.* *If no change then water moving in both directions/no net water movement. Higher or high to low/er WP ora.*	*If no changes in length recorded, allow 20mm/2cm – final length.*	
(d)	**(i) Describe and explain the results from all the solutions that you made.**	2 ACE interpretation		**[2]**
	changes are small/accuracy of measuring/ruler +/–1mm/parallax error; widths are not standard; syringe qualified with ref. to uncertainty/large size vs coarse measurement; evaporation of solution; strips float/not immersed; no/not enough repeats/replicates; times different/not possible to add/remove at same time;	*Mark any correct.* *Reject bubbles in syringe.* *Reject if just syringe not accurate.* *Must have +/–*		
	(ii) Suggest how you could improve this experiment.	ACE improvements		**[3 max]**
	more concentrations/examples (at least 2) any between those given; smaller syringe/syringe with lower uncertainty/finer divisions; method/how to remove bubbles in syringe; longer strips; cover solution; repeat/use more strips; use burette/graduated pipette; use vernier callipers; do one experiment at a time/timed sequence/AW;			
(e)	**(i) Complete the Table 1.1 by calculating the missing value.**	PDO display		**[1]**
	<u>5.6, –1.4;</u>	*Only these answers.*		

	(ii) When the student performed this investigation, the diameter of cell 2 in 0.20 mol dm^{-3} solution was 3.1 μm. Explain why the student discarded this result and repeated the experiment with freshly made solutions.	MMO decision		**[1]**
	reading should have been more/too low/reading anomalous/not reliable/does not fit trend;	*Allow idea of e.g. reading is odd/completely different.*	*Ignore just some error.*	

O	*x*-axis conc.(sucrose)/mol dm^{-3} or mol/dm^3;	M or molar or mole(s)/*l* or per litre
S/P	scale *x*-axis 0.2 to 2cm and *y*-axis uses half or more plotting crosses or dot in circle ONLY, correct for correct graph i.e. mean diameter of red blood cells only; Allow ecf from their figures/ crosses in circles	Ignore if 0 not at origin but if scale starts at 0.2 then must have 0.2. Reject if **mean change.** Reject 1 mm or more blobs in circles. Ignore shape of circles.
L	either ruled/straight lines joining each point/ ruled line of best fit with 2 one side and one the other/one on the line and two each side of the line;	If join the dots, then allow only 1mm/half square extension beyond first and last point. If line of best fit then allow 2mm/one square at 0.8/high concentration and to the axis for 0.05/low concentration end Reject line if more than 1mm thick

	(f) The greater the concentration of sucrose solution, the greater the diameter of red blood cells.	ACE conclusions		**[2]**
	hypothesis wrong/incorrect; as the concentration increases, the diameter of cells decreases/inversely proportional; ORA	*Needs clear statement.* *Idea of correct relationship may quote figures to get same idea.*	*Reject idea that not totally wrong.*	

2 (a) (i)	**Draw a LARGE, LOW-POWER plan diagram of part of specimen K TS Ranunculus.**	1 MMO collection, 3 PDO layout		**[4]**
	(quarter that is) 4 to 7 vascular bundles drawn, sharp, clear unbroken lines; no cells, larger than 6 cms in any one direction; distance of outer epidermis to top of nearest vascular bundle less than top of vascular bundle to pith; largest vascular bundle at least twice size of smallest vascular bundle; 	 *Ring 3 errors on simple diagram then reject.* *Use acetate square, accept if any line outside.*	*Ignore labels.* *If more than a quarter drawn, then max1 point 2 only.* *Reject if no pith drawn or a dotted line.*	

(ii)	**Use this information to calculate the actual width of the vascular bundle.**	2 MMO collection, 1 PDO recording, 1 PDO display	**[4]**

How to mark the calculation.

Step 1: W ✓ (1)

X

Y

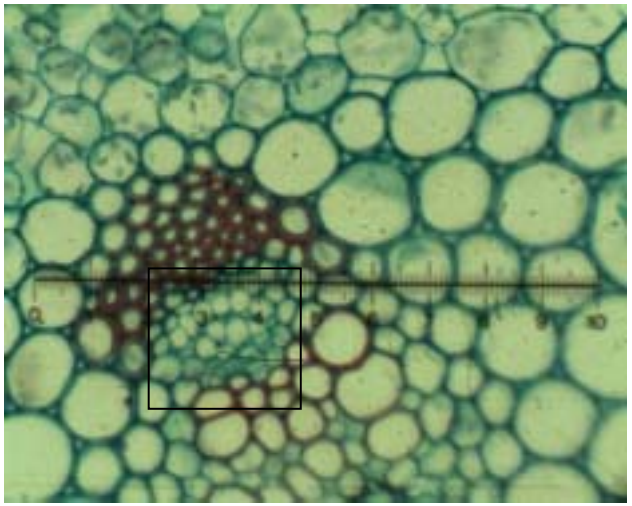
Z

Step 2: Calculate the answer USING their figures (Z/Y × X × W) ×1000

Step 3:

Answer correct AND rounded correctly to 1 decimal place only. Round 0.5 up or down. If close, check where they may have rounded differently. ✓✓✓	Answer correct BUT not rounded or rounded incorrectly. ✓✓	Answer wrong. Go back to working MUST show Z/Y × X × W – all figures must be there and doing the correct thing in whatever order OR have calculated it correctly (ignore decimal figures). ✓ AND Look for ×1000 or × 10^3. Must be shown not implied. ✓

Either between 2 and 3.5 any 1 decimal place OR between 20 and 35.5 only allow .5 no other decimals.

(iii)	**Suggest how an error in measuring the vascular bundle could occur.**	ACE interpretation	**[1]**
	thickness of lines/difficult to line up scales/depth of focus/not knowing where edge of vascular bundle is;	*Allow focussing problem/blurring/aligning.* *Ignore can't count/do a mean/average/other excuses.* *Reject scale not calibrated correctly.* *Ignore parallax.*	
(iv)	**Make a LARGE, HIGH-POWER drawing of 5 cells to include a companion cell.**	1 MMO collection, 3 MMO decisions	**[4]**
	5 complete cells, all touching (one group of five cells); sharp, clear unbroken lines, larger than 6 cm in any one direction; (companion cell) smallest cell drawn less than a quarter of the largest cell (phloem sieve tube), no more than one nucleus in a smaller cell, no sieve plates; all cells have single line walls, no shaded walls, no intercellular spaces; 	*Reject if more than 6 cells/no marks for textbook diagrams.*  *3 rings for errors reject touching cell wall lines/incomplete cell walls.* *Use acetate square.* *Reject if drawing not like slide e.g. too much detail drawn sieve plate and pores between cells or nuclei in cells.*	

2 (b) (i) Suggest the purpose of the region Y (collenchyma cells) in corner of stem.	ACE conclusion		**[1]**
support stem/keep shape of stem/makes corner;	*Allow strengthening*		
(ii) Compare and contrast TS Ranunculus with Fig 2.2.	2 MMO collection, 1 PDO recording, 2 ACE interpretation		**[3 max]**
organise as a table/venn diagram/ruled connected boxes, correctly labelled; (1) comparative statements opposite each other/in one sentence; (1) **THREE from**:	First table ignore additional e.g. similarities separate table minimum. Allow similarities vs differences as column headings.	Allow for one statement as comparison. Reject two separate lists.	

	K1 (Ranunculus)	Fig 2.4
(pith)	space in middle/no pith,	no space/has pith;
(shape)	circular/no corners, no protrusions/AW/Y,	square/has (4) corners protrusions/AW/has Y;
(vascular bundles)	lots/many, all round/evenly spaced, rounded shape/oval, big and small, arranged around sides,	few/not as many; mainly in corners/square; shape described/curved; big and small; arranged round sides;
AVP;	no trichomes/AW,	trichomes;

Reject spherical.