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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2008 question paper

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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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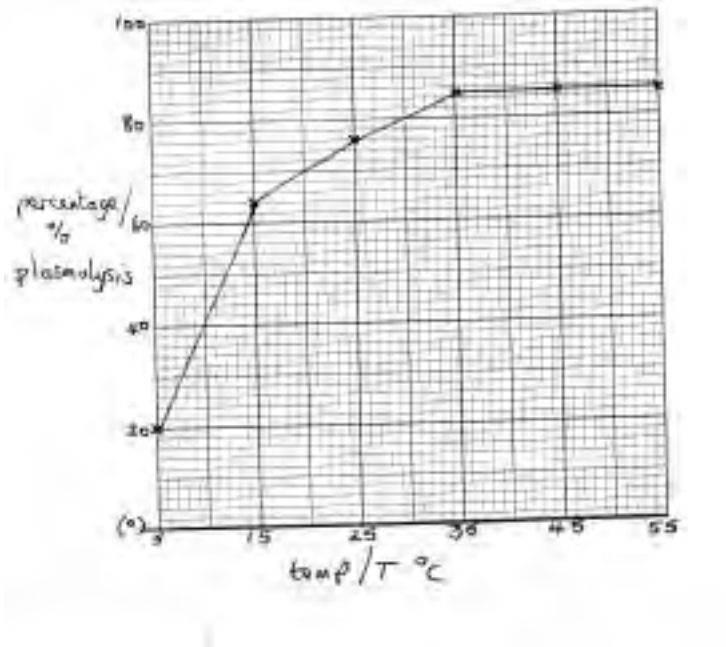
UNIVERSITY of CAMBRIDGE
International Examinations

Question	Expected Answers			Additional Guidance	Marks
Record OBSERVATIONS and NUMERICAL MEAN DEGREE OF PLASMOLYSIS				2PDO recording, 2MMO collection, 2MMO decision.	
1 (a) (i)	table, **AND** plasmolysis/numerical (estimate) ; shows **5** cells recorded per solution; (water) 1 or label; (**S1**) number more than water or label; (**S2**) number between **S1** and water or label;	(all table) cells drawn between different text	**AND** (*heading above data)* **W** or water or 0 and S1 or 1 and S2 or 0.5; Ignore units. Look at mean first (if there) so should be 1 – ignore any decimal places. Numbers mostly 1 if 5 cells recorded.	Mark best table, ignore any additional text or drawings. No outer boundary needed. Any evidence of five cells only, e.g. five drawn per solution or total cells 5 or 1 + 3 + 2 + 1 + 1 1 / 2 / 3 / 4 none / slight / extensive / severe Allow any correct numbers. Ignore decimal places.	**[6]**
Describe and explain observations from water, S1 and S2.				3 MMO decisions	
1 (a) (ii)	**Idea of** 1. high/0 to low/ from higher to lower less negative/0 to more negative water potential/ down water potential gradient 2. (in water) cells turgid/no or slight plasmolysis 3. (in **S1**) cells plasmolysed/flaccid/described **OR** (in **S2**) no/less/capped plasmolysis/described accept cytoplasm/cell membrane pulled away from cell wall/vacuole shrinks. **Reject** cell shrinks		**AND** by osmosis; **AND** water has moved in/no net movement/correct idea of water out; **AND** water moved out; **AND** no net movement/water moved out;	In correct context. Accept ψ. Solute/osmotic potential is ignored but must be the same as water potential i.e. from high to low so reject pt1 if wrong way. Ignore hypotonic and hypertonic but must be in correct context if used. Ignore 'no change'. **Must be correct with the candidate's own results**.	**[3]**

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Identify two sources of error in this experiment			2 ACE interpretation	
1 (a) (iii)	**Two from** difficult to judge degree of plasmolysis, or have to estimate between values for plasmolysis; evaporation from solutions/concentration of solution changes/(**S1**/**S2**)diluted by distilled water; (cells) left different times/too short a time/not long enough; AVP; volume/no. of drops used, or different onions, or different parts of onion/not fresh/have been frozen/stored;	Reject just time or just volume alone. Accept different or varied. Reject immersed. Reject should be same time – not an error. Reject air bubbles. Reject amount.	Mark for any correct. Reject **improvements**. Such as 'should keep time the same, etc.'	**[2 max]**
Suggest how you would improve this experiment.		ACE improvements		
1 (a) (iv)	one/more/serial dilution concentration; examples at least 3 in addition to 0.0, 0.5 and 1.0 ; repeat each concentration/more than one strip (per concentration); keep the time the same/give an example of time/longer time; keep the volume the same **AND** method/use burette/graduated pipette, or smaller syringe /count no. of drops/AW, or cover solution to prevent evaporation, or immerse in **S1** or **S2** before mounting; same onion/part of onion/fresh onion; count more cells or more than 5/have more detailed numerical estimates;	Beware repeat experiment with different variable. Reject measuring cylinder. Accept photographs.		**[3 max]**

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Complete the Table 1.2 by calculating the missing values			PDO display		
1 (b) (i)	**64 AND 85;**		***A whole numbers only and both correct***		**[1]**
1 (b) (ii)					
	O	x-axis T/temp./temperature **AND** °C	**AND** y-axis percentage/% plasmolysis;		**[1]**
	S/P	scale as shown/x axis must start at 5, allow no 0 and no 100 marked	**AND** plotting crosses or dot in circle ONLY **AND** 5 (20), 25(76), 45 and 55 (both 85) plotted correctly; NO cross larger than **X** or **O**. Plots 20, 76 must be on horizontal line, both 85's between the horizontal lines. Ignore incorrect calculated mean plots i.e. 15 and 35	Reject blobs in or out of circle.	**[1]**
	L	either straight lines joining each point or smooth curve; quality – no thicker than _____ not feathery, for the complete line. Check 5 to 15 must be connected point to point exactly, by straight line or curve **AND** 45 to 55 must be a horizontal line. Ignore 25 and 35 unless candidate draws up and down.		Reject any extrapolation beyond either axis.	**[1]**

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State temperature at which 50% plasmolysis occurred				ACE interpretation		
1 (b) (iii)	take reading from candidate's own graph **AND** ^{o}C;			Allow only 0.0 or 0.5, no intermediate decimals must round correctly.		**[1]**
Percentage plasmolysis is proportional to temperature, draw conclusion and include whether the data supports the hypothesis and produce a revised hypothesis if necessary				ACE conclusion		
1 (c)	**Draws conclusion:** as temp. increases the percentage plasmolysis increases/is proportional; **Then one of** quotes figs. between 5^{o}C and 55^{o}C and the two %'s **OR** (increases) up to 35^{o}C or no more plasmolysis after 35^{o}C;	supports hypothesis (reject supports conclusion); **(but if rejected because of conclusion then can still have)** **Then** quotes figs between 5^{o}C and 55^{o}C and the two %'s **OR** (increases) up to 35^{o}C or no more plasmolysis after 35^{o}C;	does support at start but then does not support, or partially supports hypothesis (reject conclusion) **(but if rejected because of conclusion then can still have)** or is not a straight line/not linear or is not proportional**;** **Then one of** after 15 not linear; levels off/stops increasing/up to a point;	Needs clear statement. Reject any ref. to **100%** plasmolysis or cells dying/denatures. **ACCEPT 35/45 OR BETWEEN, DEPENDING ON THE CANDIDATE'S GRAPH.**	**IGNORE** rate.	**[1]** **[1]**
					Total	**[21]**

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Draw a LARGE, LOW-POWER plan diagram of photomicrograph fig. 2.1. (trachea)				1MMO collection, 3 PDO layout	
2 (a) (i)	sharp, clear unbroken lines, no cells at least 8 lines across lumen at any point; incomplete ring of cartilage;	**AND** 3 bulges; **AND** no shading	**AND** larger than 6cm;	Allow 3 ringed errors for first part of point 1. Ignore additional shaded circles and one layer with dashes. NO block shading of layers. Has to have drawn whole specimen.	



Point 1

No more than three errors ringed.

Point 3 anywhere in diagram at any point there are 8 lines across.



[4]

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Use this information to calculate the actual width of the lumen.		2MMO collection, 1PDO recording, 1PDO display	
2 (a) (ii)	Each division on stage scale is 0.1 mm = V. First and second mark reject if any measurements given e.g. mm. If point 1 right then must be answer from box below. If point 1 wrong then can have any other pair.	Allow units or divisions.	

First Mark	No.of eyepiece grat. W	7	15		29/30				
Second Mark	No.of eyepiece grat. Y	8	7	16	7	14	21	32	39
	No on stage micrometer Z	9	4	9	2	4	6	9	11

Third Mark	Show logical reasoning	**EITHER** Z divided by Y first then proceed and allow multiplication by either V and then W, or W and then V, even though not strictly the correct reasoning. Ignore answer and units. Rej. if additional figs., even if x1.	**OR** Z x V AND divided by Y. followed by x W. Ignore answer and units. Rej. if additional figs. even if x1. Ignore multiplication for units, even metres.
Fourth Mark	Need NOT be the correct answer. Reject if given choice of units unless both correct.	Either answer (between 100 and 999 with) μm. Allow standard form if correct. Reject metres.	OR answer (between 0.1 and 0.99 with) mm. Allow standard form if correct. Reject metres.

First two marks are for – collecting the correct data. The third mark is for display – showing clear reasoning in the calculation.

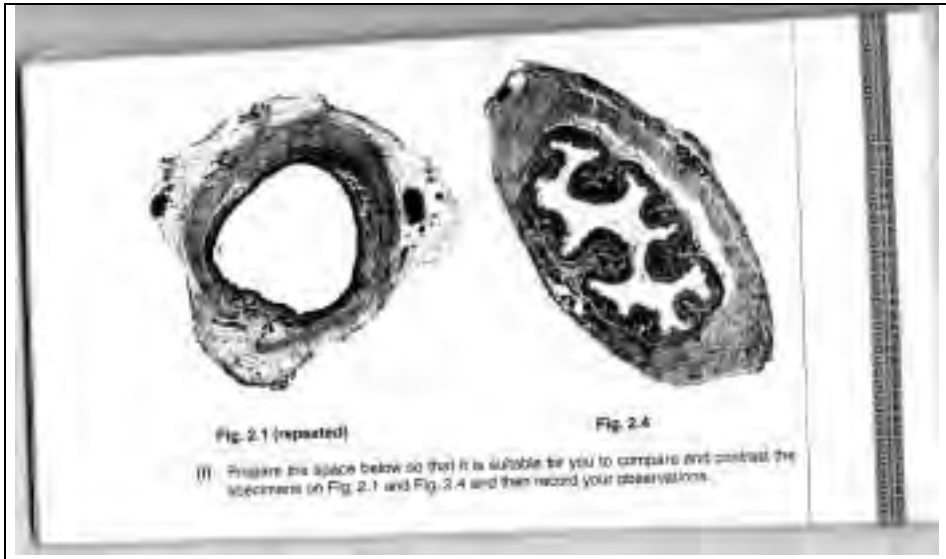
Fourth mark is for recording – use of the correct units.

[4]

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Suggest how an error in measuring the width of the lumen could occur.		1 Ace interpretation		
2 (a) (iii)	Not knowing where the edge is **Or** lumen or shape irregular shape or not circular **Or** preparation squashed **Or** only 1 measurement **Or** thickness of lines (stage micrometer) **Or** (lumen) between divisions on eyepiece graticule **Or** focussing of both scales (NOT specimen) **Or** lining up the scales.	Ignore **parallax error.**	*Any lumen as question does not specify this lumen.* Reject thickness of scale and lines on eyepiece graticule.	**[1]**

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Compare and contrast specimens Fig 2.1 and 2.4.

2 MMO collection 1 PDO recording 2 ACE interpretation

2 (b) (i)

Organised as a table/venn diagram/ruled boxes connected, correctly headed; comparative statements opposite each other/in one sentence;

	Fig. 2.1	Fig. 2.4
Both have	lumen;	
Inner layer/membrane/wall or lumen shape	smooth/rounded,	folded/irregular/ lobed;
lumen	larger/wider or smaller/narrower; Allow either way round	
Overall shape positive statement on both sides	triangular/ rounded circular,	oval AW;
Cartilage/C shape (layer)	present/has,	none/no;
contents	nothing/no,	filled/has;

If named headings only e.g. artery/vein then reject. **[1]**

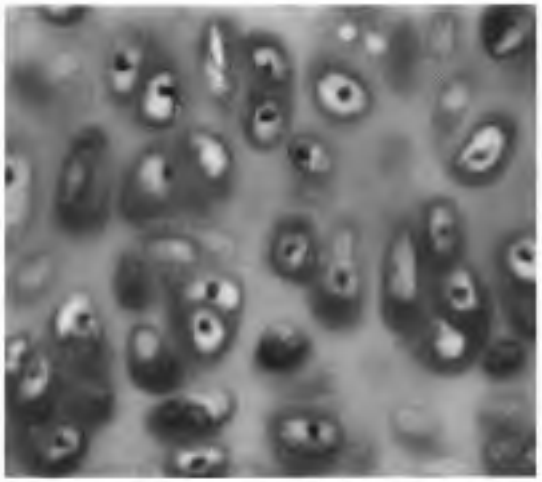
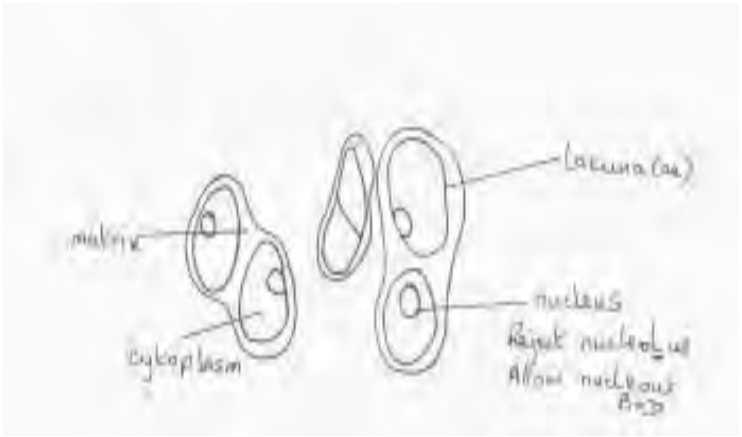
Then 3 for showing comparative statements if correct + lumen + larger difference. **[1]**

Most pairs of statements are comparative. **[1]**

Must have at least 1 similarity.
Accept hollow/cavity/space
IGNORE tubular (in question)
any ref. to cells or cilia as not visible.
Uses tissue names and lighter/darker and 3-D descriptors e.g. spherical.
Allow two drawings correctly headed with correct annotations.
Ignore 'no hollow'.

Max 2 for differences

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Both involved in transport. State one observation that relates to this function.		ACE conclusion		
2 (b) (ii)	lumen/space/cavity/are hollow/tubular;			**[1]**
Make a labelled drawing of 5 representative cells that are close together.		1MMO collection, 3 MMO decisions		
2 (c)	1 group of 5 complete lacunae on fig. 2.5; line drawn around any lacuna; shape/relative size/position of 2 nuclei compares well with those in their marked group ; label lines to nucleus plus one from: cytoplasm/lacunae/chondrocyte/chondroblast/matrix;	Allow 5 separate circles but if these are joined as one circle, it will only contain five complete lacunae. Ignore part lacunae. Ignore shading. Accept the best two. Accept nucleous. Reject if second 'l'.	**Reject** if not drawn 5 lacunae.	
 **Fig. 2.5**				**[4]**

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

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Question	Expected Answers		Additional Guidance	Marks
Draw and label ONE cell in distilled water			2 MMO collection	
1 (a) (i)	one cell drawn (at high power), two lines for cell wall; correct cell structure and <u>cell wall</u> and <u>nucleus</u> labelled correctly;		Ignore low power. Reject two or more cells together. Rej. if have additional organelles mitochondria, chloroplasts, Golgi.	**[2]**
Present your observations from the slides made from distilled water, T1 and T2			2 MMO decisions, 2 PDO recording	
1 (a) (ii)	**Either** single table, all cells drawn, column headings: solution/slide/(distilled) water/**W** and **T1** and **T2**; to left/across top, observations/feature/e.g. to right/ underneath/clear what is recorded in the boxes; **T1** cell membranes/cytoplasm pulled away from cell wall/plasmolysed; **T2** granules/particles in cell/more plasmolysed/destroyed/stained/coloured e.g. brown/black/AW;	**Or** when **only** drawings given three drawings, labelled (distilled) water/**W**, **T1** and **T2**; clear that cell walls and cell membranes are all different (for water, **T1** and **T2**); **T1** cell membranes/cytoplasm pulled away from cell wall/plasmolysed; **T2** granules/particles in cell/<u>more</u> plasmolysed/destroyed/stained/coloured e.g. brown/black/AW;	No outer boundary needed for table. Reject cells shrink or become smaller. Accept vacuole shrinking or drawn. Allow any description that cells have been destroyed/cell membranes ruptured/disorganised/ leakage of cell. Reject cell walls broken down.	**[4]**

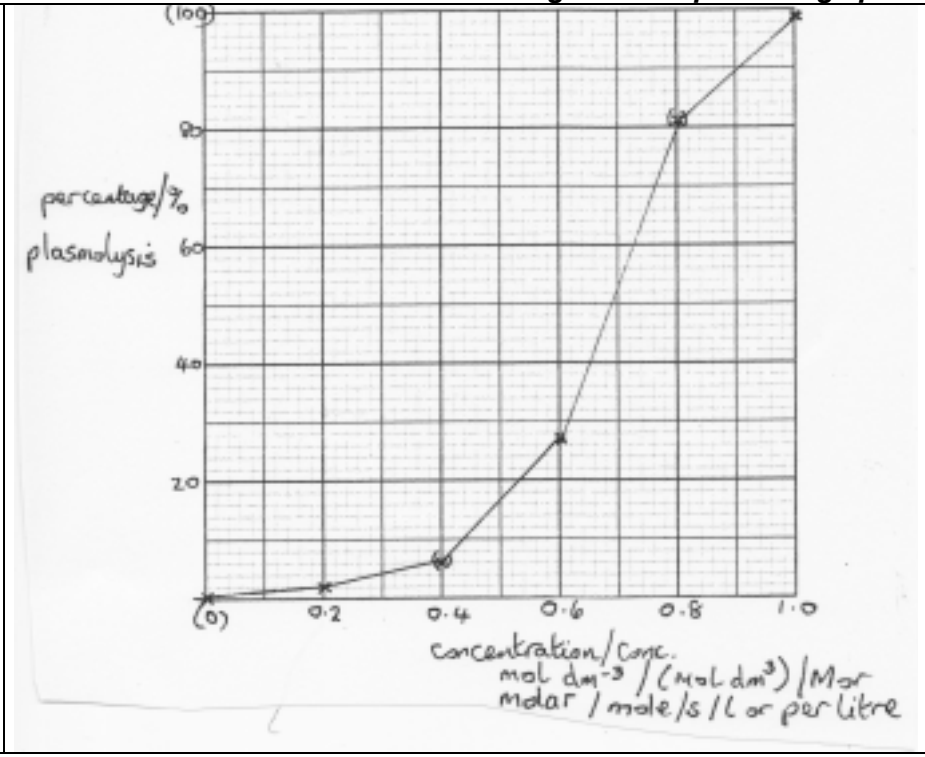
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Explain observations from water, T1 and T2.					
1 (a) (iii)	**Idea of** 1. high/less negative water potential to lower/more negative water potential/down water potential gradient Any two of: 2. (in water)idea of water has moved in/no net movement; 3. (in **T1**/**T2**) idea of water has moved out; 4. (in **T2**/lead nitrate) killed/destroyed cells/toxic/effect described/AW;	**AND** by osmosis at any point;	In correct context. Accept ψ. Solute/osmotic potential is ignored but must be the same as water potential i.e. from high to low, so reject pt1 if wrong way. Ignore hypotonic and hypertonic but must be in correct context if used. Must be correct with the candidate's own results. Reject cell wall destroyed.		**[1]** **[2 max]**
Identify two sources of error in this experiment				2 ACE interpretation	
1 (a) (iv)	**Two from** evaporation from solutions/concentration of solution changes; cells left <u>different</u> lengths of time/too short a time/not long enough; AVP; volume/no. of drops used; **or** different or different onions/parts of onion/not fresh/have been frozen/stored;		Reject not immersed. Reject should be same time –not an error. Reject amount.	Mark for any correct. Reject improvements.	**[2 max]**

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Suggest <u>how</u> you could modify the experiment to investigate the effect of lead nitrate.		3 ACE improvements		
1 (b)	more/serial dilution concentrations of lead nitrate; Then any **TWO** from at least 3 specified lead nitrate concentrations; repeat each concentration/more than one strip (per concentration); keep the time the same/give an example of a time/longer time; keep the volume **AND** method /use graduated pipette/no.of drops the same/AW; same onion/same part/fresh; detailed measurement method/use of eyepiece graticule to measure plasmoylsed cells/count number of plasmolysed cells in a sample of 20 or more;	Reject shorter time.		**[1]** **[2 max]**

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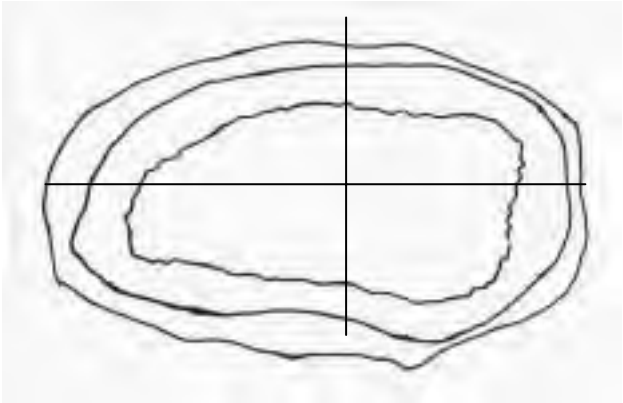
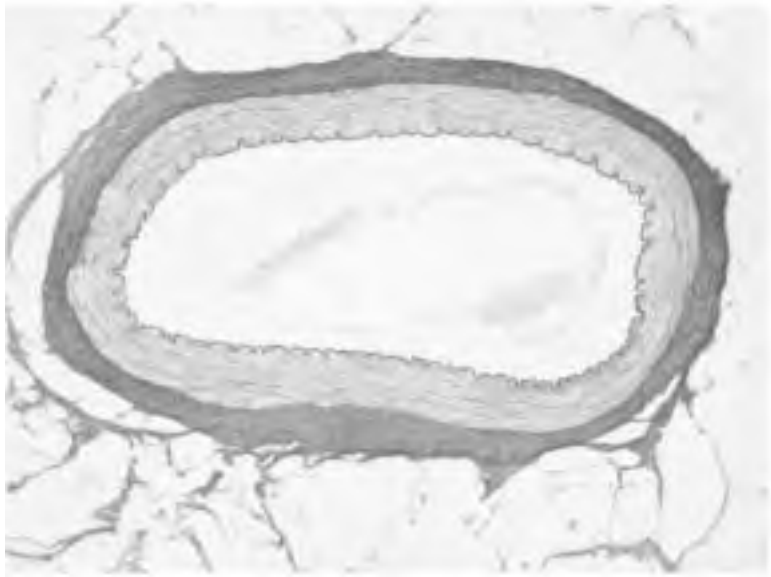
Complete the Table 1.2 by calculating the missing values		PDO display	
1 (c) (i)	**6,81;**	*A whole numbers only and both correct*	**[1]**
Plot a graph of concentration of sodium chloride against the percentage plasmolysis of the cells		PDO layout	
1 (c) (ii)			**[3]**

O	x-axis conc, mol dm^{-3}/M or molar/mole(s)/l or per litre	**AND** y-axis percentage/% plasmolysis;	Rej. mol/dm^{-3} and mol dm^3.	[1]
S/P	scale as shown/y axis 25 to 2cms, allow no 0 marked	**AND** plotting crosses or dot in circle ONLY **AND** 0.0, 0.2 and 0.6 and1.0 plotted correctly; no larger then **X** or **O** plots 0.2 must be on horizontal line, 0.2 and 0.6 and 1.0 between the horizontal lines. Ignore incorrect calculated mean plots i.e. 0.4 and 0.8.	Rej. blobs in or out of circle.	[1]
L	either ruled lines joining each point or smooth curve through 0; no thicker than _____ no feathery line, line must go to 0		Rej. any extrapolation beyond either axis.	[1]

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Question	Expected Answers	Additional Guidance	Marks
State concentration at which 50% plasmolysis occurred		1 ACE interpretation	
1 (c) (iii)	take reading from candidates own graph, **AND** must have units;	Allow two decimal places. Ecf units from graph.	**[1]**
'The more concentrated the solution the more plasmolysed the cells become' ***draw conclusion include whether the data support the hypothesis and produce a revised hypothesis if necessary***		2 ACE conclusion	
1 (d)	General statement : Either support or no support or partial support for the hypothesis or writes a conclusion which states the hypothesis; quotes 2 sets of figs. with both axes; **OR** idea that up to 0.4 /low concentration only small % plasmolysed/or % plasmolysis does not increase evenly with increasing concentration/or levels off at high concentration;	Needs clear statement. Reject supports conclusion. Idea of correct relationship may quote figures to get same idea. Reject all/100% plasmolysed.	**[2]**

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Question	Expected Answers	Additional Guidance		Marks
Draw a LARGE, LOW-POWER plan diagram of photomicrograph fig 2.1. (artery)		1 MMO collection, 3 PDO layout		
2 (a) (i)	sharp, clear unbroken lines, height no more than two thirds the length ; no cells, no shading, larger than 6 cm in any direction; at least three lines (plus very thin inner layer if shown); uneven all the way round and one solid inner line;	Outer two lines **only** 	No more than 2 errors. Actual = 5.5 cm to 9 cm.	**[4]**
 				

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Use this information to calculate the actual width of the lumen.		2 MMO collection, 1 PDO recording, 1 PDO display	
2 (a) (ii)	Each division on stage scale is 0.1 mm = V **First mark** Reject any measurements given for mark points 1 and 2. Accept units or divisions.		

First Mark	No. of eyepiece grat. W	7		14		28				29			
Second Mark	No. of eyepiece grat. Y	4.5	9.0	9	18	7	18	25	36	7	18	25	36
	No on stage micrometer Z	5	10	5	10	2	5	7	10	2	5	7	10
Third Mark	Show logical reasoning	**EITHER** Z divided by Y first, then proceed and allow multiplication by either V and then W, or W and then V, even though not strictly the correct reasoning. Ignore answer and units. Rej. if additional figs. even if x1.				**OR** Z x V AND divided by Y. followed by x W Ignore answer and units. Rej. if additional figs. even if x1.							
Fourth Mark	Need NOT be the correct answer	Either between 100 and 999 with μm Allow standard form if correct. Reject metres.				OR answer between 0.1 and 0.99 with mm; Allow standard form if correct. Reject metres.							

First two marks are for – collecting the correct data. The third mark is for display – showing clear reasoning in the calculation.
Fourth mark is for recording – use of the correct units. **[4]**

Suggest how an error in measuring the lumen could occur		1 ACE interpretation	
2 (a) (iii)	not knowing where edge is/lumen irregular shape/preparation squashed/only 1 measurement/thicknesses of lines(stage micrometer)/between divisions on eyepiece graticule/one scale line is not at edge of lumen/focussing of both scales/lining up the scales;	Ignore parallax error	**[1]**

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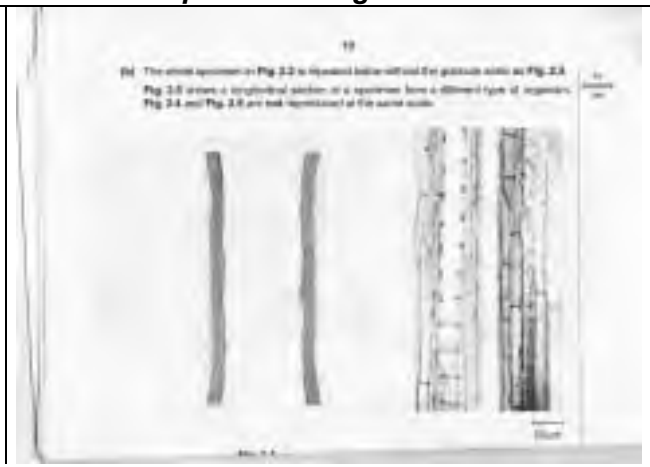
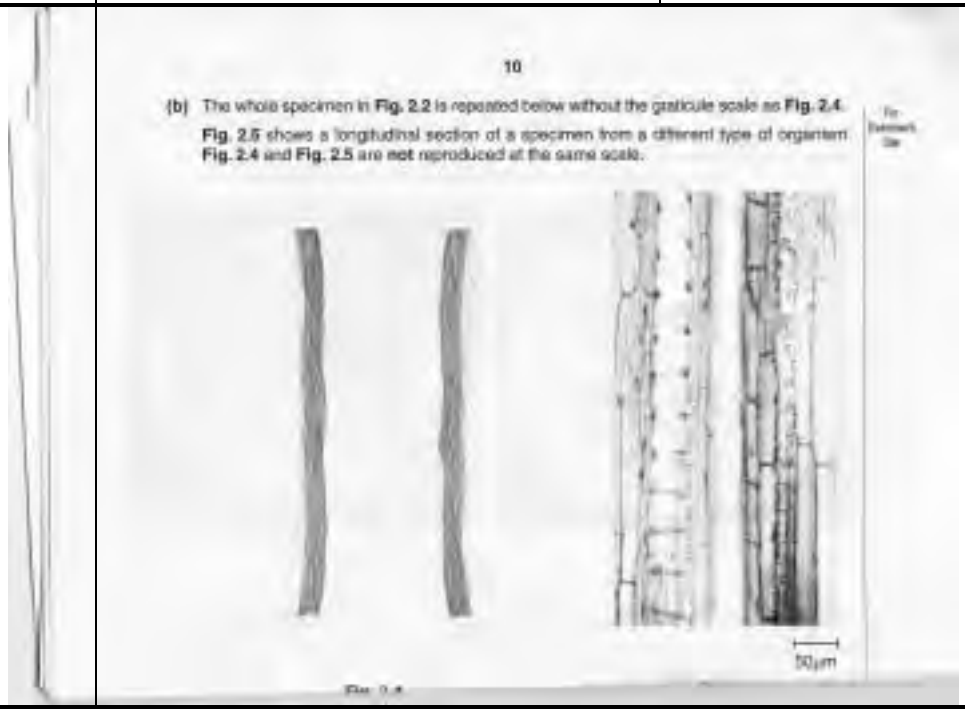
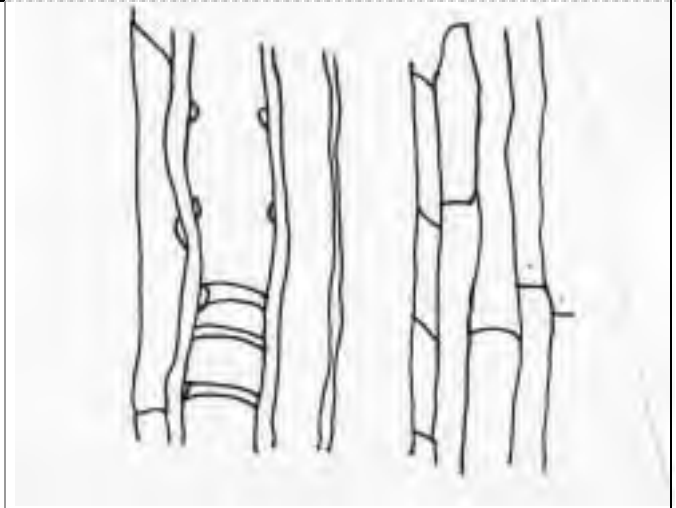
Compare and contrast specimens Fig. 2.4 and 2.5.		2 MMO collection 1 PDO recording 2 ACE interpretation	
2 (b) (i)			
organised as a table/Venn diagram/ruled boxes connected, correctly headed; comparative statements opposite each other;		**Must have at least one similarity.** ___ ___ Accept tubes/vessels as alternative to lumen. Reject ref. to Fig. 2.4 having cells – not visible. Reject uses Rej. ref. lignin/cellulose with walls or bands.	**[5]**

	Fig. 2.4	Fig. 2.5
both have	lumen/central space;	
lumens	larger,	smaller;
number (lumen/tubes)	single/one,	more/lots;
cells /cell walls/end walls	none/absent,	present;
bands	absent/none	present;
Ref. pits/circles/spots	none,	present;

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Suggest one feature which indicates the Fig 2.5 is a plant			ACE conclusion		
2 (b) (ii)	have cell walls/xylem/phloem/sieve tube (element)/companion cell/pits/rings;		Ignore cellulose, lignin, vessel on own. Reject sieve plates.		**[1]**
Make a labelled drawing of 5 representative cells.			1 MMO collection, 3 MMO decisions		
2 (b) (iii)	5 shown on Fig.; drawn 3 diverse cells; 3 different sizes; at least 1 cell drawn with bands/parts of bands/pits;	**AND** longer than wide;	Reject point 1 if more than 5 marked or drawn. Entire cells or open tubes. **Ignore labels.**	Reject points 2, 3 and 4 if more than 2 TS or textbook. Max 1 point, 1 only	**[1]** **[3]**





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