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MARK SCHEME for the October/November 2014 series

9700 BIOLOGY

9700/31 Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

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max	indicates the maximum number of marks that can be given
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I	ignore

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1 (a) (i) at least four further concentrations of **E +** % **;**

for at least 3 concentrations of **E** correct volumes of **E +** cm^3 **;**

for at least three concentrations final volumes add up to 10 **+** cm^3 **;** [3]

(ii) as concentration of **E** increases the time taken to reach the end-point decreases **;** [1]

(iii) at high enzyme concentration more ESCs / more substrate binds
or
at low enzyme concentration less ESCs / less substrate binds **;** [1]

(iv) replace enzyme / **E** with water / **W** **;** [1]

(v) 1 organised into table with all columns separated by a line **+** all headings underlined **;**

2 headings (top or to left of data) % concentration of **E +** (any column / row headed) time / seconds **;**

3 records lowest concentration first **+** whole seconds **;**

4 highest concentration recorded in shorter time than next concentration **;**

5 results for control as 'more than 300' **;** [5]

(vi) 1 divided by result for 5% **E** to correct number of significant figures **;** [1]

(vii) (dependent variable) colour or end-point **+** idea of judging / determining **;** [1]

(viii) ± **+** half smallest division **+** cm^3 **;** [1]

(b) 1 at least 5 temperatures **;**

2 narrower range of temperatures around optimum / uses optimum temperature **;**

3 use thermostatically-controlled water-bath **;**

4 temperature of milk (**M**) equilibrated (before **E** added) **;** [max 3]

[Total: 17]

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2 (a) (i) at least 4 lines **+** size at least 60 mm across radius **+** no shading **;**

no cells drawn **+** correct sector drawn **;**

shows one outer vascular bundle at least twice the size of other outer vascular bundle **;**

label **+** line to vascular bundle **;** [4]

(ii) 1 at least 3 cells **+** size at least 50 mm across largest cell at widest point **+** sharp continuous lines **;**

2 only 3 cells drawn **+** each of the cells touching each other **;**

3 cells walls drawn as double lines with middle lamella between **;**

4 one complete intercellular space visible between cells **;**

5 label **+** line to cell wall **;** [5]

(b) (i) measures scale bar within range (13 – 15 mm) **+** mm **+** to 0.5 **;**

shows conversion of scale bar measurement to μm × 1000 **;**

measurement of scale bar **÷** scale **+** rounds to whole number **;** [3]

(ii) 1 organise as table with 3 columns headed feature **+ J1 +** Fig. 2.2 **;**

2 only observable differences recorded **;**

max 2 for differences:

mp	point of comparison	J1	Fig 2.2
3	shape of stem	bumps less pronounced	8 pronounced bumps **;**
4	vascular bundles xylem vessels	4 rings xylem vessels larg(er)	1 ring xylem vessels small(er) **;**
5	gaps in stem	present	absent **;**
6	central tissue / pith	spaces present / not filled with cells	no spaces / filled with cells **;**
7	cortex	not thickened	thickened cells **;**

[max 4]

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(c) (i) 1 (*x*-axis sucrose concentration / mol dm^{-3}
+ (*y*-axis) change in distance between cut ends / mm **;**

2 (*x*-axis) 0.2 to 2 cm **+** labelled each 2 cm (except origin and 0.8)
+ (*y*-axis) 2 to 2 cm **+** labelled each 2 cm (except –4 and +4) **+** plus and minus shown **;**

3 correct plotting of five points as small cross or dot in circle or cross **;**

4 five plots **+** ruled lines exactly point to point or line of best fit **+** sharp line **;** [4]

(ii) reference to water movement **;**

at 0.0 mol dm^{-3} water enters **+** at 0.8 mol dm^{-3} water leaves **;**

no net water movement where line intercepts *x*-axis **;** [3]

[Total: 23]

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9700/33 Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

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1 (a) (i) **3** directions / arrows correct **;** [1]

(ii) organised into table
+ all columns separated by a line **+** all headings underlined **;**

headings solution **+** direction of movement **;**

results for **S1** 'down' or downward arrow **+ S2** 'up' or upward arrow **;** [3]

(iii) **P** is …'**more**' concentrated than 0.10 mol dm^{-3} (**S1**)
+ **P** is '**less**' concentrated than 1.00 mol dm^{-3} (**S2**)
+ estimate of **P** is less than 1/**S1** or more than 0.1/**S2 ;** [1]

(iv) **S2** or 1.0 mol dm^{-3} **;**

(concentration of) **P**, was less concentrated than **S2**/1.0 mol dm^{-3} **;** [2]

(v) records at least 4 concentrations of sucrose solutions **+** mol dm^{-3} **;**

for at least 3 concentrations of sucrose records volumes of sucrose solutions **+** cm^3 **;**

for 3 concentrations final volume makes 40 **+** cm^3 **;** [3]

(vi) records directions for at least 3 concentrations of sucrose **;**

records correct trend **+** directions in continuous order **;**

shows results for repeated drops **;** [3]

(vii) correct estimate of **P** with their results **;** [1]

(viii) 1 hydrolysis of sucrose solutions or described **;**

2 heat Benedict's solution to stated temperature (e.g. 70°, 75°, 80°, 85°, 90°, 95°) or to 100 °C or boiling water **;**

3 comparing colours of sucrose solutions **+ P ;**

4 same or stated volume of sucrose solutions (e.g. 2 cm^3)
+ same or stated volume of **P** (e.g. 2 cm^3) **;** [max 3]

[Total: 17]

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2 (a) (i) 1.232 **+** 1.601 **;** [1]

(ii) 0.975 **;** [1]

(iii) label on *x*-axis (different) ages of aphid **+** label on *y*-axis rate of flow of sap / $\mu l\, h^{-1}$ **;**

(*x*-axis) bars of equal width and equal distance apart, using more than 4 cm **+** scale on *y*-axis is 0.5 to 2 cm **+** labelled each 2 cm (except origin and 2.0) **;**

correct plotting of each bar in the order of the table (**H**, **J**, **K**, **L**, **M**) **;**

sharp vertical lines and horizontal lines (less than line thickness on grid) **+** labels for **H**, **J**, **K**, **L**, **M** directly below bar **;** [4]

(iv) as the age of the aphid increases the rate of flow of sap increases **;** [1]

(v) as aphids become older the stylets become larger **;**

as aphids become older access to larger phloem sieve tubes **;** [2]

(b) (i) 1 at least 4 lines **+** size at least 60 mm across radius **+** no shading **;**

2 no cells drawn **+** correct quarter drawn **;**

3 at least 5 layers (6 lines drawn) **;**

4 epidermis drawn as two lines **;**

5 label **+** label line to pith **;** [5]

(ii) 1 at least 3 cells **+** size at least 40 mm across largest cell at widest point **+** (quality of outer lines) sharp continuous line for each cell **;**

2 only 3 cells drawn **+** as one group of touching cells **;**

3 cell walls drawn as double lines (for at least 2 cells) with middle lamella between **;**

4 drawn an air space between cells **;**

5 label **D** **+** label line to cell structure **;** [5]

(c) measures line **R** to **T** within range **+** units mm / cm **;**

converts to μm by multiplying by 1000 (if **R**/**T** in mm) or 10 000 (if **R**/**T** in cm) **;**

shows division by 120 **;**

correct significant figures for answer **;** [4]

[Total: 23]

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MARK SCHEME for the October/November 2014 series

9700 BIOLOGY

9700/34 Paper 3 (Advanced Practical Skills 2), maximum raw mark 40

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1 (a) (i) organised into table with all columns separated by a line + all headings underlined **;**

headings (top or to left of data) sample + (any column / row headed) scale **;**

result for **P1** is a lower number than **P2 ;**

result for **W** is 0 **;** [4]

(ii) U is less concentrated than **P1** and **P2** + **U** is less than 0.8% **;** [1]

(iii) **P1 ;**

U lower scale number than **P1 ;** [2]

(iv) at least four further concentrations of **E** + % **;**

shows transfer of 10 of **P** from previous beaker to three beakers + cm^3 **;**

adds 10 of water to three beakers + cm^3 **;** [3]

(v) records colours + numbers for at least three concentrations **;**

records correct trend for concentrations **;** [2]

(vi) correct estimate of **U ;** [1]

(vii) colorimeter **;** [1]

(b) (i) 1 (*x*-axis) albumin concentration + g per 100 cm^3
(*y*-axis) frequency + number of people **;**

2 (*x*-axis) bars of equal width
(*y* axis) 2 cm to 10 number of people labelled each 2 cm except origin and 60 **;**

3 correct plotting of bars in order of the table **;**

4 six bars + ruled sharp vertical and horizontal lines **;** [4]

(ii) people with different health or sex or age or metabolism **;** [1]

(iii) albumin slows blood circulation or causes osmotic or kidney problems **;** [1]

[Total 20]

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2 (a) (i) 1 at least three lines + size at least 40 mm at widest point + no shading ;

2 no cells drawn + one curved end ;

3 epidermis drawn as two lines ;

4 at least two vascular bundles drawn ;

5 label + line to palisade layer ; [5]

(ii) 1 at least four whole cells + largest epidermal cell at least 40 mm at widest point + sharp continuous outer lines ;

2 at least one epidermal cell + at least three cells for trichome ;

3 cell walls as double line with middle lamella between ;

4 line to nucleus ; [4]

(b) (i) 1 organise as a table with 3 columns + two columns headed **L1** and **L2** + one column with at least one feature ;

	(feature)	L1	Fig 2.2
2	trichome	has trichomes on both surfaces	trichomes on one surface ;
3	folds	no folds / absent / no / (*only*) 1–3 / less / fewer	has fold / present / yes ;
4	vascular bundles number	less / few(er)	more / many ;
5	vascular bundles position	not in folds / only in midrib	one in each fold ;
6	xylem	small(er)	large(r) ;
7	air spaces or packing of cells	large / many / present or cells loosely packed	smaller / fewer / absent or cells densely packed ;
8	cuticle	thick(er) / thin(ner)	thick(er) / thin(ner) ;

[max 4]

(ii) 1 measure scale bar + line + units ;

2 566 divided by measurement of scale bar or length of line divided by length of scale bar or length of scale bar divided by 566 ;

3 measurement of line multiplied by answer to mp2 or answer to mp2 multiplied by 566 or length of line divided by answer to mp2 ;

4 rounds answer to no more than correct decimal places ; [4]

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(iii) measures at least 5 folds **;**

converts to actual length **;** [2]

(iv) folded leaf retains humidity or cuticle prevents transpiration **;** [1]

[Total: 20]

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1 (a) (i) (10) 5 + 2.5 + 1.25 + 0.625 / 0.63 + percentage at least once ;

shows transfer of 20 cm^3 of suspension from previous beaker to 4 beakers ;

adds 20 cm^3 of water / **W** / H_2O to 4 beakers ; [3]

(ii) 1 all columns separated by a line + all headings underlined (or all rows separated by a line) ;

2 (top or left of data) percent(age) / % concentration of **Y** or yeast + (any column / row headed) colour / observation / appearance ;

3 records colours for at least 3 concentrations ;

4 records correct pattern ;

5 repeats ; [5]

(iii) ± + half smallest division + cm^3 ; [1]

(iv) colour (change) + difficult to judge / see / identify ; [1]

(v) 1 use different indicator ;

2 repeat ;

3 put glucose solution in water-bath to equilibrate ;

4 use set of colour standards in order to judge final colours ; [max 1]

(b) (i) 1 selects two variables ;

m*ax 2 for description of 2 methods – must have variable + description:*
2 pH + use of buffers ;

3 temperature + use thermostatically-controlled water-bath ;

4 type of milk / age of milk + same type / same age ;

5 size of beads/surface area / number of beads + use ruler / count beads ; [max 3]

(ii) 1 (label on *x*-axis) time alginate beads in contact with milk / minutes / mins + (label on *y*-axis) percentage / % hydrolysis (of) lactose ;

2 (scale on *x*-axis) 20 to 2 cm + labelled each 2 cm (except origin and 120) + (scale on *y*-axis) 20 to 2 cm + labelled each 2 cm (except origin and 100) ;

3 correct plotting of 5 points as small cross or dot (in circle) or cross in a circle ;

4 5 plots + ruled lines exactly point to point or curve through all plots + sharp line (less than line thickness on grid) ; [4]

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(iii) correct answer according to graph ; [1]

(iv) less contact time + fewer enzyme substrate complexes / ESCs ; [1]

(v) less substrate available/reference to equilibrium / end product inhibition ; [1]

[Total: 21]

2 (a) (i) 1 at least 2 cells in each (**I**, **M** and **DW**)
+ size at least 60 mm across widest point of widest cell
+ sharp continuous line for outermost line of each of the cells ;

2 3 groups of 2 cells + in each of the 3 groups the 2 cells touching ;

3 double lines for cell walls (for at least two cells) with middle lamella ;

4 at least one nucleus shown ;

5 nuclei uneven sizes ;

6 label with label line to one nucleus ; [6]

(ii) colour different / acceptable answer from candidates drawings ; [1]

(b) (i) folds / ridges / pits / grooves / projections / AW + large surface area ; [1]

(ii) only three extensions into the projection + width at widest point at least 60mm
+ no shading ;

no cells drawn + only drawn section in the box ;

at least one taste bud on each side of projection + irregular upper surface ;

draws tissues in correct proportion ; [4]

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(c) (i) 1 organise as a table + 2 columns headed Fig 2.3 and Fig. 2.4 (in any order) + third column or row containing at least one feature **;**

o*bservable differences max 3 – see table below:*

mp	(feature)	Fig. 2.3	Fig 2.4
2	furrows between projections / papillae / AW	(relative to Fig. 2.4) deep(er) or long(er) wider	(relative to Fig. 2.3) shallow(er) or short(er) narrower **;**
3	shape of projection / AW	(relative to Fig. 2.4) long(er) / columnar / elongated / rectangular / AW *not finger-like*	(relative to Fig. 2.3) Round / oval / circular / shorter / AW **;**
4	taste buds	(relative to Fig. 2.4) visible / present / large(r)	(relative to Fig. 2.3) not seen / absent / small(er) **;**
5	**E** (epithelial layer) surface of layer **E**	(relative to Fig. 2.4) thick(er) / wide(r) / large(r) / long(er) rough / wavy / uneven	(relative to Fig. 2.3) narrow(er) / thin(ner) / small(er) / short(er) rounded / smooth **;**
6	**L** layer surface of layer	(relative to Fig. 2.4) narrow (er) / thin(ner) / small (er) rounded / smooth	(relative to Fig. 2.3) thick(er) / wide(r) / large(r) wavy / uneven / rough **;**
7	extensions into projection / AW	(relative to Fig. 2.4) 3 extensions / more	(relative to Fig. 2.3) 1 extension / less **;**

[max4]

(ii) measures width of line **E** ± 1 mm + width of line **L** + units **;**

shows **L** divided by **E ;**

answer as larger whole number to: smaller whole number **;** [3]

[Total: 19]

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1 (a) (i) at least 4 further concentrations of **E** + % ;

at least 3 correct volumes for **E** + cm^3 ;

for at least three concentrations of **E** final volumes add up to 20 + cm^3 ; [3]

(ii) 1 organised into table
all columns separated by a line + all headings underlined ;

2 headings (top or to left of data) percentage concentration of **E** +
(any column / row headed) time (/)s or seconds ;

3 whole seconds for at least three concentrations of **E** ;

4 highest concentration of **E** recorded in shorter time than next concentration ;

5 records in multiples of 30 seconds ; [5]

(iii) (dependent variable) colour or end-point + idea of judging / determining ; [1]

(iv) replicates or put **E** / **M** in water-bath (to reach temperature) ; [1]

(b) (i) 1 selects temperature + pH ;

2 temperature + use thermostatically controlled water-bath ;

3 pH + use buffers ; [3]

(ii) 0.250 ;

0.019 ; [2]

(iii) 1 (*x*-axis time / min(utes) + (*y*-axis) mass of glucose / mg ;

2 (*x*-axis) 2 cm to 5 minutes labelled each 2 cm except origin and 20 minutes
+ (*y*-axis) 2 cm to 1 mg each 2 cm except origin and 5 ;

3 correct plotting of five points as small cross or dot in circle or cross ;

4 five plots + ruled sharp lines exactly point to point
or
ruled line of best fit + sharp smooth line ; [4]

(iv) (between 0 and 12 minutes)
many enzyme substrate complexes / ESCs / binding / fitting of substrate / enzyme ;

(between 12 and 20 minutes) fewer ESCs or less substrate can bind ; [2]

[Total: 21]

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2 (a) (i) central stele / vascular tissue ; [1]

(ii) 1 at least 2 lines + size at least 100 mm across diameter + no shading ;

2 no cells + half drawn ;

3 endodermis shown by 2 lines ;

4 correct proportion stele compared to cortex ;

5 label + line to xylem ; [5]

(ii) 1 at least 6 cells + size at least 40mm across largest cell at widest point + sharp continuous lines ;

2 only 6 whole cells drawn + as two groups of touching cells ;

3 cell wall of xylem cells drawn correctly (angular) ;

4 cell walls as double lines with middle lamella between ;

5 label + line to lumen ; [5]

(b) measures line **Y** within range + mm + to 0.5 ; *(range 86–88 mm)*

measures line **Z** within range + mm + to 0.5 ; *(range 14–16 mm)*

answer as larger whole number to smaller whole number to simplest ratio ; [3]

(c) 1 organise as table with 3 columns headed feature + **M1** + **Fig. 2.2** ;

2 only observable differences recorded ;

max 3 for differences – see table below:

mp	point of comparison	Fig 2.1	Fig 2.2
3	*stele shape* vascular bundle / vascular tissue / xylem / phloem	cross (do not accept irregular / central)	round / circular / scattered ;
4	*stele* layers around stele endodermis	1 or 2 layers / fewer layers / thin	2 or 3 layers / more layers / thick ;
5	*stele* size <u>in relation to diameter</u> of root / size of specimen	small(er)	larg(er) ;

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mp	point of comparison	Fig 2.1	Fig 2.2
6	*cortex* air spaces shape of cells length of cells	 air spaces absent round / circular / oval small / short(er)	 air spaces present elongated / long / rectangular large / long(er) ;
7	*cortex* number of cells in cortex *(must refer to cortex)* packing	 filled with cells / more / many cells more packed	 not filled with cells / less / few(er) less packed ;
8	*epidermal layer* red stained cells (near epidermis)	 one layer / thin(ner) absent	 several layers / thick(er) present ;
9	total number of layers	less / few(er) layers or expressed as a number of layers, e.g. 5	more layers or expressed as a number of layers, e.g. 8 ;

[max 5]

[Total: 19]

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