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MARK SCHEME for the October/November 2015 series

9700 BIOLOGY

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

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;	separates marking points
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R	reject
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I	ignore

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1 (a) (i) draws at least 3 additional beakers **;**
shows 4 concentrations of **S**, 1 **+** 0.1**+** 0.01**+** 0.001**+** % **;**
shows transfer of 2 cm^3 solution from previous beaker to next beaker **;**
shows addition of 18 cm^3 of water to each beaker **;** [4]

(ii) states volume **+** cm^3 **+** *ref. to* covering potato **;** [1]

(iii) mp1 table drawn **+** heading for percentage concentration **+ S ;**

mp2 heading for colour **;**

mp3 uses scale (e.g. +++) to record intensity of colour **;**

mp4 result for 10% sodium chloride solution is the highest intensity **+** water is the lowest intensity **;** [4]

(iv) low or medium **;** [1]

(v) to show that the results were due to sodium chloride solution and not any other factor **;** [1]

(vi) *ref. to* other more significant errors than measuring to accuracy of 0.01 cm^3 **;** [1]

(b) (i) mp1 (*x*-axis) time in sodium chloride solution / days
+ (*y*-axis) mean length of roots / mm **;**

mp2 (*x*-axis) 2 cm to 2, labelled each 2 cm, except origin and 10
+ (*y*-axis) 2 cm to 5, labelled each 2 cm, except 55 or 60, with 30 or 35 at origin **;**

mp3 for 1 mM sodium chloride solution, correct plotting of five points as small cross or dot in circle **;**

mp4 for 1 mM sodium chloride solution, five plots **+** ruled sharp lines exactly point to point **;** [4]

(ii) shows 39.5 – 38 divided by 2 **;**
0.75 **;** [2]

(iii) correct *ref. to* water potential **;**
ref. to movement of water entering cells **;** [2]

(iv) uses at least 5 temperatures **;**
(controls temperature by) greenhouse / incubator / temperature controlled room **;**
ref. to how standardisation of other variable carried out **;** [3]

[Total: 23]

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2 (a) (i) mp1 size at least 70 mm **+** no shading **;**

mp2 no cells **+** at least 3 lines **+** correct section drawn **;**

mp3 shows end of the leaf curving inwards **;**

mp4 uses label line **+** label to cuticle / trichome / folding of leaf **;**

mp5 feature annotated (cuticle – reduces water loss by evaporation, trichome and folding – reduces diffusion gradient) **;** [5]

(ii) mp1 at least 4 cells **+** size at least 40mm **+** sharp continuous lines **;**

mp2 4 cells drawn **+** each cell touching at least 2 of the other cells **;**

mp3 cell walls drawn as double lines **+** middle lamella between **;**

mp4 correct proportion of width of cell wall to cell **;**

mp5 uses label line **+** label to cytoplasm **;** [5]

(b) (i) uses label line **+** label '**X**' to xylem tissue **;** [1]

(ii) shows correct number of eyepiece graticule units for line **Y** (40 – 44) **;**
shows multiplication by 12 **;**
shows correct answer **;** [3]

(c) organised as table with 3 columns or rows **+** headed for, feature **+ J1 +** Fig. 2.2 **;**
2 observable differences between **J1** and Fig. 2.2 **;;** [3]

[Total: 17]

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1 (a) (i) medium or high **;** [1]

(b) (i) at least 3 percentage concentrations of **S** + **SY** **;**
volumes for 3 percentage concentrations of **S** + **SY** **;**
volumes for 3 percentages making 10 cm^3 **;** [3]

(ii) mp1 table drawn + heading for percentage concentration + **SY** **;**

mp2 heading for temperature + ºC **;**

mp3 records results for initial temperatures + final temperatures **;**

mp4 records temperatures to the correct accuracy **;**

mp5 result for 0% **SY** recorded first **;**

mp6 processes results recorded in table **;** [6]

(iii) *ref. to* control **;** [1]

(iv) half the value of the smallest division stated multiplied by 2 **;** [1]

(v) *ref. to* loss of heat to surroundings **;** [1]

(vi) uses 0% **S** or other stated concentration of **S** **;**
uses at least 5 concentrations of hydrogen peroxide **;**
concentrations of hydrogen peroxide prepared by simple or serial dilution **;** [3]

(c) (i) mp1 (*x*-axis) percentage concentration of copper sulfate
+(*y*-axis) rate of catalase activity / number of bubbles released per minute **;**

mp2 (*x*-axis) 2 cm to 0.05, labelled each 2 cm, except origin and 0.3
+(*y*-axis) 2 cm to 10, labelled each 2 cm, except origin and 40 **;**

mp3 correct plotting of 5 points as small cross or dot in circle **;**

mp4 5 plots + ruled sharp lines exactly point to point **;** [4]

(ii) *ref. to* inhibition **;**
fewer enzyme-substrate complexes **;** [2]

[Total: 22]

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2 (a) (i) mp1 draws correct proportion of vascular bundle + no shading ;

mp2 no cells + vascular bundle subdivided into at least 2 layers of tissue ;

mp3 draws correct shape of vascular bundle ;

mp4 correct proportion of xylem tissue compared to other tissues in the vascular bundle ;

mp5 uses label line + label to xylem ; [5]

(ii) mp1 at least 4 cells + size at least 40 mm across largest cell + sharp continuous lines ;

mp2 only 4 cells drawn + 2 cells touching + at least one of these cells touching one other cell ;

mp3 cell walls drawn as double lines + middle lamella between ;

mp4 correct proportion of width of cell wall to cell ;

mp5 uses label line + label to cell wall ; [5]

(b) (i) correct measurement of line **A** (40–42 mm) ;
shows multiplication by 1000 + division by 125 ; [2]

(ii) shows ratio as larger whole number to smaller whole number to lowest common denominator ; [1]

(iii) water habitat + air spaces ; [1]

(c) organised as table with 3 columns or rows headed for feature + **K1** + Fig. 2.1 ;
3 observable differences between **K1** and Fig. 2. 1 ;;; [4]

[Total: 18]

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1 (a) low **;** [1]

(b) (i) shows at least 2 more sizes cut using previous size **;** [1]

(ii) (dimension) $\underline{5 \times 5 \times 20}$ (surface area) $\underline{450}$ **;**
dimension) $\underline{5 \times 5 \times 10}$ (surface area) $\underline{250}$ **+** (dimension) $\underline{5 \times 5 \times 5}$ (surface area) $\underline{150}$ **;** [2]

(iii) use syringe to measure same volume for all test-tubes **or** mark the level on first test-tube and then use this to mark other test-tubes **;** [1]

(iv) mp1 table drawn **+** heading for surface area **+** mm^2 **;**

mp2 heading for number **;**

mp3 records values for at least 4 different size pieces **;**

mp4 records results as whole numbers **;**

mp5 records the highest surface area as having the highest intensity **;**

mp6 repeats **;** [6]

(v) random **;**

correct error described e.g. ends not vertical or *idea of* problems cutting the potato to the correct dimensions **;** [2]

(vi) diffusion **;** [1]

(vii) (standardise surface area) same size / measurements **;**

(change temperature) 5 temperatures or examples of temperatures **;**

use a thermostatically controlled water-bath **;** [3]

[**Total: 17]**

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2 (a) (i) at least 6 starch grains **+** size at least 30 mm across the largest starch grain **+** sharp continuous lines **;**
draws only 6 whole starch grains **+** no shading **;**
correct shape **;**
shows different sizes **;**
shows correct pattern of lines inside at least 3 starch grains **;** [5]

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

(iii) *idea of* patterns not visible as iodine stains the starch grains blue / black **;** [1]

(b) (i) circled **only** 16.525 **;** [1]

(ii) correct mean 16.250 **;** [1]

(iii) mp1 (*x*-axis) type of maize **+** (*y*-axis) mean size of starch grains (/) μm **;**

mp2 (*x*-axis) even bar widths **+** equal spaces between bars **+** (*y*-axis) 0.5 to 2 cm labelled each 2 cm with origin at 16 **;**

mp3 correct plotting of each bar in order in table **+** with horizontal line ruled within half a square **;**

mp4 clear sharp lines **+** labelling of bars **D**, **E**, **F**, **G** and **H ;** [4]

(iv) genetic **or** DNA **or** different enzymes **or** age **or** sample size too small to show a valid difference **;** [1]

(c) (i) shows 0.023 multiplied by 1000 or 10^3 **;**
23μm **;** [2]

(ii) correct number of eyepiece graticule units **;**
shows eyepiece graticule units multiplied by the answer to **(c)(i) ;** [2]

(d) mp 1 size at least 90 mm **+** no shading **;**

mp 2 no cells **+** at least 4 lines **+** one enclosed area drawn **+** correct section drawn **;**

mp 3 draws vascular bundle inside bulge **;**

mp 4 draws vascular bundle with central enclosed area within an outer enclosed area **;**

mp 5 correct label with label line to the vascular bundle **;** [5]

[Total: 23]

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1 **(a)** medium or high **;** [1]

(b) **(i)** stated volume (2 or 3 or 4 or 5 cm^3) **+** use a syringe **+** same volume for each pH solution **;** [1]

(ii) mp1 table drawn **+** heading for solution(s) **;**

mp2 heading for colour **;**

mp3 records a colour for all 6 solutions (**pH3**, **pH4**, **pH6**, **W**, **S1** and **S2**) **;**

mp4 records **pH6** as a paler colour (pink, red or purple) than **pH3 ;**

mp5 records a darker or brighter colour (pink, red or purple) for **S2** than for **pH3 or** red for **S2** if **pH3** is pink **;** [5]

(iii) correct position of **pH3**, **pH4** and **pH6** on the scale **;**
W, **S1** and **S2** in correct positions on scale **;** [2]

(c) **(i)** mp1 (*x*-axis) temperature (/) °C **+** (*y*-axis) absorbance (of) light (by) coloured liquid (/) arbitrary units **or** au **;**

mp2 (*x*-axis) 5 to 2 cm labelled each 2 cm origin labelled 20 or 25 **+** (scale for *y*-axis) 0.1 to 2 cm labelled each 2 cm **;**

mp3 correct plotting of 5 points as a small cross or dot in circle **;**

mp4 5 plots **+** ruled sharp lines exactly point to point **;** [4]

(ii) shows on graph where reading taken off at 40 °C **;**
correct reading from graph **+** arbitrary units **or** au **;** [2]

(iii) as the temperature increases the permeability of the cell surface membranes increases **;**
cell membrane contains) protein **;**
high temperature denatures protein **;** [3]

(iv) thermostatically controlled water-bath **;** [1]

(iv) 5 or more concentrations of alcohol **or** examples of 5 concentrations **;**
serial dilution **or** simple dilution **or** described **;** [2]

[Total: 21]

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2 (a) (i) mp1 size at least 90 mm **+** no shading **;**

mp2 no cells **+** at least 3 lines **+** at least 3 enclosed areas drawn (denoting vascular bundles) **+** only half drawn **;**

mp3 draws outline with either 1 bulge or 2 half bulges **;**

mp4 at least 2 lines for epidermis (small space between these lines) **;**

mp5 uses label line **+** label to xylem **;** [5]

(iii) pith cells larger **or** pith cells have intercellular spaces **or** pith cells more loosely packed **or** pith cell wall thinner **or** pith cells rounder **ora ;** [1]

(iii) mp1 at least 4 cells **+** size at least 40 mm across largest cell **+** sharp continuous lines **;**

mp2 only 4 cells drawn **+** each cell must touch at least one point on 2 other cells **+** no shading **;**

mp3 minimum of one intercellular space between cells **;**

mp4 cell walls drawn as double lines **+** middle lamella between **;**

mp5 uses label line **+** label to cell wall **;** [5]

(b) (i) correct measurement of line **A** (19–21 mm) **;**
shows division by 100 **;**
shows multiplication by 1000 or 10^3 **;** [3]

(ii) organised as table with 3 columns or rows headed for feature **+ K1 +** Fig. 2.1 **;**
3 observable differences between Fig.2.1 and Fig. 2. 2 **;;;** [4]

(iii) correct ratio as a larger whole number to a smaller whole number to the lowest common denominator **;** [1]

[Total: 18]

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1 (a) (i) at least 2 cells **+** size at least 70 mm **+** sharp continuous lines **;**
2 cells drawn **+** no shading **;**
uses label line **+** label to cell wall **;** [3]

(ii) only one cell drawn **+** cell wall drawn as double lines **;**
draws membrane **+** nucleus **;**
uses label line **+** label to feature (membrane, nucleus, cytoplasm) **+** stained **;** [3]

(b) (i) (×)10 **or** (×)40 **;** [1]

(ii) (for ×10) 10 or more cells / (for ×40) 10 cells or less **;** [1]

(iii) shows number of plasmolysed cells divided by total number of cells counted multiplied by 100 **;** [1]

(iv) mp1 table drawn **+** heading for cells **;**

mp2 heading for plasmolysis **;**

mp3 records ✓or ✕ (for each cell) **;**

mp4 replicates **;**

mp5 processes results recorded in table **;** [5]

(v) *ref. to* difficulty of judging degree of plasmolysis for each cell **;** [1]

(vi) correct *ref. to* movement of water into the cells **;**
by osmosis **;**
ref. to higher water potential outside cell **;** [3]

(vii) uses at least 5 concentrations of sodium chloride solution **;**
concentrations of sodium chloride solution prepared by simple or serial dilution **;**
ref. to comparing plasmolysis of unknown solution with plasmolysis of known concentrations **;** [3]

[Total: 21]

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2 (a) (i) shows squares on grid included in surface area ;
does not include squares less than half a square ;
total number of squares within range ;
answer shows cm^2 ; [4]

(ii) shows ratio as larger whole number to smaller whole number to lowest common denominator ; [1]

(b) (i) mp1 (*x*-axis) number of leaves **+** (*y*-axis) transpiration rate / μl per minute ;

mp2 (*x*-axis) 2 cm to 2, labelled each 2 cm, except origin and 14
+ (*y*-axis) 2 cm to 2, labelled each 2 cm, except origin and 10 ;

mp3 correct plotting of 5 points as small cross or dot in circle ;

mp4 5 plots **+** ruled sharp lines exactly point to point or curve through 5 plots ; [4]

(ii) shows on graph where reading taken for 12 leaves ;
correct reading **+** μl per minute ; [2]

(c) mp1 size at least 90 mm **+** no shading ;

mp2 no cells **+** at least 4 lines **+** one enclosed area **+** correct section drawn ;

mp3 shows subdivision of vascular bundle ;

mp4 correct position of vascular bundle within bulge ;

mp5 uses label line **+** label to xylem ; [5]

(d) organised as table with 3 columns or rows headed for feature **+** Fig. 2.2 **+** Fig. 2.3 ;
2 observable differences between Fig. 2.2 and Fig. 2.3 ; [3]

[Total: 19]

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