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BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 2016**

MARK SCHEME

Maximum Mark: 40

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I	ignore

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1 (a) (i) *(decides level of water)*
two levels of water drawn **+** labelled 'before' **+** 'after' **;**
bottom level drawn still above / covering the level of reducing sugar Visking tubing **;** [2]

(ii) *(decisions on completion of table)*
correct volumes of **G** for four further dilutions **;**
correct total volumes of 10 for each concentration **;** [2]

(iii) *(recording results)*
1. heading (top left of data), % / percentage concentration of reducing sugar solution **;**
2. heading (any column / row), time **+** seconds **;**
3. *collects* readings of reducing sugar solutions as whole seconds **;**
4. concentration at top **+** other concentrations in decreasing order **;** [4]

(iv) *(decision about variable to standardise)*
volume / 3 cm^3, of Benedict's (solution) **or** volume / 2 cm^3, of **U** / sample **or** temperature (of water-bath) **;** [1]

(v) *(interprets results)*
time recorded in whole seconds **+** correct units **;** [1]

(vi) estimate for **U** matches results in **(a)(iii)** **;** [1]

(b) (i) *(line graph)*
1. (*x*-axis) percentage concentration of sucrose solution **+** (*y*-axis) time (to) decolourise potassium manganate(VII) solution / s **;**
2. (scale on *x*-axis) 0.5 to 2 cm **+** labelled at least every 2 cm **+** (scale on *y*-axis) 40.0 to 2 cm, labelled at least each 2 cm **;**
3. correct plotting of five points with a small cross **or** dot in circle **;**
4. five plots **+** thin line drawn **;** [4]

(ii) *(interpretation)*
correctly reads from graph time to decolourise at 1.75% **;**
correctly reads from graph time to decolourise **+** units **;** [2]

(iii) *(conclusion)*
more substrate / higher enzyme activity **;**
more active sites occupied / bind / join **or** more enzyme-substrate complexes / ESCs **;** [2]

(iv) *(modifications)*
1. (standardise sucrose concentration) using same (sucrose) concentration **or** named sucrose concentration **;**
2. (independent variable pH) at least five pH **or** five examples **;**
3. (method) use of buffers (to make pH at regular intervals) **;** [3]

[Total: 22]

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2 (a) (i) *(plan diagram)*

1. plan diagram of appropriate size **+** no shading **;**
2. no cells **+** correct section drawn **;**
3. endodermis shown by two lines in the correct proportions **;**
4. uses one label line **+** one label to xylem **;** [4]

(ii) *(drawing)*

1. quality of line for outer wall of cells **+** size at least 40 mm across largest cell **;**
2. only four cells drawn, each cell touching at least one other cell **;**
3. cell walls drawn as two lines close together **;**
4. cells drawn with correct proportion of length to width **;**
5. uses one label line **+** one label to cell wall **;** [5]

(b) (i) *(calculation)*

collects correct measurements of lines **K**, **L**, **M**, **N**, **O +** correct units for each measurement **;**
shows division by the magnification (25) **;** [2]

(ii) *(displays and division)*

shows addition of 5 measurements **+** shows division by 5 **;**
correct answer **+** correct units **;** [2]

(iii) *(conclusion)*

aquatic **+** air cavities for buoyancy **or** support **or** providing / storing oxygen **;** [1]

(c) *(observable difference between root on **J1** and stem in **Fig. 2.2**)*

organises comparison into three columns with one column for features, one headed **J1** and one headed **Fig. 2.2 ;**
any three observable differences of comparison **;;;**
e.g. **J1** has smaller air cavities than **Fig 2.2** [4]

[Total: 18]

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BIOLOGY **9700/32**

Paper 3 (Advanced Practical Skills 2) **May/June 2016**

MARK SCHEME

Maximum Mark: 40

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1 (a) (i) *(measures room temperature)*
whole number **or** to half a degree **+** °C **;** [1]

(ii) *(decides on intervals for temperatures)*
at least three additional temperatures **+** whole numbers **+** at even intervals **+** °C **;** [1]

(iii) *(recording results)*
1. table drawn **+** heading, temperature **+** °C **;**
2. heading, height **or** length (of foam) **+** mm **;**
3. records results for at least four temperatures **;**
4. correct pattern of results **;**
5. height **or** length (of foam) recorded as whole mm **;** [5]

(iv) *(sources of error with reason)*
appropriate error with reason **;**
e.g. difficulty of maintaining temperature within acceptable range
appropriate error with reason **;**
e.g. difficulty of measuring foam as not even layer in test tube [2]

(v) *(decides on control)*
boils yeast suspension **or** replaces yeast cell suspension with same volume of water **;** [1]

(vi) *(conclusion)*
(as temperature increases) *ref. to* more kinetic energy **;**
more successful collisions **or** more enzyme-substrate-complexes / ESCs formed **;** [2]

(vii) *(modification to investigate another variable)*
1. (to standardise temperature) stated temperature **+** thermostatically controlled water-bath **;**
2. (independent variable) at least five pHs **;**
3. (method) *ref. to* use of buffers **;** [3]

(b) (i) *(line graph)*
1. (*x*-axis) percentage concentration of glucose solution **+** (*y*-axis) volume of CO_2 released / cm^3 **;**
2. (scale on *x*-axis) 2.0 to 2 cm, labelled at least each 2 cm **+** (scale on *y*-axis) 2.0 to 2 cm, labelled at least each 2 cm **;**
3. correct plotting of five points with a small cross **or** dot in circle **;**
4. five plots **+** thin line drawn **;** [4]

(ii) *(interpretation)*
correctly reads from graph the volume of CO_2 at 3.5% **;** [1]

[Total: 20]

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2 (a) (i) *(plan diagram)*

1. plan diagram of appropriate size **+** no shading **;**
2. no cells **+** at least two vascular bundles **+** correct section drawn **;**
3. vascular bundle divided into at least two regions **;**
4. depth of one vascular bundle drawn in correct proportion to width of lamina **;**
5. uses one label line **+** one label to xylem **;** [5]

(ii) *(drawing)*

1. quality of line for outer wall of cells **+** size at least 40 mm across largest cell **;**
2. only four cells drawn, each cell touching at least one other cell **;**
3. cell walls drawn as two lines close together **;**
4. cells in a chain form part of a circle **;**
5. uses one label line **+** one label to cell wall **;** [5]

(b) *(calculation)*

1. *collects* number of eyepiece gratitude units equal to the length of the vascular bundle **;**
2. records whole numbers for eyepiece graticule units **;**
3. shows multiplication of numbers for eyepiece graticule units by 29.5 μm **;**
4. answer shown to appropriate accuracy **+** μm **;** [4]

(c) (i) *(observable differences between the leaf on **M1** and the leaf in **Fig. 2.2**)*
organises comparison into three columns with one column for features, one headed **M1** and one headed **Fig. 2.2** **;**
any three observable differences of comparison **;;;**
e.g. **M1** has more vascular bundles than **Fig. 2.2** [4]

(ii) *(conclusion)*
(feature) thick cuticle or sunken stomata or few stomata **;**
(explanation) reduces evaporation or reduces transpiration **;** [2]

[Total: 20]

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BIOLOGY **9700/33**

Paper 3 (Advanced Practical Skills 1) **May/June 2016**

MARK SCHEME

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1 (a) (i) *(risk assessment)*
(hydrogen peroxide) harmful **or** irritant **+** medium **or** high **;** [1]

(b) (i) *(measures room temperature)*
whole number **or** to half a degree **+** °C **;** [1]

(ii) *(decides on interval for temperature)*
at least three additional temperatures **+** whole numbers **+** even intervals **;**
°C **;** [2]

(iii) *(recording results)*
1. table drawn **+** heading, temperature **+** °C **;**
2. heading, time **+** seconds **;**
3. records results for at least five temperatures **;**
4. correct pattern of results **;**
5. times recorded as whole seconds **;**
6. records results for repeats **+** means calculated **;** [6]

(iv) *(source of error with reason)*
appropriate error with reason **;**
e.g. concentration of hydrogen peroxide decreases
appropriate error with reason **;**
e.g. different volumes of extract on each square of filter paper [2]

(v) *(conclusions)*
(as temperature increases, activity increases) more successful collisions **or** more enzyme-substrate-complexes / ESCs **;**
(decreased / no activity) denatures **or** changed shape of active site **;** [2]

(vi) *(modification to investigate another variable)*
1. (to standardise temperature) stated temperature **+** thermostatically controlled water-bath **;**
2. (independent variable) at least five concentrations of catalase **;**
3. (method) simple dilution / proportional dilution / serial dilution **;** [3]

(c) *(chart)*
1. (*x*-axis) different plant species **+** (*y*-axis) initial rate of activity of catalase / s^{-1} **;**
2. (scale on *x*-axis) even width of bars **+** (scale on *y*-axis) 0.05 to 2 cm, labelled at least each 2 cm **;**
3. correct plotting of five bars **;**
4. five bars labelled with each horizontal line drawn as a thin line **+** each column labelled **;** [4]

[Total: 21]

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2 (a) (i) *(plan diagram)*

1. plan diagram of appropriate size **+** no shading **;**
2. no cells **+** at least two vascular bundles **+** correct section drawn **;**
3. epidermis drawn as two lines drawn closely together **;**
4. line drawn to show area of cells located at tip of leaf **;** [4]

(ii) *(drawing)*

1. quality of line for outer wall of cells **+** size at least 50 mm across largest cell **;**
2. only four cells drawn, each cell touching at least one other cell **;**
3. cell walls drawn as two lines close together **;**
4. one cell which shows a difference from other cells **;**
   e.g. cell contains an inclusion
5. uses one label line **+** one label to cell wall **;** [5]

(b) (i) *(ratio)*

1. measures depth of midrib **+** diameter of the vascular bundle **;**
2. records whole numbers **or** to 0.5 for both measurements **;**
3. *decides to* use same units for both measurements **;**
4. displays, in final ratio, larger number to smaller number **;**
5. final answer as simplest ratio **;** [5]

(ii) *(conclusion)*

(habitat) water **+** (feature) large air spaces **or** more air spaces **or** AVP **;** [1]

(c) *(observable difference between leaf on **K1** and leaf in **Fig. 2.2**)*

organises comparisons into three columns with one column for features, one headed **K1** and one headed **Fig. 2.2 ;**

any three observable differences of comparison **;;;**

e.g. **K1** has more vascular bundles than **Fig. 2.2** [4]

[Total: 19]

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BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 2016**

MARK SCHEME

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1 (a) (i) *(decides sampling times)*
(0) 5 **+** 10 **+** 15 **+** or every 5 **+** minutes **;** [1]

(ii) *(decides on reagent and method to test for starch)*
iodine solution or **I** **+** add to sample **+** orange / yellow / brown if starch absent **or** (blue-)black if starch present **;** [1]

(b) *(risk assessment)*
(acid / amylase / potassium manganate(VII)) harmful **or** irritant **+** medium **or** high **;** [1]

(c) (i) *(collects room temperature)*
records whole number **or** to 1 decimal place **+** °C **;** [1]

(ii) *(recording results)*
1. table drawn **+** heading (sample time) **+** minutes **;**
2. appropriate heading for raw results **;**
3. appropriate colours recorded for starch test for at least four times including 20 minutes **;**
4. correct pattern of results **;**
5. processed times recorded as whole seconds **;** [5]

(iii) *(interpretation of significant error)*
correct calculation of difference **+** not significant **;**
A significant *if difference 5 °C or more* [1]

(iv) *(conclusions)*
1. (more heat energy / higher temperature*) idea of* (more / increase in) kinetic / movement energy **;**
2. (more heat energy / higher temperature) *idea of* more successful collisions between **S** and **E** **or** more active sites bind / join with substrate **or** more enzyme substrate complexes / ESCs **;**
3. (at high temperature **or** increasing by 30 °C **or** above the optimum) *idea of* denatured or active site changes shape (so fewer ESCs) **;** [3]

(v) *(modifications)*
1. at least five pH **or** five examples **;**
2. use of <u>buffer</u>s **;**
3. remove sample after set time / example of time **or** test with iodine and *idea of* looking for a colour change **or** test with potassium manganate(VII) and time taken to decolourise **;** [3]

(d) (i) *(line graph)*
1. (*x*-axis) percentage concentration of starch **+** (*y*-axis) initial rate of reaction of amylase / arbitrary units **;**
2. (scale on *x*-axis) 1.0 to 2 cm **+** labelled at least every 2 cm **+** (scale on *y*-axis) 100.0 to 2 cm **+** labelled at least each 2 cm **;**
3. correct plotting of six points with a small cross **or** dot in circle **;**
4. six plots **+** thin line drawn **;** [4]

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(ii) *(display of calculations)*
1. shows on the graph V_{max} line at top of curve to the *y*-axis from the maximum rate of reaction **;**
2. shows on the graph how K_m is read off at half V_{max} **;**
3. correct answer for K_m from candidate's graph **;** [3]

[Total: 23]

2 (a) (i) *(plan diagram)*
1. plan diagram of appropriate size **+** no shading **;**
2. no cells **+** only two whole vascular bundles **+** epidermis drawn **;**
3. epidermis shown by two lines in the correct proportions **;**
4. all vascular bundles divided into at least three regions **;**
5. uses one label line + one label to xylem in any on vascular bundle **;** [5]

(ii) *(drawing)*
1. quality of line for outer wall of cells **+** size at least 40 mm across largest cell **;**
2. draws **only** four whole cells **+** each cell of the group must touch at least two other cells **;**
3. at least one intercellular space **;**
4. cell walls drawn as two lines close together **;**
5. uses one label line **+** one label to cell wall **;** [5]

(b) (i) *(calculation)*
1. collects correct measurement of length of scale bar **+** length of line drawn across cell **X +** correct units **;**
2. displays correct method for calculation **;**
3. correct answer to calculation **;** [3]

(ii) *(observable difference between stem on **N1** and root in **Fig. 2.1**)*
organises comparison into three columns with one column for features, one headed **N1** and one headed **Fig. 2.1 ;**
any three observable differences of comparison **;;;**
e.g. **N1** has smaller xylem vessels than **Fig 2.1** [4]

[Total: 17]

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BIOLOGY **9700/35**

Paper 3 (Advanced Practical Skills 1) **May/June 2016**

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1 (a) (i) *(decisions on serial dilutions)*
1. correct concentrations of 0.5, 0.25, 0.125, 0.0625 **+** % **;**
2. shows transfer of 10 cm^3 of 1(%) to next dilution **+** 10 cm^3 transferred from 2nd to 3rd beaker and from 3rd to 4th and from 4th to 5th **+** cm^3 **;**
3. adds 10 cm^3 of water to each beaker **;** [3]

(ii) *(interpretation of percentage error)*
(actual error) ± half the smallest division on syringe **;**
(percentage error) correct answer using actual error **;** [2]

(iii) *(recording results and completing column headings)*
1. heading, percentage concentration of glucose **+** (units for time) seconds **;**
2. records results for times and colours for five concentrations of glucose solutions **;**
3. result for time for first colour 1% concentration of glucose is faster than for the lowest concentration of glucose recorded **;**
4. times recorded as whole seconds **;** [4]

(iv) *(decides how to standardise Benedict's test)*
decides to use the same volumes of glucose and Benedict's (2 cm^3) **;**
decides to heat water-bath to boiling **;** [2]

(v) *(collects result for solution **P**)*
records time **+** seconds **+** colour for solution **P** **;** [1]

(vi) *(interprets result for solution **P**)*
correct estimate for concentration of solution **P** **;** [1]

(vii) *(improvement)*
use colorimeter **or** carry out repeats **or** use more concentrations within range of the estimate **;** [1]

(viii) *(improvement)*
draw a calibration curve **;**
read off concentration of unknown from the calibration curve **;** [2]

(b) (i) *(graph)*
1. (*x*-axis) time after eating the meal / minutes **+**
(*y*-axis) concentration of glucose in blood plasma / mmol dm^{-3} **;**
2. (scale on *x*-axis) 20.0 to 2 cm, labelled at least each 2 cm **+**
(scale on *y*-axis) 0.5 to 2 cm, labelled at least each 2 cm, with 5 at the origin **;**
3. correct plotting of five points with a small cross **or** dot in circle **;**
4. five plots with either ruled lines exactly point to point **or** smooth curve drawn as thin line **;** [4]

(ii) *(calculation)*
shows 6.750 minus 5.125, divided by 5.125 and multiplied by 100 **or** alternative correct method **;** [1]

(iii) *(conclusion)*
draws one label line and label **X** to indicate the section of the graph between time at 0 minutes and time at 20 minutes **;** [1]

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(iv) *(conclusion)*
ref. to glucose used by the cells (for respiration) or AVP **;** [1]

[Total: 23]

2 (a) (i) *(plan diagram)*
1. plan diagram of appropriate size **+** no cells **;**
2. at least three layers of tissue (4 lines) **+** correct section drawn **;**
3. draws tissue layer beneath epidermis **;**
4. diameter of the stele approximately a third of the diameter of the root **;**
5. uses one label line **+** label **Z** to the endodermis **;** [5]

(ii) *(conclusion)*
root **+** stele / xylem / vascular tissue in the centre **;** [1]

(iii) *(drawing)*
1. quality of line for outer wall of cells **+** size at least 40 mm across largest cell **;**
2. only four cells drawn **+** each cell touching two of the other cells **;**
3. cell walls drawn as two lines close together **;**
4. records at least one air space between the cells **;**
5. uses one label line **+** one label to cytoplasm of one cell **;** [5]

(b) *(calculation of magnification)*
1. measures line **A** – **B** correctly in whole mm **or** 0.5 mm **;**
2. shows measurement for **A** – **B**, converted to micrometres, divided by 3000 or measurement for **A** – **B** in millimetres divided by 3 **;**
3. correct magnification from calculation **;** [3]

(c) *(observable similarities between organ on **L1** and that shown in **Fig. 2.2**)*
organises table so that one column for features **;**
any two observable similarities **;;**
e.g. **L1** and **Fig. 2.2** stele / vascular bundle in centre [3]

[Total: 17]

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