CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

9700/31 Paper 3 (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, which would have considered the acceptability of alternative answers.

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Mark scheme abbreviations:

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AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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1 (a) (i) volume given the same or more than **G** (4–10 inclusive) **;** [1]

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

headings temp(erature) / °C **+** time / s or sec(onds) **;** [2]

(iii) answer according to candidates results + further qualification **;**

use of data (at least two temperatures AND two references to time)
or
idea of an increase in kinetic energy increases the rate of reaction **;** [2]

(iv) statement of temperature with units °C + valid reason **;** [1]

(v) shows transfer of 15 cm^3 (of 2% to the next dilution)
+ adds 15 cm^3 of (distilled) water / **W ;**

1(.0)% AND 0.5% **;** [2]

(vi) all four volumes correct **;**

solution	**volume/cm^3**
Benedict's	same volumes as stated in **(a) (i)**
glucose	4
S1	4
S2	4

[1]

(vii) records 6 times (for 4 concentrations of glucose + **S1** + **S2**) **;**

records whole seconds only **;**

highest concentration of glucose is shortest time **;** [3]

(viii) shows position of 0.5, 1(.0) and 2(.0), scale – one space = 0.5 **;**

shows position of **S1 + S2** correctly according to their results **;** [2]

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(ix) more / wider / narrower range of glucose concentrations ;

do individually / each test-tube separately to prevent timing error
or
replicate / repeat ;

idea of thermostatically-controlled water-bath ;

use of white card / tile to observe colour change ; [max 3]

(x) syringe or thermometer or stopwatch **+** no effect **+** if use same syringe or thermometer or stopwatch
or
idea of different syringe used **+** systematic error **+** not true value ; [1]

[Total: 18]

2 (a) (i) at least 2 lines for upper epidermis **+** 2 lines for lower epidermis **+** vascular bundle **+** size at least 60mm across midrib **+** no shading ;

no cells **+** one complete vascular bundle in the midrib **+** vascular bundle subdivided ;

one concave surface and one convex surface **+** enclosed area beneath or above (or around) the vascular bundle ;

uses label line **+** label to xylem ; [4]

(ii) at least 6 cells **+** size at least 20 mm across largest cell at narrowest **+** sharp continuous lines ;

only 2 groups of 3 cells drawn, each cell touching at least one other cell ;

one cell has at least 3 corners ;

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

use label line(s) + label to <u>one</u> lumen ; [5]

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(b) (i) correct measurement of line **X** (18–20 mm or 1.8–2(.0) cm) **;**

uses mm and converts to μm by multiplying by 1000 **;**

shows division by 230 **;**

rounds answer to one decimal place **;** [4]

(ii) idea of stomata / guard cell(s) **+** closed
+ reduces transpiration or evaporation or diffusion of water **;** [1]

(c) **mp1** organise as table with 3 columns headed feature **+** Fig. 2.2 **+** Fig. 2.3 **;**

max 3 for differences

mp	feature	Fig. 2.2	Fig 2.3
2	guard cells **size**	(some) large(r) / thicker	(some) small(er) / thinner **;**
3	nucleus of the guard cells	rounder or small(er) / short(er)	more elongated or large(r) / long(er) **;**
4	stomata **shape or length**	narrow / elongated / slits or long(er)	oval or short(er) **;**
5	stomata / guard cell **number**	few(er)	more **;**
6	(epidermal) cells **shape** or **size**	narrow / elongated / rectangular / oblong or longer / narrower	irregular / star-shaped / convoluted or shorter / wider **;**
7	(epidermal) cells **wall**	small indentations wavy	large indentations smooth **;**
8	number of types of cells	more	less **;**
9	arrangement of any cells	in rows / lines / linear / parallel	scattered / random **;**
10	line or strip	present	absent **;**

[max 4]

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(d) (x-axis) concentration of CO_2 μmol mol^{-1}
+ label on blocks upper epidermis / U, lower epidermis / L, 380 **+** 560**+** 800
+ (y-axis) mean number of stomata / mm^2 **;**

(x-axis) even width of blocks and even distance between blocks **+**,
+ (y-axis) 20 to 2 cm labelled every 2 cm, except 0 **;**

correct plotting of each bar in the same order as the table
+ ruled sharp line **;**

all vertical lines drawn as ruled sharp lines + all lines meeting exactly
+ labels for upper and lower must either be directly below the correct bar or inside the bar or shaded with a key **;** [4]

[Total: 22]

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

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

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1 (a) (i) (labels under correct sequence of beakers) **+** 10 **+** 5 **+** 2.5 **+** % **;**
adds previous concentration of **C** to each of the last two beakers **+** 10cm^3 **;**
adds water / **W +** 10 cm^3 to three beakers **;** [3]

(ii) organised into table **+** all columns separated by a line **+** all headings underlined **;**
headings (top or to left of data) percentage concentration **+** (any column/row headed) time (/)s or seconds **;**
whole seconds for at least three concentrations **;**
records highest concentration first **;**
highest concentration recorded in shorter time than next concentration **;** [5]

(iii) (dependent) stage 3 or end-point **+** *idea of* judging / determining **;** [1]

(iv) syringe or thermometer **+** no effect **+** if use same syringe or thermometer **;** [max 1]
or
syringes **+** affect accuracy **+** not true value **;**

(v) replaces calcium chloride / **C** with water **;** [1]

(b) (i) calcium chloride
+ optimum % conc. of calcium chloride from investigation or stated figure % e.g. 20% **;**

type of milk or volume of milk
+ <u>same</u> milk or <u>same</u> volume or stated volume e.g. 2 cm^3 **;**

temperature of water-bath
+ use 70 °C maintained by thermostatically controlled water-bath
or
temperature of milk (reaching desired temperature)
+ check temperature of milk has reached 70 °C
or milk (has reached) 70 °C (before enzyme added) **;**

volume of enzyme
+ use <u>same</u> volume of **E** or stated volume e.g. 1 cm^3 of **E**
or
concentration of enzyme / **E**
+ use <u>same</u> conc. of **E** or 1% **E ;** [max 2]

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(ii) (*x*-axis) time of heating solution **E** / seconds
+ (*y*-axis) time to reach the end-point / seconds **;**

(*x*-axis) 2 cm to 50 seconds, labelled each 2 cm, except origin and 300 seconds
+ (*y*-axis) 2 cm to 50 seconds, labelled each 2 cm, except origin and 250 **;**

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

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

(iii) structure of protein / substrate / enzyme / active site or bonds
+ changed / altered / destroyed / no longer complementary / broken **;**

fewer ESCs / Enzyme Substrate Complexes or less substrate can bind **;**

idea of enzyme denatured **;** [3]

[Total: 20]

2 **(a)** at least 3 lines **+** size at least 40 mm across greatest width of root tip **+** no shading **;**
no cells **+** one closed end with one open end **;**
root cap as separate area or two lines around margin **;**
chooses (correct) area to cells undergoing mitosis **;**
label (e.g. mitosis) to area with cells undergoing mitosis **;** [5]

(b) at least 5 cells **+** size at least 50 mm across largest cell at widest point **+** sharp continuous lines **;**
only 5 whole cells drawn **+** enclosure drawn in cells **Q** and **S** **;**
for cells **P**, **R** and **T** whole nuclei drawn as different shapes **;**
for **Q** chromosomes drawn as a mass **;**
2 labels **+** 2 lines **+** 2 different stages of mitosis identified **;**
one correct annotation of one stage **;** [6]

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

shows conversion of scale bar in mm to μm (× 1000)
or
shows conversion of 31 μm to mm (31 divided by 1000 = 0.031 mm) **;**

show measurement of scale bar in μm divided by 31 μm
or
shows measurement of scale bar in mm divided by 0.031 mm **;**

correct answer 451.61 / correct answer rounded to a whole number (452) **; ecf** [4]

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(d) organise as table with 3 columns headed feature **+** Fig. 2.1 **+** Fig. 2.2 **;** [5]

max 4 for differences

point of comparison	**Fig 2.1**	**Fig 2.2**
cells undergoing mitosis	more	few(er)
visibility of chromosomes	chromosome / chromatids visible	chromosome / chromatids not visible **;**
metaphase or anaphase	present / (one cell in) metaphase / anaphase	absent / no metaphase / anaphase **;**
interphase or telophase	less **or** no telophase	more **or** (one / two cells in) telophase **;**
cell walls **or** cell shape **or** cell arrangement	not visible / absent **or** rectangular / 4 sides **or** scattered / irregular / random	prominent / present **or** 6 sides / 5 sides **or** aligned / regular / ordered **;**
cell packing **or** air spaces **or** cells touching	loosely packed / more spaced out / separated **or** more air spaces **or** have spaces between cells or cells not touching	closely packed / less spaced out; **or** none or few air spaces **or** have no spaces between cells or cells touching **;**
nucleus	present **or** all cells show a nucleus	not all cells show a nucleus or some cells have a nucleus **;**

[max 5]

[Total: 20]

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

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

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1 (a) (i) records volume of **H** as whole number (or to 0.5) **+** cm^3 **;** [1]

(ii) records length of time as every 2 minutes, e.g. 2, 4, 6, 8 **+** 10 minutes **;** [1]

(iii) *source of error*
end of delivery tube different level in each test-tube
or time to transfer delivery tube different each time
or loss of $\underline{CO_2}$ from delivery tube **;**

description
mark delivery tube or test-tube
or keep clock running, record time delivery tube in **C**
or seal end of delivery tube during transfer **;** [max 2]

(iv) organised into table all columns separated by a line **+** all headings underlined **;**
headings (top or to left of data) time / minutes **+** (any column / row headed) volume of **H** / hydrochloric acid / HC*l* / cm^3 **;**
collects readings for at least 4 volumes **;**
records all volumes less than volume recorded in **(a)(i) ;**
all results to no more than one decimal place **;** [5]

(v) difficult judging colour of end-point (blue / cloudy yellow) or mixing **H** and **C** varies for each test-tube **;** [1]

(vi) syringe or ruler **+** no effect **+** if use same syringe or ruler
or
syringe or ruler **+** results not accurate **+** not true value **;** [max 1]

(b) (i) (*x*-axis) even bar widths (**R** + **T**) up to 1 cm **+** (*y*-axis) labelled mean leaf area / cm^2 $plant^{-1}$ × 103 **+** scale (zero at origin) 1.0 to 2 cm, labelled every 2 cm **;**

correct plotting of each bar, in the order in the table, with horizontal, ruled sharp line **;**

(bars) quality of vertical lines, ruled, sharp lines that meet horizontal line exactly **+** labelled with clear labels (**R** and **T**) **;**
labels must be directly below bars or inside bars or shaded with key [3]

(ii) (for **R** + **T**) as concentration of $\underline{CO_2}$ increases the leaf area increases **;**
quoted figures to support idea that plant **R** has greater mean leaf area than plant **T** at highest concentration of CO_2
or
mean leaf area of plant **T** increased less between 380 and 719 than **R ;** [max 2]

(iii) the higher leaf area for **R** the more transport **;**
increased transpiration or translocation **;** [2]

(c) at least 2 lines for upper epidermis and 2 lines for lower epidermis
+ one enclosed area **+** size at least 80 mm for depth of midrib **+** no shading **;**

no cells **+** one enclosed area (vascular bundle) **;**
correct proportion of vascular bundle in relation to distribution of tissues in midrib **;**
uses label line and label to vascular bundle **;** [4]

[Total: 22]

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2 (a) (i) at least 9 separate cells in total drawn in boxes **S1**, **S2** and **S3 +** size at least 10 mm across largest cell, in any box **;**
from 2 to 6 whole cells (not overlapping) drawn in each of the boxes **S1**, **S2** and **S3 ;**
drawn only 3 cells in each of the three boxes **;**
at least one colour stated for each of the cells in the boxes **S1**, **S2** and **S3 ;** [4]

(ii) **S1** – 100 (°C)
S2 – 45 (°C)
S3 – 80 (°C) **;** [1]

(iii) yeast cells blue **+** therefore inactive or dead **;** [1]

(iv) heat to at least two named temperatures, at least 10 °C apart, between 45 °C and 80 °C **;**
count dead / blue yeast cells (from sample of yeast cells) **;**
plots graph to find unknown temperature **;** [3]

(b) (i) at least 4 whole cells **+** no shading **+** size at least 20 mm across cell with greatest width **+** sharp and continuous outer line **;**

only five whole cells **;**
at least 2 cells with inclusions **;**
at least 2 cells with buds **;**
uses label line and label to nucleus or cytoplasm **;** [5]

(ii) five (measurements) between (9 mm to 15 mm) **+** to 0.5 mm **;**
shows addition of measurements **+** shows division by number of measurements **;**
show division by 1200 **;**
shows conversion of mm to μm as × 1000 **+** units **;** [4]

[Total: 18]

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GCE Advanced Subsidiary Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

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

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1 (a) (i) idea of increase ; [1]

(ii) stated volume or same volume of sample or starch **+** syringe ; [1]

(iii) two levels drawn and labelled with 'before' ;
+ 'after' **+** water level after lower than before ;

lowest level still covers contents of Visking tubing ; [2]

(iv) stated volume or same volume of sample or starch **+** syringe ; [1]

(v) all columns separated by a line **+** all headings underlined ;

(top or left of data) time (/) min(utes) ;
+ (any column / row headed) vol(ume) of iodine or I cm^3 or ml(s) ;

records results at four times (0, 5, 10, 15) ;

records a value for 5 minutes that is lower than the rest ;

all values to one decimal place ; [5]

(vi) check results against answer to **(a)(i)** *must show agreement* ; [1]

(vii) idea of serial dilution or simple dilution (of 1%) ;

use graph to find % concentration ; [2]

(viii) syringe or stopwatch **+** no effect **+** if use same syringe or stopwatch
or
idea of different syringe used **+** systematic error **+** not true value ; [max 1]

(b) (i) (*x*–axis) vol(ume) of iodine (/) cm^3
+ (*y*–axis) percent(age) or % of starch reacted (with iodine solution) ;

(*x*–axis) 0.5 to 2 cm labelled each 2 cm except origin and 3.0 / 3.5
+ (*y*–axis) 20 to 2 cm labelled each 2 cm except origin and 100 ;

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

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

(ii) correct estimation from graph by shown extrapolation ; [1]

(iii) idea of too much ascorbic acid then iodine may not stain
or
idea of having to add more iodine in order to observe colour ;

need to know how much ascorbic acid in plant tissues to make test accurate ; [max 2]

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(iv) use 3 cm^3 or more of iodine or more iodine, or excess iodine
or
the volume given in **(b)(ii)** or more **;** [max 1]

[Total: 22]

2 (a) (i) at least 3 enclosed areas **+** size 40 mm across largest enclosed area at widest point **+** sharp continuous line **+** no shading **;**

only three complete enclosed areas
+ each enclosed area touching at least one other enclosed area **;**

nucleus drawn **+** membrane no more than twice the width of the nucleus **;**

uses label line **+** label to only one nucleus **;** [4]

(ii) correct label line to the surface of the alveoli **;** [1]

(iii) air space / large surface area / wall one cell thick / thin alveolar wall **;**

diffusion or idea of more efficient gas exchange **;** [2]

(b) (i) **Z** to closed guard cells **;**

idea of stomata / guard cell / air space(s) **+** closed
+ reduces diffusion of water or reduces evaporation **;** [2]

(ii) at least whole 5 cells **+** size of the largest cell at its largest dimension at least 50 mm
+ no ruled lines **+** no shading **;**

draws only whole cells within the boundary **+** at least five cells **;**

length of stomatal gap is the same or shorter than the length of the guard cell on the right **;**

shows inclusions in the three largest cells **;**

correctly labelled with label line to only one guard cell **;** [5]

(iii) measures scale bar to 22 **+** mm **+** to within 1 mm **;**

(A) shows conversion of scale bar in mm to μm (× 1000)
or
(B) shows conversion of 54 μm to mm (54 divided by 1000 = 0.054 mm) **;**

(A) show measurement of scale bar in μm divided by 54 μm
or
(B) shows measurement of scale bar in mm divided by 0.054 mm**;**

(A) and **(B)** rounds answer to a whole number**;**

[4]

[Total: 18]

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9700 BIOLOGY

9700/35 Paper 35 (Advanced Practical Skills 1), maximum raw mark 40

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1 (a) (i) (middle of winter) blue-black **+** (beginning of spring) lighter blue-black **+** (middle of spring) orange / red / brown **;**
all three correct for one mark [1]

(ii) iodine (solution) **;**
(of iodine) same volume / same number of drops / stated number of drops
+ (of starch) same volume / same number of drops / stated number of drops **;** [2]

(iii) organised into table all columns separated by a line **+** all headings underlined **;**
records colours for at least 3 solutions **;**
records correct colour for **S2** (most blue / black) **+ S3** (orange / yellow) **;** [3]

(iv) **S2** (middle of winter) **+ S1** (beginning of spring) **+ S3** (middle of spring) **;** [1]

(v) headings (top or to left of data) samples **+** (any column / row headed) time (/) seconds **;**
(record results as) whole seconds (less than 300) **;**
(shows correct pattern) **G1** longest time **+ S3** shortest time **;** [3]

(vi) greater than 1% **;** [1]

(vii) **mp1** more glucose concentrations above 1% **;**
mp2 two named examples of concentrations above 1% **;**
mp3 repeat experiment at least twice **;**

mp4 thermostatically controlled water-bath for the Benedict's test
or
use graduated pipette or burette or syringe with smaller divisions **;**

mp5 video camera / play back (of appearance of first colour)
or
perform each test separately or stagger start or use help **;** [max 3]
max 1 for mp3, mp4 and mp5

(viii) syringe or thermometer **+** no effect **+** same syringe / thermometer used
or
syringe or thermometer **+** affects accuracy **+** not true value **;** [max 1]

(b) (i) *x*-axis: *x*-axis time in storage / days **+** *y*-axis: mean percentage change in water content **;**

scale *x*-axis 5 to 2 cm, labelled each 2 cm, except origin and 25 **+** *y*-axis 5 to 2 cm, labelled each 2 cm, except origin and 20 **;**

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

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

(ii) (20 day sample has highest percentage gain in mass) so water potential lowest in cells (in roots stored for 20 days) **;**
steeper water potential gradient **+** more water molecules diffuse or more water molecules move by osmosis **+** into carrot cells **;** [2]

[Total: 21]

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2 **(a)** at least 4 enclosed areas in total + size at least 70 mm across largest vessel **+** no shading **;**
no cells + only 2 complete vessels **;**
at least one vessel with wall with at least two layers **;**
one vessel drawn with thicker wall than other vessel **;**
uses label line and label to inner (endothelium) layer in vessel with thicker wall and narrower lumen + statement that is folded ora
or
two label lines, each annotated, folded for artery and not folded for vein **;** [max 5]

(b) at least 5 cells + size at least 30 mm across largest cell at widest point + sharp and continuous lines **;**
only 5 whole cells drawn **;**
nuclei occupy most of the cytoplasm in at least 3 whole cells **;**
at least 3 nuclei in whole cells drawn as different shapes **;**
labels to nucleus + cytoplasm + membrane in one cell only **;** [5]

(c) **(i)** larger number of white blood cells in Fig. 2.1 **;**
idea of produced by uncontrolled / abnormal division / production **;** [2]

(ii) five measurements within range (12 mm – 18 mm) + mm + to 0.5 **;**
shows addition of measurements (e.g. plus sign) + shows division by number of measurements **;**
shows division by 500 **;**
shows conversion of mm to μm (×1000) **;** [4]

(d) **mp1** organise as table with 3 columns headed features **+** Fig. 2.2 **+** Fig. 2.3 **;**

mp	feature	Fig. 2.2	Fig. 2.3
2	nucleus	absent	present **;**
3	shape of cell	round / irregular	oval **;**
4	number of cells	more	few(er) **;**
5	size of cells	small(er)	big(ger) **;**

[max 3]

[Total: 19]

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