Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2020**

MARK SCHEME

Maximum Mark: 40

Published

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
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Science-Specific Marking Principles

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3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
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For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

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State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
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A	accept (for answers correctly cued by the question, or by extra guidance)
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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Question	Answer	Marks
1(a)(i)	1 three additional concentrations of milk **;** 2 correct volumes of milk and water **;**	**2**
1(a)(ii)	1 *heading for independent variable:* percentage concentration of milk (before heading for dependent variable) and no units in the body of the table ; 2 *heading for dependent variable:* time and seconds and no units in body of table ; 3 includes three times for each concentration of milk (raw data) ; 4 includes mean data (processed results) ; 5 all the results recorded to the nearest whole second ;	**5**
1(a)(iii)	describes correct trend in the results **;**	**1**
1(a)(iv)	records the time for **U** and units **;**	**1**
1(a)(v)	estimates the correct concentration of milk in **U ;**	**1**
1(a)(vi)	1 describes changing the copper sulfate solution for each trial as an improvement to the procedure **;** 2 describes using a wider test-tube as an improvement to the procedure **;** 3 identifies a different error, e.g. drop does not reach the bottom of the test-tube **;** 4 describes drawing a mark higher up the test-tube and timing to that mark as an the improvement to the procedure **;**	**4**
1(a)(vii)	states that error is random and gives reason e.g. error does not occur every time **;**	**1**
1(b)(i)	1 *x*-axis: type of mammal and *y*-axis: mean fat globule diameter / μm **;** 2 scale on *x*-axis: even width of bars and scale on *y*-axis: 2 μm to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of all bars **;** 4 bars drawn separated and labelled appropriately and with horizontal and vertical lines joined precisely **;**	**4**
1(b)(ii)	1 buffalo and large fat globules have a small surface area to volume ratio **;** 2 buffalo and less area for enzyme attachment compared to the volume of the fat globule **;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 suitable size <u>and</u> number of tissue layers ;
2 draws correct region of the root section <u>and</u> no cells drawn ;
3 correct proportions of stele compared to the diameter of the root ;
4 draws subdivision of the stele ;
5 label line <u>and</u> label to endodermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 suitable size <u>and</u> all lines sharp and continuous ;
2 draws only four whole cells ;
3 cell wall drawn as two lines around each cell <u>and</u> three lines where cells touch ;
4 each cell touches at least one other cell ;
5 label line <u>and</u> label to the lumen in one cell ;</td><td>5</td></tr>
<tr><td>2(b)</td><td>1 records at least one similarity <u>and</u> at least one difference ;
2, 3 and 4
any three from:

<table><tr><th>feature</th><th>Fig. 2.1</th><th>J1</th></tr><tr><td>similarities
position of vascular tissue
size of xylem lumens
shape of root</td><td>
central
large
circular</td><td>
central ;
large ;
circular ;</td></tr><tr><td>differences
hairs
endodermis
outer layer</td><td>
many
present
smooth / continuous</td><td>
fewer ;
absent ;
broken / not continuous ;</td></tr></table></td><td>4</td></tr>
<tr><td>2(c)</td><td>1 records measured diameter of the whole root section ;
2 records measured diameter of the vascular tissue ;
3 shows measurement for the diameter of the vascular tissue divided by the diameter of the whole root section ;
4 answer multiplied by 100 ;
5 (final answer) to the correct degree of accuracy ;</td><td>5</td></tr>
</table>

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Question	Answer	Marks
1(a)(i)	assesses the risk for the procedure as low or medium and valid reason ;	**1**
1(a)(ii)	1 four additional concentrations of yeast ; 2 correct volumes of yeast and water ;	**2**
1(a)(iii)	1 *heading for independent variable*: percentage concentration of yeast (before heading for dependent variable) and no units in body of table ; 2 *heading for dependent variable*: time and seconds and no units in body of table ; 3 times for all samples ; 4 time for the highest concentration of yeast shorter than for the lowest concentration of yeast ; 5 results recorded to nearest whole second ;	**5**
1(a)(iv)	1 identifies one error and gives reason e.g. end-point and hard to determine ;	**1**
1(a)(v)	1 describes the apparatus and suitable method used e.g. upturned measuring cylinder filled with water ; 2 for a set time ;	**2**
1(b)(i)	1 correct calculation of rate, e.g. 1.82 or 1.8 ; 2 correct units, e.g. cm s^{-1} ;	**2**
1(b)(ii)	1 *x*-axis: temperature / °C and *y*-axis: mean time to rise / seconds ; 2 scale on *x*-axis: 10 °C to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 20 seconds to 2 cm, labelled at least every 2 cm ; 3 correct plotting of all points using small crosses or dots in circles ; 4 plots joined with thin line passing through all points ;	**4**
1(b)(iii)	correct description of the trend ;	**1**

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Question	Answer	Marks
1(b)(iv)	*between 10 °C and 40 °C* 1 enzyme and substrate have more kinetic energy ; 2 more successful collisions or more enzyme substrate complexes formed ; *between 40 °C and 55 °C* 3 shape of the active site changes or enzyme denatures ; 4 substrate prevented from binding ; 5 fewer enzyme substrate complexes formed ;	**3**

Question	Answer	Marks
2(a)(i)	1 suitable size and no shading ; 2 draws only outline of tissues and no cells drawn ; 3 draws correct proportions of vascular bundle ; 4 draws subdivision of vascular bundle ; 5 label line and label to epidermis ;	**5**
2(a)(ii)	1 suitable size and lines sharp and continuous ; 2 draws only four whole cells and each cell touches at least two other cells ; 3 draws correct shape of cells ; 4 two lines around each cell and three lines where cells touch ; 5 label line and label to one cell wall ;	**5**
2(b)(i)	1 records measured total width of the stem ; 2 records measured width of the central air space ; 3 suitable units for measuring width of stem and width of central air space ; 4 (final answer) shows larger number to smaller number as a ratio and no units ; 5 (final answer) to the correct degree of accuracy ;	**5**
2(b)(ii)	replicate measurements and calculate mean ;	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(iii)</td><td>1 records only observable differences ;
2, 3 and 4
any three from:

<table>
<tr><th>feature</th><th>K1</th><th>Fig. 2.2</th></tr>
<tr><td>number of vascular bundles</td><td>many</td><td>fewer ;</td></tr>
<tr><td>shape of stem</td><td>irregular</td><td>circular ;</td></tr>
<tr><td>air spaces</td><td>absent</td><td>present ;</td></tr>
<tr><td>trichomes</td><td>present</td><td>absent ;</td></tr>
</table>
</td><td>3</td></tr>
</table>

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BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 2020**

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Question	Answer	Marks
1(a)(i)	1 *labels under correct sequence of beakers:* 1.0, 0.1, 0.01, 0.001, 0.0001 and % at least once **;** 2 shows transfer of 1 (cm^3) to each beakers from the previous beaker **;** 3 shows 9 (cm^3) of, **W** /water, added to each beaker **;**	**3**
1(a)(ii)	1 *heading for independent variable*: percentage concentration of starch (before heading for dependent variable) and no units in body of table **;** 2 *heading for dependent variable*: symbol **;** 3 symbols for all samples **;** 4 results for the highest concentration of starch more than for the lowest concentration of starch **;** 5 results recorded for the highest concentration of starch more than for the next concentration of starch **;**	**5**
1(a)(iii)	1 records results for **X** and **Y ;**	**1**
1(a)(iv)	1 estimates the correct concentrations of starch in **X** and **Y ;**	**1**
1(a)(v)	1 Benedict's reagent **;** 2 time to first colour change / prepare known colour standards **;** 3 five reducing sugar concentrations ; 4 compare unknown, time / colour, with known concentrations, times / colours ;	**3**
1(b)(i)	1 *x*-axis: concentration of maltose / mol dm^{-3} and *y*-axis: initial rate of reaction of maltase / arbitrary units **;** 2 scale on *x*-axis: 1 mol dm^{-3} to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 50 arbitrary units to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of all points using small crosses or dots in circles **;** 4 plots joined with thin line passing through all points **;**	**4**
1(b)(ii)	1 correct calculation of ½ V_{max} **;** 2 correct value for K_m from graph **;**	**2**
1(b)(iii)	maltase and has a higher K_m **;**	**1**

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Question	Answer	Marks
1(b)(iv)	*any **two** from:* *as substrate concentration increases* 1 more substrate molecules ; 2 more successful collisions or more enzyme substrate complexes formed ; *levels off because* 3 active sites are saturated ;	**2**

Question	Answer	Marks
2(a)(i)	1 suitable size and no shading ; 2 draws only correct region of the stem and no cells drawn ; 3 draws correct proportions of vascular bundle compared to the bulge ; 4 draws flattened vascular bundle ; 5 label line and label to xylem ;	**5**
2(a)(ii)	1 suitable size and all lines sharp and continuous ; 2 draws only four whole cells and each cell touches at least two other cells ; 3 draws correct shape of cells ; 4 two lines around each cell and three lines where cells touch ; 5 label line and label to one cell wall ;	**5**
2(b)(i)	1 records measured total diameter of the stem and units ; 2 records measured diameter of the inner layer and units ; *for total diameter or inner layer* 3 shows addition of three measurements and shows division by 3 and division by 32 ; 4 (final answer) to the correct degree of accuracy and units ;	**4**
2(b)(ii)	larger number to smaller number ;	**1**

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<table>
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2, 3 and 4
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<table>
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<tr><td>number of vascular bundles</td><td>many</td><td>fewer ;</td></tr>
<tr><td>shape of stem</td><td>circular</td><td>square ;</td></tr>
<tr><td>air space</td><td>absent</td><td>present ;</td></tr>
<tr><td>epidermis</td><td>thick</td><td>thin ;</td></tr>
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GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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7 Guidance for chemical equations

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Mark scheme abbreviations

;	separates marking points
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Question	Answer	Marks
1(a)(i)	1 *labels under correct sequence of beakers:* 1.0, 0.5, 0.25, 0,125 and % at least once ; 2 shows transfer of 10 (cm^3) from previous beaker transferred to the next beaker in sequence and cm^3 once ; 3 shows 10 (cm^3) of, **W** / water, added to each beaker and cm^3 once ;	**3**
1(a)(ii)	1 *heading for independent variable*: percentage concentration sugar and before heading for dependent variable) and no units in body of table ; 2 *heading for dependent variable*: time and s(econds) and no units in body of table ; 3 times for all concentrations ; 4 correct trend in results ; 5 results recorded to nearest whole second ;	**5**
1(a)(iii)	records the time for **U** and s(econds) ;	**1**
1(a)(iv)	estimates the correct concentration of reducing sugar in **U** from the results given in **1(a)(ii)** ;	**1**
1(a)(v)	any **two** from: 1 using more concentrations of reducing sugar between two concentrations that lie either side of the estimate ; 2 (dilutions made) using proportional dilution ; 3 plot a graph of known concentrations and read off the value of sample ;	**2**
1(b)(i)	1 reads off V_{max} correctly from the graph at 4.3 au ; 2 calculates ½ V_{max} correctly ; 3 reads off the value for K_m mmol dm^{-3} correctly from the graph ;	**3**
1(b)(ii)	identifies enzyme sucrase has a lower affinity for its substrate and K_m higher for sucrase ;	**1**
1(b)(iii)	all active sites are occupied by substrate / AW ;	**1**

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Question	Answer	Marks
1(c)	1 x-axis: type of fruit juice and y-axis: concentration of sugar / a.u ; 2 scale on x-axis: even width of bars and scale on y-axis: 5 a.u to 2 cm., labelled at least every 2 cm and origin at zero ; 3 correct plotting of all bars ; 4 separate bars drawn with horizontal and vertical lines joined precisely ;	**4**

Question	Answer	Marks
2(a)(i)	1 suitable size, using most of the available space and no shading ; 2 draws only correct section of leaf drawn and no cells ; 3 draws correct proportions of epidermis compared to the depth of the leaf ; 4 draws the section at the leaf tip as a separate tissue ; 5 label line and label to epidermis ;	**5**
2(a)(ii)	1 suitable size for the smallest cell and all lines sharp and continuous ; 2 draws only four whole cells and each cell touches at least one other cell in a line ; 3 draws correct feature of cells, e.g. shape of cells or inclusions ; 4 draws two lines around each cell and three lines where cells touch ; 5 label line and label to one cell wall ;	**5**
2(a)(iii)	1 records measured diameter of the field of view in mm. ; 2 divides measurement for the field of view by the number of epidermal cells across the diameter of the field of view (which was counted and recorded) ; 3 correct answer in μm ;	**3**
2(a)(iv)	eyepiece graticule and stage micrometer ;	**1**
2(b)(i)	identifies a feature and suggests a reason ; e.g. curved leaf / trichomes / cuticle / sunken stomata and reduces evaporation of water	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(ii)</td><td>1 records only observable similarities and differences ;

2, 3 and 4
any three from:
<table>
<tr><th>feature</th><th>M1</th><th>Fig. 2.2</th></tr>
<tr><td>similarities
packing of cells at leaf tip
air spaces
cuticle
epidermis</td><td>
closely packed
present
present
one layer</td><td>
closely packed ;
present ;
present ;
one layer ;</td></tr>
<tr><td>differences
hairs / trichomes
shape of leaf
number of vascular bundles
sunken stomata</td><td>
more / many
curved / AW
less / few
present / many</td><td>
less / few ;
flat / AW ;
more / many ;
absent / few ;</td></tr>
</table></td><td>4</td></tr>
</table>

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Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 2020**

MARK SCHEME

Maximum Mark: 40

Published

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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Question	Answer	Marks
1(a)(i)	1 shows four additional concentrations of urease (5.0%, 2.5%, 1.25%, 0.625%) ; 2 shows transfer of 5 cm^3 of 5.0% urease to next beaker, 5 cm^3 of 2.5% urease to next beaker and 5 cm^3 of 1.25% urease to next beaker ; 3 shows addition of 5 cm^3 of water to each beaker ;	**3**
1(a)(ii)	1 shows heading for percentage concentration of urease and no units in body of table and shows heading for symbol or colour ; 2 records data using symbols ; 3 results for concentrations of urease and result for water ; 4 expected pattern for the results, with the highest concentration of urease the most blue ;	**4**
1(a)(iii)	1 describes the correct trend in the candidate's results ;	**1**
1(a)(iv)	1 records the result for B using the symbols in the key ;	**1**
1(a)(v)	1 correct interpretation of the concentration of urease in extract B according to the candidate's results ;	**1**
1(a)(vi)	1 use more intermediate concentrations of urease either side of the estimated concentration of B ;	**1**
1(a)(vii)	any two from: 1 drop sizes not precise and use a syringe to deliver the same volume each time ; 2 litmus paper in urease concentrations for different lengths of time and carry out individual test for each concentration of urease ; 3 litmus paper of different sizes and cut to exact measurement ;	**2**
1(b)(i)	1 *x*-axis: soil temperature / °C and *y*-axis: urease activity / arbitrary units ; 2 scale on *x*-axis: 10 °C to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 10 arbitrary units to 2 cm, labelled at least every 2 cm ; 3 correct plotting of all six points using small crosses or dots in circles ; 4 all plots joined with thin line passing through all points ;	**4**
1(b)(ii)	1. shows intersect on *x*-axis at 21 °C ; 2. correct value for 21 °C from candidate's graph and units ;	**2**

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Question	Answer	Marks
1(b)(iii)	1 reference to increasing temperature and kinetic energy (enzyme movement) ; 2 more successful collisions or more enzyme substrate complexes formed ; 3 (above 45 °C) the active site changes shape or enzyme starts to denature ;	**3**

Question	Answer	Marks
2(a))(i)	1 suitable size and no shading ; 2 draws whole section of leaf and no cells ; 3 correct proportions of tissues drawn ; 4 correct shapes and number of tissues / layers ; 5 label line and label to palisade mesophyll ;	**5**
2(a)(ii)	1 suitable size and all lines sharp and continuous ; 2 draws only four whole cells and each cell touches at least one other cell ; 3 draws two lines around each cell and three lines where two cells touch ; 4 draws correct shape of cells ; 5 label line and label to one cell wall ;	**5**
2(a)(iii)	1 records **only** observable differences between the upper epidermis and the lower epidermis ; 2 and 3 *any **two** from:* **feature** / **upper epidermis** / **lower epidermis** hairs or trichomes / absent / present ; stomata / absent / present ; thickness of epidermis / large / small ;	**3**

Question	Answer	Marks
2(b)	1 records measured depth of the leaf and units ; 2 records measured length of scale bar and units ; 3 shows working, e.g. scale bar length (mm) divided by 2.5 ; 4 shows working, e.g. divides depth of leaf by value for magnification ; 5 answer to correct degree of accuracy and units ;	**5**

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