CAMBRIDGE
International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2024**

MARK SCHEME

Maximum Mark: 40

Published

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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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mp	marking point (with relevant number)
ecf	error carried forward
AVP	alternative valid point

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Question	Answer	Marks
1(a)(i)	1 states 0.2%, 0.04%, 0.008%, 0.0016 **;** 2 shows transfer of 2 cm^3 to each beaker from the previous beaker **;** 3 shows 8 cm^3 of **W** added to each beaker **;**	**3**
1(a)(ii)	1 heading for independent variable: % concentration of starch-milk **;** 2 heading for dependent variables: colour score **;** 3 states results for all concentrations **;** 4 correct trend for results (the colour score for 1% starch-milk is higher than the colour score at the lowest concentration of starch-milk) **;** 5 records results using colour score **;**	**5**
1(a)(iii)	adds 1 cm^3 of contaminated milk **;**	**1**
1(a)(iv)	records the colour score for contaminated milk (5–0) **;**	**1**
1(a)(v)	estimates concentration of starch in contaminated milk using results in (a)(ii) and (a)(iv) **;**	**1**
1(a)(vi)	identifies the difficulty of matching the colour in the test-tube with a colour score as a source of error **;**	**1**
1(a)(vii)	states that water would dilute the colour **;**	**1**
1(a)(viii)	1 use Benedict's solution and heat to greater than 80 °C or boil **;** 2 measure time to first colour change **;**	**2**
1(b)(i)	1 *x-axis*: labelled 'concentration of lactose / mmol dm^{-3} **and** *y-axis*: labelled 'rate of reaction / arbitrary units' **;** 2 scale on *x*-axis: 40 to 2 cm scale, on *y*-axis: 0.25 to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of 6 points with cross or dot in circle **;** 4 smooth, thin line, joined point to point, through all the points **;**	**4**
1(b)(ii)	1 rate increases as lactose concentration increase and then plateau **;** 2 rate increases as more substrate available **;** 3 active sites saturated **;**	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 uses most of the available space and no shading ;
2 draws the correct region of the leaf and no cells included ;
3 draws the correct proportion of palisade layer in proportion to depth of leaf ;
4 draws area under vascular bundle or subdivision of the vascular bundle ;
5 label line and label to the lower epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 uses most of the available space and lines continuous, thin and sharp ;
2 draws only four xylem vessel elements and each vessel touches at least one other vessel ;
3 two lines around each vessel and three lines where cells touch ;
4 draws correct shape of cells with 4 or 5 sides ;
5 label line and label to wall of one xylem vessel element ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>differences between J1 and Fig. 2.2 ; ; ;
any three from :
<table><tr><th>(feature)</th><th>J1</th><th>Fig. 2.2</th><th></th></tr><tr><td>thickness of palisade layer</td><td>thick</td><td>thin</td><td>;</td></tr><tr><td>endodermis</td><td>not visible</td><td>present and distinct</td><td>;</td></tr><tr><td>shape of vascular bundles</td><td>circular</td><td>double / 2 regions</td><td>;</td></tr><tr><td>size of mid-rib</td><td>smaller</td><td>larger</td><td>;</td></tr></table></td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>1 states 10 eyepiece graticule units in 0.2 mm ;
2 divides 0.2 by 10 ;
3 correct answer and appropriate units (µm or mm) ;</td><td>3</td></tr>
<tr><td>2(b)(iii)</td><td>1 states the correct number of eyepiece graticule units across width of section ;
2 shows 75 multiplied by the answer to (b)(ii) ;</td><td>2</td></tr>
</table>

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Question	Answer	Marks
1(a)(i)	measuring the height of the foam;	**1**
1(a)(ii)	1 states 50%, 25%, 12.5% **;** 2 shows transfer of 30 cm^3 to each beaker from the previous beaker **;** 3 shows 30 cm^3 of **W** added to each beaker **;**	**3**
1(a)(iii)	1 heading for independent variable: % concentration of ethanol **;** 2 heading for dependent variable: height of foam / mm **;** 3 states results for 0 % concentration ethanol and results at 1 minute and at 2 minutes for all concentrations **;** 4 correct trend for results (the height of foam at the highest concentration is lower than at the lowest concentration of ethanol **;** 5 records results to the nearest whole millimetre **;**	**5**
1(a)(iv)	shows how both rates are calculated and units for both rates included **;**	**1**
1(a)(v)	states how the rate changes with time for results collected **;**	**1**
1(a)(vi)	shows the activity of catalase without ethanol **;**	**1**
1(a)(vii)	height of the foam **;**	**1**
1(a)(viii)	*any **two** from:* 1 more concentrations of ethanol **;** 2 carry out repeats and calculate a mean **;** 3 use a gas syringe to measure volume of gas	**2**
1(b)(i)	1 *x–axis*: labelled 'concentration of ethanol / μldm^{-3} **and** *y-axis*: labelled 'PPO activity arbitrary units / au' **;** 2 scale on *x*–axis: 100 to 2 cm **and** scale on *y*–axis: 0.5 to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of 5 points with cross or dot in circle **;** 4 smooth, thin line, joined point to point, through all the points **;**	**4**

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Question	Answer	Marks
1(b)(ii)	*any **two** from:* 1 as concentration of ethanol increases PPO activity decreases **;** 2 ethanol acts as an inhibitor **;** 3 as concentration of ethanol increases less enzyme-substrate complexes **;** 4 at higher concentrations of ethanol PPO enzyme starts to denature **;**	**2**

Question	Answer	Marks
2(a)(i)	1 uses most of the available space and no shading **;** 2 draws the correct region **and** no cells included **;** 3 draws the layer of tissue beneath the epidermis **;** 4 draws at least one vascular bundle **;** 5 label line and label to a epidermis **;**	**5**
2(a)(ii)	1 uses most of the available space and lines are continuous, thin and sharp **;** 2 draws only four cells and each cell touches at least two other cells **;** 3 two lines around each cell and three lines where cells touch **;** 4 draws cells with 5 or 6 sides **;** 5 label line and label to cell wall of one cell **;**	**5**
2(b)(i)	1 states five measurements for length of vascular bundles and units **;** 2 shows five measurements added together and divided by 5 (to calculate a mean) **;** 3 shows value divided by 12 **;** 4 answer given to nearest 0.5 mm **;**	**4**
2(b)(ii)	*any **two** for **one** mark from:* 1 measure all the vascular bundles 2 larger magnification to make it easier to measure 3 take more sections	**1**

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<table>
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<tr><td>2(c)</td><td>only observable differences ;

differences between K1 and Fig. 2.3:

any three from:

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<tr><td>thickness of epidermis</td><td>thin</td><td>Thick ;</td></tr>
<tr><td>shape of stem</td><td>circular</td><td>Wavy ;</td></tr>
<tr><td>number of vascular bundles</td><td>more</td><td>Fewer ;</td></tr>
<tr><td>position of vascular bundles</td><td>scattered</td><td>arranged in rings ;</td></tr>
</table>
</td><td>4</td></tr>
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Question	Answer	Marks
1(a)(i)	1 (three concentrations of sugar / mol dm^{-3}) 0.75, 0.5, 0.25 **;** 2 correct volumes of **S** and **W** to make 10 cm^3 **; ecf**	**2**
1(a)(ii)	1 heading for independent variable: concentration of sugar / mol dm^{-3} (before heading for dependent variable) **and** no units in body of table **;** 2 heading for dependent variable: time / s **and** no units in body of table **;** 3 a time for each concentration **;** 4 time to reach the end-point for the highest concentration of sugar is shorter than for the lowest concentration of sugar **;** 5 records time in whole seconds **;**	**5**
1(a)(iii)	records a time for **C ;**	**1**
1(a)(iv)	correct estimate for **C** based on candidate's results **;**	**1**
1(a)(v)	1 stated concentrations both sides of the estimate **;** *Any **two** from:* 1 more concentrations **;** 2 colorimeter **;** 3 plot a graph and read off the concentration of **C ;** 4 repeat and calculate the mean **;** 5 carry out each concentration separately **;**	**3**
1(a)(vi)	*any **one** from:* 1 size / mass of vegetable **;** 2 volume of vegetable extract **;**	**1**
1(a)(vii)	1 five concentrations of starch **;** 2 iodine **and** reference to determining colour intensity **;**	**2**

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Question	Answer	Marks
1(b)(i)	1 x-axis: mass of potassium manganate(VII) / g **and** y-axis: mean post-harvest life / days **;** 2 scale on x-axis: 2 g to 2 cm **and** labelled at least every 2 cm **and** scale on y-axis: 1 day to 2 cm **and** labelled at least every 2 cm, with 9 at the origin **;** 3 correct plotting of all five points using dots in circles or small crosses **;** 4 five plots joined with thin line passing through all points **;**	**4**
1(b)(ii)	1 shows interpolation on the graph **;** 2 correct value **;**	**2**
1(b)(iii)	*any **one** from:* 1 *ref. to* the effect of potassium manganate(VII) on bananas (e.g. toxic, affects flavour, affects enzymes) **;** 2 *ref. to* the effect of water and carbon dioxide on bananas (e.g. disrupts osmotic balance, changes pH, encourages the growth of microorganisms) **;**	**1**

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<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 minimum size and no shading ;
2 draws whole root section and no cells drawn ;
3 draws the correct shape of the section and the endodermis ;
4 draws the correct proportion of the vascular tissue to the whole root section ;
5 label line and label to endodermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 minimum size and all lines sharp and continuous ;
2 draws a group of four cells and each cell touches at least two other cells ;
3 two lines around each cell and three lines where cells touch ;
4 draws correct shape of cells ;
5 label line and label to cell wall ;</td><td>5</td></tr>
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three correct differences:

any three from:

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<tr><td>2(c)</td><td>1 correct measurement of scale bar and units ;
2 correct measurement of scale line A–B and units ;
3 shows division of the measured diameter by the measurement of the scale bar and multiplied by 525 ;
4 correct answer and unit ;</td><td>4</td></tr>
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- the standard of response required by a candidate as exemplified by the standardisation scripts.

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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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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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
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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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

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.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

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

Mark scheme abbreviations

;	separates marking points
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A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
I	ignore
( )	the word / phrase in brackets is not required, but sets the context
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
AVP	alternative valid point

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Question	Answer	Marks
1(a)(i)	reference to the contents of the test-tubes reaching the temperature of the water-bath **;**	**1**
1(a)(ii)	1 same volume or excess Benedict's reagent <u>and</u> heated to at least 80°C **;** 2 highest amount of reducing sugar has the shortest time **;**	**2**
1(a)(iii)	temperature **;**	**1**
1(a)(iv)	1 heading for independent variable: temperature / °C (before heading for dependent variable) <u>and</u> no units in body of table **;** 2 heading for dependent variable: time / s (for first colour change for reducing sugar) <u>and</u> colour (for starch) <u>and</u> no units in body of table **;** 3 a time (reducing sugar) for each sample **;** 4 a colour (starch) for each sample ;	**4**
1(a)(v)	1 correct sequence for reducing sugar based on candidate's results **;** 2 correct sequence for starch based on candidate's results **;**	**2**
1(a)(vi)	*Any **three** from:* 1 S1 – enzyme hydrolyses some starch **;** 2 S2 – enzyme hydrolyses some starch **;** 3 S3 – enzyme does not hydrolyse starch / enzyme is denatured **;** 4 correctly compares the number of enzyme substrate complexes between two solutions **;** 5 correctly compares the hydrolysis of starch between S1, S2 and S3 **;**	**3**
1(a)(vii)	records a time (reducing sugar) and a colour (starch) for U **;**	**1**
1(a)(viii)	correct estimate for **U** based on candidate's results **;**	**1**

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Question	Answer	Marks
1(a)(ix)	*Any **four** from:* 1 at least five known concentrations of reducing sugar **;** 2 Benedict's test and time for first colour change for known concentrations of reducing sugar **;** 3 test unknown sample of reducing sugar (with Benedict's) **;** 4 compare time for unknown sample with times for known samples of reducing sugar **;** 5 draw a graph of known concentrations of reducing sugar against time (to first colour change) **;** 6 read off unknown sample of reducing sugar **;**	**4**
1(b)	1 x-axis: temperature / °C and y-axis: rate of reaction / arbitrary units **;** 2 scale on x-axis: 5°C to 2 cm with 20 at the origin and labelled at least every 2 cm and scale on y-axis: 20 au to 2 cm and labelled at least every 2 cm **;** 3 correct plotting of all five points using dots in circles or small crosses **;** 4 five plots joined with thin line passing through all points **;**	**4**

Question	Answer	Marks
2(a)(i)	1 minimum size and no shading **;** 2 draws whole leaf section and no cells drawn **;** 3 draws the correct shape of the palisade tissue**;** 4 draws the correct shape of the vascular bundle **;** 5 label line and label to palisade tissue **;**	**5**
2(a)(ii)	1 minimum size and all lines sharp and continuous **;** 2 draws two cells from the upper epidermis and two cells from below the epidermis and each cell touches at least two other cells **;** 3 two lines around each cell and three lines where cells touch **;** 4 draws correct shape and size of cells **;** 5 draws chloroplasts in palisade cells **;** 6 label line and label to one chloroplast **;**	**6**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)</td><td>three correct differences ;;;
any three e.g.:

<table>
<tr><th>feature</th><th>M1</th><th>Fig. 2.1</th></tr>
<tr><td>shape of vascular bundle</td><td>flat</td><td>oval</td></tr>
<tr><td>palisade tissue</td><td>upper epidermis</td><td>upper and lower epidermis</td></tr>
<tr><td>bulge</td><td>present</td><td>absent</td></tr>
<tr><td>lamina / leaf blades</td><td>thin</td><td>thick</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>2(c)</td><td>1 correct measurement of lines P1, P2, P3, P4 and P5 <u>and</u> units ;
2 shows addition of five values <u>and</u> division by five ;
3 shows division of mean length thickness by the magnification ;</td><td>3</td></tr>
</table>

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CAMBRIDGE
International Education

Cambridge International AS & A Level

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 2024**

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level 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 descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

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max	indicates the maximum number of marks that can be given
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Question	Answer	Marks
1(a)(i)	1 states at least three more concentrations of hydrochloric acid e.g. 1.6, 1.2 and 0.8 mol dm^{-3} **;** 2 states appropriate volumes of **H** to make up the concentrations **;** 3 states the appropriate volumes of **H** and **W** to add up to 5 **;**	**3**
1(a)(ii)	decides on a key in words and symbols **;**	**1**
1(a)(iii)	1 heading for independent variable: concentration of hydrochloric acid / HCl / **H** mol dm^{-3} **;** 2 heading for dependent variable: observation / cloudiness or symbol **;** 3 uses the key from **(a)(ii)** and states results for five concentrations at 0, 5 and 10 minutes **;** 4 correct trend for results at 0 minutes **;** 5 correct trend for results at 10 minutes **;**	**5**
1(a)(iv)	states the trend at 0 minutes – as the concentration of hydrochloric acid decreases the less cloudy the solutions **;**	**1**
1(a)(v)	1 states that the higher the acid concentration, the higher the rate of precipitation **;** 2 refers to observations of cloudiness at 0, 5 and 10 minutes **;**	**2**
1(a)(vi)	states the type of error as systematic **and** there was no effect on the trend **;**	**1**
1(a)(vii)	1 identifies the error as judging the cloudiness **;** 2 suggests the modification as using a colorimeter **;** **or** 3 identifies the error as the reaction time of **P** was different for each of the concentrations of acid **;** 4 suggests the modification as carrying out each test separately **;**	**2**
1(b)(i)	1 *x-axis*: labelled 'protein in blood plasma **and** each bar labelled with the name of the protein **and** *y-axis*: labelled 'percentage of total protein **;** 2 scale on *x*-axis: bars same width and evenly spaced **and** scale on *y*-axis: 10 to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of 5 bars **;** 4 5 bars plotted with horizontal lines joined precisely **;**	**4**
1(b)(ii)	1 shows the addition of 12.5, 16.5 and 8.5, multiplied by 70 and divided by 100 **;** 2 gives answer to appropriate number of significant figures **;**	**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 uses most of the available space and lines continuous, thin and sharp ;
2 draws two starch grains from slide C and two starch grains from slide D ;
3 all the starch grains have surface patterns ;
4 for sample C, shows the correct position of circles on at least one starch grain ;
5 for sample D, shows the correct pattern on at least one starch grain ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>iodine solution and blue-black colour ;</td><td>1</td></tr>
<tr><td>2(a)(iii)</td><td>starch broken down to glucose or to release energy ;</td><td>1</td></tr>
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2 draws the correct region and no cells included ;
3 draws at least two vascular bundles ;
4 draws correct shape of outline or draws the distinct area at the tip of the leaf ;
5 label line and label to one vascular bundle ;</td><td>5</td></tr>
<tr><td>2(b)(ii)</td><td>only observable differences ;

differences between N1 and Fig. 2.1:

any three from:

<table><tr><th>(feature)</th><th>N1</th><th>Fig. 2.2</th><th></th></tr><tr><td>number of vascular bundles</td><td>fewer</td><td>more</td><td>;</td></tr><tr><td>location of vascular bundles</td><td>central in the leaf</td><td>nearer to the epidermis</td><td>;</td></tr><tr><td>vascular bundles</td><td>located in one line</td><td>located in two lines</td><td>;</td></tr><tr><td>presence of trichomes</td><td>present</td><td>absent</td><td>;</td></tr></table></td><td>4</td></tr>
<tr><td>2(b)(iii)</td><td>1 states the line Q – R is 28 eyepiece graticules ;
2 shows the number of eyepiece graticules multiplied by 34 ;
3 states the correct answer with the appropriate units (μm or mm or cm) ;</td><td>3</td></tr>
</table>

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