Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2019**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(i)	shows at least three more concentrations of ethanol **;** shows correct volumes of **A** and **W** to make these concentrations **;**	**2**
1(a)(ii)	1. *heading for independent variable*: percentage concentration ethanol **and** before heading for dependent variable **and** no units in body of table **;** 2. *heading dependent variable*: symbol or colour intensity **;** 3. readings for all samples **;** 4. intensity of red colour decreases with decreasing concentration **;** 5. results recorded using ++++ scale **;**	**5**
1(a)(iii)	identifies the independent variable as concentration of ethanol **;**	**1**
1(a)(iv)	*any **three** from*: 1. proteins in membrane denatured **;** 2. dissolved phospholipids / hydrophobic components (of membrane) **;** 3. increases permeability **;** 4. higher concentrations of ethanol **and** more diffusion of pigment **;**	**3**
1(a)(v)	*any **two** sources of error **and** improvements from*: 1. colour judgement subjective **;** 2. colorimeter or use of colour chart **;** 3. cutting to 2 cm **;** 4. use of cutting template or more precise method of cutting described **;** 5. time lag **;** 6. staggered start **;** 7. washing only once **;** 8. standardise, e.g. washing twice **;**	**4**

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Question	Answer	Marks
1(b)(i)	1. *x*-axis: water potential / MPa **and** *y*-axis: acoustic emission / arbitrary units **;** 2. scale on *x*-axis: 0.25 MPa to 2 cm, labelled at least every 2 cm **and** scale on *y*-axis: 20 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. six plots joined with thin line passing through all points and line is either smooth curve or joined plot to plot **;**	**4**
1(b)(ii)	correct value from graph **;**	**1**
1(b)(iii)	*any **one** from*: reduce gap between intervals **;** AVP **;**	**1**

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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 and no shading and no cells ;
2. draws correct sector ;
3. correct shape and distribution of tissues ;
4. correct proportions of tissues ;
5. label line and label to epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1. lines continuous, thin and sharp ;
2. draws only four whole cells and each cell touches at least two other cells ;
3. two lines around each cell and three lines where cells touch ;
4. at least one cell with three or more angles ;
5. label line and label to one cell wall ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>1. measures and records length of C–D, E–F and G–H ;
2. measures and records depth of six outer layers ;
3. (for diameter) shows addition of three values and shows division by three
and (for depth of outer layer) shows addition of six values and shows division by six ;
4. answers to correct degree of accuracy ;</td><td>4</td></tr>
<tr><td>2(b)(ii)</td><td>states answer as larger whole number to smaller whole number and simplest whole number ratio ;</td><td>1</td></tr>
<tr><td>2(c)</td><td>1. organises comparison into three columns with one column for features and collects only differences ;

any three from:

<table>
<tr><th>Feature</th><th>J1</th><th>Fig. 2.2</th></tr>
<tr><td>size of vascular bundles</td><td>smaller</td><td>larger ;</td></tr>
<tr><td>xylem</td><td>fewer</td><td>more ;</td></tr>
<tr><td>phloem</td><td>fewer</td><td>more ;</td></tr>
<tr><td>layers of cells around vascular tissue</td><td>two layers</td><td>one layer ;</td></tr>
<tr><td>air spaces</td><td>present / more / larger</td><td>absent / less / smaller ;</td></tr>
<tr><td>thickened layer beneath epidermis</td><td>present</td><td>absent ;</td></tr>
<tr><td>cortex cells</td><td>fewer</td><td>more ;</td></tr>
<tr><td>gaps in outer surface</td><td>present / more</td><td>absent / fewer ;</td></tr>
<tr><td>AVP</td><td>described</td><td>described ;</td></tr>
</table>
</td><td>4</td></tr>
</table>

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Question	Answer	Marks
1(a)(i)	assesses the risk for **E** as medium or high, for **S** as low and for **C** as medium or high **;**	**1**
1(a)(ii)	1 0.2%, 0.02%, 0.002%, 0.0002% (labels under correct sequence of beakers) **;** 2 shows transfer of 1 (cm^3) copper sulfate solution to each beaker from the previous beaker **;** 3 shows 9 (cm^3) of water added to each beaker **;** *max 2 if cm^3 omitted from mp2 and mp3*	**3**
1(a)(iii)	1 *heading for independent variable*: percentage concentration copper sulfate solution **and** before heading for dependent variable **and** no units in body of table **;** 2 *heading dependent variable*: time and seconds **and** no units in body of table **;** 3 readings for all samples **;** 4 time for iodine to remain yellow increases with increasing concentration **;** 5 results recorded to nearest whole second **;**	**5**
1(a)(iv)	records result for **U and** seconds **;**	**1**
1(a)(v)	correctly estimates the concentration of copper sulfate in **U ;**	**1**
1(a)(vi)	*any **one** from*: 1 difficulty in judging exact time of colour change **;** 2 colour may change between time intervals **;** 3 using glass rod causes drop sizes to be of unequal sizes **;**	**1**
1(a)(vii)	*any **one** from :* more concentrations between the two concentrations that lie each side of the estimate **;** AVP **;**	**1**
1(a)(viii)	*any **two** from:* 1 use colorimeter **;** 2 standard colours to compare **;** 3 more intermediate times **;** 4 choose end point that is dark brown **;** 5 use pipette for iodine or sample **;**	**2**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: temperature / °C **and** *y*-axis: rate of reaction / arbitrary units **;** 2 scale on *x*-axis: 10 °C 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 five points using small crosses or dots in circles **;** 4 five plots joined with thin line passing through all points and line is either smooth curve or joined plot to plot **;**	**4**
1(b)(ii)	correct value from graph **;**	**1**
1(b)(iii)	*any **three** from:* 1 *(between 5.5 °C and 36 °C)* enzyme and substrate have more kinetic energy **;** 2 more successful collisions or more enzyme substrate complexes formed **;** 3 *(between 36 °C and 49.5 °C)* shape of the active site changes or enzyme dentures **;** 4 fewer enzyme substrate complexes formed **;**	**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 suitable size and no shading and no cells ;
2 draws whole leaf and closed at both ends ;
3 draws minimum number of tissues ;
4 correct proportions of vascular bundle to depth of lamina ;
5 label line and label to epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 lines continuous, thin and sharp ;
2 draws only four whole cells and each cell touches at least one other ;
3 two lines around each cell and three lines where cells touch ;
4 label line and label to one cell wall ;</td><td>4</td></tr>
<tr><td>2(b)(i)</td><td>1 measures and records length of line X-Y and units ;
2 measurement of line X-Y divided by 74 ;
3 units (mm or µm) for final correct answer ;</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>shows addition of five numbers and shows division by 5 ;</td><td>1</td></tr>
<tr><td>2(b)(iii)</td><td>1 organises comparison into three columns with one column for features and collects only differences ;
any three from:
<table>
<tr><th>feature</th><th>K1</th><th>Fig. 2.1</th></tr>
<tr><td>vascular tissue</td><td>flatter /
more oval</td><td>rounder ;</td></tr>
<tr><td>air spaces</td><td>more / larger</td><td>fewer / smaller ;</td></tr>
<tr><td>epidermis</td><td>thinner</td><td>thicker ;</td></tr>
<tr><td>ring of cells around vascular tissue</td><td>absent</td><td>present ;</td></tr>
<tr><td>cuticle</td><td>thicker / present</td><td>thinner / absent ;</td></tr>
<tr><td>AVP</td><td>described</td><td>described ;</td></tr>
</table></td><td>4</td></tr>
</table>

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BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 2019**

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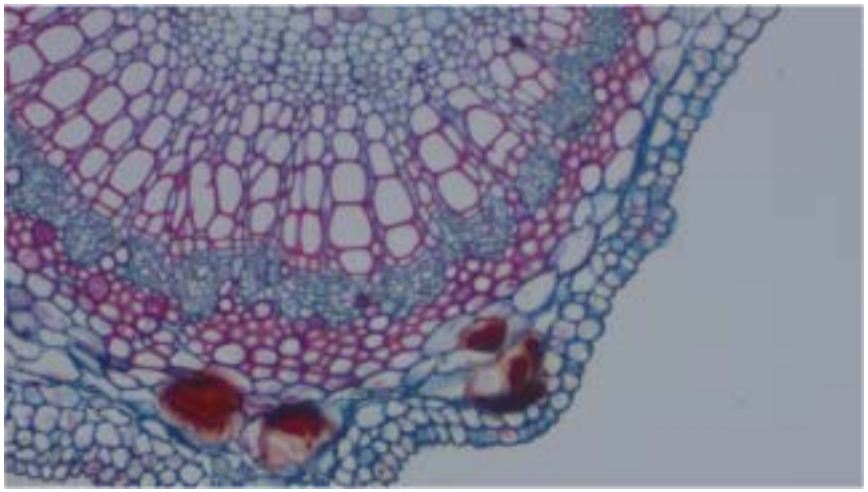
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1(a)(i)	collects three lengths within the range given as whole numbers or to 0.5 ;	**1**
1(a)(ii)	cut all to same length ;	**1**
1(a)(iii)	stated volume of buffer ;	**1**
1(a)(iv)	1. (heading) pH ; 2. (heading for dependent) colour intensity ; 3. collects results for 5 pH values ; 4. correct trend in results ; 5. results recorded using (**++**) scale ;	**5**
1(a)(v)	uses symbols to record results ;	**1**
1(a)(vi)	correct answer from candidates results ;	**1**
1(a)(vii)	colour standards **or** colorimeter **or** use more intermediate pH values ;	**1**
1(a)(vii)i	use a thermostatically controlled water-bath ; use at least 5 different temperatures ;	**2**
1(b)(i)	1. label on *x*-axis soil pH **+** label on *y*-axis mean mass of grass (/) g ; 2. scale on *x*-axis 0.5 to 2 cm **+** labelled each 2 cm **+** scale on *y*-axis is 1 to 2 cm **+** labelled each 2 cm ; 3. correct plotting of 5 points with a small cross or dot in circle ; 4. smooth line, joined point to point, through 5 points / curve or line of best fit ;	**4**

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Question	Answer	Marks
1(b)(ii)	as the pH increases the mass of grass increases ; idea that the mass increases at a decreasing rate or correct data quotes to illustrate the trend ;	**2**
1(b)(iii)	denatures proteins ; reduced absorption of minerals by active transport ;	**2**
2(a)(i)	***M1*** *TS Tilia Leaf*  1. midrib minimum depth at least 90 mm **+** no shading **+** no cells ; 2. correct section drawn ; 3. vascular bundle correctly subdivided into at least 3 layers ; 4. correct proportion of the vascular tissue the other tissues ; 5. label line and label to lower epidermis ;	**5**

Question	Answer	Marks
2(a)(ii)	 1. all lines should be continuous, thin and sharp **+** minimum size **;** 2. draws only 4 whole cells **+** each cell touching at least one of the other cells **;** 3. two lines drawn around each cell **+** three lines where two cells touch **;** 4. draws cells the correct shape **;** 5. label line and label to cell wall **;**	**5**
2(b)	thick cell wall **or** has lumen **or** is hollow **;**	**1**
2(c)(i)	measures **L** (within range) **+** units (mm **or** cm) **;** records the number of eyepiece graticule units (within range) **;** shows eyepiece graticule units multiplied by 15 **;** correct answer from their eyepiece graticule units measurements **+** correct units **;**	**4**

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Question	Answer	Marks
2(c)(ii)	shows depth of **Fig 2.3** divided by answer to **(c)(i) ;**	**1**
2(c)(iii)	annotates 3 correct features on **Fig 2.3** using labels **R**, **S** and **T ;;;** e.g. **Fig 2.3** is more rounded than **J1**	**3**

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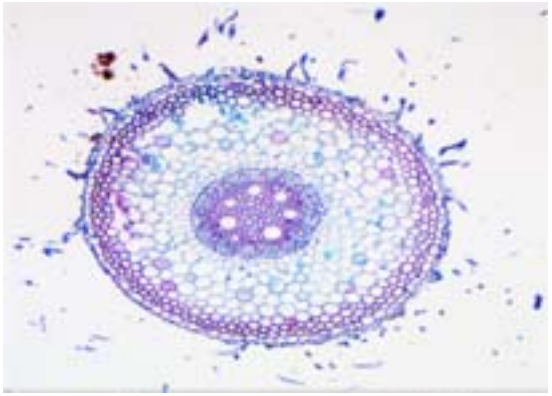
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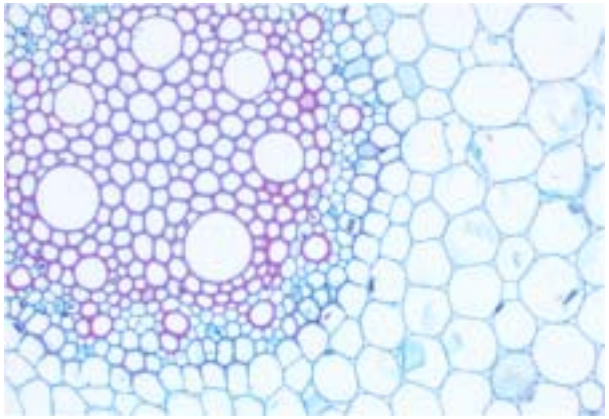
Question	Answer	Marks
1(a)(i)	4 more sizes **;** all are cubes equal length × width × depth **;** all calculations correct **;**	**3**
1(a)(ii)	1. (heading) surface area:volume **;** 2. (heading for dependent) time **+** units 3. collects results for all different size cubes **;** 4. records all results using whole seconds **;**	**4**
1(a)(iii)	correct trend from candidates own results **;**	**1**
1(a)(iv)	repeat at least twice more **;**	**1**
1(a)(v)	replace ascorbic acid / **A** with water **;**	**1**
1(a)(vi)	*any **two** from:* 1. further diffusion distance **;** 2. idea of not enough oxygen / nutrients / named nutrient reaching the centre of the organism **;** 3. limits the activity / size of the organism **or** larger organisms need a transport system **;**	**2**

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<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(b)(i)</td><td>
<table>
<tr><td>the agar block, B, had lumps in it where it was not dissolved properly</td><td>random + the idea of cubes with less lumps would have a much quicker diffusion time ;</td></tr>
<tr><td>it was difficult to judge the end-point</td><td>random + idea of judging the end-point before true end-point for some cubes and after for other cubes
or
systematic + no effect as the same individual would judge the same end-point ;</td></tr>
</table>
</td><td>2</td></tr>
<tr><td>1(b)(ii)</td><td>appropriately sized cube from candidates results + units ;</td><td>1</td></tr>
<tr><td>1(b)(iii)</td><td>5 different concentrations ;
using serial or proportional dilution ;</td><td>2</td></tr>
<tr><td>1(c)(i)</td><td>0.31 ;</td><td>1</td></tr>
<tr><td>1(c)(ii)</td><td>1. label on x-axis plant extract + label on y-axis ascorbic acid concentration (/) mg cm^{-3} ;
2. scale on x-axis labelled bars of same width + scale on y-axis is 0.2 to 2 cm + labelled each 2 cm ;
3. correct plotting of 5 bars ;
4. smooth sharp lines + bars separated equally ;</td><td>4</td></tr>
</table>

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Question	Answer	Marks
2(a)(i)	***L1*** *TS Wheat root*  1. suitable size **+** no shading **+** no cells **;** 2. whole root section drawn **+** at least 3 lines **;** 3. correct root shape **+** at least 5 lines across width of section from the centre of drawing **+** thin epidermis layer **;** 4. correct proportion of the diameter of the central region to the total diameter of the root **;** 5. label line and label to epidermis **;**	**5**

Question	Answer	Marks
2(a)(ii)	 1. lines continuous, thin and sharp ; 2. draws only 4 whole cells + each cell touching at least two of the other cells ; 3. two lines drawn around each cell + three lines where two cells touch ; 4. smaller cell at least half the size of the larger cell ; 5. draws cells the correct shape ; 6. label line and label to lumen ;	**6**

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<tr><td>2(b)(i)</td><td>anaphase ;

chromatids have separated and moved towards the <u>poles</u> ;</td><td>2</td></tr>
<tr><td>2(b)(ii)</td><td>3 or 4 ;</td><td>1</td></tr>
<tr><td>2(b)(iii)</td><td>mp1 correct measurement of line R + units ;

<table>
<tr><td>mp2</td><td>conversion of line R</td><td>conversion of actual cell Q length</td></tr>
<tr><td></td><td>(mm)
shows (whatever measurement of R) multiplied by 1000
or
(cm)
shows (whatever measurement of R) multiplied by 10 000 ;</td><td>(mm)
shows 41.6 divided by 1000
or
(cm)
shows 41.6 divided by 10 000 ;</td></tr>
<tr><td>mp3</td><td>shows (measurement of R) divided by 41.6 ;</td><td>shows (measurement of R) divided by 0.0416
or
shows (measurement of R) divided by 0.00416 ;</td></tr>
</table>

mp4 correct answer ;</td><td>4</td></tr>
</table>

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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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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).
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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Question	Answer	Marks
1(a)(i)	**H** medium **or** high **and** **W** low **and** **P** medium **or** high **;**	**1**
1(a)(ii)	shows at least **three** more concentrations of **P ;** shows correct volumes of **P** and **W** to make these concentrations **;**	**2**
1(a)(iii)	1. *heading for independent variable*: percentage concentration plant extract **and** before heading for dependent variable **and** no units in body of table **;** 2. *heading dependent variable*: time **and** seconds **and** no units in body of table **;** 3. readings for all samples **;** 4. time for disc to reach the surface increases with decreasing concentration **;** 5. results recorded to nearest whole second **;**	**5**
1(a)(iv)	identifies the independent variable as concentration of plant extract **;**	**1**
1(a)(v)	*any **three** from*: 1. same hydrogen peroxide is used for each test **and** change hydrogen peroxide for each test **;** 2. paper discs have varied amount of plant extract **and** standardise amount of extract **;** 3. paper discs not blotted for same amount of time **and** standardise a way of blotting **;** 4. judging when disc reaches surface **and** marking beaker to see disc reaching end-point **;** 5. discs may stick to the side of beaker **and** use wider beaker **;**	**3**
1(b)(i)	8.6 **;** answer to correct degree of accuracy **;**	**2**

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Question	Answer	Marks
1(b)(ii)	1. *x*-axis: percentage concentration of hydrogen peroxide **and** *y*-axis: volume of oxygen produced in 30 seconds / cm^3 **;** 2. scale on *x*-axis: 0.5% to 2 cm, labelled at least every 2 cm **and** scale on *y*-axis: 2.0cm^3 to 2 cm, labelled at least every 2 cm **;** 3. correct plotting of five points using small crosses or dots in circles **;** 4. six plots joined with thin line passing through all points and line is either smooth curve or joined plot to plot **;**	**4**
1(b)(iii)	correct value from graph **;**	**1**
1(b)(iv)	1. more substrate molecules **;** 2. more successful collisions **;** 3. more enzyme substrate complexes formed **;**	**3**

Question	Answer	Marks
2(a)(i)	1. suitable size **and** no shading **and** no cells **;** 2. draws correct sector **and** at least two vascular bundles **;** 3. draws at least minimum number of tissue layers **;** 4. correct proportion of vascular bundle to depth of stem **;** 5. label line **and** label to xylem **;**	**5**
2(a)(ii)	1. lines continuous, thin and sharp **;** 2. draws only four whole xylem vessels **and** each vessel touches at least two other vessels **;** 3. two lines around each vessel **and** three lines where vessels touch **;** 4. at least one vessel with three or more angles **;** 5. label line and label to the cell wall of one vessel **;**	**5**
2(b)(i)	1. counts and records number of eyepiece graticule divisions for line **X**–**Y ;** 2. shows number of eyepiece graticule divisions units for line **X**–**Y** multiplied by 24.6 **;** 3. correct answer **;** 4. correct units **;**	**4**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(ii)</td><td>1. organises comparison into three columns with one column for features and collects only differences ;

any three from:

<table>
<tr><th>feature</th><th>N1</th><th>Fig. 2.2</th></tr>
<tr><td>number of vascular bundles</td><td>many</td><td>one ;</td></tr>
<tr><td>position of vascular bundles</td><td>around edge</td><td>in centre ;</td></tr>
<tr><td>xylem tissue</td><td>oval</td><td>cross shaped ;</td></tr>
<tr><td>central area</td><td>hollow / cells absent</td><td>not hollow / cells present ;</td></tr>
<tr><td>epidermis</td><td>smooth</td><td>rough ;</td></tr>
<tr><td>AVP</td><td>described</td><td>described ;</td></tr>
</table>
</td><td>4</td></tr>
</table>

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