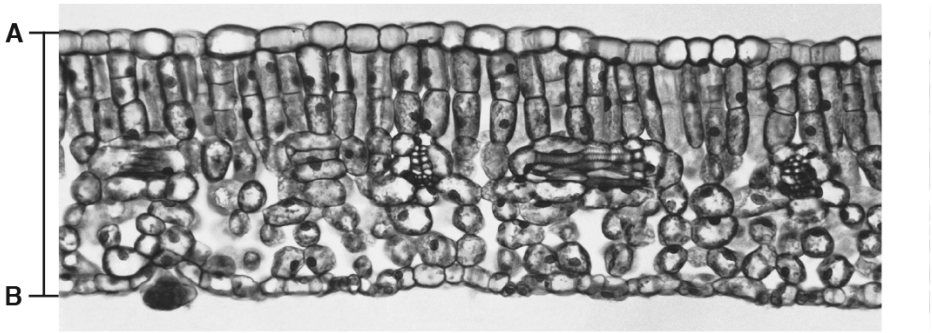
1.2 Concept and use of a classification system

01.0610_s19_qp_61 Q: 2

(a) Fig. 2.1 is a photomicrograph of a cross-section of part of a leaf.



magnification ×100

Fig. 2.1

(i) Draw a large diagram to show the layers present in the leaf section shown in Fig. 2.1.

Do not draw any cells.

(ii) Measure the thickness of the leaf along the line **AB** on Fig. 2.1.

length of line **AB** .....

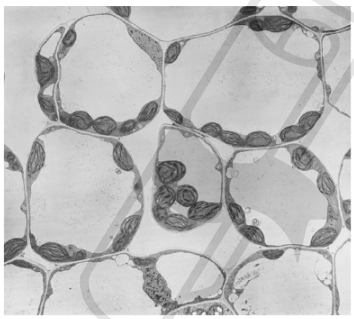
Calculate the actual thickness of the leaf using your measurement and the formula.

Include the units.

$$\text{magnification} = \frac{\text{length of line } \mathbf{AB} \text{ on Fig. 2.1}}{\text{actual thickness of leaf}}$$

.....
[3]

(iii) Fig. 2.2 shows a photomicrograph of cells from one type of tissue found in leaves.



magnification ×300

Fig. 2.2

Label the layer on your drawing, with the letter **X**, to show where this type of tissue is found. [1]

(b) Scientists carried out an investigation into the effect of light on the growth of leaves.

Plants of the same species (**A**) were grown in three different light intensities.

The plants were grown in the same soil and kept in glasshouses with automatic watering.

A sample of 100 leaves was selected at random and collected from plants in each of the three different light intensities. A total of 300 leaves were collected.

The scientists studied the variations in the size and structure of the leaves in each sample.

(i) Suggest why the scientists used large samples of leaves.

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..... [1]

(ii) Suggest why the leaves in each light intensity were selected at random.

.....

..... [1]

(iii) A grid, divided into millimetre squares, was used to measure the surface area of the leaves.

Outline how the grid could have been used.

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..... [2]

(iv) State the variable that was changed (independent variable) in this investigation.

..... [1]

(c) The scientists collected data from one other plant species (**B**).

Table 2.1 shows the results.

Table 2.1

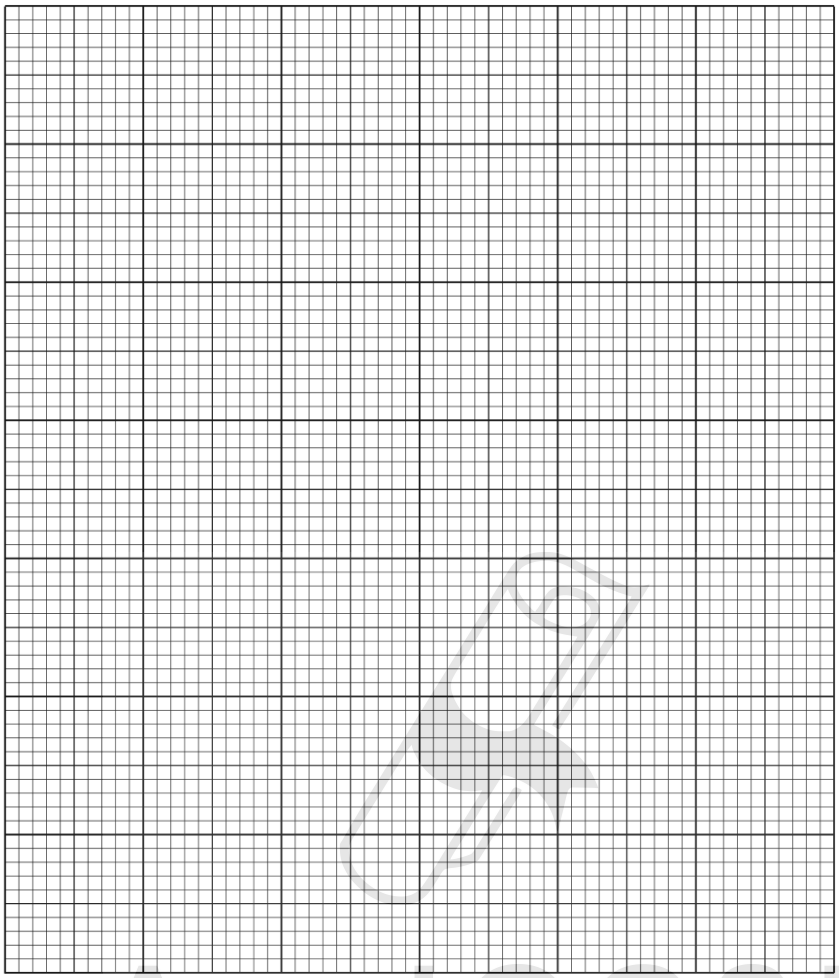
light intensity / arbitrary units	average leaf area / mm^2	
	species **A**	species **B**
100	3600	2800
50	3900	3400
10	6500	2900

(i) Calculate the percentage difference in the average leaf area for species **A** from a light intensity of 50 arbitrary units to 10 arbitrary units.

Show your working and give your answer to the nearest whole number.

.....%
[2]

(ii) Plot a bar chart on the grid to show the average leaf area for species **A** and **B**, at each light intensity.



[4]

(iii) Describe the trends shown in your graph for species **A** and species **B**.

.....

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.....

..... [2]

(iv) The scientists want to determine more precisely the light intensity that results in the largest leaf area for species **B**.

Suggest how the method used in the investigation could be modified to achieve this.

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..... [1]

[Total: 21]

	Answer	Mark	Partial Marks
(a)(i)	*line*: clear single continuous lines without shading ; *size*: occupies at least half the space available ; *detail*: layers in correct proportions ;	3	
(a)(ii)	length of line **AB** = 40 mm ; actual length =0.4 mm ;;	3	**A** □1 mm **A** □0.01 mm
(a)(iii)	**X** written on the spongy mesophyll of drawing ;	1	
(b)(i)	to obtain a representative leaf size ; to identify anomalous results ;	1	
(b)(ii)	to avoid bias / gain a representative sample / AW ; so that a comparison can be made (between the different light intensities) ;	1	**A** leaves at different heights may be different sizes
(b)(iii)	draw round the outline of the leaf on a grid / place leaf under a (transparent) grid ; count the squares ; include any squares more than half covered / other valid method described ;	2	
(b)(iv)	light intensity ;	1	
(c)(i)	67(%) ;;	2	

	Answer	Mark	Partial Marks
(c)(ii)	*axes labelled with units:* light intensity / arbitrary units or au **and** average leaf area / mm^2 **and** species A and B labelled / key given ; *scale and size:* even scale for leaf area sequential for *x*-axis bars/plotting area to occupy at least half the grid in both directions ; *plots:* 6 values plotted accurately □ ½ small square ; 4 bars: bars the same width (at least 1 small square wide) gaps present between bars / pairs of bars ;	4	
(c)(iii)	*species **A**:* as the light intensity decreases the (average) leaf area increases / ; **ora** *species **B**:* (average) leaf area increases with increasing light intensity (to maximum at 50 au) and then decreases ; **ora**	2	
(c)(iv)	measure leaf growth at a narrower range of light intensities around 50 (au) ;	1	