

2.1

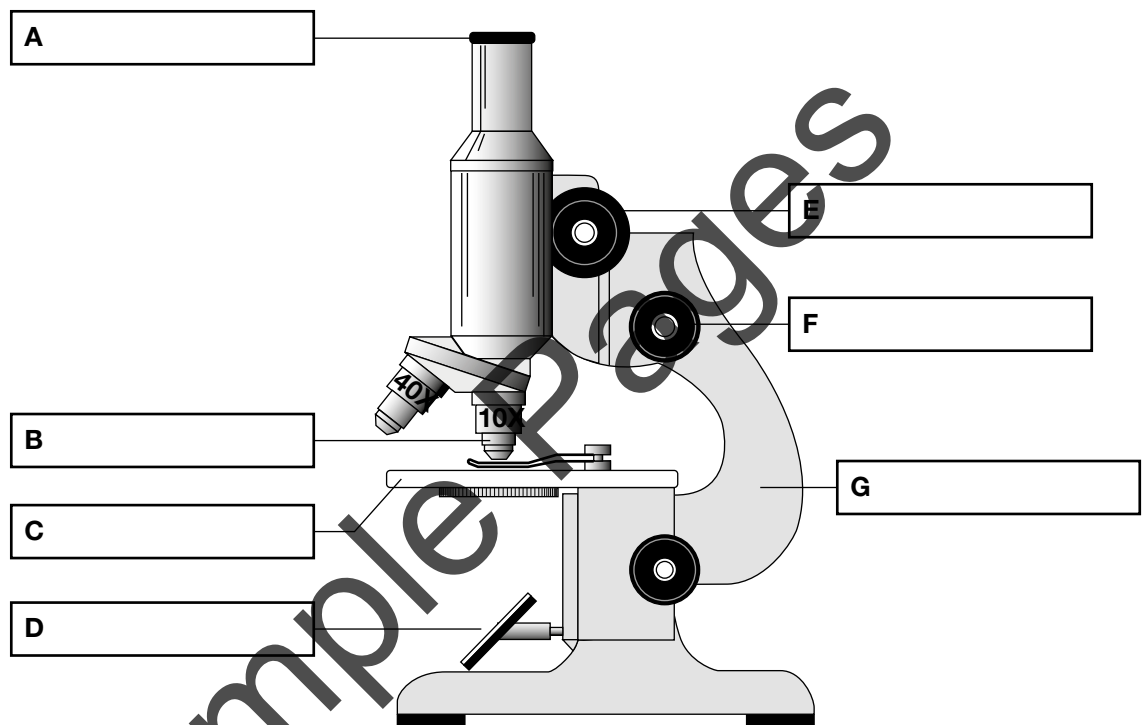
Getting to know your microscope

Working scientifically

L Literacy **WE** Work and enterprise

1 Name the parts labelled A to G on the diagram from the list below.

stage	fine focus knob	coarse focus knob	mirror
	objective lens	eyepiece	handle



2 Identify the correct description of each of the following parts of the microscope by joining them with a line.

- | | |
|----------------------------------|--|
| (a) Eyepiece | Part of the microscope on which the specimen is placed |
| (b) Coarse focus knob | Sharpens the focus on high power |
| (c) Stage | Unit used to measure microscopic objects |
| (d) Objective lens | Equipment used to make a wet mount |
| (e) Micrometre (μm) | The object being studied using the microscope |
| (f) Specimen | The lens of the microscope closest to the specimen |
| (g) Mirror | The part of the microscope you look through |
| (h) Fine focus knob | Used to reflect light through the specimen |
| (i) Slide and coverslip | Used to focus the microscope on low power |

Knowledge and understanding

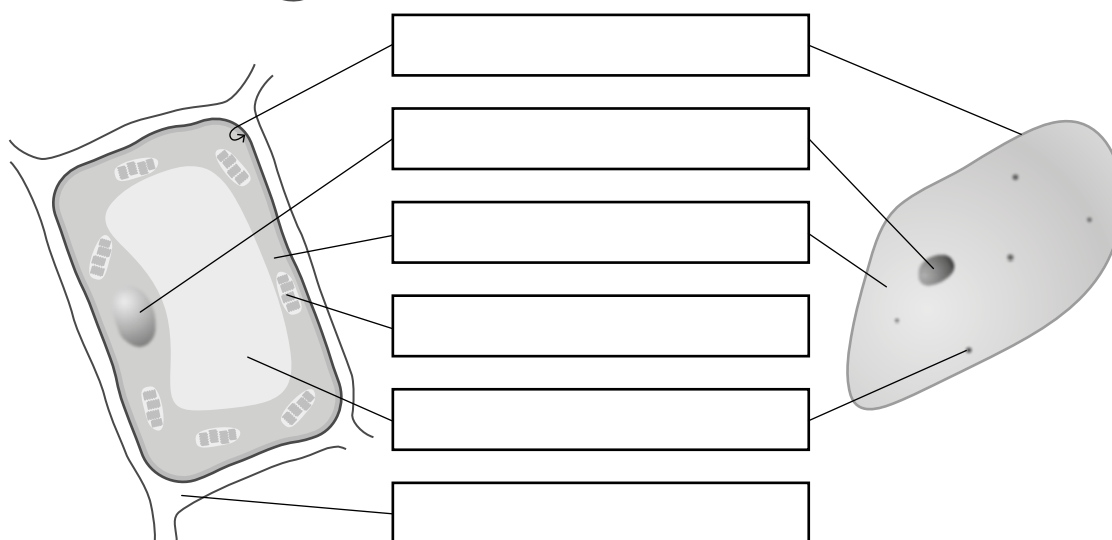
L Literacy

- 1 Plant and animal cells have a number of different parts. **Recall** the job of each by matching the cell part (on the left-hand side) with the job it does (on the right-hand side) by joining them with a line. Two have been done for you.

(a) Cell wall	The 'skin' that holds the cell together
(b) Cell membrane	A watery, jelly-like mixture that contains many smaller parts where the work of the cell takes place
(c) Nucleus	The powerhouses of the cell where the energy we need is released from the food we eat
(d) Cytoplasm	The skeleton of a plant
(e) Vacuole	The garbage disposal units that get rid of wastes from the cell
(f) Mitochondria	Part of some plant cells where photosynthesis takes place
(g) Ribosome	Control centre of the cell
(h) Endoplasmic reticulum	Contains wastes or chemicals that are being moved around the cell
(i) Lysosome	Microscopic factories that produce the proteins we use to grow and repair our bodies
(j) Chloroplast	Pathways that allow materials to move quickly and easily through the cell

- 2 Some features are found only in plant cells, some are found only in animal cells, and others are common to both plant and animal cells. **Identify** the parts of the plant and animal cells by selecting the correct word from the list below.

nucleus chloroplast vacuole cell wall cell membrane cytoplasm

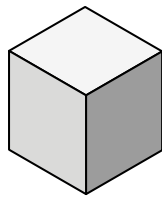


Working scientifically

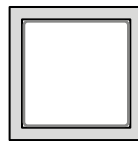
CCT Critical and creative thinking

A major difference between plant and animal cells is that plant cells have a cell wall and animal cells do not. Let's investigate the significance of this difference.

For this activity you will need to think and imagine. Think of an animal cell as being like a water-filled balloon. A plant cell will be like a box made of stiff cardboard with a water-filled balloon inside.



Plant cell: outside view



Plant cell: inside view



Animal cell

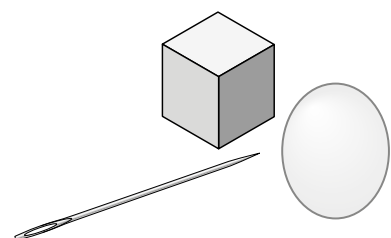
- 1 (a) **Construct** diagrams of what the following could look like.

A pile of 10 plant cells	A pile of 10 animal cells

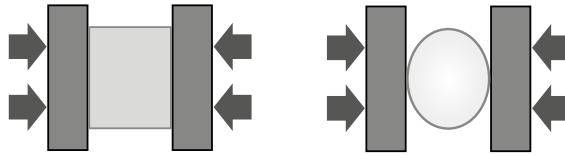
- (b) **Describe** what would happen if you piled the animal cells one on top of another.

- (c) **Describe** what would happen if you piled the plant cells one on top of another.

- 2 **Compare** how easy it would be to burst open the plant and animal cells to let the watery contents spill out.



3 Imagine the cells are being pushed from two sides.



(a) **Construct** diagrams to show what would happen to both types of cell.

Plant cell	Animal cell

(b) **State** whether the plant or animal cell is able to change its shape most easily.

4 **Propose** what would happen to a tree if suddenly all of its cells turned into animal cells.

5 **Propose** what would happen if all the cells in the body of this runner suddenly changed to plant cells.



6 (a) **List** the advantages and disadvantages of having cells like animal cells.

Advantages	Disadvantages

(b) **Explain** how animals have overcome these disadvantages.

7 (a) **List** the advantages and disadvantages of having cells like plant cells.

Advantages	Disadvantages

(b) **Explain** how plants have overcome these disadvantages.

Working scientifically

N Numeracy **CCT** Critical and creative thinking

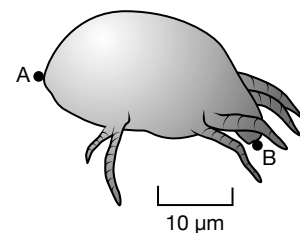
It is not practical to measure microorganisms and cells of plants and animals with a normal ruler. Cells measure only fractions of a millimetre. The unit used to measure cells is a micrometre. A micrometre is a thousandth of a millimetre and has the symbol μm .

- 1 Calculate** the missing values in the table below by converting to the units shown. To convert from centimetres to millimetres, multiply by 10. To convert millimetres to micrometres, multiply by 1000. To reverse each of these, divide by these factors of 10 and 1000. The first one has been done for you.

cm	$\xrightarrow{\times 10}$ $\xleftarrow{\div 10}$	mm	$\xrightarrow{\times 1000}$ $\xleftarrow{\div 1000}$	μm
0.03		0.3		300
0.7				
		2		
				45
0.03				
				130
		0.04		
				78

Using scales

- 2** When scientists draw diagrams of very small objects, they enlarge them. A scale is then added to the diagram to give an idea of the real size. This is a drawing of a dust mite. Dust mites are found everywhere but they are too small for us to see easily. How big are they?



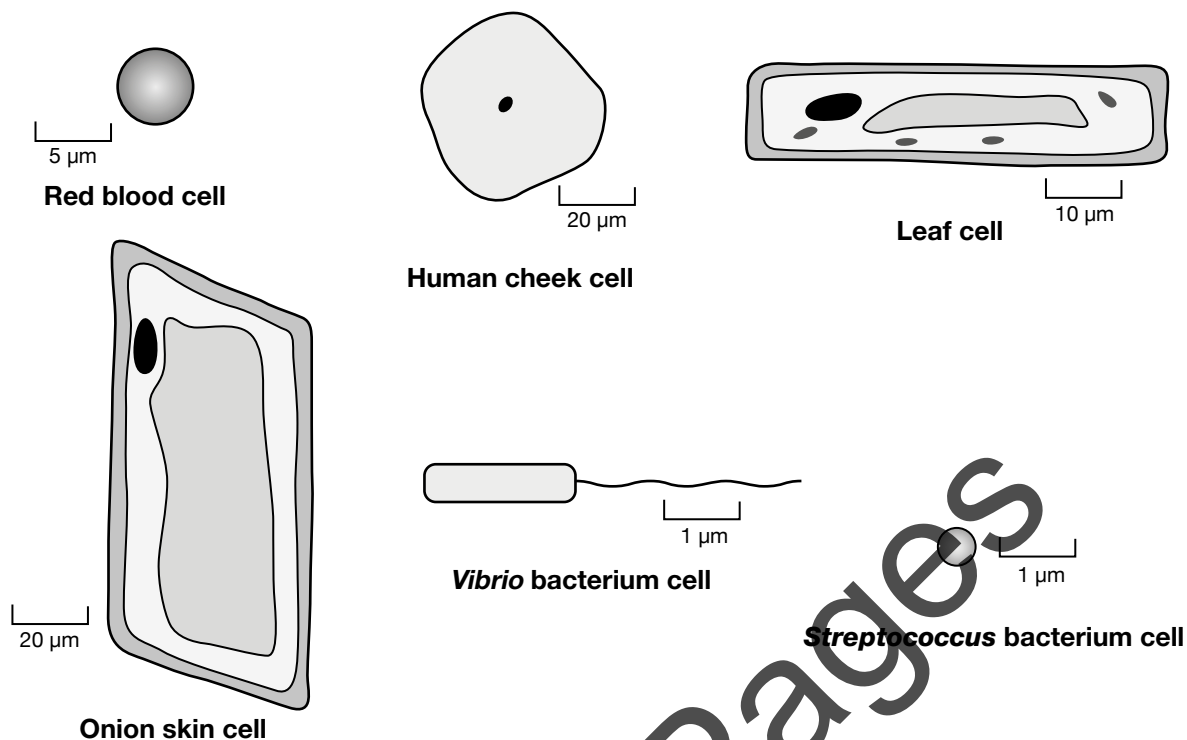
- (a)** Use a ruler to measure the length of the body from point A to point B. **State** this measurement in centimetres. _____

Use a ruler to measure the length of the line on the scale. It should be 1 cm long. This tells you that every centimetre of the drawing represents 10 μm of the real animal.

Multiply the length of the dust mite (measured in centimetres) by 10. This will give you the actual length of the dust mite in micrometres (μm).

- (b)** **State** the length of the dust mite. _____

3 (a) Use these drawings to **calculate** how big cells really are then complete the table below.



Question	Measurement (cm)	Scale	Calculation	Actual size (µm)
What is the diameter of the red blood cell?				
What is the diameter of the human cheek cell?				
What is the length of the cell from the leaf?				
What is the width of the cell from the leaf?				
What is the length of the onion skin cell?				
What is the width of the onion skin cell?				
What is the length of the body of the <i>Vibrio</i> bacterium?				
What is the diameter of the body of the <i>Vibrio</i> bacterium?				
What is the length of the tail of the <i>Vibrio</i> bacterium?				
What is the diameter of the <i>Streptococcus</i> bacterium?				

(b) **Calculate** the number of *Streptococcus* bacterial cells placed side by side that would fit across the diameter of a human cheek cell. _____

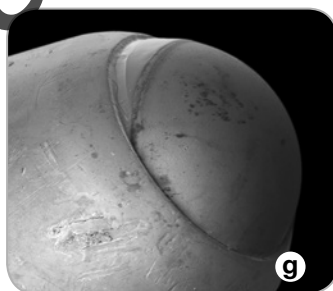
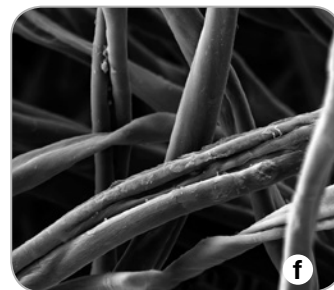
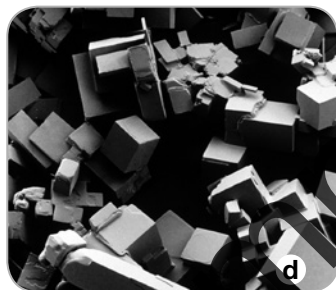
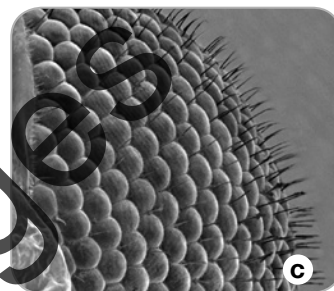
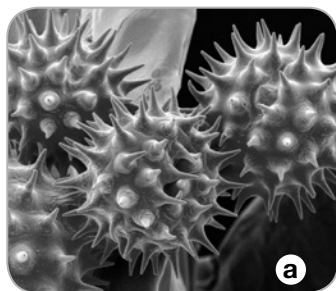
(c) **Calculate** the number of red blood cells placed side by side that would fit along the length of a leaf cell. _____

Knowledge and understanding**CCT Critical and creative thinking**

When scientists first used microscopes and then electron microscopes they saw familiar things magnified and saw other things that had never been seen before. They had to try to make sense of the images. How easy do you think that was?

The following pictures are electron micrographs of familiar objects.

- 1 Propose** what the following photographs represent. **Record** your ideas in the boxes under the pictures.



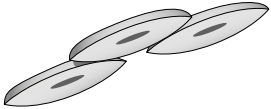
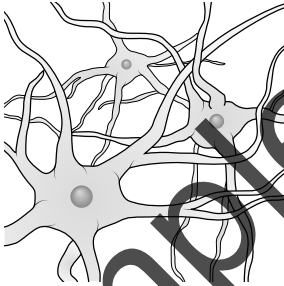
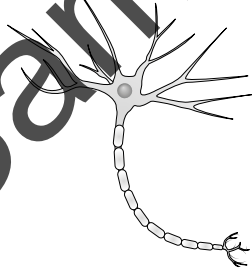
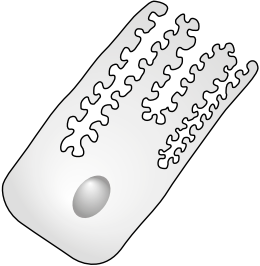
- 2 Discuss** your experience of trying to work out what these photographs represent.

Knowledge and understanding

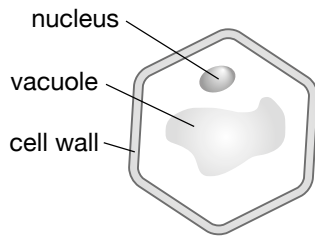
L Literacy **N** Numeracy **CCT** Critical and creative thinking

The cells found in plants and animals are of different shapes and sizes depending on what they do.

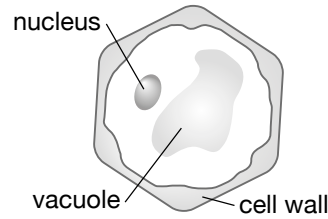
- 1 Think about where these cells are found and the jobs they have to do. **Explain** why their shapes mean that the cells are well suited to the jobs.

Cell type	Diagram of cell	Cell function	Why the shape makes the cell suited to its job
(a) Human skin cell		Provides a complete covering for the body	
(b) Nerve cell in brain		Sends information to and receives information from different parts of the brain	
(c) Nerve cell in body		Sends information from all parts of the body to the brain	
(d) Cell from small intestine		Passes digested food from space inside the intestine into the circulatory system of the body	

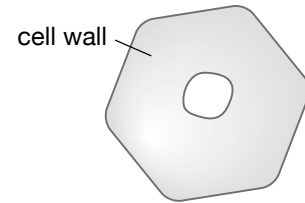
- 2 Some plant cells change as they get older. These three diagrams represent a cell from the stem of a tree.



Cell in the stem of a seedling at 10 days old



Same cell at 3-4 months old



Same cell in mature tree at 5 years old

- (a) **Describe** the changes that have occurred.

- (b) **Propose** how these changes would help the plant survive.

- 3 The following table contains a list of features of particular cells. **Propose** how each feature would help the cell carry out its job.

Feature of cell	How the feature helps the cell do its job
(a) Cells in the upper layers of leaves have large numbers of chloroplasts.	
(b) Muscle cells in the human leg have large numbers of mitochondria.	
(c) Cells in plant stems that carry water from the roots have no cross walls so they form a continuous tube like a drinking straw.	
(d) Cells in bone can produce a hard substance that completely surrounds them.	

Working scientifically

N Numeracy **CCT Critical and creative thinking**

Cells come in many different shapes, but they are all small. This activity explores the advantages of being small.

The cell membrane acts as a barrier between the outside of the cell and the inside of the cell. Anything that the cell needs to get rid of has to move out through the membrane. Anything the cell needs has to move in through the membrane. The cell will function best if there is an efficient exchange of materials across the membrane, which is the surface of the cell.

- 1 For this part of the activity, imagine a cell as being like a cube.

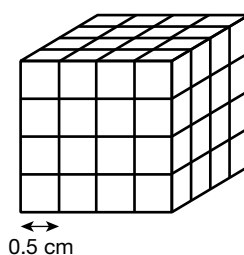
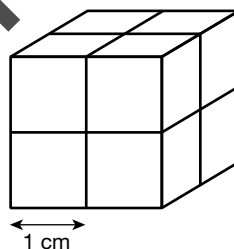
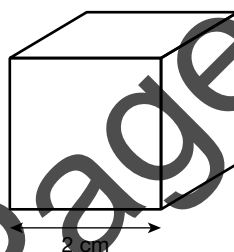
The surface of this cube is made up of the faces of the cube. The surface area of the cube is the area of all six sides of the cube added together.

- (a) This cube has sides that are 2 cm long.
Calculate the surface area of the cube.

Imagine the cube now being cut into eight smaller cubes.

- (b) **Calculate** the surface area of each of the smaller cubes and then the total surface area of the cubes.

- (c) Now cut each small cube into eight smaller cubes again. **Calculate** the surface area of each of the smaller cubes and then the total surface area.



- (d) **Record** your results in the first three rows of this table.

Length of side (cm)	Surface area of cube (cm ²)	Number of cubes	Total surface area (cm ²)
2		1	
1		8	
0.5			
0.25			
0.125			

(e) **Describe** the pattern of change in the surface area.

(f) Use this pattern to **predict** the values that will complete the last two rows of the table. At each stage, each cube is cut into eight.

(g) **Calculate** how much faster water would move into 64 cube-shaped cells with sides of 0.5 cm than into one cell with sides of 2 cm.

- 2 The cells covering the surface of a plant root are mostly like those shown in Figure 2.7.1a. However, in the area where most water enters the root, the cells are shaped like those of Figure 2.7.1b. **Explain** why these cells would be an advantage to the plant.

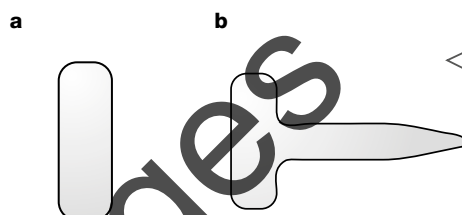


Figure 2.7.1

- 3 Figure 2.7.2a shows the typical shape of the cells lining your gut. In a part of the gut called the small intestine the cells are more like those of Figure 2.7.2b. **Propose** what might happen in the small intestine.

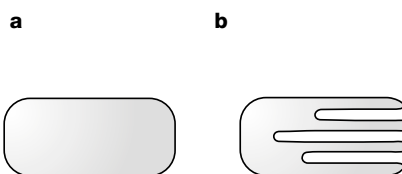


Figure 2.7.2

- 4 During the night, leaf cells take in oxygen gas from the air. They also release waste carbon dioxide gas into the atmosphere. **Evaluate** the two arrangements of cells shown in Figure 2.7.3 and decide which one would carry out the job of gas exchange more efficiently.

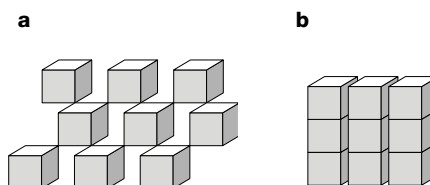


Figure 2.7.3

Justify your answer.

Knowledge and understanding

L Literacy **CCT** Critical and creative thinking

1 Use words from the list below to complete the sentences.

carbon dioxide	chlorophyll	glucose	oxygen
phloem	root hairs	sunlight	water
		water	xylem

- (a) The raw materials for photosynthesis are _____ and _____.
- (b) Also required are the green chemical called _____ found in chloroplasts and energy from _____.
- (c) _____ is produced by photosynthesis.
- (d) A waste product from photosynthesis is _____.
- (e) Water is taken into the plant through _____ and travels up the _____ to the leaves of the plant.
- (f) Glucose is distributed throughout the plant in the _____.

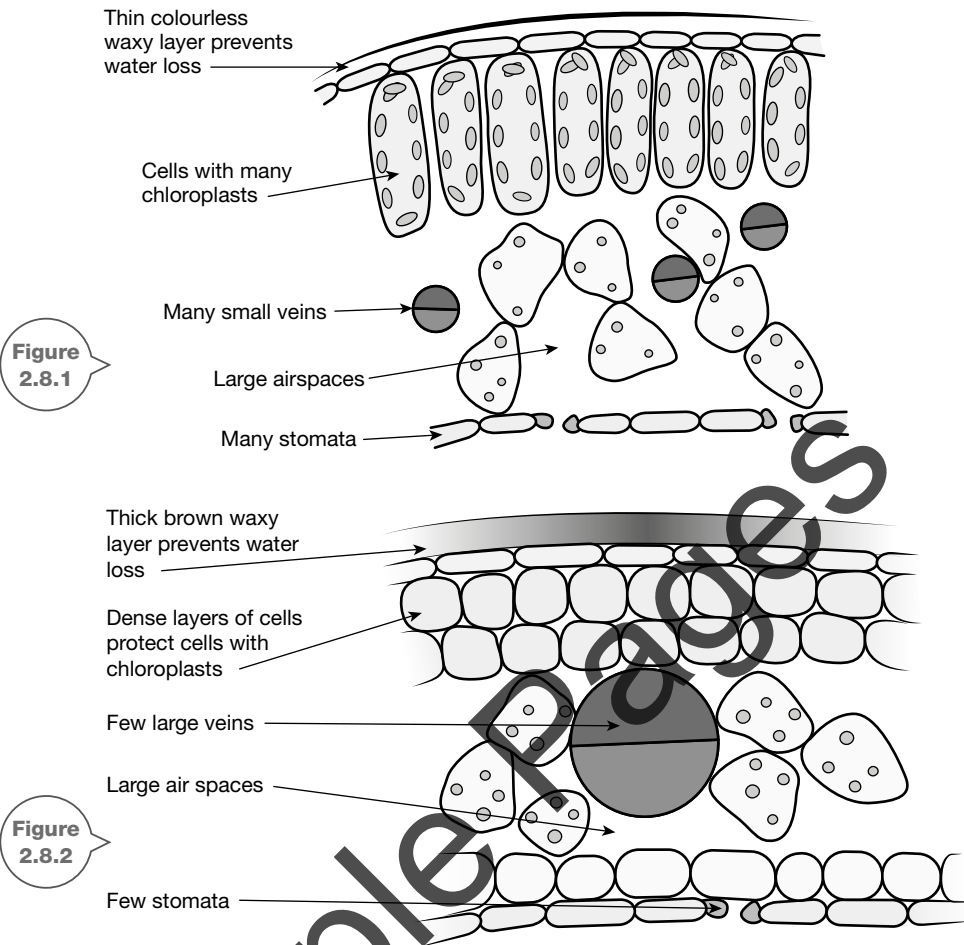
2 Propose an advantage, for the plant, of the cells with large numbers of chloroplasts being situated towards the upper surface of the leaf.

3 Glucose is carried in the phloem from the cells where it is made, up the plant towards the tips of branches and down towards the root. **Propose** why glucose would be needed in:

- (a) the tips of branches

- (b) in roots.

- 4 (a) **Contrast** the organisation of the tissues in the leaves shown in Figures 2.8.1 and 2.8.2.



- (b) **Discuss** any differences you think there would be in the efficiency of the leaves in carrying out photosynthesis.

Difference	Effect on photosynthesis

Knowledge and understanding**L** Literacy **CC** Civics and citizenship

Refer to the Learning Across the Curriculum in unit 2.4 in your student book to answer the following questions.

1 Define the term *cell culture*.

2 List some of the uses of cultured cells.

3 Explain how stem cells are different from other cells such as muscle cells.

4 Construct a flow diagram of the process of growing a new bladder.

5 Explain why a **shell** is necessary when growing a new bladder but is not used when growing skin.

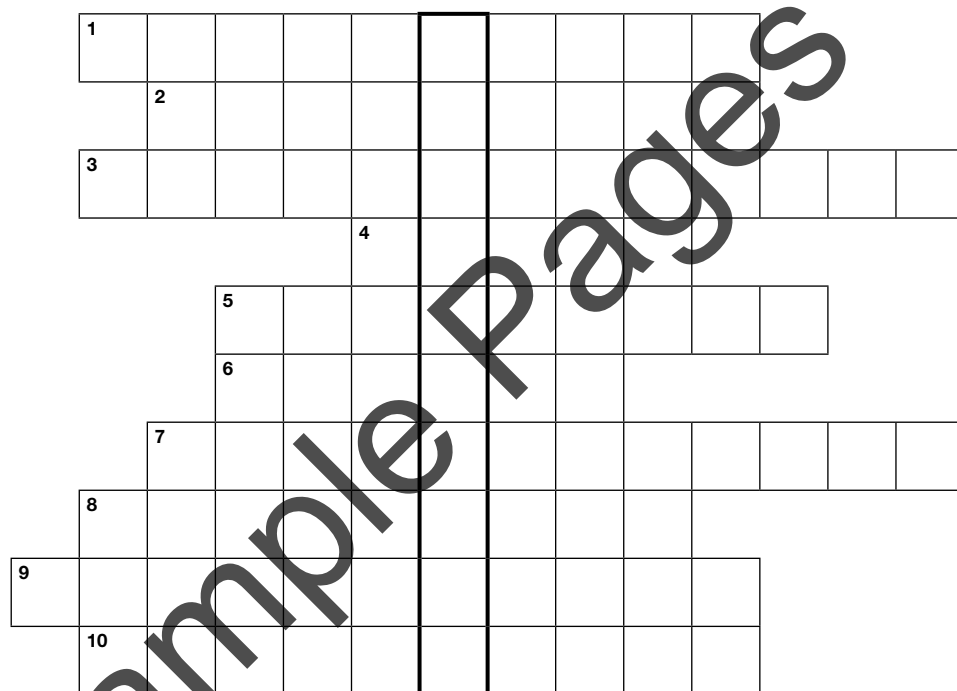
6 List the two types of cells that were cultured to grow the new bladder.

7 Explain why two different types of cells were needed.

Knowledge and understanding

L Literacy

- 1 (a) **Use** the clues to complete the crossword.
- (b) Read the letters in the bolded column. **State** the word they spell.
- _____
- (c) **Define** this word.



- 1 Unit used to measure microscopic things
- 2 When small things are made to look bigger they are _____
- 3 Describes an organism made up of many cells
- 4 Group of different tissues that work together
- 5 Watery, jelly-like substance found inside cells
- 6 Groups of cells of the same type
- 7 Powerhouses of the cell
- 8 Organelles that produce proteins
- 9 The organelle that makes plants green and where they make their food
- 10 Small parts found within cells

- 2 The key terms in the table below are somewhere in this wordfind. Where there is more than one word in the key term, the words will either be on the same line or will intersect, like the words in a crossword.

Find each term in the grid, then **define** the key term to complete the table.

S	P	E	C	I	M	E	N	A	C	G	L
B	E	R	R	E	T	I	C	U	L	U	M
L	P	N	E	N	T	I	S	S	U	E	S
F	I	E	L	D	O	F	V	I	E	W	N
B	T	W	R	O	O	F	A	M	A	R	E
T	H	A	H	P	R	O	C	U	L	A	R
C	E	L	L	L	G	G	U	N	E	F	V
L	L	L	C	A	A	H	O	S	N	F	E
U	I	A	R	S	N	E	L	O	S	E	C
V	U	F	I	M	A	G	E	L	A	G	E
D	M	U	S	I	S	I	M	F	U	C	L
O	T	N	U	C	L	E	U	S	R	L	L

Key term	Definition
Cell wall	
Endoplasmic reticulum	
Epithelium	
Field of view	
Image	
Nerve cell	
Nucleus	
Ocular lens	
Organ	
Specimen	
Tissue	
Vacuole	