| **p29** | **1** | A labelled diagram of a microscope. |

Eyepiece lens

Coarse focus

Tube

Revolving nosepiece

Fine focus

Stage

Objective lens

Mirror

2 What is the magnification power if the eyepiece lens is 5x and the objective lens is 40x?

Magnifying power = 5x × 40x = 200x

3 To make a wet mount place the sample on the slide. Use an eyedropper to put a drop of water on the sample. Place one end of the cover slip on the slide and slowly lower the other end using the end of a toothpick to prevent air bubbles from getting trapped under the cover slip.

4 A wet mount fills the space between the cover slip and the slide allowing light to pass easily through the slide, the sample, and the cover slip. The water in a wet mount will also help support the sample.
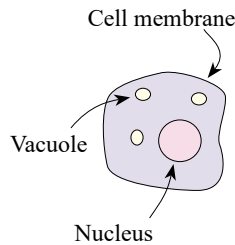
p30	**1** 1000 micrometres = 1 millimetre? **2** Convert 0.85 mm to microns. $\quad$ 0.85 mm $\;= 0.85 \times 1000 \quad \{1mm=1000\mu m\}$ $\qquad\qquad\quad = 850$ microns (or 850 μm) **3** Convert 0.05 mm to microns. $\quad$ 0.05 mm $\;= 0.05 \times 1000 \quad \{1mm=1000\mu m\}$ $\qquad\qquad\quad = 50$ microns (or 50 μm) **4** Convert 75 microns to mm. $\quad$ 75 μm $\qquad = 75 \div 1000 \quad \{1mm=1000\mu m\}$ $\qquad\qquad\quad = 0.075$ mm **5** Convert 250 microns to mm. $\quad$ 250 μm $\qquad = 250 \div 1000 \quad \{1mm=1000\mu m\}$ $\qquad\qquad\quad = 0.25$ mm **6** Convert 5 microns to mm. $\quad$ 5 μm $\qquad = 5 \div 1000 \quad \{1mm=1000\mu m\}$ $\qquad\qquad\quad = 0.005$ mm **7** Estimated length of the paramecium in the above field of view is about 0.6 mm or 600 μm. **8** Estimated length of the onion cell in the above field of view is about 400 μm or 0.4 mm.
p31	**1** Three different types of microscopes are the compound light microscope, the stereo microscope, a USB microscope, the scanning probe microscope, the acoustic microscope, the electron microscope. **2** If the field diameter at 40x is 4 mm, what is the field diameter at 150x? $\qquad$ Field diameter $\quad = \dfrac{known\ fd \times known\ power}{unknown\ power}$ $\qquad\qquad\qquad = \dfrac{4 \times 40}{150} = 1.07$ mm **3** If the field diameter at 40x is 4 mm, what is the field diameter at 200x? $\qquad$ Field diameter $\quad = \dfrac{known\ fd \times known\ power}{unknown\ power}$ $\qquad\qquad\qquad = 4 \times 40 \div 200 = 0.8$ mm **4** If the field diameter at 40x is 4 mm, what is the field diameter at 600x? $\qquad$ Field diameter $\quad = \dfrac{known\ fd \times known\ power}{unknown\ power}$ $\qquad\qquad\qquad = 4 \times 40 \div 600 = 0.27$ mm

p35	**1** Labelled animal cell.

2 A human cheek cell is about 50 microns (ie 50 µm) wide.   50 µm $= 50 \div 1000$ {1mm=1000µm}
$= 0.05$ mm

3 Animal cells are multicellular. Multicellular means having many cells.

4 Describe the function of each of the following organelles:
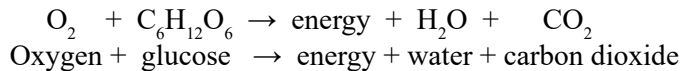**a)** The nucleus has DNA which controls the action of the cell.
b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.
c) The cytoplasm is jelly-like substance making up most of the celland is where the important reactions take place.
d) Mitochondria are tiny powerhouses in the cell. Mitochondria convert glucose into energy (respiration: O_2 + glucose $\rightarrow$ water + CO_2).

5 Mitochondria are difficult to view in a light microscope.

6 Respiration provides every cell with the energy that they require.

O_2 + $C_6H_{12}O_6$ $\rightarrow$ energy + H_2O + CO_2
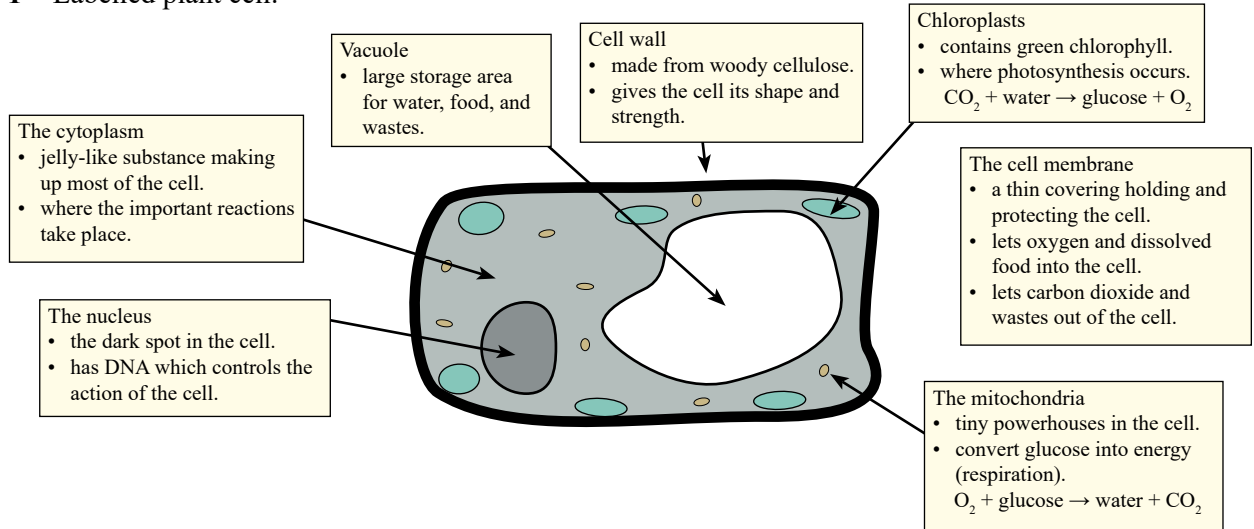Oxygen + glucose $\rightarrow$ energy + water + carbon dioxide

7 More mitochondria would be expected in a muscle cell than in a kidney cell because muscle cells require more energy than do kidney cells.

8 Animal cells don't have a cell wall. This might be an advantage to an animal by allowing an animal to more more freely.

9 Human skin is made up of many different kinds of cells working together to protect the human body.

The skin cells that are likely to contain the most mitochondria would be in the dermis, the layer under the epidermis. The dermis consists of connective tissue and more mitochondria, than in the epidermis, would be needed to provide energy for the connective tissue.

p37	**1** Labelled plant cell.

The cytoplasm
- jelly-like substance making up most of the cell.
- where the important reactions take place.

Vacuole
- large storage area for water, food, and wastes.

Cell wall
- made from woody cellulose.
- gives the cell its shape and strength.

Chloroplasts
- contains green chlorophyll.
- where photosynthesis occurs.
  CO_2 + water → glucose + O_2

The cell membrane
- a thin covering holding and protecting the cell.
- lets oxygen and dissolved food into the cell.
- lets carbon dioxide and wastes out of the cell.

The nucleus
- the dark spot in the cell.
- has DNA which controls the action of the cell.

The mitochondria
- tiny powerhouses in the cell.
- convert glucose into energy (respiration).
  O_2 + glucose → water + CO_2

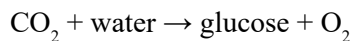**2** An onion cell is about 0.2 mm in length = 0.2 × 1000 μm = 200 μm (microns).

3 Plant cells are multicellular. Multicellular means having many cells.

4 Describe the function of each of the following organelles found in plant cells:
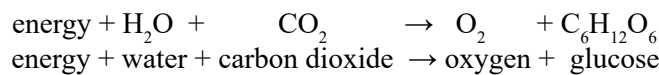   **a)** The nucleus has DNA which controls the action of the cell.
   b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.
   c) Chloroplasts contain green chlorophyll. Chloroplasts are where photosynthesis occurs.
   CO_2 + water → glucose + O_2
   d) Vacuoles are storage areas for water, food, and wastes.

5 Photosythesis provides plant cells with their source of food.
   energy + H_2O + CO_2 → O_2 + $C_6H_{12}O_6$
   energy + water + carbon dioxide → oxygen + glucose

6

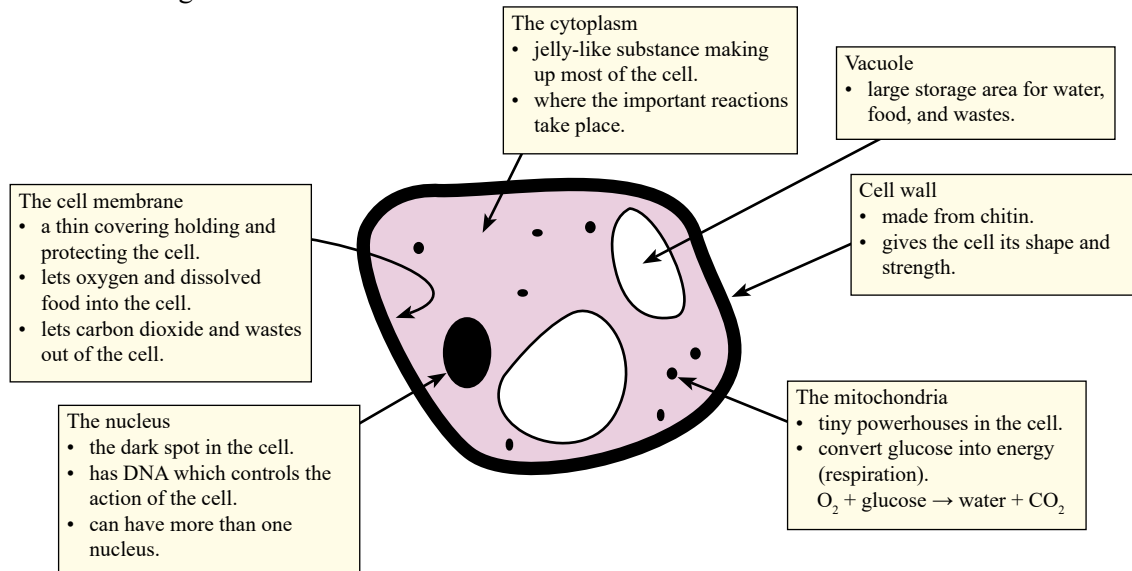| Organelle	Plant cells only	Animal cells only	Both
Nucleus			✔
Cell membrane			✔
Cell wall	✔		
Cytoplasm			✔
Chloroplasts	✔		
Mitochondria			✔
Large vacuole	✔	Have small vacuoles	

7 Plant cells have cell walls that maintain the shape of the plant.

8 Mitochondria would be expected to be found in plant cells as well as animal cells because they produce energy for the cells, and both animal and plant cells need energy to function.

9 Chloroplasts in a plant cell are involved in photosynthesis.

10 Mitochondria in a plant cell are involved in respiration.

| **p39** | **1** | Labelled fungus cell. |

The cytoplasm
- jelly-like substance making up most of the cell.
- where the important reactions take place.

Vacuole
- large storage area for water, food, and wastes.

The cell membrane
- a thin covering holding and protecting the cell.
- lets oxygen and dissolved food into the cell.
- lets carbon dioxide and wastes out of the cell.

Cell wall
- made from chitin.
- gives the cell its shape and strength.

The nucleus
- the dark spot in the cell.
- has DNA which controls the action of the cell.
- can have more than one nucleus.

The mitochondria
- tiny powerhouses in the cell.
- convert glucose into energy (respiration).
O_2 + glucose → water + CO_2

2 A yeast cell is about 4 microns (μm) across = 4 ÷ 1000 = 0.004 mm.

3 Fungal cells range from unicellular to multicellular. Multicellular means having many cells.

4 Describe the function of each of the following organelles found in plant cells:
a) The nucleus has DNA which controls the action of the cell.
b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.
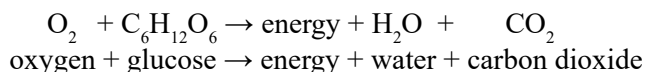**c)** The cell wall gives the cell its shape and strength.
d) Vacuoles are storage areas for water, food, and wastes.

5 Fungal cells don't have chloroplasts. This suggests that fungal cells obtain their food source from other plants or animals.

6 Fungi belong to the eukaryotes. Eukaryotic cells have a membrane covered nucleus (eukaryotic).

7 Respiration provides every cell with the energy that they require.

$$O_2 + C_6H_{12}O_6 \rightarrow energy + H_2O + CO_2$$
oxygen + glucose → energy + water + carbon dioxide

8 Mitochondria would be expected to be found in fungal cells as well as animal cells because they produce energy for the cells, and both animal and fungal cells need energy to function.

9 Fungi secrete digestive enzymes (and acids such as acetic acid) and then absorb the partly digested food through their cell walls and cell membranes.
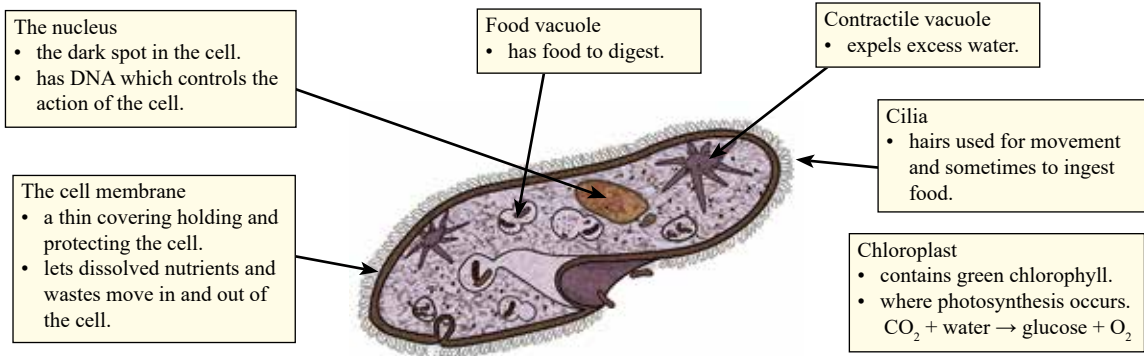
These digestive enzymes breakdown the cellulose cell walls of plants.

Fungal cell walls are made of chitin instead of cellulose to avoid the digestion by fungal digestive enzymes.

10 Can you suggest a way of separating the nucleus of plant cells from the other plant organelles?

Use a fungal digestive enzyme to break down the cell wall to free the cell organelles. Then use a centrifuge. It might be expected that the nucleus is the denser organelle and would then be found at the bottom of a test tube.

p41	**1** Labelled euglena.

The nucleus
• the dark spot in the cell.
• has DNA which controls the action of the cell.

Food vacuole
• has food to digest.

Contractile vacuole
• expels excess water.

Cilia
• hairs used for movement and sometimes to ingest food.

The cell membrane
• a thin covering holding and protecting the cell.
• lets dissolved nutrients and wastes move in and out of the cell.

Chloroplast
• contains green chlorophyll.
• where photosynthesis occurs.
CO_2 + water → glucose + O_2

2 A euglena is about 0.1 mm in length = 0.1 × 1000 = 100 microns (μm).

3 Describe the function of each of the following organelles:

a) The nucleus has DNA which controls the action of the cell.

b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.

c) The cytoplasm is the jelly-like substance making up most of the cell and is where the important reactions take place.

d) The mitochondria are tiny powerhouses in the cell. Mitochondria convert glucose into energy (respiration: O_2 + glucose → water + CO_2).
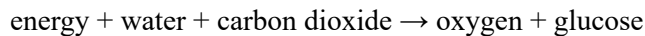
e) The vacuoles are large storage areas for water, food, and wastes.

4 Many protists have a flagellum or cilia.
The flagellum or cilia could be used for movement and to catch or collect food.

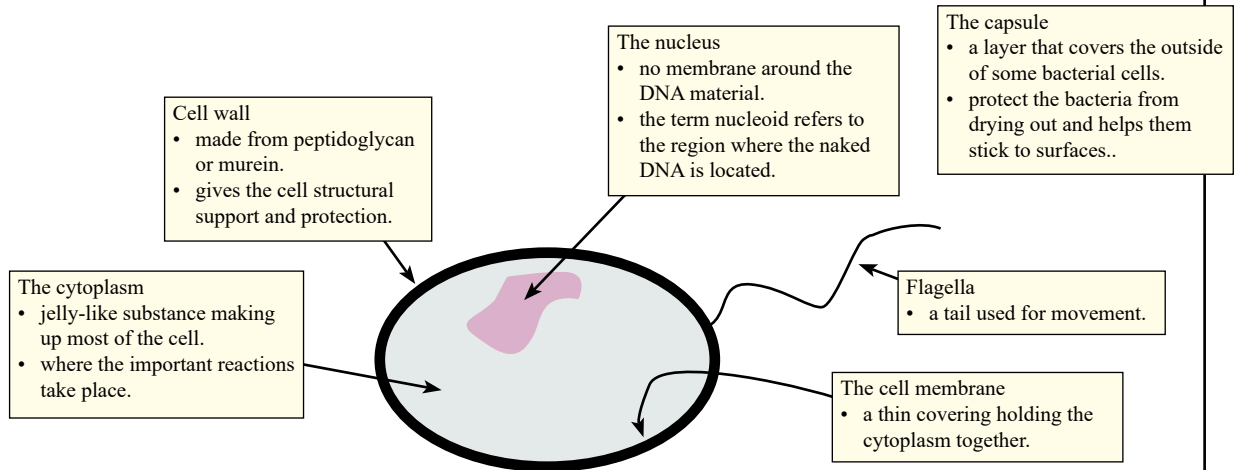**5** Photosythesis can occur when light shines on chloroplasts.
Write the following symbolic equation for photosynthesis in words:

$$energy + H_2O + CO_2 \rightarrow O_2 + C_6H_{12}O_6$$
energy + water + carbon dioxide → oxygen + glucose

6 Some protists, such as euglena, have green algae living inside them. The green algae may be useful in producing food, through photosynthesis, for the algae and the euglena.

7 Some protists are able to live in water with very low oxygen concentrations. This might be possible by using the green algae to not only produce food but also oxygen through photosynthesis (energy + H_2O + CO_2 → O_2 + $C_6H_{12}O_6$).

| **p43** | **1** | Labelled bacterial cell. |

The nucleus
- no membrane around the DNA material.
- the term nucleoid refers to the region where the naked DNA is located.

The capsule
- a layer that covers the outside of some bacterial cells.
- protect the bacteria from drying out and helps them stick to surfaces..

Cell wall
- made from peptidoglycan or murein.
- gives the cell structural support and protection.

The cytoplasm
- jelly-like substance making up most of the cell.
- where the important reactions take place.

Flagella
- a tail used for movement.

The cell membrane
- a thin covering holding the cytoplasm together.

2 A bacillus (rod-like) bacterial cell is about 2 microns (μm) in length = 2 ÷ 1000 = 0.002 mm

3 Many protists eat bacteria. If a bacteria is 2 μm in length and a euglena is 100 μm in length, how many times larger is the euglena? The euglena is 50 times larger.
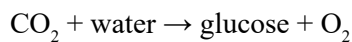
4 Bacteria are prokaryotic. Prokaryotic means that there is no membrane around their nucleoid DNA.

5 Describe the function of each of the following organelles found in bacterial cells:
a) The nucleus has DNA which controls the action of the cell.

b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.

c) Chloroplasts contain green chlorophyll. Chloroplasts are where photosynthesis occurs.

CO_2 + water → glucose + O_2

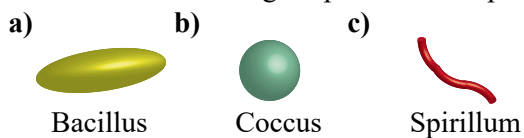**d)** The vacuoles are large storage areas for water, food, and wastes.

6 Use the terms rod-like, spiral, and spherical to describe the following bacterial shapes:
a) coccus - spherical.
b) bacillus - rod-like.
c) spirillum - spiral.

7 Describe the following shapes as either spirillum, coccus, or bacillus:
a)   **b)**   **c)**

Bacillus   Coccus   Spirillum

8 The bacteria 'bacillus anthracis' causes anthrax. The name suggests that the bacteria has a rod-like shape?

9 Staphylococcus bacteria cause a wide variety of diseases in humans. If the term 'staphyl' describes a bunch of grapes, staphylococcus suggests spherical bacteria in bunches.

10 Many bacteria have a covering outside the cell wall. The purpose of the covering is probably for protection.

p44	**1**	Mitosis is the name given to the process of a cell dividing to produce two identical cells.
	2	The main purpose of cell division is for growth and repair.
	3	If a cell divides into two every minute. How many cells will there be after 10 minutes?
		0 2 3 4 5 6 7 8 9 10
		1 2 4 8 16 32 64 128 256 **512**
	4	Name two parts of the body where you would expect cell division to be happening most of the time.
		The skin and the bone marrow (where blood cells are produced).
	5	A cell nucleus has 46 chromosomes. The cell undergoes mitosis and becomes two cells. There will be 46 chromosomes are in each new cell?
p45	**1**	Mitosis is the name given to the process of a cell dividing to produce two identical cells.**2** Why is it important that cells to be able to divide?
	3	The four phases of mitosis are prophase, metaphase, anaphase, telophase.
	4	In the diagram on the left, which phase of mitosis is: **a)** A - anaphase. **b)** B - metaphase. **c)** C - prophase. **d)** D - anaphase.
	5	The evidence that the cells on the left are plant cells are the cell walls giving structure to each onion cell.
p52	**1**	Three different types of microscopes are the compound light microscope, the stereo microscope, a USB microscope, the scanning probe microscope, the acoustic microscope, the electron microscope.
	2	1000 micrometres = 1 millimetre?
	3	Convert 0.50 mm to microns. 0.50 mm = 0.50 × 1000 {1mm=1000µm} = 500 microns (or 500 µm)
	4	Convert 0.05 mm to microns. 0.05 mm = 0.05 × 1000 {1mm=1000µm} = 50 microns (or 50 µm)
	5	Convert 0.002 mm to microns. 0.002 mm = 0.002 × 1000 {1mm=1000µm} = 2 microns (or 2 µm)
	6	Convert 300 microns to mm. 300 µm = 300 ÷ 1000 {1mm=1000µm} = 0.3 mm
	7	Convert 50 microns to mm. 50 µm = 50 ÷ 1000 {1mm=1000µm} = 0.05 mm
	8	Convert 4 microns to mm. 4 µm = 4 ÷ 1000 {1mm=1000µm} = 0.004 mm

p52	**9** Estimated length of the paramecium in the above field of view is about 0.6 mm or 600 μm.
	10 Estimated length of the onion cell in the above field of view is about 400 μm or 0.4 mm.
	11 If the field diameter at 40x is 4 mm, what is the field diameter at 150x?

$$\text{Field diameter} = \frac{known\ fd \times known\ power}{unknown\ power}$$

$$= \frac{4 \times 40}{150} = 1.07 \text{ mm}$$

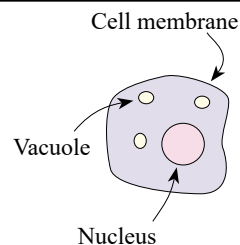**12** If the field diameter at 40x is 4 mm, what is the field diameter at 200x?

$$\text{Field diameter} = \frac{known\ fd \times known\ power}{unknown\ power}$$

$$= 4 \times 40 \div 200 = 0.8 \text{ mm}$$

13 If the field diameter at 40x is 4 mm, what is the field diameter at 600x?

$$\text{Field diameter} = \frac{known\ fd \times known\ power}{unknown\ power}$$

$$= 4 \times 40 \div 600 = 0.27 \text{ mm}$$

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p53

1 Labelled animal cell.

2 A human cheek cell is about 50 microns (ie 50 μm) wide. 50 μm = 50 ÷ 1000 {1mm=1000μm}
= 0.05 mm

3 Animal cells are multicellular. Multicellular means having many cells.

4 Describe the function of each of the following organelles:
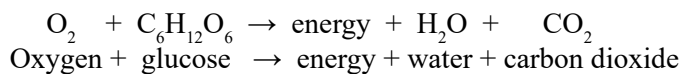**a)** The nucleus has DNA which controls the action of the cell.
b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.
c) The cytoplasm is jelly-like substance making up most of the celland is where the important reactions take place.
d) Mitochondria are tiny powerhouses in the cell. Mitochondria convert glucose into energy (respiration: O_2 + glucose → water + CO_2).

5 Respiration provides every cell with the energy that they require.

O_2 + $C_6H_{12}O_6$ → energy + H_2O + CO_2
Oxygen + glucose → energy + water + carbon dioxide

6 More mitochondria would be expected in a muscle cell than in a kidney cell because muscle cells require more energy than do kidney cells.

p53

8 Labelled plant cell.

Vacuole
- large storage area for water, food, and wastes.

Cell wall
- made from woody cellulose.
- gives the cell its shape and strength.

Chloroplasts
- contains green chlorophyll.
- where photosynthesis occurs.
  CO_2 + water → glucose + O_2

The cytoplasm
- jelly-like substance making up most of the cell.
- where the important reactions take place.

The cell membrane
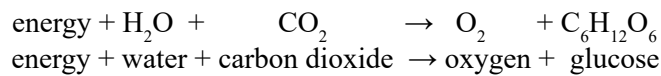- a thin covering holding and protecting the cell.
- lets oxygen and dissolved food into the cell.
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The nucleus
- the dark spot in the cell.
- has DNA which controls the action of the cell.

The mitochondria
- tiny powerhouses in the cell.
- convert glucose into energy (respiration).
  O_2 + glucose → water + CO_2

9 An onion cell is about 0.2 mm in length = 0.2 × 1000 μm = 200 μm (microns).

10 Describe the function of each of the following organelles found in plant cells:
a) The nucleus has DNA which controls the action of the cell.
b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.
c) Chloroplasts contain green chlorophyll. Chloroplasts are where photosynthesis occurs.
CO_2 + water → glucose + O_2
d) Vacuoles are storage areas for water, food, and wastes.

11 Photosythesis provides plant cells with their source of food.
energy + H_2O + CO_2 → O_2 + $C_6H_{12}O_6$
energy + water + carbon dioxide → oxygen + glucose

12

Organelle	Plant cells only	Animal cells only	Both
Nucleus			✔
Cell membrane			✔
Cell wall	✔		
Cytoplasm			✔
Chloroplasts	✔		
Mitochondria			✔
Large vacuole	✔	Have small vacuoles	

p54	**1** Labelled fungus cell.

The cytoplasm
- jelly-like substance making up most of the cell.
- where the important reactions take place.

Vacuole
- large storage area for water, food, and wastes.

The cell membrane
- a thin covering holding and protecting the cell.
- lets oxygen and dissolved food into the cell.
- lets carbon dioxide and wastes out of the cell.

Cell wall
- made from chitin.
- gives the cell its shape and strength.

The nucleus
- the dark spot in the cell.
- has DNA which controls the action of the cell.
- can have more than one nucleus.

The mitochondria
- tiny powerhouses in the cell.
- convert glucose into energy (respiration).
  O_2 + glucose → water + CO_2

2 A yeast cell is about 4 microns (μm) across = 4 ÷ 1000 = 0.004 mm.

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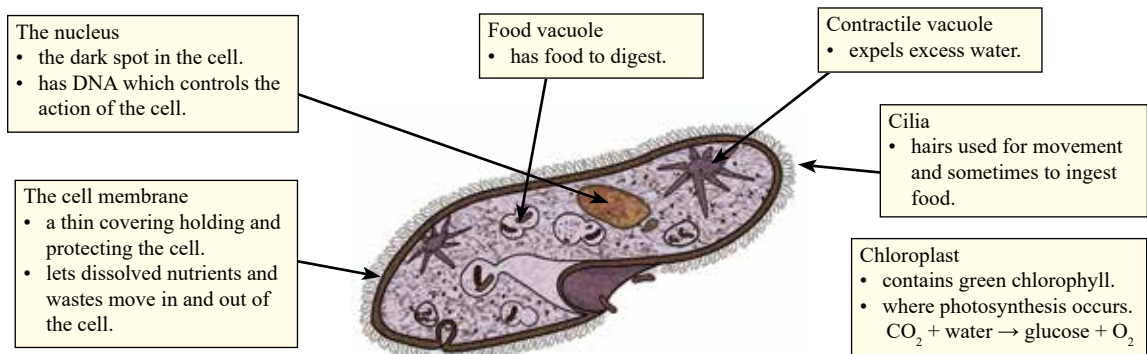
c) The cell wall gives the cell its shape and strength.

d) Vacuoles are storage areas for water, food, and wastes.

5 Fungal cells don't have chloroplasts. This suggests that fungal cells obtain their food source from other plants or animals.

6 Fungi belong to the eukaryotes. Eukaryotic cells have a membrane covered nucleus (eukaryotic).

7 Labelled protista cell.

The nucleus
- the dark spot in the cell.
- has DNA which controls the action of the cell.

Food vacuole
- has food to digest.

Contractile vacuole
- expels excess water.

Cilia
- hairs used for movement and sometimes to ingest food.

The cell membrane
- a thin covering holding and protecting the cell.
- lets dissolved nutrients and wastes move in and out of the cell.

Chloroplast
- contains green chlorophyll.
- where photosynthesis occurs.
  CO_2 + water → glucose + O_2

8 Many protists have a flagellum or cilia.
The flagellum or cilia could be used for movement and to catch or collect food.
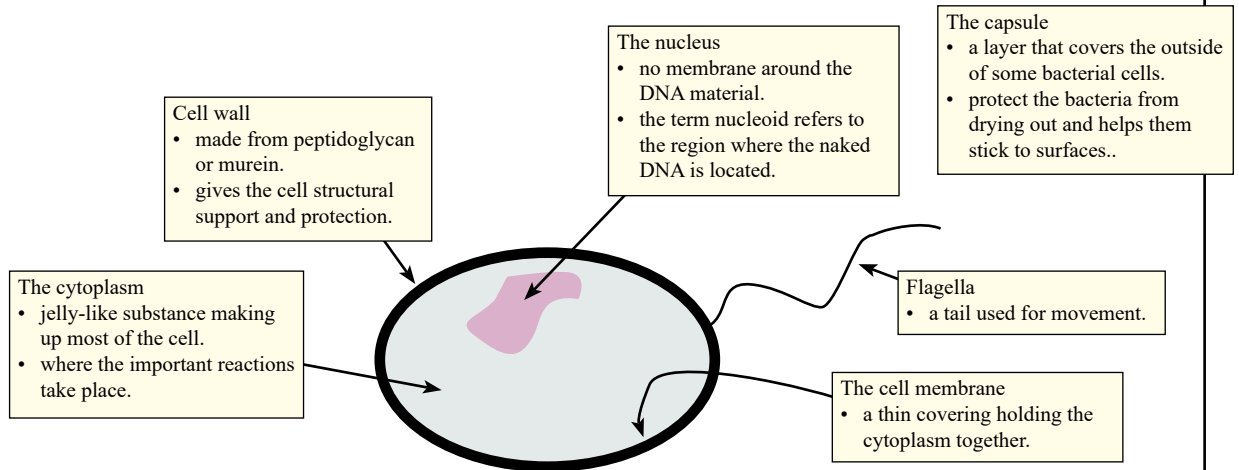
p54	**9** Describe the function of each of the following organelles: **a)** The nucleus has DNA which controls the action of the cell. **b)** The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell. **c)** The cytoplasm is the jelly-like substance making up most of the cell and is where the important reactions take place. **d)** The mitochondria are tiny powerhouses in the cell. Mitochondria convert glucose into energy (respiration: O_2 + glucose → water + CO_2). **e)** The vacuoles are large storage areas for water, food, and wastes. **10** Photosythesis can occur when light shines on chloroplasts. Write the following symbolic equation for photosynthesis in words: energy + H_2O + CO_2 → O_2 + $C_6H_{12}O_6$ energy + water + carbon dioxide → oxygen + glucose **11** Some protists, such as euglena, have green algae living inside them. The green algae may be useful in producing food, through photosynthesis, for the algae and the euglena.
p55	**1** A bacteria divides into two every minute. Starting with one bacteria, Mins 0 2 3 4 5 6 7 8 9 10 No: 1 2 4 8 16 32 64 128 256 512 **a)** it take 4 mins to get 8 bacteria. **b)** it will 6 mins take to get 32 bacteria. **c)** it will take 7 mins to get 64 bacteria. **2** A bacteria divides into two every five minutes. Starting with one bacteria at 9 am. mins 0 5 10 15 20 25 30 35 40 45 50 55 60 No: 1 2 4 8 16 32 64 128 256 512 1024 2048 4096 **a)** No. bacteria after an hour = 4096 or 2^{12}. **b)** No. bacteria after a day = 2^{288} {There are 12×24 five minutes in a day}. **3** A bacteria divides into two every minute. One bacteria is put in a container at 9 am. The container is half full at 10 am. The container will be full at 10:01 am. **4** A bacteria divides into two every minute. One bacteria is put in a container at 9 am and the container is full at 10 am. The container was half full at 9:59 am.

p56	**1** Labelled bacterial cell.

Cell wall
- made from peptidoglycan or murein.
- gives the cell structural support and protection.

The nucleus
- no membrane around the DNA material.
- the term nucleoid refers to the region where the naked DNA is located.

The capsule
- a layer that covers the outside of some bacterial cells.
- protect the bacteria from drying out and helps them stick to surfaces..

The cytoplasm
- jelly-like substance making up most of the cell.
- where the important reactions take place.

Flagella
- a tail used for movement.

The cell membrane
- a thin covering holding the cytoplasm together.

2 A bacillus (rod-like) bacterial cell is about 2 microns (μm) in length = 2 ÷ 1000 = 0.002 mm

3 Many protists eat bacteria. If a bacteria is 2 μm in length and a euglena is 100 μm in length, how many times larger is the euglena? The euglena is 50 times larger.
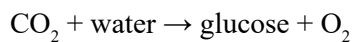
4 Bacteria are prokaryotic. Prokaryotic means that there is no membrane around their nucleoid DNA.

5 Describe the function of each of the following organelles found in bacterial cells:
a) The nucleus has DNA which controls the action of the cell.

b) The cell membrane is a thin covering holding and protecting the cell. The cell membrane lets oxygen and dissolved food into the cell, and lets carbon dioxide and wastes out of the cell.

c) Chloroplasts contain green chlorophyll. Chloroplasts are where photosynthesis occurs.

CO_2 + water → glucose + O_2

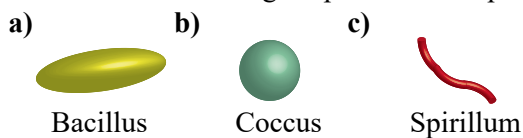**d)** The vacuoles are large storage areas for water, food, and wastes.

6 Use the terms rod-like, spiral, and spherical to describe the following bacterial shapes:
a) coccus - spherical.
b) bacillus - rod-like.
c) spirillum - spiral.

7 Describe the following shapes as either spirillum, coccus, or bacillus:
a)   **b)**   **c)**

Bacillus   Coccus   Spirillum

8 The bacteria 'bacillus anthracis' causes anthrax. The name suggests that the bacteria has a rod-like shape?

9 Staphylococcus bacteria cause a wide variety of diseases in humans. If the term 'staphyl' describes a bunch of grapes, staphylococcus suggests spherical bacteria in bunches.

10 Many bacteria have a covering outside the cell wall. The purpose of the covering is probably for protection.

p57	1	At 100x the field diameter is 1.8 mm. The diagram has a diameter of 3.5 mm, the shape has a length of 1.2 mm.

<table>
<tr><td rowspan="8">p57</td><td>1</td><td>At 100x the field diameter is 1.8 mm. The diagram has a diameter of 3.5 mm, the shape has a length of 1.2 mm.

Length of shape = 1.2 × 1.8 ÷ 3.5 mm = 0.62 mm</td></tr>
</table>

p57

1 At 100x the field diameter is 1.8 mm. The diagram has a diameter of 3.5 mm, the shape has a length of 1.2 mm.

Length of shape = 1.2 × 1.8 ÷ 3.5 mm = 0.62 mm

2 Convert 0.85 mm to microns.

 Ratio of a plant cell to a bacterium = 0.1 ÷ 0.001 = 100. A plant cell is 100 times larger.

3 What magnification would Simone use in order to view about 50 animal cells beside each other:

 Width of 50 animal cells = 50 × 0.01 = 0.5 mm. Then use 100x {Won't quite fit in the 400x}

 b)

4 c)

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p58

1 I would expect more mitochondria in a heart muscle cell than in a skin cell because a muscle cell would need more energy than a skin cell.

2 Animal cells don't have a cell wall. This might be an advantage to an animal by aloweing the animal greater freedomto move without being restricted by a rigid cell wall.

3 Most plant cells have cell walls to support and protect the cell.

4 The organelle in a plant cell involved in photosynthesis is the chloroplast.

5 The organelle in a plant cell involved in respiration is the mitochondria.

6 I would expect to find mitochondria in plant cells as well as animal cells because both cells need energy to carry out their functions.

7 Draw a table similar to the one below to indicate the differences between animal, plant, and fungal cells.

Organelle	Plant cells only	Animal cells only	Both
Nucleus			✓
Cell membrane			✓
Cell wall	✓		
Cytoplasm			✓
Chloroplasts	✓		
Mitochondria			✓
Large vacuole	✓	Have small vacuoles	

8 Fungi secrete digestive enzymes (and acids such as acetic acid) and then absorb the partly digested food through their cell walls and cell membranes.

These digestive enzymes breakdown the cellulose cell walls of plants.

Fungal cell walls are made of chitin instead of cellulose to avoid the digestion by fungal digestive enzymes.

9 Can you suggest a way of separating the nucleus of plant cells from the other plant organelles?

 Use a fungal digestive enzyme to break down the cell wall to free the cell organelles. Then use a centrifuge. It might be expected that the nucleus is the denser organelle and would then be found at the bottom of a test tube.

10 b) Streptococcus.

p58	**11** Some protists, such as euglena, have green algae living inside them. The green algae may be useful in producing food, through photosynthesis, for the algae and the euglena. **12** Some protists are able to live in water with very low oxygen concentrations. This might be possible by using the green algae to not only produce food but also oxygen through photosynthesis (energy + H_2O + CO_2 → O_2 + $C_6H_{12}O_6$). **13** The species most closely related are a) and b). **14** Fungi typically secrete enzymes to digest organic material outside their body and then absorb some of the broken down material through their cell membrane. This is called extracellular digestion. Some fungi secrete an enzyme called cellulase. Cellulase breaks down plant cell walls into simple sugars. Suggest three possible human uses for cellulase. a) To break down plant cell walls in the pulp and paper industry. b) To break down plant cell walls in the cotton industry for the production of cotton clothes. c) To break down plant cell walls in the production of wine and beer from plants. d) To break down plant cell walls in the production of animal feed. e) To break down plant cell walls in the production of olove oil.