Chapter 1

Cells and organisms

Characteristics of living organisms

Exercise 1.1

IN THIS EXERCISE YOU WILL:

- practise naming and describing the characteristics of living things.

Focus

1 Draw lines to match each term with its description.

Term	Description
nutrition	making more of the same kind of organism
respiration	removing waste products of metabolism
growth	a permanent increase in size and dry mass
excretion	taking in materials for energy, growth and development
reproduction	chemical reactions that release energy from nutrient molecules

KEY WORDS

excretion: the removal of waste products of metabolism and substances in excess of requirements.

growth: a permanent increase in size and dry mass.

metabolic reactions: chemical reactions that take place in living organisms.

movement: an action by an organism or part of an organism causing a change of position or place.

nutrition: the taking in of materials for energy, growth and development.

organism: a living thing.

reproduction: the processes that make more of the same kind of organism.

respiration: the chemical reactions in cells that break down nutrient molecules and release energy for metabolism.

Practice

2 Figure 1.1 shows a plant, growing towards the light. Inside its leaves, photosynthesis is taking place. Photosynthesis uses carbon dioxide to make glucose, and releases oxygen.

Add labels to Figure 1.1. Your labels should include short descriptions stating how the plant is showing these characteristics of living things:

- reproduction
- growth
- sensitivity
- excretion.

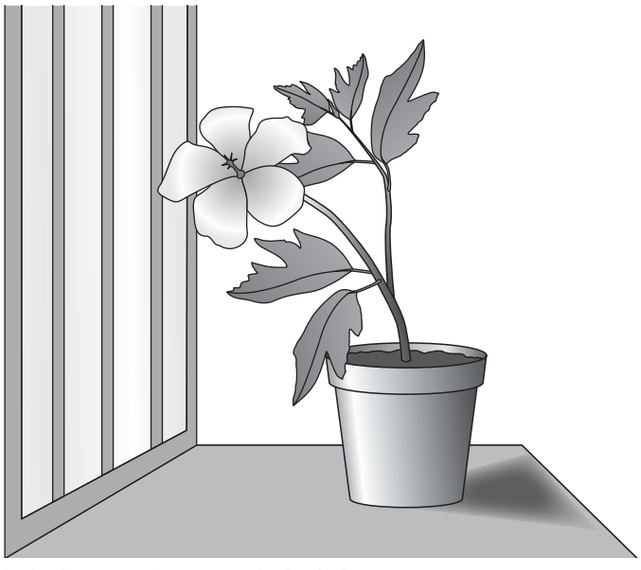

Figure 1.1: A plant growing towards the light.

KEY WORD

sensitivity: the ability to detect and respond to changes in the internal or external environment.

Challenge

3 Imagine that someone from another planet is visiting Earth. They see aeroplanes and birds moving through the sky.

Explain to the visitor why birds are alive and aeroplanes are not alive, even though they seem to share some of the characteristics of living things.

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Cell structure

Exercise 1.2

IN THIS EXERCISE YOU WILL:

- practise drawing and labelling animal and plant cells
- outline the functions of some of the parts of cells
- use information to explain some of the features of a specialised cell.

Focus

Figure 1.2 shows an animal cell and the outline of a plant cell.

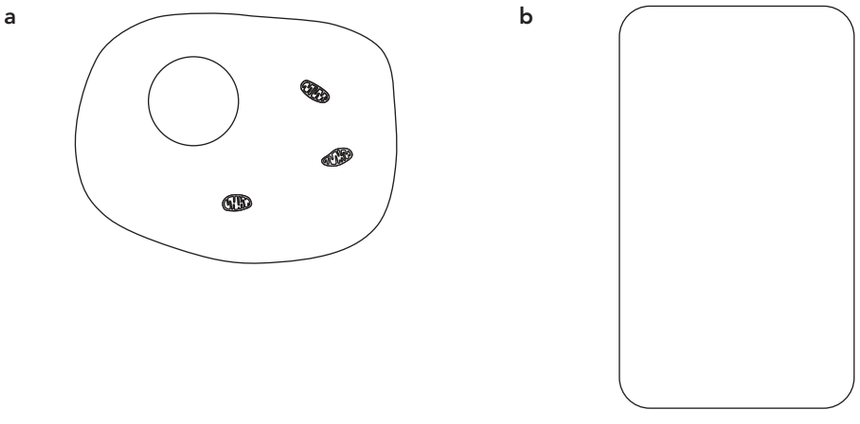

Figure 1.2 a: An animal cell. **b:** A plant cell.

1 On the animal cell diagram, label these parts:

cell membrane **cytoplasm** **mitochondrion** **nucleus**

2 Complete the diagram of the plant cell, and then label these parts:

cell membrane **cell wall** **chloroplast**

vacuole containing cell sap **cytoplasm** **mitochondrion**

nucleus **membrane around vacuole**

KEY WORDS

aerobic respiration: a chemical reaction that happens in mitochondria, where oxygen is used to release energy from glucose.

bacteria: unicellular organisms whose cells do not contain a nucleus.

cell: the smallest unit from which all organisms are made.

cell membrane: a very thin layer surrounding the cytoplasm of every cell; it controls what enters and leaves the cell.

cell sap: the fluid that fills the large vacuoles in plant cells.

cell wall: a tough layer outside the cell membrane; found in the cells of plants, fungi and bacteria.

cellulose: a carbohydrate that forms long fibres, and makes up the cell walls of plants.

chromosome: a length of DNA, found in the nucleus of a cell; it contains genetic information in the form of many different genes.

cytoplasm: the jelly-like material that fills a cell.

SELF ASSESSMENT

How confident do you feel about drawing a plant cell? Give yourself a mark for each of the points in the checklist. Award yourself:

2 marks if you did it well
1 mark if you made a good attempt at it and partly succeeded
0 marks if you did not try to do it, or did not succeed

Checklist	Marks awarded
I used a sharp pencil for drawing.	
I drew single, clean lines; the lines are not broken or fuzzy.	
I did not use any shading or colours.	
I drew the parts of the cell in the right place.	
I drew label lines with a ruler.	
Each label line touches the part it is labelling.	
Total (out of 12):	

Practice

3 **a** Describe the function of each of these parts in a plant cell.

Cell membrane

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Mitochondrion

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KEY WORDS

DNA: a molecule that contains genetic information, in the form of genes, that controls the proteins that are made in the cell.

fully permeable: allows all molecules and ions to pass through it.

Chloroplast

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b When a plant is growing, new cells are produced. Describe where these new cells come from.

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4 Describe the function of each of these parts in a bacterial cell.

Cell wall

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Ribosome

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Circular DNA

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5 Arrange these four terms in order from smallest and simplest to largest and most complex.

organ **tissue** **organ system** **cell**

KEY WORDS

mitochondrion: a small structure in a cell, where aerobic respiration releases energy from glucose.

nucleus: a structure containing DNA in the form of chromosomes.

partially permeable: allows some molecules and ions to pass through, but not others.

ribosomes: very small structures in a cell that use information in DNA to make protein molecules.

vacuole: a fluid-filled space inside a cell, separated from the cytoplasm by a membrane.

Challenge

6 Neurones are cells that transmit electrical signals throughout the body. This requires a lot of energy. They also synthesise (make) proteins, which help them to communicate with other neurones nearby.

Use this information to explain why neurones contain many mitochondria and many ribosomes.

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Specialised cells and sizes of specimens

Exercise 1.3

IN THIS EXERCISE YOU WILL:

- use the magnification equation
- practise giving answers to a required number of decimal places
- practise rearranging the magnification equation
- convert from millimetres to micrometres (μm) when using the magnification equation.

KEY WORD

magnification: how many times larger an image is than the actual object.

Focus

1 Complete the equation that we can use to calculate magnification.

magnification = _____

2 An apple is 60 mm in diameter. In a photograph of the apple, the apple is 120 mm in diameter. What is the magnification of the photograph? Show your working.

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3 Figure 1.3 shows a leaf.

Figure 1.3: A leaf.

The actual length of the leaf (including the stalk) is 32 mm.

a Measure the length of the leaf in Figure 1.3. Write down your answer.

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b Calculate the magnification of the leaf image in Figure 1.3. Show your working. Give your answer to one decimal place.

TIP

It is always best to measure in millimetres (mm). Remember to include the unit when you write down your measurement.

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Practice

4 Look at the drawing of an animal shown in Figure 1.4.

Figure 1.4: A chameleon.

a Measure the length of the animal from its nose to the base of its tail.

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b The actual length of this animal is 105 mm.

Calculate the magnification of the diagram.

Show your working and give your answer to *two* decimal places.

TIP

If an object is drawn smaller than its actual size, then the magnification is less than 1.

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5 A photograph of an ant shows the length of the ant's antennae to be 25 mm. The magnification of the photograph is ×12.

Calculate the actual size of the ant's antennae. Show your working and give your answer in millimetres, to the nearest whole number.

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Challenge

6 Figure 1.5 shows a specialised cell.

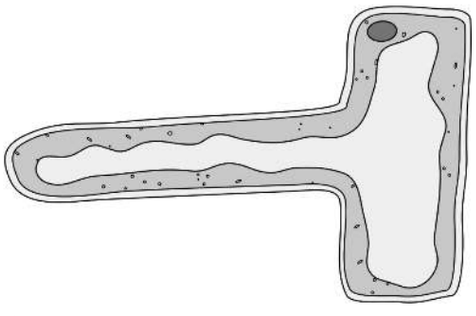

Figure 1.5: A specialised cell.

a Name this cell *and* describe its function.

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b An actual root hair cell is about 100 µm long.

Calculate the magnification of the diagram. Show your working.
Give your answer to *three* significant figures.

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Chapter 2

Movement into and out of cells

Diffusion

Exercise 2.1

IN THIS EXERCISE YOU WILL:

- calculate means, to complete a results chart
- decide whether a set of results supports a hypothesis
- think about the design of an experiment, including standardising variables
- think about factors that affect the rate of diffusion
- identify sources of error and suggest improvements.

A learner did an experiment to test this hypothesis:

The higher the temperature, the faster diffusion takes place.

She took four Petri dishes containing agar jelly. She cut four holes in the jelly in each dish, as shown in Figure 2.1.

She placed 0.5 cm^3 of a solution containing a red dye (coloured substance) into each hole.

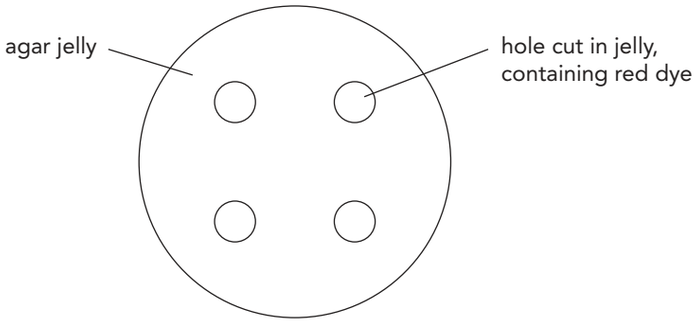

Figure 2.1: Petri dish of agar jelly with four holes.

The learner then covered the dishes and carefully placed them in incubators set at different temperatures.

She left them for two hours. Then she measured how far the red dye had moved into the agar around each hole.

KEY WORDS

concentration gradient: an imaginary 'slope' from a high concentration to a low concentration.

dependent variable: the variable that you measure, as you collect your results.

diffusion: the net movement of particles from a region of their higher concentration to a region of their lower concentration (i.e. down a concentration gradient), as a result of their random movement.

independent variable: the variable that you change in an experiment.

net movement: overall or average movement.