Introduction

Welcome to Stage 7 of Cambridge International Lower Secondary Science. We hope this book will show you how interesting and exciting science can be.

Science is everywhere. Everyone uses science every day. Can you think of examples of science that you have seen or used today?

Have you ever wondered about any of these questions?

- What am I made of?
- Where do all the dead plants, animals and their waste disappear to?
- Why does frozen water behave differently to liquid water?
- What happens in a chemical reaction?
- What is electricity?
- How did the planets form around the Sun?

You will work like a scientist to find answers to these questions and more. It is good to talk about science as you investigate and learn. You will share your ideas with classmates to help them understand, and listen to them when you need reassurance. You will reflect on what you did and how you did it, and ask yourself: 'would I do things differently next time?'

You will practise new skills and techniques, check your progress and challenge yourself to find out more.

You will make connections between the different sciences and how they link to maths, English and other subjects.

We hope you enjoy thinking and working like a scientist.

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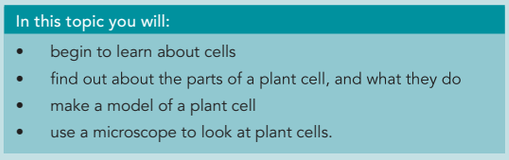
Contents

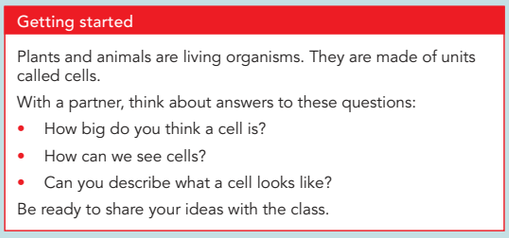
How to use this book

This book contains lots of different features that will help your learning. These are explained below.

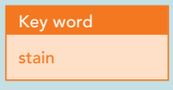
This list sets out what you will learn in each topic. You can use these points to identify the important topics for the lesson.



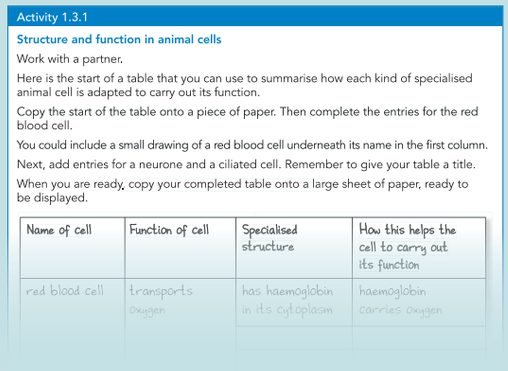
This contains questions or activities to help find out what you know already about this topic.



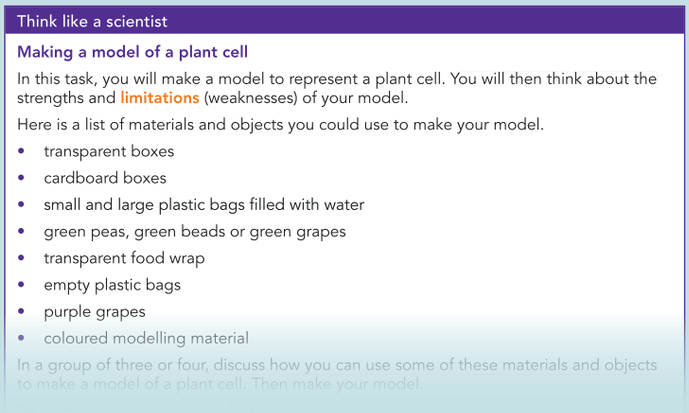
Important words are highlighted in the text when they first appear in the book. You will find an explanation of the meaning of these words in the text. You will also find definitions of all these words in the Glossary and Index at the back of this book.



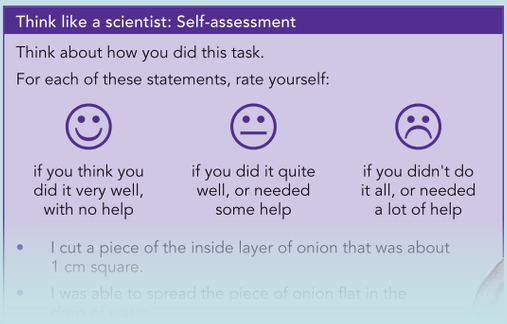
You will have the opportunity to practise and develop the new skills and knowledge that you learn in each topic. Activities will involve answering questions or completing tasks.



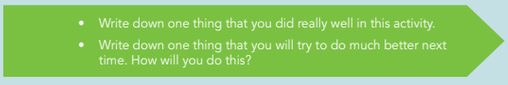
This provides an opportunity for you to practise and develop scientific enquiry skills with a partner or in groups.



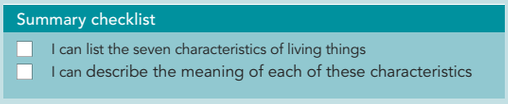
After completing an activity, this provides you with the opportunity to either assess your own work or another student's work.



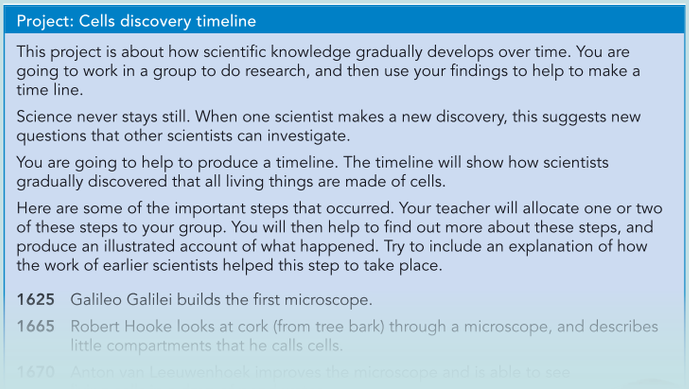
This contains questions that ask you to look back at what you have covered and encourages you to think about your learning.



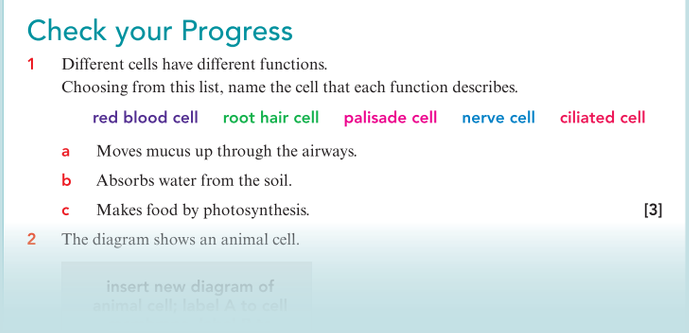
This list summarises the important material that you have learnt in the topic.



At the end of each unit, there is a group project that you can carry out with other students. This will involve using some of the knowledge that you developed during the unit. Your project might involve creating or producing something, or you might all solve a problem together.



These questions look back at some of the content you learnt in each session in this unit. If you can answer these, you are ready to move on to the next unit.



1 Cells

1.1 Plant cells

In this topic you will:

- begin to learn about cells
- find out about the parts of a plant cell, and what they do
- make a model of a plant cell
- use a microscope to look at plant cells.

Getting started

Plants and animals are living organisms. They are made of units called cells.

With a partner, think about answers to these questions:

- How big do you think a cell is?
- How can we see cells?
- Can you describe what a cell looks like?

Be ready to share your ideas with the class.

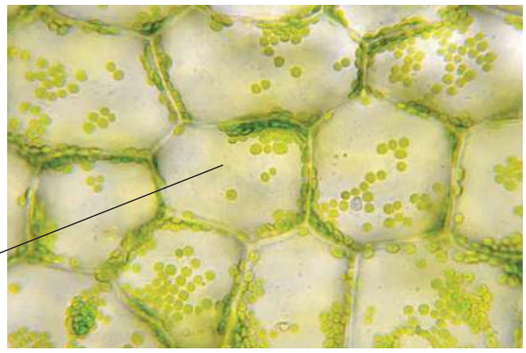
Key words

cell
cell membrane
cell wall
cellulose
chlorophyll
chloroplast
cytoplasm
limitations
magnify
mitochondria
nucleus
sap vacuole

Cells

If you study a plant by observing part of it through a microscope, you will see that it is made up of a very large number of tiny 'boxes'. These are called **cells**. All living organisms are made of cells.

Cells are so small that you cannot see them with your eyes alone. The photograph of the plant cells was taken through a microscope. The microscope **magnifies** the view of the cells, so that they look much bigger than they really are.



Part of a leaf seen through a microscope

Parts of a plant cell

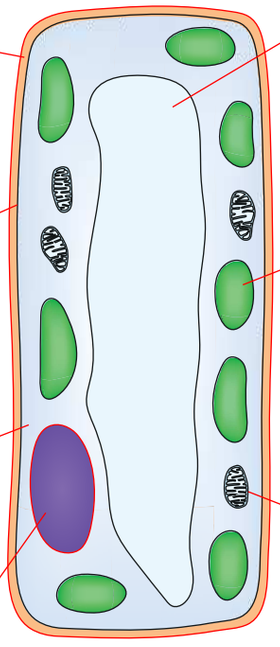
The diagram shows a plant cell from a leaf.

cell wall
Every plant cell has a cell wall. The cell wall is strong and stiff. It holds the plant cell in shape. Plant cell walls are made of a substance called **cellulose**.

cell membrane
All cells have a cell membrane. The cell membrane is very thin and flexible. It is like the thin skin of a soap bubble. It lies along the inner edge of the cell wall. The cell membrane controls what goes in and out of the cell.

cytoplasm
All cells have cytoplasm. Cytoplasm is like clear jelly. Chemical reactions happen inside the cytoplasm. These reactions keep the cell alive.

nucleus
Most cells have a nucleus. The nucleus controls the activities of the cell.



sap vacuole
This is a large, fluid-filled space inside a plant cell. The liquid inside it is a solution of sugars and other svubstances dissolved in water. The solution is called cell sap.

chloroplast
Plant cells that are in the sunlight often contain chloroplasts. This is where plants make their food. Chloroplasts look green because they contain a green substance called **chlorophyll**.

mitochondrion
All plant cells have mitochondria (singular: mitochondrion). Inside mitochondria, energy is released from food.

Diagram of a leaf cell

Questions

1 Look at the photograph of the plant cells on this page.
What do you think the little green circles inside the cells are?
Why are they green? What happens inside them?

2 Describe four differences between a cell wall and a cell membrane.

How have you tried to remember the difference between a cell wall and a cell membrane? How successful do you think you have been?

Think like a scientist

Making a model of a plant cell

In this task, you will make a model to represent a plant cell. You will then think about the strengths and **limitations** (weaknesses) of your model.

Here is a list of materials and objects you could use to make your model.

- transparent boxes
- cardboard boxes
- small and large plastic bags filled with water
- green peas, green beads or green grapes
- transparent food wrap
- empty plastic bags
- purple grapes
- coloured modelling material

In a group of three or four, discuss how you can use some of these materials and objects to make a model of a plant cell. Then make your model.

Be ready to explain your model to others.

Questions

1 Compare your model cell with the models made by other groups.

Are there are any features of your model that are better than those in the other groups' models?

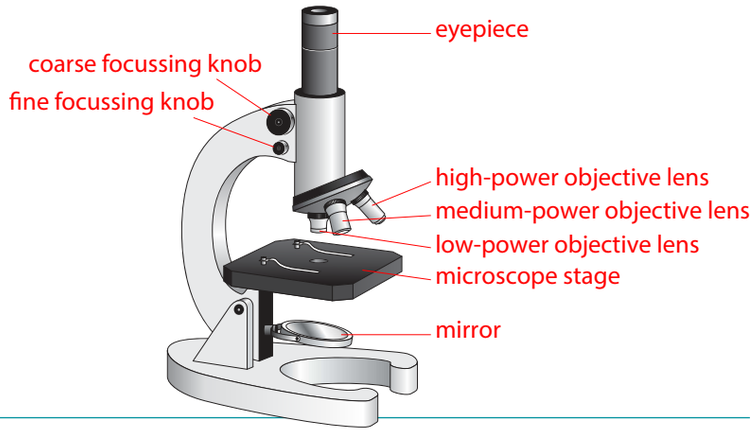
Are there any features of other groups' models that are better than yours?

2 Discuss how well your model cell represents a real plant cell.

Microscopes

Scientists who study living organisms often use microscopes to help them to see very small things.

The diagram shows a microscope. Look at a real microscope and find all of these parts on it.



A microscope

Think like a scientist

Looking at plant cells through a microscope

This task gives you practice in using scientific equipment and doing practical work safely.

You will need:

- a microscope, a microscope slide, a cover slip, a piece of onion bulb, tweezers (forceps), a small sharp knife, a dropper pipette, a small container of water

Safety Take care with the sharp knife. Cut the onion with the blade pointing away from you, so that if it slips you don't cut your fingers.

1. Collect a small piece of onion. Cut out a piece about 1 cm square.
2. Use a dropper pipette to put a small drop of water into the middle of a clean microscope slide.
3. Very carefully, peel the thin layer from the inside of your piece of onion.
4. Gently push the layer into the drop of water on the slide. Spread it out as flat as you can.
5. Collect a very thin piece of glass called a cover slip. (Take care – cover slips break very easily!) Gently lower the cover slip over your piece of onion on the slide. Try not to get air bubbles under the cover slip.
6. Turn the objective lenses on the microscope until the smallest one is over the hole in the stage.
7. Put the slide onto the stage of the microscope, with the piece of onion over the hole.
8. Look down the eyepiece. Slowly turn the focussing knob to move the lens away from the slide. Stop when the piece of onion comes into focus.
9. Make a drawing of some of the cells you can see.

Continued

Questions

1 Suggest why the cells from the onion do not look green.

2 Describe any difficulties you had with this activity. How did you solve them?

Self-assessment

Think about how you did this task.

For each of these statements, rate yourself.

if you think you did it very well, with no help

if you did it quite well, or needed some help

if you didn't do it all, or needed a lot of help

- I cut a piece of the inside layer of onion that was about 1 cm square.
- I was able to spread the piece of onion flat in the drop of water.
- I put the cover slip over the onion without getting any air bubbles.
- I saw onion cells down the microscope.
- I focussed the microscope so that I could see the cells really clearly.

- Write down one thing that you did really well in this activity.
- Write down one thing that you will try to do much better next time. How will you do this?

Summary checklist

- ☐ I can name all the structures in a plant cell, and describe what they do.
- ☐ I can make a model of a plant cell, and discuss its strengths and limitations.
- ☐ I can use a microscope to look at plant cells.