OXFORD SCIENCE 8

*
TWELVE APOSTLES, VICTORIA, AUSTRALIA. FIVE NEW LIMESTONE SEA STACKS, THOUGHT TO BE UP TO 60,000 YEARS OLD, WERE DISCOVERED VIA SONAR MAPPING IN 2016. KNOWN AS THE 'DROWNED APOSTLES' THEY ARE 50 M BENEATH THE SURFACE.

HELEN SILVESTER

VICTORIAN CURRICULUM

OXFORD

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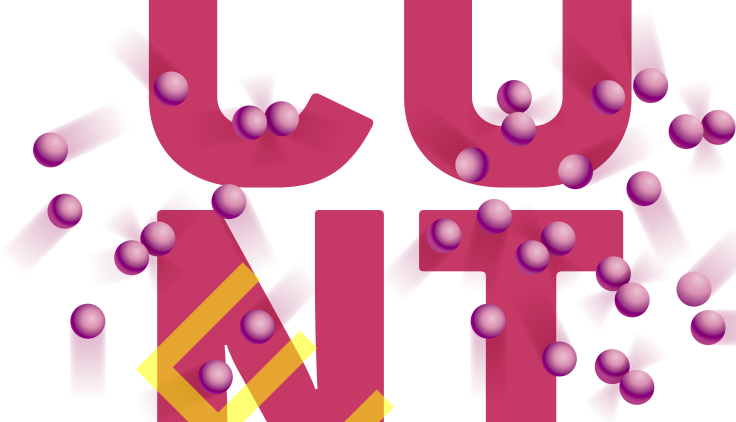
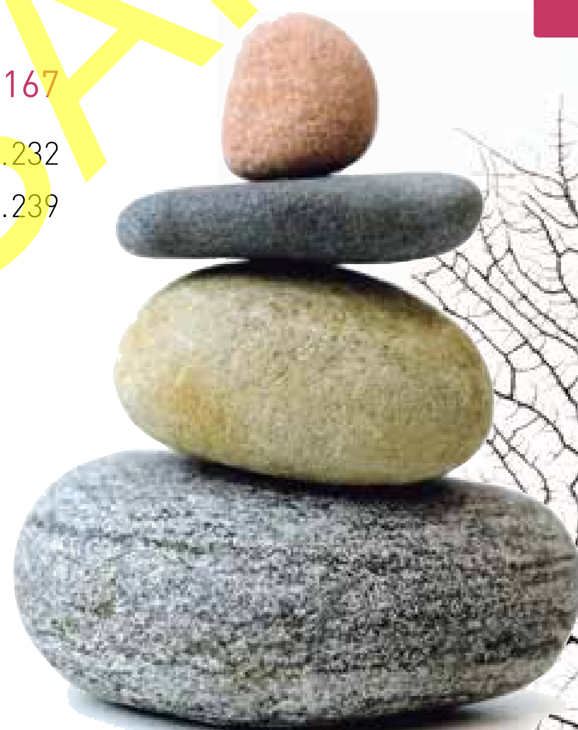
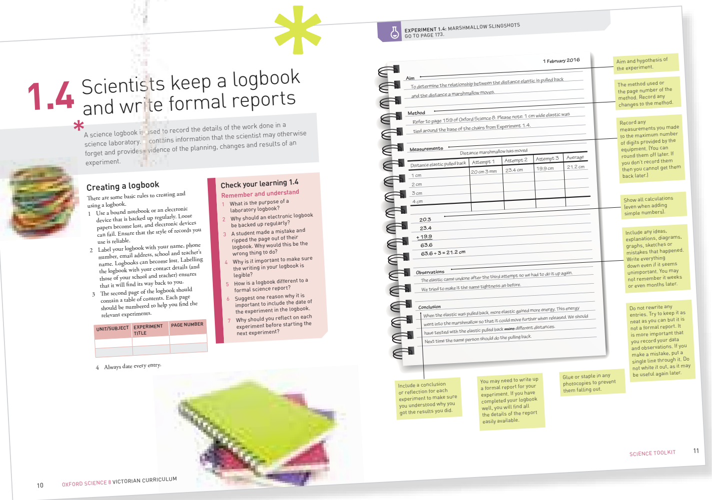




Using Oxford Science

Oxford Science is a series developed to meet the requirements of the Victorian Curriculum: Science across Years 7 to 10. Taking a concept development approach, each double-page spread of Oxford Science represents **one concept** and **one lesson**.



What if?

Student-directed inquiry is encouraged throughout this series using a simple questioning technique. As the series progresses, students discover that their own *What if* questions are actually testable '*if and then*' hypotheses. For example, 'What if *the bubble is touched with a finger*' becomes 'If *the bubble is touched with a finger*, then *it will pop*'.

Concept development

Students are given access to the chapter concepts at the start of every chapter. Each double-page spread of this series represents **one concept**. Students explore concepts one-by-one encouraging incremental learning and, by the end of the chapter, complete understanding.

The unit heading introduces the concept.

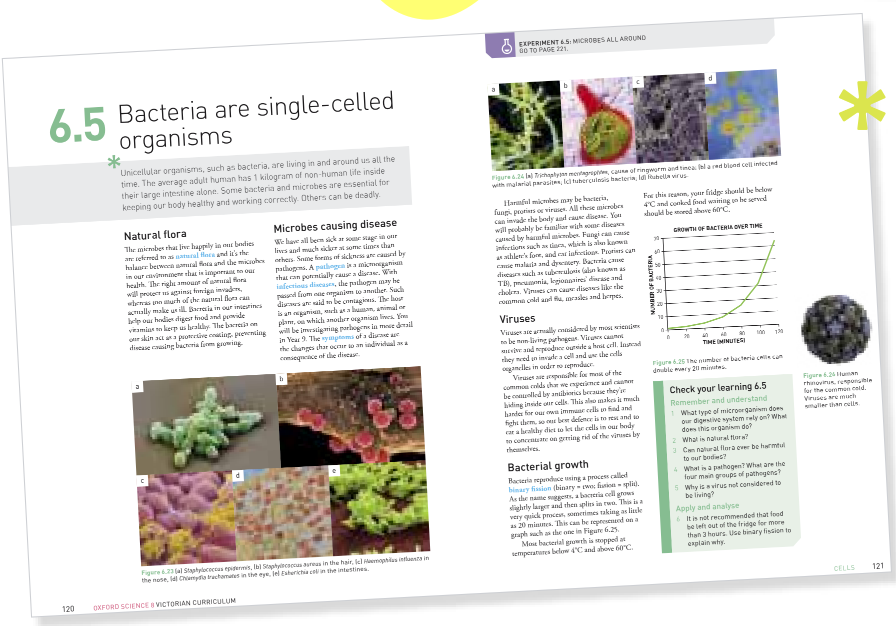
Each unit begins with a short summary of the concept.

Body text elaborates on the concept in clear and accessible language.

Every spread is linked to one or more experiment, challenge or skills task as a practical application of the concept.

Diagrams and photos are used to illustrate the concept and engage students.

Every double-page spread ends with **Check your learning** questions, allowing students to consolidate their understanding. Questions are graded according to Bloom's Taxonomy – catering for a range of abilities and learning styles.



Accessibility and engagement

Oxford Science has been engineered to be accessible to all science students. We believe that science students are served best when they are free to focus on learning the knowledge and skills of science in simple accessible language, crafted into short sentences. Students will be engaged by the inclusion of stunning photography throughout.

Science as a human endeavour

Concepts are linked to real-world applications in the highly engaging **Science as a human endeavour** spreads. The **Extend your understanding** questions on this spread are designed to be used flexibly as either homework tasks or as an extended project.

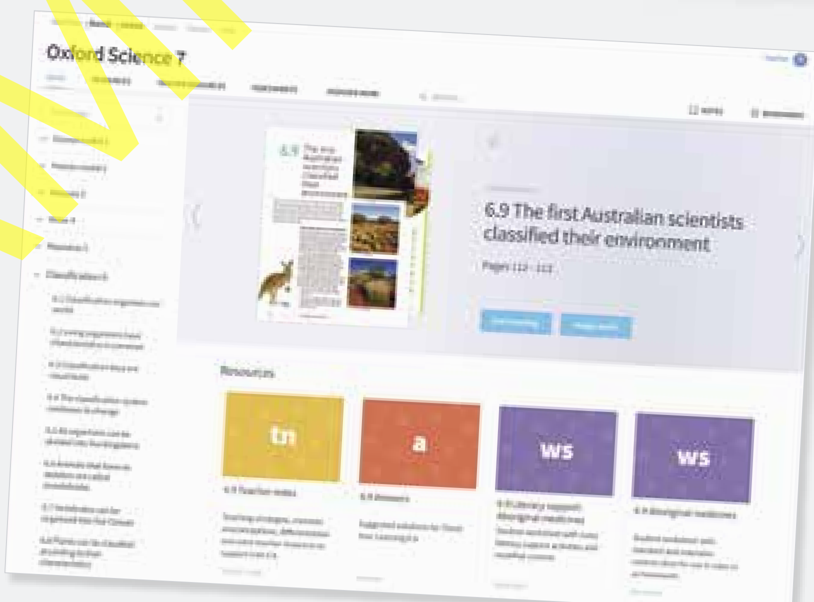
Experiments

Uniquely, experiments are organised at the end of the book in an extended experiments chapter, rather than being confined to each double-page spread. There is a link on most double-page spreads to an experiment, challenge or inquiry task to ensure that practical activites remain aligned to the content.

Integrated teaching and learning support

obook assess

obook assess provides an electronic version of the student book in an easy-to-read format. **obook** is compatible with laptops, iPads, tablets and IWBs and can be used online or offline. **assess** provides 24/7 online assessment designed to support student progression and understanding.



Student dashboard

The student dashboard ensures that students can easily and quickly find extra resources linked to every page of the student book. Student resources include videos, multimedia links and worksheets.

Teacher dashboard

The innovative teacher dashboard is an online lesson control centre, which allows teachers to instantly view or assign related resources and deliver incredibly engaging digital learning experiences.

The Oxford Science teacher dashboard includes teacher notes, answers, tests, literacy support worksheets, student worksheets, interactive learning modules, flashcard glossaries, multimedia links and videos. Experiments are further supported by risk assessments, lab tech notes and experiment worksheets.

obook assess allows teachers to manage their classes by assigning work, tracking progress and planning assessment.

SCIENCE TOOLKIT 1

1.1 Science laboratories contain hazards

1.2 Dissection is an important science skill

1.3 Scientists design their own experiments

1.4 Scientists keep a logbook and write formal reports

1.5 Tables and graphs are used to present scientific data

What if?

Observations

What you need:

A4 paper, notebook and pen

What to do:

1. Look at one of the pictures on this page for 30 seconds.
2. Cover the picture with the A4 paper.
3. Write down all the things you observed in the picture.
4. Check your answers. How many things did you observe?

What if?

» What if you had more time to observe the picture?

» What if you knew that you had to write an observation list before you viewed the picture?

» What if you repeated the test?

1.1 Science laboratories contain hazards

Science is a practical subject that includes hands-on laboratory investigations. You will be using many pieces of equipment, chemicals and other materials that are hazardous. A **hazard** is something that has the potential to put your health and safety at risk. You must learn to recognise the risks involved with working in a science laboratory and the appropriate safety procedures in case something goes wrong.

Figure 1.1 Lab coats, safety glasses and gloves protect your body and clothing.

Chemical safety

A chemical may be listed as hazardous if it is considered dangerous for a person to touch, or **inhale**. Most of the chemicals you will use in your school science laboratory are safe to use provided appropriate precautions are taken. When working with chemicals, you should always wear a buttoned-up lab coat to protect your skin and clothes. Safety glasses should cover your eyes, long hair should be tied back and closed-toed shoes should always be worn. Occasionally you will need to wear gloves. Never taste, smell or mix chemicals unless specifically directed by your teacher as this may cause a harmful reaction.

When observing chemical reactions ensure that you do not lean over any open containers and never breathe in any gases that may be produced. If your teacher instructs you to smell anything in the laboratory, use your hand to gently waft the gas towards your nose. If you have any concerns tell your teacher immediately.

Figure 1.2 Never smell anything in the laboratory unless instructed to. What piece of safety equipment should these students be wearing?

Hazard symbols

In Australia, and many other countries, hazard symbols (see Figures 1.3 to 1.11) are used to indicate the level of risk or danger of a substance. Hazard symbols are required by law in many situations and you may see some in your science laboratory.

Safe disposal of chemicals and other materials

Safely disposing of chemicals is just as important as safely using them. Not everything can be poured down the sink. Some schools have acid neutralising traps in the drains that allow dilute acids to be disposed of in this way. Other chemicals can react with the acid traps or are toxic for the environment. As a result, these chemicals must be collected at the end of the class and disposed of appropriately by your teacher. These chemicals include **corrosive** liquids, grease and oils, biohazardous wastes and toxic solids. Table 1.1 lists the safe disposal techniques for various materials.

Table 1.1 Safe disposal of materials.

MATERIAL	EXAMPLES	WHAT TO DO WITH IT
Biohazardous waste	Animal cells and tissue	Solids should be collected by your teacher. Deactivate liquid with bleach (1 part bleach to 9 parts water) for 30 minutes before pouring down the drain.
Grease and oils	Vegetable oils Machinery oil	Collect in a bottle and place in regular rubbish. Dispose of as hazardous chemical waste.
Corrosive liquids	Weak acids Strong acids or alkalis	Pour down the drain. Neutralise the acid or alkali and pour down the drain.
Solids	Play dough	Place in regular rubbish.
Hydrogen peroxide	> 8%	Dilute before pouring down the drain.

Figure 1.3 **Health hazard** Substance can cause serious health effects if touched, inhaled or swallowed.

Figure 1.4 **Flammable** Substances that catch fire easily.

Figure 1.5 **Exclamation mark** Substance that can cause irritation (redness or rash).

Figure 1.6 **Gas cylinder** Contains gas under pressure. Released gas may be very cold. Gas container may explode if heated.

Figure 1.7 **Corrosive** Substances that are corrosive (destructive) to living tissues, such as skin and eyes. Also used for substances that are corrosive to metals.

Figure 1.8 **Exploding bomb** Substances that may explode if exposed to fire, heat, movement or friction.

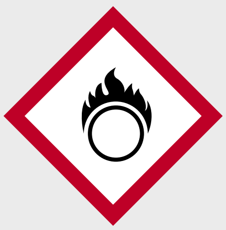


Figure 1.9 **Flame over circle – oxidising** Provides oxygen to make other substances burn more fiercely.

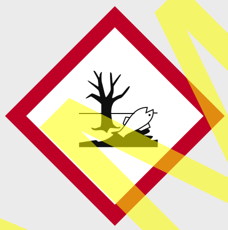


Figure 1.10 **Environmental hazard** Substance is toxic to marine organisms and may cause long-lasting effects in the environment.

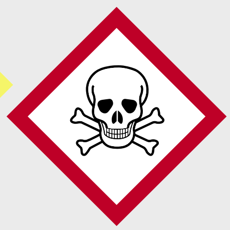


Figure 1.11 **Skull and cross bones – toxic** Can cause death if touched, inhaled or swallowed.

Figure 1.12 Pouring substances down the drain can be a hazard.

Check your learning 1.1

Remember and understand

1 What is the purpose of:
   a a lab coat?
   b safety glasses?
   c gloves?
   d close-toed shoes?

2 Why would you be unlikely to find a substance with the skull and crossbones hazard symbol in a school science laboratory?

3 What precautions might you take when using a substance labelled with the exclamation mark hazard symbol?

4 What is an acid neutralising trap used for?

Apply and analyse

5 Some acids are considered corrosive. Research the word 'corrosive' and write its definition. What precautions should you take when handling acids?

6 Why should you never randomly mix chemicals together in a science laboratory?

7 Some people are allergic to the latex found in gloves. How could you tell if someone is allergic to a substance and what alternative safety precautions might be taken?

1.2 Dissection is an important science skill

Dissection (*Latin: to cut to pieces*) is the process of cutting apart and observing something to study it. Dissection requires the use of specialised equipment and techniques.

Dissections

Scientists throughout history have used dissections. Although it sounds gory, dissection is an essential learning tool for scientists. Dissecting organs and organisms isn't just 'chopping them up'. It requires careful techniques to make sure that the tissues aren't destroyed so that their structures (**anatomy**) can be analysed accurately. Dissection also relies on care being taken with very sharp instruments, such as scalpels.

Figure 1.13 Scissors Used for cutting skin and other tissue. Dissection scissors often have rounded tips, which are less destructive to the tissue being cut.

Figure 1.14 Probe Used to look at and explore a specimen, and to probe openings.

Figure 1.15 Scalpel Small and extremely sharp steel blade used for precision cutting.

Figure 1.16 Forceps or tweezers Hinged instrument used for grasping and holding tissues.

Figure 1.17 Early surgical equipment.

Surgical instruments of the past

Early anatomists (scientists who do dissections) didn't always have access to sterile (clean) and sharp cutting instruments, such as scalpels and precision saws for dissections. Dissections were performed with the same tools that surgeons used in early operations.

Hands-on dissection

Some science skills are best learnt by doing! Follow the steps in Skills Lab 1.2 to learn how to dissect a chicken wing.

Safety first

Dissection instruments and workspaces should be cleaned while you are still wearing your safety gear. Your lab coat and gloves should be on before you start your dissection and they shouldn't come off until the dissection is completely finished – this includes disposal and cleaning! The last things you should do are: remove your gloves and throw them in the bin; wash your hands thoroughly; and take off your lab coat and hang it up.

Check your learning 1.2

Remember and understand

1 How is dissection different to just cutting something up?
2 Why is dissection a useful tool for scientists?
3 List three important safety rules that you must follow during a dissection.
4 Why might gloves *not* be essential for all dissections?
5 Name three tools that are used as part of a dissection. Include a sketch of each tool.
6 Why is it important to leave lab coats and gloves on until *after* the clean-up?

Apply and analyse

7 Without dissection, do you think our knowledge of human anatomy would be more or less advanced? Explain.
8 Draw your own surgical tool of the past. Write a description of this tool and give it a name.

1.2
SKILLS LAB

Dissecting a chicken wing

Materials

- Chicken wing
- Newspaper
- Dissection board
- Forceps
- Probe
- Scalpel
- Dissection scissors
- Plastic bag for disposal

Here you will dissect a chicken wing, and step by step, you will practise the correct skills and techniques of dissection to ensure you stay safe and sterile.

After dissecting your specimen, draw a labelled diagram.

Step 1 Make sure you are wearing appropriate safety gear: gloves, lab coat and safety glasses.

Step 2 Set up your workspace, covering surfaces with newspaper that can be disposed of easily and collecting any dissection tools you may need.

Step 3 Collect your specimen for dissection. Identify all external structures.

Step 4 You may want to pin the specimen to the dissection board to keep it from moving.

Step 5 Use probes to look inside any folds.

Step 6 Use forceps to hold and pull tissue.

Step 7 Use scalpels to cut carefully away from your hands. Run the scalpel gently over the tissue several times to cut through. Do not dig the scalpel into the specimen or expect to cut through in one movement.

Step 8 Use scissors to cut when you can see what's under the structure you're cutting. Scissors with rounded ends are less likely to cause unnecessary damage than those with pointed ends.

Step 9 Fingers are always the least damaging way to 'look around' your specimen.

Step 10 When finished, your specimen should be wrapped in newspaper for disposal. Your instruments should be rinsed, cleaned and disinfected, and your hands should be washed thoroughly.

1.3 Scientists design their own experiments

As a scientist you will need to design your own experiments that can be repeated by other scientists. This requires you to control all the variables in the experiment. This is called **fair testing**.

Balloon rockets

Before continuing, complete Experiment 1.3A on the opposite page.

Asking 'What if?'

A **variable** is something that can affect the results of an experiment. You can find out how a variable affects the results by asking a 'what if' question.

> What if the balloon was blown up more?
> What if the string had less friction?
> What if the string had more friction?
> What if the straw was shorter?

Each of these questions asked what would happen if the **independent variable** were increased or decreased. In a fair test only one variable should be changed at one time.

The impact of this change is measured at the end of the experiment. This is called the **dependent variable**. In this experiment, the dependent variable is the distance the balloon rocket travels. All the other variables must be kept the same. They are called **controlled variables**.

Now try changing the independent variable in Experiment 1.3B.

What if the straw were shorter?

IF the straw were shorter THEN the balloon rocket would travel further.

Independent variable: the variable that is deliberately changed.

Dependent variable: the variable that is tested at the end.

Figure 1.18 A **hypothesis** describes the expected relationship between the independent variable and the dependent variable. A 'what if' question can be changed into a hypothesis by removing the 'what' at the start, and adding a 'then' at the end of the question.

Check your learning 1.3

Remember and understand

1 What are the three types of variables in an experiment?
2 Why is it important for an experiment to be reproducible?
3 How do you change a 'what if' question into a hypothesis? Use one of the 'what if' questions above that you did not test, as an example.
4 Were there any variables that you could not control in your balloon rocket experiment?

Apply and analyse

5 Most experimental methods are checked by other scientists. Can you suggest a reason for this?

1.3A

EXPERIMENT

Materials

> 1 balloon
> A long piece of string
> Sticky tape
> 1 plastic straw
> 1 tape measure

Making a balloon rocket

Method

1 Tie one end of the string to a chair.
2 Place the other end of the string through the straw.
3 Tie the loose end of the string to a second support so that the string is pulled tight.
4 Blow the balloon up and stick it to the straw. (Do not tie the end of the balloon.)
5 Measure the circumference of the balloon with the measuring tape.
6 Release the end of the balloon so that the straw slides along the string.
7 Measure how far the balloon rocket moved along the string.
8 Repeat this experiment twice more with the same balloon blown up the same amount. You now have a reproducible test for your balloon rocket.

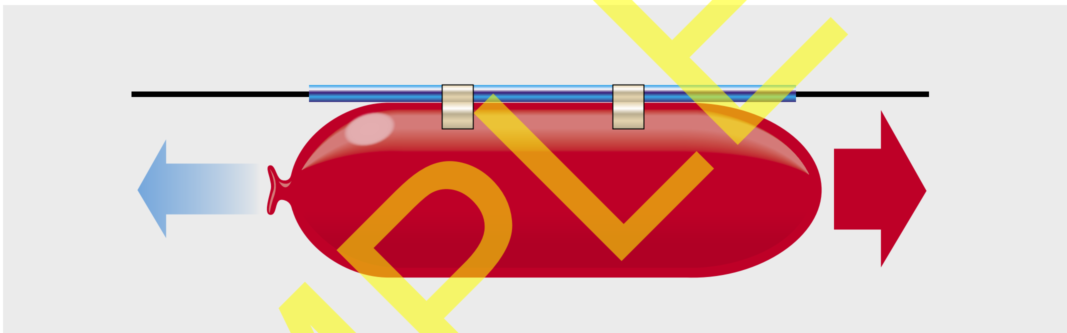


Figure 1.19 When the balloon rocket is released, the straw will slide along the string.

1.3B

EXPERIMENT

Aim

To determine factors that affect the distance a balloon rocket will travel.

Changing the independent variable

Method

1 Choose one of the following questions to investigate.
   > What if the balloon was blown up more?
   > What if the string had less friction?
   > What if the string had more friction?
   > What if the straw was shorter?
2 Now, follow these steps.
   > Write a hypothesis for your enquiry.
   > What *independent* variable will you change from the first method?
   > What *dependent* variable will you measure and observe?
   > What variables will you need to control to ensure a fair test?
   > How will you control them?
   > Test your hypothesis. Repeat your test at least three times to make sure your results are reliable.

Results

Record your results in a table. Include the units for all measurements.

Discussion

1 Was your hypothesis supported? Use evidence from your results to support your answer.
2 Write a summary of your results.

1.4 Scientists keep a logbook and write formal reports

A science logbook is used to record the details of the work done in a science laboratory. It contains information that the scientist may otherwise forget and provides evidence of the planning, changes and results of an experiment.

Creating a logbook

There are some basic rules to creating and using a logbook.

1. Use a bound notebook or an electronic device that is backed up regularly. Loose papers become lost, and electronic devices can fail. Ensure that the style of records you use is reliable.
2. Label your logbook with your name, phone number, email address, school and teacher's name. Logbooks can become lost. Labelling the logbook with your contact details (and those of your school and teacher) ensures that it will find its way back to you.
3. The second page of the logbook should contain a table of contents. Each page should be numbered to help you find the relevant experiments.

UNIT/SUBJECT	EXPERIMENT TITLE	PAGE NUMBER

4. Always date every entry.

Check your learning 1.4

Remember and understand

1. What is the purpose of a laboratory logbook?
2. Why should an electronic logbook be backed up regularly?
3. A student made a mistake and ripped the page out of their logbook. Why would this be the wrong thing to do?
4. Why is it important to make sure the writing in your logbook is legible?
5. How is a logbook different to a formal science report?
6. Suggest one reason why it is important to include the date of the experiment in the logbook.
7. Why should you reflect on each experiment before starting the next experiment?

1 February 2016

Aim

To determine the relationship between the distance elastic is pulled back and the distance a marshmallow moves.

Method

Refer to page 159 of Oxford Science 8. Please note: 1 cm wide elastic was tied around the base of the chairs from Experiment 1.4.

Measurements

	Distance marshmallow has moved			
Distance elastic pulled back	Attempt 1	Attempt 2	Attempt 3	Average
1 cm	20 cm 3 mm	23.4 cm	19.9 cm	21.2 cm
2 cm				
3 cm				
4 cm				

20.3
23.4
+ 19.9
63.6
63.6 ÷ 3 = 21.2 cm

Observations

The elastic came undone after the third attempt so we had to do it up again. We tried to make it the same tightness as before.

Conclusion

When the elastic was pulled back, more elastic gained more energy. This energy went into the marshmallow so that it could move further when released. We should have tested with the elastic pulled back ~~more~~ different distances.

Next time the same person should do the pulling back.

Aim and hypothesis of the experiment.

The method used or the page number of the method. Record any changes to the method.

Record any measurements you made to the maximum number of digits provided by the equipment. (You can round them off later. If you don't record them then you cannot get them back later.)

Show all calculations (even when adding simple numbers).

Include any ideas, explanations, diagrams, graphs, sketches or mistakes that happened. Write everything down even if it seems unimportant. You may not remember it weeks or even months later.

Do not rewrite any entries. Try to keep it as neat as you can but it is not a formal report. It is more important that you record your data and observations. If you make a mistake, put a single line through it. Do not white it out, as it may be useful again later.

Include a conclusion or reflection for each experiment to make sure you understood why you got the results you did.

You may need to write up a formal report for your experiment. If you have completed your logbook well, you will find all the details of the report easily available.

Glue or staple in any photocopies to prevent them falling out.

1.5 Tables and graphs are used to present scientific data

Graphs make the information (data) you gather in an experiment easier to analyse. Graphs show what happened. Patterns in the data can be seen and this enables you to predict what might happen if you continued the experiment.

Common features in graphs

There are four features all graphs have in common.

1 A descriptive title of what the graph shows.
2 A grid that is used to plot the points or data.
3 The independent variable on the horizontal axis.
4 The dependent variable on the vertical axis.

Interpreting graphs

Line graphs are the most common graphs that are drawn in scientific reports. These graphs are used to show the relationship between the independent variable and the dependent variable. The shape of the graph gives a hint of how the two variables are related.

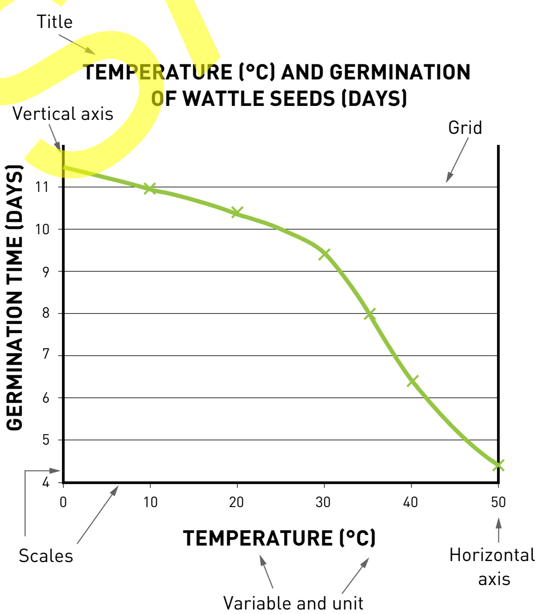
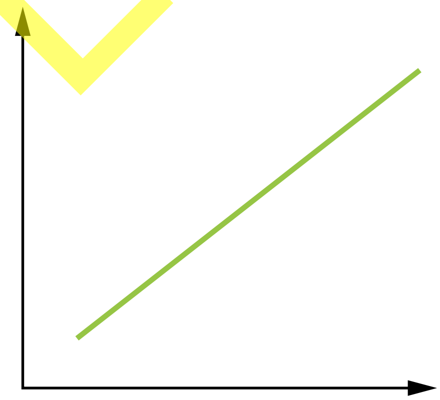


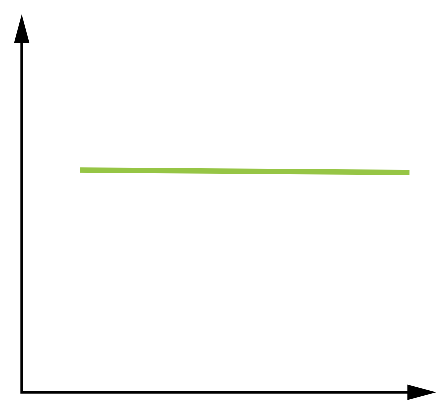
Figure 1.20 The independent variable (temperature) should be on the horizontal axis and the dependent variable (germination time) should be on the vertical axis.

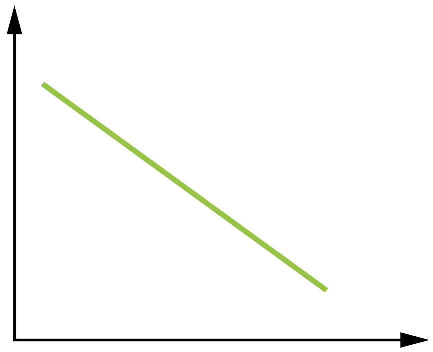
When the line slopes upwards, this means the dependent variable increases as the independent variable increases. This is called a **directly proportional relationship**.



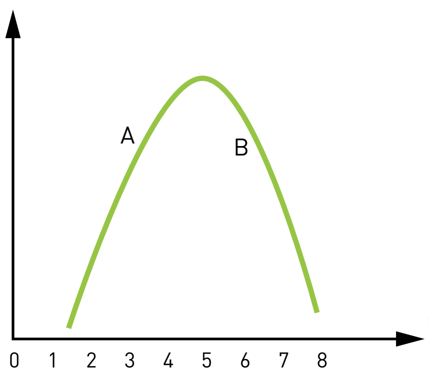
When the line is horizontal, it means the dependent variable is not affected by the independent variable.

If the line is sloped down, then the dependent variable decreases as the independent variable increases. This is called an **inversely proportional relationship**.

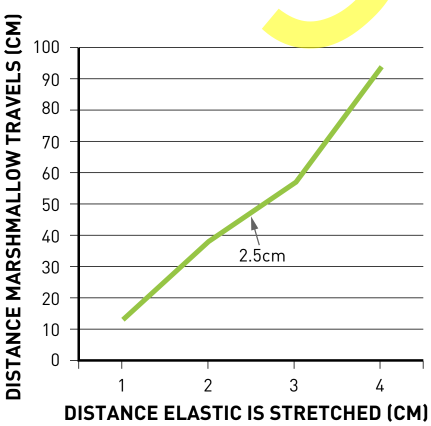




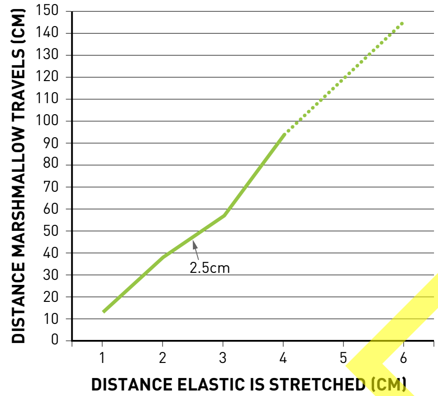
Occasionally a graph is curved. These graphs can be considered in sections. In section A (between 1 and 4), the dependent variable increase as the independent variable increases. In section B (between 4 and 7) the dependent variable decreases as the independent variable increases.



Sometimes you may have recorded the results for a set of whole numbers. An example of this is pulling back the elastic and marshmallow in the previous experiment 1 cm, 2 cm, 3 cm and 4 cm. If you draw an accurate line graph of your data, then you may be able to use the graph to see what would happen if you pulled back the marshmallow 2.5 cm.



A graph can also be used to extrapolate results. This means you can continue the shape of the graph to determine what would happen if you continued the experiment.



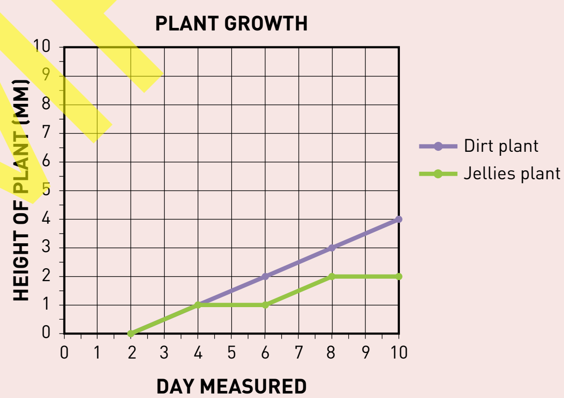
Check your learning 1.5

Remember and understand

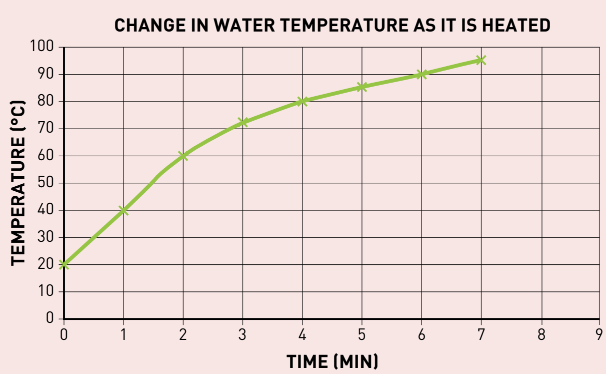
1 What features should all graphs have in common?

2 What does 'extrapolate results' mean?

3 Describe the relationship between the independent variable and dependent variable in the following graph.



4 Extrapolate the following graph to determine what would happen if the water were heated for 8 minutes.



Apply and analyse

5 Explain why graphs are often used in scientific reports.

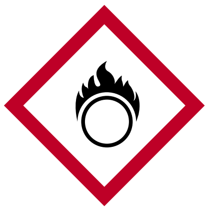
1 REVIEW

Remember and understand

1 When are the following symbols or objects used?

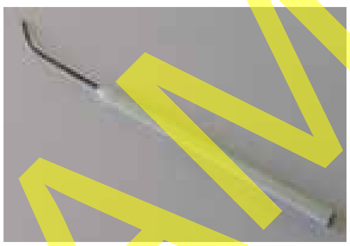
a

b



c

d



2 How should you dispose of hazardous waste from dissections?

3 Define the following words:

a dissection

b anatomy

c dependent variable

d hypothesis.

4 Describe the information that should be included in an experimental logbook.

5 Why is it important to include any changes you make to an experimental method in your logbook?

6 What are the four common features that should be present on all graphs?

7 What is the difference between the independent variable and the dependent variable?

8 How should you safely dispose of:

a newspaper used for dissections?

b vegetable oil?

c weak acid?

d strong acid?

Apply and analyse

9 What dissection tools do you have in the science laboratory?

10 How can you make sure an experiment is a fair test?

11 Why should you wash science equipment thoroughly before putting it back?

12 What might happen if you put play dough down the sink?

13 What is the difference between a logbook and a formal written report? When should a formal written report be used?

Evaluate and create

14 Draw a graph from the data below that show how much Enza has grown in her first 8 years.

AGE (YEARS)	HEIGHT (CM)
1	75
2	86
3	91
4	99
5	105
6	110
7	117
8	121

Extrapolate the results to predict how tall Enza will be when she is 10 years old.

15 Answer the following questions about the graph on the next page.

a What label should be on the x-axis?

b What label should be on the y-axis?

c Which year had the greatest number of road deaths?

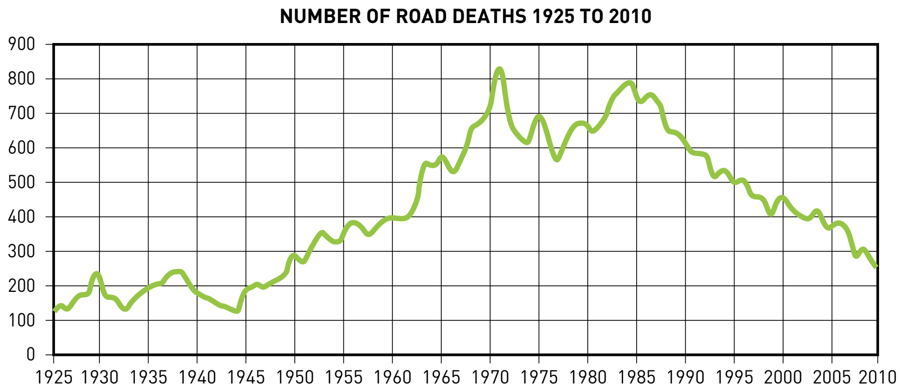
d How many road deaths were there in 1965?

e Describe the trend in:

i 1945–1965

ii 1975–1985

iii 1990–2010.



f What could have caused the trend from 1985 to the current day?

16 One of the first scientists to record their dissections was Leonardo da Vinci. Create a picture scrapbook of copies of some of Leonardo da Vinci's best work on the study of the human body.

17 Scientists present formally written reports in scientific journals. Many of these reports must be examined by other scientists before they will be accepted for publishing. Suggest a reason for this.

Ethical understanding

18 Dissections and research involving animals have contributed significantly to our understanding of the human body. In fact, it would probably be fair to say that we couldn't have come this far without them. Critically evaluate the positives and negatives involved in using animals for medical research purposes. Discuss your points with a partner and share your thoughts with the class. Do you think animals should continue to be used for medical research?

Research

19 Choose one of the following topics for a research project. A few guiding questions have been provided for you, but you should add more questions that you want to investigate. Present your research in a format of your own choosing, giving careful consideration to the information you are presenting.

> **Testing sticky tape**

Design an experiment to test the strength of different types of sticky tape. What is your independent variable? How will you measure your dependent variable? List all the variables that could affect the results. How will you control these? What materials will you need? Write out a method in a step-by-step manner.

> **Early anatomists**

Research how early anatomists such as the Egyptians or the Greeks made their discoveries. What was the relationship between barbers (male hairdressers) and surgeons? Who were they allowed to dissect legally according to King Henry VIII? How do current surgeons learn anatomy?

> **Laboratory chemicals**

Many chemicals are banned from use in school laboratories. Research one of these chemicals. When was it banned? Why is it considered dangerous for use by students? Is it still used in other workplaces? What precautions need to be taken by people who work with this chemical?

KEY WORDS

1

anatomy
structure of an organism and its component parts; usually refers to human anatomy

controlled variables
variables that will remain unchanged through the experiment

corrosive
a substance that is destructive to living tissues such as skin and eyes, or to some types of metals

dependent variable
variable that may change as a result of the experiment

directly proportional relationship
the dependent variable increases as the independent variable increases

dissection
the process of disassembling and studying the internal structures of plants, animals and humans

fair testing
experiment where only the independent variable is changed and all other variables are kept constant

hazard
something that has the potential to put your health and safety at risk

hypothesis
a statement that describes the expected relationship between the independent variable and the dependent variable

independent variable
a variable (factor) that is changed in an experiment

inhale
to breathe in

inversely proportional relationship
the dependent variable increases as the independent variable decreases

variable
something that can affect the results of an experiment