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and David Sang

Cambridge Checkpoint Science

Workbook 7

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Introduction

What is this Workbook for?

This Workbook will help you to develop your knowledge and skills in science.

As you work carefully through it, you should find that you get gradually better and better at doing things such as:

- using your knowledge to work out the answers to questions, rather than just remembering the answers
- planning experiments, recording results, drawing graphs and making conclusions.

How is the Workbook organised?

Laboratory apparatus

The first few pages in the Workbook show you diagrams of the different kinds of laboratory apparatus you will use when you do practical work.

You can write in their names and what you used them for.

Useful words

There are some words that you will use quite often during your science course. Their meanings are explained on pages **10** and **11**.

Exercises

The exercises will help you to develop the skills you need to do well in science.

The exercises are not quite the same as the questions that you will meet on the Progression Tests or your Checkpoint examination.

This is because the exercises are to help you to get better at doing particular things, rather than testing how well you can do them.

The exercises are arranged in the same order as the topics in your Coursebook.

Each exercise has the same number as a topic in the Coursebook.

There is not always an exercise for each topic. For example, there is an exercise for each of topics 1.1, 1.2, 1.3 and 1.5. There is no exercise for topics 1.4 or 1.6.

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Laboratory apparatus

You will use lots of different pieces of apparatus when you do practical work.

Each time you use a new piece of apparatus, find its picture here and write in its correct name. Then describe what you used the apparatus for. There are spaces on page **9** to add more apparatus you have used.

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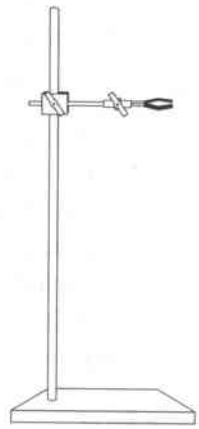

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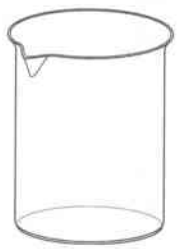

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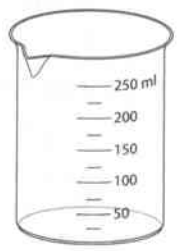

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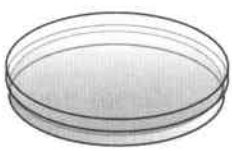

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Laboratory apparatus

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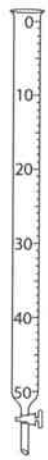

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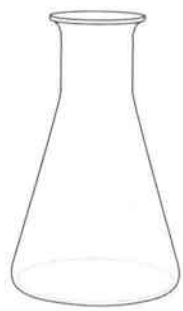

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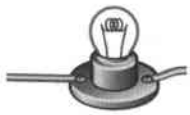

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Useful words

absorb soak up

Plant leaves **absorb** energy from sunlight.

Porous rocks can **absorb** water.

conclusion a simple statement summarising what the results of an experiment tell you

Jovanka did an experiment to investigate whether metals and non-metals conduct electricity.

Her **conclusion** was that metals conduct electricity, but most non-metals do not conduct electricity.

describe say what happens, or what you can see, or what your results are

Shane **described** what happened when he added some acid to some alkali. He said that the indicator changed colour from the UI colour at pH 10 to the UI colour at pH 7.

explain say why something happens

Shane **explained** what happened when he added some acid to some alkali. He said that the pH changed from pH 10 to pH 7, because the acid neutralised the alkali.

fair test an experiment where all the variables are kept the same, except the one whose effect we are investigating

Sonali is doing an experiment to investigate how temperature affects the rate at which a fungus grows on bread.

She makes it a **fair test** by making sure that the only variable that changes is the temperature.

function job, use or purpose

One **function** of a plant's roots is to absorb water.

The **function** of a forcemeter is to measure a force.

particle a very small piece

Sometimes, we use the word 'particle' to mean the very smallest piece of something that can exist – so small that we cannot see it even with a microscope.

In a solid, the **particles** are tightly packed in a regular arrangement, vibrating on the spot.

Sometimes, we use the word 'particle' to mean a bigger piece – something that we can easily see with our eyes.

In a clay soil, the soil **particles** are small with only tiny air spaces between them.

property the way that something behaves

One **property** of metals is that they can conduct electricity.

A **property** of liquids is that they can flow.

unit a standard quantity that we use for measuring something

The **unit** for measuring length is the metre.

The **unit** for measuring mass is the kilogram.

variable something that can change, especially in an experiment

Sonali is doing an experiment to investigate how temperature affects the rate at which a fungi grows on bread.

The **variable** she changes is the temperature.

The **variable** she measures is the growth of the fungus.

Three of the **variables** she keeps the same are the kind of bread, the size of the bread and the amount of water he adds to the bread.

Exercise 1.1 Comparing leaves

This exercise will help you to practise observing carefully. You will also think about how to record your observations in a table.

1 Find two leaves from two different plants. Decide which one will be Leaf **A** and which will be Leaf **B**.

2 Look very carefully at the two leaves. Make a list of **three** features that are the **same** in both leaves.

first feature

.....

.....

second feature

.....

.....

third feature

.....

.....

3 Now look for **differences** between the leaves. Write descriptions of the differences in the table. You can add more rows to the table if you like.

Feature	Leaf A	Leaf B
length		
shape		
colour		
surface		
edge		
pattern of veins		

Exercise 1.2 Human organ systems

This exercise will help you to remember what you have learnt about four organ systems in the human body.

For each of the functions listed, write the name of the organ system that has this function. Choose from:

respiratory system **nervous system**
circulatory system **digestive system**

Then list at least **two** organs that are part of each organ system.

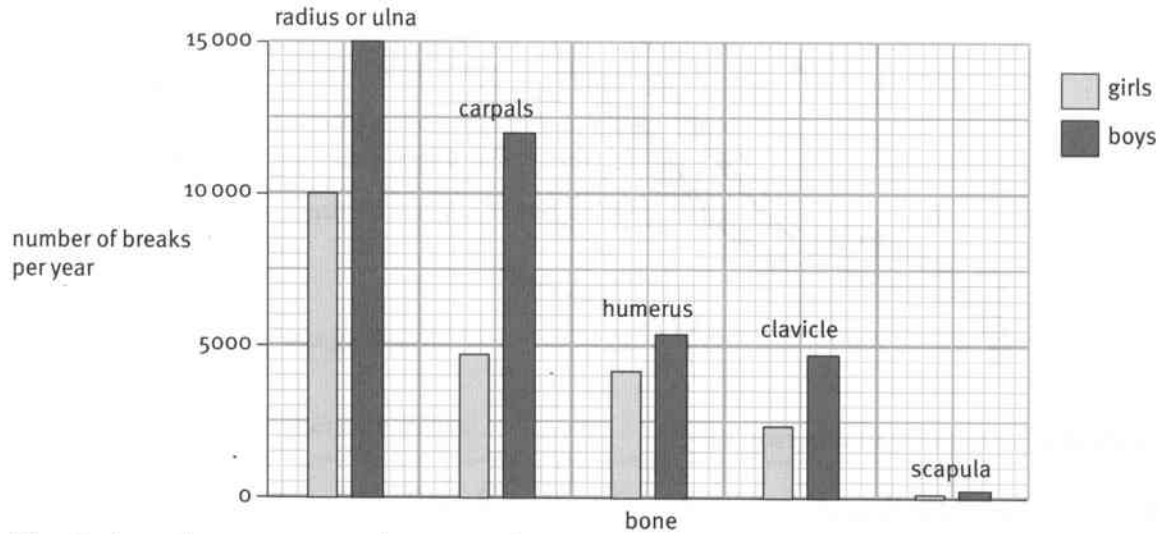
Function	Organ system	Some organs in the system
transporting substances round the body		
breaking down food and absorbing it into the blood		
taking oxygen into the body and getting rid of carbon dioxide		
helping different parts of the body to communicate		

Exercise 1.3 Breaking bones

This exercise will help you to practise reading information from a bar chart.

Most of our bones are very strong. They do not break easily. But very strong forces on a bone can make it snap.

The bar chart below shows information about the bones broken in a country in Europe in one year. It shows which bones in the arms and shoulders were broken most often in people under 18 years of age.



Use the bar chart to answer these questions.

1 Which bones were broken most often?

.....

2 For boys, how many times was a humerus broken during the year?

.....

3 How many more times did a boy break his radius or ulna than his humerus? Show how you worked out your answer.

.....

.....

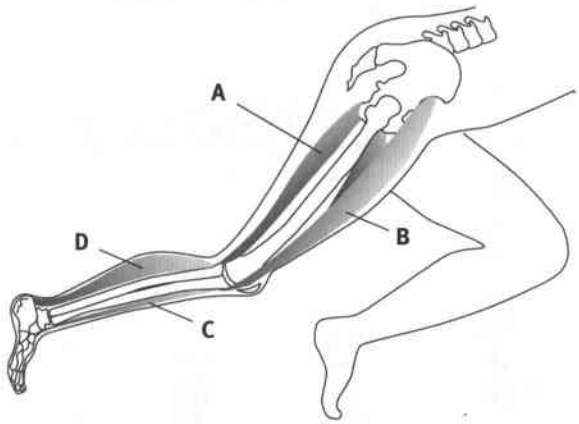
4 How many times did girls break a bone in a part of the arm below the elbow? Show how you worked out your answer.

.....

.....

Exercise 1.5 Antagonistic muscles in the leg

In this exercise, you will be using what you have learnt about the muscles in the arm to predict how the muscles in the leg work. It's important not to get worried when you see something new that you think you have not learned about. Just think about what you have learnt, and use it to help you in this unfamiliar situation.



This diagram shows the muscles in a person's leg.

1 On the diagram, label these bones:

the femur **the pelvis** **the tibia**

2 What kind of joint is the knee joint?

.....

.....

3 On the diagram, label a ball-and-socket joint.

4 Look carefully at the diagram. What will happen at the knee joint when muscle **A** contracts?

.....

5 What will happen at the knee joint when muscle **B** contracts?

.....

6 Which of these pairs of muscles are antagonistic pairs? Underline the **two** correct answers.

A and **B** **A** and **D** **B** and **C** **C** and **D** **C** and **A**

Exercise 2.1 Characteristics of living organisms

Doing this word search will help you to learn and remember the seven characteristics of living things, and how to spell them.

Find the words with each of these meanings.

a Being able to sense and respond to stimuli. .....

b A chemical reaction that takes place in all living cells, releasing energy from food. .....

c Changing the position or shape of part of the body. .....

d Getting rid of waste products from the chemical reactions taking place inside body cells. .....

e Taking in nutrients that are needed to keep the organism alive. .....

f Making new living organisms. .....

g A permanent increase in size. .....

z	q	x	u	e	e	b	c	y	s	t	n	p	r
r	a	c	h	p	x	e	l	h	t	w	o	r	g
e	m	q	u	a	l	w	h	t	r	e	i	n	e
s	j	u	z	c	k	e	m	n	i	x	t	f	s
p	g	n	w	y	a	o	o	m	t	c	c	x	e
i	m	p	c	b	l	i	v	k	d	r	u	s	t
r	h	c	t	i	t	o	e	c	e	e	d	r	l
a	u	p	b	i	e	i	m	o	u	t	o	w	t
t	e	r	r	v	s	c	e	p	s	i	r	r	e
i	n	t	r	e	s	k	n	f	f	o	p	e	r
o	u	y	t	i	v	i	t	i	s	n	e	s	g
n	h	i	j	t	u	f	v	j	e	a	r	d	e

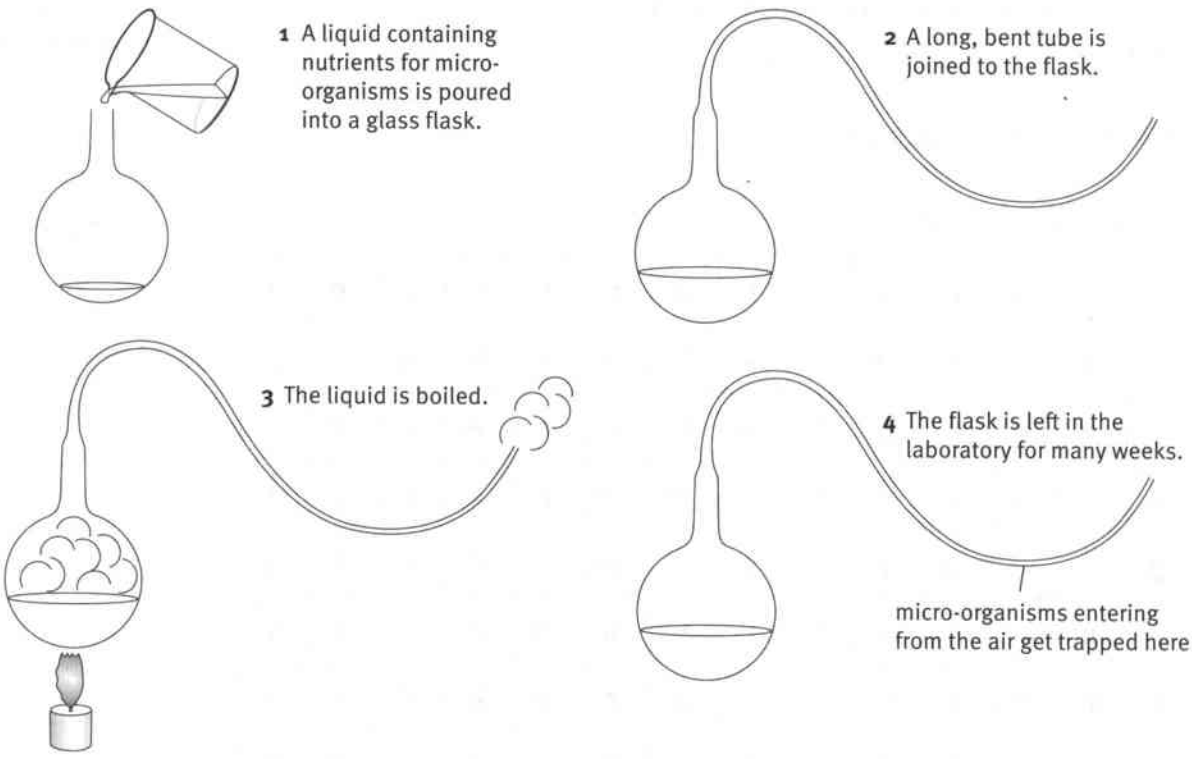
Exercise 2.2 Pasteur and spontaneous generation

Louis Pasteur was a brilliant scientist. He lived at a time when people were only just beginning to understand anything about micro-organisms. This exercise will help you to learn about one of his most famous experiments. You will also think about using evidence to make conclusions.

In the nineteenth century, many people believed that micro-organisms could just appear from non-living material. This was called spontaneous generation.

Louis Pasteur thought that this idea was wrong. He thought that micro-organisms could only be formed when other micro-organisms reproduced. He planned an experiment to test this idea.

Pasteur used some very special glass flasks for his experiment. The diagram shows what he did.



1 Explain how Pasteur made sure that there were no micro-organisms in the flask before he left it in the laboratory.

.....

.....

.....

2 Explain how Pasteur made sure that any micro-organisms that appeared in the flask had food and oxygen.

.....

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3 Pasteur found that the liquid in the flask stayed unchanged for many months.

Do you think that this provides evidence against the idea of spontaneous generation? Explain your answer.

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4 After several months, Pasteur cut the curved neck off the flask.
He found that the liquid went bad in just a few days.

Suggest why this happened.

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5 Do you think that the result of cutting the curved neck off the flask provides evidence that the idea of spontaneous generation is not correct?

Explain your answer.

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Exercise 2.3 Investigating leaf decay

This exercise gives you practice in thinking about how to do an experiment to test an idea. You will also think about presenting results and using evidence to make conclusions.

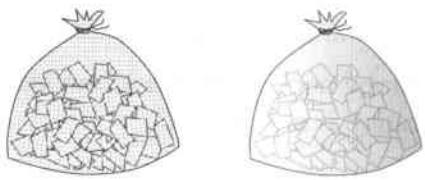
Tom knew that micro-organisms cause dead leaves to decay. He predicted that bigger organisms, such as earthworms and other tiny animals in the soil, might also help to make the leaves decay.

In June, Tom made two identical small bags out of nets with different sized mesh.

Bag **A** 1 cm mesh Earthworms and other small animals can get through the holes.

Bag **B** 0.005 mm mesh Only micro-organisms can get through the holes.

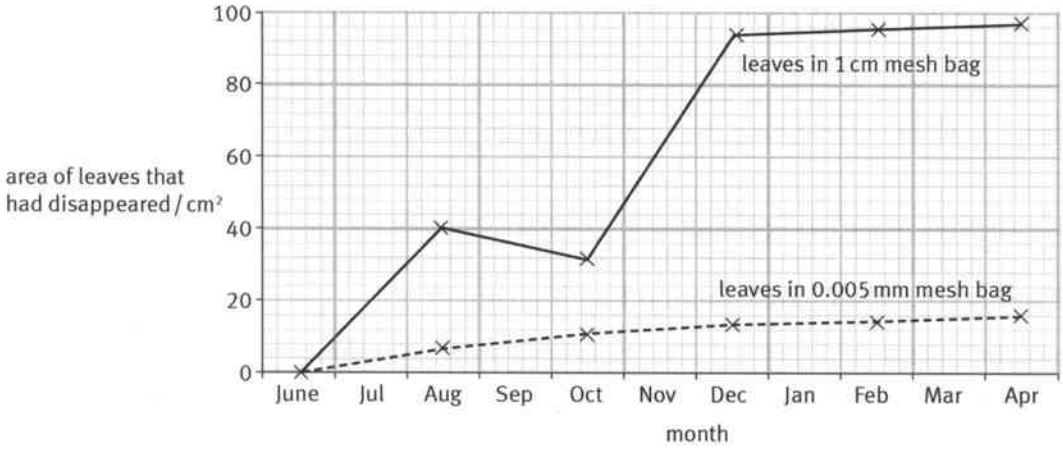
Next, Tom collected some dead leaves. He carefully cut rectangles measuring 1 cm × 2 cm from the leaves. He put 50 leaf rectangles into each bag.



Tom buried the bags close to each other in the soil in his garden.

Every two months, he dug up the bags. He measured how much of the leaves had disappeared from each bag.

The graph shows Tom's results.



1 Tom decided that one of his results was wrong. He must have made a mistake when he was making his measurements.

Which result was wrong?

.....

2 In which bag did the largest area of leaves disappear during Tom's experiment?

.....

3 Which organisms could reach the leaves in this bag?

.....

4 Tom decided that his prediction was correct. Explain the evidence that he had for this decision.

.....

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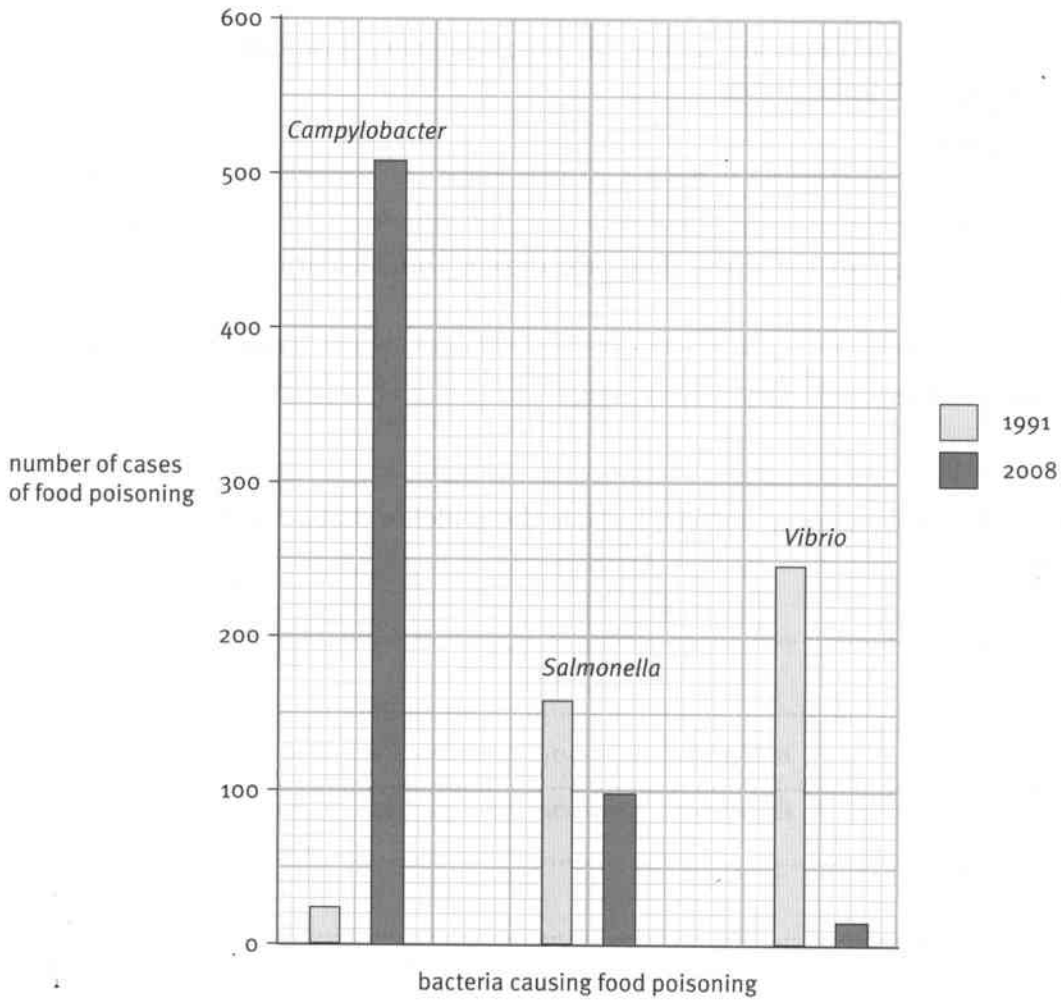
Exercise 2.5 Food poisoning in Japan

This exercise gives you practice in using a bar chart to find information. You will also apply your knowledge about the conditions that micro-organisms need to grow.

Food poisoning happens when you eat food that contains large numbers of harmful bacteria.

Three types of bacteria that cause food poisoning are called *Campylobacter*, *Salmonella* and *Vibrio*. (Their names are written like this because they are Latin, scientific names. The bacteria don't have common English names.)

The bar chart shows the numbers of cases of food poisoning caused by these three kinds of bacteria in Japan in 1991 and in 2008.



Use the bar chart to answer these questions.

1 Which bacterium caused the most cases of food poisoning in 1991?

.....

2 How many cases of food poisoning did *Salmonella* cause in 1991?

.....

3 How did the importance of food poisoning by *Campylobacter* change between 1991 and 2008?

.....

.....

.....

4 In Japan, many cases of food poisoning are caused by people eating undercooked chicken.

Explain why cooking chicken thoroughly could prevent food poisoning.

.....

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Exercise 2.7 Comparing plant cells and animal cells

You should not find this exercise too difficult. Try to do it without looking anything up.

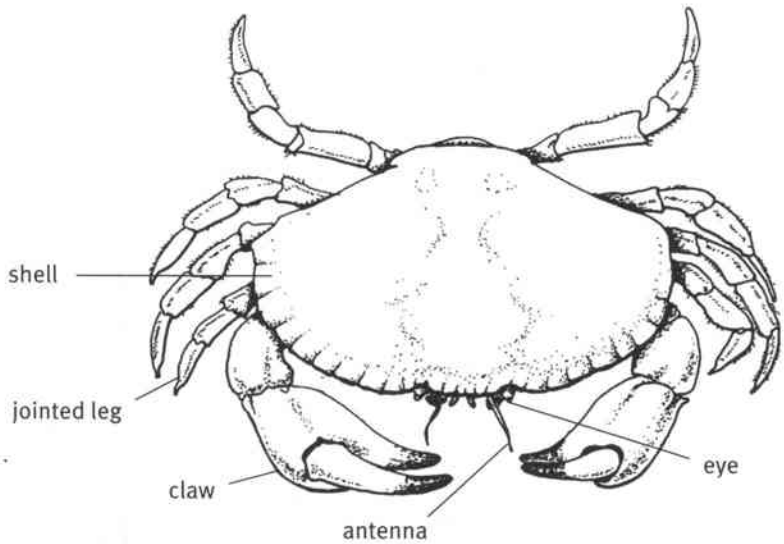
Complete the table to show which structures are found in plant cells and animal cells.

Structure	Is it found in plant cells?	Is it found in animal cells?
cell wall		

Exercise 3.1 Animal adaptations

This exercise will give you practice in describing how particular features of animals adapt them to live in their habitat.

1 The drawing shows a crab. Crabs live on the sea bed. They feed on dead animals, and the remains of food that other predators have eaten.



Complete the table to describe **three** features of the crab that are adaptations for its way of life.

Feature	How it helps the crab to survive

2 Think of an interesting animal that lives in a particular habitat on land.

Make a drawing of your animal. Use labels to explain how it is adapted to survive in its habitat.

Exercise 3.3 Leafhoppers

This exercise is about food chains, and how humans can affect food chains.

Rice is an important food crop in many countries. The rice plants produce seeds, which are harvested and eaten by people.

The diagram shows this as a food chain. The arrows in the food chain show how energy passes from each step to the next.

Sun → rice → humans

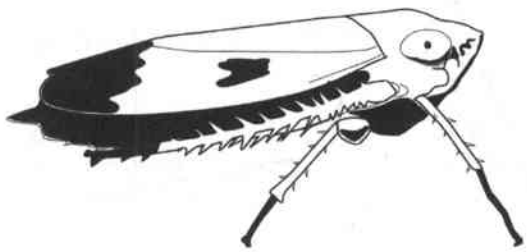
1 How does energy pass from the Sun to the rice?

.....

2 How does energy pass from the rice to the humans?

.....

3 Other organisms, such as green leafhoppers, also like to eat the rice. Green leafhoppers also eat grass, but they prefer to eat rice.



Suggest why the numbers of green leafhoppers are much larger in rice fields than in other places.

.....

.....

4 Some farmers keep carp and other fish in the water in their rice fields. The carp eat the leafhoppers and their eggs.

Draw a food chain to show how energy passes from the Sun to the carp.

.....

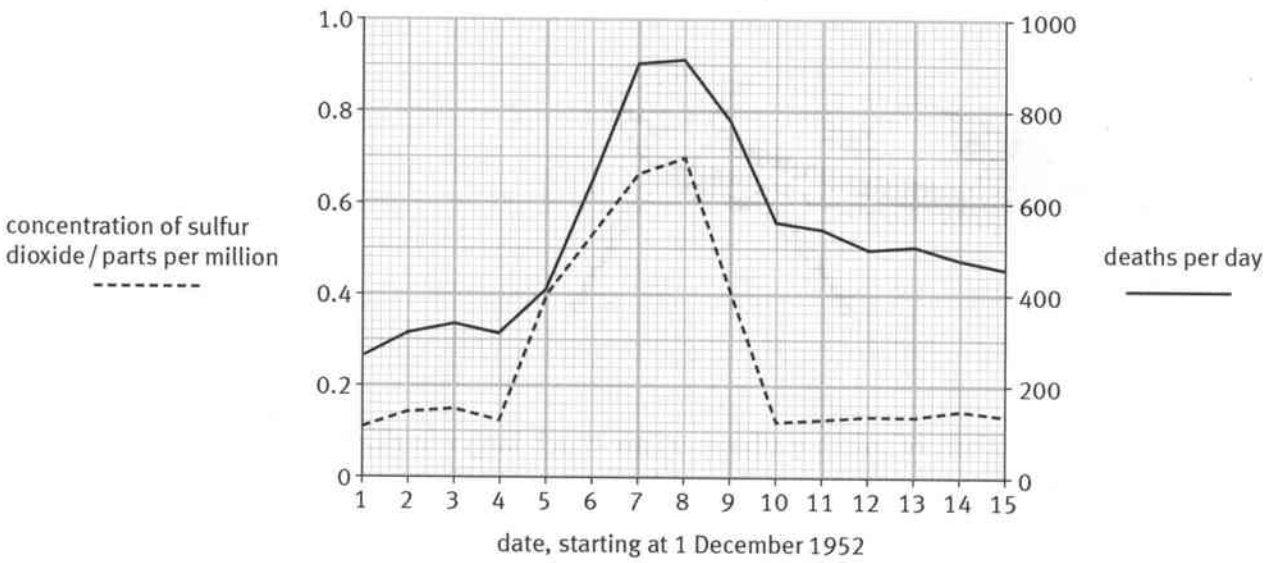
Exercise 3.4 The great London smog

This is a true account of a serious pollution event that happened many years ago. You will need to think about the causes and effects of pollution. You will also practise getting information from a graph, and using numbers to provide evidence.

London, in England, used to be famous for its foggy atmosphere. In the 1950s, many people in London burned coal to heat their houses. Smoke and sulfur dioxide mixed with the fog, producing a smelly mixture called smog.

Sulfur dioxide irritates the nose and throat. People who have asthma or other problems with their lungs can develop severe problems if they breathe in a lot of sulfur dioxide.

In December 1952, the smog was especially bad. The graph shows the concentration of sulfur dioxide in the air during the first 15 days of that month. It also shows how many people in London died each day.



1 The smog contained sulfur dioxide. Explain where the sulfur dioxide came from.

.....

2 On which day of December was the concentration of sulfur dioxide in the air the greatest?

.....

3 What was the concentration of sulfur dioxide on that day?

.....

4 It is recommended that people should not be exposed to sulfur dioxide concentrations greater than 0.2 parts per million.

Draw a horizontal line on the graph to show this concentration.

Then work out the number of days between 1 and 15 December when the sulfur dioxide concentrations were above that level.

.....

5 How many people died in London on 1 December .....

6 How many more people died on 8 December than on 1 December?

.....

7 Describe the evidence from the graph which suggests that the sulfur dioxide might have caused some people to die.

.....

.....

.....

8 Explain why we cannot be sure that it was the sulfur dioxide that caused people to die.

.....

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Exercise 3.5 Melanoma in Australia

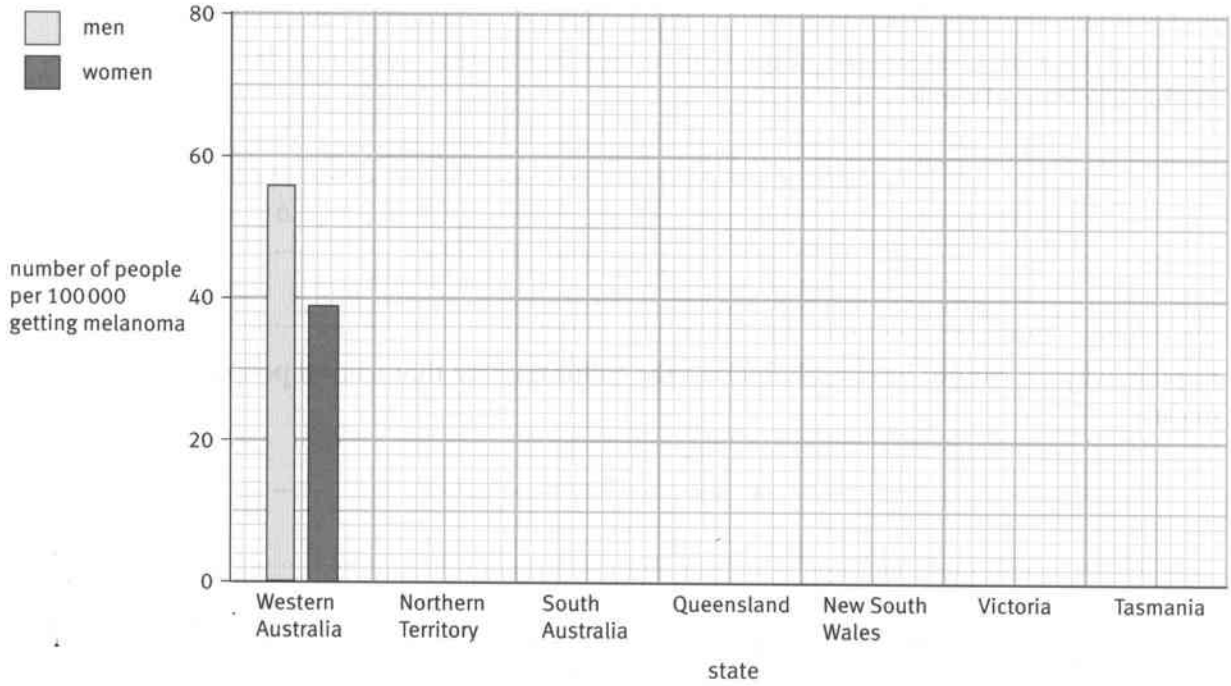
You will practise drawing a bar chart in this exercise. You will also have to think of a sensible explanation for the patterns in the data, and to use your knowledge and understanding to make a prediction.

Australia is in the southern hemisphere. It is close to the hole in the ozone layer.

The map shows information about a type of skin cancer called melanoma in the year 2000, in each state in Australia.

The figures on the map are the number of men and women in every 100 000 who were diagnosed with melanoma.

1 Complete the bar chart to show this information.



2 Melanoma is often caused by ultraviolet radiation that is absorbed by the skin.

Suggest an explanation for the differences in the figures for men and women, shown on your bar chart.

.....

.....

.....

.....

3 The numbers of people with melanoma in Australia increased between 1983 and 2000.

Use what you know about the ozone layer to suggest why this happened.

.....

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4 Melanoma usually takes many years to develop.

Today, people in Australia are very careful to avoid exposing their skin to too much sunlight.

Predict what will happen to the numbers of people in Australia getting melanoma in the future. Explain your prediction.

.....

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.....

.....

Exercise 3.6 Conserving giant pandas

In this exercise, you will practise finding information in a written passage. Try to write your answers in your own words rather than just copying pieces from the passage.

Read the information about giant pandas, and then use the information and your own knowledge to answer the questions.

Giant pandas live in China. They eat bamboo.

Bamboo is tough and difficult to digest. Giant pandas have a sixth 'finger' that helps them to hold bamboo stems firmly while they eat the bamboo. They have a large head with very strong jaw muscles, and very big molar teeth to help them to chew.

Many bamboo forests have been cleared in China, to provide more land for farming and building houses. The numbers of giant pandas have fallen so much that they are in danger of becoming extinct.

To help to save the giant panda, China has created many nature reserves where the panda's habitat is protected.

1 Draw a food chain to show how giant pandas get their energy.

.....

2 Describe **three** ways in which giant pandas are adapted for their way of life. For each adaptation, explain how it helps them to survive.

first way .....

.....

second way .....

.....

third way .....

.....

3 Explain why giant pandas are in danger of becoming extinct.

.....

.....

.....

.....

4 Many tourists to China want to see giant pandas. Suggest how this could be used to help to conserve the pandas.

.....

.....

.....

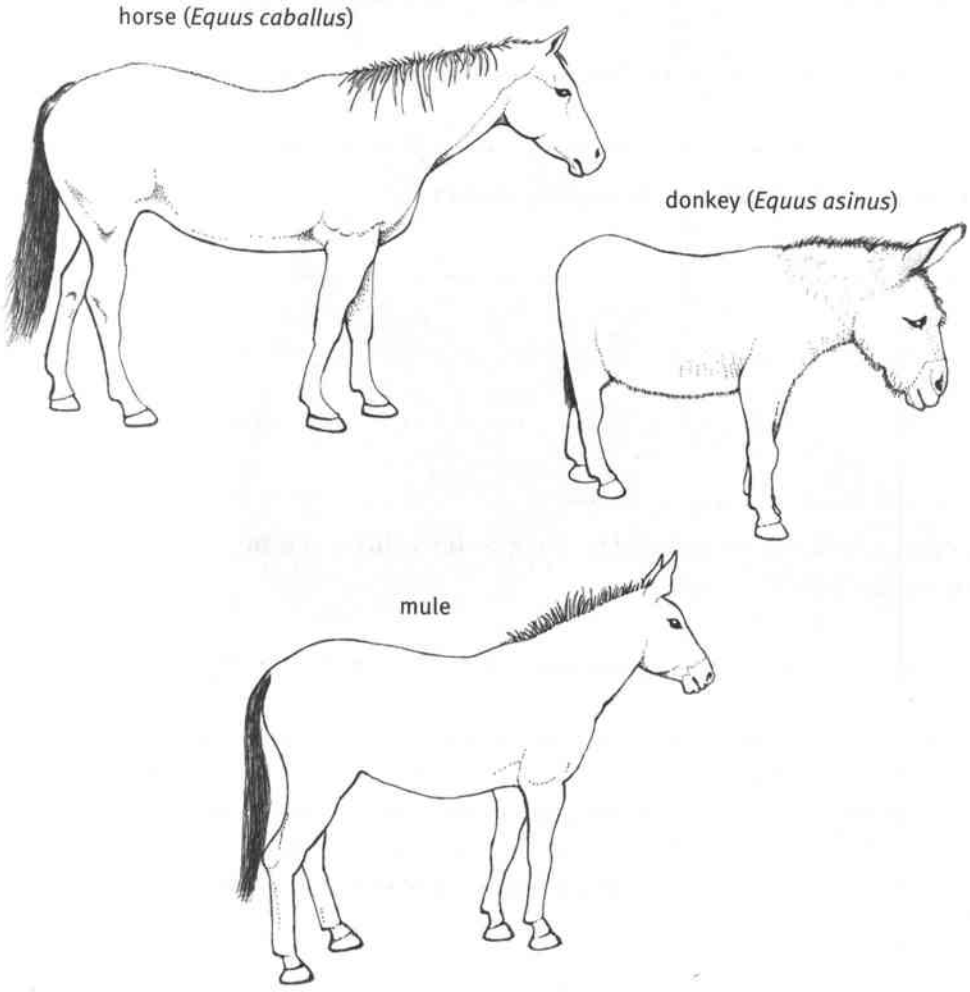
.....

Exercise 4.1 Horses, donkeys and mules

This exercise is about the meaning of the word 'species'. It will also give you practice in observing carefully and recording your observations.

The Latin name for a horse is *Equus caballus*. The Latin name for a donkey is *Equus asinus*.

People sometimes breed a female horse with a male donkey. The offspring is called a mule. Mules are big and strong, like horses. They are quiet and easy to handle, like donkeys. Mules are infertile.



1 Write down **three** similarities between a horse and a donkey.

first similarity .....

.....

second similarity .....

.....

third similarity .....

.....

2 Write down **two** ways in which a donkey differs from a horse.

first difference .....

.....

second difference .....

.....

3 Find **two** pieces of evidence in the information on page **34** showing that horses and donkeys belong to different species.

first piece of evidence .....

.....

.....

second piece of evidence .....

.....

.....

Exercise 4.2 Variation in hair colour

Doing this exercise will make sure that you can use tables to record data about variation, and also that you can draw a frequency diagram.

The students in Nisha's class come from many different countries. Nisha recorded the hair colour of ten of her friends.



These are the results she wrote down.

Dervla – red

Janya – black

Raphael – black

Raakel – blonde

Ahmed – black

Kay – blonde

Dean – brown

Lakshan – black

Jinjing – black

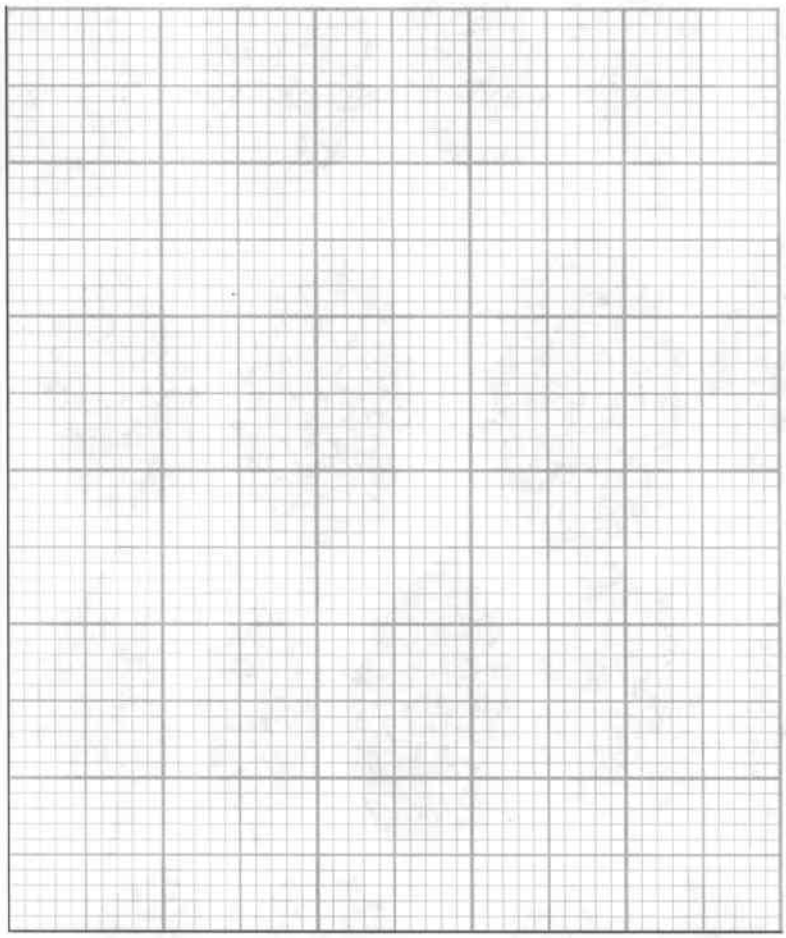
Shane – brown

1 Complete Nisha's results table.

Hair colour				
Tally				
Number of people				

2 Complete the frequency diagram to show Nisha's results.

number of people



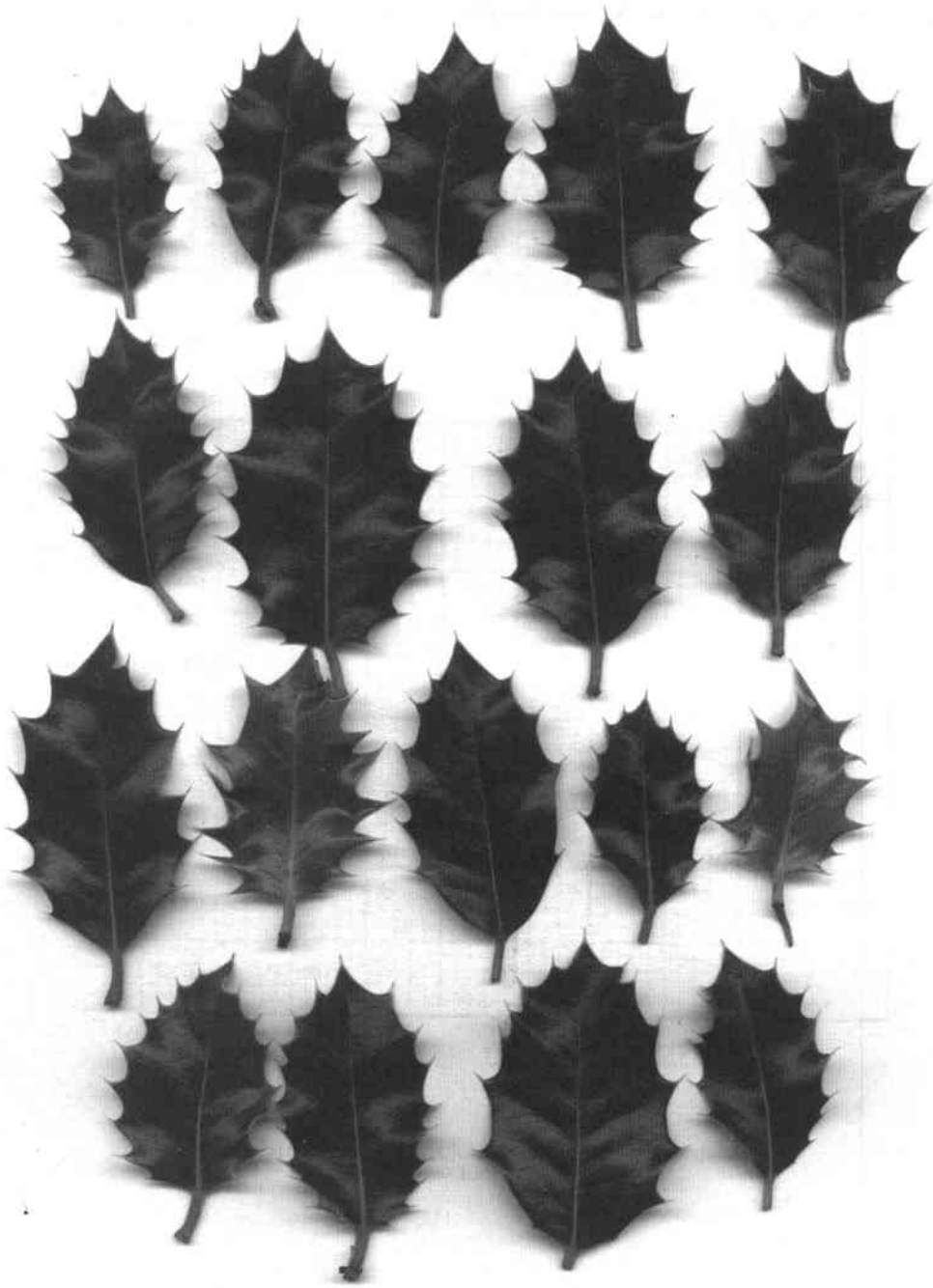
hair colour

Exercise 4.3 Variation in holly leaves

This exercise gives you more practice in calculating a mean, and in recording variation in a results table and a frequency diagram. This time, you have to work out both the axis labels and scales yourself.

Pempho investigated variation in the number of prickles on holly leaves.

The photograph shows the leaves.



1 Count the number of prickles on each leaf, and write them down.

.....

.....

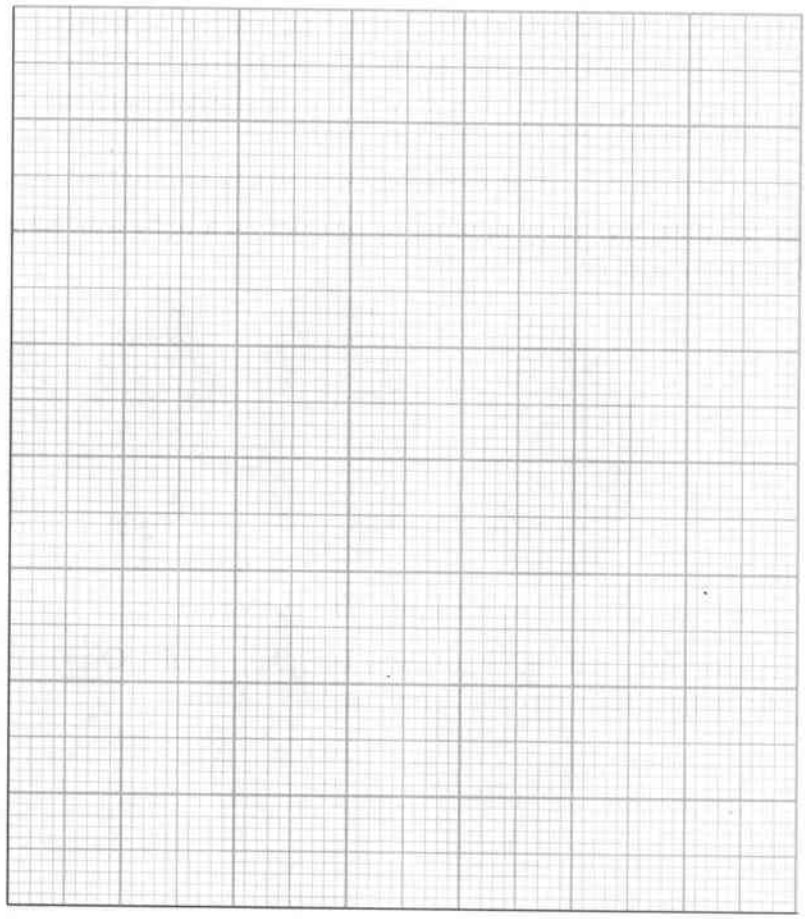
.....

2 Calculate the mean (average) number of prickles on a holly leaf. Show how you worked out your answer.

mean number of prickles .....

3 Draw a results table, and fill it in to show Pempho's results. Organise the results so that you can use them to draw a frequency diagram.

4 Draw a frequency diagram to show Pempho's results.



5 What is the range in Pempho's results?

.....

6 What is the median number of prickles on the holly leaves?

.....

7 What is the mode in these results?

.....

8 State **one** other feature that shows variation in these holly leaves.

.....

Exercise 4.5 Classifying vertebrates

Do you remember the names of the five groups of vertebrates? How well do you know the characteristics of each group? Try to do this exercise without looking anything up.

The table shows some characteristics of six vertebrate animals, **A** to **F**.

Characteristic	Animal					
	A	B	C	D	E	F
Does it have fins?	no	no	no	no	no	yes
Does it live in water?	no	no	no	yes	sometimes	yes
What covers its skin?	hair	feathers	hair	scales	no covering	scales
Does it have lungs or gills?	lungs	lungs	lungs	lungs	gills when young, lungs as adult	gills
Does it have wings?	yes	yes	no	no	no	no
Does it lay eggs in water?	no	no	no	no	yes	yes
Does it lay eggs on land?	no	yes	no	yes	no	no

Decide which vertebrate group each animal belongs to.

A ..... **B** .....

C ..... **D** .....

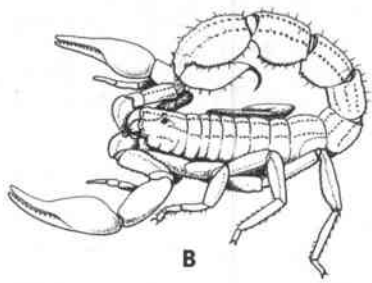
E ..... **F** .....

Exercise 4.6 Classifying invertebrates

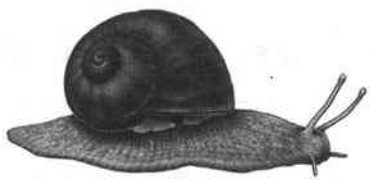
This exercise will help you to think about and remember the characteristics of some of the different groups of invertebrates.

The drawings show some invertebrates.

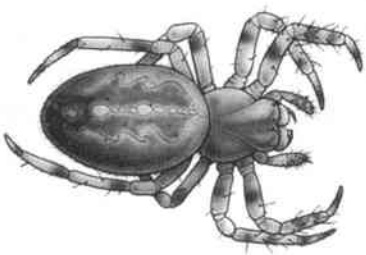
A



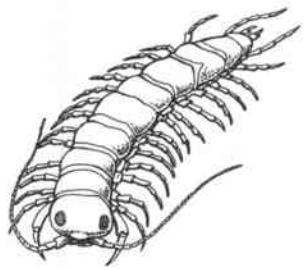
B



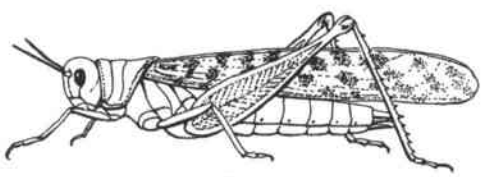
C



D



E



F

G

H

Write the letter of each animal in the appropriate space in the table.

Molluscs	Annelids	Arthropods			
		Insects	Spiders	Crustaceans	Myriapods

Unit 5 States of matter

Exercise 5.1 Solids, liquids and gases

This exercise will help you to understand and remember the properties of matter. You will have to use your knowledge about the three states of matter to work out the answers to question **2**.

1 Complete the sentences.

Solids, liquids and gases are called the three ..... of matter.

In solids the ..... and ..... stay the same. Solids cannot be ..... and they do not flow.

Liquids always take the shape of the ..... they are in.

They cannot be compressed – their ..... stays the same.

Liquids can be ..... .

Gases do not have a fixed .....

or ..... . They can be ..... .

2 Devon has been asked to test five materials to see if they are solid, liquid or gas. He has carried out some simple tests on some of the materials. He has not yet completed his tests.

This is his results table.

Material	Can it be compressed?	Does it flow?	Does it stay the same shape?	Does the volume stay the same?
A	yes	yes		
B		yes		yes
C		yes		
D		yes		yes
E				yes

a Is material **A** a solid, a liquid or a gas? Explain your answer.

.....

.....

.....

b Is material **B** a solid, a liquid or a gas? Explain your answer.

.....

.....

c Devon thinks that material **C** is either a liquid or a gas. Which **one** other test would you carry out to find out which it is? Explain your choice.

.....

.....

.....

d Devon thinks material **D** is a liquid. Is he correct? Explain the reason for your answer.

.....

.....

.....

e Devon knows that material **E** is not a gas. Explain how he knows this.

.....

.....

f What test should he do to decide if material **E** is a liquid or a solid? Explain your answer.

.....

.....

.....

Exercise 5.2 Particle theory

This exercise is to help you remember the facts about how particles are arranged in a solid, a liquid and a gas. Take care with the diagrams! Think carefully about how the particles are arranged and whether they are touching or not.

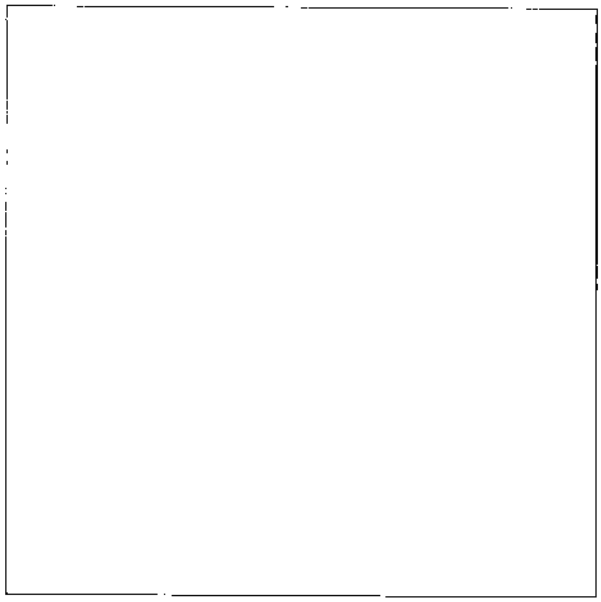
1 In the box below draw a diagram to show how the particles in a solid are arranged.

2 What keeps the particles in a solid in this arrangement?

.....

.....

3 In the box below draw a diagram to show how the particles are arranged in a liquid.

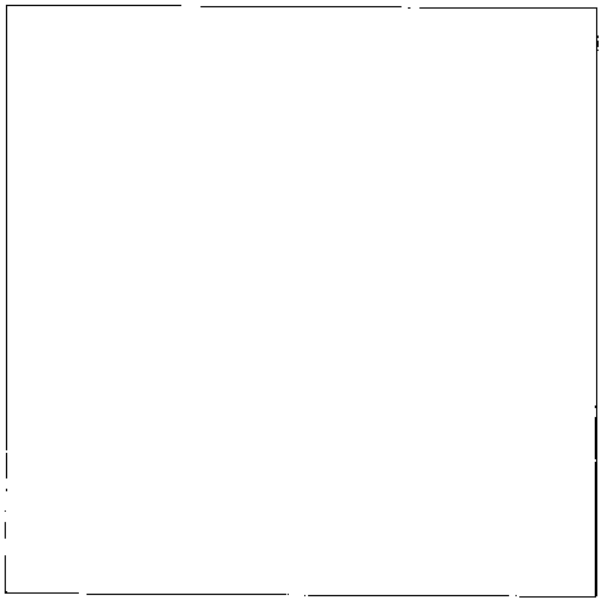


4 What keeps these particles in a liquid in this arrangement?

.....

.....

5 In the box below draw a diagram to show how the particles are arranged in a gas.



Exercise 5.3 Heating a liquid

This exercise is about recording results in a results table and a graph. You will practise drawing a best fit line. You'll also need to think hard about what happens to a liquid when it gets so hot that it boils.

Marlon heats liquid in a beaker for 10 minutes. He takes the temperature every minute.

1 What safety precautions is Marlon taking?

.....

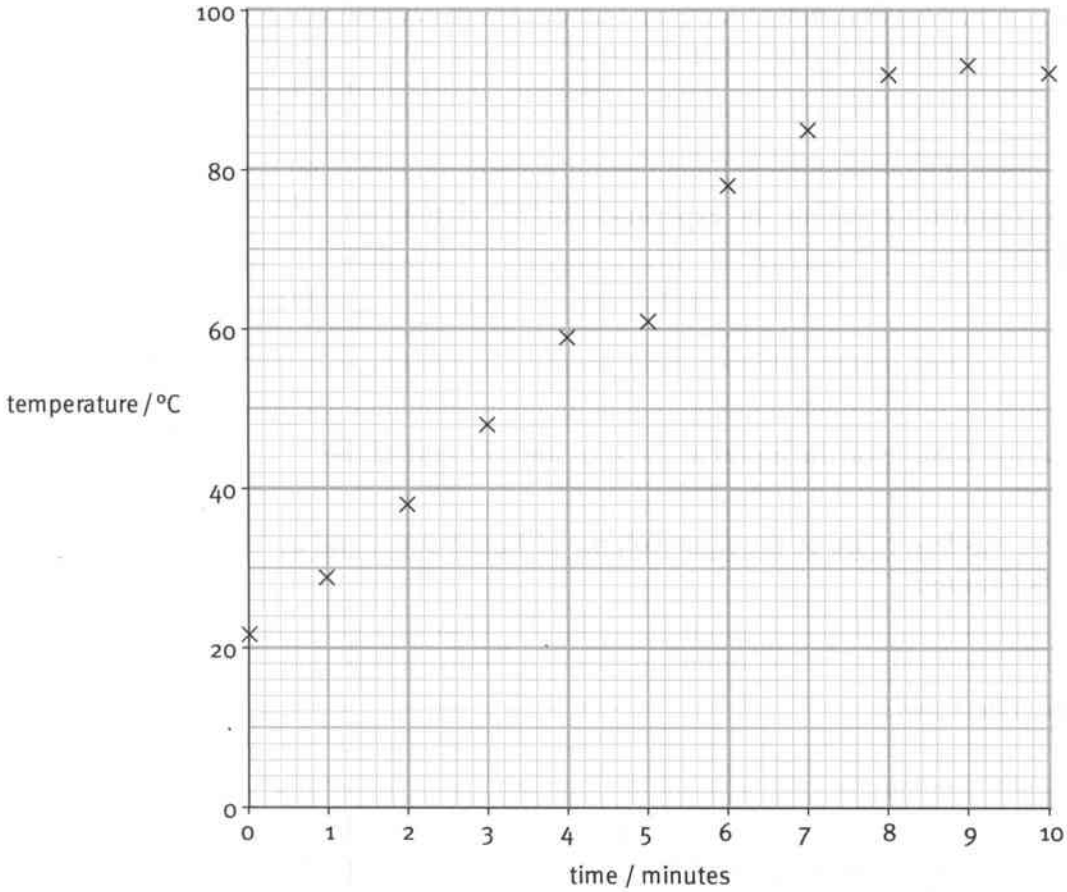
2 This is Marlon's results table.

Time	Temperature
0	22
1	29
2	38
3	48
4	59
5	61
6	78
7	85
8	92
9	93
10	92

There are two important things missing in Marlon's results table.

Write the **two** missing things in the correct spaces in the results table.

3 Here is the graph he plotted from his results.



a One of the points on the graph does not fit the pattern. Draw a circle around it.

b Suggest what Marlon should do about this result.

.....

.....

4 Look carefully at the pattern the points make on the graph. Can you see that they follow a curve?

Using a sharp pencil, draw a smooth line that follows this curve. The line does not need to go through every point. There should be the same number of points above your curve as below it.

This is called a **line of best fit**.

5 Describe what happens to the temperature of the liquid as it is heated.

.....

.....

.....

6 The temperatures towards the end of the experiment do not change very much. Why is this?

.....

.....

7 Marlon measured the volume of the liquid at the start and the end of the experiment.

Do you think there was less, more or the same volume of liquid at the end as there was at the beginning?

.....

Give a reason for your answer.

.....

.....

.....

Exercise 5.4 Explaining changes of state

This exercise gives you practice in explaining changes of state, using particle theory. It's important to know the scientific meanings of each of the terms in the list, and to be able to use them correctly.

Use the following words in your answers. Use each word at least once. You will need to use some of the words more than once.

condensation **energy** **evaporation** **forces**
particle **melting** **move** **transfer** **vibrate**

1 Use particle theory to explain what happens when a solid is heated and it changes into a liquid.

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.....

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2 Use particle theory to explain what happens when a gas reaches a cold surface and it changes into a liquid.

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3 Use particle theory to explain what happens when a liquid is heated and it changes into a gas.

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Unit 6 Material properties

Exercise 6.1 Metals

This exercise will help you to remember the properties of metals, and to think about how we make use of some of these properties.

1 Draw a circle around each word, or group of words, that describes a property of metals.

malleable	**has a shiny surface**	**brittle**
does not conduct heat	**ductile**	**feels warm to the touch**
makes a ringing sound when tapped	**has a dull surface**	**conducts electricity**

2 Which properties of metals are important in each of these examples?

a Copper is used for electrical wiring.

.....

b Gold is used for making jewellery.

.....

c Aluminium is used to build aircraft.

.....

Exercise 6.3 Comparing metals and non-metals

This exercise will help you to distinguish between metals and non-metals.

1 Draw a labelled diagram to show how you could test a material to find out if it conducts electricity or not.

2 Write **true** or **false** next to each of these statements.

a All metals are magnetic. .....

b Solid non-metals are brittle. .....

c All metals are solids. .....

d Metals conduct heat energy. .....

e Non-metals are good conductors of electricity. .....

Exercise 6.4 Everyday materials and their properties

This exercise will help you to decide which properties of everyday materials are important for particular jobs.

1 Glass and plastic are very useful materials for packaging and storing food and drink.

a Which properties of glass are useful for this job?

.....

.....

b Which properties of glass are a problem in transporting food and drink?

.....

.....

c Which properties of plastics are useful in transporting food and drink?

.....

.....

d Which properties of plastics cause a problem when the container is empty?

.....

.....

2 Imagine you are the owner of a factory making shirts. You are going to make a new design of shirt to be worn in a tropical climate.

The table below shows some properties of three materials that you could use – **A**, **B** and **C**.

	Material A	**Material B**	**Material C**
Cost	expensive	very cheap	cheap
Easy to make?	very easy	very difficult because the material slides about	easy
Easy to wash?	very easy	easy	easy
Does it dye well?	very well	patchy	fairly well
Keeps colour after washing ten times?	no fading	very faded	slight fading
Drying time	fast	very fast	slowest
Can sweat evaporate from the skin through the material?	yes	no	yes

a Which material would you choose to use to make the shirts?

.....

b Explain the reasons for your choice.

.....

.....

.....

.....

.....

Unit 7 Material changes

Exercise 7.1 Acids and alkalis

This exercise will help you remember important information about acids and alkalis and how to work safely in the laboratory.

1 The words below each have something to do with either acids or alkalis. Write each word, or group of words, in the correct column in the table.

citric acid **cola** **corrosive** **irritant** **lemon juice**
nitric acid **sharp** **sodium hydroxide** **soap**
sour **vinegar** **washing powder** **washing soda**

Acid	Alkali

2 In the boxes below, draw the hazard labels for corrosive and harmful/irritant.

corrosive

harmful/irritant

3 The table lists some safety points to think about when you use chemicals. Complete the table by explaining the reason for each safety point.

Safety point	Reason
wearing safety glasses	
standing up to work	
placing bottle stoppers upside down on the bench	
replacing the bottle stopper as soon as you have finished using the bottle	
working in an orderly way	

Exercise 7.2 Indicators

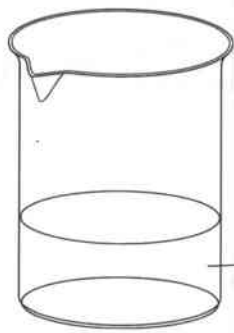
This exercise will make you think about the practical work that you have done. It is important to be able to describe how you do something.

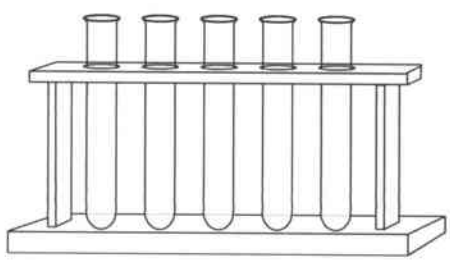
1 You have used indicators in experiments. Explain what an indicator does.

.....

.....

2 The diagram shows some equipment in a laboratory.





Describe how you could use the equipment to make your own indicator.

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3 Describe how you would test your indicator to check that it works.

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4 Explain why an indicator like the one you made cannot help you to find out if coffee or cola is an acid or alkali.

.....

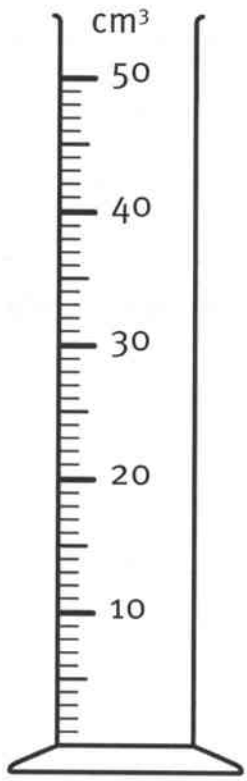
.....

.....

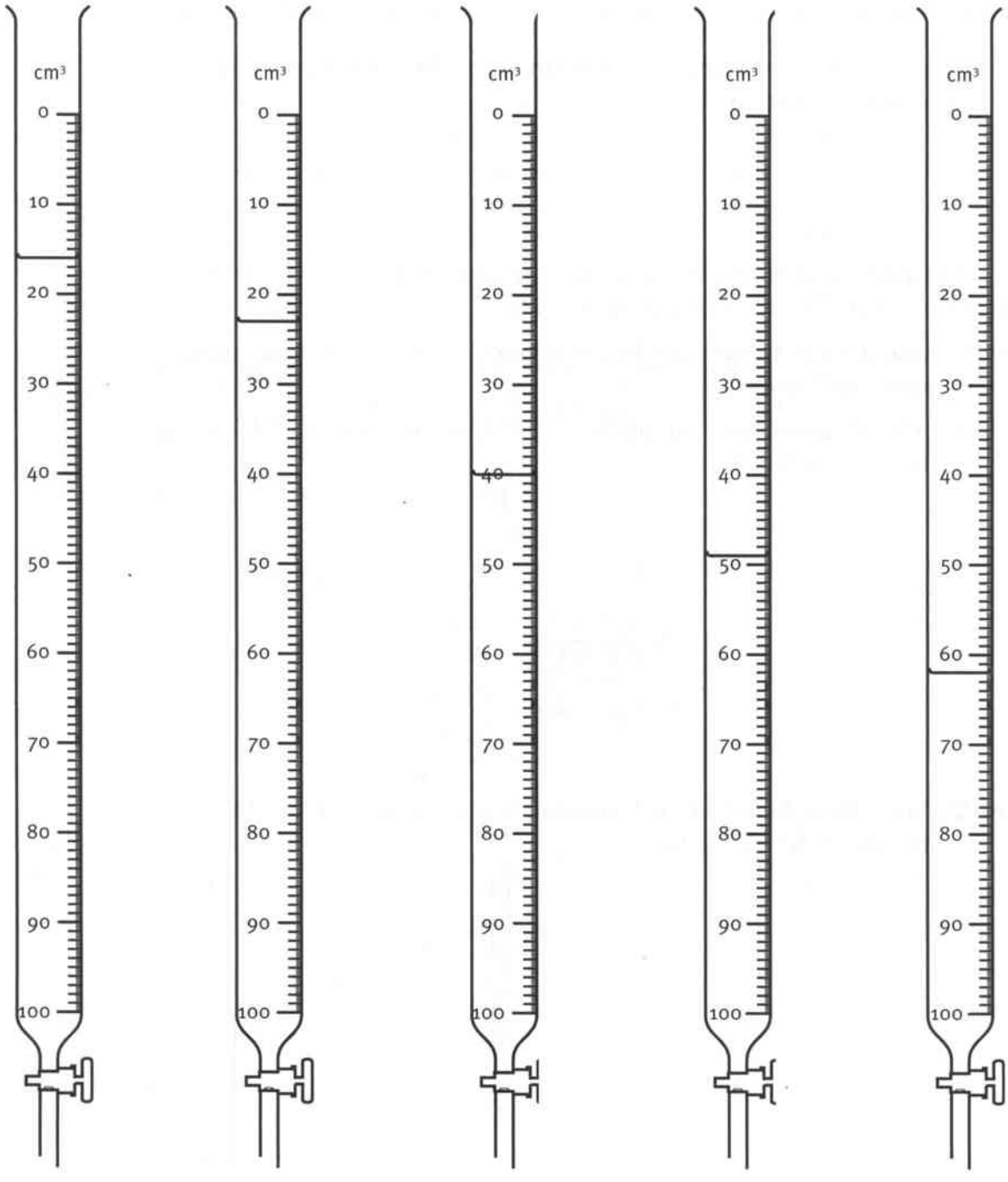
Exercise 7.4 Neutralisation

This exercise gives you practice in measuring volumes using two different pieces of apparatus – a measuring cylinder and a burette.

1 The diagram shows a measuring cylinder. Draw the meniscus of water in the measuring cylinder when it contains 25 cm^3. (Reminder: the meniscus is the surface of the water.)



2 The diagram shows some burettes with different volumes of liquid in them.
Write down the reading on each burette. Remember to include the units.



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Exercise 7.6 Planning investigations

This exercise helps you to think about how scientists plan and carry out investigations.

1 When scientists do experiments, they must think carefully about variables. Explain what a 'variable' is.

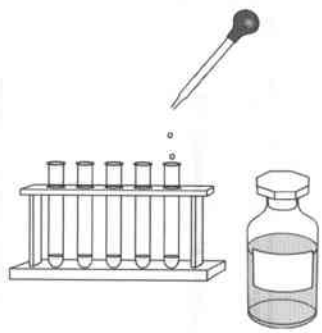
.....

.....

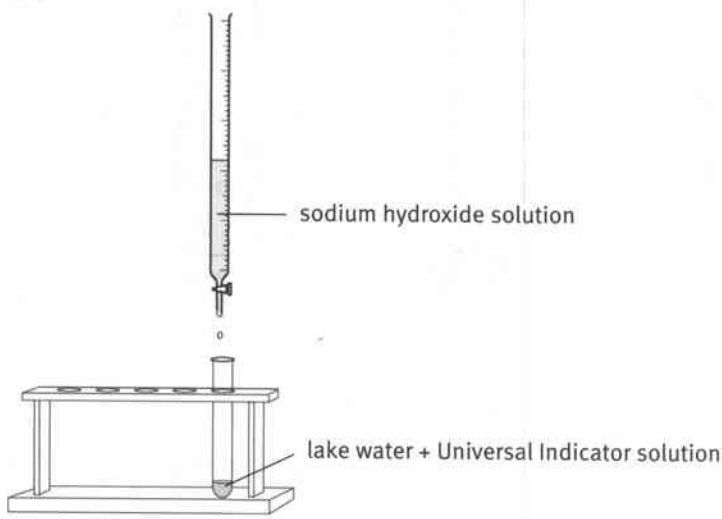
2 An environmental scientist tests the water from a number of lakes in the area where she works. The lakes have become acidic.

The scientist needs to know which lake is the most acidic so that work can start on neutralising the acid.

Step 1 The scientist takes a sample from each lake and tests it with Universal Indicator solution.



Step 2 She adds sodium hydroxide solution to see how much is needed to neutralise the lake water.



a Explain what the scientist should do to make sure that she carries out a fair test in **step 2**.

.....

.....

b The scientist tests each sample three times. Explain why it is important to do this.

.....

.....

c The table shows the scientist's results.

	Volume of sodium hydroxide needed to neutralise sample / cm^3			
Lake	**1st try**	**2nd try**	**3rd try**	**Mean**
A	4	6	5	5
B	10	9	11	10
C	1	1	1	1

What do these results tell you about the acidity of the three lakes, **A**, **B** and **C**? Explain your answers.

.....

.....

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Unit 8 The Earth

Exercise 8.1 Rocks, minerals and soils

This exercise will help you to remember some facts about rocks, minerals and soils.

1 What is the scientific term for someone who studies rocks?

.....

2 What is the difference between rocks and minerals?

.....

.....

3 Name **three** minerals.

.....

.....

.....

4 Name **three** things you would expect to find in soil.

.....

.....

.....

Exercise 8.3 Igneous rocks

This question is about how igneous rocks are made. It will give you practice in using some important scientific words.

Complete the sentences using words from the list. You may use each word once, more than once or not at all.

crystals **fossils** **grains** **granite** **heat**
igneous **limestone** **magma** **marble**
metamorphic **more quickly** **particles**
porous **pressed** **pressure** **sedimentary**

Rocks that are formed when molten ..... cools are called

..... rocks. ..... can often be seen in these rocks.

Rocks with small crystals cooled ..... than rocks with larger

crystals. If the magma cools very quickly then no ..... are formed.

An example of an igneous rock is ..... .

Exercise 8.4 Sedimentary rocks

Completing these sentences will help you to check that you understand how sedimentary rocks are made.

Complete the sentences using words from the list. You may use each word once, more than once or not at all.

crystals **fossils** **grains** **granite** **heat**
igneous **limestone** **magma** **marble**
metamorphic **more quickly** **particles**
porous **pressed** **pressure** **sedimentary**

Rocks formed from layers of ..... settling on top of one another and being ..... down are called ..... rocks.

Small ..... can be seen in the rock.

These rocks often contain fossils and are ..... .

An example of this type of rock is ..... .

Exercise 8.5 Metamorphic rocks

Completing these sentences will help you check that you understand how metamorphic rocks are formed.

Complete the sentences using words from the list. You may use each word once, more than once or not at all.

crystals **fossils** **grains** **granite** **heat**
igneous **limestone** **magma** **marble**
metamorphic **more quickly** **particles**
porous **pressed** **pressure** **sedimentary**

Metamorphic rocks are formed from other types of rocks that are subjected to a lot of ..... and ..... underground.

Metamorphic rocks are harder than ..... rocks.

An example of a metamorphic rock is ..... .

Exercise 8.6 Weathering

In this exercise, you will practise organising results into a results table and then use them to construct a line graph.

In question **3**, you are asked to compare two sets of results. This is not easy! You should try to write sentences that say something about **both** rocks, and that use words such as 'faster' or 'more'.

Some students investigated the action of acid on two different kinds of rocks – rock **A** and rock **B**.

At the start of the experiment the students measured and recorded the mass of each rock sample.

Then they placed the rocks in a beaker of a weakly acidic solution.

The students removed the rocks every day and measured their masses again.

These are the results that they wrote down.

Day 1 - rock A 35.5 g, rock B 29.7 g

Day 2 - rock A 35.4 g, rock B 29.0 g

Day 3 - rock A 35.2 g, rock B 27.4 g

Day 4 - rock A 35.1 g, rock B 26.5 g

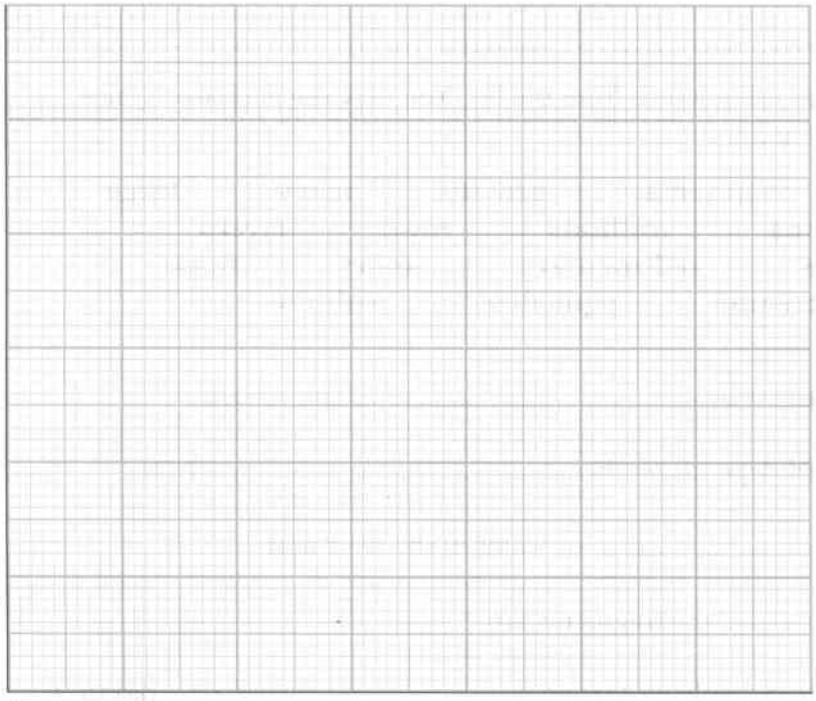
Day 5 - rock A 34.8 g, rock B 25.7 g

Day 6 - rock A 34.6 g, rock B 25.1 g

Day 7 - rock A 34.5 g, rock B 24.6 g

1 Construct a results table to show these results.

2 Plot these results on the graph paper below.



3 Compare the results for rock **A** and rock **B**.

.....

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4 Which type of rock is rock **B** likely to be? .....

5 Predict what would happen if the students carried on with their experiment for another week.

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Exercise 8.7 Moving rocks

This exercise will help you to remember how rock fragments are transported and deposited.

Complete the sentences using words from the list. You may use each word once, more than once or not at all.

distance **fragments** **gravity** **heavy** **large**
layers **long** **millions** **mud** **rivers**
sand **sea** **sedimentary** **short** **slope**
speed **streams** **squashed** **volume**

Rock fragments are carried by ..... and streams.

The distance they travel depends on the ..... of the ground, the ..... of water in the river and how ..... the fragments are.

The heaviest fragments can only be carried a ..... distance. Smaller, lighter fragments are carried a long way. The sand and mud may get carried to the ..... .

The layers of sand and mud build up over ..... of years and the fragments are ..... together by the ..... on top. This forms ..... rock.

Exercise 8.10 Structure of the Earth

This exercise will help you to remember the development of ideas about the structure of the Earth.

1 Draw a labelled diagram to show the internal structure of the Earth as we know it today.

2 Which two metals are found in the area in the centre of the Earth?

.....

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3 In 1912 Alfred Wegener came up with the idea of continental drift. Explain what is meant by continental drift.

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4 What was the evidence that led Wegener to this idea?

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5 Some people did not believe Wegener's idea because he could not explain how continental drift happened. What theory was developed in the 1960s that explained his ideas?

.....

6 How did this theory explain the idea of continental drift?

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Unit 9 Forces and motion

Exercise 9.1 Force detectives

Forces are invisible – but we know that they are there! These two exercises will help you to become better at detecting forces.

1 Read the following sentences. Draw a ring around any word that tells you that a force is at work. There is one in each sentence.

Ashok pushed open the door and went out into the street.

He was pulling a heavy bag of books for school.

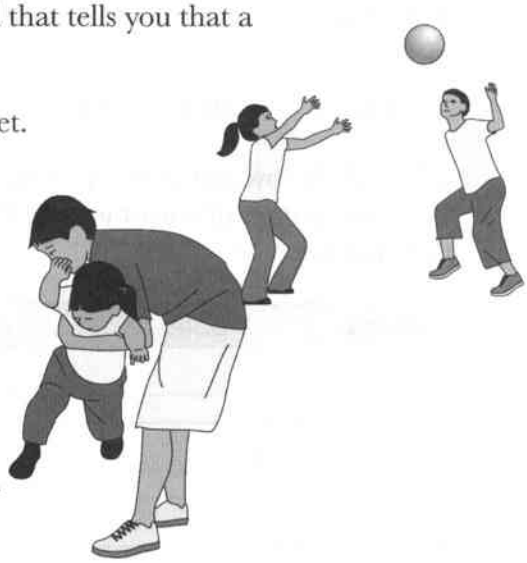
He kicked a stone along the ground.

When he saw his little sister Guri, he lifted her up.

She did not like this, so she pulled his ear.

When Ashok met his friends, they were throwing a ball.

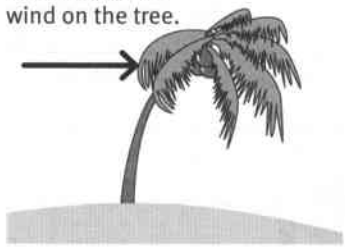
Ashok tried to catch the ball but it hit him on the nose.

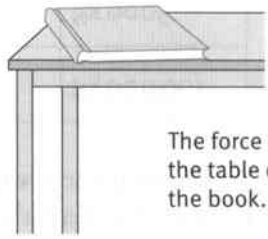


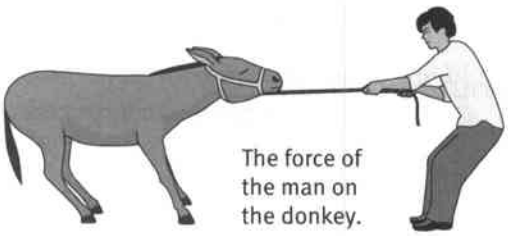
2 We draw force arrows to show when a force is acting. The arrow shows the direction of the force.

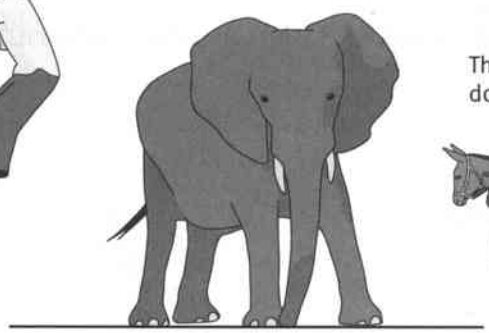
A force arrow should be labelled to show which object is making the force and which object the force is acting on.

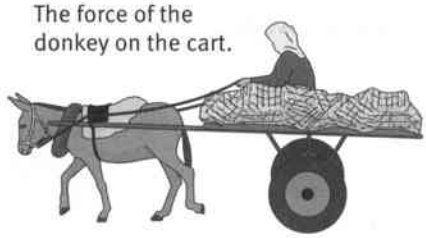
Draw an arrow on each picture to show the forces described. The first example has been done for you.











Exercise 9.3 Mass and weight

Mass and weight are two important quantities in science. It is easy to confuse them. These exercises will help you to learn the difference between them.

1 The **mass** of an object is measured in grams (g) or kilograms (kg). Here is a list of objects.

bus **mouse** **car** **cow** **girl** **house** **book**

The table below shows the mass of each of these objects, but which is which? Write the names of the objects in the second column of the table, to show their masses.

Mass	Object
20 g	
500 g	
30 kg	
250 kg	
800 kg	
5000 kg	
100 000 kg	

2 To find out the **weight** of an object, we multiply its mass in kg by 10. This is because the Earth's gravity pulls on every kg of mass with a force of 10 N.

weight (in N) = mass (in kg) × 10

Vikram's baby brother had a mass of 3.0 kg when he was born. Calculate the baby's weight.

.....

3 Write **mass** or **weight** next to each statement in the second column of this table.

Statement	Mass or weight?
the force of gravity acting on an object	
measured in kilograms	
gets much less if you go to the Moon	
can be represented by a force arrow	
measured in newtons (N)	
'Add 50 g of salt to 1 kg of water.'	
stays the same even if you are far out in space	
5 apples are about 5 N	

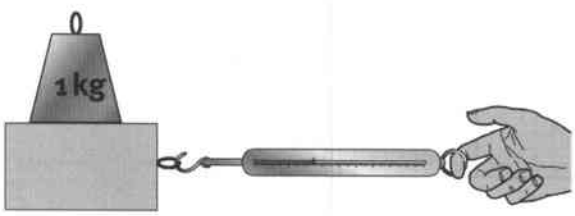
Exercise 9.4 Measuring friction

This exercise will give you practice in displaying and interpreting data collected in an experiment.

In an experiment to investigate friction, Pablo weighed a wooden block using a forcemeter. This told him the weight of the block.

Then he placed the block on a table and pulled it along using a forcemeter. This told him the force of friction acting on the block.

Pablo increased the weight of the block by placing heavy weights on top of it.



The table shows Pablo's results.

Weight of block / N	Friction / N
5.0	2.0
20.0	8.0
15.0	6.0
10.0	4.0

1 Pablo added another weight to the block, so that it weighed 25.0 N. He found that the frictional force was 10.0 N. Add this result to the table on the right.

2 It would have been easier to see the pattern in Pablo's results if he had increased the weight of the block step-by-step.

Complete the second table to show how he should have recorded his results.

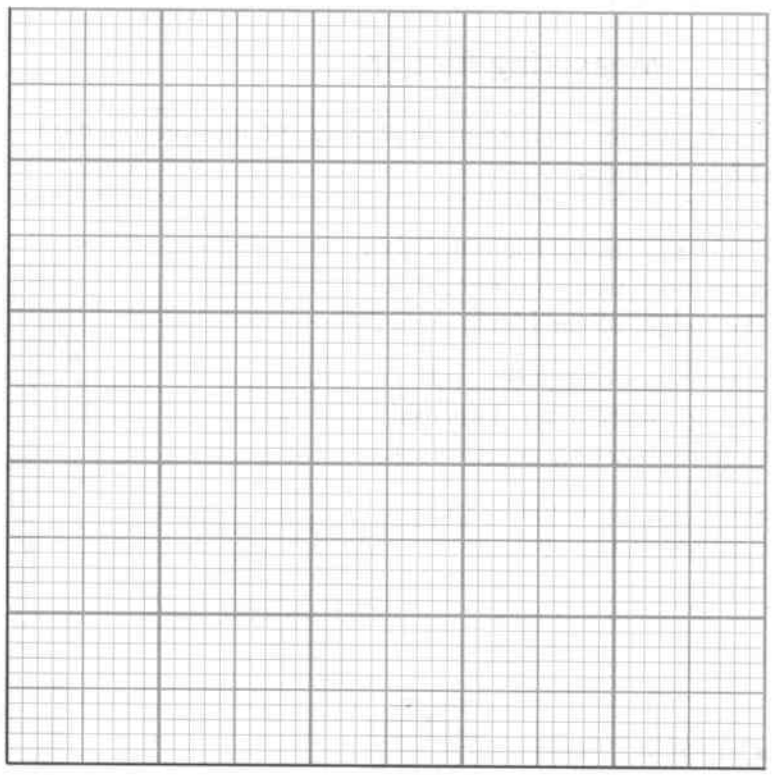
Weight of block / N	Friction / N
5.0	
10.0	
15.0	
20.0	
25.0	

3 On the grid below, draw a graph of Pablo's results.

Show the weight of the block on the horizontal axis.

Show the force of friction on the vertical axis.

Draw a line through the points to show the pattern of Pablo's results.



4 Study Pablo's table of results and your graph. Decide which of the statements in the table below are **true** and which are **false**. Write your answers in the second column.

Statement	True or false?
1 Pablo measured the weight of the block in kilograms.	
2 Pablo measured the force of friction in newtons.	
3 As the weight of the block increased, the force of friction decreased.	
4 The force of friction increased in equal steps as the weight of the block increased.	
5 Every time the weight of the block was increased by 2 N, the friction increased by 5 N.	
6 The graph of Pablo's results forms a straight line.	
7 The graph shows that increasing the weight of the block increases the force of friction acting on it.	

5 Three of the statements in question 4 were false. Rewrite them here, correcting the mistakes in them.

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Exercise 9.6 Patterns of movement

In science, we try to understand how things move. This exercise will help you to analyse the pattern of a moving object – a spider!

Sin Mui watched a spider running around on her table. To record how it moved, she marked its position every second.

The diagram shows the pattern of the spider's movement.

1 On the diagram:

- **a** Mark a section where the spider was **moving at a steady speed**.
- **b** Mark a section where the spider was **speeding up** (getting faster).
- **c** Mark a section where the spider was **slowing down**.
- **d** Mark a section where the spider was **changing direction**.

2 **a** Explain how you can tell from the pattern of dots that the spider was moving at a **steady speed**.

.....

.....

b Explain how you can tell from the pattern of dots that the spider was **speeding up**.

.....

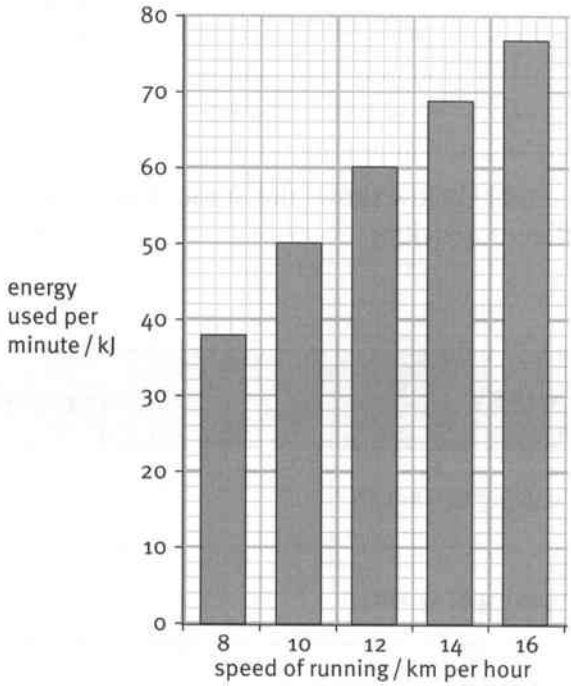
.....

Exercise 10.1 Body energy

This exercise will help you to understand some of the ways in which we use our bodies' energy stores. It will also give you practice in interpreting data.

Your body stores energy, which you need for everyday activities. If you are not active enough, you may put on weight. Exercise helps you to use up excess energy.

The bar chart shows how much energy you use when running at different speeds. For example, if you run at 8 km per hour, you use about 38 kJ of energy each minute.



1 Complete the table below to show the data in the bar chart. The first row has been done for you.

Speed of running / km per h	Energy used per minute / kJ
8	38
10	
12	
14	
16	

2 Akram runs at 8 km / h for 10 minutes. Amit runs at 12 km / h for the same time.

Which boy uses more energy? Explain your answer.

.....

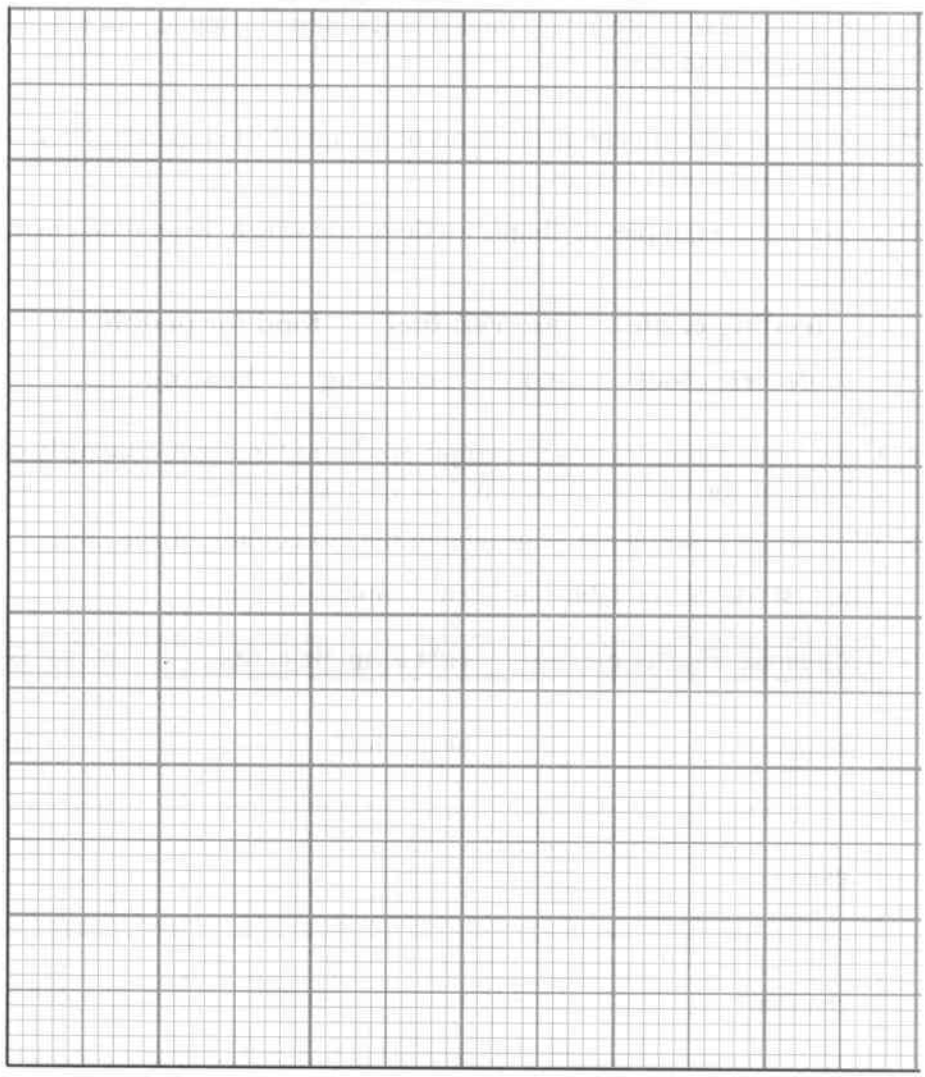
.....

.....

3 The table below shows the amount of energy used each minute in different activities.

Activity	Energy used per minute / kJ
walking at 6 km / h	28
running at 12 km / h	60
cycling at 16 km / h	31
swimming at 25 m / minute	23
aerobics (vigorous)	42

On the grid below, draw a bar chart to show these data.



4 Amit says that cycling is a good way of using up energy because you go faster than when you are running. Akram says that running is better.

Who is right? Explain your answer.

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Exercise 10.2 Chemical stores of energy

This exercise will help you to think about different chemical stores of energy and how we use them.

We use many different chemical stores of energy. A chemical reaction must happen to release their stored energy.

Here are some examples of things we do or use which depend on chemical stores of energy.

feeding cattle **aircraft fuel** **food for people**

electric clock **cars** **cooking** **heating**

1 Copy these examples into the empty spaces in the **First example of use** column of the table to show a use for each store.

2 Write more examples of your own in the last column of the table.

The first row of the table has been completed for you.

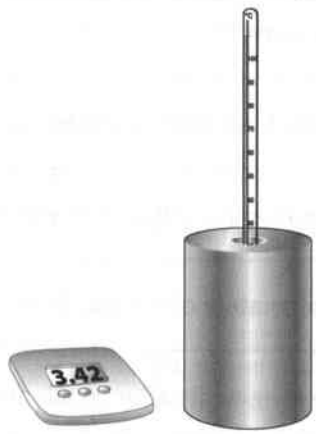
Chemical store of energy	First example of use	Second example of use
kerosene	aircraft fuel	lamps
grass		
charcoal		
batteries		
petrol		
wood		
rice		

Exercise 10.4 Heating a block

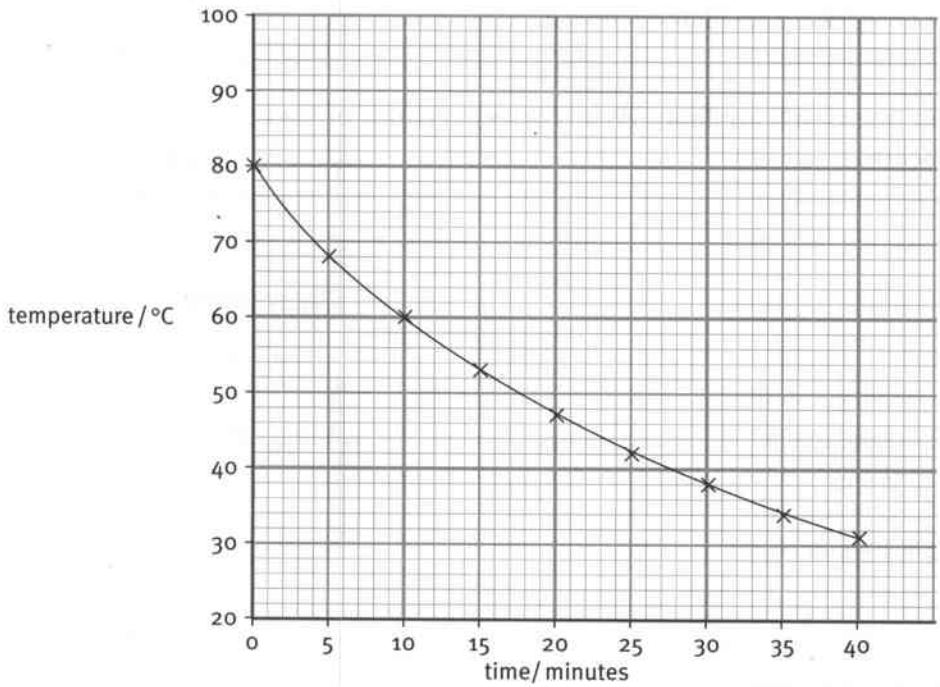
This exercise will give you practice in interpreting graphs of experimental data.

Anna investigated the cooling of a metal block.

- She put the block in a bath of hot water for 10 minutes.
- Using tongs, she took the block out of the water and dried it with a towel.
- She placed a thermometer in a hole in the block.
- She recorded the temperature of the block every 5 minutes.



The graph shows Anna's results.



1 Study the graph. What was the temperature of the block at the start of the experiment?

.....

2 Explain why Anna used tongs to take the block out of the water.

.....

.....

3 Decide whether each of the following statements is **true** or **false**.

Statement	True or false?
The block gradually got cooler.	
The temperature of the block fell more and more quickly.	
After 10 minutes, the temperature of the block was 70 °C.	
After 20 minutes, the temperature of the block had fallen by 33 °C.	
Anna stopped taking measurements after 30 minutes.	
The block cooled because energy was spreading out from it.	

4 Three of the statements in question **3** are false. Write correct versions of these statements in the spaces below.

Exercise 10.5 Using energy ideas

In this exercise, you will use the ideas about energy that you have learned so far.

Below, you will see two types of statement.

- Statements in rounded boxes are **observations**.
- Statements in rectangular boxes are **explanations**.

Your task is to join each observation to the statement that explains it. Draw lines joining the boxes to show your ideas.

If you touch a spinning wheel, the wheel slows down and your finger feels hot.	To use the energy from a chemical store, a chemical reaction must take place.
A cooking pot cools down when it is removed from the stove.	Friction can change kinetic energy to thermal energy.
You must lift a hammer high if you want to crack a tough coconut.	A moving object with more mass has more kinetic energy than one with less mass.
Burning charcoal can be used as a fuel for cooking.	Energy can spread out from a thermal store.
It is harder to stop a fast-moving cricket ball than a small rubber ball.	When an object is lifted, its gravitational potential store of energy is increased.

Exercise 10.6 Energy stores and transfers

Energy can be transferred from one place to another in different ways. These questions will test your understanding of this.

Use the words from this list to fill the gaps in the sentences which follow. You will have to use some words more than once.

chemical **electricity** **gravitational potential**
heat **light** **thermal**

1 At 6 o'clock this morning, my alarm clock went off. The clock has a battery, which is a store of ..... energy.

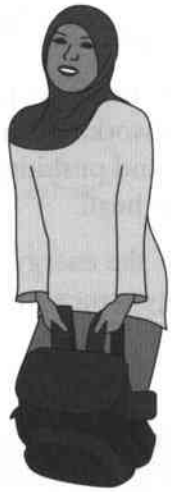
2 I switched on the light. Energy is transferred to the light by ..... in the wires.

3 Two types of energy spread out from the light:

..... energy, which we can see with our eyes, and ..... energy, which feels warm.

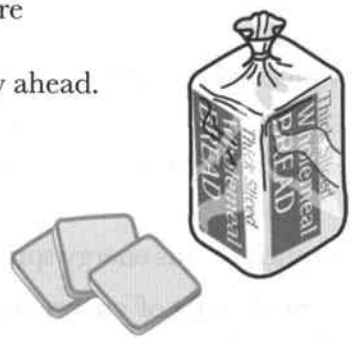
4 I picked up my heavy bag of books and put it on the table. This increased the

..... energy of the bag.



5 I ate three slices of bread to make sure that I had a good store

of ..... energy in my body for the day ahead.



6 When I picked up my cup of tea, I found that it was cold.

Its store of ..... energy
had spread out into the surroundings.

7 As I left the house, I switched off the radio so that no more

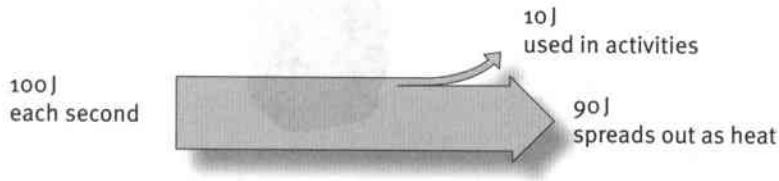
energy was transferred to it by ..... .

Exercise 10.8 Energy arrows

In this exercise, you will think about how the human body uses energy. You will also learn to interpret scientific diagrams.

We eat food to give us the energy we need for life. We need energy to keep our bodies working and to do physical activities such as walking, carrying and pushing. Most of the energy escapes from our bodies as heat.

The arrow diagram shows the energy used by a young person in 1 second. Energy is measured in joules (J).

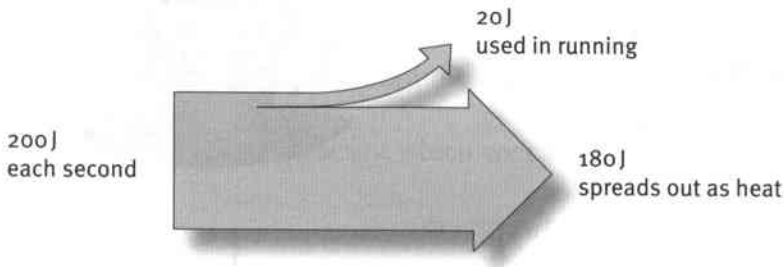


1 a How much energy does this person use each second? .....

b How much of this energy is used for physical activities? .....

c How much of this energy spreads out from the person's body as heat? .....

2 An athlete needs a lot of energy to run fast. Here is the arrow diagram for a marathon runner.



How can you tell from the diagram that the runner uses a lot of energy?

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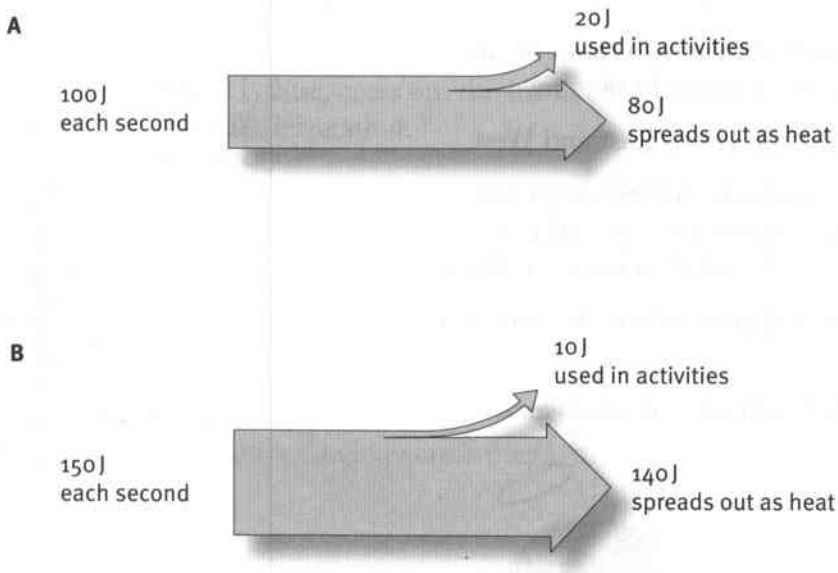
3 Bigger people need more energy just to keep their bodies working. People also need more energy if they are more active.

Study these two energy arrows.



a Which arrow is for a bigger person who is not very active? Explain your answer.

.....

.....

b These energy arrow diagrams show how we can account for all of the energy that a person gets from their food. In other words, they show that energy is conserved (it is neither created nor destroyed). Explain how you can tell this from the diagrams.

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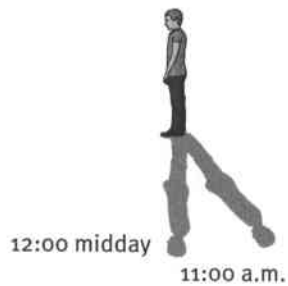
Unit 11 The Earth and beyond

Exercise 11.1 The Earth in a spin

This exercise will help you to check that you understand why we have night and day.

1 The picture shows a person's shadow at two times of the day. The position of the Sun is shown at 11:00 a.m.

Sun at 11:00 a.m.



a On the diagram, label the directions East and West.

b Draw a line to show the path that the Sun seems to take across the sky, from sunrise to sunset. Add an arrow to show the direction in which it seems to move.

c Mark, on the line you have drawn, where the Sun will be at midday (12:00).

2 The picture below shows the Earth turning on its axis. The Sun is on the left.

a Label the Earth's axis.

b On the diagram, mark one point where it is night. Label this point **N**.

c Points **A** and **B** are on the Earth's equator. It is daytime at both **A** and **B**. Explain how you can tell this from the diagram.

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d At which point, **A** or **B**, will nightfall happen first? Explain your answer.

.....

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Exercise 11.2 The truth about the stars

Test yourself – how much do you know about the night sky?

Decide whether each of the statements below is **true** or **false**. Draw a circle round your choice.

For each statement that is false, cross out the incorrect part and write the correction in the space underneath it.

1 We cannot see the stars during the daytime. **true / false**

.....

2 This is because they stop shining during the day. **true / false**

.....

3 At night, we see the stars moving across the sky from north to south. **true / false**

.....

4 The stars make patterns called constellations. **true / false**

.....

5 The stars in a constellation are very close to each other in space. **true / false**

.....

6 The Earth follows a path called its orbit around the Sun. **true / false**

.....

7 The Earth takes one day to travel around its orbit. **true / false**

.....

8 In December and June we see different stars in the night sky. **true / false**

.....

Exercise 11.3 Researching a planet

The Earth is a planet. There are seven other planets in the solar system. In this exercise, your task is to find information about one of the planets and compare it to the Earth.

Choose a planet. Find out the information needed to complete the table below. You will need to find the same information about the Earth.

You may be able to find a picture of your planet to stick on the right, or make a drawing of it.

Information needed	Earth	The planet .....
type of planet		
position in solar system		
distance from Sun		
size of planet		
number of moons		
average temperature		
strength of gravity on surface		
water on surface?		
other important facts		

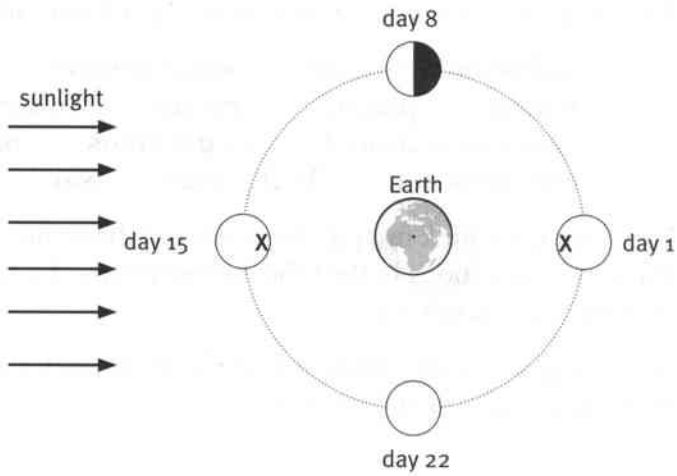
Exercise 11.5 Day and night on the Moon

This exercise will remind you about why we have night and day, and how the Moon orbits the Earth.

The diagram shows the Moon in its orbit around the Earth. The Sun is shining from the left.

The Moon is shown on four different days.

Study the diagram and follow the instructions below.



1 Look at the Moon on **day 8**. It is shaded to show that half of it is in darkness.

Shade the other three Moon outlines to show which parts are in darkness on these days.

Shade the Earth as well.

2 On the Earth, mark a point where it is night. Label this point **N**.

3 How many days does it take for the Moon to travel around its orbit?

..... days

4 In the diagram, one point on the Moon is marked with an **X**. This is on the side of the Moon which faces the Earth.

On **day 1**, is it day or night at point **X**? .....

On **day 15**, is it day or night at point **X**? .....

5 Imagine that you could stand on the Moon at point **X**. On **day 8**, you look into the sky and you can see the Earth. In the space below, draw how the Earth would look, seen from the Moon.

Exercise 11.7 Astro quiz

This exercise will help you to remember some important ideas from astronomy – and you can test your friends, too!

Here is a list of some of the terms you have learnt in this unit.

heliocentric model **solar system** **asteroid** **star**
galaxy **planet** **gravity** **Galileo** **telescope**
geocentric model **Copernicus** **orbit**
constellation **Milky Way** **Sun** **gas giant**

Your task is to think up quiz questions to which these terms are the answers. Write your questions in the table below and on the next page. You can then test your friends' knowledge.

It will help if you give them the first letter of each term. Two are given as examples. Can you answer them?

Clue	Answer
What **G** is the force that holds us on to the Earth?	
What **G** is a large number of stars, clustered together?	

Clue	Answer

Exercise 11.8 Satellites in space

This exercise will help you to understand some of the different things that spacecraft can do.

There are many spacecraft in space. The table describes some of the things these spacecraft can do.

Complete the second column of the table by suggesting who would find these spacecraft useful, and why.

What the spacecraft can do	Who would find this useful? And why?
A **meteorological satellite** can photograph clouds and see where it is raining. It can measure temperatures on Earth.	
A **military spacecraft** can photograph trucks moving around and photograph small objects on the ground.	
A **communications satellite** helps to send telephone messages and computer data from one side of the Earth to the other.	
A **GPS satellite** sends signals down to Earth so that anyone with a receiver can tell exactly where they are.	
A **space telescope** in orbit around the Earth can see far out into space and photograph distant stars and galaxies.	
A **space laboratory** is a good place to do experiments where gravity has no effect.	
A **television satellite** broadcasts television programmes to viewers down on Earth.	