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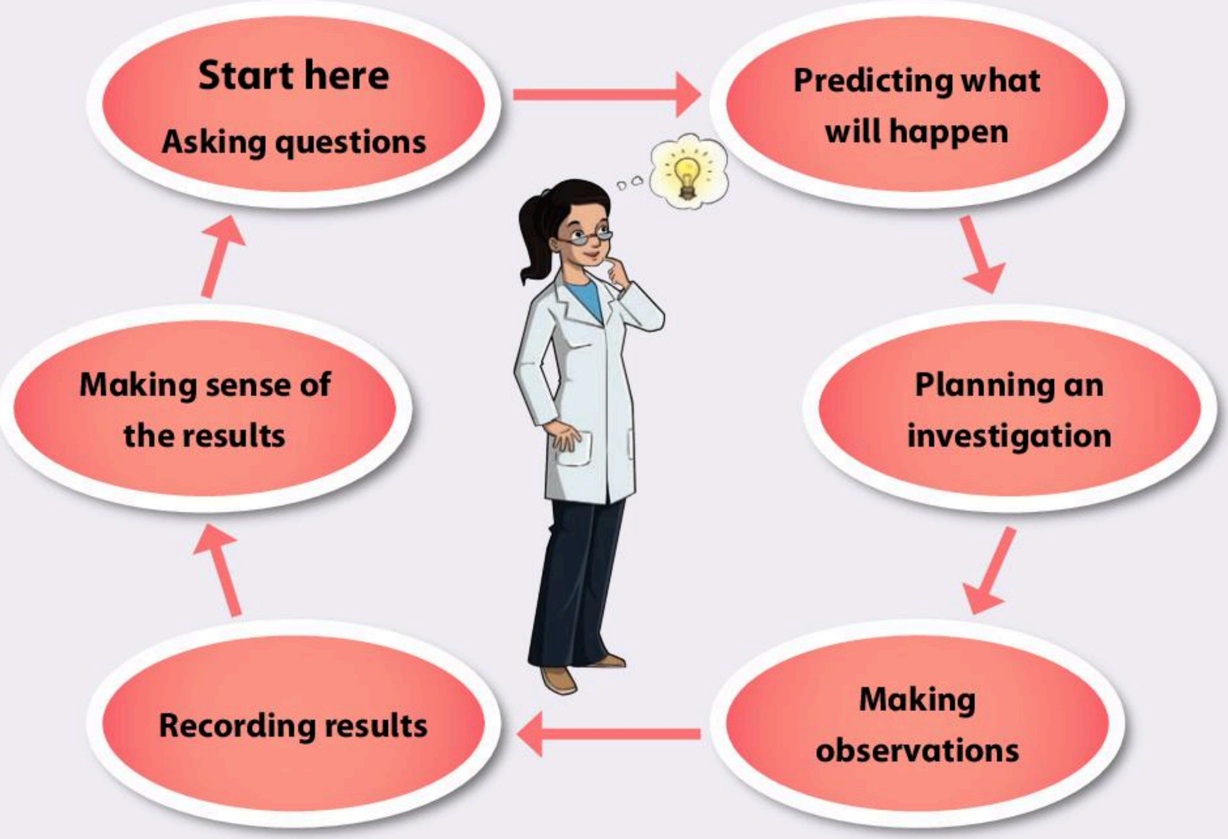
Contents

How to be a Scientist

Scientists wonder how things work. They try to find out about the world around them. They do this by using scientific enquiry.

The diagram shows the important ideas about scientific enquiry.



An example investigation:

Which drinks contain the most sugar?

Asking questions

How can you ask questions?

Start your questions with words such as 'which', 'what', 'how', 'do' and 'does'.

- Which drinks contain sugar?
- How can I find out how much sugar each drink has in it?
- Do all drinks contain the same amount of sugar?

Predicting what will happen

A prediction is when you say what you think will happen in your investigation.

There are two parts to a prediction:

- what results you think you will find
- a reason that explains why you think you will get these results.

This is what stops a prediction being a guess.

Here is an example of a question, a prediction and a reason.

Question; Which drink contains the most sugar?

Prediction; The fizzy cola

Reason; This drink tastes very sweet.

Planning an investigation

When you plan an investigation think about what you will do. You know that if you evaporate a liquid then any solids will be left behind. You must also plan how you will make your investigation a fair test.

What will you keep the same? These are the control variables:

- the amount of drink you are testing
- how you heat the drinks.

What will you change? These are called the independent variables:

- the type of drink.

The thing you are measuring is called the dependent variable. In this investigation it is the amount of sugar in each drink.

Making observations

You will measure the volume of each drink to make sure it is the same. You will evaporate all of the liquid away and then measure the amount of sugar left behind. You will do this by finding the number of grams using a top-pan balance.

Recording results

There are many ways to record results. A good way is to complete a table. A table keeps all of your results neat and tidy. You can also use your results to draw a chart or graph. These can help you to see patterns. They are also useful for communicating your ideas to other people.

Making sense of the results

At the end of your investigation you must look at your results carefully. Check to see which drinks contained the most sugar.

You are comparing the drinks.

You then select the one with the most sugar.

Was your prediction correct?

How reliable were your results?

Can you think of any ways to make your investigation more accurate?

What next?

Scientific enquiry always leads to other questions. These can lead to more investigations.

Do low sugar drinks really have less sugar?

Do natural fruit juices have less sugar than fizzy cola?

1 Human Organs and Systems

In this module you will:

- learn where the major organs are to be found in the human body
- find out about the main functions of the major organs
- understand how the functions of the major organs are essential
- learn scientific names for some major organs of the body's systems.

Word Cloud

major organs
system
liver
stomach
function
cure
intestines
kidneys
heart
circulation
lungs
brain
digestion
excrete

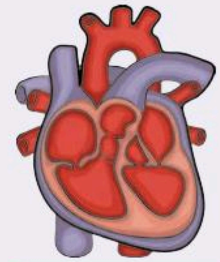
Amazing fact

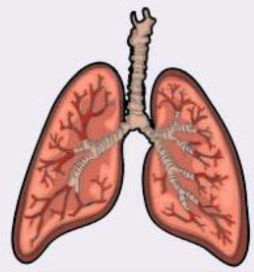
The adult human heart beats between 30 and 40 million times a year!

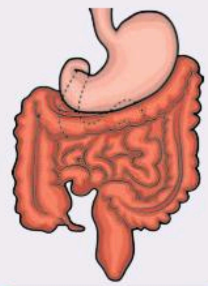
Our **major organs** keep us alive. Inside our bodies, our major organs are working hard all the time when we breathe, when we eat, when we run, when we play and even when we sleep.

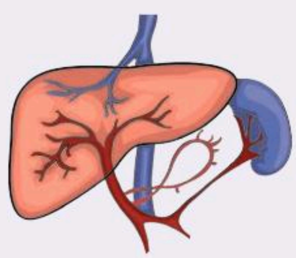
There are six major organs. Can you name any of them?

Can you put the names to the major organs below? Use the words in the word bank. The **liver** is done for you.









Liver

Word Bank

lungs brain heart kidneys
stomach and intestines ~~liver~~

Our major organs keep us alive!

Where are our major organs?

Learn where the major organs are to be found in the human body.

The Big Idea

We need food, water and air to stay alive. To keep us alive our major organs process the food, water and air.

The life span of a flowering plant when it goes from seed to death has a name. Do you remember what it is?

All living things have a life cycle which takes them from birth to death.

What three things do we need to take into our bodies to keep us alive?

Which parts of our bodies are most important in keeping us alive? Choose from the word bank below. One has been done for you.

brain

Word Bank

~~brain~~	heart	arms	lungs
ears	bones	kidneys	liver
eyes	legs	stomach and intestines	

We can divide the human body into three sections. They are the:

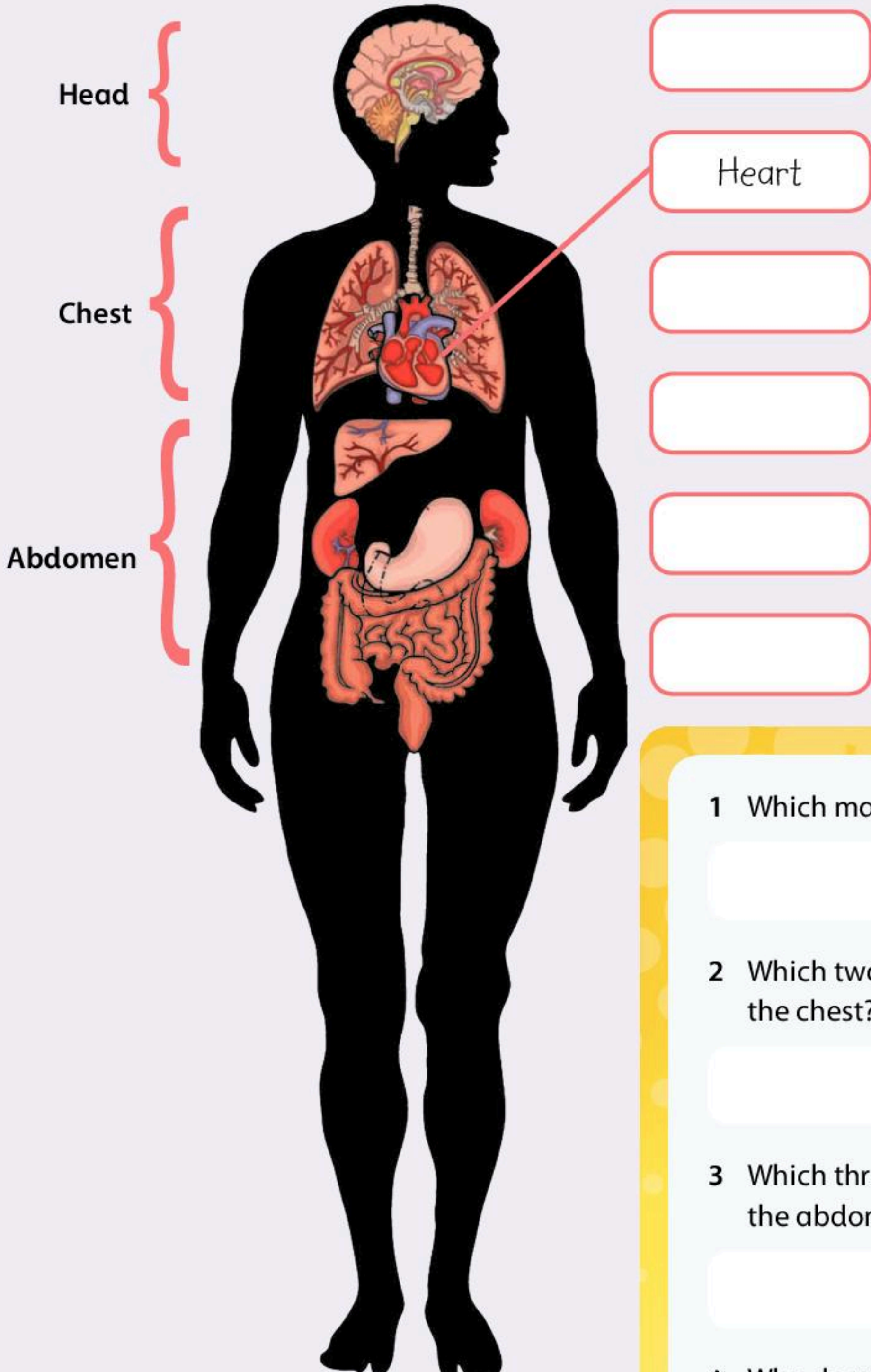
- head
- chest
- abdomen.

You can see these in the drawing opposite.

The neck separates the head and chest. The waist separates the chest and abdomen.

The body's major organs are inside the three sections of the body.

Look at the diagram of the body. Label the major organs using the names in the word bank. One has been done for you.



Think about...

How do you think your heart is protected?

Word Bank

brain ~~heart~~ liver

stomach and intestines

kidneys lungs

1 Which major organ do we find in the head?

2 Which two major organs do we find in the chest?

3 Which three major organs do we find in the abdomen?

4 Why do we call these organs 'major'?

Now turn to page 22 to review and reflect on what you have learned.

What do our major organs do?

Find out about the main functions of the major organs.

The Big Idea

Each organ performs its own job to keep us alive.

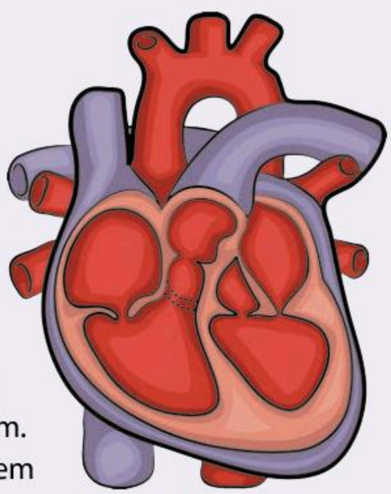
How many of the major organs can you name?

Some major organs keep us alive by using the food we eat. Some major organs keep us alive by using the air we breathe. All our major organs need water to keep us alive.

The body is made up of different working parts. The parts that work together are called a **system**. Each major organ and its system has a special job to do. This is called their **function**.

Heart

The **heart** pumps blood around our body. Blood flows through the body in tubes called blood vessels.

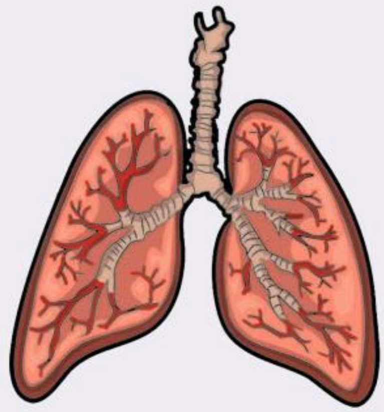


The heart, blood and blood vessels make up the **circulation** system. This circulation system takes blood to and from every one of the millions of cells in our body.

If the heart pumps once every second, that means it pumps 3 600 times in an hour. Work out how many times it pumps in a day.

Lungs

We breathe air into our **lungs**, which are part of the respiratory system. We cannot live more than a few minutes without air. Air contains oxygen gas which is vital for life. We call this process breathing.

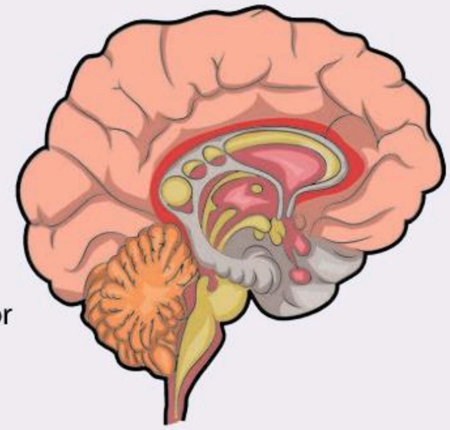


During this process, the body produces a waste gas called carbon dioxide. Carbon dioxide poisons us if we do not get rid of it. Our lungs push out this gas as we breathe out.

The lungs work 24 hours a day throughout a person's life time. Why are our lungs so important?

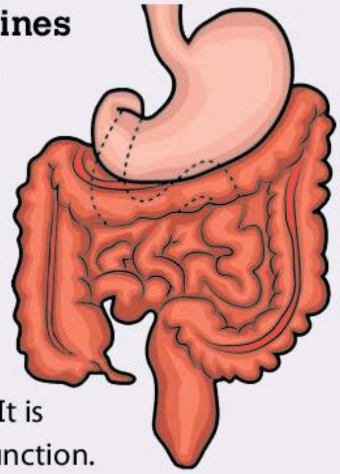
Brain

The **brain** is part of the nervous system. It is the control centre of the body. It does millions of tasks for you without you having to think about them.



Can you name five things we do that are controlled by the brain?

Stomach and intestines

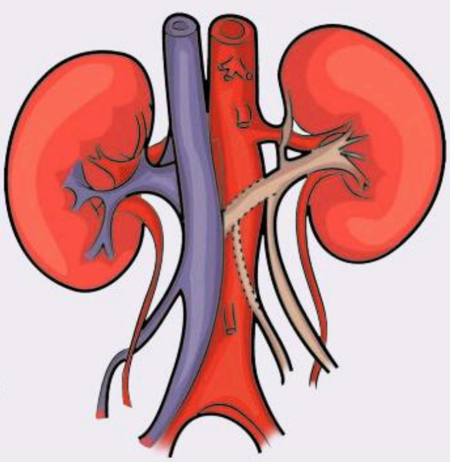


Food goes in at one end of the body and waste comes out at the other end. As the food we chew moves through the body it is broken down and absorbed into the blood. This is called the **digestion**. It is the digestive system's function.

Food contains energy which powers all the human processes that keep us alive. This is why after a few weeks the body begins to die if we do not have any food.

What does the digestive system do?

Kidneys

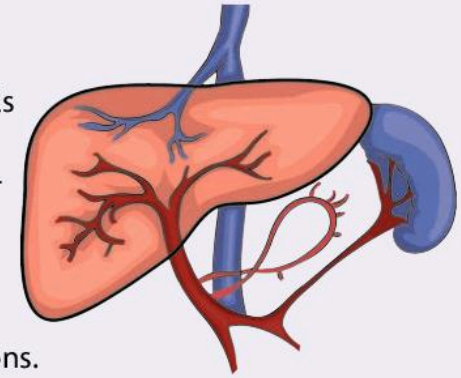


The body has two **kidneys**. The kidneys are part of the excretory system. They filter the blood and remove the wastse materials we make as we live and grow. These are called urea and ammonia. They are diluted in water and **excrete** them as urine.

Do you know what a filter is?

Liver

The liver is a vital organ. It has many uses. It is a link between the digestive system and the circulatory system. The liver makes important chemicals such as hormones to help control your body. It also can remove harmful chemicals from the blood such as poisons. The liver also makes bile. This helps us digest our food.



Why is the liver's function important?

What does each organ do? Copy and complete the table in your Investigation Notebook using the names of the organs in the word bank. One has been done for you.

Major organ	What it does
Brain	Acts as the body's control centre
	Breaks down food and takes in water
	Pumps blood around the body
	Filter out ammonia and urea
	Removes poisons from the blood
	Take in air

Word Bank

liver **heart** **kidneys** ~~**brain**~~
stomach and intestines **lungs**

What do our major organs do?

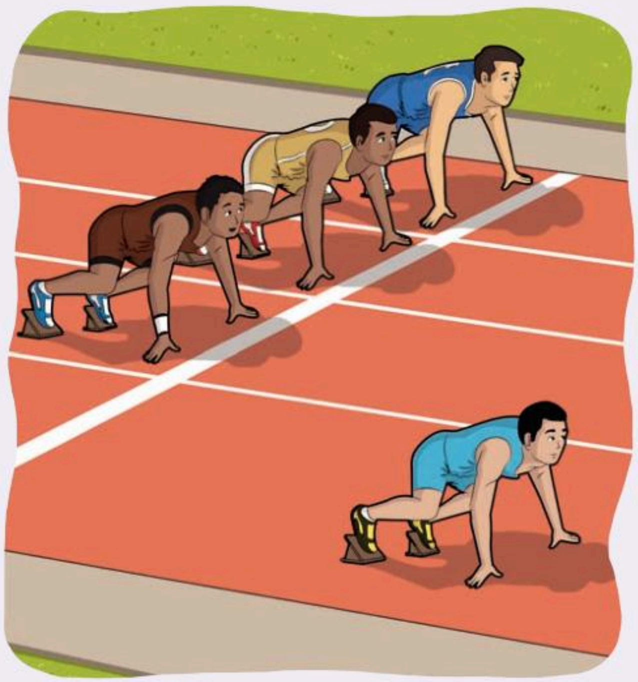
Find out about the main functions of the major organs.

The Big Idea

Who can blow up the balloon the biggest?

You are going to investigate who has the biggest lungs in your class.

When we investigated before, the teacher helped us to be fair. We must think of the one thing we want to change. Everything else in the test must stay the same. This is fair testing.



How can you make this a fair test? Think about the kind of balloon and the number of breaths.

We want to see the difference between students. How can we do this?

Think about the easiest way to measure a long balloon.

How can you measure a round balloon?

The picture shows runners at the start of a race. What is not fair?

Using balloons how can we find out who has the biggest lungs? How can you make everything the same for everyone in the test?

Think about...

The human body is made up of about 70% water. Humans cannot live for more than a week without water. Why do you think that water is so important to our bodies?

Investigation: Carry out your investigation.

What did you do? Complete the sentences below using words from the word bank.

Every student blew into a balloon. We blew very ______. To make our investigation ______ we used the same type of balloon. We used only ______ breath. We ______ the size of everyone's balloons.

Word Bank

hard measured one ~~balloon~~ fair

Collect the results. Then copy and complete the table below in your Investigation Notebook. An example has been done for you.

Boy or Girl	Balloon measurement
Boy	10 cm

Do not blow up the balloon too much. If it bursts it can damage your hearing.

Look at the results. You will see that many of them are similar, but some are different.

Can you see a pattern in the results? Write a conclusion.

Imagine your teacher asks you to do this investigation again. How will you make it better?

1 We need to take in food, water and air to stay alive. Which two major organs are responsible for food, water and air?

2 What is the name of the waste gas we have to get rid of when we breathe?

3 Which major organ controls everything in the body?

Now turn to page 23 to review and reflect on what you have learned.

What happens if our major organs don't work?

Understand how the functions of the major organs are essential.

The Big Idea

When we are ill doctors and medicines can help us get better.

Our major organs are very important to us. They help our body systems to function.

What happens if our major organs stop working correctly?

We need our organs to function so that we stay healthy. Sometimes organs stop working correctly. When this happens we get ill.

Can you remember what the heart does?

Sometimes the heart stops working correctly. Most people do not have problems with their heart until they are old. As we get older our heart and circulation system do not work as well as when we are young.

Do you know anyone who has a heart problem?

Heart problems may include:

- High blood pressure. This can cause blood vessels to burst.
- Blood vessels in the heart get narrow and block up. This can cause a heart attack.
- Blood vessels to the brain get narrow and block up. This can cause a stroke.

Many heart problems can be treated. Doctors give people medicines to lower their blood pressure. This may stop a heart attack. Sometimes doctors widen blood vessels in an operation.

Write down three things that can happen when the heart stops working correctly.

Can you remember what the lungs do?

Sometimes our lungs do not work correctly. Diseases can reduce the flow of oxygen to the lungs. This can make it difficult to breathe.

Doctors use medicines to get more oxygen into a person's lungs. This helps them breathe more easily, but doctors cannot always **cure** lung disease.

Can you remember what the brain does?

When the blood supply to the brain stops for a short time the brain cells die. Sometimes the person may no longer be able to walk or talk. Careful nursing helps people to get better but they may not recover fully.

Do you know anyone who has had a stroke?

Can you remember what the kidneys and liver do?

If the kidneys and liver stop working properly the body cannot excrete poisons. They build up inside the body. Doctors can help by using machines such as dialysis machines to clean the blood. To get better the person needs a new organ.

Amazing fact

Most major organs can be replaced. We call this an organ transplant.

Can you remember what the stomach and intestines do?

A nurse sets up a dialysis machine

What happens if our major organs don't work correctly? Match the organ with its illness. The first one has been done for you.

Heart	Cannot digest food
Lungs	Stroke
Brain	Heart attack
Kidneys and liver	Unable to breathe properly
Stomach and intestines	Body cannot excrete poisons

What happens if our major organs don't work?

Understand how the functions of the major organs are essential.

The Big Idea

We can help our organs by staying healthy and fit.

Do you remember the picture of the athletes at the start of this module? Why do they need to be fit to run the race?

Healthy people usually have healthy organs and live longer.

How do you think we can stay healthy?

Can you name two ways to keep our organs healthy?

The heart is the organ that doctors listen to first when they check our health. Our heartbeat tells them how healthy we are.

Our heartbeat is measured in beats per minute (bpm). A normal heartbeat for a person sitting quietly is 60–80 bpm.

We can check our heartbeat through:

- feel – when a doctor or nurse measures our pulse rate
- listening – when a doctor listens to our heartbeat through a stethoscope
- looking at a graph of heartbeat – doctors can see how well a heart is working using an ECG machine.

In the next lesson, we are going to measure the heartbeat of everyone in the class. You are going to take each other's pulse rate to find out your partner's heartbeat.

What is a normal pulse rate for a person sitting quietly?

Can you remember learning about muscles contracting? The heart is a large muscle. When the muscle contracts it forces blood out of the heart and circulates it around the body. Every time the heart does this it sends out a pulse of blood.

We can feel the pulse of blood at several places around the body. The easiest place to feel it is the inside of the wrist. You will need to practise taking a pulse.

Take your partner's pulse while your partner is sitting quietly.

Count the beats over 15 seconds and then multiply the result by 4 to give the beats per minute (bpm).

Swap places and your partner will take your pulse.

Write down your pulse rate in beats per minute.

Scientists often repeat their tests to check if their first reading is correct.

Take your partner's pulse again. Swap places.

Write down your pulse rate in beats per minute.

How do the two results compare?

When scientists compare results that are repeated they allow for a small difference. This is called an error of measurement. Usually, no two results are the same when repeated. The results need to be close to each other. With a pulse rate this is three or four pulses higher or lower.

If your first pulse is 70 bpm, the second pulse can be between 66 and 74 bpm. If the pulse is much higher or lower, then you need to take it again.

What happens if our major organs don't work?

Understand how the functions of the major organs are essential.

The Big Idea

We make predictions and then test to see if they are correct.

Can you remember what a normal pulse rate is for someone sitting quietly?

Measuring the heartbeat is a good way of telling whether our major organs are working well. If our organs are fit and healthy, our bodies are usually fit and healthy.

Scientists ask questions and then they try to **predict** the answers. The next step scientists take is to set up an investigation to test the prediction.

Here is the question you are going to predict the answer to:

What happens to your pulse rate when you exercise?

Make a prediction about the change in pulse rate. Will it go up? Or will it go down?

As a class, predict up or down. Then count the votes by putting a mark in the 'Up' or 'Down' column as in the example below. Copy and complete the table in your Investigation Notebook. Add up the results.

Up	Down
////	//

In this example, the students voted in favour of an 'up' prediction. This means that they think pulse rate will increase.

What does your class predict? Circle the answer.

We predict that our pulse rate will increase/decrease when we do exercise.

As a scientist you now have a prediction. Next you need to test the prediction through an investigation.

Before you start, you must decide what the investigation is going to do.

- We need to find out whether the pulse is faster or slower after exercise.
- We need to measure the pulse before the exercise and then again after the exercise.

As scientists we know that the tests must be the same for everyone if it is to be a fair test. If it is not a fair test then scientists have to ignore the findings and start again.

How can we make sure that our test is fair?

Answer the questions below.

a How shall we take everyone's pulse before the exercise? We need to take the pulse when it is at its slowest. Which is better? Sitting or standing?

b Do we need to take the pulse again to check?

c Do we need to make sure that everyone does the same amount of exercise?

Investigation: Carry out an investigation to test how exercise affects the pulse rate.

Copy the table below into your Investigation Notebook, and record your results. An example is done for you.

Name	At rest	After exercise	Difference
Student 1	72	92	+20

Do not over-exercise. Stop if you feel tired or dizzy.

Remember your class's prediction. Was the prediction correct?

Can you **explain** why this happened? Think about what you know about the function of the heart.

What happens if our major organs don't work?

Understand how the functions of the major organs are essential.

The Big Idea

We need to understand our findings when there are a lot of numbers to deal with.

Think back to the investigation to test how exercise affects the pulse rate. Can you think of ways of listing everyone's results?

We measured some students' pulse rates. The results are shown in the table below.

Name	At rest	After exercise	Difference
Student 1	80	125	45
Student 2	60	90	30
Student 3	75	115	40
Student 4	90	140	50

We need to understand our results. Look at the 'At rest' column. You can see the numbers are all jumbled up. We need to put the numbers in order.

How do you think we can order the numbers in the 'At rest' column?

Look at the table of pulse rates in your Investigation Notebook. Write the numbers in the 'At rest' column in order.

Match the numbers in the 'After exercise' column and the 'Difference' column to each student.

Our table now looks like this:

Name	At rest	After exercise	Difference
Student 2	60	90	30
Student 3	75	115	40
Student 1	80	125	45
Student 4	90	140	50

Placing numbers in order from highest to lowest or lowest to highest is known as placing them in rank order.

Look at all the results. Can you see a pattern?

Which is the highest in the 'Difference' column?

Which is the lowest in the 'Difference' column?

What do you think this means?

Your table will have more results. It may not be easy to see the typical 'at rest' heartbeat for the class.

How can you find out the typical heartbeat at rest for the class?

Work out the average heartbeat at rest for the class.

What is the average heartbeat after exercise for the class?

What is the average difference in heartbeat at rest and after exercise?

What are the averages telling you?

You can compare your average heartbeat at rest and after exercise with others in your class.

Write a conclusion. Circle the answers.

a My heartbeat at rest is more than/less than/the average when compared with the rest of my class.

b My heartbeat after exercise is more than/less than/the average when compared with the rest of my class.

c The difference between my heartbeat at rest and my heartbeat after exercise is more than/less than/the average when compared with the rest of my class.

Think about...

Which of the major organs do you think cannot be replaced? Why do you think this is?

1 How can you check if the heart is healthy?

2 Can you name two ways to help you keep your organs healthy?

3 The normal pulse rate when at rest is between 60 and 80 bpm.

a If a person is fit what do you think that person's pulse will be?

b If a person is unfit what do you think that person's pulse will be?

4 How did you make sure that the pulse investigation was fair?

Now turn to page 23 to review and reflect on what you have learned.

Scientific names for the major organs

Know scientific names for some major organs of the body's systems.

The Big Idea

Doctors and scientists use special names for the major organs.

Doctors and scientists use medical and scientific language. This means they can explain exactly what is wrong with patients and what treatment they need.

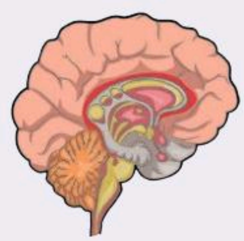
Pair up information about the major organs with the words in the word bank. One has been done for you.

Information	Organ
Blood	Heart
Control	
Oxygen	
Digestion	
Urine	
Poison	

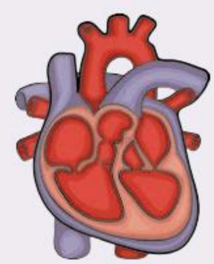
Word Bank

liver **kidneys** **brain** **lungs**
~~heart~~ **stomach and intestines**

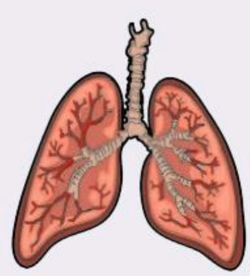
Many of the human organs and systems have scientific names as well as their everyday names.



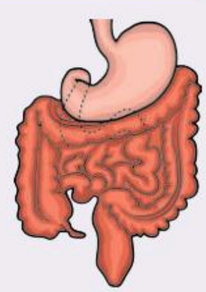
a Brain – cerebral



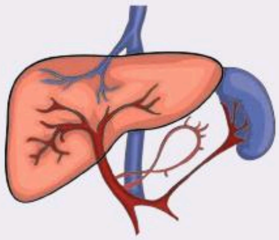
b Heart – cardiac

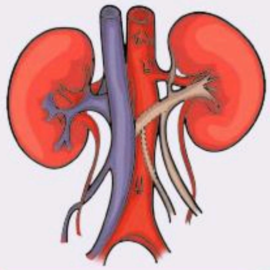


c Lungs – pulmonary



d Stomach – gastric





e Liver – hepatic

f Kidneys – renal

Look at the pictures of the major organs. Can you see their names? The other words are the scientific names of the organs.

Can you pair any of the scientific words with the name of an organ and fill in the spaces below? It may help you to think of other names that are associated with the illness of an organ.

Organ	Scientific name
	pulmonary
	cardiac
Liver	
Brain	
Stomach	
	renal

When people collapse and their heart and lungs stop working, medical staff use CPR to try to bring them back to life. The R stands for Resuscitation which means to bring back to life.

What do the C and the P stand for?

Look for clues to the organ in the sentence. Fill in the missing scientific words using the word bank. One has been done for you.

a We have a patient with a pulmonary infection. Her lungs need extra oxygen.

b We have a patient with failing kidneys. He is going to be moved to the ________ ward.

c We have a patient with a ________ ulcer. She is going to have a stomach operation.

d We have a patient with liver problems. He has a ________ C infection.

e We have a patient who is recovering from ________ arrest. She needs to be linked to the heart monitor immediately.

Word Bank

cardiac ~~**pulmonary**~~ **hepatitis** **gastric** **renal**

Which major organ am I?

1 I am one of a pair and I am part of your pulmonary system.

2 I am the only other major organ that comes as a pair.

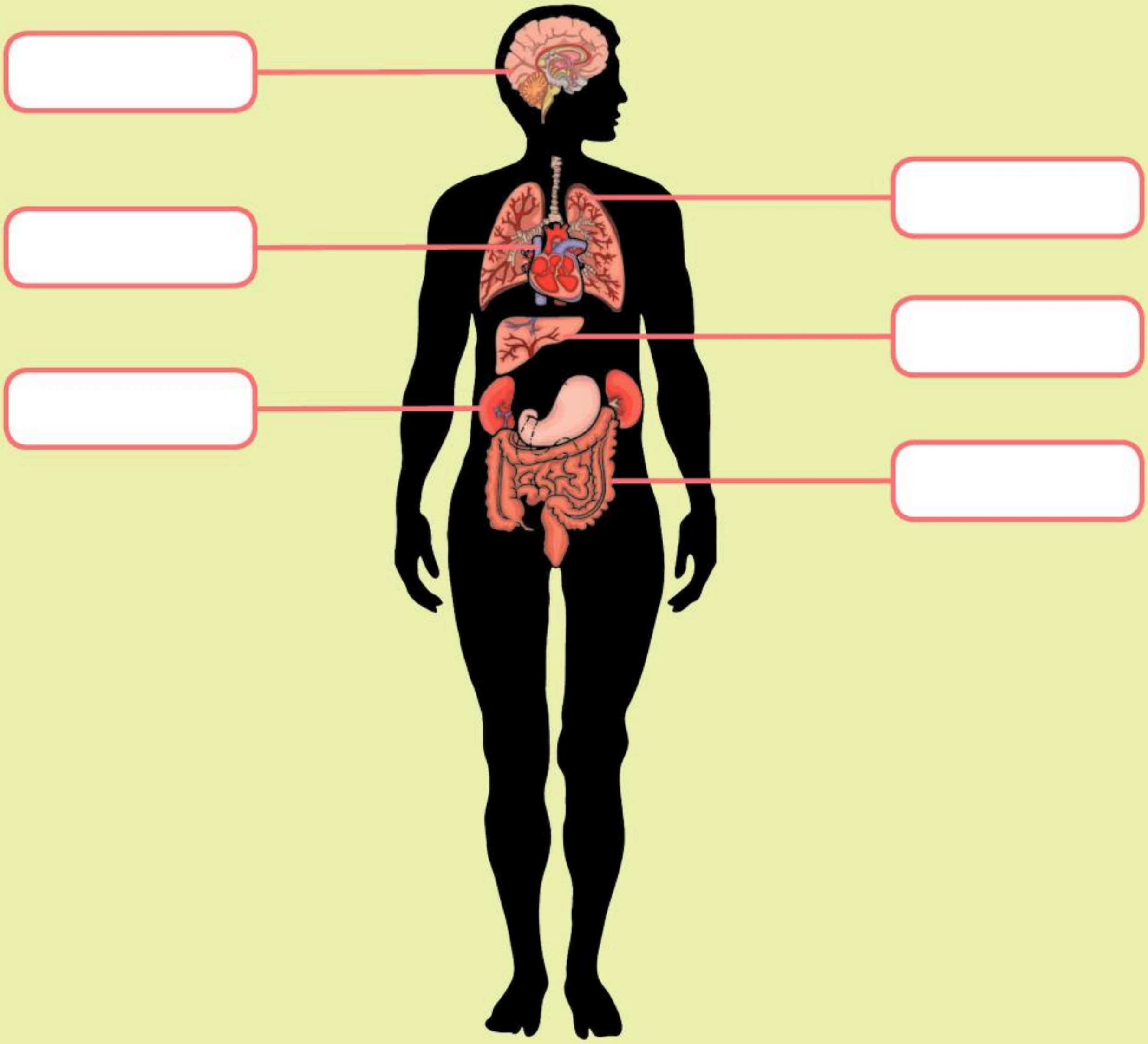
3 Without me nothing works!

Now turn to page 23 to review and reflect on what you have learned.

What we have learned about human organs and systems

Where are our major organs? (pages 6–7)

Label the diagram with the names of the organs.



Which two major organs are in the chest?

Which three major organs are in the abdomen?

I know the names of the major organs.

I know where the major organs are in the body.

What do our major organs do? (pages 8–11)

What is the function of the kidneys?

Fill in the gap in the sentence below.

The heart is part of the ________________ system.

Which two things must you keep the same in the investigation to find who can blow the biggest balloon?

I understand the functions of the major organs.

What happens if our major organs don't work? (pages 12–19)

Which major organ causes the most problems as we age?

Can you name one way to stay healthy?

What is a normal pulse rate for a person sitting quietly?

How do we place numbers in rank order?

I understand what happens if our organs don't work.

I can take a person's pulse.

I know how to order numerical results.

Scientific names for the major organs (pages 20–1)

What is the scientific name for things to do with the heart?

I know the scientific names of two of the major organs.

2 Reversible and Irreversible Reactions

In this module you will:

- understand the difference between a reversible and an irreversible change
- explore how solids can be mixed and how it is often possible to separate them again
- know about changes that happen when some solids are added to water
- understand how some solids that do not dissolve or react with water can be separated by filtering
- find out how some solids dissolve in water to form solutions and understand that the substance is in the solution.

Word Cloud

reaction
variable
separate
reversible
soluble
solution
dissolve
insoluble
irreversible

Can this metal be made back into a solid?

Why can some things go back to how they started and others cannot?

What will happen to the trees after the fire has gone out?

Can you imagine what the trees will look like?

Why do fire-fighters not use a fire extinguisher to put the fire out?

Reversible and irreversible changes

Understand the difference between a reversible and an irreversible change.

The Big Idea

Some changes can be reversed but others cannot.

I have just baked a cake using two eggs.

Can I get the eggs back out of the cake?

What is a chemical reaction?

When you mix chemicals together sometimes they join together to make new chemicals. We call this a chemical reaction. There are some clues to look for to see whether a chemical reaction is taking place.

Sometimes a gas is made. You may see gas bubbles. The gas may have a smell. The new chemicals that are made may be a different colour.

During a chemical reaction there may be a change in the temperature. Some reactions give out a lot of heat. Other reactions feel cold.

Chemical reactions make new substances. When reactions like this take place it is not possible to reverse them. The change is permanent.

Steel rusting is an example of this. The rust is different from the steel. This is an **irreversible** reaction or change.

List below the ways you can tell whether a reaction has taken place.

Water has been made into ice cubes.

Can you get the water back from ice cubes?

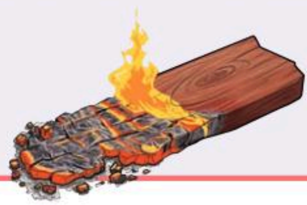
Solid ice looks different from liquid water, but it is the same chemical. It is easy to change the water back to ice again. No new chemicals have been made. This is a **reversible** reaction or change.

These changes are also called physical changes. All changes of state are reversible changes. Dissolving sugar in a cup of tea is also a reversible change. The sugar may look and behave differently, but it is still the same chemical.

Explain how an ice cube can be made into water again.

Describe how you can get the sugar back out of the tea.

Look at the pictures. Predict whether the reactions are reversible or irreversible.



Is the reaction reversible or irreversible? Write your answer below each picture.

Sometimes it is obvious which reactions are reversible or irreversible. Think about fireworks.

Write down two examples of reversible changes.

Write down two examples of irreversible changes.

Fill in this paragraph using words from the word bank.

In an irreversible change the change is permanent. New ________ are made by a chemical ________. With reversible changes no new ________ are made. The changes are only physical. The substance may look and behave ________ but it is still the same ________.

Word Bank

reaction	**chemical**	**differently**
chemicals	~~**permanent**~~	

Reversible and irreversible changes

Understand the difference between a reversible and an irreversible change.

The Big Idea

Burning causes irreversible changes.

Do you think cooking is a reversible or irreversible change? Explain why you think this.

When we cook food we need to use heat. This makes the food hotter and sometimes there is a chemical change.

Is a chemical change reversible? Explain your answer.

What do they need to do to make the fire give out heat?

Many chemical reactions need energy to start them, for example using heat to make wood or paper catch fire. If the person uses a flame to light the fuel in the fire a chemical reaction starts. Once the fire starts it carries on burning until all the fuel is used up.

Circle what kind of reaction this is.

Reversible Irreversible

Which new chemicals are made?

Is it possible to do this? Can you un-cook food?

When food is cooked a chemical reaction happens.

If you cool the food does it change back to the ingredients?

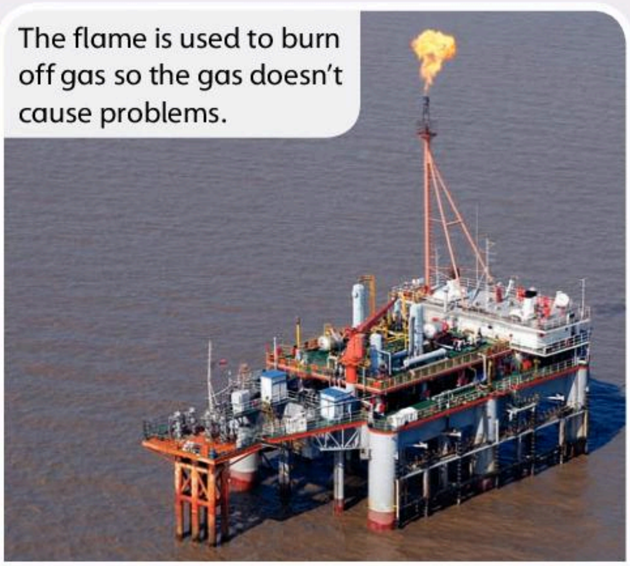
What happens to the food if you remove the heat too soon?

What is burning?

If substances are heated they can burst into flames. This is called burning. The flame is energy coming off as heat and light. You may have seen paper or garden rubbish burning. Burning is an irreversible process.

We burn some substances to give us energy for houses, cars and airplanes. The substances we use are very good at burning. They give out a lot of energy. We call these substances fuels. It is important that we use the right fuel.

The flame is used to burn off gas so the gas doesn't cause problems.



Investigation: How can we investigate burning?

We can observe whether fuels burn with a flame or not. Look at the fuels that your teacher gives you. Can you predict whether they will burn or not?

Copy and complete the table below in your Investigation Notebook. Record your predictions. Then carry out your investigation and write down your observations.

Type of fuel	Prediction– will this burn?	Observation– did it burn?
Paper	Yes	Yes
Twigs		
Cardboard		

Can you see a pattern in your observations?

Write a conclusion about your observations. Use your results to help you do this.

_______________ burned the best.

I know this because I observed

____

____

____

Be careful with naked flames. Do not lean over or put anything nearby that could catch fire.

Reversible and irreversible changes

Understand the difference between a reversible and an irreversible change.

The Big Idea

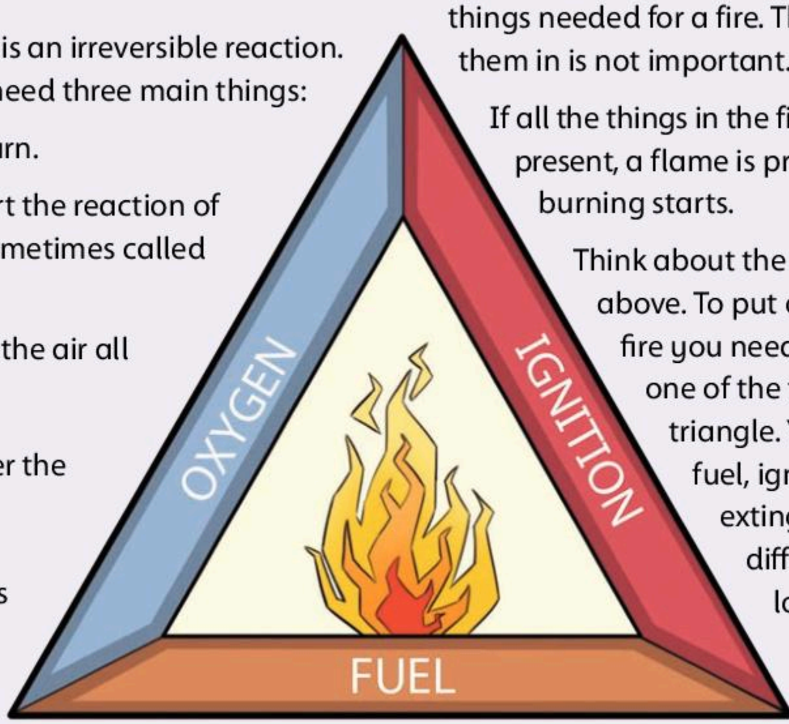
Sometimes we need to put out fires.

When do we need to put a fire out?

Remember burning is an irreversible reaction. To make a fire you need three main things:

- A fuel that can burn.
- Something to start the reaction of burning. This is sometimes called ignition.
- Oxygen. This is in the air all around us.

To help us remember the things needed for a fire to burn, we can arrange their names in a triangle. Each side of the triangle represents one of the three things needed for a fire. The order you put them in is not important.



If all the things in the fire triangle are present, a flame is produced and burning starts.

Think about the burning building above. To put out or extinguish a fire you need to remove at least one of the things in the fire triangle. You can remove the fuel, ignition or oxygen. Fire extinguishers do this in different ways. There are lots of different kinds of fire extinguisher.

Investigation: Carry out a survey of your school. List all the different kinds of fire extinguisher you can find. When you are shopping or out in the community look out for extinguishers. How many different kinds can you find? Use the table below to help you.

Type of extinguisher	Colour	To be used on	Not to be used on
Water	Red	Wood, paper, textiles	Flammable liquids, live electrical fires
Dry powder	Blue	Wood, paper, textiles, flammable liquids, gaseous fires, live electrical equipment	
Foam	Cream	Wood, paper, textiles, flammable liquids	Live electrical equipment
CO_2	Black	Flammable liquids, live electrical equipment	Anything in a confined space
Wet chemical	Yellow	Wood, paper, textiles, cooking oil fires	Live electrical equipment

What happens to water when it is heated?

Imagine a pan of oil catches fire. You pour water onto the flames to put out the fire. The water gets hotter and hotter. As this happens, it rises underneath the oil. It pushes the oil out of the pan and into the flame. This can cause very serious fires.

Imagine an electrical appliance such as a computer catches fire. What happens if you put water on the fire?

It is possible to remove the fuel from the fire but sometimes this can be very difficult.

Amazing fact

Fire-fighters use fire to put out fire!

In a forest the fuel is the wood in the trees. When fire-fighters cannot stop the fire by removing oxygen or the heat energy they burn the fuel. They set fire to the trees before the wood catches fire. This removes the fuel.

Reversible and irreversible changes

Understand the difference between a reversible and an irreversible change.

The Big Idea

We can make our own fire extinguisher.

Look at the two pictures. Write down one use for each of the extinguishers.

Many fire extinguishers remove the heat that keeps the fire going. Water cools the heat of the flame. The problem with water is that you can only use it on certain kinds of fire. You must use the right type of fire extinguisher for different fires. If you put water on an oil fire the water will fall to the bottom of the oil.

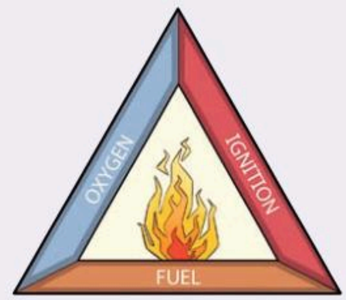
Carbon dioxide fire extinguishers stop oxygen getting to the flame. There are many ways to produce enough carbon dioxide to do this. Carbon dioxide is a gas. We breathe out carbon dioxide but this is not enough to put out a fire. Lots of carbon dioxide is needed to extinguish a flame. When we blow out a candle we do not do this with carbon dioxide. We blow the flame away from the fuel of the candle.

We can make carbon dioxide gas. When acid is added to chalk or limestone the chalk or limestone reacts. The fizzing is carbon dioxide.

Vinegar is an acid. If we mix it with chalk we make carbon dioxide.

Investigation: Make and test a fire extinguisher. Your teacher will give you the things you need.

You will need to make a fire to test this. Think about how you will keep safe.



What did you remove from the fire triangle?

Did your fire extinguisher put out the fire?

Be very careful with a flame. Do not lean over it or place things near. Never touch the flame as it will burn you.

Investigation: Repeat the investigation using water as your fire extinguisher. Compare the two fire extinguishers you have used.

Copy and complete the table below in your Investigation Notebook. Write down your observations.

Fuel	**Observations using chalk and vinegar extinguisher**	**Observations using water**
Wood		
Paper		
Twigs		

Did one of the fire extinguishers work better than the other? Which one worked better?

Understand the difference between a reversible and an irreversible change.

The Big Idea

Fire is dangerous.

What do you need to start a fire? Think about the fire triangle.

Burning is a combustion reaction. These reactions are used every day in modern life. Combustion is used to generate electricity and even makes the engine work in cars and buses.

Amazing fact

Controlled fire was used in everyday life thousands of years ago. People still use this method to clear trees to make farming land.

Fire kills!

Thousands of people are killed and injured in fires in homes every year.

The temperature of a house fire can reach 1 000°C to 1 400°C. The hottest recorded temperature of a house fire is 2 000°C.

Eighty per cent of deaths caused by fires are in people's homes. Most of these can be avoided.

Why do you think there are so many fires in people's homes? We know how to control fire so why do so many people die in house fires?

Think about...

Research how many house fires there were in your area this year. Was it possible to prevent them?

Do a survey of your home. How many fire extinguishers or fire blankets do you have?

Fire drills

We practice what to do and where to go in case there is a fire. This is called a fire drill.

Imagine a fire breaks out at home. Ask your family how they can escape from all the rooms in your home. Write a fire plan and ask your family to read it.

Some places are more likely to have a fire than others. This is because they may use fires to cook or heat water. The places are said to have many fire hazards. A hazard is a risk of danger.

Design a poster to help the people you live with stay safe. Some rooms have more fire hazards than others.

Which room do you think is most likely to be a fire risk? Explain your answer.

Design a leaflet for the kitchen. You will need a heading that will attract the attention of the people using the kitchen. Here are some examples to help you. Try to think of one of your own.

Fire safety starts with you!

If you are in doubt and you can't put it out sound the alarm.

Make safety your priority.

In your leaflet, include where the fire extinguishers are kept. Make sure everyone knows how to use the fire extinguishers.

Make a poster explaining how to use the extinguishers. Here is an example to help you.

Amazing fact

Finland has the highest number of deaths caused by fire in the world.

1 Write down one example of a reversible reaction.

2 Write down two examples of irreversible reactions.

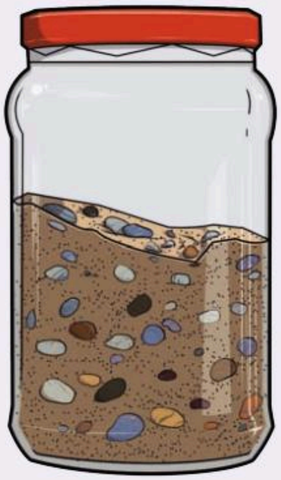
Now turn to page 50 to review and reflect on what you have learned.

Can mixtures be separated?

Explore how solids can be mixed and how it is often possible to then separate them again.

The Big Idea

We can get the things we need out of a mixture.



How can you tell if something is a solid?

If lots of different things are put into a container we call it a mixture.

How can you **separate** these objects?

Often we have to use special techniques and equipment to separate solids in a mixture. You can use a sieve to remove the pebbles from the sand.

Some solids **dissolve** in water. The solid does not disappear but mixes with the particles of water. If a solid dissolves it is **soluble**.

Other solids do not dissolve at all. They are called **insoluble**.

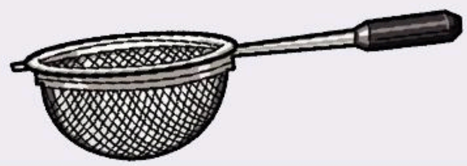
The solid is called the solute. The liquid it dissolves in is called a solvent. When the solute dissolves in the solvent the result is a **solution**.

When coffee is added to water the solvent is the water. Coffee powder or granules is the solute. The cup of coffee is the solution.

Sieves and filter paper can be used to separate solids of different sizes. Filter paper has tiny holes in it that only let very small, solid particles through.

Your teacher will give you some solids. Your task is to separate them from the mixture.

Look at the picture of the equipment you need. Can you name each piece of equipment?



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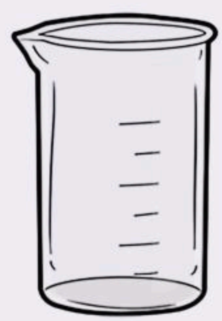

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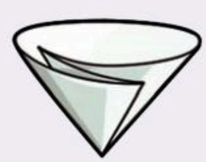

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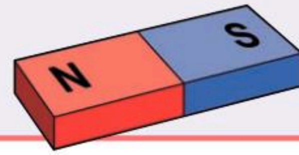

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Write down two safety rules that you must follow to keep safe during this investigation.

Investigation: Separate the solids from the mixture.

Copy and complete the table below in your Investigation Notebook. List the solids that you separated. Write next to each solid the technique you used to separate it.

Solid	Technique used to separate solid from mixture
Pebbles	Use large sieve

Write your answers to these questions in your Investigation Notebook.

1 Explain how you can separate sand from salt.

2 What equipment will you use to separate salt from a solution?

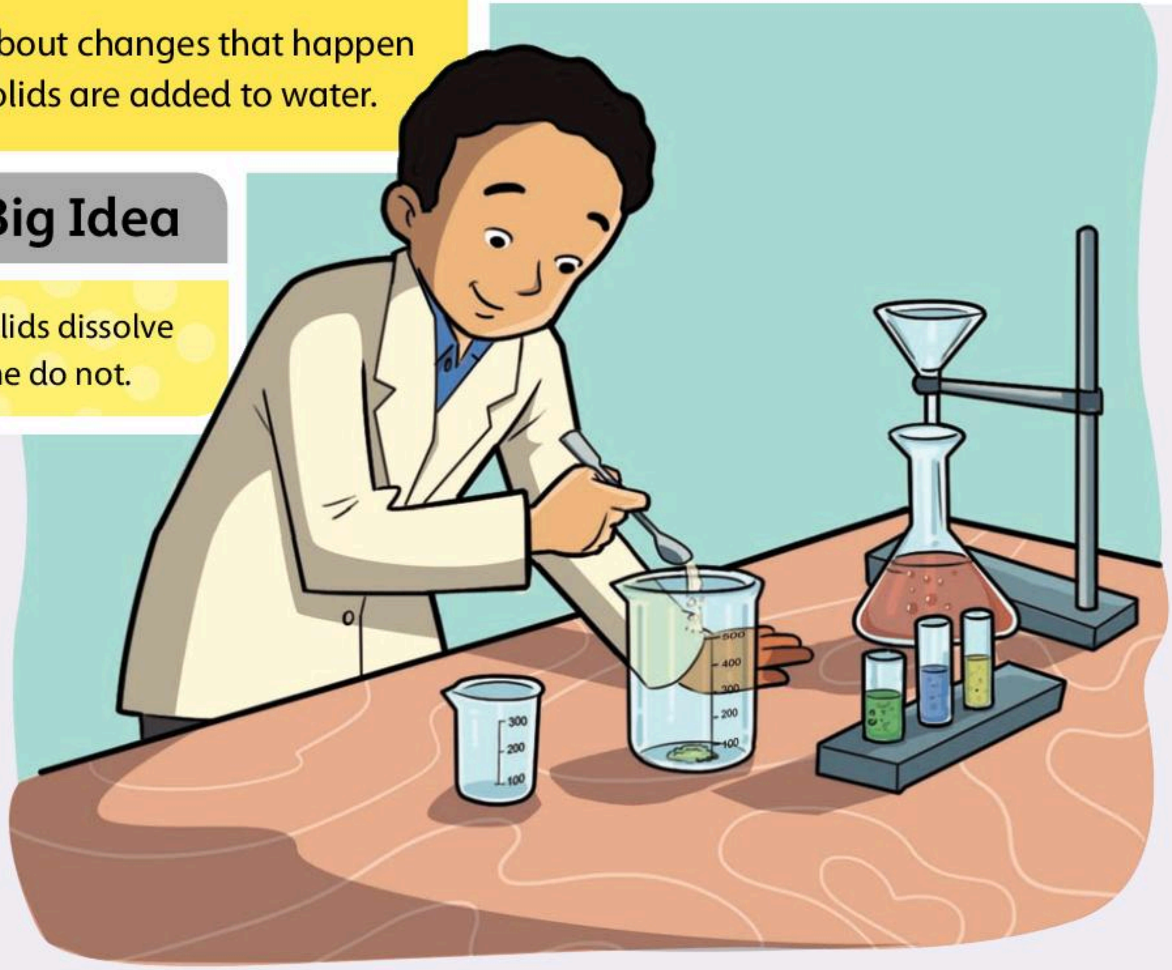
Now turn to page 50 to review and reflect on what you have learned.

Adding solids to water

Know about changes that happen when solids are added to water.

The Big Idea

Some solids dissolve and some do not.



Write down a soluble solid that you have used.

Write down a solid that does not dissolve in water.

Some solids dissolve in water. We say they are soluble.

Some solids do not dissolve in water. What do we call these?

How can you tell whether a substance added to water has dissolved?

How much sugar will dissolve in water?

Investigation: Investigate how much sugar will dissolve in water.

How do you know that you cannot dissolve any more sugar? What will you see?

We say this is saturated.

Copy and complete the table below in your Investigation Notebook. Record your results and observations.

Spatulas of sugar	Observation

When a solid dissolves in a liquid scientists say it is soluble. Solubility is the process of dissolving solids in liquids. If a substance does not dissolve in water we say it is insoluble.

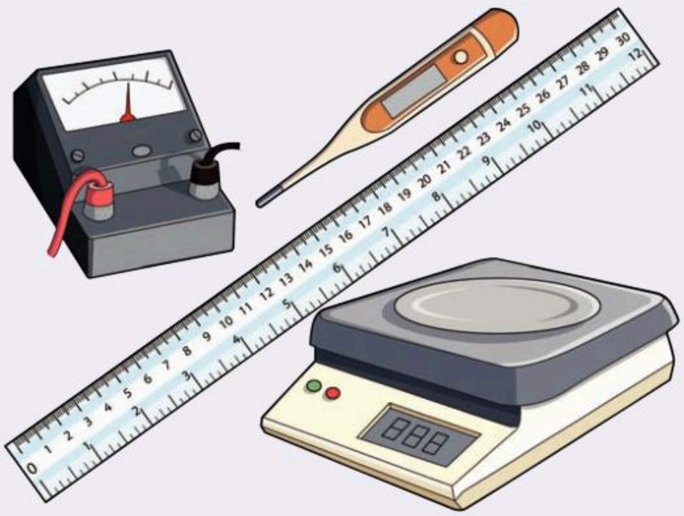
Think about...
Try to dissolve other solids and see if they are insoluble or soluble. Test things at home and school. Make a list of soluble and insoluble solids.

Can you change the solubility of a solute?

Will the temperature of the water affect how much sugar dissolves in the water?

Investigation: Investigate whether the temperature of the water affects how much sugar dissolves.

Which piece of equipment will you use to measure the temperature?



What unit will you measure the temperature in?

How can you make sure this is a fair test?

Think about the amount of water you use. If you use a different amount each time will it affect the solubility?

Be careful with hot water. Tell your teacher if any spills over.

This time the temperature of the water is the independent **variable**. Remember this is the thing you are changing in the investigation. This will go in the first column. The dependent variable will be the measurement of sugar that you dissolve. This is the variable that you find out from the investigation.

Adding solids to water

Know about changes that happen when solids are added to water.

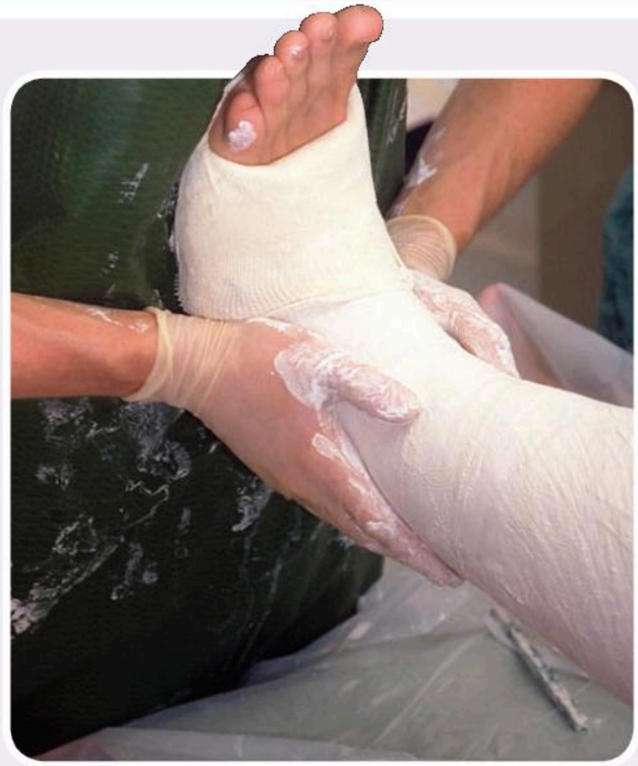
The Big Idea

Some reactions give out heat.

Can you remember the changes that can happen in a chemical reaction?

Reactions happen when we mix chemicals together. The chemicals we add to a reaction are called the reactants. The reactants join together and make new substances. It is not possible to reverse this kind of reaction. When you burn a piece of magnesium ribbon, the magnesium combines with the oxygen in the air and the product is magnesium oxide. This cannot be reversed.

The reaction releases lots of energy. It needs heat to start the reaction and then the reactants release energy. The flame burns so brightly that it is dangerous to look at it directly.



Plaster of Paris is used for lots of things. It is sometimes used to make casts to help people repair broken bones. Some people use it to make models and statues. It is also used in tablets that you take when you are ill.

The Plaster of Paris mixes with the water to produce a smooth paste.

What happens to the thermometer?

The temperature increases as the reactants are mixed together. This is called an exothermic reaction. The chemicals produce their own heat.

If you break up the word into 'exo' and 'therm' does it become clearer?

'Exo' comes from the Greek word meaning outside.

'Therm' comes from thermal which means heat.So, exothermic means heat outside. Heat goes outside or leaves the reaction.

Burning or combustion is also an exothermic reaction. We know this because it releases heat. We use this heat to cook food and warm our homes.

Discuss all the uses of concrete you know. *Hint*: Look around the room you are in or outside.

Cement powder can burn your hands and eyes. Wear protective gloves and eye glasses.

Think about...

Imagine that chemical reactions never give out heat. What will happen to cooking stoves, fireworks, matches, cars, trains and electricity? How will your world change?

Investigation: Investigate whether making concrete is an exothermic reaction.

Answer the questions about making concrete.

a What do you notice about the change in temperature?

b Do you think this reaction is reversible?

c Is this reaction exothermic? Explain your answer.

Fill in the missing words by using the correct word from the word bank.

When water evaporates to give water vapour it is a reversible change. When magnesium burns in air to give magnesium oxide it is an __________ change. Some substances react together and give out heat. We use a __________ to measure this. Chemical reactions that give out heat are called __________. Another example of this type of reaction is when we burn __________ in cars and cookers.

Word Bank

fuels **thermometer** ~~**reversible**~~ **irreversible** **exothermic**

Now turn to page 51 to review and reflect on what you have learned.

Separating solids from solutions

Understand how some solids that do not dissolve or react with water can be separated by filtering.

The Big Idea

We can separate insoluble solids from mixtures.

What do we call a solid that does not dissolve in water? Can you name three examples?

Gardeners use sieves to break up the soil. The stones and lumps of soil are kept in the sieve. The holes of the sieve are too small for the large particles to pass through.

Can you use this sieve to separate the lumps out of flour? Explain your answer.

There are lots of different sieves for different jobs. They all use the same technique but just different-sized holes in the sieve.

Why can't you use a garden sieve or a sieve for flour to separate a sugar or salt solution?

Very small solids cannot be separated using a sieve. The small solid will pass through the holes.

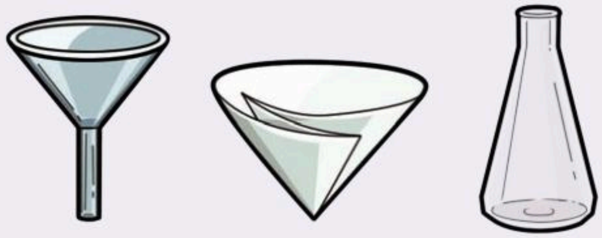
Investigation: Sand does not dissolve in water. How can you prove this?

What do you see? Where does the sand go?

Try to stir the mixture. Does this make a difference?

Even if the water was hotter or you stirred it more, it will not dissolve. Sand is insoluble.

Filter paper works like sieving. The holes in the paper are tiny. They stop smaller particles moving through the paper. This separates them from the mixture.



Investigation: How can you separate sand from water?

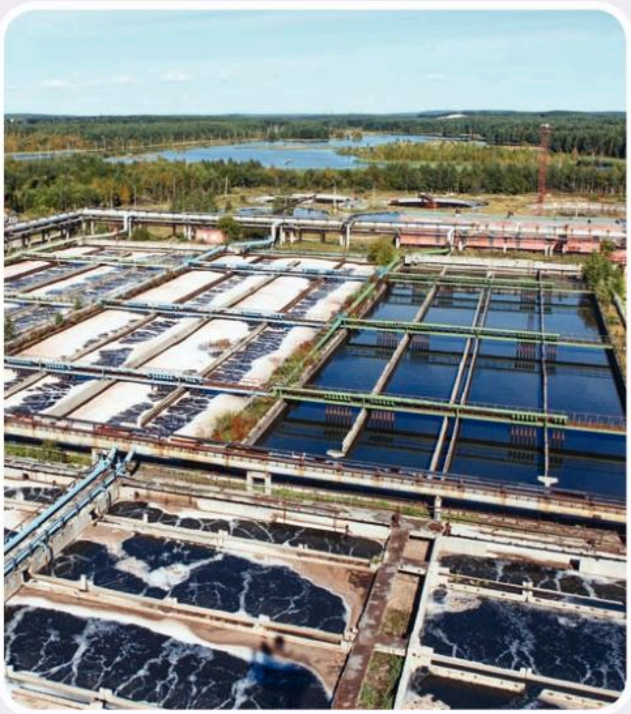
Try pouring water and sand through the filter paper. What do you observe?

This process is called filtration. It is a very useful process and is used in science for separating insoluble substances from water.

Some coffee machines use filtration. Hot water is poured over the coffee very slowly. The small particles of coffee flavour the water. The bigger particles are collected in the paper.

Investigation: Make your own filter bed.

You are going to design, make and test your own filter bed.



On a much larger scale, filter beds are used to make clean water that is safe to drink.

Amazing fact

Filtration is used to clean water. Water is poured over sand very slowly. Solids that are in the water are collected by the grains of sand. The sand works like the filter paper.

Some filter beds use carbon.

This black powder is inside the water filter. It works in the same way as the sand in your filter bed. The carbon absorbs or holds on to the particles of dirt in the water. The clean water slowly filters through the carbon. The dirt is left in the carbon.

Think about...

Around the world, much of the pollution in water is soil, sand and oil. Can you advise people on how to clean this water? What technique can be used to remove these three pollutants?

Separating solids from solutions

Understand how some solids that do not dissolve or react with water can be separated by filtering.

The Big Idea

Although a solid in a solution cannot be seen it is still there.

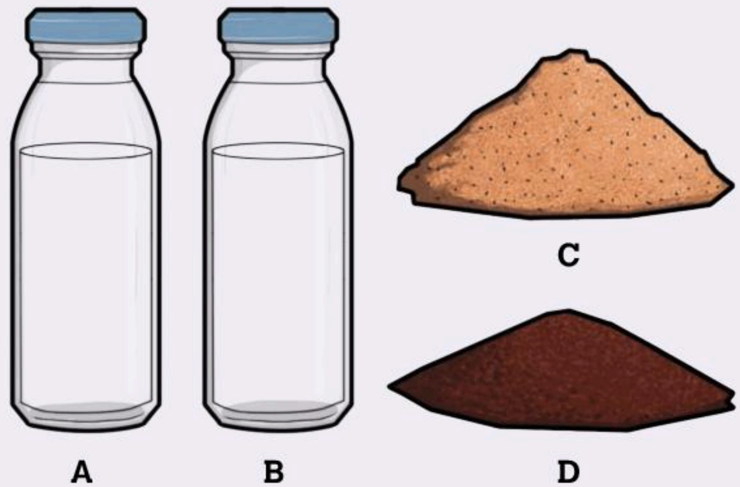
Look at the sample of seawater. Is it a mixture or a pure substance? Explain your answer.

Sometimes it is easy to see whether a substance is a mixture or not. With the seawater, it is easy to see if there are grains of sand and pieces of seaweed in the mixture.

Write down two other substances you may find in seawater.

Some of the substances found in seawater are not easily seen. You will remember that if a substance dissolves it looks as if it has disappeared. It has spread out into the water.

It is important to investigate substances very carefully to find out whether they are mixtures or not.



You have four substances. Two of the substances are pure. The other two are mixtures. Plan an investigation to find out which is which.

Write down two ways to separate mixtures.

How can you check to see whether a liquid has anything dissolved in it?

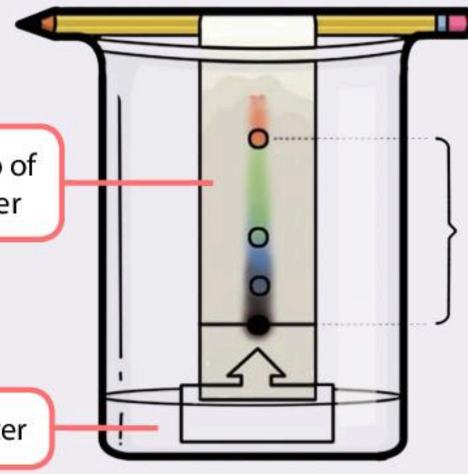
Think about...

Separation techniques are used to provide clean drinking water to villages, towns and cities. Do some research to find out more about this.

Can we separate mixtures of inks?

Chromatography is another way of separating mixtures. You can see how it works by using it to separate a mixture of coloured inks. First, a spot of the ink is placed near the bottom of a piece of filter paper and allowed to dry.

The bottom edge of the paper is dipped into water. The water slowly rises up the paper and carries some of the ink with it. You must stop the experiment before the water runs all the way to the top of the paper. If it does the inks will all travel too far.



Investigation: Plan and carry out an investigation to find out which colours are found in different coloured pens. Use chromatography as your technique.

Answer the following questions to help you with your investigation.

a Why is it important to stop the chromatography before the water reaches the top of the paper?

b Why is it important that the inks dissolve in water?

c Why can't we use chromatography to separate different coloured pencils?

Think about...

Scientists investigating crimes sometimes check to see whether a pen has been used to write a message. The ink of the pen will have a special mixture of colours. How can you use chromatography to help with the investigation?

True or false?

	True/False
1 When a solid dissolves in water it disappears.	______
2 A solid that dissolves in water is called soluble.	______
3 Sand is an insoluble solid.	______
4 Seawater is an example of a solution.	______
5 Coloured dyes can be separated by filtration.	______

Now turn to page 51 to review and reflect on what you have learned.

Investigating solids and solutions

Find out how some solids dissolve in water to form solutions and understand that the substance is in the solution.

The Big Idea

Design, plan and carry out a fair test.

Write down two times you dissolved something today or someone dissolved something for you.

When a solid dissolves in water what is made?

Sugar is dissolved in many drinks. Drinking sugar-filled drinks is bad for your health. The sugar can cause tooth decay and you can become overweight if you have too much sugar.

Can you tell how much sugar there is in a drink just by looking at it? Explain your answer.

Investigation: A dentist asks you to investigate some drinks. The results from your investigation will help people make the right decision about which drinks they buy.

When you receive your samples of drinks you must plan and carry out an investigation to test how much sugar is in each of the drinks.

Some of the drinks look clear. Does this mean they do not have any sugar in them? Explain why you must investigate further.

Remember you are not allowed to taste the drinks. Why is this?

What method will you use to separate any sugar that may be in the drink?

What equipment will you need to investigate this? Make a list of all the equipment you will need.

How will you make this a fair test? What will you need to keep the same?

If you plan a fair test this means other scientists can repeat the investigation. You can then compare lots of results. This means the results will be more reliable.

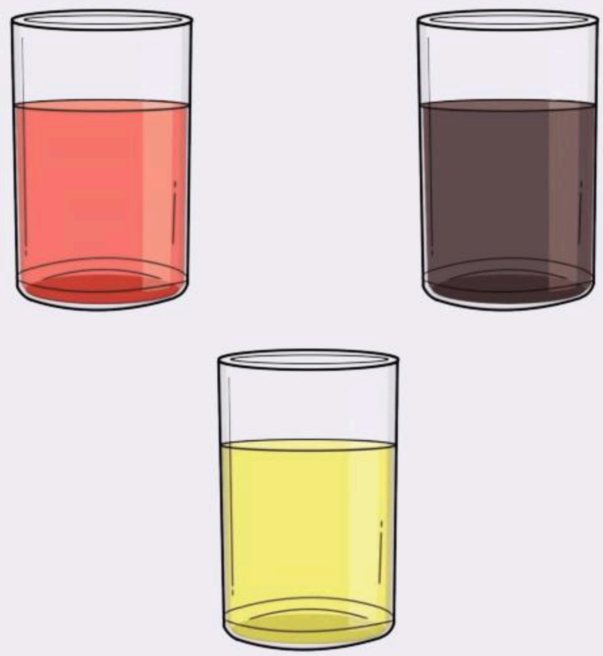
How will you plan to collect reliable data?

Make a table of results so that you can record your findings. Which column will the independent variable go in?

How can you measure how much sugar there is in the drink? What pieces of equipment can you use?

Look back at your table of results. Can you write a conclusion with no help?

The drink with the most sugar was ________________. The drink with the smallest amount or no sugar was________________.



Did any of the drinks not have any sugar in them? These are the ones you can recommend to the dentist. If they all had sugar the one with the lowest amount is better for you.

It is difficult to see patterns in results when they are in a table. Drawing graphs and charts makes it much easier to see patterns.

Draw a bar chart in your Investigation Notebook to show how much sugar there is in the drinks you have tested.

Investigating solids and solutions

Find out how some solids dissolve in water to form solutions and understand that the substance is in the solution.

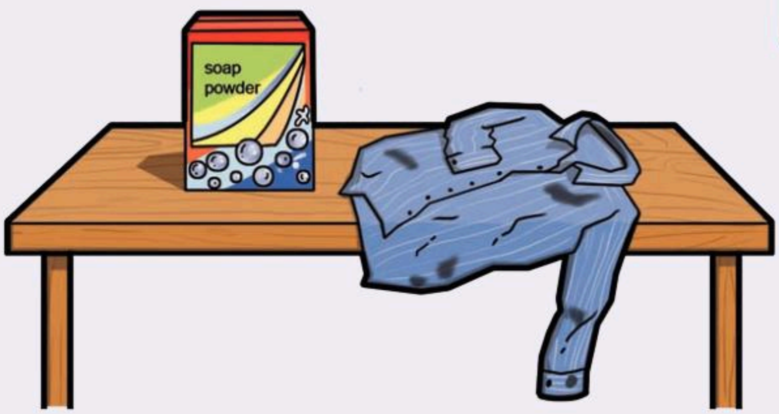
The Big Idea

Investigate washing clothes!

Is washing powder a solid, liquid or a gas?

Why do we use washing powder?

Washing powder dissolves in water. This makes a solution. The washing powder dissolves dirt and grease from our clothes.



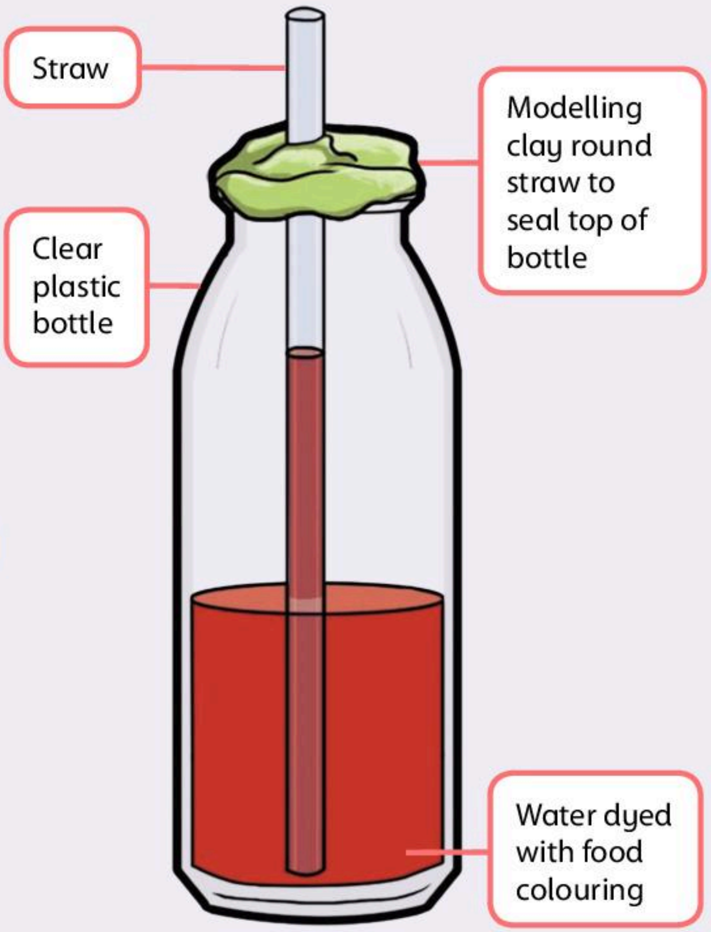
You are going to investigate how to get dirty clothes clean. First you are going to make your own thermometer to help you in your investigation.

Investigation: Make your own thermometer.

Did you know you can make your own thermometer?

What temperature does water boil at?

What temperature does water freeze at?



What happens to the level of the liquid in the straw?

What do you predict will happen to the level of the liquid in the straw if you put your thermometer into a refrigerator?

You can use your thermometer in your investigation about washing clothes. Why is it better to use a proper thermometer?

Investigation: You are going to investigate whether the temperature of the water changes the solubility of the washing powder. The more washing powder that dissolves, the quicker your clothes will become clean.

A beaker or plastic container can be used in the place of a washing machine. Think about how to make this a fair test.

- How much water you will use?
- How will you measure the temperature of the water?
- How will you measure how much powder has dissolved?

To be a fair test all these questions must be answered.

How can you record your results? Copy and complete the table below in your Investigation Notebook.

You can plot the results on a line graph. Remember the independent variable is plotted on the *x* axis.

Temperature of water(°C)	Spatulas of powder dissolved	Spatulas of powder dissolved	Spatulas of powder dissolved	Average spatulas of powder dissolved

Be careful with washing powder. Do not get any on your skin.

Think about...

Do scientists investigate products? Have a look at some clothes labels and washing powder packets. Are there any recommended temperatures?

1 List two everyday uses of dissolving.

2 How can you make a solid dissolve quicker?

Now turn to page 51 to review and reflect on what you have learned.

What we have learned about reversible and irreversible reactions

Reversible and irreversible changes (pages 26–35)

Can you name a reversible reaction?

A chemical change is not reversible. Can you explain why?

What three things do you need to make a fire?

How do carbon dioxide extinguishers put out a fire?

I can predict whether a reaction is reversible or irreversible.

I know the three things needed to make a fire.

I know about different types of fire extinguishers.

Can mixtures be separated?

(pages 36–7)

How can you separate the mixtures below?

a Sand and water

b Salt and water

c Sand and pebbles

I know how to separate dissolved solids from a solution.

I can separate insoluble solids using filtration.

Adding solids to water
(pages 38–41)

What do we call a solid that dissolves in water?

Can you think of a way to make a solute dissolve more quickly in a solution?

What is the name of the reaction that gives out heat?

I know that temperature changes solubility.

I understand that some reactions need energy to start.

Separating solids from solutions (pages 42–5)

What is filtration used for?

I know how to separate a solid from a solution.

Investigating solids and solutions (pages 46–9)

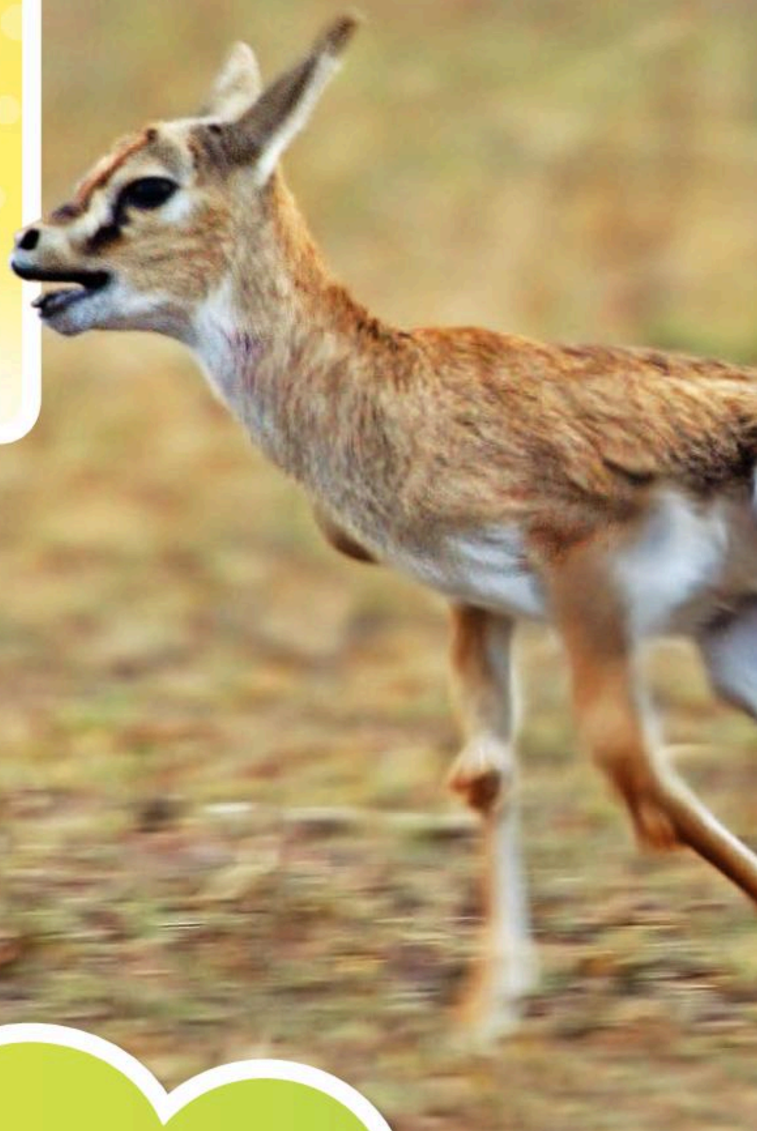
How can you separate sugar from a sugary drink?

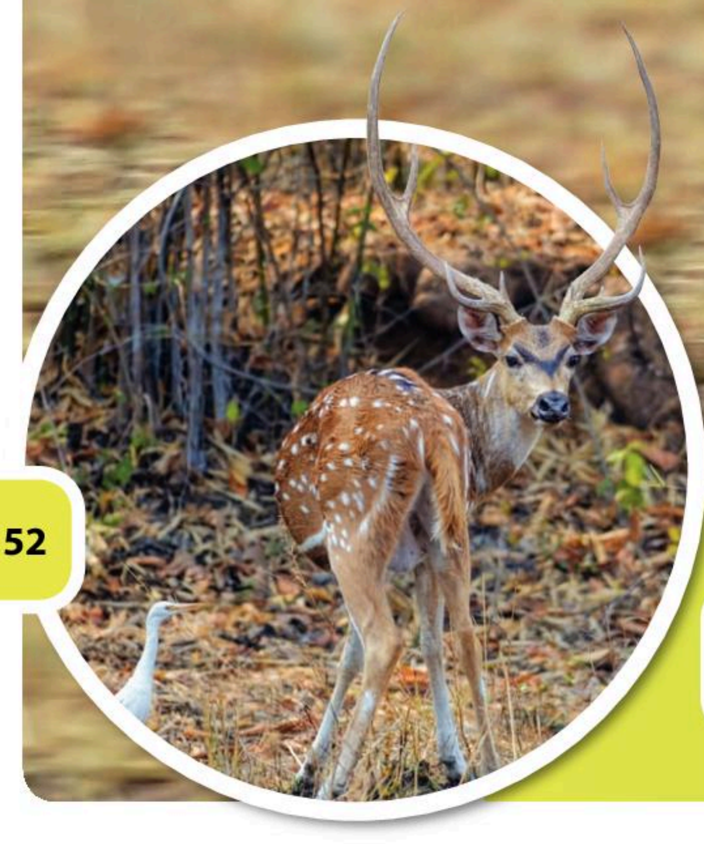
I understand that solids dissolved in water are still in the solution.

3 Food Chains

In this module you will:

- find out that food chains can be used to represent feeding relationships in a habitat
- learn that food chains begin with a plant (the producer), which uses energy from the Sun
- learn about and understand the words 'producer', 'consumer', 'predator' and 'prey'
- make food chains for different habitats.





Amazing fact

Did you know that every living thing needs sunshine to survive?

- Can you remember what we mean by the word 'habitat'?
- How many animals can you see on these pages?

Word Cloud

food chain
feeding relationship
consumer
producer
predator
prey

Along the chain we go!

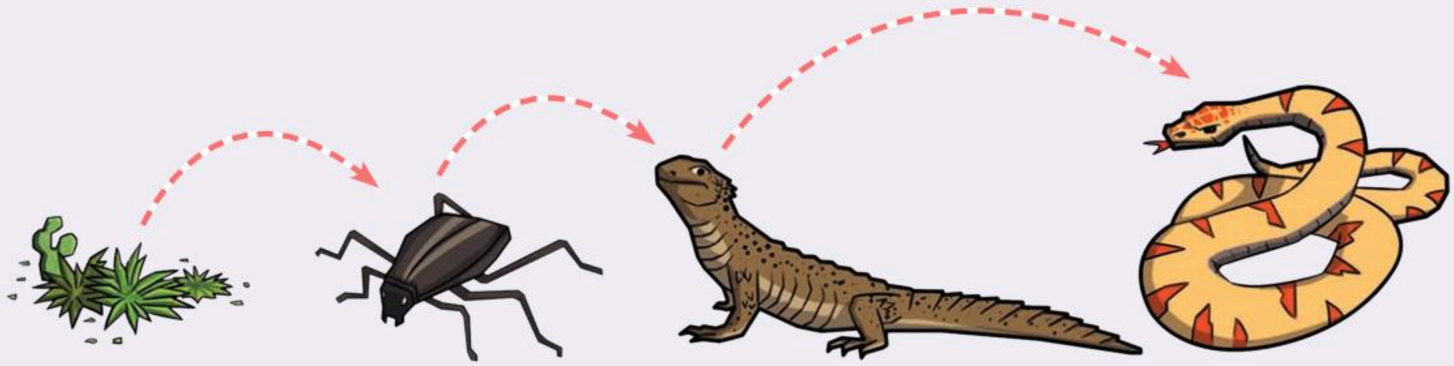
Find out that food chains can be used to show feeding relationships in a habitat.

The Big Idea

Food chains can be used to show feeding relationships.

A **feeding relationship** Shows us what each animal eats. This can be plants or other animals.

Look at the picture of a food chain. What do you think it tells us?



Animals eat plants and other animals and the way this happens is shown in a **food chain**.

We can also show food chains like this:

plants → insects → lizards → snakes

What do food chains tell us?

Food chains tell us what each animal eats along the chain. We use arrows to give information about the feeding relationships in a habitat. A habitat is where an animal or plant lives.

The feeding relationship for the food chain shown is:

- Plants provide food for insects:

  plant → insect

- Insects provide food for lizards:

  insect → lizard

- Lizards provide food for snakes:

  lizard → snake

Think about some local habitats. How do you think the plants and animals can make up a food chain?

Construct your own food chain using words and pictures.

Do you think that you can be in a food chain? Think about what you eat. Where does it come from?

Construct a food chain using words, with you at the end of it.

Use the words in the word bank to complete the paragraph about food chains. The first one has been done for you.

Food chains are useful because they show how plants and animals need food to live. We can use words or ________ to create food chains. We use ________ to show us feeding ________.

Word Bank

arrows **pictures** **~~live~~** **relationships**

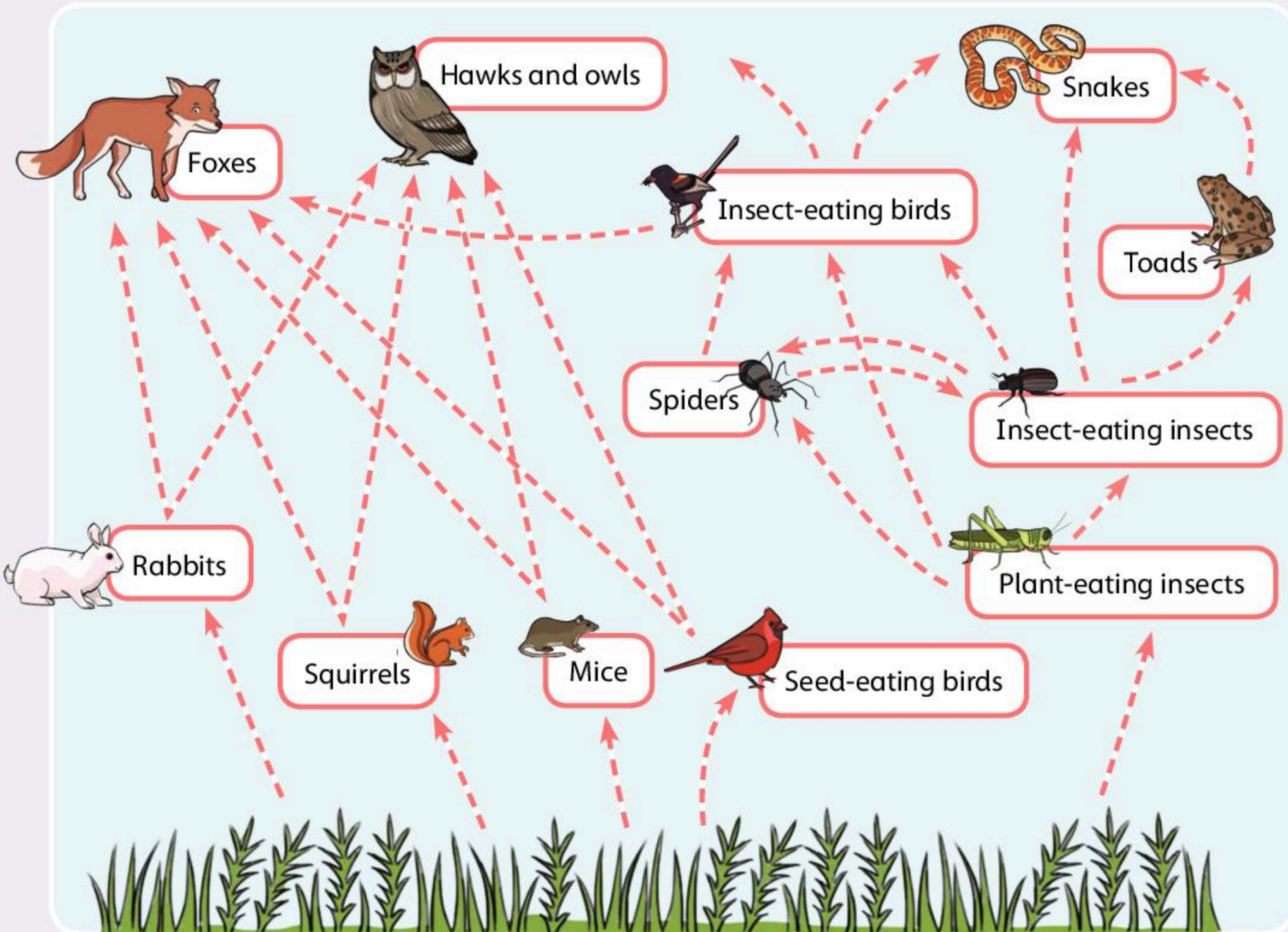
Along the chain we go!

Find out that food chains can be used to show feeding relationships in a habitat.

The Big Idea

Chains can be extended to make webs!

Look at the picture of a food web. How is it different from a food chain?



Food webs give us more information about feeding relationships. The feeding relationships are still shown by the arrows, but now there are more arrows.

We eat lots of different things. If we eat the same thing all the time we get bored!

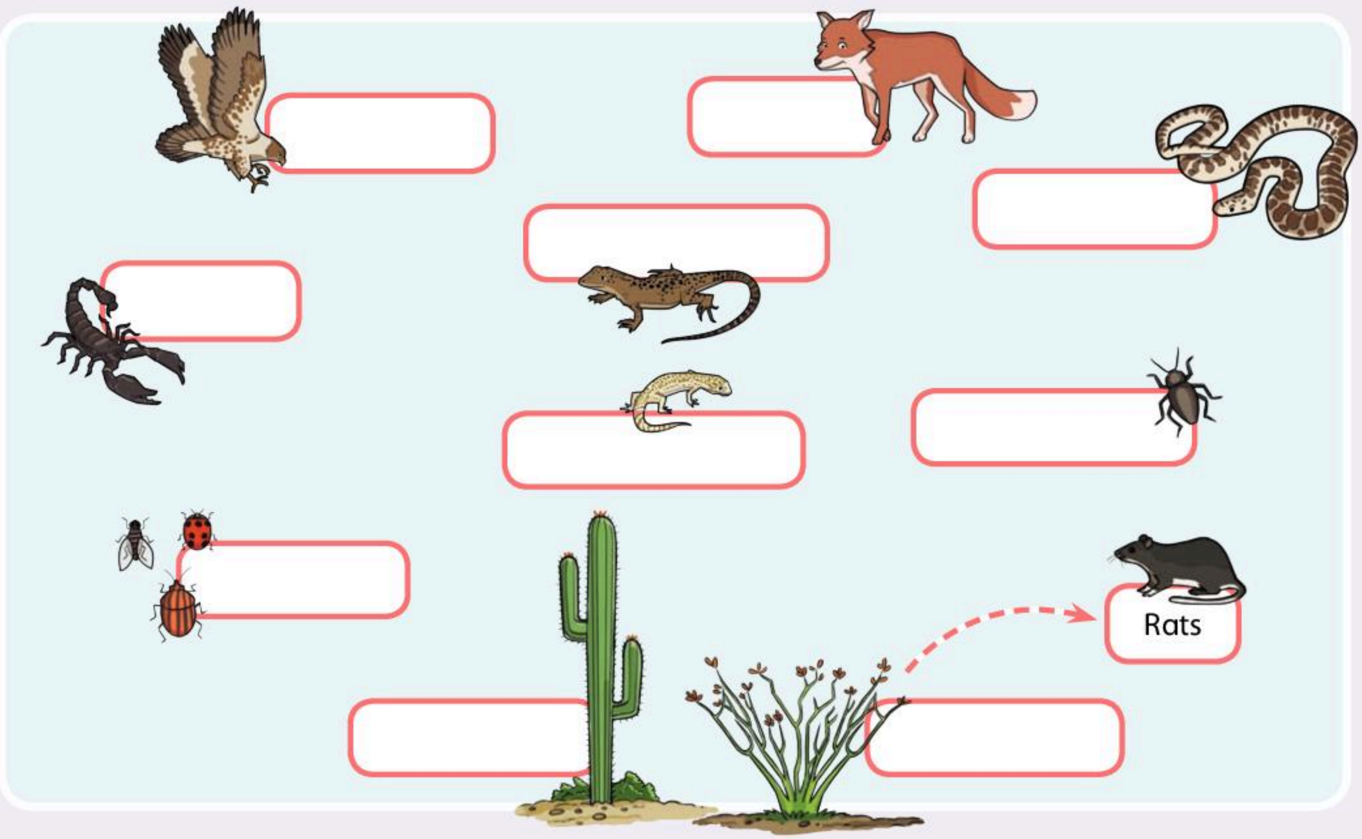
A food web shows all the different things that animals eat in a habitat. For example, an eagle does not only eat snakes. It may eat a bird or a lizard or a mouse sometimes. Food webs show all the feeding relationships in a habitat.

Look at this food web.

Write the names of the plants and animals in this food chain in the boxes. Use the words from the word bank. One has been done for you.

Where will you put the arrows?

Draw in the arrows to show all the different feeding relationships. One has been done for you.



Some words are used more than once.

Word Bank

desert plants	**cacti**	**foxes**	**scorpions**	**snakes**
birds of prey	~~**rats**~~	**insects**	**lizards**	

True or false?

		True/False
1	Food webs and food chains give information about feeding relationships.	________
2	We use arrows to show us what each animal eats.	________
3	Food webs give more information than food chains.	________

Now turn to page 72 to review and reflect on what you have learned.

It all begins with sunlight

Learn that food chains begin with a plant (the producer), which uses energy from the Sun.

The Big Idea

The Sun provides energy for plants to make their own food.

Plants can make their own food using energy from the Sun. Do you remember what else plants need so they can grow?

Write down two ideas.

Plants need ____________ and ____________.

Look at the pictures of a healthy plant and an unhealthy plant.

Write in the speech bubbles which plant is healthy and which plant is unhealthy.

What do you notice about the healthy plant? What do you notice about the unhealthy plant?

Write down your observations using ideas from the word bank. You can use the ideas to make three sentences to describe what you can see.

A healthy plant has ____________________ ____________ but the unhealthy plant has ________________________. The healthy plant has ____________________ but the unhealthy plant has ____________ ____________________. The healthy plant has __________________________ but the unhealthy plant has ____________________ ____________________.

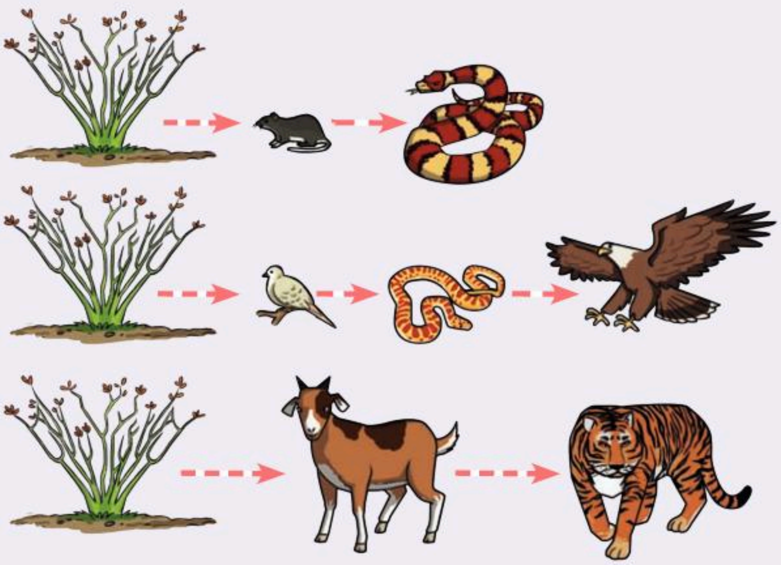
Word Bank

green leaves	**discoloured green leaves**
upright leaves	**no new leaves growing**
wilted leaves	**new leaves growing**

Producers

When plants are healthy and can use energy from the Sun to make their own food we call them **producers**. A producer can provide food for insects and animals.

Food chains always start with the producers. Here are some examples.



Use the word bank to write down the food chains shown above. One has been done for you. The words can be used more than once.

Food chain 1
plant → rat → snake

Food chain 2

Food chain 3

Word Bank

goat	snake	plant	rat
tiger	eagle	small bird	

Remember
We can use pictures or words when making food chains.

Use the words in the word bank to complete the paragraph about producers. The first one has been done for you.

Food chains always start with producers. They are called producers because they can make their own food using ________ from the ________. A healthy plant needs sunlight, water, ________ and a suitable place to ________.

Word Bank

energy	soil	grow
~~producers~~	Sun	

It all begins with sunlight

Learn that food chains begin with a plant (the producer), which uses energy from the Sun.

The Big Idea

We can use pyramids to tell us how energy flows through food chains and webs!

Green plants can produce their own food using energy from the Sun.

What is the word we use to describe green plants?

We describe green plants as ______________.

All living things need food because it provides the energy they need to live. We have looked at food chains and food webs. They all start with green plants called producers.

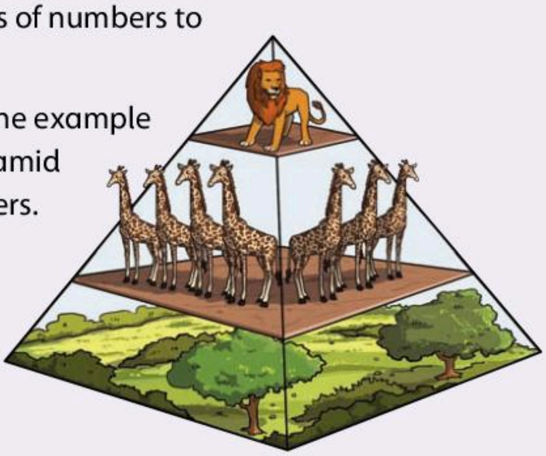
Animals cannot make their own food. They have to eat something to get the energy they need.

What happens to the energy?

Some of the energy is used by the animal. The rest of the energy is passed along the food chains and webs.

We can get clues about how the energy is passed along food chain or webs. We use pyramids of numbers to help us.

Here is one example of a pyramid of numbers.



Look at the pyramid of numbers. Count the numbers of giraffes and lions.

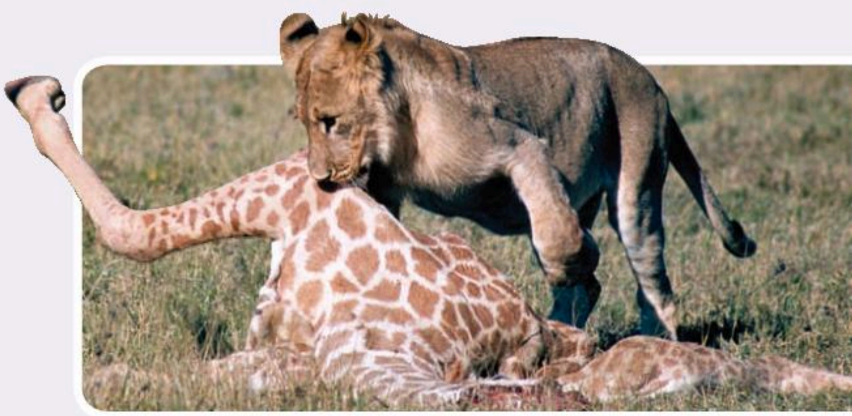
How many giraffes are there?

How many lions are there?

What does the pyramid of numbers tell us?

The pyramid of numbers shows us how many plants or animals are in each level. This tells us how many plants or animals are needed to feed the animal at each level of the pyramid. The pyramid of numbers also gives us information about how much energy animals need at each level.

The lion needs lots of energy. It feeds on giraffes to get this energy.

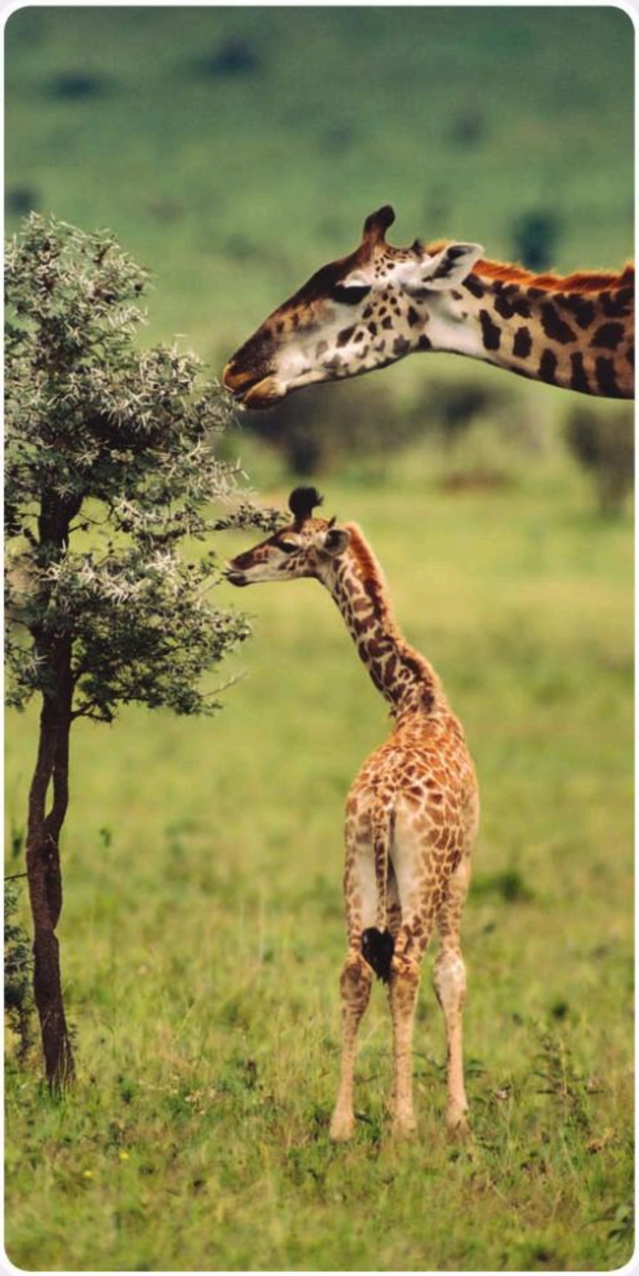


Why do lions need lots of energy?

Give one reason why lions need lots of energy.

How many giraffes do you think it takes to feed a lion?

The giraffe needs lots of energy. It feeds on trees and green plants.



Why do giraffes need lots of energy?

Give one reason why giraffes need lots of energy.

What about the trees and green plants that the giraffes eat?

Where do trees and green plants get their energy from?

What do trees and green plants use the energy for?

Complete the crossword using the clues below.

Across

1 Green plants are called this. (9)

4 Animals eat food so they can get this. (6)

Down

2 Plants use this to make their own food. (8)

3 The name of the shape showing energy flow. (7)

Think about...

Look at the pyramid of numbers again.

Why do you think there aren't as many lions as giraffes?

It all begins with sunlight

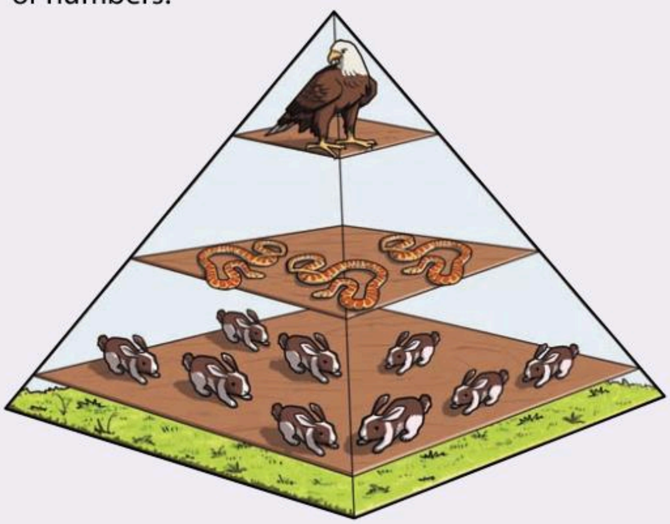
Learn that food chains begin with a plant (the producer), which uses energy from the Sun.

The Big Idea

Pyramids of numbers can be shown in different ways but it all begins with the Sun.

What does a pyramid of numbers tell us?

Look at another example of a pyramid of numbers.



Describe what you can see. Count the number of animals on each level.

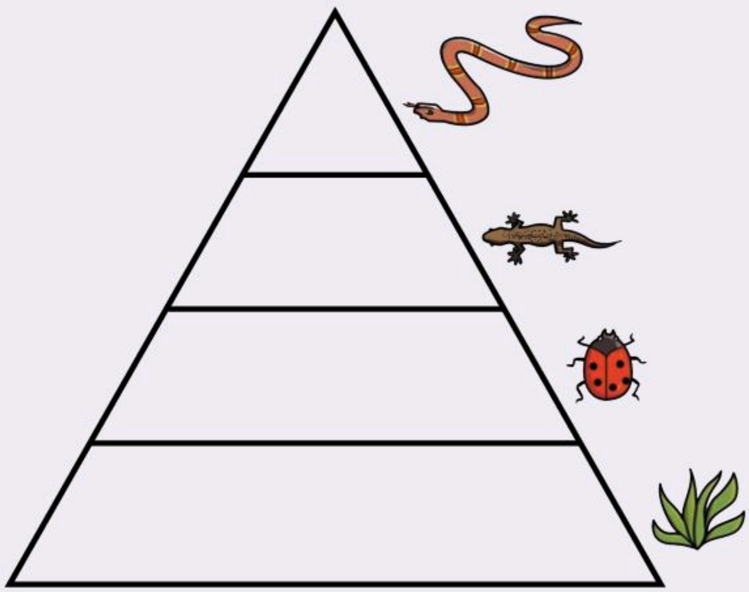
We know that pyramids of numbers show us how many plants and animals are needed to feed each level.

The pyramid shows us that the number of animals decreases as it goes up the pyramid.

How many snakes can nine rabbits feed?

It takes three snakes to feed how many eagles?

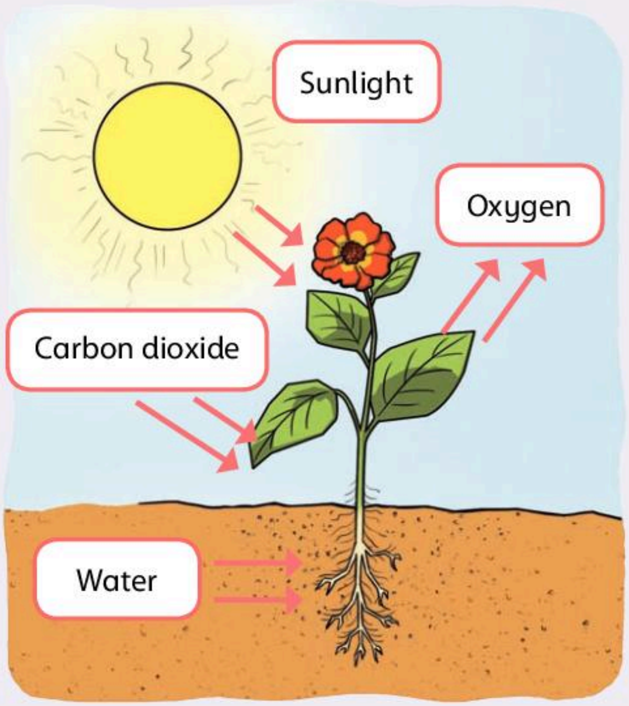
Use the information in the table to complete this pyramid of numbers.



Grass	1 500
Insects	29
Lizards	3
Snakes	1

In this topic we have looked at how energy flows in pyramids of numbers. Let's have a closer look at how important sunshine is in starting the energy flow.

Look closely at this picture. It shows how green plants use energy from the Sun to make their own food.



We can show how this happens by using a word equation:

$$\text{carbon dioxide} + \text{water} \xrightarrow{\text{light energy}} \text{glucose} + \text{oxygen}$$

When green plants make food using light energy from the Sun it is called photosynthesis. Green plants use carbon dioxide from the air and water from the soil to make glucose. Glucose is the name of the food the plant needs so that it can grow. Oxygen is released into the air from the green plant. Humans and other animals use oxygen when they breathe.

Green plants are very important to humans and other animals for two reasons.

- Green plants provide food energy for humans and other animals.
- Green plants produce oxygen for humans and other animals.

Create a poster to show how green plants use energy from the Sun to make their own food. On your poster include the word equation for photosynthesis.

Use the words in the word bank to complete the sentences below. The first one has been done for you.

The Sun provides __energy__ for green plants to produce food. Green plants are called ________ because of the ability to make their own food. When green plants make food using energy from the Sun it is called ________.

We can represent energy flow using pyramids of ________ because a pyramid of numbers tells us exactly how much each animal eats at each level. We can get clues from a pyramid of numbers about how much energy an animal needs to ________.

Word Bank

numbers	**producers**	**live**
~~energy~~	**photosynthesis**	

Now turn to page 72 to review and reflect on what you have learned.

Producers and consumers

Learn about and understand the words 'producer' and 'consumer'.

The Big Idea

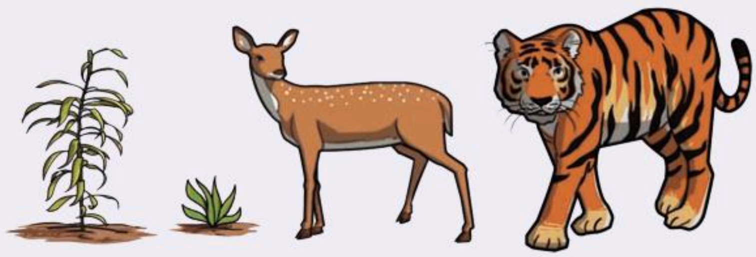
Producers using energy from the Sun provide food for consumers.

What is the insect in the picture doing?

We know that plants use energy from the Sun to produce their own food. Now let's look at the next stage in a food chain. The **producer** provides food for animals and insects. Animals and insects cannot produce food of their own.

We call animals and insects **consumers** because they consume plants or other animals just as we consume our food.

Look at these pictures of plants and animals. Which are producers? Which are consumers?



Write down the name of one plant and two animals. Are they producers or consumers? An example of each has been given to start you off.

Camel - consumer
Date palm - producer

Different types of consumer

In a food chain there may be different types of consumer. This depends upon how many plants and animals are in the chain.

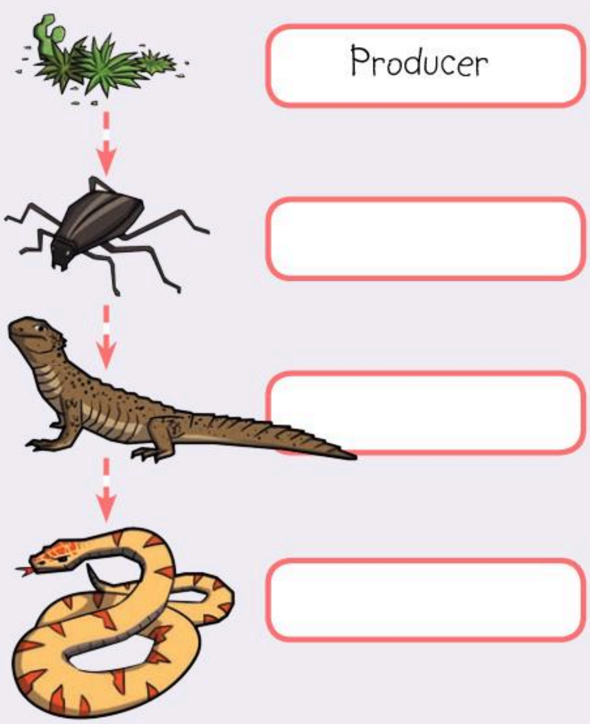
Look at this food chain.

We give special names to each consumer in this food chain:

1 Primary consumer – in this example it is the insect.

2 Secondary consumer – in this example it is the lizard.

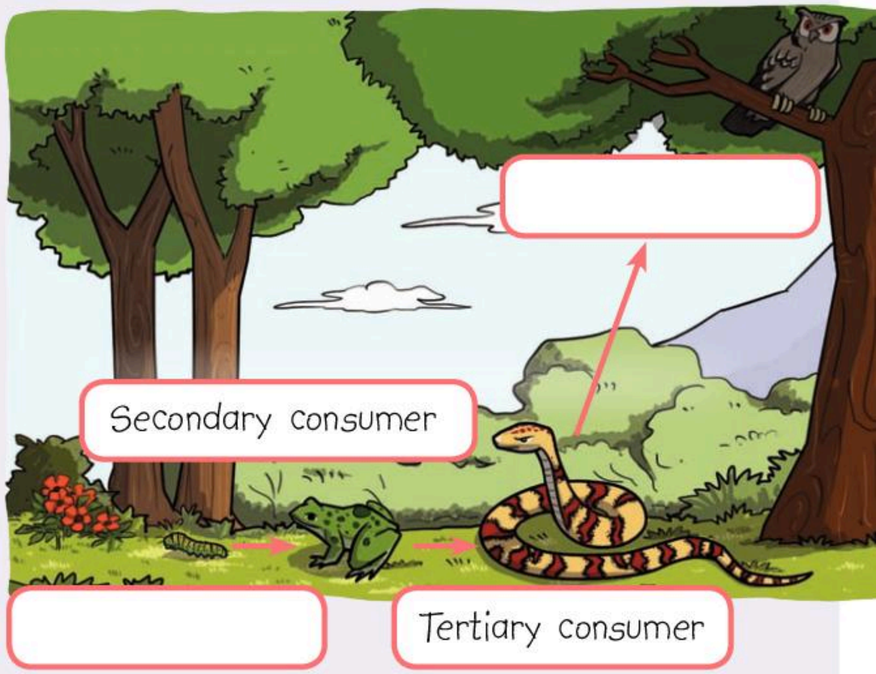
3 Tertiary consumer – in this example it is the snake.



How many consumers are there in this food chain?

Write in the correct type of consumer in the boxes on the food chain shown.

Look at this food chain.



In this food chain there are four consumers. They are different types of consumer – primary, secondary, tertiary and quaternary.

Write in the boxes which is the primary consumer and which is the quaternary.

Find the four mistakes in this paragraph.

Plants use energy from the earth to make their own food. We call them consumers. Insects and other animals are called producers because they cannot make their own food. The different types of producer are primary, secondary, tertiary and quaternary.

Now turn to page 73 to review and reflect on what you have learned

Predators and prey

Learn about and understand the words 'predator' and 'prey'.

The Big Idea

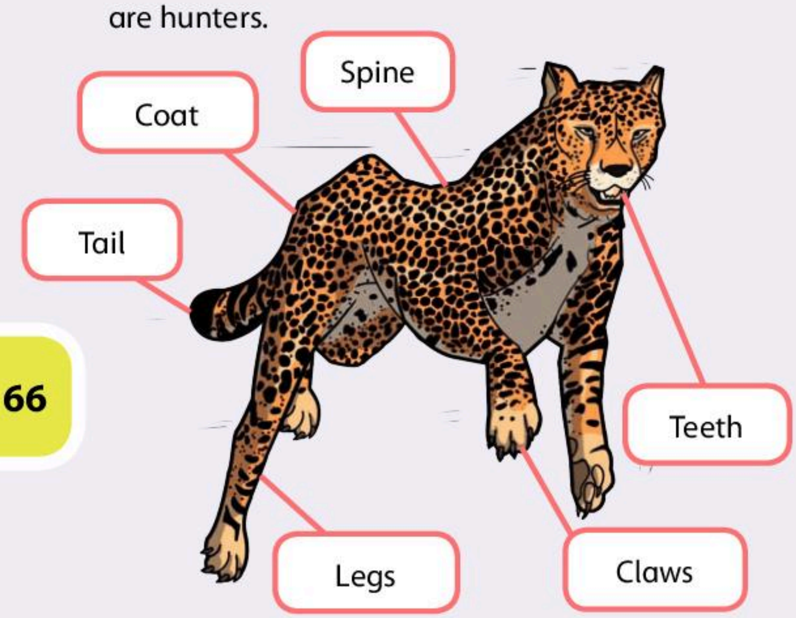
Some animals hunt other animals.

Do you know the names of any animals that kill other animals for their food?

Animals that hunt other animals for food are called **predators**. Predators kill other animals. These animals are called **prey**.

How do we know which animals are predators and which animals are prey if we do not see what they eat?

Let's look at a predator. The cheetah is the fastest animal on earth. It can run as fast as 100 kph. Cheetahs are found in Africa. They are hunters.



Look at the picture of the cheetah. Answer the questions about this predator.

a Why do you think the cheetah has long legs and a flexible spine?

b Why do you think the cheetah has a long, flat tail?

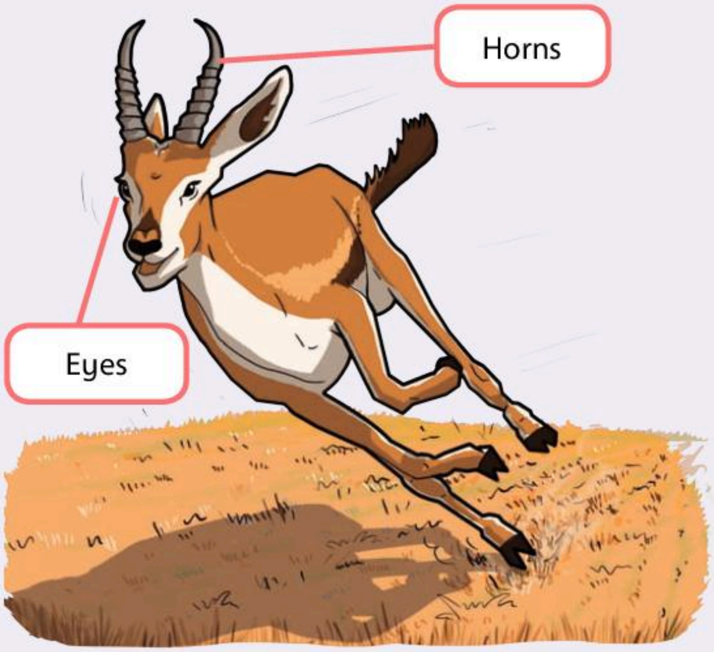
c Why do you think the cheetah has ridges on its paws and its claws are always out?

d Why do you think the cheetah has a small, aerodynamic head and lightweight body?

e Why do you think the cheetah has spots on its coat?

f What senses do you think the cheetah uses when hunting for prey?

Here is an example of prey. The gazelle can be found in Africa and Asia. It can run fast. Gazelles mainly eat green plants. They are hunted by lions, leopards, cheetahs and hyenas.



Look at the picture of the gazelle. Answer the questions about this prey.

a Why do you think the gazelle can run fast?

b Why do you think the eyes of the gazelle are on the side of its head?

c Why do you think the gazelle has a coat of browns and white?

d Why do you think the gazelle has horns?

Choose one predator and one prey. Copy the table below into your Investigation Notebook. Write down a feature of the predator and explain how this helps it to catch its prey. An example is given to help get you started. Do the same for the prey.

The predator I have chosen is: Cheetah	
Adaptation	Effect
Flexible spine	To help it to run fast

Use the words in the word bank to complete the paragraph about predators and prey. The first one has been done for you

Some animals hunt for their food and are called predators. The animals that are hunted and killed by predators are called ______. Predators and prey are both ______ because they cannot produce their own ______.

Word Bank

consumers food ~~predators~~ prey

Now turn to page 73 to review and reflect on what you have learned.

Different habitats, different food chains

Make food chains for different habitats.

The Big Idea

Food chains can be constructed for many different habitats.

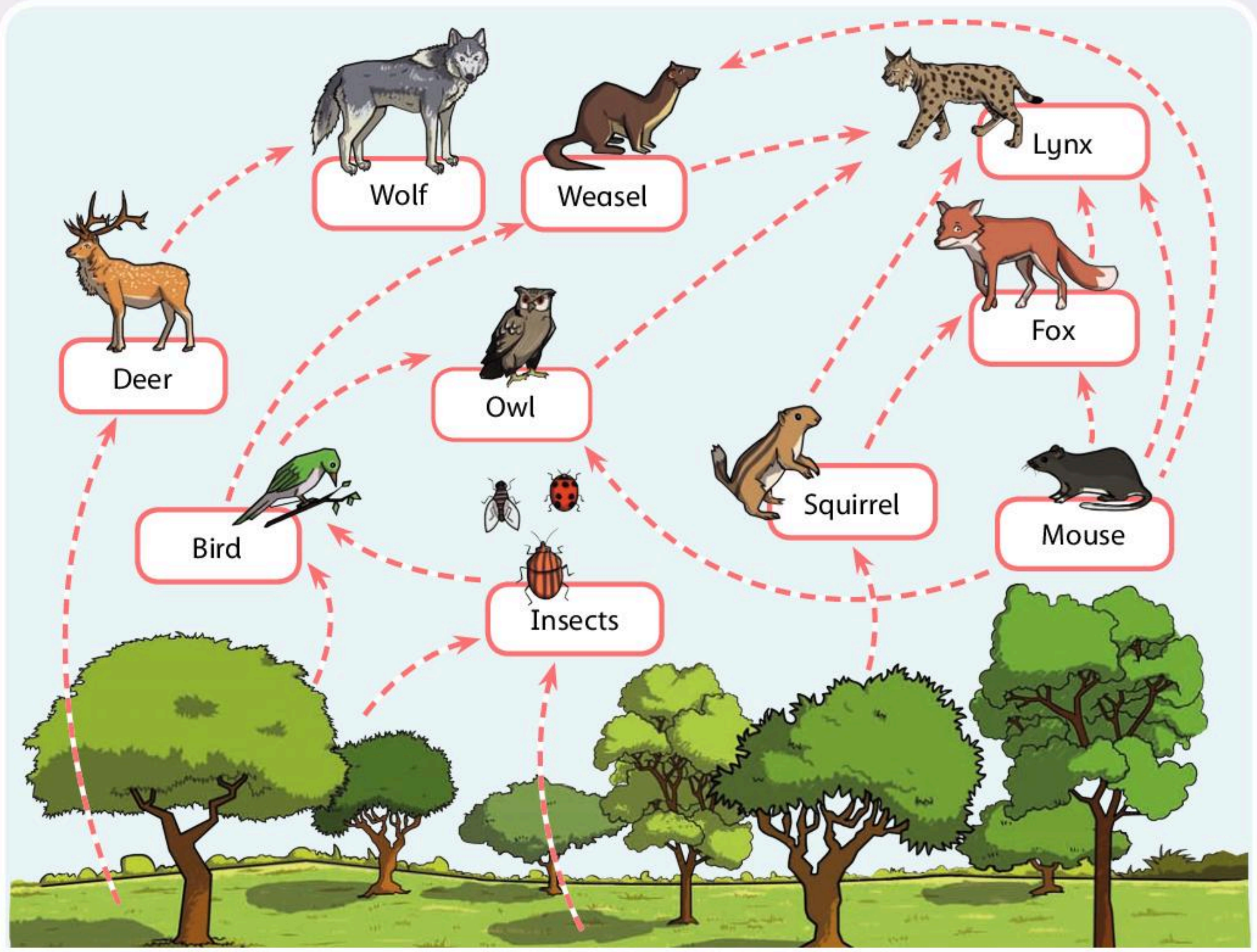
How many different habitats can you name?

Which habitat do you find the most interesting, and why?

Each stage of a food chain or food web provides energy in the form of food. We know that all food chains start with a producer and end with a consumer. Producers provide food for consumers. This food gives consumers the energy they need.

Some consumers can be predators or prey. But did you know that some animals can be both predators and prey? This is because some predators can become food for other bigger predators.

Look at the picture of the forest food chain. Can you see any animals that are both predators and prey?



Write down answers to these questions.

a Name two predators in the picture.

b Name two prey in the picture.

c Look closely at the picture. Name two predators that are eaten by bigger predators.

Think about the habitat that you find very interesting. What plants and animals are in that habitat?

In your Investigation Notebook create a food chain for a habitat of your choice. You can draw the animals and plants if you like.

Complete the word search – try to find the the key words used in this module that are given in the word bank. One has been done to start you off.

Word Bank

producer	**energy**	**food chain**
plant	**prey**	**habitat**
consumer	**sun**	**feeding**
relationship		~~**predator**~~

S	S	E	P	R	K	E	S	T	R	A	E	N
I	F	C	L	Y	E	U	N	P	W	N	S	I
F	A	P	R	E	D	A	T	O	R	M	Z	O
E	O	R	S	O	L	E	G	H	S	P	H	F
E	F	O	L	P	S	C	L	E	E	H	M	T
D	E	D	D	P	C	S	X	I	S	E	E	H
I	T	U	Z	C	O	T	E	S	T	S	S	N
N	T	C	I	R	H	J	E	N	R	A	H	O
G	S	E	C	M	I	A	C	C	F	D	A	T
C	P	R	E	Y	T	M	I	O	L	E	B	T
J	R	E	L	A	T	I	O	N	S	H	I	P
X	G	R	N	P	F	R	Q	S	N	E	T	A
K	L	R	Z	E	A	Y	F	U	O	U	A	I
F	G	E	M	I	R	E	S	M	O	H	T	P
O	D	L	F	C	N	G	E	E	T	T	E	Z
I	I	V	P	Y	E	T	Y	R	F	E	E	O

True or false?

		True/False
1	Food chains start with a consumer.	________
2	Consumers can be predators or prey.	________
3	We can use food chains for different habitats.	________

Different habitats, different food chains

Make food chains for different habitats.

The Big Idea

Green plants are not the only producers!

How can we create a food chain that includes fish?

We can use the ideas we have learned so far to create food chains for unfamiliar habitats.

Do you think that all producers are green plants that grow on land?

Look at the picture of a marine food chain. Answer the questions.

a What do you think is the producer in this marine food chain?

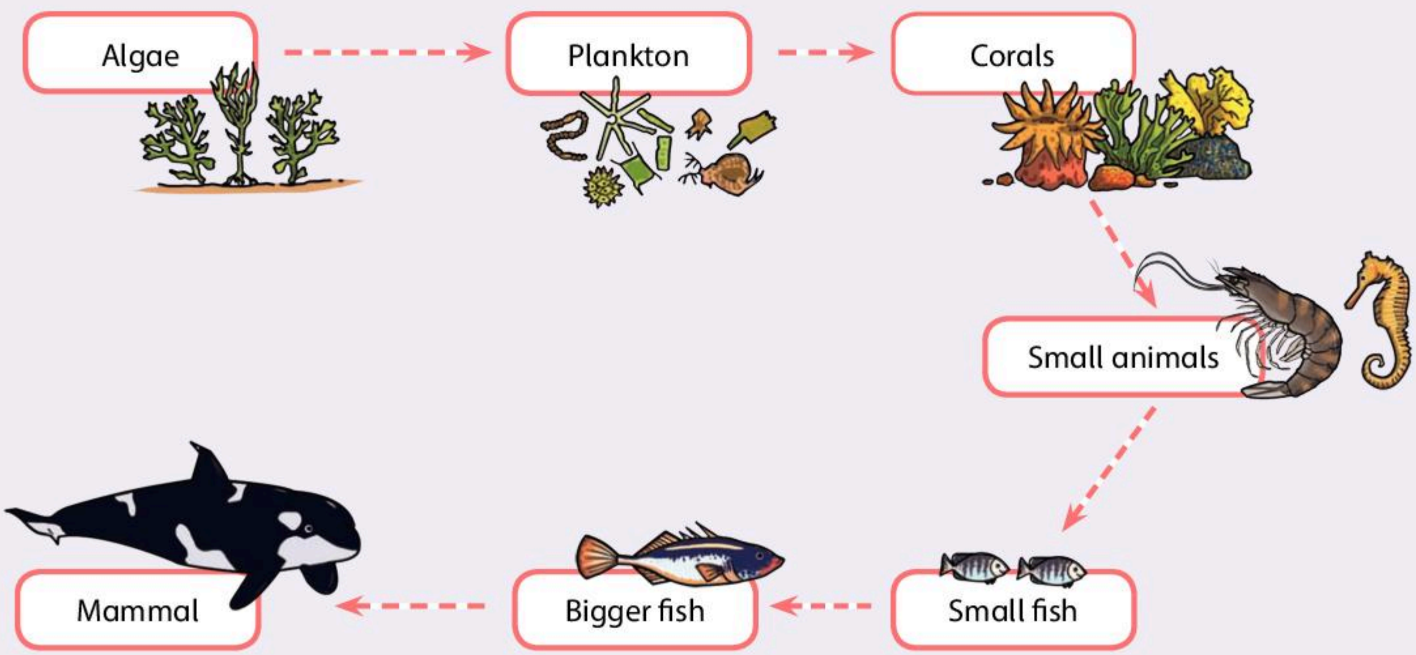
b What do you think fish eat?

c What do you think small animals in the oceans eat?

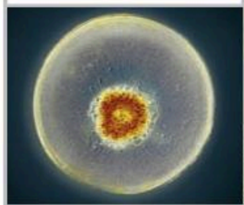
Think about different habitats. Are there any other habitats that do not have green plants as the producer?

Write down the name of one habitat that does not have green plants as the producer.

Think about all the ideas we have studied in this module. Look at the arctic food chain on the next page. This is a food chain that does not have green plants grown on land as its main producer.



Use your knowledge. Cross out the incorrect word in the headings. One has been done for you.

Algae	Shrimp	Cod	Seal	Polar bear
Producer or Consumer	Producer or Consumer	Producer or Consumer	~~Producer or~~ Consumer	Producer or Consumer
				
	Predator and/or Prey	Predator and/or Prey	Predator and/~~or~~ Prey	Predator and/or Prey

Answer the questions about the arctic food chain.

a Which animal is the primary consumer?

b Which animal is the secondary consumer?

c Which animal is the tertiary consumer?

d Which animal is the quaternary consumer?

Complete the paragraph about food chains using the words from the word bank. The first one has been done for you.

Food chains are used to show feeding relationships. Not all food chains start with green plants. For example, ____________ is the producer in a ____________ habitat. Food chains can also include information about ____________ and prey in a different habitats. Some ____________ can be predators and prey!

Word Bank

predators algae ~~relationships~~
marine animals

Match the words with the correct definitions.

consumer	animals hunted and eaten by predators
predators	an animal or insect that cannot produce its own food
prey	animals that hunt and eat other animals
producers	plants that make food using energy from the Sun

Now turn to page 73 to review and reflect on what you have learned.

What we have learned about food chains

Along the chain we go!

(pages 54–7)

Draw a diagram for a food chain using words and pictures.

What is the difference between a food chain and a food web?

Which animal do you think is at the top of the food chain?

Draw arrows in the food web below to show the different feeding relationships.

Fox

Hawk

Mouse

Insect-eating birds

Plants

Plant-eating insects

I know that food chains and food webs show the feeding relationships in a habitat.

It all begins with sunshine

(pages 58–63)

Why are plants called producers?

What does the pyramid of numbers show?

I understand that sunlight provides energy for plants to make their own food.

I know that animals on the level above have to eat more animals on the level below.

I understand that green plants provide food energy and oxygen for humans and other animals.

Producers and consumers
(pages 64–5)

Why are animals called consumers?

What is a tertiary consumer?

I know that producers provide food for animals and insects.

I know that animals are called consumers.

Predators and prey (pages 66–7)

What do we call animals that are hunted by other animals for food?

I know that predators hunt prey.

Different habitats, different food chains (pages 68–71)

All food chains begin with a producer.

a What is the producer in a forest food chain?

b What is the producer in a marine food chain?

I understand that every stage in the food chain provides energy in the form of food.

I know that some animals can be both predator and prey.

I know that some habitats do not have green plants as the producer.

4 Electrical Conductors and Insulators

In this module you will:

- find out how some materials are better conductors of electricity than others
- find out how some metals are good conductors of electricity and most other materials are not
- learn why metals are used for cables and wires and why plastics are used to cover wires and as covers for plugs and switches
- predict and test the effects of making changes to circuits
- draw diagrams of series circuits using symbols.

Word Cloud

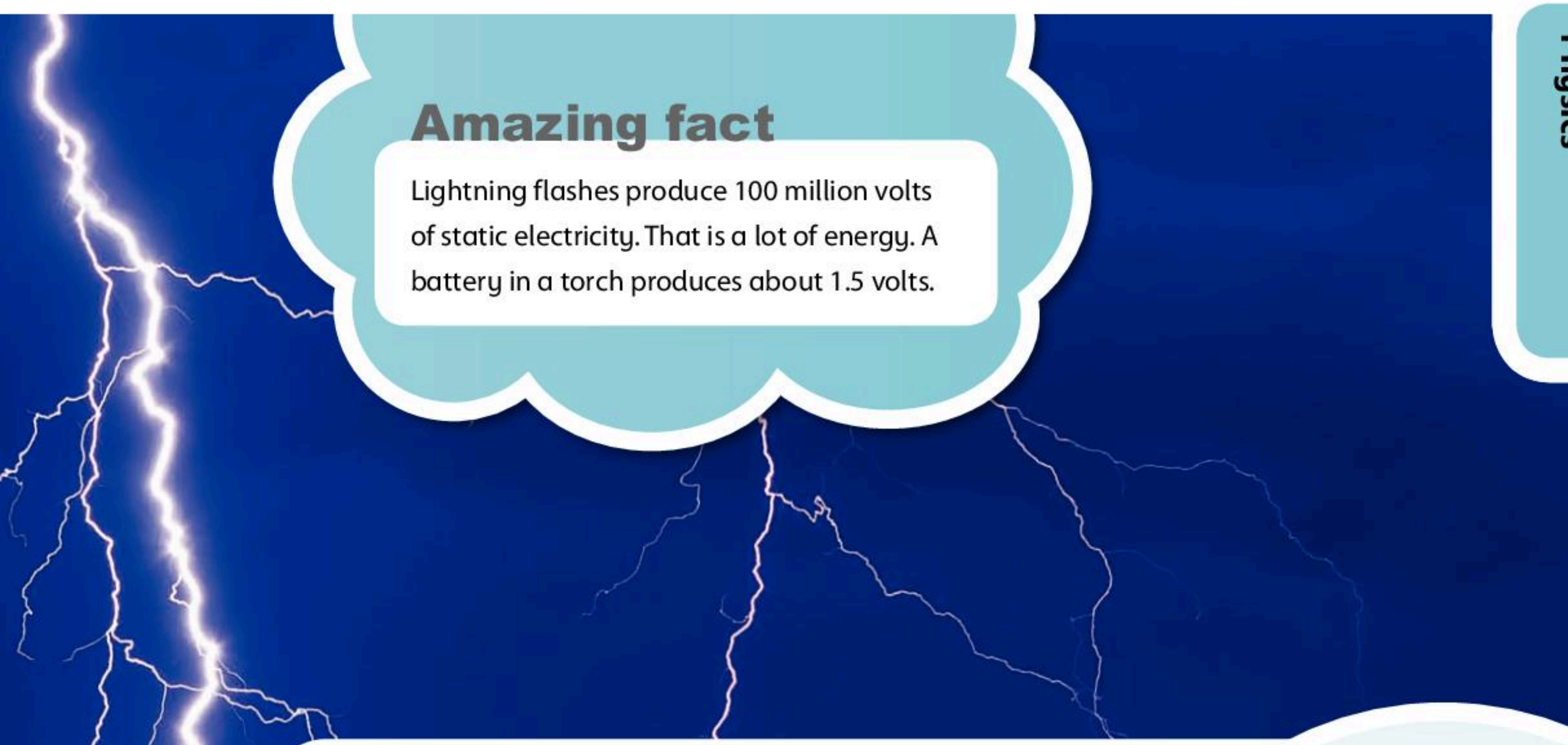
circuit diagram

insulator

circuit

conductor

battery



Amazing fact

Lightning flashes produce 100 million volts of static electricity. That is a lot of energy. A battery in a torch produces about 1.5 volts.

Can you make electricity with your hair or your clothes?

When you comb your hair, or rub a piece of plastic on your clothes, a small amount of electricity is made. The electricity does not move anywhere. We call it static electricity.

Investigation: How can you investigate this?

Try combing your hair, or rub a piece of plastic on your clothes. Then hold the comb or plastic near small pieces of paper. What happens to the pieces of paper?

Now move the comb or plastic over other small objects.

What can you see?

Electricity can also flow through wires.

Wires are thin metal threads that conduct electricity.

When do you use electricity that flows through wires?

Many appliances such as cookers and computers use electricity.

This type of electricity can be very dangerous, but it is also very useful.

Look at this sign. Is it good or bad? Why?

Good or poor conductors?

Find out how some materials are better conductors of electricity than others.

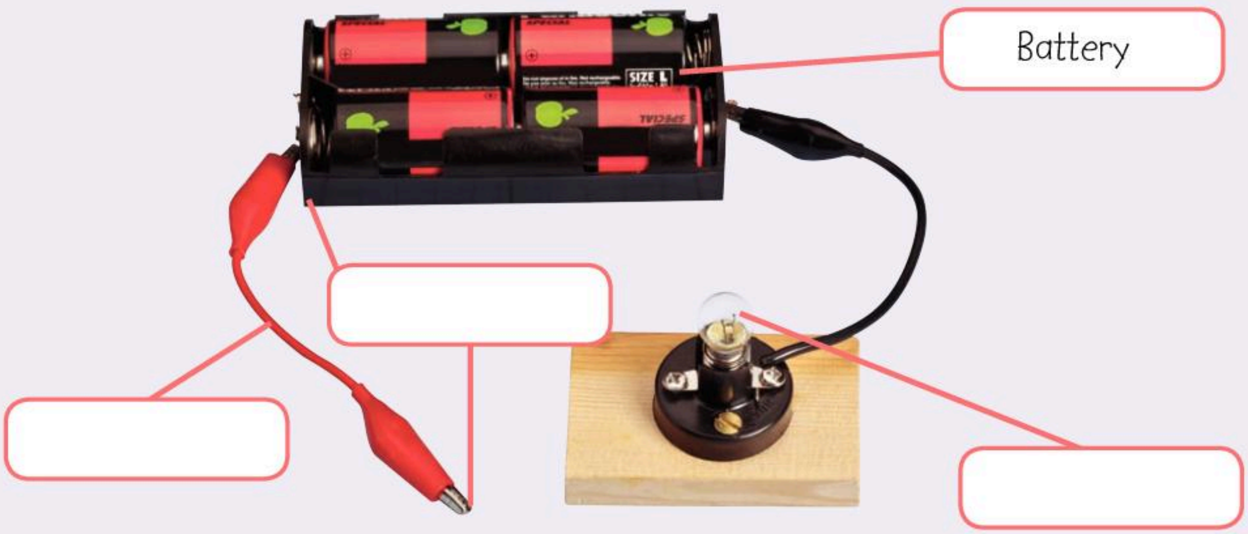
The Big Idea

Some materials are better **conductors** of electricity than others.

Can you remember any parts of a **circuit** from earlier learning?

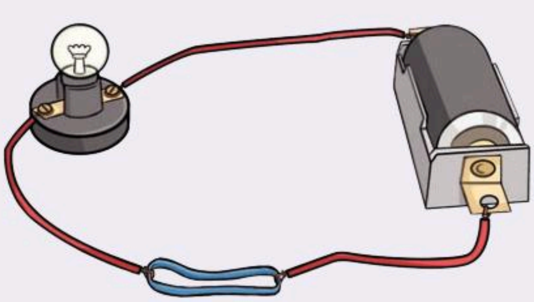
Look at the picture of a circuit. A circuit is where electricity can flow through a series of conductors.

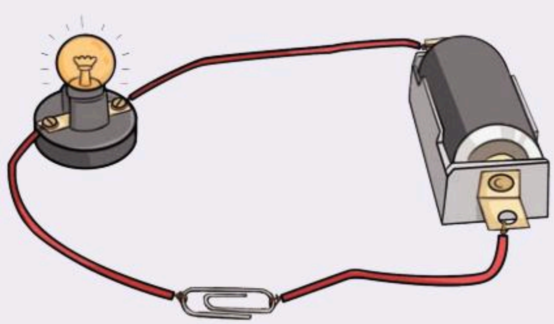
Name the parts of the circuit. Use the words from the word bank.



Word Bank

wire	~~battery~~	bulb	connectors





Look at the picture of the circuit. You can see that the bulb in the circuit is not lit up.

The bulb, or light bulb, is the glass part of a lamp. The bulb is lit up when electricity flows through it.

Why doesn't the bulb light up? How can you make it light up?

How has the circuit above been changed so that the electricity can flow from the **battery** and light up the bulb?

A battery, or cell, contains chemicals which produce an electrical current when connected to a circuit.

A **conductor** is a material that allows electricity to flow through it. Electricity flows through some conductors easily.

Some materials are poor conductors. Electricity does not flow easily through them.

Investigation: Let's investigate which is the best conductor. You will use the circuit we saw earlier.

We use batteries to investigate electricity. Electricity from sockets at school or at home is dangerous. It is safer to use a battery.

Remember

If the bulb lights up, then electricity must be moving through the material from the battery to the bulb.

Use a table to help you to record your results (write down what you have found out). Copy and complete the table below in your Investigation Notebook.

Material	Good conductors	Poor conductors
Paper		✓

Group the materials into good conductors and poor conductors.

Do not touch any bare wires. Keep the batteries in the battery holder.

Think about...

What is a superconductor?

Are all conductors the same?

Can you find a pattern in your results? Which materials are better conductors? Which materials are poor conductors?

In your group choose one material that you think is the best conductor. Compare your choice with other groups' choices.

Insulators

A material that does not allow electricity to flow through it is called an **insulator**. Insulators have important uses. They can stop electricity flowing into you.

Think about your investigations. Which materials are insulators?

The wires in the circuit you are using are covered in plastic. Why?

Plastic is a material that cannot conduct electricity.

Good or poor conductors?

Find out how some materials are better conductors of electricity than others.

The Big Idea

Some materials are better conductors of electricity than others.

Think back to the last unit. Which materials were good conductors? How did you find this out?

Imagine we do the investigation again. This time the bulb lights up and it is very bright. What does this tell you about the material? Is it a good conductor? Is there a lot of electricity reaching the bulb?

If the bulb lights up brightly, then lots of electricity is passing through the material from the battery to the lamp or bulb. This material must be a good conductor.

Think about...

What is an electric shock?

Amazing fact

Humans are very good conductors of electricity!

That is why you have to be very careful when using electricity. If electricity is conducted through humans, they may get an electric shock. This can be very serious. Electricity can kill!

Some electrical things use batteries as a source of their electricity.

Make a list of three things that use batteries. Here's an example to get you started.

Torch

In many cities and homes we use electricity that flows from a power station through cables. This is called mains electricity.

Cables are made of two or more wires fixed together side by side and used to conduct electricity.

Make a list of five things that you plug into the mains electricity. If you cannot think of any, look around the room where you are for a clue. Here's an example to get you started.

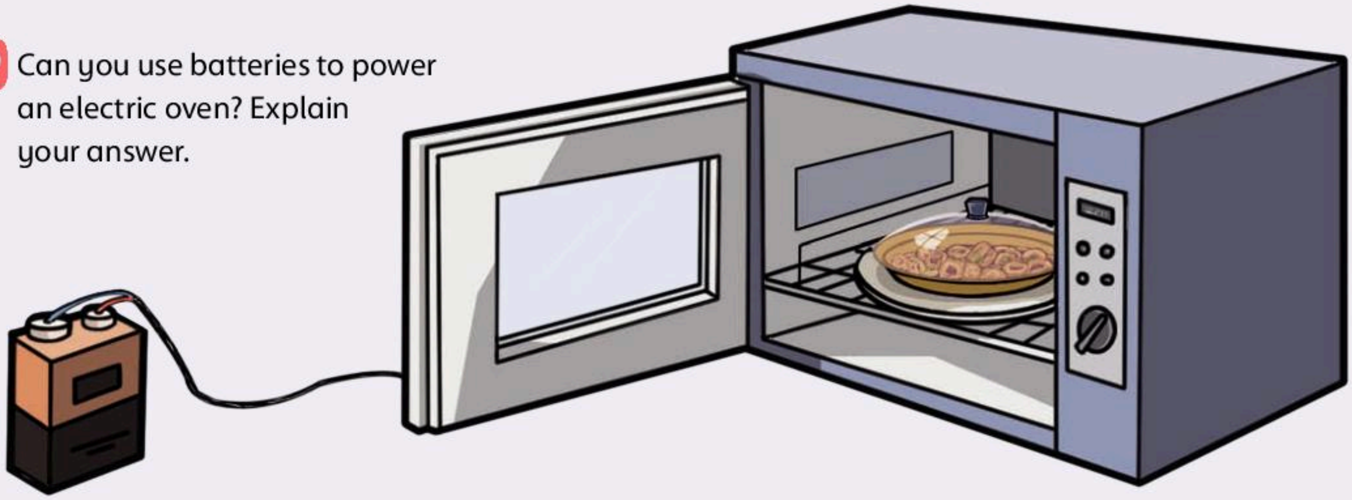
Computer

Electricity from the mains is much more powerful than batteries.

From your list, decide which thing needs more electrical power to work properly.

When electricity is used to make something work scientists say electricity powers it.

Can you use batteries to power an electric oven? Explain your answer.



Electricity flows through a circuit when everything is joined up correctly. We call this electricity the current. The current flows from the power source, which produces the electricity, through conductors back to the power source. This is why it is called a circuit, like a running track.

If there is a break in the circuit, the electricity will not flow. The electric oven and your other appliances will not work.

That is why good conductors are used in homes, schools and hospitals to make sure all the electrical appliances work when they are needed.

Insulators are useful because they stop electricity from flowing into us. They can stop or slow down the flow of electricity because they do not conduct electricity.

1 Can you explain why an electrical circuit is called a circuit?

2 Can you predict (think about and suggest) any materials from your investigations that will make good insulators?

3 What happens if the wire to your teacher's computer breaks? Why is it important to use the correct type of wire to mend your teacher's computer?

Now turn to page 92 to review and reflect on what you have learned.

Choose your conductor

Find out how some metals are good conductors of electricity and most other materials are not.

The Big Idea

Some metals are good conductors of electricity. Most other materials are poor conductors.

List any metals you can think of. Here's an example to get you started.

Gold

Choose two of the metals on the list. What do you think they are used for?

Remember from your investigations which materials were good conductors. They were usually metals.

Amazing fact

You may have seen gold used in jewellery or coins, but gold is a very good conductor of electricity.

Never put electrical appliances near water. It is very dangerous.

How can you investigate this?

There are some non-metals that are good **electrical conductors** too. For example, graphite in your pencil, tap water and sea water. That is why you must never spill water near an electrical socket as it can **conduct** electricity into you!

Think about...

Look at the information above. Why do you think humans are good conductors of electricity?

Are all conductors the same?

You know that lots of materials are good conductors. Now we will find out if some materials are better than others.

How can you find out which materials are good conductors and which are not as good?

Investigation: Set up your test circuit again. This time you are going to investigate different metals.

Copy and complete the table below to record your observations. One example is given to you to get started.

Metal	How bright is the bulb?
Copper	Very bright

Look at your observations. Are some metals better conductors than others?

Write down some ways you can improve your investigation to make it a fair test.

You used the brightness of the bulb to measure the amount of current flowing through the circuit. Scientists use a piece of equipment to measure the current in a circuit. It is called an ammeter. The stronger the current is, the higher the number on the ammeter.

In your group investigate which materials conduct electricity the best. This time use an ammeter to measure which material allows the most current through.

Make a table in your Investigation Notebook. Put the best conductor at the top and the worst conductor at the bottom.

Do you remember which materials conducted electricity the best?

Does this investigation agree with what you learned before?

Copper, steel, gold, silver and iron are some of the best electrical conductors.

Did you find that metals were good conductors?

Remember

The brighter the bulb, the better the conductor is.

Amazing fact

A French scientist called André-Marie Ampère invented the ammeter.

The unit used to measure current is the ampere (or amp). The amp is named after him. The symbol for the ammeter is Ⓐ.

An ammeter measures the current flowing through a circuit.

1 Which metal was the best conductor?

2 What does an ammeter measure?

3 What other materials conduct electricity?

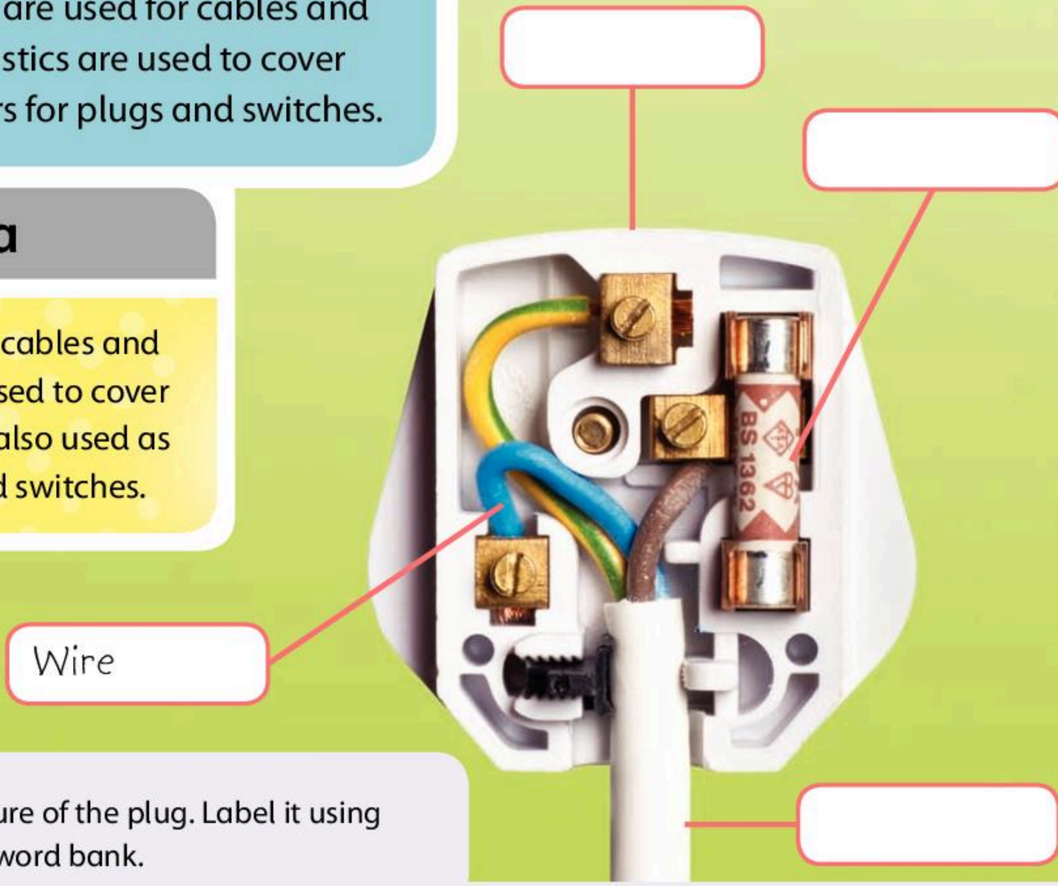
Now turn to page 92 to review and reflect on what you have learned.

Using metals and plastics

Learn why metals are used for cables and wires and why plastics are used to cover wires and as covers for plugs and switches.

The Big Idea

Metals are used for cables and wires. Plastics are used to cover wires and they are also used as covers for plugs and switches.



Look at the picture of the plug. Label it using words from the word bank.

Make a list of all the materials you can see in the picture. Here's an example to get you started.

Plastic

Word Bank

~~wire~~ **fuse** **casing** **cable**

Copper is mostly used in the wires in your classroom and at home and in electrical sockets. This is because copper is a good conductor. It lasts a long time.

Metals used to make wires must have other properties, not only conductivity. They need to be stretched and pulled into wires. The wires must be cheap to make.

Look at the information in the table below. Then answer the questions that follow.

Metal	Conductivity	Can be pulled into a wire	Cost
Gold	Very Good	Very easy	Very expensive
Copper	Excellent	Very easy	Very cheap
Mercury	Good	Not possible	Expensive
Graphite	OK	Not possible	Cheap
Aluminium	Very good	Very easy	Cheap

a Why do you think gold is not used in wires often?

b Why is copper used in wires more than other metals?

Overhead cables sometimes have to stretch across very large distances. They connect homes and other buildings to the main supply of electricity.

Aluminium is the best metal for overhead cables. This is because it is cheaper than other metals. It is also strong when it is made into wires.

The aluminium cables carry more than 765 000 volts of electricity. The batteries you used in your investigations carry about 1.5 volts.

Why are overhead cables from power stations made from aluminium?

What material is the casing of the plug made from?

Amazing fact

The longest overhead cable is 2.7 kilometres. It connects Zhoushan island to the Chinese mainland.

Why is this material used?

What can happen if the insulation around a wire breaks?

1 Why are wires covered in plastic?

2 What metal is used in wires around the house?

3 Explain why gold is not used in overhead cables.

Now turn to page 92 to review and reflect on what you have learned.

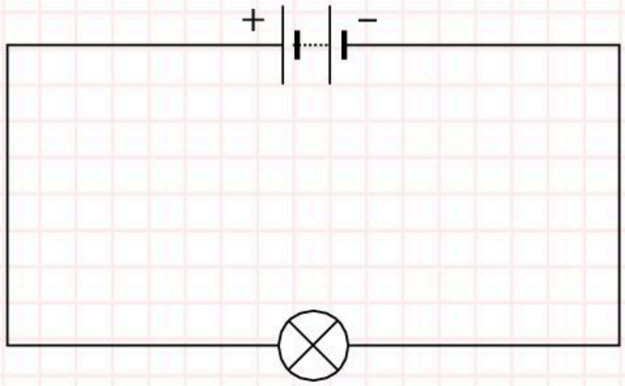
Making and breaking circuits

Predict and test the effects of making changes to circuits.

The Big Idea

Predict what will happen before you make a change to a circuit. Make the change and see what happens.

Can you make the circuit in the diagram?



Can you predict what will happen to the circuit if you add more bulbs?

Write down the answers to these questions.

a What will happen if you increase the number of batteries?

b What will happen if you increase the length of the wires?

Investigation: In your pair plan an investigation into what happens when you change parts of your circuit. Start by making a simple circuit as before. Then decide what you are going to change.

Write down the answers to these questions.

a Are you going to change the number of bulbs?

b Are you going to change the number of batteries?

c Are you going to change the length of the wire?

d What are you going to measure?

To make the test fair you must only change one thing at a time. For example, if you are investigating the length of the wire, then the number of batteries and bulbs must stay the same.

What will you keep the same in your investigation to make it a fair test?

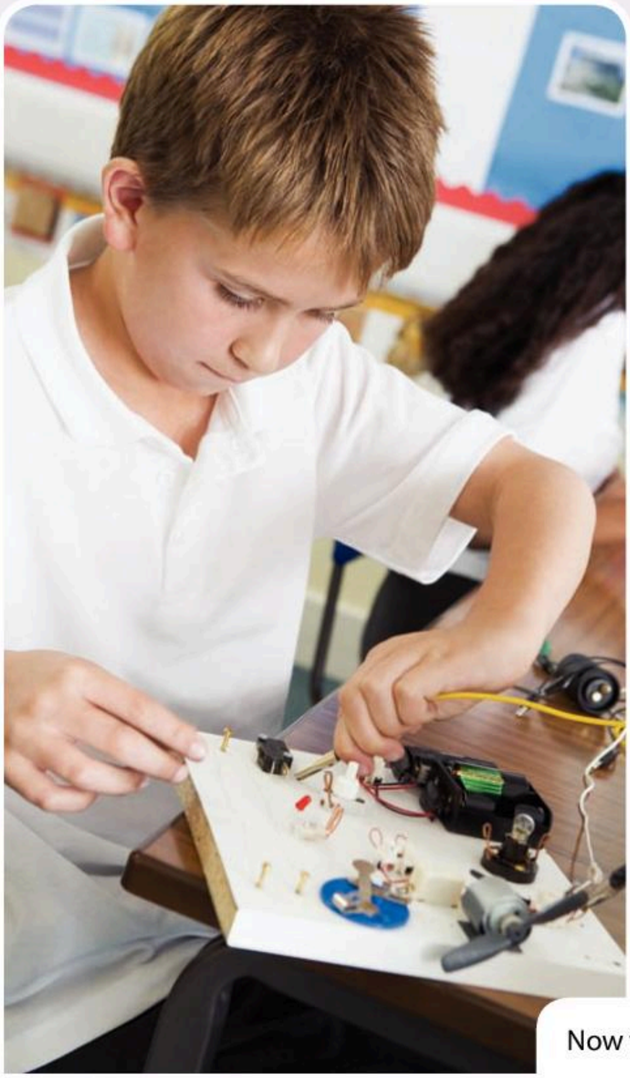
Think about...

How many different ways can you investigate wiring three bulbs into a circuit?

In your Investigation Notebook, draw a picture of the circuit you are using to test what happens when you make changes to your circuit.

How will you record your results?

Investigation: Carry out your investigation.



Record the change you made. Write down what happened to your circuit.

A conclusion is a decision you come to when looking at the results in an investigation.

Can you write a conclusion from your results?

How did you make sure you carried out a fair test? What did you do?

Remember

How you measured how good a conductor was.

1 What will happen to the brightness of a bulb if the wire is thicker?

2 What will happen to the brightness of a bulb if the wire is shorter?

Now turn to page 93 to review and reflect on what you have learned.

Using circuit diagrams

Draw diagrams of series circuits using symbols.

The Big Idea

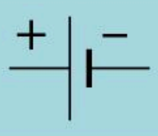
You can draw series circuits to show what they look like. You can use symbols to show different parts of a circuit.

A series circuit is an electric circuit which has only one path through it.

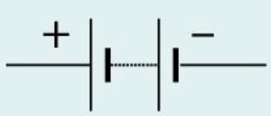
List all the things you use when making circuits.

It takes time to draw the different types of circuits. Think how long it took you to draw a circuit. To save time we use symbols to draw **diagrams of circuits**. All the things you drew are called components, or parts. There is a symbol for every component we use.

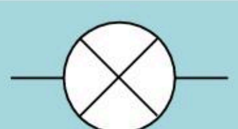
The symbol for a cell is



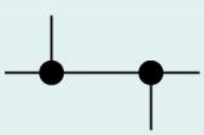
The symbol for a battery is



The symbol for a bulb is



We draw wires as straight lines



What is a battery?

A battery is a collection of smaller units called cells.

One end of a battery is positive (+). The other end is negative (–). When you make a circuit with more than one battery you must set up the batteries correctly. You must join together opposite ends of the battery so that the current flows round the circuit. You must not join two positives or two negative ends together. If you join the same ends together the current will not flow round the circuit.

Why does the circuit have to be complete for electricity to flow?

Think about...

Some scientists say that a battery acts like a water pump. Can you use the information above to explain this idea?

Which conductor will you use? Why?

Can you draw circuit diagrams with these parts or components? Draw the diagrams in your Investigation Notebook.

a one battery, wires and one bulb

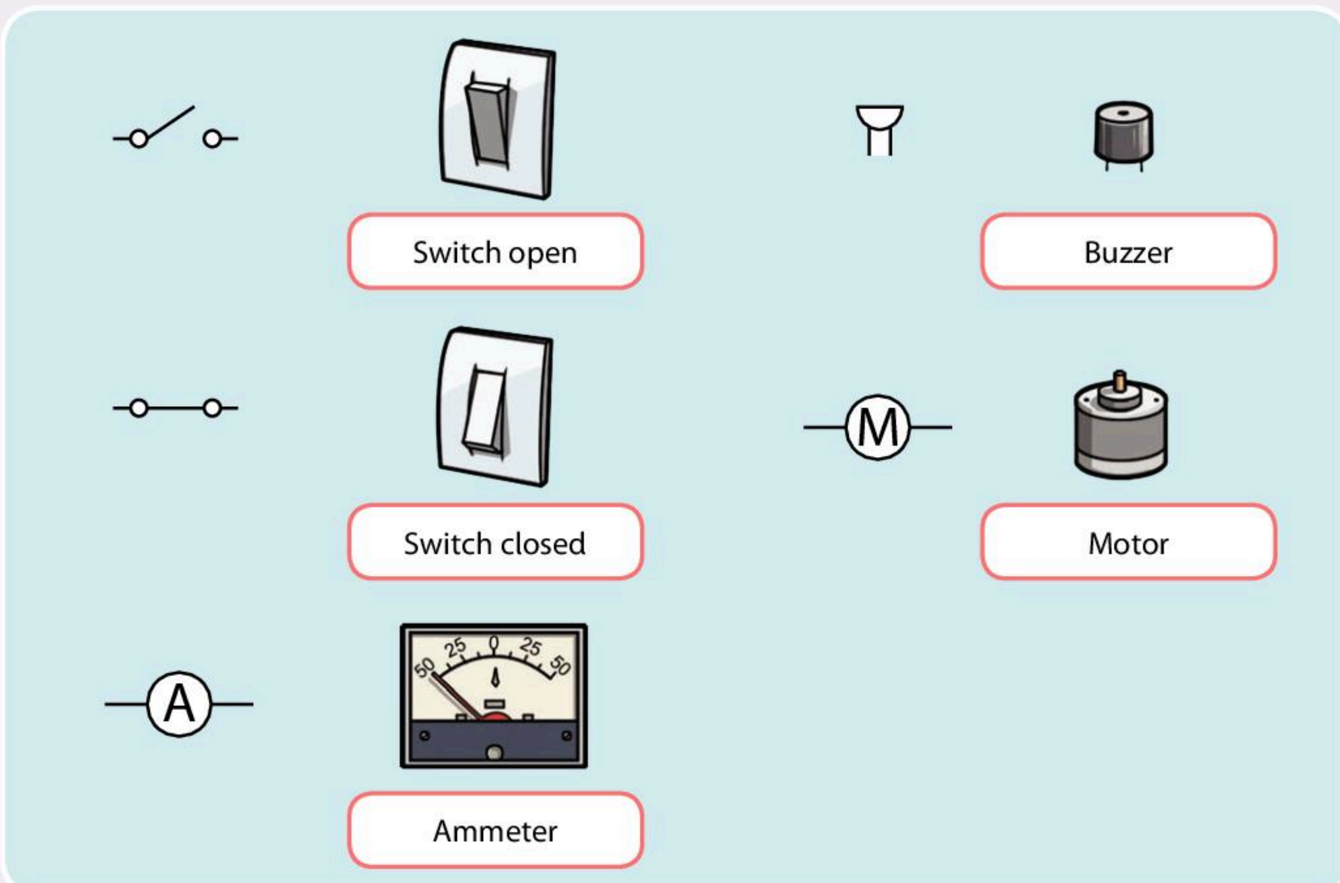
b two batteries, wires and one bulb

c two batteries, wires and three bulbs

d two batteries, wires, three bulbs and an ammeter.

There are many important symbols that you need to learn. You know the symbols for cell, battery, wire and bulb.

Look at the symbols below.



You need to practise drawing circuits with these symbols.

Try drawing the following circuits in your Investigation Notebook.

a two bulbs, one battery, wires, a switch and a motor

b two batteries, wires, one bulb and a buzzer.

Using circuit diagrams

Draw diagrams of series circuits using symbols.

The Big Idea

Make a circuit from a circuit diagram.

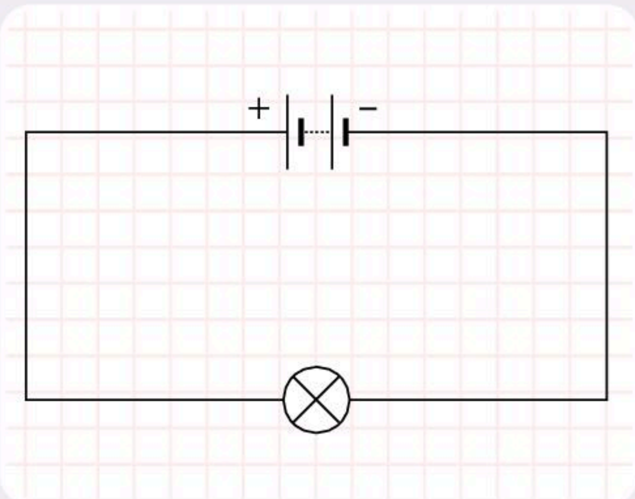
What is a conductor?

Can you list three conductors?

Can electricity cross the gaps in a circuit?

How can the cars get to the other side of the bridge?

Electricity cannot cross the gaps. It has to travel through a conductor.



Look at the **circuit diagram**. Are there any gaps between the wires and the other components?

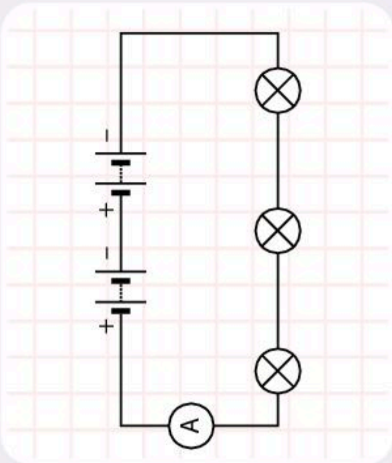
A circuit diagram must be drawn accurately. There must be no gaps between the wires and the components. This is because the diagram shows how electricity flows through a real circuit.

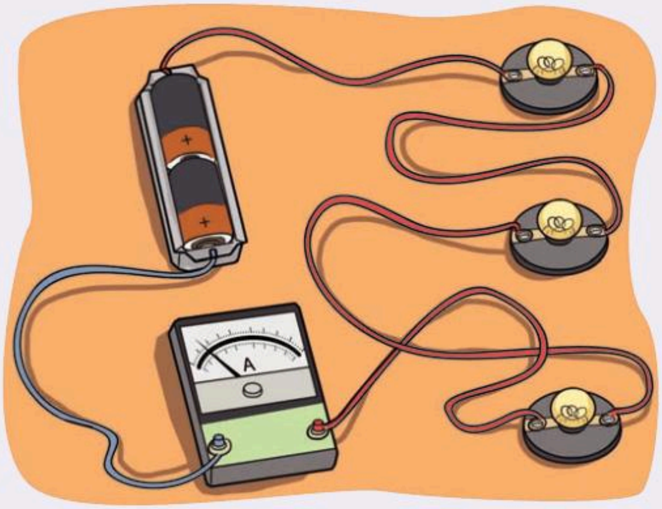
Why do we use circuit diagrams?

Circuit diagrams are neater and easier to follow than other pictures. The symbols are the same everywhere in the world. This means that a person can follow a circuit diagram without being able to speak the language.

The wires in an actual circuit can look jumbled up. The bulbs and other components can be spread out over a whole building. A circuit diagram uses straight lines and is tidier.

When scientists show a simple version of something it is called a model.





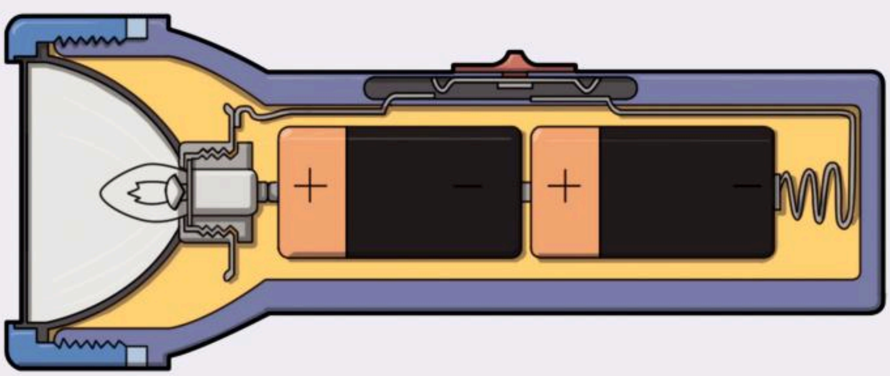
Look at the pictures of a circuit. Then answer the questions.

a Which of the pictures shows a circuit diagram?

b Which of the pictures is easier to understand?

c Write down two reasons why circuit diagrams are used worldwide.

Look at the picture of the torch. Draw a circuit diagram in your Investigation Notebook to show how the batteries, bulbs and wires in the torch will be connected.



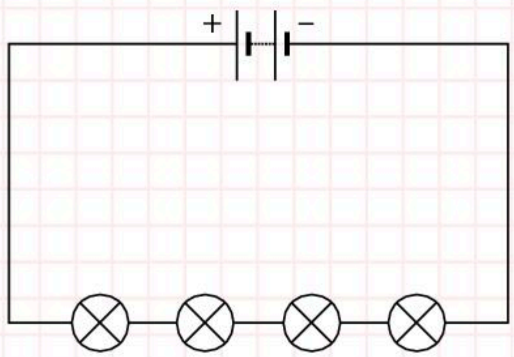
Using circuit diagrams

Draw diagrams of series circuits using symbols.

The Big Idea

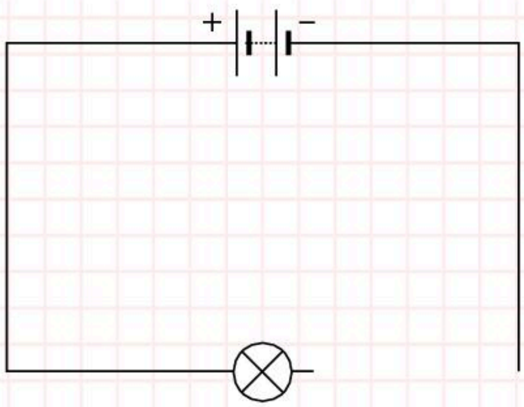
Diagrams can be used to predict if a circuit will work.

Look at the circuit diagram. How bright will the bulbs be? How could you make them brighter?



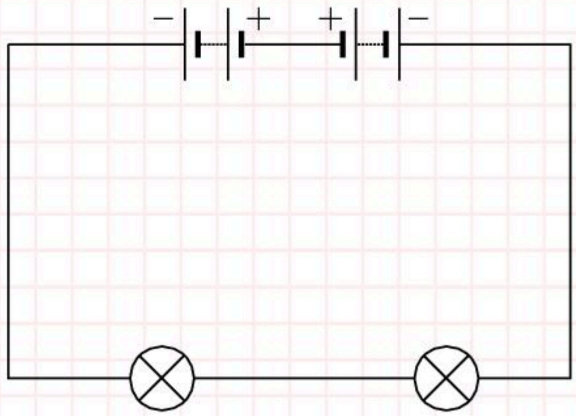
In a circuit diagram there must not be any gaps between the symbols and the wires. This is because the diagram shows how electricity flows through a real circuit.

A student drew the diagram below.



Will this diagram work? Can you explain why? Can you correct it?

What is wrong with the student's diagram? Correct the diagram. Redraw it in the box below.

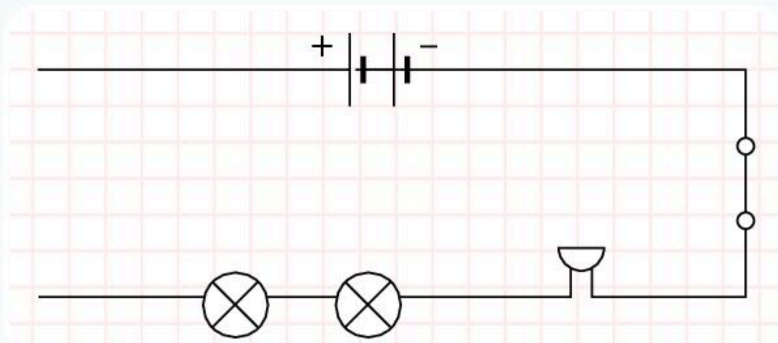


In your Investigation Notebook, draw an accurate circuit diagram with three batteries, wires, two bulbs and a closed switch. Colour in the bulb to show how bright you predict it will be.

In your Investigation Notebook, draw another diagram with one battery, wires, two buzzers and an open switch. Will you hear the buzzer?

I will hear/not hear the buzzer.

1 Your friend built this circuit but it does not work. How can you correct it for him?



2 Copy and complete the table. Name the missing components and draw in the symbols.

Component	Symbol
Battery	
Switch closed	
	
Bulb	

Now turn to page 93 to review and reflect on what you have learned.

What we have learned about electrical conductors and insulators

Good or poor conductors?

(pages 76–9)

True or false? Electricity travels through conductors.

What do we call materials that do not conduct electricity?

I know the difference between conductors and insulators.

I understand how insulators protect us.

Choose your conductor

(pages 80–1)

Name three good conductors of electricity.

Why do scientists use ammeters?

I can name three metals that conduct electricity.

I know why we use an ammeter.

Using metals and plastics

(pages 82–3)

Why is copper used in wires and electrical sockets?

Metals used in wires must have two properties. Name them.

Why are wires covered with plastic?

I understand why plastics are used to cover wires, plugs and switches.

I know why aluminium is the metal used in overhead cables.

Making and breaking circuits

(pages 84–5)

Write down three components of a simple circuit.

What happens to the bulb if the battery is not connected properly?

A person investigates what happens to a circuit when the number of bulbs is changed. The person also changes the number of batteries. Is it a fair test?

I can name three components of a simple circuit.

I understand that electricity will not flow if there is a break in the circuit.

I know how to carry out a fair test.

Using circuit diagrams

(pages 86–91)

Draw the symbol for a battery.

Draw the symbol for a bulb.

Draw a circuit diagram for a circuit with a battery, wires, a buzzer and two bulbs.

I know how to draw a series circuit diagram using symbols.

5 Caring for the Environment

In this module you will:

- find out how humans have positive (good) and negative (bad) effects on the environment
- think about a number of ways of caring for the environment.

Word Cloud

environment
recycle
litter
conservation
pollution
landfill
acid rain
greenhouse effect
deforestation

Amazing fact

Did you know that we can harm our **environment** just by the way we live our lives? Good news! We can do something about it!

- How can we work to save our natural world?
- What can we do to save energy?
- How do we harm our world?
- How can small things such as recycling help to care for our environment?

Looking after our world

Find out how humans have positive and negative effects on the environment.

The Big Idea

We can affect our environment in positive and negative ways.

What do tigers and pandas have in common?

Protecting the environment

There are many animals and plants that are endangered. We will lose these endangered species (species are types of living things) forever unless we protect them and their natural habitats. They will become extinct.

A habitat is where an animal or a plant lives. Many animals and plants are lost due to human activities. Hunting and cutting down forests can destroy natural habitats and the animals and plants that live there. There are many plants we have not yet discovered. They may help us with medicines or other useful things.

Why is it important to protect endangered species and habitats?

Write down two ideas here.

How can we protect endangered species?

Write down two ideas for protecting endangered species and habitats.

What can we do to protect our environment?

Throughout the world caring for the environment is big news. There are many organisations that work to help protect the environment. One of these organisations is the World Wide Fund for Nature (WWF). It works to protect the future of the natural world. The WWF started its **conservation** work over 50 years ago.

We can do lots of things to help protect our environment. Here are some ideas:

Teach others how important it is to protect the environment.

Replace trees in forests. Repair damaged habitats.

Encourage others to care for the environment.

Establish parks and nature reserves.

Show you care by doing simple things. Here's something you can do to help. Remember to turn off lights when you leave a room.

Remember TREES!

Imagine a habitat in your local area. The habitat is in danger of damage. What can you do to protect the habitat?

Write down two ways you can protect a local habitat.

Complete the following information about the environment. Use the words from the word bank. The first one is done for you.

Human activities can have positive and ________ effects upon the environment. There are some plants we have not yet ________. They may help us with new ________. It is important to protect the environment so we can save habitats for ________ species.

Word Bank

negative	**endangered**	~~**activities**~~
discovered	**medicines**	

Think about...

Imagine you can design your own natural habitat. What animals and plants will you include?

What can you do to make sure your habitat is not damaged?

Looking after our world

Find out how humans have positive and negative effects on the environment.

The Big Idea

We can investigate the environment.

How do scientists investigate the environment?

We can investigate the environment in many ways. For example, we can count how many animals live in an area. This helps us to work out whether they are an endangered species. Organisations such as the WWF do this type of work. They have found out that some species are in danger of being lost forever.

One of the animals the WWF has counted is the Bengal tiger. There are only 1 850 Bengal tigers alive. The Bengal tiger is one of the most endangered species in the world. It is on the 'Red List'. This means it may become extinct.

The Bengal tiger is endangered because humans want the land where it lives. People need places to live and are moving into the natural habitat of the tiger. This means that the tiger is fighting to survive. As the tigers live very close to people, they are often killed by the people who live near to them. So the Bengal tiger is also endangered because of hunting.

When we investigate a habitat we need to think about a lot of things. For example:

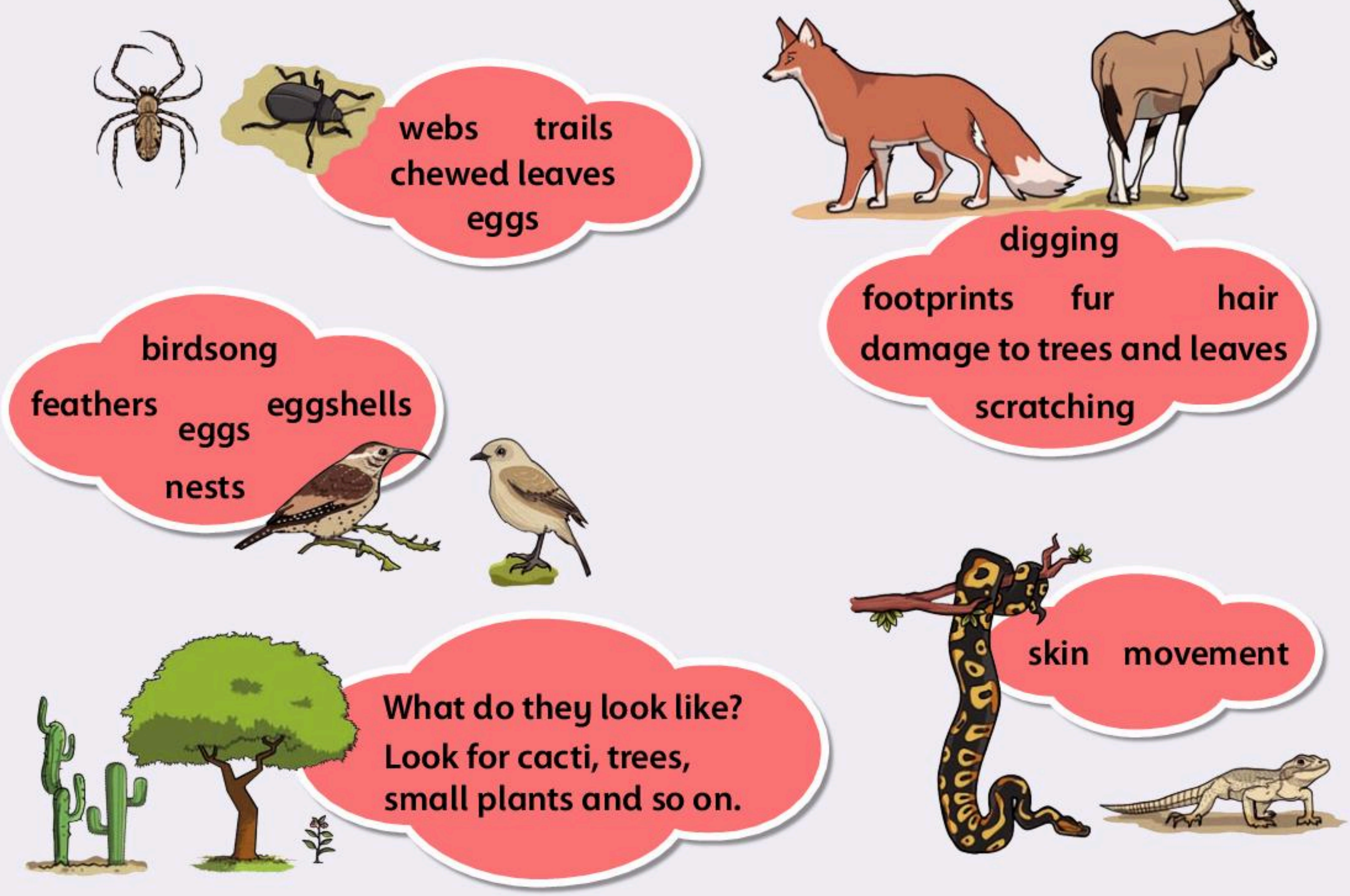
- What plants and animals live in the habitat?
- How can we identify the animals and plants in the habitat?
- How many plants and animals are there in the habitat?
- What clues can we look for?
- What are the threats to the habitat?
- How can we protect the habitat?

How can the Bengal tiger be protected?

Write down two ideas about how to protect the Bengal tiger.

Here are two activities about the environment. Your teacher will decide which one you will do.

Investigation: Investigate a local habitat. Try to identify the plants and animals that live in the habitat. The picture shows you some clues you can look for. Write down what you see on the identification key your teacher gives you.



Create an information leaflet about the habitat. Include tables, bar charts or line graphs of your findings in the leaflet. Identify what can be done to protect the habitat for the future.

Investigation: Imagine you work for a local company. Near where you work is a large area of land that is not used. You want to create a small natural habitat in this area. Design your perfect natural habitat. Share your ideas with your group.

Think about...

We have thought about why we need to protect natural habitats and endangered species. But what can we do about things we do that damage the environment?

We do lots of things that can damage the environment. Can you think of any examples? Clue: Think about where our power comes from.

Looking after our world

Find out how humans have positive and negative effects on the environment.

The Big Idea

Human activities can damage the environment but we can help to repair the damage.

Look at the pictures. What do you think has happened to the trees?

Human activities can affect the environment in lots of ways. Human activities can have positive effects on the environment. They can also have negative effects.

We also need to think about how we can repair an environment that humans have damaged.

Acid rain

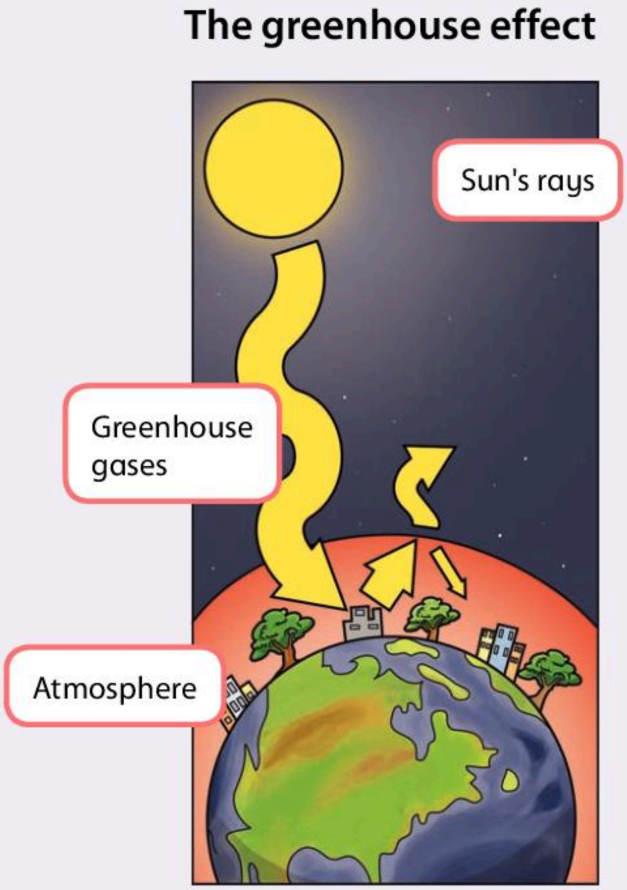
Rain is very important for life. All living things need water to live. Rain brings us water that we need. In many places in the world, rain is a problem. **Pollution** from factories, cars, buses and lorries, and homes makes the rain more acidic. This rain is known as **acid rain**.

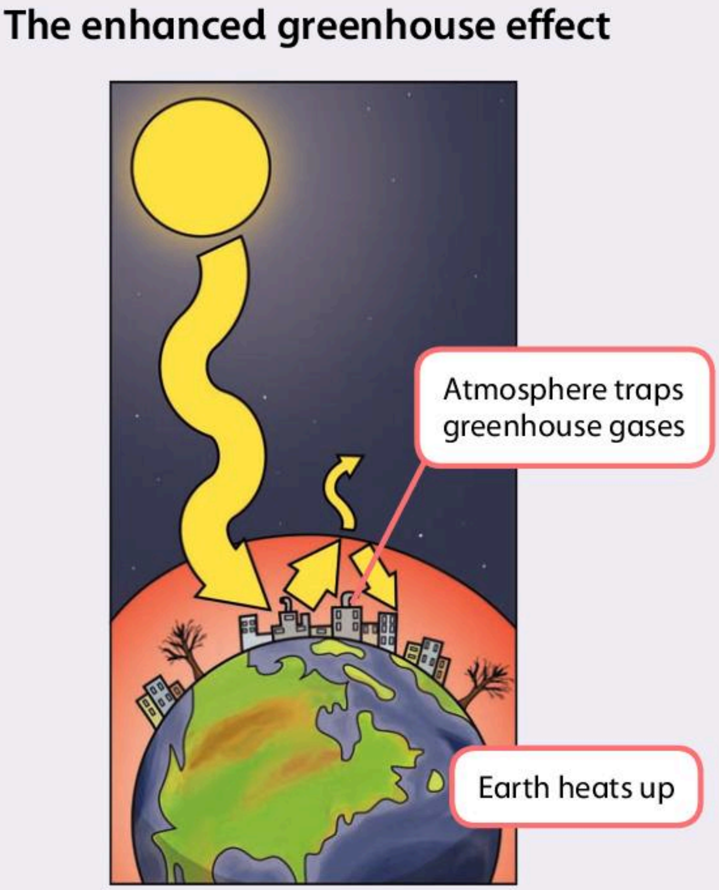
When fossil fuels such as coal and oil are burned in power stations, factories or in our homes, they make acidic gases. Most of these acidic gases are mixed into the air. When the gases mix with the clouds it can cause rain to become more acidic. Acid rain can damage living and non-living things.

Look at the picture to see how acid rain can damage buildings.

How can we reduce the amount of acid rain?

Write down two ways to reduce the amount of acid rain.





The Earth is surrounded by layers of gases. The layers are called the atmosphere.

The **greenhouse effect** is a natural process. The atmosphere traps some of the Sun's heat energy. This warms the Earth so that it can support life.

The main greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide and ozone.

Many scientists think that human activities increase the amount of greenhouse gases in the atmosphere. This is known as the enhanced greenhouse effect. It is one of reasons why people are concerned about climate change. The gases the scientists are worried about are:

- carbon dioxide – this comes from burning fossil fuels and cutting down trees
- methane – this comes from rice paddies and from animals such as cows.

How do you think we can reduce the enhanced greenhouse effect?

Write down two things we can do to reduce the enhanced greenhouse effect.

Think about...

We have thought about how gases can produce acid rain and the enhanced greenhouse effect.

How else do we damage the environment? Clue: Think about the materials we use for buildings.

Looking after our world

Find out how humans have positive and negative effects on the environment.

The Big Idea

We need lots of things to live in a modern world. Do they harm our environment?

What is your house made of?

Quarrying

We need certain materials so that we can build homes, shops, factories and offices. We need limestone, chalk and clay for our buildings. These materials are found in the ground.

We get limestone, chalk and clay out of the ground by quarrying. Local people earn a living working in the quarry. Quarrying also gives the local community an income. Unfortunately, quarrying can have a negative impact upon the environment. You can see this damage in the picture.

What do you think quarrying has done to the local environment?

Write down two ways we can repair the damage caused by quarrying.

Deforestation

We need wood. But how much wood do we need?

Deforestation means cutting down trees on a very large scale. Forests are cut down for wood for buildings, furniture, doors and paper making. Forests are also cut down to make room for growing crops and for building new houses.

Why is deforestation a problem?

If we cut down large areas of trees many things can happen.

- When large areas are cleared of trees, the soil can be washed away. This means that no new plants can grow.
- Trees absorb rainfall. If deforestation happens in mountainous regions, there are no trees to soak up the rainfall. This can cause flooding in the lower regions.

- Trees can help produce rainfall. Without forests the climate may become drier.

How can we reduce the effects of deforestation? We can plant trees to replace the ones chopped down. We can stop chopping down very old forests.

Quarrying and deforestation are two human activities that have a negative effect upon the environment. But there are many more.

Waste disposal

How does waste disposal affect the environment?

Water pollution

How does water pollution affect the environment?

Write down two effects of waste disposal on the environment.

Write down two effects of water pollution on the environment.

We have thought about the positive and negative effects of some human activities on the environment. How much do you remember?

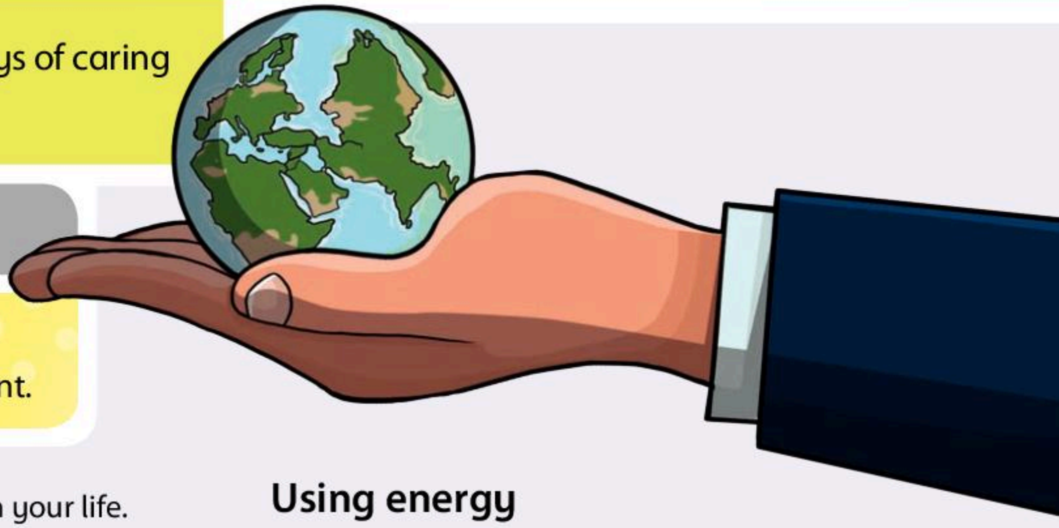
True or false?

		True/False
1	We can reduce the problems caused by acid rain.	________
2	We can help the environment by planting more trees.	________
3	It is not important to protect endangered species and habitats.	________

Now turn to page 112 to review and reflect on what you have learned.

Caring for the environment

Think about a number of ways of caring for the environment.



The Big Idea

By doing small things we can help to care for the environment.

Think about a typical day in your life. How is your food cooked? Where do you go? What energy do you use?

Our environment needs our help to protect habitats and endangered species. We need to think about the local and the global (world-wide) environments. Many of our activities affect the local and global environments. Here are some ways to help care for the environment.

Power stations produce the electricity we use every day

Using energy

We use energy for lots of things. If we want to care for the environment we need to think about the energy we use. We also need to think about how our energy is produced.

What type of things use energy?

Write down three things in your home that use energy.

Saving energy

One of the things we can do to care for the environment is to use less energy in our everyday lives. When you walk out of a room at night do you turn off the light?

How can we reduce the amount of energy we use?

Write down two things you can do to save energy.

Save energy, save money

Producing energy can cost a lot of money. We pay for the energy we use. So if we save energy we can save money and also help to care for the environment.

Renewable energy

There are lots of different ways to produce the energy we need. Some ways of producing energy pollute the environment. There are other cleaner ways of producing energy.

Solar panels capture sunlight energy which is coverted into electrical energy for use in the home

Many countries are producing energy using renewable sources – sources of energy which are never used up. Solar power (from the Sun), hydroelectric power (from water), geothermal power (from the heat inside the Earth) and wind power are examples of renewable sources of energy. Renewable energy does not affect the environment as much as other ways of producing energy. We call this environmentally friendly energy production.

Talk about renewable energy.

What examples of renewable energy can you think of?

Complete the following paragraph about our use of energy. Use words from the word bank. The first one is done for you.

We use __energy__ in our everyday lives. We can save energy by doing simple things. We need to remember to turn off __________ when we leave a room at night time. When we save energy, we also save __________. We can produce energy using renewable sources. The __________ and the wind are renewable sources.

Word Bank

light bulbs **Sun** ~~**energy**~~ **money**

Caring for the environment

Think about a number of ways of caring for the environment.

The Big Idea

We need to reuse things to help care for our environment!

Do you like to drink bottled water or fizzy drinks? What is the bottle made of?

When you finish your drink what do you do with the bottle?

Recycling

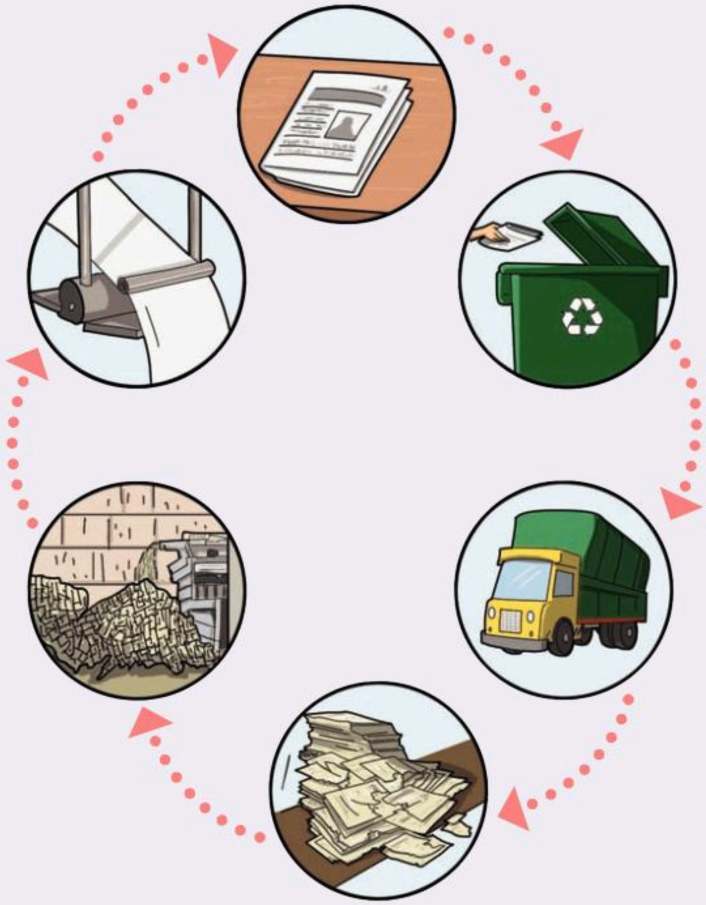
We can help our local and global environments in many ways. One way is to **recycle**. Recycling is a way of reusing things we no longer need. Recycling also helps to reduce waste.

Recycling glass

One of the things we can recycle is glass. We use glass for many things such as drinks bottles and food jars. If we recycle our empty bottles and jars we can make new glass products.

Recycling paper

We use paper in lots of things such as newspapers and paper bags. We can also recycle paper. Then we can save trees!



What other things can be recycled?

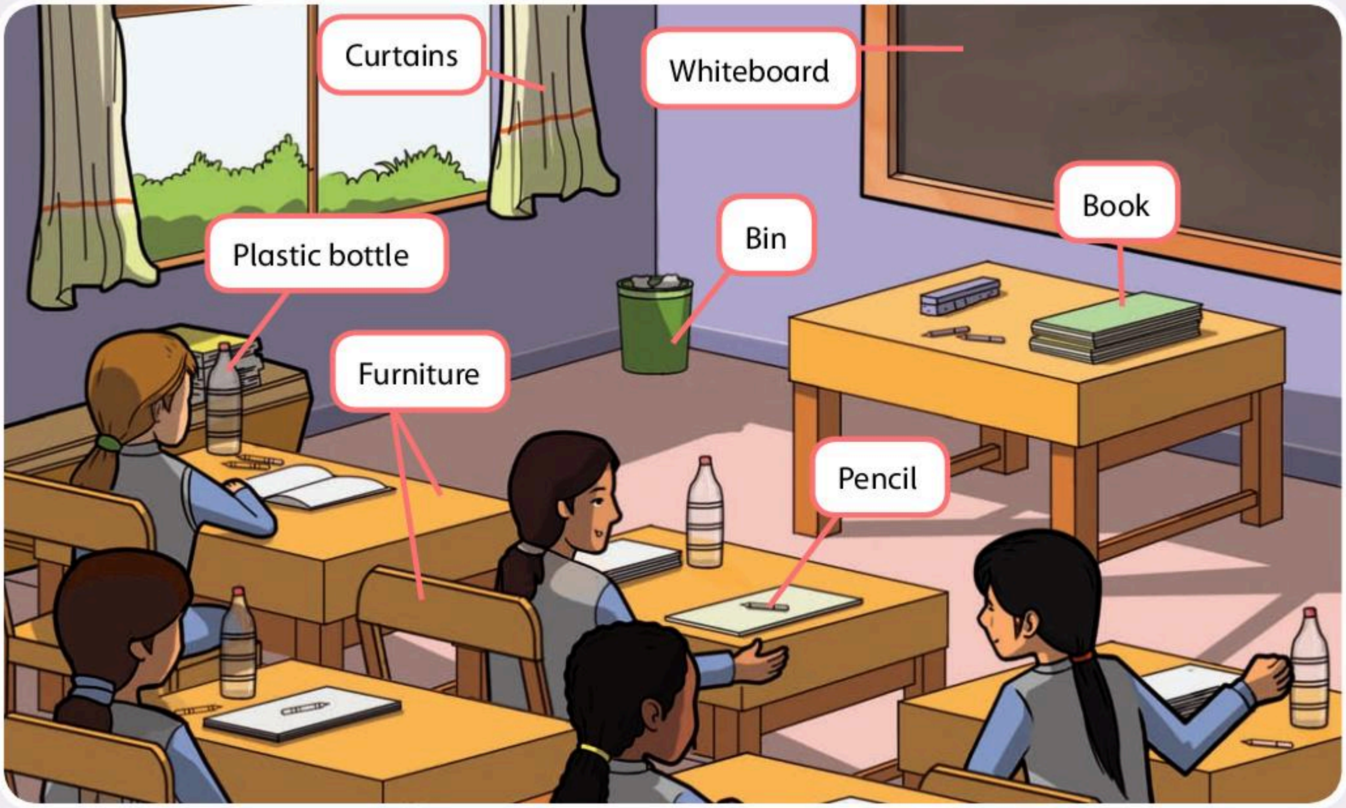
Write down two things that can be recycled.

Recycling in the classroom

Investigation: Find out about recycling by looking at the things we throw away.

Write the results of the investigation in your Investigation Notebook.

Look at this picture of a classroom and compare it to your own classroom. Answer the questions.



a Name one thing in your classroom that can be recycled instead of thrown away.

b How can we encourage recycling in the classroom?

c What can we do with the things that cannot be recycled?

Complete the following paragraph about recycling. Use words from the word bank. The first one is done for you.

We can help our local and ___global___ environments by recycling. ________ is an example of something that we can recycle. There are some things that ________ be recycled. Think before you throw anything away. Can it be ________? If it cannot be recycled then put it in the ________.

Word Bank

recycled **cannot** **~~global~~** **glass** **bin**

Caring for the environment

Think about a number of ways of caring for the environment.

The Big Idea

We can care for the environment by tidying up and not dropping litter.

What do you do with your **litter**? Do you put it in the litter bin? Do you throw it on the ground?

What is litter?

Litter is any waste materials, for example empty drinks bottles that people throw away carelessly. Litter can be found in many places.

Where can we find litter?

Write down three places where we can find litter.

Often when people drop litter they think "my small piece of litter will not make a difference". Imagine if we all thought like that. Then we would have big problems!

What sort of thing do we think of as litter? Think about the food and drink you have. Think about the sort of packaging it comes in.

Write down three different types of litter.

Why do we need to care about littering?

Littering causes many problems. Litter is not very nice to look at. It is not nice to walk past litter on the way to school, home or work. The problem is more serious than this though. Litter can harm people because it can attract rats that carry diseases. Some litter may contain broken glass that can harm people and animals. As litter builds up it needs to be put somewhere else so that it does not harm people or animals. By carelessly dropping litter we put ourselves and wildlife at risk.

Imagine a hungry animal trying to find food. It smells food but it isn't food. It is food packaging. There may be a small amount of food in the packaging. But usually there is a lot more packaging than food. The hungry animal wants to eat. It eats some of the packaging. Unfortunately, many sorts of packaging cannot be digested by the animal. Packaging can cause many health problems.

We know how important it is to not to drop litter. In some places litter is a big problem. The Maldives are very beautiful islands and are visited by lots of tourists. The tourists and the islanders produce lots of litter and general waste. To dispose of all this litter and waste one of the islands is now used as a **landfill** site.

Whose job is it to stop or reduce littering?

Is littering each person's responsibility? Or is littering the responsibility of the community?

What did you decide?

What can you do to help?

Suggest one way you can help to reduce littering.

We have looked at reducing littering and reducing waste as two ways of helping to care for the environment.

Are the following statements true or false?

True or false?

		True/False
a	It is not a problem to drop litter in the street.	________
b	I put my litter in the litter bin.	________
c	We need to reduce waste.	________

Now turn to page 113 to review and reflect on what you have learned.

Caring for the environment

Think about a number of ways of caring for the environment.

The Big Idea

We need to work together to look after our environment.

What can you do to help others to care about the environment?

In this unit you will work on a project to encourage others to care for the environment. Below is some information about projects you can do. Each project asks you some questions.

You will need to research to find the answers.

At the end of the project you will give a presentation. Think about the sort of presentation you can do. Maybe you can do a play. Maybe you can design a poster that all the school can see.

Project 1 Making our community a tidy place to be

This project is about littering.

In your group, talk about some of these questions.

a Is our school tidy or is there any litter?

b Is there any litter on the street outside school?

c Is there any litter near our homes?

d Are the play areas clean and safe to play in?

How can you do this project? Here are some ideas.

- You can find pictures on the Internet or in books of areas where litter is a problem.
- Who can you ask about litter and what happens to it?
- Where does the litter go when it is collected?
- How can we use this information to encourage people to care about the environment?

Project 2 Saving energy

This project is about saving energy.

In your group, talk about some of these questions.

a In our school, do we waste energy or are we energy efficient?

b Does our school use renewable energy?

c Is there a factory or office that uses energy near our homes?

d How can we save energy in our homes?

How can you do this project? Here are some ideas.

- You can find pictures on the Internet or in books of areas where energy is being wasted.
- Who can you ask about energy?
- Where can we find information about renewable energy?
- How can we use this information to encourage people to save energy? How can we encourage them to care about the environment?

Project 3 The problems with acid rain

This project is about the problems with acid rain.

In your group, talk about some of these questions.

a What is acid rain?

b How is it caused?

c Why is acid rain a problem?

d What can we do about reducing acid rain?

How can you do this project? Here are some ideas.

- You can find pictures on the Internet or in books of areas where acid rain is a big problem.
- Who can you ask about acid rain?
- Where can we find information about acid rain?
- How can we use this information to encourage people to understand the problems of acid rain? How can we encourage them to care about the environment?

Now turn to page 113 to review and reflect on what you have learned.

What we have learned about caring for the environment

Looking after our world

(pages 96–103)

Fill in the missing words in these sentences.

Human activities can damage the environment. Plants and animals living in their natural habitat may be ________________. If we don't protect them they may become ________________.

Can you name two things we can do to protect the environment?

How do scientists find out if animals such as the Bengal tiger are endangered?

Burning fossil fuels makes pollution in the atmosphere. Name two damaging effects pollution has on our environment.

What does the enhanced greenhouse effect do to the Earth?

Which two gases cause the enhanced greenhouse effect?

Name two human activities that have a negative effect on the environment.

I know we need to look after plants and animals to stop them becoming endangered.

I know how burning fossil fuels damages our environment.

I understand the negative effects of deforestation and quarrying on the environment.

Caring for the environment

(pages 104–11)

How can we produce energy without damaging the environment?

Scientists talk about environmentally friendly energy production. What do they mean?

Name two things that we can recycle.

Can you name two problems that litter causes?

Can you think of two ways to encourage your friends and family to care for the environment?

I know two different ways of producing energy that are environmentally friendly.

I know that recycling helps our environment in two ways.

I understand how littering causes problems.

6 Mass and Weight

In this module you will:

- understand the difference between mass measured in kilograms and weight in Newtons
- use units of force, mass and weight
- identify the direction in which forces act
- know and understand the idea of energy in movement
- understand how friction can change the speed objects move.

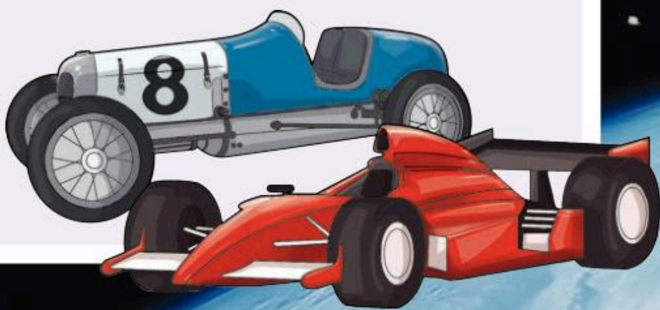
Why can astronauts float in space?

Why can't we do this on Earth?

Did you know you can jump much higher on the Moon than you can on Earth?

This building weighs thousands of tonnes. A scientist says if we take this building into space we can lift it using one hand! Can this be true?

Which of these cars do you think is the fastest? Why?



Word Cloud

kilograms (kg)
mass
force
Newtons (N)
energy
weight
direction
objects
speed up
friction
air resistance
slow down

Things that go up always come down

Understand the difference between mass measured in kilograms and weight in Newtons.

The Big Idea

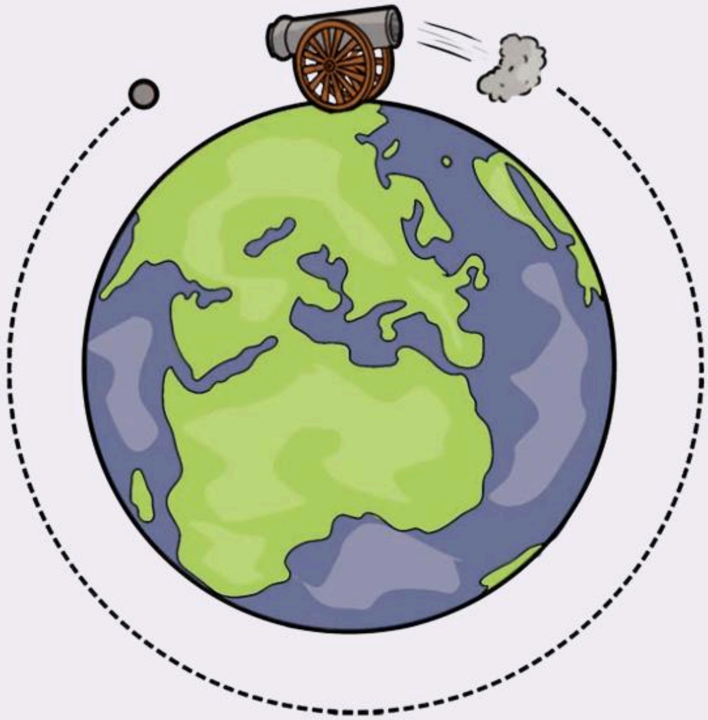
Gravity is a force.

Can you remember any forces you have studied? Write them in the box below.

The scientist Galileo

The scientist Galileo was born 450 years ago. He was famous for dropping **objects** from the top of the leaning tower of Pisa in Italy. Galileo investigated why the Moon travelled round the Earth. He dropped metal balls of different weights from the top of the tower and measured how fast they travelled. He discovered that they all travelled at the same speed.

Do you think Galileo was correct? How can you test this?



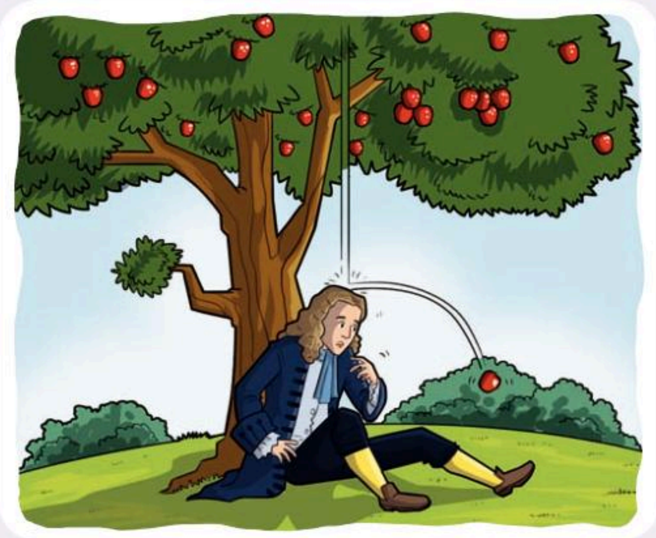
Galileo fired lots of cannon balls from different places. He discovered that the faster the cannon ball travelled the less curved its path was. He thought that if a cannonball travels very fast it will never land on the Earth. It will keep falling. He thought this was how the Moon orbited round the Earth but never landed on it.

Other people believed that a **force** was pushing the Moon round and round.

What are your ideas about how the Moon stays in space?

Newton and the force of gravity

Isaac Newton was born 380 years ago in England. One day he was sitting under a tree when an apple fell to the ground. Newton realised that the apple was not just falling but some kind of invisible force was pulling it to the ground. He called this force gravity.



What force pulled the apple from the tree to the ground?

Isaac Newton started to think that there was not a force pushing the planets round in an orbit. He realised that the force of gravity was stopping the planets flying off into space. This meant they were trying to fly outwards all the time but were being pulled towards the Sun. Newton realised that the Moon was being pulled to Earth by gravity. This is why it did not speed off in a straight line into space.

We now know that the planets are held in orbit by the pull of gravity from the Sun. Newton discovered that the bigger the planet or star the bigger the force of gravity it has.

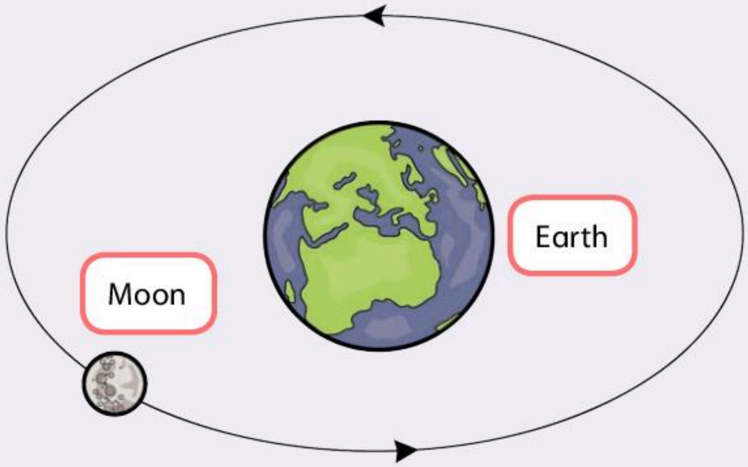
Amazing fact

Isaac Newton used mathematics so much to work out the orbits of planets that he invented a new branch of mathematics known as calculus.

The laws of motion

Newton spent many years working out the shapes and sizes of the planets. He worked out rules for gravity and how everything in the universe moves. These are known as the three laws of motion. 'Motion' means movement.

Can you think of any examples of seeing the laws of motion in action?



First law	Objects continue doing what they are doing unless other forces **speed them up** or **slow them down**.
Second law	Heavier objects need more force to move them.
Third law	Whenever an object pushes another object it gets pushed back in the opposite **direction** equally hard.

Things that go up always come down

Understand the difference between mass measured in kilograms and weight in Newtons.

The Big Idea

Weight is measured in Newtons, but we use kilograms in everyday life.

The **Newton (N)** is a unit of measurement.

Where do you think the name comes from?

Isaac Newton investigated gravity for a long time. We now know that gravity pulls you down towards the centre of the Earth. This is true when you are in the air, in water or just standing on land.

When you throw a ball up in the air what happens to it?

Wherever you are on Earth the force of gravity is almost the same.

When a shopkeeper weighs fruit what unit of measurement does he use? Circle the correct answer.

metres kilograms Newtons

Most people talk about **weight** being measured in **kilograms**. This is incorrect but it is easier for us to think about it in this way. **Mass** is the amount of matter or particles in an object. It is measured in kilograms or **kg** for short. Weight is the force of gravity. Scientists measure all forces in Newtons.

Investigation: On Earth a mass of 1 kg weighs about 10 N. How can you investigate this?

We use forcemeters to measure the mass and the weight of an object. With special scales we can even measure our mass and weight.

Copy the table below in your Investigation Notebook and add five blank rows. Find five objects. Measure the mass and weight of each object and record the results in your table. One example is given for you.

Object	Mass	Weight
1 litre bottle of water	1 Kg	10 N

Answer these questions in your Investigation Notebook.

a Are the results you collected reliable?

b What can you do in your investigation to help you get reliable results?

c Can you see a pattern in your results?

Remember

1 kg is 10 N.

Astronauts need to understand the difference between mass and weight. The Moon is much smaller than Earth. It has a much smaller force of gravity. Some other planets are much bigger than the Earth. Their force of gravity is much bigger.

Can you put the planets in the table below in order of highest to lowest force of gravity?

Planet	Mass compared to Earth	Rank force of gravity
Uranus	14.5	
Jupiter	316	
Mars	11	
Mercury	0.05	
Earth	1	
Saturn	95	
Venus	0.8	
Neptune	17	

True or False?

	True/False
1 Gravity is a force.	________
2 Mass is measured in Newtons (N).	________
3 1 kilogram (kg) is about 10 Newtons (N).	________
4 Mercury has the smallest force of gravity.	________

Now turn to page 138 to review and reflect on what you have learned.

Investigating mass and weight

Use units of force, mass and weight.

The Big Idea

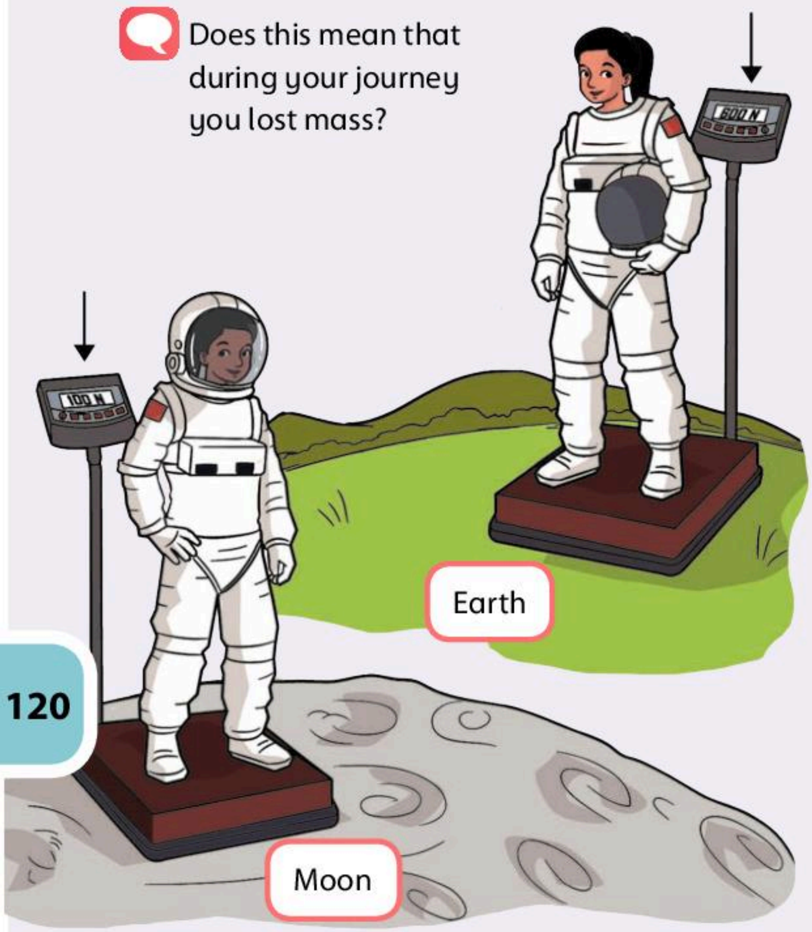
Gravity is different on the Moon and other planets.

What is the unit of measurement of the force of gravity on Earth?

Why do we say a person has a weight of 60 kg when we mean a mass of 60 kg?

This means if you are an astronaut and you have a mass of 60 kg on Earth you weigh 600 Newtons (N). When you set off in your rocket and arrive at the Moon you will only weigh 100 N.

Does this mean that during your journey you lost mass?



It takes about two days to travel to the Moon in a space ship. It is not possible to lose weight so quickly. You cannot lose mass that quickly either. It must be the force of gravity that has changed.

Is the force of gravity the same everywhere?

The size of the force of gravity is related to the size of the planet. The greater the mass of an object the greater the gravity is.

Does this mean the Earth is smaller than the Moon? Or is it bigger?

Most astronauts have a mass of 120 kg. On Earth an astronaut weighs 1200 N. On the Moon he weighs 200 N because the force of gravity is six times less.

Look at the picture of the astronaut walking on the Moon. Can you explain why he walks on the Moon like this?

Even with a heavy spacesuit the astronaut's weight is much less than on Earth. He can move more easily. The force of gravity is much less and so this is not pulling him to the surface of the Moon.

A student has a mass of 40 kg. She wanted to find out how much she would weigh on other planets and the Moon. She researched the gravity on the planets and the Moon. She then calculated her weight. Here are her results.

Planet	Force of gravity per kg	Weight of the student (N)
Mercury	4	160
Venus	9	360
Earth	10	400
Mars	4	160
Jupiter	25	1 000
Saturn	9	360
Uranus	8	320
Neptune	11	440
Moon	1.66	80

Remember: the Moon is not a planet.

What is the best method of displaying these results?

A bar chart can show the force of gravity on each planet. Another bar chart can show the mass of the student on each planet.

Decide how you are going to show the results. Are you going to use a graph or a chart?

What are the rules for drawing good graphs and charts?

Can you see a pattern in the results?

On what planet does the student weigh the most?

What is her mass on every planet?

Use the information to write a conclusion. Circle the correct answer.

As the force of gravity increases the weight increases/decreases.

This shows that the force of gravity affects weight.

Amazing fact

On Mercury an elephant will weigh less than half its weight on Earth. On the Moon, you may be able to lift an elephant!

Investigating mass and weight

Use units of force, mass and weight.

The Big Idea

We must not mix up mass and weight.

What unit of measurement is mass measured in?

What unit of measurement is weight measured in?

Weight in Newtons = Mass in kilograms x 10

An object has a mass of 10 kilograms. What is its weight in Newtons?

Very small and very large objects are difficult to measure in kilograms. We use different units to measure them. We measure small objects in grams. Very big objects are measured in metric tonnes.

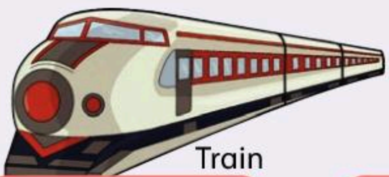
1 000 grams = 1 kilogram

1 000 kilograms = 1 metric tonne

What unit do we use to measure our mass?

What unit do we use to measure the mass of a grain of rice?

Using the word bank, write below each of these objects what unit of measurement you will measure it in.



Train

Petal

a

b

Feather

Man

c

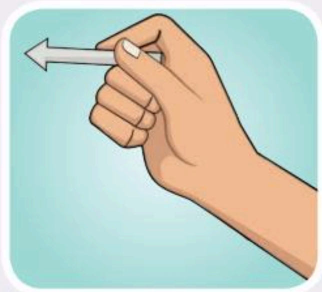
d

Word Bank

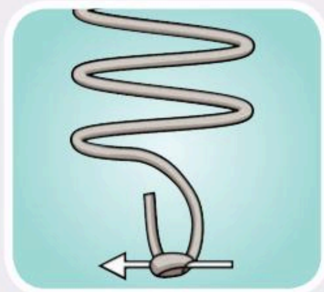
grams **kilograms** **metric tonnes**

Investigation: Make a forcemeter.

1 Take a spring.



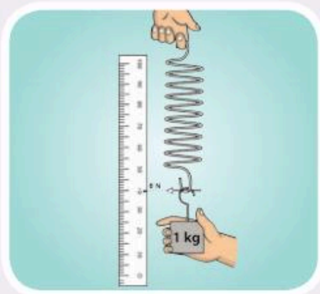
2 Make a cardboard arrow.



3 Attach the arrow to the bottom coil of the spring using tape.

4 Take the spring by the top coil and hold it next to an upright ruler.

5 Mark where the arrow reaches as zero.



6 Hang a 1 kg mass from the bottom of the spring.

7 Mark this as 10 N on the ruler.

8 Split the gap between 0 and 1 N into 10 equal sections of 1 N.

Use your forcemeter to find the weight of three objects in the classroom.

Answer these questions.

a How accurate is your forcemeter?

b How can you alter it so you can weigh objects up to 5 N in weight?

1 Can you explain what mass is?

2 What unit is mass measured in?

3 What unit is weight measured in?

Now turn to page 138 to review and reflect on what you have learned.

Investigating forces

Identify the direction in which forces act.

The Big Idea

Invisible forces are acting all around us.

Think back to your work on gravity. Why can astronauts jump higher on the Moon than on Earth?

There is an invisible force keeping the person in the chair. What do you think it is?

What direction is the force on the person?

In science we draw arrows on diagrams to show the direction of the force.

If the force of gravity is pulling us to the centre of the Earth why do we stay on the surface?

The surface of the Earth is also pushing us up. This keeps us on the surface of the Earth. The pushing is called upthrust. The force of gravity and upthrust keep us on the planet. We do not fly off and we do not sink down to the centre of the Earth.

Which two forces are keeping the person in the chair?

Whenever an object pushes another object it gets pushed back in the opposite direction equally hard.

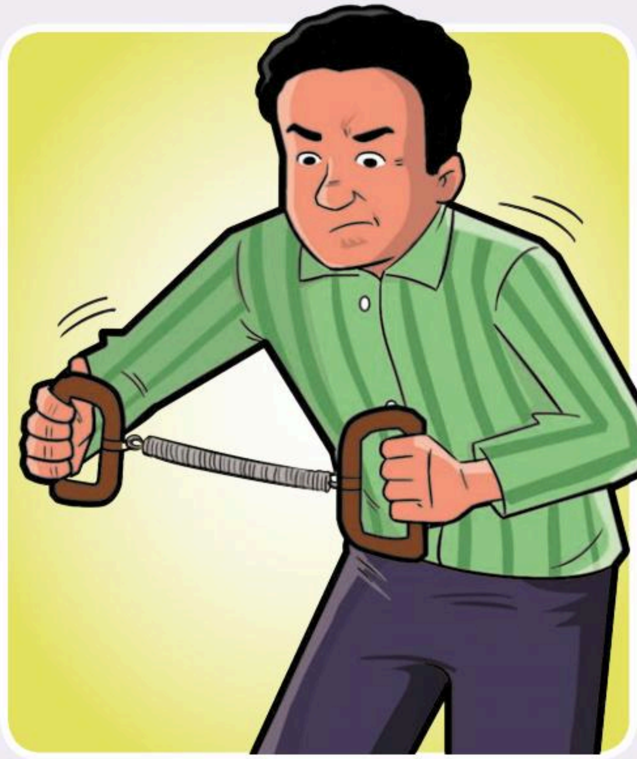
Remember

When you push against a solid object such as a wall you can feel a force pushing back. This is called an opposite force. Think back to Newton's third law of motion.

Investigation: How can you investigate the third law of motion?

If you place an object on weighing scales it bounces up and down for a while. This is because the forces are acting against each other.

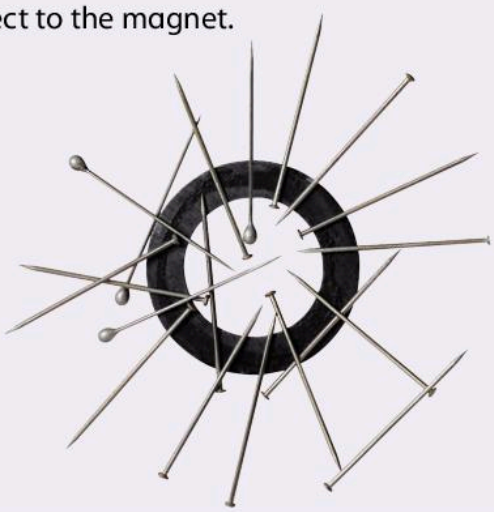
Try pulling on an elastic band. What can you feel? Why is it difficult to pull it straight?



The person in the drawing is applying a pulling force to the spring. The spring wants to stay in a coiled shape. The person needs to use up **energy** to uncoil it. The spring pulls back in the opposite direction to try to keep its shape. Elastic bands behave in the same way.

If you hold a magnet close to a magnetic material what can you feel?

The invisible force of magnetism attracts the object to the magnet.



You cannot see the force of magnetism but you can see the effects.

Have you ever wondered why some things float and some do not?

Investigation: Choose three objects and see which ones float and which ones do not.

Copy the table into your Investigation Notebook and record your results.

Object	Floats	Sinks
Stone		Yes

Which objects sink and which objects float? Can you see a pattern?

Imagine trying to push a plastic ball under water. What does it feel like?

You are pushing down on the water. The water is pushing back.

You will study floating and sinking in more detail in the next lesson.

Investigating forces

Identify the direction in which forces act.

The Big Idea

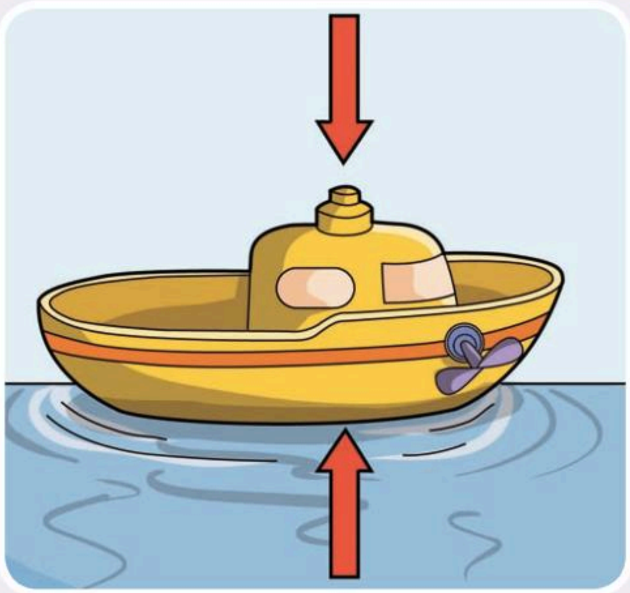
Forces are invisible but you can show them in drawings.

Amazing fact

An oil tanker weighs 70 000 tonnes. But it still floats.

List the forces that act on a floating object.

Objects float if the force they push down with is the same as the water pushing back. The object is pushing down because of the force of gravity. The pushing back is the upthrust from the water.



The forces are balanced so the boat floats. If the upthrust is too small then the boat sinks. Spreading out the weight of an object can help it to float. This is why a metal lid floats but a lump of metal of the same mass does not.

Investigation: Can you sink an object by increasing its weight?

Copy the table into your Investigation Notebook. Use it to record your results.

Size of lid (cm)	Number of pins needed to sink it
Small	
Medium	

Is there a pattern between the size of the lid and the number of pins needed to sink it?

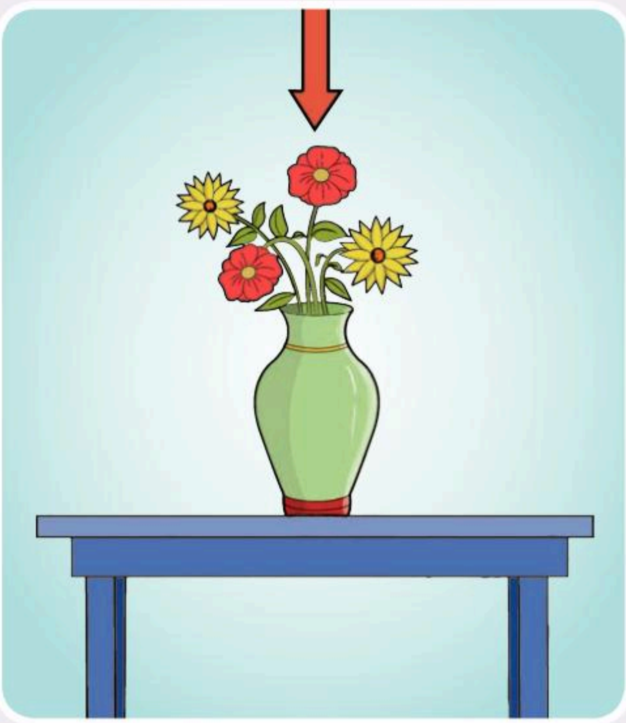
Write a concluding sentence about your investigation. Circle the correct answer.

As the size of the lid increases the number of pins needed to sink it increases/decreases.

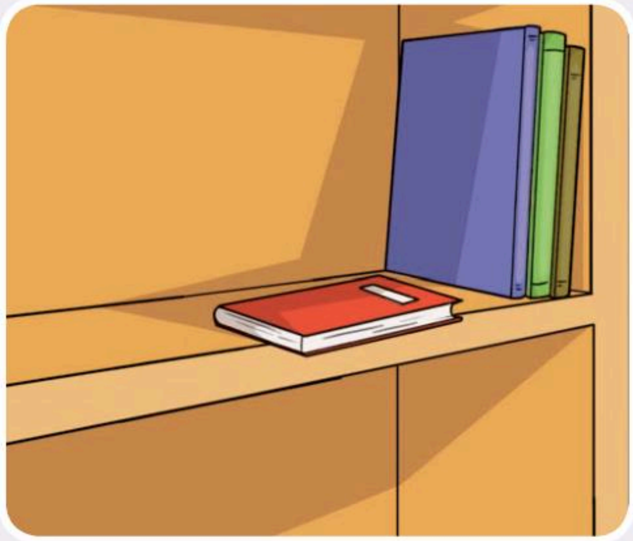
How does your investigation explain why heavy metal ships float but pins do not?

We know that the invisible forces acting on an object are balanced by using arrows.

The downward arrow shows the force and direction of gravity on a vase of flowers. There is a second force acting on it. We know this or the vase of flowers will be at the centre of the Earth. The name of the force is upthrust.



Can you draw an arrow on the diagram to show this?



Can you draw the arrows showing the forces on this object?

Why is this object falling? What has changed?

The forces are no longer balanced. To make the book move one of the forces has changed or a different force introduced. For example, someone may have pushed or pulled the book. Now there is no upthrust from the shelf. Gravity is pulling the book down.

Investigating forces

Identify the direction in which forces act.

The Big Idea

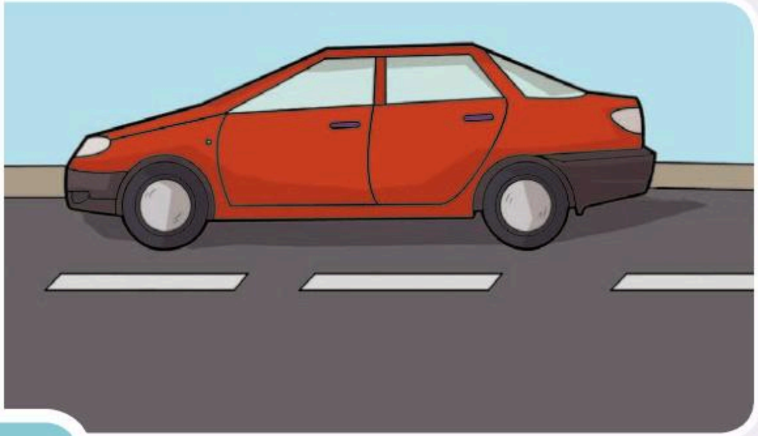
Forces can be very useful.

Remember

The direction of the arrows shows the direction of the force.

Which force pulls objects down to the Earth?

Which force pushes back against gravity?



Draw arrows on the diagram to show the forces on the car.

Friction

There are other forces acting on the car. The engine is pushing the car forward. Also when two surfaces touch each other they slow each other down. This is called **friction**.

Friction gives us grip on things such as shoes and car tyres. The brakes on a bicycle and car also rely on friction. Sometimes we do not want a lot of grip. If people are ice skating or skiing they want to go faster without being slowed down. Machine parts are helped to move without friction by adding oil.

Rough surfaces give a lot of friction.

Think about...

Think about how your shoes create friction between your shoe and the floor. Which floors are you most likely to slip on?

Smooth surfaces reduce friction.

Why is oil added to machines?

Moving objects

It is more difficult to draw force arrows on things that move. We have to work out which force is having the biggest effect. If the car is driving along the road the push from the engine must be greater than the force of friction.

What happens if the force of friction increases?

What happens if the force from the engine decreases but the force of friction stays the same?

We draw a thick arrow(➡) to show a bigger force.

A thin arrow (→) shows a weaker force.

Draw the force arrows on the diagram. Remember to show the size of the force with the size of the arrow.

Which force needs to change to stop the boat sinking? Is there a force you cannot change?

1 If forces are invisible how can you show them?

2 What does the size of the arrow show?

3 Draw an arrow to show the direction that gravity acted on Newton's apple.

Now turn to page 138 to review and reflect on what you have learned.

Balanced and unbalanced forces

Know and understand the idea of energy in movement.

The Big Idea

Forces can change the direction and speed of an object.

Can you remember how forces can change the shape of an object?

What other effects of forces can you remember?

When the forces on an object change this has an effect on the object. If we hammer a metal we are applying a force. The metal pushes back, but if this force is weaker the metal changes shape.

Investigation: Exploring forces.

Place a toy car on a flat surface. Answer the questions below.

a What happens to the car?

b Push the car a little. What happens?

For an object to move the push force has to be more than the other forces such as friction. Forces such as friction can slow moving objects down or stop them. Some surfaces cause more friction than others.

c Push the car more to the left. What do you observe?

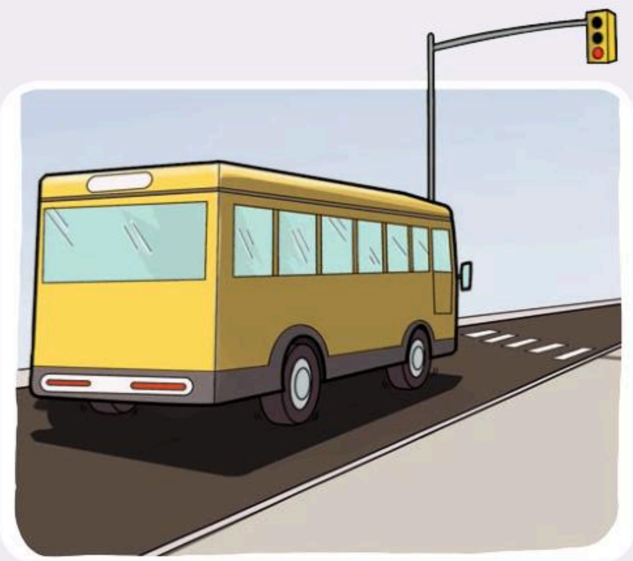
d Push the car more to the right. What do you observe?

We can change the direction of an object by changing the size and position of the force. This can be very useful when driving a car.

When have you changed the direction of an object?

What forces are needed for these cars to speed up?

On the diagram below can you draw arrows showing the forces when the bus is stopping? Remember the arrows show the size of the force and the direction.



What force does the bus driver need to increase to stop the bus in time?

What force does the bus driver need to decrease to stop the bus in time?

When the forces are the same we call them balanced. This means nothing happens.

When you observed your toy car at the beginning of your investigation it did nothing. This means the forces were balanced.

When you pushed your car it moved. This means the forces were now no longer balanced and something happened. The car moved!

How can you measure whether the change in force changes the speed of an object?

How do we measure speed?

Remember we have to measure the distance that the object travels and the time it takes.

Investigation: Measure the speed of a toy car.

Copy the table below into your Investigation Notebook and record your results.

Angle of the ramp (degrees)	Time taken to travel 1 metre (s)	Speed (m/s)
20	6	0.16
30		
40		
50		
60		

Can you notice any pattern in your results?

How else can you speed up the car?

Plan an investigation to find out whether the surface has an effect on the speed of the car. How will you make this a fair test?

Balanced and unbalanced forces

Know and understand the idea of energy in movement.

The Big Idea

Energy makes things move.

Where do you get your energy from?

There are many different forms of energy. Electrical and heat (or thermal) energy are two types. Our food contains chemical energy. Our body converts this chemical energy into many other kinds of energy. For example, it is changed to kinetic energy when we move. Kinetic energy is a scientific term that means movement energy.

You are studying forces. Is it true that forces can make things move?

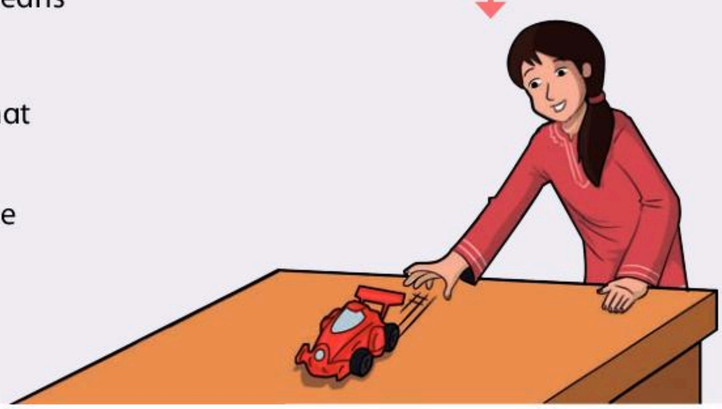
Forces such as pushes and pulls must use energy or nothing will happen.

When you pushed the toy car in the earlier investigation where did the energy come from?

The Sun's energy is used by the plant. This makes chemical energy

The person gets energy from the plant

The person uses the chemical energy from food that is eaten to push the car. The chemical energy is changed into kinetic energy



Once the toy car is moving it will continue at the same speed and in the same direction. If another force is applied it may change speed or stop altogether.

Energy is measured in joules. To pick a book up you will need about 1 joule of energy. To pick more books up you will need more joules of energy. If you want to move the books to another room you need even more joules of energy.

How many joules of energy will you need to pick up:

a 10 books? ________________

b 20 books? ________________

Amazing fact

Heat is a form of energy. When devices work they usually produce waste heat energy. That is why televisions and computers become hot.

Think about...

Energy is like money. You can spend it or save it up and use it later. Using energy is like spending money. If you spend it then you have to replace it or you run out.

A cyclist has to work hard to make a bicycle go fast. The amount of work this cyclist does depends on:

- the distance she travels
- the mass of what she is moving. This is the bicycle and herself and the force of gravity (10N/Kg).

Work done is the force acting on an object multiplied by the distance the object is moved. It is the mass multiplied by 10 (average force of gravity).

1. If the forces on an object are balanced will there be a change in its movement?

2. If the forces on an object are unbalanced will there be a change in its movement?

Now turn to page 139 to review and reflect on what you have learned.

Friction can be useful

Understand how friction can change the speed objects move.

The Big Idea

Friction and air resistance slow things down.

List all the forces that you have learned about so far.

Can you remember how **friction** affected your toy car?

How did friction help the Formula 1 driver?

Friction can be very useful. It helps cars and buses to slow down and stop. This is how brakes work. If the object has a large surface area friction has more of an effect.

Investigation: Rub two of your fingers together quickly. What do you feel?

Now rub your hands together quickly. What do you feel?

Notice how your hands became hotter. More skin surface rubbed together and so more friction was made.

As objects move through the air they are held back. Scientists call this **air resistance** or drag. The amount of air resistance depends on the size or surface area. Shape can also affect the amount of air resistance.

A small object cuts through the air better than a large object and so air resistance is lower.

Investigation: Investigate air resistance with paper. Drop a piece of flat paper and observe how quickly it travels to the ground.

What forces are acting on the paper?

Now scrunch the paper into a ball. What do you observe when you drop the scrunched paper?

Is this a fair test?

Measure the height you drop the paper from and keep it the same. Time how long it takes to drop to the ground. Record your results in a copy of the table below in your Investigation Notebook.

What piece of equipment will you use to measure the time taken?

Paper type	Time taken to fall (seconds) Try 1	Time taken to fall (seconds) Try 2	Time taken to fall (seconds) Try 3
Scrunched			
Open			

Answer these questions about your investigation.

a What do you notice about the time it takes for both pieces of paper to fall?

b Do they take the same amount of time to fall?

The flat piece of paper has the bigger surface area. This means that it is being affected more by air resistance. The scrunched up paper has a smaller surface area. This means it is less affected by the force of air resistance. Air resistance is an example of friction. The object is rubbing against particles in the air.

What two things affect the amount of air resistance the most?

Friction can be useful

Understand how friction can change the speed objects move.

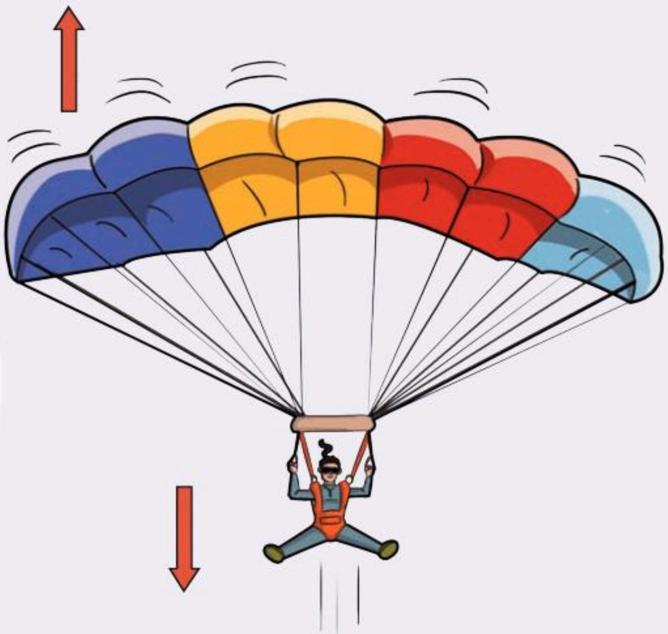
The Big Idea

Which parachute works best?

What forces are acting on a parachutist? How is the parachutist using air resistance?

When people use a parachute to land back on Earth it is called parachuting or sky diving.

Parachutes use the force of air resistance. The parachute is designed to increase air resistance. The large surface area of the parachute hits many more air particles than a person's body. This helps the parachutist to fall very slowly.



It depends on the distance jumped, but if there was no air a parachutist could hit the ground at more than 1000 kilometres per hour (km/h) even with a parachute.

Parachutes have different designs and sizes. They are also made out of different materials.

Parachutes are designed differently because they have different functions. Some skydivers want to do difficult tricks and movements. Lots of people just want a parachute to get them back to the ground safely.

Investigation: You are going to make parachutes and then test them to see which one lands the slowest.

Choose a material to investigate. Then decide on the sizes of parachute you are going to test.

Predict which of your parachutes will land the slowest.

Will this be a fair test if you change the material and the size of the parachute?

Amazing fact

In 2012 Felix Baumgartner jumped out of a balloon 39 kilometres above the Earth. It took more than four minutes for him to safely land back on the ground.

Carry out your investigation.

Measure how long it takes for your parachute to safely land. Copy the table below into your Investigation Notebook and complete the results.

Parachute width (cm)	Time for parachute to land (seconds)						
	Try 1	Try 2	Try 3	Try 4	Try 5	Try 6	Average

In the table there are lots of columns to repeat the experiment.

Why do scientists repeat experiments?

Discuss in your group which parachute is the best.

Is there a pattern in the results that you have collected?

Which one took the least time to fall?

Which one took the most time to fall?

Can you explain how air resistance affected your results?

Remember it took 10 minutes for Felix Baumgartner to land back on Earth.

Write a conclusion about your results.

Draw a force diagram for your parachute in your investigation Notebook.

1 Why does a scrunched up piece of paper fall faster than a flat one?

2 Explain how a parachute stops you from landing too quickly.

Now turn to page 139 to review and reflect on what you have learned.

What we have learned about mass and weight

Things that go up always come down (pages 116–19)

What does the force of gravity do to all things on the Earth?

What is the unit of measurement for weight?

I know that gravity is a force measured in Newtons.

I know that mass is the amount of material in an object.

Investigating mass and weight (pages 120–3)

True or false? The size of the force of gravity is related to the mass of the planet.

If we know the mass of something in kilograms (kg), how can we find its weight in Newtons (N)?

I can weigh objects in kilograms and Newtons.

I know that different planets have different gravity and this affects the weight of objects on those planets.

I can make a forcemeter.

Investigating forces (pages 124–9)

How do you show the size and direction of a force?

An oil tanker with a mass of 70 000 tonnes weighs 70 million N! What is the force called that keeps the ship afloat?

I know that there is an invisible force called upthrust.

I can show the direction and size of invisible forces on diagrams.

Balanced and unbalanced forces (pages 130–3)

If a toy car travels 1 metre in 7 seconds what is its speed?

What happens to an object if all the forces are balanced?

What does a force have that causes things to move?

I know that forces can change the speed, direction and shape of an object.

Friction can be useful

(pages 134–7)

What holds back objects moving through the air?

True or false? A large parachute falls faster then a small parachute.

I know that when objects move against each other friction is created.

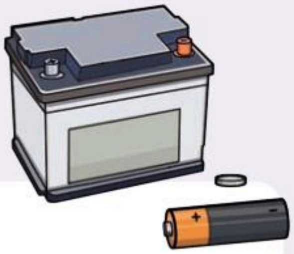
I understand that the larger the surface area the greater the air resistance.

Glossary

Key words

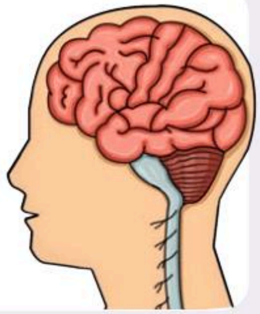
acid rain

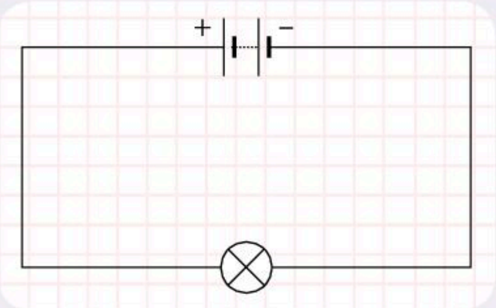
air resistance



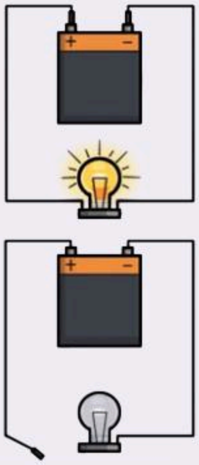
battery

brain

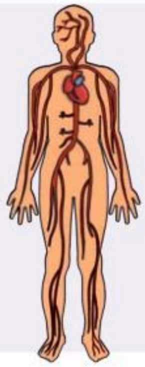




circuit

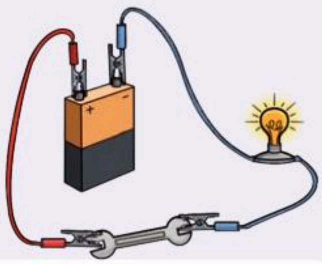


circuit diagram



consumer

circulation

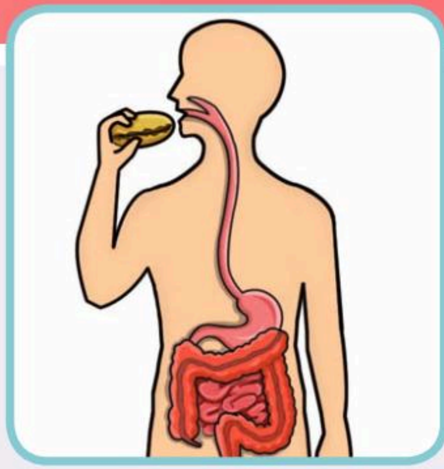


cure

conductor

conservation

deforestation



digestion

energy

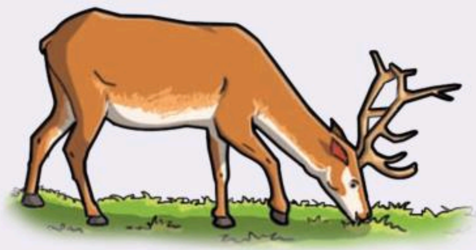
direction

environment

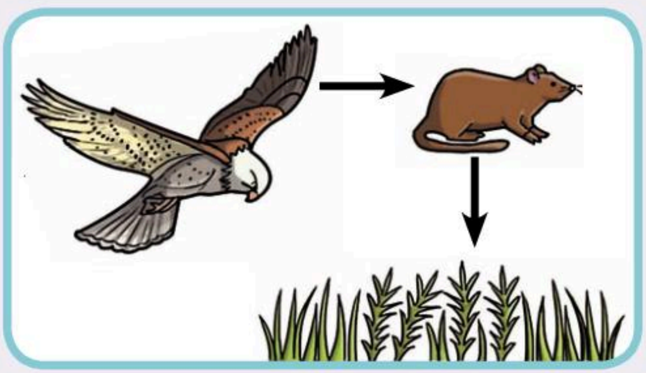
dissolve

excrete

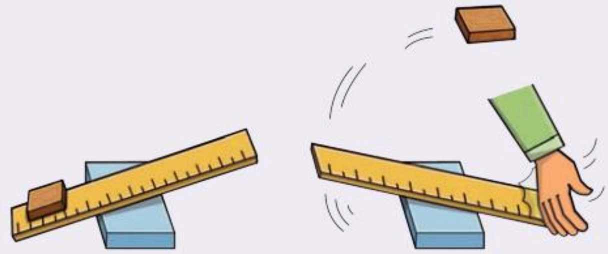
excretion



feeding relationship



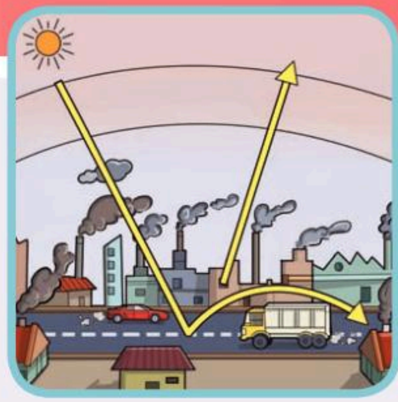
food chain



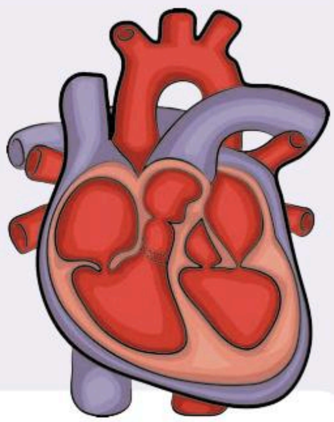
force

friction

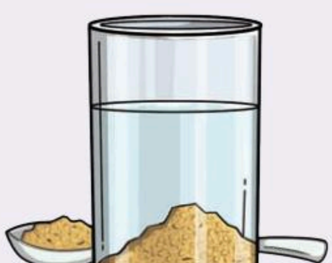
function



greenhouse effect

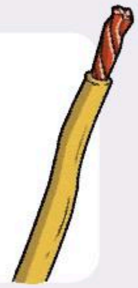


heart

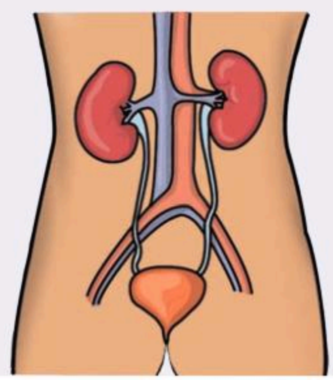


insoluble

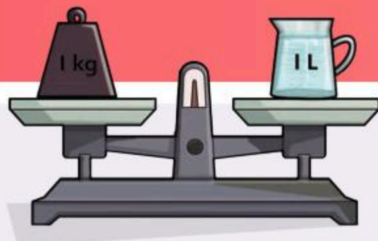
insulator



irreversible



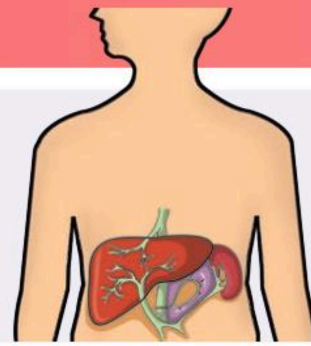
kidneys



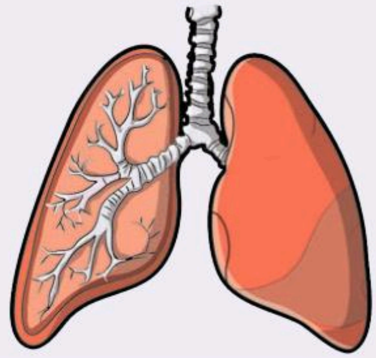
kilograms (kg)

landfill

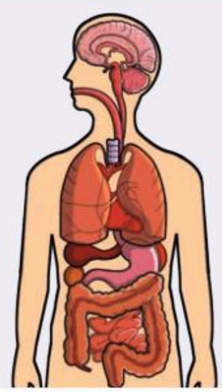
litter



liver



lungs



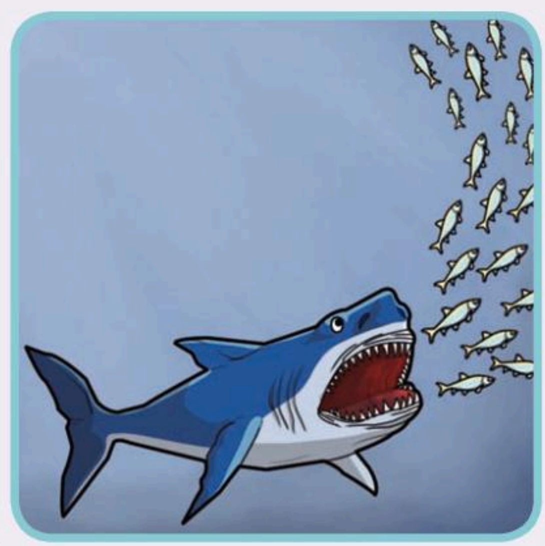
major organs

mass

Newtons (N)

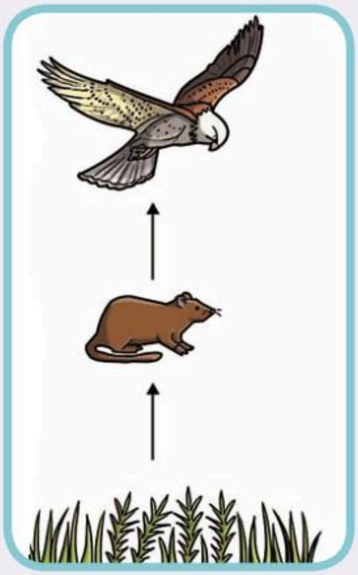
object

pollution

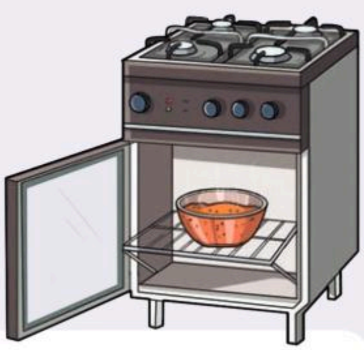


predator

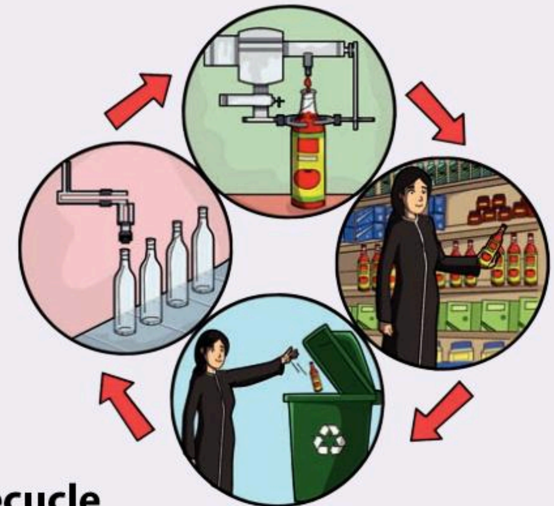
prey



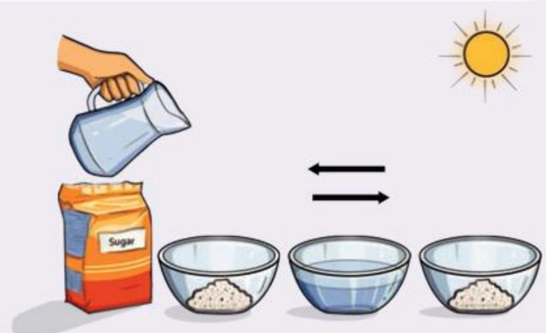
producer



reaction

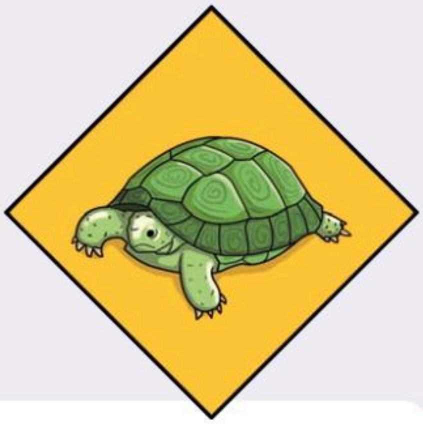


recycle



reversible

separate



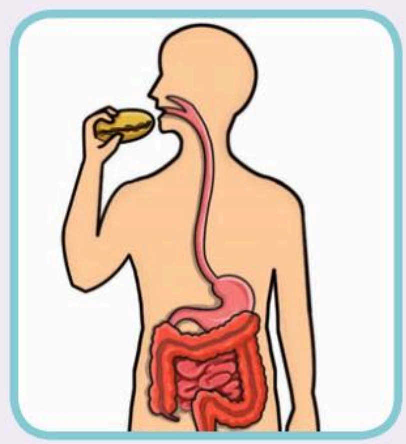
slow down

soluble

solution

speed up

stomach



stomach and intestines

symptoms

system

variable

weight

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6

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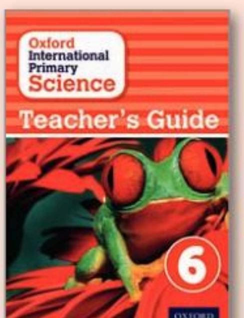

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