

# Dead or Alive

I am a personal trainer

My job is to help people get fit and stay healthy. I get to meet lots of famous people who need to look good.

I help people by showing them different exercises they can do. I also work out a fitness programme they can follow.

In my job, I need to know about the different organs in the body. This helps me to understand how to work out exercises people can do to improve fitness of different parts of their bodies.



## Life processes

Humans are living things. Something is a living thing because of the seven life processes.

- ◆ growth – all living things can get bigger
- ◆ nutrition – living things need food
- ◆ reproduction – living things have young
- ◆ movement – even plants can move
- ◆ sensitivity – this is reacting to things like touch
- ◆ excretion – getting rid of waste
- ◆ respiration – releasing energy from food.



Which life process resulted in the baby elephant?

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### QUESTIONS

- 1 Write down the seven processes of living things.
- 2 Write down the meaning of the word excretion.

#### CHALLENGE QUESTION:

- 3 How does oxygen get from the lungs to the heart?

## Body systems

The human body need body systems to help with the life processes.

Some of the body systems are described in the table.

body system	the main organs	job of the body system
circulatory	heart and blood vessels	to transport food and oxygen in the blood
digestive	stomach and intestine	to break down food so it can get into the blood
respiratory	lungs	take in oxygen from the air

## Organs

Body systems are made up of organs. The diagram shows the main organs in the body.

## Organ transplants

Organs can sometimes stop working and need replacing.

Some healthy organs can be removed from a dead person and transplanted to a living person.

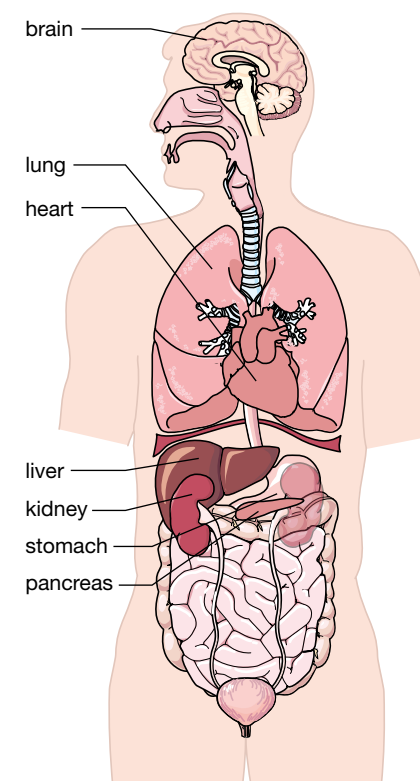
- ◆ The dead person is the donor.
- ◆ The living person is the host.

When the organ is removed it needs to be kept cold to stop it decaying.

Sometimes the new organ is rejected by the host.

Only some people want to donate organs when they die.

This is why people carry donor cards.



### QUESTIONS

- 4 Write down the main organs in the circulatory system.
- 5 Why do people carry donor cards?
- 6 When an organ is taken from a body for a transplant it is kept cold. Explain why

#### CHALLENGE QUESTION:

- 7 Look at the diagram showing the organs in the body. Which organ could be donated by a living person?

## Cells

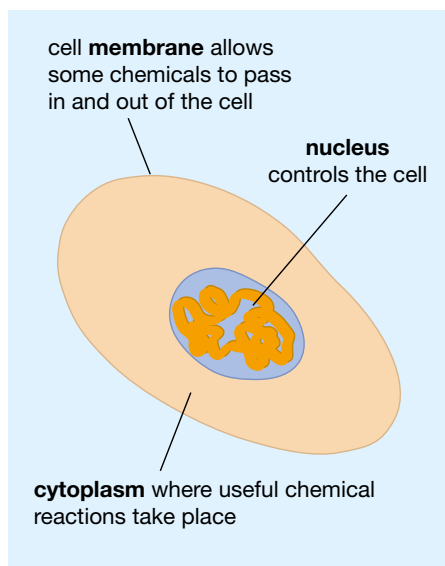
All living things are made of cells.

As your body grows it needs to make new cells.

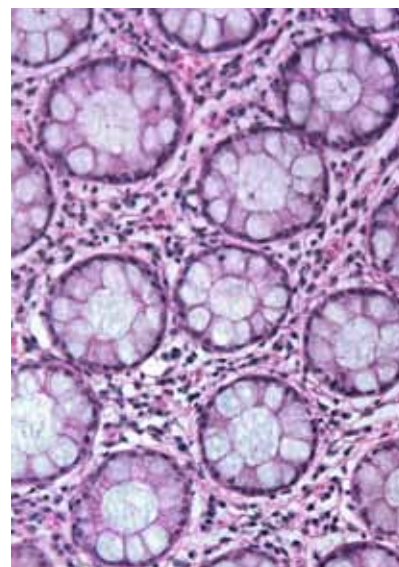
The diagram shows the parts of an animal cell.

New cells are also needed if the old ones are damaged, for example when you get a cut.

New cells are made when old cells divide.



Which part controls the cell?



Cells seen under a microscope.

## Pulse rate

Your heart beats to pump blood around the body.

You can measure how fast your heart beats by counting your pulse rate. Place your fingers on your wrist just below your thumb. You should feel your pulse moving blood through the artery.

During exercise your pulse rate goes up. After exercise your pulse rate goes back to normal. The time it takes to get back to normal is your recovery time.

The fitter you are the quicker your recovery time.

How quick your breathing rate gets back to normal is another measure of recovery time and how fit you are.

**Remember**, animal cells don't have cell walls!

### QUESTIONS

- 8 Write down the part of the cell where useful chemical reactions take place.
- 9 How does the body make new cells?
- 10 Finish the sentence.

The time it takes your pulse rate to get back to normal after exercise is called your ..... time.

### CHALLENGE QUESTION:

- 11 Describe one way you could measure recovery time.

## Exercise

When we exercise our muscles contract to move our bodies.

When muscles contract they need energy. The more you exercise the more energy your muscles need.

Energy comes from food. Respiration in your cells releases the energy in the food. Energy comes from glucose (sugar) in food. Respiration needs oxygen. As you exercise your muscles need more oxygen.

To get more oxygen into the body your breathing rate goes up.

Your pulse rate also goes up because the heart pumps faster. Your heart pumps faster to get the oxygen to your muscle.

Sometimes when we exercise we can injure ourselves. Warming up before exercise and warming down after exercise may stop us pulling a muscle.



Why does your breathing rate go up during exercise?

**Remember**, energy comes from food not oxygen

### CAN-DO TASK

Level 3 2 1

I can measure a person's breathing rate or pulse rate.

### QUESTIONS

- 12 Write down the gas needed for respiration.
- 13 Why do muscles need energy?
- 14 Why should you warm up before playing football?

### CHALLENGE QUESTION:

- 15 Kim measures her pulse rate – before and after exercise. Her pulse rate before exercise is 72 beats per minute. Her pulse rate after exercising is 112 beats per minute.
  - a) Calculate the amount by which Kim's pulse rate went up.
  - b) Explain why her pulse rate went up. Use ideas about muscles and oxygen in your answer.

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# Babies

**I am a midwife**

My job is to help women during pregnancy. I help lots of babies enter the world.

I spend time with the mother during pregnancy to make sure all is well with her and the baby. I will then be with the mother during the birth.

In my job, I need to know about how the baby develops inside the womb. I also need to be able to monitor the baby and mother's health both before and after birth.



## Reproductive organs

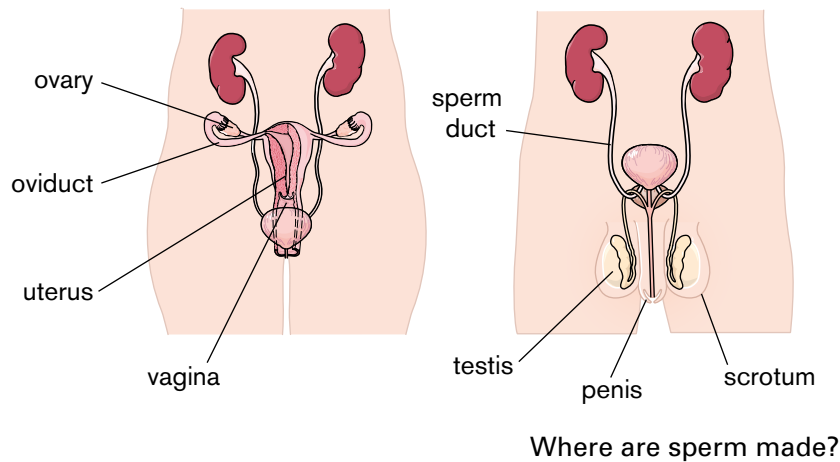
Males and females have different reproductive organs. The female makes eggs in her ovaries. The male makes sperm in his testes.

## Fertilisation

When a male releases sperm into the vagina of a female fertilisation can take place.

Fertilisation is the point when the sperm fuses with the egg. This normally happens in the oviduct.

The fertilised egg develops into a foetus. The foetus grows into a baby.



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## Pregnancy

When the egg starts to develop into a foetus a woman is said to be pregnant.

One of the first signs of pregnancy is that a woman's periods stop. She will also start to gain weight.

## Antenatal care

During the pregnancy women meet with the midwife at the antenatal clinic. This is where tests are carried out to make sure the baby is growing properly.

To check the mother's health and the baby's progress the midwife measures the mother's blood pressure, weight and height. The midwife can also look at ultrasound scans to check how the baby is growing.



Why is the mother's weight monitored during pregnancy?

## Twins

Sometimes a woman can have more than one baby at a time.

- ◆ If two eggs are fertilised then she can have non-identical twins.
- ◆ Identical twins develop when one fertilised egg splits in two at the start of pregnancy.



What is the baby called before it is born?

**Remember**, only one sperm can enter an egg – you can't get twins by two sperm entering one egg

### QUESTIONS

- 1 Write down the part of a female where the eggs are made.
- 2 Write down the meaning of the word **fertilisation**.
- 3 **CHALLENGE QUESTION:** Where does fertilisation normally take place?

### QUESTIONS

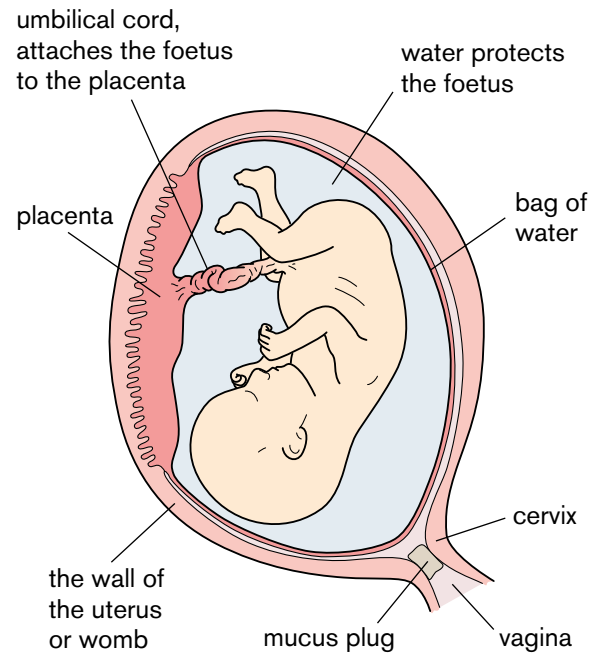
- 4 Write down **two** tests a midwife might carry out on a pregnant woman.
- 5 What happens to a woman's periods when she is pregnant?
- 6 Which type of twins develop from one egg?
- 7 **CHALLENGE QUESTION:** Find out why blood pressure is monitored during pregnancy.

## Inside the womb

Look at the diagram. It shows a foetus inside the womb.

As the foetus grows inside the womb it needs to be protected and fed.

- ◆ the placenta is where oxygen and food moves from the mother's blood into the blood of the foetus
- ◆ the cord carries the blood to and from the placenta
- ◆ the bag of water protects the foetus from knocks



Which part protects the foetus from knocks?

## Birth

When the baby is ready to be born the woman goes into labour.

The muscle wall of the womb contracts giving the woman labour pains.

When her waters break (water flows out of the womb) she knows that the birth is getting closer.

The contractions will increase as they start to push the baby out of the womb.

After the baby is born the placenta is pushed out. This is the afterbirth.

Some time after her baby's birth, the woman's periods will start again.

**Remember,** the mother's blood does not mix with the blood of the foetus – there are membranes to keep them separate.

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## Growing babies

After they are born, babies are monitored to check they are growing properly.

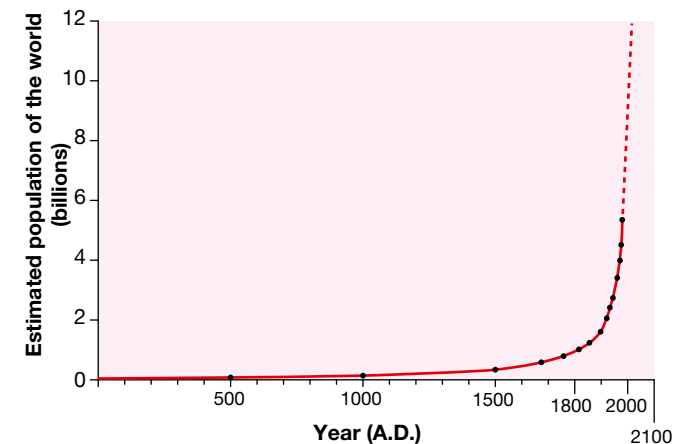
They may also have other checks such as hearing and sight. Look at the diagram. It shows the record for one baby born on the 9th of February.

WEIGHT RECORD (birth to 2 yrs)			
Date	Weight	Weight gain	Comments
9/2/05	3.82 kg	birth weight	
20/2/05	4.50 kg	0.68 kg	
19/3/05	4.95 kg	0.45 kg	reflexes ok
16/4/05	5.12 kg	0.7 kg	small weight gain
14/5/05	5.54 kg	0.42 kg	
11/6/05	5.95 kg		hearing, sight ok

How much did the baby weigh at birth?

## Growing population

Every second at least three babies are born somewhere in the world. This means the world population is going up and up. The graph shows how much it has changed.



What is happening to the world population?

People need resources such as homes, food, clean water and fuel. The more people there are the more resources we need. If the population keeps on going up we will run out of some resources.

People also make waste such as sewage and household rubbish. We are running out of places to put all the rubbish we make.

### CAN-DO TASK

Level 3 **2** 1

I can read data from a graph.

### QUESTIONS

8 Finish the sentence about the placenta.

The placenta is where ..... and food passes into the foetus's blood.

9 What causes labour pains?

10 Finish the sentence.

After the baby is born the placenta is lost as the .....

#### CHALLENGE QUESTION:

11 The growing foetus makes waste like carbon dioxide. Find out how the waste is removed from the foetus.

### QUESTIONS

12 Look at the record card.

- a) What did the baby weigh on the 20th of February?
- b) What is the weight gain for the 11th of June?
- c) Draw a graph of the baby's weight gain from birth until the 11th of June.

13 Write down one resource that might run out if the population gets too high.

#### CHALLENGE QUESTION:

14 Plastic household waste is more of a problem than paper waste. Suggest a reason why.

# Acids and alkalis

**I am a textile technician**

My job is to create new dyes for the fashion industry. I extract dyes from lots of different plants. I have to find ways to stick my new dye colours to many different fabrics.

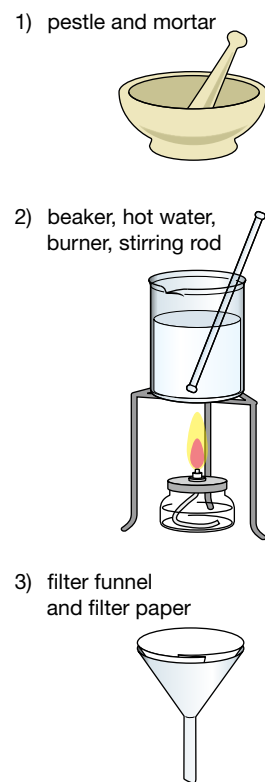
It is great when you get to see your work on the catwalk. As a textile technician I need to understand about acids and alkalis and how they react. I need to understand how to use acids and alkalis to alter the colours of my new dyes.



## Extracting a dye

A dye is a chemical that can change the colour of fabrics.

This diagram shows how to extract a dye from a plant.



What could you do with this dye?

## Using dyes as indicators

Some dyes change their colour in acid and alkali solutions. We call these indicators.

This table shows some examples.

dye	colour in acid	colour in alkali
beetroot	red	purple
red onion	red	green
Geranium	orange - red	blue
Litmus	red	blue

### QUESTIONS

- 1 What is a dye?
- 2 Which indicators in the table turn red in acids?

#### CHALLENGE QUESTION:

- 3 Describe how you could you extract the dye from rose petals.

## Strong acids

You will have already used bottles of acid in science. These acids are mainly strong acids. They will have a hazard label on them telling you they are harmful or corrosive. When you use them you need to wear safety glasses, and possibly gloves and a lab coat.



Hydrochloric acid is corrosive

## Natural acids

Many things we eat contain naturally occurring acids. Examples are: lemons and limes, vinegar, tea and coffee.

These acids are weak acids and not harmful, so they do not need hazard labels on them and you do not need safety precautions to eat or drink them.

Acids have a sour taste and add to the flavour of food.

**Remember**, not all acids are harmful. Many foods and sweets contain acids.

## Alkalis

Alkalis are the opposite of acids. Sometimes they are known as 'antacids'. Alkalis are used to react with oil to make soap, to stick some dyes to fabrics, to react with sand to make glass and to cure indigestion.

## Single colour change indicators

Many indicators only show a single colour change in acids and alkalis. This means they cannot be used to find if a solution is neutral (not acid or alkali).



indicator colour in	acid	neutral	alkali
phenolphthalein	colourless	colourless	pink
methyl orange	red	yellow	yellow

Phenolphthalein only changes colour when a solution is alkaline, and methyl orange only changes colour when a solution is acidic.

**CAN-DO TASK**  
Level 3 2 1  
I can use a measuring cylinder to measure volume.

### QUESTIONS

- 4 Give three examples of acids we eat.
- 5 Which hazard label should be put on  
a) 2M hydrochloric acid? b) 1M hydrochloric acid
- 6 Give three uses of alkalis.
- 7 What colour would phenolphthalein turn in an acid?

#### CHALLENGE QUESTION:

- 8 Describe why we not harmed by eating foods containing acids.

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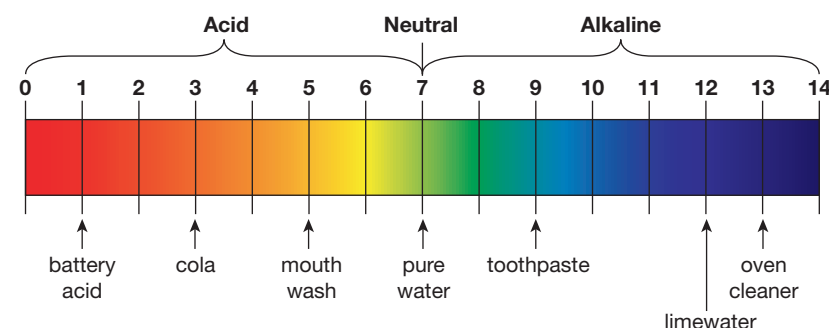
## Universal indicator

Solutions are not just acid or alkali. They can be strong or weak acids, neutral, or strong or weak alkalis.

Universal indicator is a special mixture of different dyes. It changes into different colours depending on the pH.

The pH scale shows:

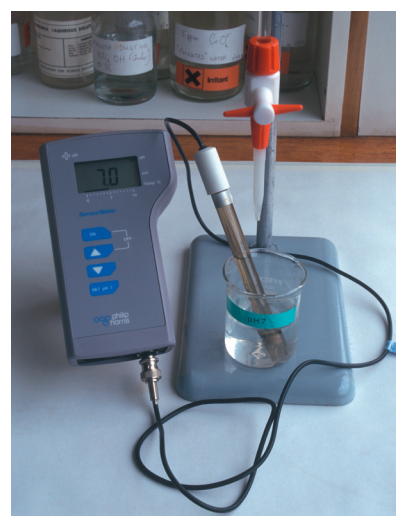
- ◆ Acids have pH numbers from 1 to 6
- ◆ Neutral solutions are pH 7
- ◆ Alkalis have pH numbers from 8 to 14
- ◆ The stronger the acid, the smaller the pH number
- ◆ The stronger the alkali, the bigger the pH number



## Measuring pH accurately

Electronic meters can measure pH accurately.

Some pH meters are hand-held. They are useful for getting an accurate reading for a single solution, such as testing soil samples. Some are connected to computers to monitor and record pH levels automatically. This is very useful in remote areas, such as checking pH of water in fish farms.



### CAN-DO TASK

Level 3 2 1

I can use universal indicator to find pH.

### Remember, increasing

the pH does not mean more acid – strong acids have low pH numbers



## Neutralisation

When the right amount of an acid and alkali are mixed, they cancel each other out. We call this neutralisation.

This reaction can be shown using this word equation:  
acid + alkali → salt + water

Too much acid can damage plants. Farmers spread lime to neutralise acid soil.

Your stomach contains hydrochloric acid. This helps break down your food. Too much acid in your stomach causes indigestion. Indigestion tablets contain a weak alkali to neutralise excess acid.

## Acids and metals

Reactive metals like magnesium, zinc and iron react with acids to make hydrogen gas.

This reaction can be shown using this word equation:  
acid + reactive metal → salt + hydrogen

You can show that the gas is hydrogen by lighting it; it burns with a 'pop'.

## Acids and carbonates

All metal carbonates react with acid to make carbon dioxide gas.

The test for carbon dioxide is to bubble in into limewater solution. The solution turns a milky white colour.

This reaction can be shown using this word equation:  
acid + carbonate → salt + water + carbon dioxide

**Remember**, only a few reactive metals react fast enough with acid to make hydrogen.



### CAN-DO TASK

Level 3 2 1

I can carry out a test to show the presence of carbon dioxide.

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### QUESTIONS

- 9 If universal indicator turns orange:
- What pH would this be?
  - What is the strength of the solution?
- 10 What happens to the pH number as the strength of acids increase?
- 11 What happens to the pH number as the strength of alkalis increase?

#### CHALLENGE QUESTION:

- 13 Suggest two uses of an automatic pH monitoring system.

### QUESTIONS

- 14 Give two useful examples of neutralisation.
- 15 a) Which solution is used to test for carbon dioxide?  
b) What would you see in this test if carbon dioxide is made?
- 16 What happens if a lighted splint is put into  
a) carbon dioxide b) hydrogen?
- 17 When a reactive metal reacts with an acid, what is made besides hydrogen?

#### CHALLENGE QUESTION:

- 12 Describe how you could find the amount of acid needed to neutralise 10 cm<sup>3</sup> of alkali.

# Cooking and cleaning

I am a trainee chef.

I work in a hotel kitchen. I have to show the Head Chef that I can cook many different dishes, using different methods. I use herbs and spices to flavour some dishes. I also bake bread and cakes. I also learn about food safety and hygiene. I need to make sure my uniform is cleaned correctly.



As a trainee chef I need to understand the chemical changes that happen when food is cooked, and how chemicals like baking powder work. I also need to understand how cleaning products work. Being a chef is not just about cooking.

## Raw food

Some foods can be eaten raw. This means you do not need to cook them. Some examples are: fresh fruits, nuts and seeds, salad vegetables, peas and beans, fish, milk and cheese.



Sushi is raw fish.

## Cooked food

Food is cooked to improve its texture, taste and flavour. This makes it easier to chew and digest it, and kills any microbes on the food. Raw potatoes are hard, do not taste nice and can give you stomach ache. Cooking makes the potato softer so it is easier to digest, and tastes better.

You can cook food in different ways. Potatoes can be:

- ◆ fried
- ◆ steamed
- ◆ baked in an oven
- ◆ boiled in water
- ◆ grilled
- ◆ microwaved.

The way you cook potatoes changes the way they taste. Fried chips taste very different to mashed potato.

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### QUESTIONS

- 1 Name two foods that can be eaten raw
- 2 Name six different ways to cook food.
- 3 Why does cooking change the taste of food?

#### CHALLENGE QUESTION:

- 4 Explain why food is cooked.

## Chemical changes

When food is cooked a chemical change takes place. Chemical changes make new substances. When meat is cooked the protein in it is changed forever. It cannot be changed back (reversed).

**Remember**, a chemical change make a new substance that cannot be changed back.

## Baking cakes

To make a sponge cake you need to weigh out and mix equal amounts of butter, sugar, eggs and self-raising flour.

- ◆ Mixing the ingredients traps air, which expands during cooking making the cake rise a bit.
- ◆ Self-raising flour contains baking powder, which is a raising agent.
- ◆ When the cake mixture cooks in a hot oven, the baking powder releases carbon dioxide gas.
- ◆ The carbon dioxide gas forms bubbles that get trapped making the cake rise even more.
- ◆ The cake hardens as it cooks, so it keeps its shape when it cools.



## Fermentation

Fermentation is used to make bread, beer and wine. A useful microbe called yeast feeds on sugar, making alcohol and carbon dioxide gas.



When bread is cooked, the carbon dioxide makes the bread rise. Cooking kills the yeast, and the alcohol that is made evaporates into the air.

To make beer or wine, sugar solution, yeast and flavouring are mixed in a container, and left at room temperature for a few weeks.

**CAN-DO TASK**  
Level 3 **2** 1  
I can carry out a test to show the presence of carbon dioxide.

### QUESTIONS

- 5 What does baking powder do?
- 6 What gas is released when baking powder is heated?
- 7 Why is bread not alcoholic?

#### CHALLENGE QUESTION:

- 8 Write a word equation for fermentation.



## Soap

Soap has been used since ancient times for washing and cleaning clothes.

You can make soap from a kit, or from basic chemicals. Soap is quite expensive to make. Soap is made when animal fat or plant oil is heated with an alkali.

In some places, water contains dissolved calcium, and this is called hard water. This makes it difficult for the soap to make a lather (foam bubbles). If your kettle furs up with limescale you live in a hard water area.

Soap can make a scum if it is used in hard water areas. In hard water areas if you use soap in your bath, the scum sticks to the sides of the bath forming a white ring.



**Remember**, in hard water areas soaps make scum, but detergents do not.

### CAN-DO TASK

Level 3 2 1

I can use a measuring cylinder to measure volume.

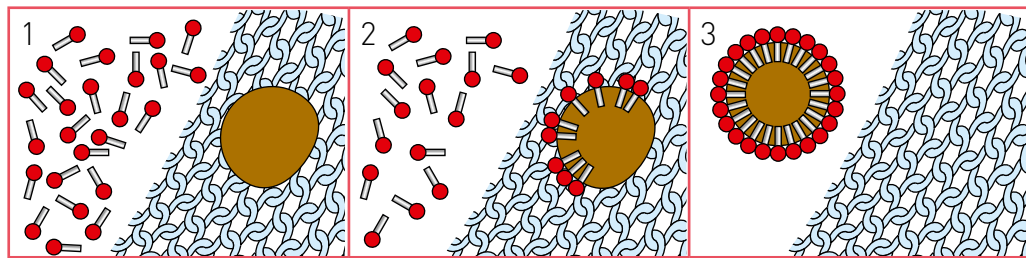
## Detergents

The first detergents were invented after the First World War in the 1920s. Detergents are made from crude oil and are cheaper to make than soap. Detergents can be powders or liquids, and are used for washing clothes and cleaning surfaces. Detergents do not make scum in hard water areas.

## How detergents work

This diagram shows detergents remove grease and dirt.

- 1 Detergent molecules are added. The round head end is attracted to water.
- 2 The tails of the molecules are attracted to the grease and stick in.
- 3 The grease is surrounded by detergent molecules and lifted off the cloth.



This diagram shows detergents remove grease and dirt.

### QUESTIONS

- 9 How is soap made?
- 10 Why does scum form in hard water areas?

#### CHALLENGE QUESTION:

- 11 When grease is removed by a detergent, why does it stay separated?

## Washing powders

Biological washing powders contain enzymes. Enzymes are protein molecules that speed up reactions without being used up. We call them biological catalysts.

In washing powders enzymes digest food stains. A different enzyme is needed for each type of food, so biological washing powders contain many different enzymes.

An enzyme works by being the right shape for the food molecule to fit in. This is known as the 'lock and key' model, as only the right shape food fits into the enzyme lock.

Biological washing powders only work well below 40°C because high temperatures destroy enzymes. Some people get a rash if they wear clothes washed in biological washing powders. They need to use a non-biological washing powder.

## Care labels

Most clothes have a care label telling you how to look after them.

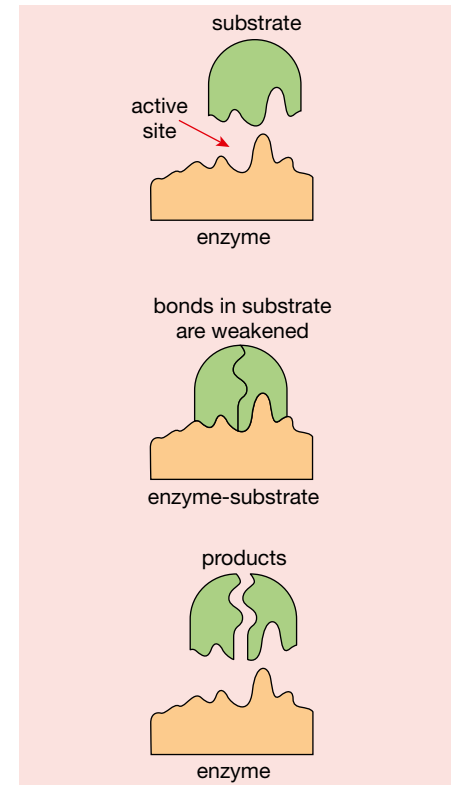
Here are the main ones.

Care symbol	Meaning	Care symbol	Meaning
	hand wash only		dry clean only
	machine wash at 40°C		do not tumble dry
	do not bleach		iron on medium heat

### QUESTIONS

- 12 What helps to digest food in a biological washing powder?
- 13 a) What does a cross mean on a wash label?  
b) What would be the symbol for iron hot?

**Remember**, enzymes do not get used up; they keep working again and again.





# Getting the message

I am a pop singer

I use wireless technology when I perform. The radio microphone is an advantage. I can dance around the stage while I'm singing. I do not have to stay in one place or have a long trailing lead. I can even go down into the audience.



When I'm on tour, I have my laptop and mobile phone with me. They also use wireless technology which means that I can use them anywhere too. It doesn't matter where I am, I can keep in touch with family, friends and fans.

## Wireless technology

The microphone, laptop and mobile phone communicate using radio signals. Radio waves travel at the speed of light – 300 000 km/s. This means messages can be sent very quickly. Some signals are sent to a satellite and back to Earth. They travel over 70 000 km in less than 1/4 second.



**Remember**, sound travels at a speed of about 340 m/s. Radio waves travel at the speed of light.

## Sending messages

Messages used to be sent in many ways. Sometimes people carried written messages; sometimes messages were passed on by word of mouth; sometimes smoke signals and signalling lamps were used. Messages should be sent carefully to avoid errors occurring.

Smoke signals and signalling lamps must have a code. Secret messages are written in a code known only to the sender and receiver.

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Some computer mice communicate using infrared radiation. Infrared radiation belongs to the same family of waves as light and radio waves. Most remote control handsets use infrared.

## On the mobile

Mobile phones are a very convenient way of keeping in touch with home and with friends. Although it is not always possible to get a signal, most of the country is covered by most mobile networks. Some networks share their aerials. This cuts down cost and the number of masts.



Mobile phones use microwaves as their signal. Microwaves also travel at the speed of light. Microwaves have quite a long range, but their signal travels in a straight line. This means the aerials have to be in *line of sight*.



## Line of sight

For aerials to be in line of sight, they must be:

- ◆ mounted very high up or
- ◆ close together.

This means that buildings and hills do not get in the way of the signal. Many mobile phone masts are disguised because people think they spoil the scenery.

**Remember**, mobile phones do not fry the brain!

## Mobile danger

Some scientists think that using mobile phones too much can be harmful. Young people could be harmed more because their bodies have not fully developed. Many people are worried that the microwave radiation from phone masts can be dangerous. They think it may even cause cancer. To be on the safe side, young people are advised to text or use hands-free kits.

**CAN-DO TASK**  
Level 3 2 1  
I can produce a poster on the safe use of mobile phones

### QUESTIONS

- 1 Which of these uses wireless technology? electric drill, microwave oven, satnav
- 2 What are the advantages of using wireless technology?

#### CHALLENGE QUESTION:

- 3 James and Sheena are standing at each end of a 100 m race track. They have two-way radios. Sheena shouts to James while her radio is on. Why does James hear the message twice?

### QUESTIONS

- 4 What is the speed of a microwave signal?
- 5 Suggest one way of reducing any danger from mobile phones.

#### CHALLENGE QUESTION:

- 6 A mobile phone network wants to put up a mast in the centre of town near to a school. Suggest one reason why they want to put the mast there. Suggest one reason why some people do not want the mast there.

## Waving

When you see a Mexican Wave at a football match, you can see the people move up and down as the wave moves around the stadium.

Light, infrared, microwaves and radio are all the same type of wave. They move up and down like the people doing the Mexican wave. They are transverse waves.

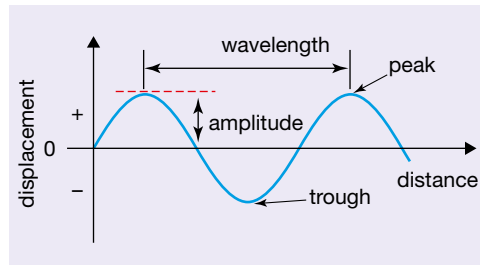
- ◆ The amplitude is the maximum distance a particle moves from its rest position.
- ◆ The wavelength is the distance between one point on a wave and the next similar point.
- ◆ The frequency is the number of complete waves passing a point in one second. It is measured in hertz (Hz).

In a transverse wave, the particles vibrate in one direction. The wave moves at right angles to them.

When you throw a stone into water, waves spread out and the water moves up and down. Energy from this movement moves outwards with the waves, but the water itself does not move outwards.

## Analogue signals

In the picture on the right, a microphone is connected to an oscilloscope. The trace on the screen represents the note being played. The shape of the wave shows the amplitude and frequency. Both are changing continually and can have any value. This is called an analogue signal.



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## The digital revolution

Many countries are switching from analogue to digital television. In the United Kingdom the government prepared plans for the switch to happen region by region.

Remember that analogue signals can have any value. Digital signals are either on or off. We often represent on as 1 and off as 0. Digital signals are better than analogue signals because they do not show as much interference. This means the picture and sound quality can be much better. You also get:

- ◆ a much larger choice of programmes
- ◆ an electronic programme guide
- ◆ interactive viewing.

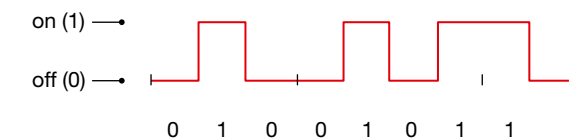
Radio programmes can also be transmitted using digital signals and this gives very good sound quality.

Most modern IT equipment relies on digital technology.

## Morse code

Morse Code uses a system of dots and dashes to represent letters. It is a digital code because there are only two values: on and off. Until recently, most navies used signalling lamps to communicate between ships in Morse Code.

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



### QUESTIONS

- 7 A wave has a frequency of 250 Hz. How many waves pass a point in one second?
- 8 The energy from a projector bulb is transferred to a screen. Answer true or false to this statement. The energy is transferred by the air in the room.

#### CHALLENGE QUESTION:

- 9 Look at the oscilloscope trace.
  - a) What does the height of the wave represent?
  - b) Some parts of the wave are closer together than others. What does this mean?

### QUESTIONS

- 10 Give one advantage of digital television.
- 11 A Morse signal is sent between two ships. Why is it a digital signal?

#### CHALLENGE QUESTION:

- 12 What does this Morse message say?  
 · · · · · - · · · · · - · · · · · / · · · · · /  
 · · · · · · · · · · / - · · · · · / - · · · · ·



# Our electricity supply



I work for an electricity supply company. It's my job to repair the high voltage overhead power lines of the National Grid when they get damaged. Power lines transfer electricity from the power station to the people who use it.

Sometimes, I have to work at the top of the electricity pylons. It is safe for me to work there because the electricity has been turned off. If it wasn't, I would be electrocuted. Transformers at the power station increase the voltage. Sometimes it is as high as 400 000V. There are more transformers at the other end of the transmission line. These decrease the voltage to the 230V used in homes and at work.



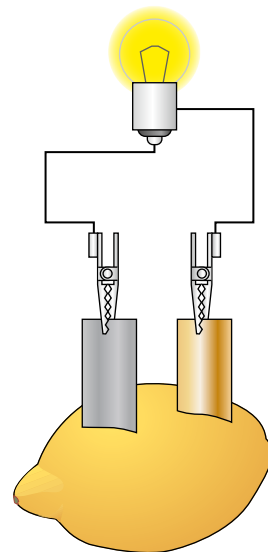
## Making electricity

Some items of electrical equipment use batteries as a source of energy. Others run off the mains electricity.

The electricity from a battery is the result of a chemical reaction. Simple batteries can be made using:

- ◆ two different metal electrodes in acid
- ◆ a pile of zinc and copper discs separated by filter paper soaked in salt solution.

The right battery must be used in a particular situation. The choice will depend on size as well as the voltage and current needed.



### QUESTIONS

- 1 What is the highest voltage used in the National Grid?
- 2 The picture shows a 12V battery. What is this battery used for?



### CHALLENGE QUESTION:

- 3 Terry tries to make two batteries. He connects each lead from a torch bulb to a steel pin and pushes the two pins into a potato. The bulb does not light. Judy does the same experiment. She attaches one lead to a copper pin and the other to a steel pin. She pushes the pins into a lemon. Her bulb lights. Suggest two reasons why Terry's bulb does not light.

## Power stations

All power stations need a source of energy.

Many power stations burn fossil fuels to create electricity.

Fossil fuels are formed from the remains of animals and plants that died millions of years ago. This is why they are called fossil fuels.

The main fossil fuels are:

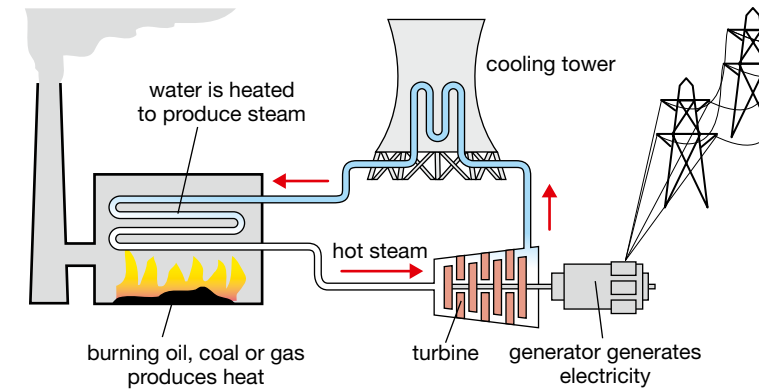
- ◆ oil
- ◆ coal
- ◆ natural gas.

In the power station:

- 1 energy from the burning fuel changes the water into steam
- 2 the steam turns a turbine
- 3 the turbine turns a generator
- 4 the generator produces electricity.

At every stage of the process, energy is lost to the surroundings as heat.

Carbon dioxide is produced whenever a fossil fuel burns. This is released into the atmosphere. Carbon dioxide is a greenhouse gas. This means it contributes to global warming.



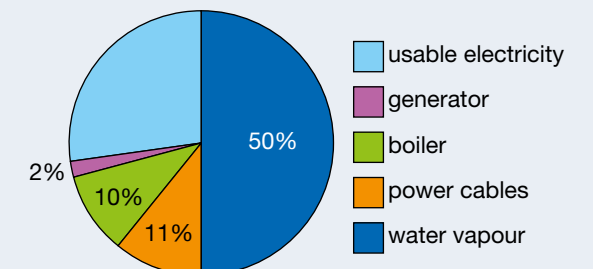
**Remember**, it is water vapour coming from the large towers of a power station, not smoke.

### QUESTIONS

- 4 Why are oil, coal and gas called fossil fuels?
- 5 What is the job of a turbine in a power station?

### CHALLENGE QUESTION:

- 6 The pie-chart shows how much energy is lost in different stages of producing electricity. What percentage of energy is transferred into usable electricity?



# Transformers

A transformer is made by winding two coils of wire onto an iron core. Transformers are used to change the size of a voltage.

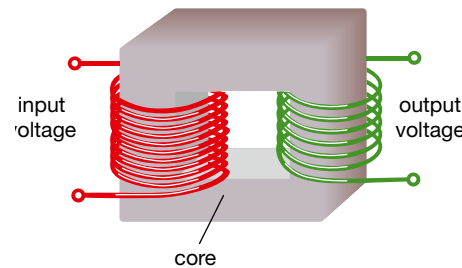
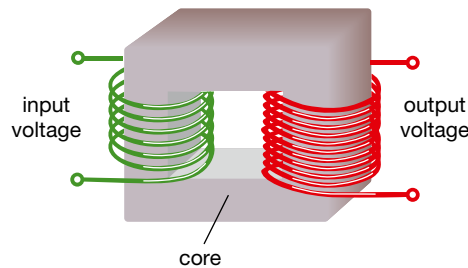
Some transformers increase the voltage. These are called step-up transformers. There are more turns of wire on the output coil than the input coil.

Some transformers decrease the voltage. These are called step-down transformers.

There are more turns of wire on the input coil than the output coil.

Step-up transformers at a power station are very large.

Some step-down transformers, like those used to charge your mobile phone, can be quite small. Some step-down transformers such as those used in electricity sub-stations are very large.



# Reading the meter

The electricity we all use at home has to be paid for. The amount we use is recorded on a meter. Most homes have the meter read every 3 or 6 months. The supply company then sends a bill.

When you read an electric meter, the last number is not recorded.



The amount of electricity used is measured in kilowatt-hours. We normally call a kilowatt-hour a *unit* of electricity.



Transformers at a power station.

**Remember**, transformers do not change AC into DC. They only increase or decrease the size of a voltage.

**CAN-DO TASK**  
Level 3 2 1

I can read a domestic electricity meter.

DRAFT - SUBJECT TO OCR APPROVAL

## QUESTIONS

- 7 What is the job of a transformer?
- 8 What is the reading on the electric meter?

### CHALLENGE QUESTION:

- 9 Suggest where you would find a very large step-down transformer.

# Paying for electricity

The cost of electricity is rising. Many people, especially some elderly, find it difficult to pay their bill.

The amount of electricity we use depends on the power of the appliance and how long it is used for.

Some appliances, such as kettles and cookers, have a high power rating. This means they use a lot of electricity. Light bulbs and door bells have a very low power rating which means they use less electricity.

Electricity supply companies all have different ways of charging. They will all show the following information:

- ◆ present and last meter readings
- ◆ units of electricity used and cost per unit
- ◆ any additional costs, savings and VAT

# Cutting the cost

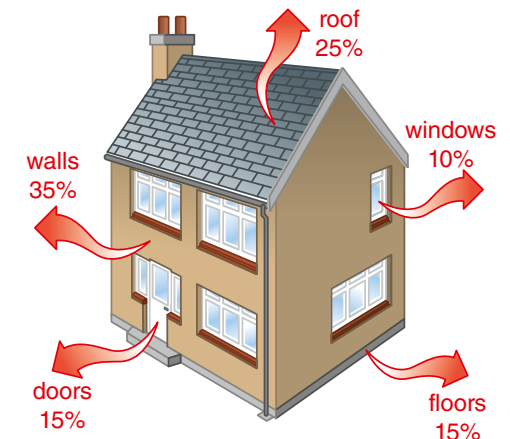
We can reduce our electricity bills by making sure there is not very much energy loss from our homes. Most energy is lost through the walls and roof. The rest is lost through the floors, doors and windows.

Energy loss can be reduced by:

- ◆ cavity wall insulation
- ◆ loft insulation
- ◆ carpet and underlay
- ◆ draught strip around doors
- ◆ curtains, curtain lining, blinds and double glazing.



How can insulation help you to save money?



## QUESTIONS

- 10 Look at the electricity bill. How much does one unit of electricity cost?

Electricity you've used this period					
Meter number 64803 General purpose rate					
Reading period 4 Mar 11 to 5 Jun 11					
	previous	latest	units	pence	charges
Electricity used	02782	03762	980	13.65	£133.77
VAT @ 5%					£6.68
<b>Total for this period</b>					<b>£140.45</b>

- 11 Suggest three ways of reducing energy loss through windows.

### CHALLENGE QUESTION:

- 12 James moves in to an old house that does not have any insulation. He cannot afford to have the house fully insulated. Why should he have cavity wall insulation before double glazing?