Lower key stage 2 – years 3-4

The principal focus of science teaching in lower key stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out.

'Working scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word reading and spelling knowledge.

Lower Key Stage 2

Working scientifically

Lower Key Stage 2 programme of study (statutory requirements)	Notes and guidance (non-statutory
• asking relevant questions and using different types of scientific enquiries to answer them • setting up simple practical enquiries, comparative and fair tests • making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • reporting on findings from enquiries, including oral and written explanations,	Pupils in years 3 and 4 should be given a range of scientific experiences to enable them to raise their own questions about the world around them. They should start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions; recognise when a simple fair test is necessary and help to decide how to set it up; talk about criteria for grouping, sorting and classifying; and use simple keys. They should begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them. They should help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used.

displays or presentations of results and conclusions • using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • identifying differences, similarities or changes related to simple scientific ideas and processes • using straightforward scientific evidence to answer questions or to support their findings.	They should learn how to use new equipment, such as data loggers, appropriately. They should collect data from their own observations and measurements, using notes, simple tables and standard units, and help to make decisions about how to record and analyse this data. With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions. With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done. They should also recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations. Pupils should use relevant scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences. These opportunities for working scientifically should be provided across years 3 and 4 so that the expectations in the programme of study can be met by the end of year 4. Pupils are not expected to cover each aspect for every area of study.

Year 4: All living things

Year 4 programme of study (statutory requirements)	Notes and guidance (non-statutory	Working Scientifically ideas
Pupils should be taught to: • recognise that living things can be grouped in a variety of ways • explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment • recognise that environments can change and that this can sometimes pose dangers to living things.	Pupils should use the local environment throughout the year to raise and answer questions that help them to identify and study plants and animals in their habitat. They should identify how the habitat changes throughout the year. Pupils should explore possible ways of grouping a wide selection of living things that include animals and flowering plants and non-flowering plants. Pupils could begin to put vertebrate animals into groups such as fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects. **Note:** Plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, such as ferns and mosses. Pupils should explore examples of human impact (both positive and negative) on environments, for example, the positive effects of nature reserves, ecologically planned parks, or garden ponds, and the negative effects of population	• Are mini beasts affected by bright light? • Compare two habitats: Which has most trees/plants/minibeasts? • In minibeasts which number of legs is most common? • What affects the numbers of different plants in different parts of the school grounds ? • Which tree has most birds on it? Pupils might work scientifically by: exploring local small invertebrates and using guides or keys to identify them; making a guide to local living things; raising and answering questions based on their observations of animals and what they have found out about other animals that they have researched.

	and development, litter or deforestation.	

Other teaching ideas

1. Using keys in reference books, identify minibeasts found in school grounds according to body parts/wings/legs/number of legs etc.
2. Using keys in reference books identify plants in classroom or school grounds according to leaf shape/flower/growth etc.
3. Odd one out. A child chooses 3 pictures of a minibeast/bird/plant. Others say which is odd one out and why
4. Make a database for minibeasts, plants or birds
5. Looking after stick insects/spiders/woodlice/caterpillars in the classroom
6. Discuss animal and plant differences re: protection e.g. colour, poisons, pattern, spikes etc.
7. Draw the food chain grass, cows, humans
8. Discuss what happens if there is not enough food or water
9. Asking children their favourite foods and sorting into plants/animals
10. Making a mobile based on a food chain or web
11. Drawing food chains which contain plants/animals with which we are familiar

Key information

- Plants need warmth, light and water for healthy growth.
- Plants grown without light often germinate quickly or grow tall but they are not strong plants.
- The plant is held in the soil by the root. The roots of different species of plant can be very different. Plants of the same species have roots which are similar.
- Plants take up water from the soil through their roots.
- When plants are pulled up, they cannot get water and the stems and leaves droop (wilt).
- When the roots are put in water, the stems and leaves become upright again.
- Seeds need space to grow away from the parent plant. Plants produce lots of seeds, only a few of them find suitable places and grow into new plants. They are adapted to be dispersed in several ways:
  - seeds blown away by the wind have parachutes e.g. dandelion or wings (sycamore);
  - seeds that stick to animal coats have tiny hooks on the outside which can be seen with a lens e.g. cleavers, burdock;
  - seeds used by animals for food, e.g. nuts are buried as a food store
  - seeds eaten by birds are encased in brightly coloured fleshy fruit. The seeds inside have a hard outer covering so they can pass through the gut and still grow into new plants e.g. berries and rosehips.
  - some seeds have an outer casing e.g. broom pods which dry and bursts open, flinging the seeds away.
- Seeds need light, water and space (to get air and sunshine) in order to grow after they have germinated.
- Plants grow from seeds that are in the soil even though we cannot see them.
- Some plants grow from pieces of root or underground stem left in the soil when it is dug.
- Plants will eventually cover (colonise) an area.
- The numbers and types of species in an area changes over the years
- Most flowers have: sepals; petals; stamens (anthers and filaments) and carpels (stigma, style and ovary)

- Flowers of the same species have common characteristics: the same number, shape and arrangement of sepals, petals, stamens and carpels, e.g. sweet pea, vetch and clover, daffodil, jonquil and narcissus .
- A 'control' in a science experiment is one which is set up under 'normal' conditions - in this case, given all the requirements for growth - so that it can be compared to the others.
- Vertebrates are animals with a backbone.
- Invertebrates are animals without a backbone.
- Vertebrates can be subdivided into other groups:

- Animals are especially suited to places where they live. To survive animals need the right food, water (or moisture) shelter, the right temperature and oxygen from *air or dissolved in water.* Habitats (except for ponds) do not have clear boundaries, animals can move away from the place where you found them, some e.g. birds may visit when you are not there.
- Animals have young so it is likely that different sizes of the same species will be found.
- Plants of the same species, growing in different places, often produce plants of a different size and shape to suit local conditions. This is called adaptation.

- Different habitats provide differing conditions for the animals that live there.
- Some animals are able to live in different habitats so you may find the same ones in different places.
- Animals are especially suited to the place where they live. Some animals, e.g. frogs / tadpoles need different conditions at different stages of their life cycle.
- Different plants grow in different habitats.
  Plants are adapted to suit the conditions where they grow. Plants of the same kind can grow differently if the conditions are not the same, e.g. bluebells grow taller in the shade than in the sun.
- All plants need different amounts of light and water to grow and produce flowers and seeds. Some plants grow best in certain kinds of soil. All species of plants have specific requirements.

Year 4: Animals, including humans

Year 4 programme of study (statutory requirements)	Notes and guidance (non-statutory	Working Scientifically ideas
Pupils should be taught to: • describe the simple functions of the basic parts of the digestive system in humans • identify the different types of teeth in humans and their simple functions • construct and interpret a variety of food chains, identifying producers, predators and prey.	Pupils should be introduced to the main body parts associated with the digestive system, such as mouth, tongue, teeth, oesophagus, stomach and intestine and explore questions that help them to understand their special functions.	• Which is the best toothpaste to clean shoe polish from a tile? • How clean are our teeth at different times during the day (Use disclosing tablets) Pupils might work scientifically by: comparing the teeth of carnivores and herbivores, and suggesting reasons for differences; finding out what damages teeth and how to look after them. They might draw and *discuss* their ideas about the digestive system and compare them with models or images.

Other teaching ideas

- Label a diagram of the different parts of the digestive system.
- Use websites to explore the digestive system such as http://kidshealth.org/kid/interactive/digestive_it.html
- Make a model of a digestive system
- Use model teeth and break up play dough
- Create food chains for animals in different countries.
- Sort animals into carnivores, omnivores and herbivores.

Key information

Teeth

A full set of teeth is: 4 incisors, 2 canines, 4 pre-molars and 6 molars, top and bottom, a total of 32 teeth.

- Teeth are adapted for different purposes:
  - sharp teeth for biting;
  - pointed teeth for holding and tearing;

- flat topped teeth for grinding.
- Carnivores, e.g. dogs, have large pointed canine teeth for tearing meat. They have no flat teeth for grinding food because their food is swallowed in lumps.
- Herbivores, e.g. rabbits, have sharp teeth for biting; they have no pointed teeth because they do not tear their food. They have lots of flat teeth for grinding up plants.
- Omnivores, have sharp teeth for biting, small pointed teeth for holding and tearing and flat teeth for grinding.

Your Digestive System

The story we're about to tell is of stormy seas, acid rains, and dry, desert-like conditions. It's an arduous journey that traverses long distances and can take several days. It's one in which nothing comes through unchanged. It's the story of your digestive system whose purpose is turn the food you eat into something useful -- for your body!

Down the Hatch

It all starts with that first bite of pizza. Your teeth tear off that big piece of crust. Your saliva glands start spewing out spit like fountains. Your molars grind your pizza crust, pepperoni, and cheese into a big wet ball. Chemicals in your saliva start chemical reactions. Seemingly like magic, starch in your pizza crust begins to turn to sugar! A couple of more chews and, then, your tongue pushes the ball of chewed food to the back of your throat. A trap door opens, and there it goes, down your gullet!

Next, your muscles squeeze the wet mass of food down, down, down a tube, or esophagus, the way you would squeeze a tube of toothpaste. It's not something you tell your muscles to do -- they just do it -- in a muscle action called peristalsis. Then, the valve to the stomach opens and pizza mush lands in your stomach!

Inside your stomach

Imagine being inside a big pink muscular bag -- sloshing back and forth in a sea of half-digested mush and being mixed with digestive chemicals. Acid rains down from the pink walls which drip with mucus to keep them from being eroded.

Sound a little like an amusement ride gone crazy? Every time you think you've got your equilibrium back, the walls of muscle contract and fold in on themselves again. Over and over again, you get crushed under another wave of slop. Every wave mixes and churns the food and chemicals together more--breaking the food into even smaller and smaller bits. Then another valve opens. Is the end in sight you ask, as the slop gets pushed into the small intestine.

Inside the small intestine, chemicals and liquids from places like your kidneys and pancreas break down and mix up the leftovers. The small intestine looks like a strange underwater world filled with things that resemble small finger-like cactus. But they're not cactus, they're villi. Like sponges, they're able to absorb tremendous amounts of nutrients from the food you eat. From the villi, the nutrients will flow into your bloodstream.

But hold on! The story's still not over yet -- the leftovers that your body can't use still have more traveling to do! Next, they're pushed into the large intestine. It's much wider and much drier. You find that the leftovers getting smaller, harder and drier as they're pushed through the tube. After all, this is the place where water is extracted and recycled back into your body. In fact, the leftovers that leave your body are about 1/3 the size of what first arrived in your intestines!

Where Food Turns Into Poop

Finally, the end of the large intestine is in sight! Now the drier leftovers are various handsome shades of brown. They sit, at the end of their journey, waiting for you to expel them -- out your anus. Of course, you know the rest! A glorious,if slightly stinky, journey, don't you think?

Year 4: States of matter

Year 4 programme of study (statutory requirements)	Notes and guidance (non-statutory	Working Scientifically ideas
Pupils should be taught to: • compare and group materials together, according to whether they are solids, liquids or gases • observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) • identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	Pupils should explore a variety of everyday materials and develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container). Pupils should observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled. Note: Teachers should avoid using materials where heating is associated with chemical change, for example, through baking or burning.	• How does the temperature of water affect the time for salt/sugar to dissolve? • How does the amount of salt/sugar affect the time for water to evaporate? • How does the type of filtering agent alter the cleanliness of water? • What affects the time for sand particles to flow in an egg-timer? • What happens when water is added to sand, salt and sugar, instant coffee, flour, and milk powder, custard powder, corn flour and icing sugar, plaster of paris, powder paint and dye. • Does the temperature of the water affect how much solid will dissolve in it? Pupils might work scientifically by: grouping and classifying a variety of different materials; exploring the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice-cream for a party). They could research the temperature at which materials change state, such as when iron melts or when oxygen condenses, using and applying what they have learnt in mathematics. They might observe and record evaporation over a period of time, such as a puddle in the playground or washing on a line, and investigate the effect

		of temperature on washing drying or snowmen melting.

Other teaching ideas

1. Discussing, sorting and grouping familiar materials as solids or liquids
2. How many powders and how many liquids can you name?
3. Discussing the difference between powders and liquids
4. Handling Smarties and Treats to see how long they take to melt
5. Time how long it takes ice to melt in different parts of the room
6. Putting liquids in the freezer e.g. water, cooking oil, milk, sauce, salad cream
7. Separating by sieving: Big beans from small bans, lentils from rice, rice from salt, sand from stones, solid particles in oven dried soils
8. Discussing, explaining and learning the meaning of dissolve, soluble, insoluble and solution in relation to salt, sand and water
9. Filtering salt water and sand in water through paper
10. Dissolving Race. Each team has a plastic bottle half full of water, and salt. One spoonful is added the teams see who can make the salt dissolve fastest
11. Making a poster or collage showing solids and liquids and/or their properties
12. Draw a storyboard about the journey of water in the watercycle.
13. Draw pictures which show examples of condensation and evaporation.

Key information

Powders are made up of tiny solid particles. Some solids dissolve in water. This means the solids spread out to become part of the liquid. This means the solids become liquid when they are put into water or another liquid. Some substances are less soluble than others. If too much powder is added to the water only some will dissolve, the solution has become saturated.

Some solids do not dissolve in water. These are insoluble substances. Sometimes tiny solid particles spread out in the water so it looks as though they have dissolved but in fact they are suspended in the liquid and are really insoluble. Insoluble substances can be separated from liquids by filtering. Gravel, sand and pebbles all make good filtering material. Some solids will float on water, some will sink.

Plaster of Paris reacts with water causing a chemical change. The water and powder combine to form a solid substance. Heat is given off during this reaction. Substances that fizz when added to water are reacting chemically and giving off carbon dioxide gas. In simple terms this change is considered to be irreversible, however this particular reaction can be reversed under certain conditions (most reactions where there is a chemical change are irreversible).

Thermometers are used to read the temperature. We often record the air temperature when we learn about the weather so that we can compare the temperature on different days. The liquid in the thermometer rises as it gets warmer. *The liquid expands on heating.* The higher the temperature, the higher the liquid will rise. The number of degrees Celsius will be greater as it gets warmer. Thermometers can be used to take the temperature of gases, liquids or solids. Changes in temperature can be recorded on a graph or bar chart. IT can be used to store, retrieve and display data.

Melting is the process in which a solid material is heated causing the material to change its state and become liquid. When the heat is removed the liquid will cool down and become solid once more. Melting is a reversible process. Solid materials have a fixed shape. Liquid materials take the shape of their container. We can change the shape of solids by melting them but the material does not change.

Sieving can separate solid particles of different sizes. When two or more substances are mixed together but can be separated out again, this is called a mixture. Sieving is one way of separating a mixture of two or more dry substances, which have different sized particles

Water cycle

The Earth is covered by water, however, almost 97% is salt water found in the oceans. We can not drink salt water or use it for crops because of the salt content. We can remove salt from ocean water, but the process is very expensive.

How many processes make up the water cycle?

There are **six** important processes that make up the water cycle.

1. Condensation - the opposite of evaporation. Condensation occurs when a gas is changed into a liquid.
2. Infiltration - Infiltration is an important process where rain water soaks into the ground, through the soil and underlying rock layers.
3. Runoff - Much of the water that returns to Earth as precipitation runs off the surface of the land, and flows down hill into streams, rivers, ponds and lakes.
4. Evaporation - the process where a liquid, in this case water, changes from its liquid state to a gaseous state.
5. Precipitation - When the temperature and atmospheric pressure are right, the small droplets of water in clouds form larger droplets and precipitation occurs. The raindrops fall to Earth.
6. Transpiration - As plants absorb water from the soil, the water moves from the roots through the stems to the leaves. Once the water reaches the leaves, some of it evaporates from the leaves, adding to the amount of water vapor in the air. This process of evaporation through plant leaves is called transpiration.

Year 4: Sound

<table>
<tr><th>Year 4 programme of study (statutory requirements)</th><th>Notes and guidance (non-statutory</th><th>Working Scientifically ideas</th></tr>
<tr><td>Pupils should be taught to:

• identify how sounds are made, associating some of them with something vibrating
• recognise that vibrations from sounds travel through a medium to the ear
• find patterns between the pitch of a sound and features of the object that produced it
• find patterns between the volume of a sound and the strength of the vibrations that produced it
• recognise that sounds get fainter as the distance from the sound source increases.</td><td>Pupils should explore and identify the way sound is made through vibration in a range of different musical instruments from around the world; and find out how the pitch and volume of sounds can be changed in a variety of ways.</td><td>• How is the volume of a bell affected by the surface it is on?
• What material conducts sound the best?
• What material is the most effective sound insulator?
• How can you amplfy sound ie make an alarm clock sound loud, shout a message across the playground?
• Make the best drum from a container.
• Does the length of material affect the pitch eg straw, string, wooden and metal ruler?
• How can you make the best string telephone?

Pupils might work scientifically by: finding patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses. They might make earmuffs from a variety of different materials to investigate which provides the best insulation against sound. They could make and play their own instruments by using what they have found out about pitch and volume.</td></tr>
<tr><td colspan="3">Other teaching ideas

1. How are sound and vibrations connected? Hands on radios, tape players and anything else that makes sound and vibrates
2. How are vibrations affected by volume, tone and tuning buttons?</td></tr>
</table>

3. Hands on our own throats whilst humming - feel the vibrations?
4. Watching rice on an upturned speaker, how is it affected by volume and tone
5. Making and testing junk instruments
6. Putting a range of vibrating tuning forks into water
7. Write a mnemonic poem about vibrations
8. Cut the top of a straw into a triangle and blow through it. Cut the straw shorter and shorter to investigate how pitch changes.
9. Challenge children to make the best string telephone with resources provided.
10. Design and make an Ear Trumpet or a megaphone

Key information

Sound is caused when an object vibrates. The faster the vibrations the higher the sound. The slower the vibrations the lower the sound. The bigger the vibrations the louder the sound. The smaller the vibrations the quieter the sound. Shorter lengths of elastic or columns of air vibrate faster making a higher sound.

Sound can travel through all materials. Some materials transmit sound better than others. Sound passes through wood, metal and water more quickly than through air. Sound passes through hard materials better than soft materials.

Ears allow us to hear. Sound is muffled when ear muffs are worn because the sound waves are not able to reach the ear drum. External ears vary. Some animals can alter the position of their ears to detect the direction of the sound.

Echoes are sound waves being reflected from surfaces. Hard surfaces are more likely to produce echoes. Soft materials absorb the sound waves. Empty rooms without any furnishing are more likely to produce echoes. Echoes can also be heard in caves, tunnels, mountainous areas, and near walls.

Noise is measured in decibels. Sound is measured with a sound meter. Too much noise can damage your ears. Sound vibrations are absorbed better by some materials. Sound does not travel through a vacuum.

Different vibrations alter the pitch and loudness of a sound. High notes vibrate more each second than low notes the frequency is higher.

Sound travels in waves. Loud and quiet noises have the same number of vibrations per second. Loud noises have a greater amplitude - quiet noises have a small amplitude. Sound travels through hard materials more easily than soft materials. Light travels much faster than sound. For example, an aircraft can be seen before the noise of the engines is heard.

Year 4: Electricity

Year 4 programme of study (statutory requirements)	Notes and guidance (non-statutory	Working Scientifically ideas
Pupils should be taught to: • identify common appliances that run on electricity • construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers • identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery • recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit • recognise some common conductors and insulators, and associate metals with being good conductors.	Pupils should construct simple series circuits, trying different components, such as bulbs, buzzers and motors, and including switches, and use their circuits to create simple devices. Pupils should draw the circuit as a pictorial representation, not necessarily using conventional circuit symbols at this stage; these will be introduced in year 6. **Note**: Pupils might use the terms current and voltage, but these should not be introduced or defined formally at this stage. Pupils should be taught about precautions for working safely with electricity.	• How is brightness of the bulb affect by number of batteries/length of wire/thickness of wire/type of wire? • Which materials conduct electricity the best? How can we stop Burglar Bill from coming into the classroom? Find the best conductors and insulators. How does the number of batteries affect the brightness of a bulb? • How does the number of bulbs affect the brightness of a bulb? Pupils might work scientifically by: observing patterns, for example that bulbs get brighter if more cells are added, that metals tend to be conductors of electricity, and that some materials can and some cannot be used to connect across a gap in a circuit.

Other teaching ideas

1. Make a light-up Christmas card
2. Making a bulb light with the least possible equipment
3. Making a bulb light with a switch in the circuit
4. Draw simple circuits using agreed symbols
5. How can you make a bulb flash and what could it be used for?
6. Writing about the journey electricity makes as it goes around a circuit describing what it does in bulbs, wires and switches

7. Check pictures of circuits, indicating which will work, then using equipment to make and test each circuit

Key information

- A complete circuit is needed to make electrical devices work. The circuit must include a battery or power supply.

- Changing over the battery terminals reverses the flow of electricity. The direction of the flow of electricity does not affect a bulb but in LED's and buzzers the electricity can only flow one way. Reversing the flow of electricity through a motor reverses the direction in which the motor rotates

- Electricity can flow through some materials more easily than others. If the electricity cannot pass through the material the circuit is not complete. Materials that electricity can pass through easily are called conductors. Most metals are good conductors of electricity. Poor conductors are called insulators.

- A circuit with two or more bulbs wired in this way is called a series circuit. If you unscrew one bulb it breaks the circuit and none of the bulbs will light.

- As the electricity flows through the bulb it makes it light; the faster the flow of electricity, the brighter the bulb will be.

- A bulb in the circuit slows down (resists) the flow of electricity. More bulbs, wired in series, will slow down the flow even more so the bulbs become dimmer.

- A circuit with two or more components wired like this is called a parallel circuit.

- The two bulbs in a parallel circuit stay bright because there is only one bulb in each 'route' to resist the flow of electricity. The flow is faster so each bulb is brighter than in a series circuit.

- If you unscrew one bulb in a parallel circuit the other bulb will stay lit because the electricity can still pass through this 'route'.

- All materials and components in an electrical circuit resist (slow down) the flow of electricity to some degree.

- As we increase the length of resistance wire through which the electricity must flow, the current is reduced (i.e. the electricity flows more slowly) so the bulb becomes dimmer. When resistance is high, the bulb will be dim. When resistance is low, the bulb will be bright.

- Resistors are used to control the flow of electricity. A variable resistor contains a long piece of resistance wire coiled to take up less space. Variable resistors can be used to control light, volume and speed.

- A cell consists of 1.5 volts. A battery is a combination of two or more 1.5 volt cells. We often refer to 1.5 volt cells as batteries by mistake!

- The voltage of the battery is like a 'push' which makes the electricity flow.
- The bigger the voltage the harder the 'push' so the current is higher i.e. the electricity flows faster. The bulb is brighter when the flow of electricity is faster.
- We use symbols to represent components in a circuit
- The symbols are used to draw a circuit diagram
- The symbols are recognised internationally.