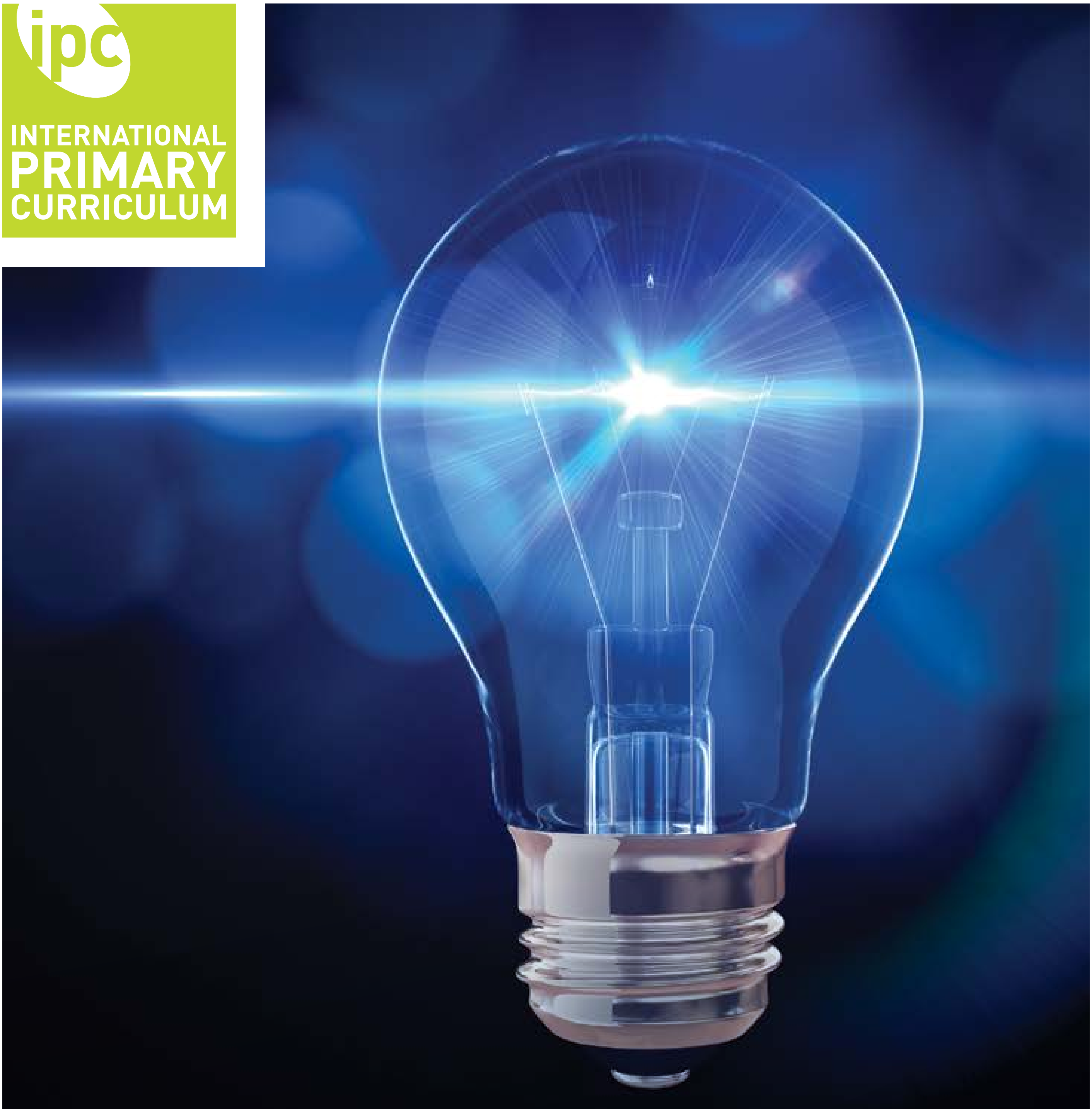
INTERNATIONAL PRIMARY CURRICULUM



Bright sparks!

Electricity

A unit for children
aged 7-9 years

Contents

Introduction

This is a unit of the International Primary Curriculum

The IPC has been developed to provide support to teachers so that four main aims can be achieved. They are:

- To help children learn the subject knowledge, skills and understandings they need to become aware of the world around them
- To help children develop the personal skills they need to take an active part in the world throughout their lives
- To help children develop an international mindset alongside their awareness of their own nationality
- To do each of these in ways which take into account up-to-date research into how children learn and how they can be encouraged to be life-long learners

The IPC has a simple but comprehensive structure

Everything is based on clearly defined learning goals which lay out the subject, personal and international knowledge, skills and understandings children need at different stages of their primary school life:

✓ **Learning Goal**
A specific statement of what children should 'know', 'be able to do' or develop an 'understanding' of at different mileposts. The IPC contains learning goals for each subject of the curriculum, for personal development and for 'international mindedness'.

See Section 6 of the teaching and implementation file for a full list of all the learning goals.

✓ **Learning Target**
An IPC learning target is a refined learning goal specifically related, where appropriate, to the content of each unit of work.

✓ **A Process of Learning**
The units of work provide practical activities which teachers can use in the classroom plus a wealth of other supportive information. Each unit is structured to make sure that children's learning experiences are as stimulating as possible.

All the units follow the same process of learning as described below (see page 1 of 'Teaching the IPC' for a full description of IPC units of work, available via the Members' Lounge).

✓ **Entry Point**

The entry point is an activity for children that begins each unit of work and provides an exciting introduction to the work that is to follow. Entry points can last from one hour to a week, depending on the age of the children and the appropriateness of the activity.

✓ **Knowledge Harvest**

The knowledge harvest takes place in the early stages of each unit and provides an opportunity for children to reveal what they already know about the themes they are studying. This bank of knowledge can then be added to, developed and even challenged by the teacher, throughout the course of the unit.

✓ **Explain The Theme**

This activity involves the teacher helping the children to see the 'big idea' of the unit of work before embarking on the subject learning.

✓ **Big Picture**

The big picture provides teachers with subject-based background information to the issues contained within the unit.

✓ **Research Activity**

Each IPC unit has a research activity and a recording activity. Research activities always precede the recording activities. During research activities, children use a variety of methods and work in different group sizes to find out a range of information.

✓ **Recording Activity**

During the recording activities, children interpret the learning they have researched and have the opportunity to explain it in ways which feature their multiple intelligences.

✓ **Exit Point**

The exit point has two main purposes. First, to help children pull together their learning from the unit and second, to celebrate the learning that has taken place.

Disclaimer

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Basic Information

This section details the time allocation for this unit of work, links to other subjects and Assessment for Learning opportunities.

Timings

This unit of work is intended to last about 2 to 3 weeks.

The following suggested timings are approximate guides and are dependent on each school's individual context.

	Approx no. of hours	Approx no. of weeks
Entry Point, Knowledge Harvest, Explain the Theme	4	½
Science	8	1
Technology	3	⅜
History	1	⅛
International	1	⅛
Exit Point	4	½

Links to other IPC subjects

ICT learning goals are included in the above subject learning.

Language Arts and Mathematics links

Suggestions of how to include links to Mathematics are provided where appropriate at the end of each learning task.

Assessment for Learning opportunities

Opportunities to assess your children's skills progress exist throughout the unit. Wherever you see the symbol, you can use the teachers' and children's rubrics in the IPC Assessment for Learning Programme.

Each task also highlights possible Assessment for Learning opportunities.

Learning Targets

Science Learning Targets

Children will:

2.1 Be able to carry out simple investigations

- **Suggesting ways of collecting evidence**
- **Preparing a simple investigation which is fair with one changing factor**
- **Predicting the outcomes of investigations**
- **Using simple scientific equipment**
- **Testing ideas using evidence from observation and measurement**
- **Linking the evidence to broader scientific knowledge and understanding**
- **Using evidence to draw conclusions**
- **Recording and communicating their observations and findings in a variety of ways**
- **Explaining their observations and findings**

2.2 Be able to gather information from simple texts

2.3 Understand the importance of collecting scientific evidence

2.4 Understand some of the effects of what they learn on people's lives

2.25 Know that some materials conduct electricity

2.26 Know that some materials conduct heat more effectively than others

2.31 Be able to compare common materials and objects according to their properties

2.34 Understand that different materials are suited for different purposes

2.35 Know about the principles of magnets and magnetic and non-magnetic materials

2.36 Be able to construct electrical circuits to make devices work

2.37 Be able to change the type or number of components in a circuit to have a different effect

2.38 Know that forces have direction

2.39 Know that forces differ in size

2.40 Know about the effects of friction

2.41 Know that light travels from a source

Technology Learning Targets

Children will:

2.1 Know the way in which products in everyday use are designed and made affects their usefulness

2.2 Be able to design and make products to meet specific needs

2.3 Be able to make usable plans

2.4 Be able to make and use labelled sketches as designs

2.5 Be able to use simple tools and equipment with some accuracy

2.7 Be able to identify the ways in which products in everyday use meet specific needs

History Learning Targets

Children will:

2.4 Be able to give some reasons for particular events and changes

2.5 Be able to gather information from simple sources

2.6 Be able to use their knowledge and understanding to answer simple questions about the past and about changes

2.7 Understand that the past can be considered in terms of different time periods

International Learning Targets

Children will:

2.1 Know about some of the similarities and differences between the different home countries and between them and the host country

2.2 Know about ways in which these similarities and differences affect the lives of people

2.3 Be able to identify activities and cultures which are different from but equal to their own

The Entry Point

In advance of the session, transform your classroom with a stunning light show! Disco ball lights that rotate, novelty lights, mini-strobe lights, lights that glow or flash in sequence can all be used to dazzling effect. Set up the lights the night before so that the children will be awestruck at their brilliance when they enter the room.

Invite your class to the party! Tell them you are celebrating the start of a new unit. Can they guess what the unit is going to be about? If you have a whiteboard and computer you could play music through Windows Media Player or similar and dance as the lights on the screen pulse to the music (visualisation).

Alternatively, depending on the time of year when you are starting the unit, you could tie in your entry point to a festival or celebration associated with lights such as Diwali, Hanukkah or Christmas. This will give more meaning and real context to the activity.

The following website provides a useful starting point for teachers who are looking to purchase disco lights:

www.amazon.com/Creative-Motion-10-Inch-Rotating-Disco/dp/B00005LZY5
Amazon website has a rotating disco ball.

Knowledge Harvest

Recall the entry point. Turn on a set of decorative lights, or a desk lamp or torch and ask the children: How do lights work?

Sometimes we just put a plug in a socket, flick a switch and a light comes on. Simple. But how does the socket and the switch work? What's going on inside the socket and switch? Electricity!

Write this word on the board in huge letters. Ask, what is this thing we call 'electricity'? Can we see it? Can we smell it? Can we touch it? (No, we shouldn't touch it!) Is it magic? Long ago people used to think it was mysterious – this was before we knew what electricity was.

Ask the children to name or make a list of some common appliances that run on electricity, e.g. TVs, refrigerators, computers, mobile phones, etc.

Sit the children in groups and give each group a statement, at random, about electricity – the statement could be written on a card (you could cut these in the shape of light bulbs) or sticky note.

For example, some true statements could be:

- Electricity is a form of energy
- Electricity flows through wires
- Electricity is dangerous
- Lightning is a form of electricity
- Batteries store electricity
- Our body contains electricity

False statements could be:

- Electricity is in everything
- Electricity is alive
- Electricity is free
- Electricity is like a gas
- Electricity evaporates
- No one knows how electricity works

Ask each group to first discuss and then decide whether they think the statement is true or false. The children should be able to explain their decision to the rest of the class. Make a list of 'true', 'false' and 'don't know' statements and display these as your knowledge harvest.

Expand on these statements to make a class mind map about electricity. You could use mind-mapping software such as Inspiration 9 (**www.inspiration.com/Kidspiration**) or 2connect (**www.2simple.com**), or download free software from the following website:

www.adrianbruce.com/computers/mindmap/mindmap.htm
Adrian Bruce website allows you to download free mind-mapping software.

Finally, you should ask the children what they themselves would like to know about electricity. They could write out their questions and then add them to the mind map.

Display the mind map as your knowledge harvest in a place that is easily accessible to the children so they can add further pictures, ideas and information as the unit progresses.

Explaining The Theme

The big idea

Electricity is a type of energy. We use electricity in our lighting and heating, TVs and computers, cars and trains, toys and games – even clocks and watches use electricity. In today's world, most people use electricity every single day. We would find it difficult to live without electricity. But how does electricity really work?

In Science, we'll be finding out:

- How to make an electrical circuit
- Which materials allow electricity to pass through them
- What happens when we change a circuit
- How to build bigger circuits
- About magnetism and electricity
- About using electricity as heat
- How to keep safe around electricity

In Technology, we'll be finding out:

- How to make a house with lighting and a door buzzer

In History, we'll be finding out:

- About the history of the electric light bulb

In International, we'll be finding out:

- How we produce electricity in our country

The Big Picture

The word ‘electricity’ derives from the Greek ‘electron’ meaning amber.

Amber is the sap of trees that lived millions of years ago. The ancient Greeks realised that if you rubbed amber with a cloth, other materials such as feathers and woollen threads would stick to it. We now know that this is because amber becomes charged with static electricity.

The ‘dark’ ages
Electricity powers our modern lifestyle. In our home, work, travel and leisure time most of us are dependent on electricity. It is hard to imagine our lives without it – we would, literally, be stumbling in the dark.

However, we only need to go back 200 years (before the invention of the light bulb) to find everyone living without any electricity. They used other things instead, e.g. candles for lighting; wood for heating; horses for transport.

Thunderbolts and lightning
There is one type of electricity that has always been with us: lightning. Long ago, lightning was thought to be a punishment from the gods. People knew lightning was powerful but they didn’t understand where it came from or know how to use it.

We now know that lightning is formed when the movement of air currents causes storm clouds to become charged with static electricity. The negative charge in the clouds builds up until eventually it forms a massive spark – a flash of lightning – that passes through the air. Then we hear thunder – this is a crackle of electricity.

A similar thing is happening when you take off a woolly jumper and hear a crackle – this is static electricity too. In the dark, you might even be able to see tiny sparks.

William Gilbert (1544-1603)
An English scientist, William Gilbert, coined the term ‘electricity’ and created an instrument called a versorium that could detect static electricity. This allowed him to distinguish between materials that developed static electricity when rubbed and those that did not.

He observed that some materials seem to ‘attract’ each other and stick together while others seem to ‘repel’ or push away from each other. This is because some materials, when rubbed, develop a negative charge while others develop a positive charge. Materials with opposite charges attract each other but those with the same charge repel.

Atoms
All materials are made from minute particles called atoms. In the middle of each atom is a nucleus of positively-charged protons and around the nucleus are negatively-charged electrons. When we rub a material, the electrons build up a charge and they move to an area of positive charge. This movement of electrons creates electricity.

Benjamin Franklin (1706-1790)
An American scientist, Benjamin Franklin, wanted to prove that lightning was electricity and that it could travel through metal. In 1752, he made a kite with a metal spike on top and he attached a key to the kite string. When he flew his kite in an electrical storm, a bolt of lightning passed down the spike, along the kite string (which had become wet with rain) and into the key, which sparked with electricity.

N.B. Do not try this experiment at home – Franklin was lucky to escape with his life!

This experiment was important because it helped Franklin's fellow scientists to understand more about 'conductors' i.e. materials, such as metals, that allow electricity to pass through them. Franklin coined the term 'conductor' to describe these materials and the spike on his kite gave him the idea for the 'lightning conductor'.

Luigi Galvani (1737-1798)
Luigi Galvani, an Italian doctor, was dissecting a frog's leg when he made a remarkable discovery. When he inserted a metal knife into the leg it twitched and appeared to jump into life. He concluded that the muscles in the frog's leg must contain electricity.

Alessandro Volta, an associate of Galvani, had a different explanation. He believed that electricity will flow from one metal (the steel knife) to a different metal (the tin tray) if you put a wet material (the frog's leg) between them.

Alessandro Volta (1745-1827)
Galvani's discovery gave Volta an idea. He layered alternating discs of copper, cardboard soaked in salty water and zinc so that they formed a stack – now known as a Voltaic pile. Then he attached wires to the top and bottom of the stack and an electric current flowed between them. A modern battery works in a similar way.

Alexander von Humboldt (1769-1859)
Galvani was partly right when he thought that the frog's muscles contained electricity. Humans have electricity in their nerve impulses. We use it to send signals from our brain to other parts of our body. But electric eels can go even further than this. They can make their own electricity as German naturalist Alexander von Humboldt was to find out from his research in 1808. An electric eel's body contains thousands of electric cells that store electricity like tiny batteries. They can generate a charge of up to 600 volts to stun prey – that's about five times more powerful than an electric socket.

André-Marie Ampère (1775-1836)
French physicist, Ampère helped discover electro-magnetism. He described a way to measure the flow of electricity. The ampere – a unit for measuring an electric current is named after him.

Humphry Davy (1778-1829)
Humphry Davy, English scientist, invented the first electric lamp by connecting two wires to a battery then attaching a charcoal strip between the ends of the wires. The charcoal, charged with electricity, glowed with light.

Georg Ohm (1789- 1854)
Georg Ohm, German physicist, discovered the relationship between voltage, current and resistance – now known as Ohm's Law. He wrote about his findings and theory of electricity in a famous book published in 1827.

Michael Faraday (1791-1867)
English physicist and chemist, Faraday studied electricity and magnetism. He wanted to find out if they could work together. He discovered that moving a magnet near a coil of copper wire produced an electric current. His research led to the invention of the electric motor and the generator.

Joseph Swan (1828-1914)
An English scientist, Joseph Swan, produced an electric light from a filament of carbon. To slow down the rate of burning, he designed a glass bulb around the filament but he couldn't create a vacuum inside the bulb so the light only glowed for a short time.

Thomas Edison (1847-1931)
American inventor, Thomas Edison, worked out how to create a better vacuum inside the bulb. He worked with Swan to develop a more long-lasting light bulb. Edison opened electrical power stations in New York and London to carry electricity along wires to street lights. In 1880 the first electric street lights were turned on in New York.

Nikola Tesla (1856-1943)
Serbian-American, Tesla discovered how to create an 'alternating current' (AC: electricity flowing in alternating directions). This had the advantage over 'direct current' (DC: electricity flowing in the same direction) because it could carry electricity over much longer distances without the wires getting too hot and losing power.

Once we knew how electricity worked, we turned our attention on how to use it...

Electrical inventions timeline

- **1808** Light
- **1821** Motor
- **1837** Industrial motor
- **1876** Telephone
- **1882** Oven
- **1885** Food mixer
- **1890** Underground train
- **1893** Toaster

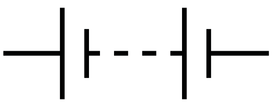
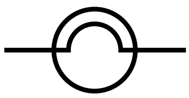
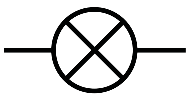
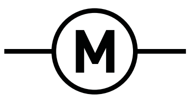
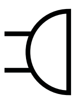
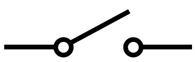
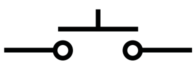
- **1907** Vacuum cleaner
- **1908** Washing machine
- **1920** Hairdryer
- **1922** Kettle
- **1925** Television
- **1936** Electric blanket
- **1947** Microwave oven
- **1959** Integrated circuit
- **1971** Microprocessor
- **1975** Home computer

Glossary of terms

- **Amber –** a resin from a fossilized tree
- **Battery –** a container that stores electrical energy
- **Charge –** to increase the power in something
- **Component –** a part of an electrical circuit
- **Conductor –** a material that allows electricity to flow through it
- **Contact –** the metal part that can be connected to a circuit
- **Current –** a flow of electricity in a circuit
- **Current electricity –** electricity that flows through wires
- **Diode –** a component that allows the current to pass in one direction only
- **Electron –** a negatively-charged particle in an atom
- **Energy –** the power to make things move and work
- **Generator –** a machine that makes electricity from wind, water, steam, gas or nuclear power
- **Insulator –** a material that does not allow electricity to flow through it
- **LED –** a light emitting diode
- **Leyden jar –** early scientists used them to store electrical energy
- **Motor –** a motor can turn electricity into movement
- **Socket –** a device through which an appliance can connect to an electricity supply

- **Static electricity –** electricity that builds up in one place
- **Switch –** a gap that can be closed to allow electricity to flow or opened to stop the flow
- **Terminal –** the metal part of a battery that can be connected to a circuit
- **Turbine –** a machine that can make electricity though wind, water or steam power
- **Voltage (symbol V) –** a measure of stored electrical potential, named after Allessandro Volta
- **Watt (symbol W) –** a unit of electrical power named after the inventor, James Watt

Conventional symbols

Symbol	Represents
	Wire
	Battery
	Bulb
	Warning light
	Motor
	Buzzer
	On/off switch
	Press switch

Scientific Investigation

Scientific Enquiry

Scientific enquiry is the process of questioning, investigating, interpreting results, drawing conclusions, communicating findings and reflecting on what we have discovered. It is the way we discover how the world works. Scientific enquiry is 'doing' science.

Children should be actively involved in decision-making. In a science context this means having opportunities to decide aspects of what they investigate and how to investigate.

Ways to Investigate in Science

There are many different types of scientific enquiry. Children need opportunities to explore and familiarise themselves with this full range. Listed below are some common approaches to scientific enquiry. Although not all of the methods are investigated during this unit, we have listed them here so that you can get a big picture of the range of possible ways to 'do' enquiry science. The list is not exhaustive.

1. **Modelling**
   A model can be used to help children understand how a process works, or to explain ideas or a concept. Some manufactured models can be useful, for example, a model electric motor or generator. Children can use the model to investigate how the motor or generator works. In this unit we will be looking at examples of computer-simulated electrical circuits or animated models to explain how electricity flows in a circuit

2. **Pattern seeking**
   This method involves observing and recording natural events, or carrying out experiments where the variables can't easily be controlled. In pattern seeking, it is still important to note and record variables. The investigator needs to try to identify patterns that result from these variables. This method is well suited to studies of physical processes. For example, the children can observe the pattern of thunder following lightning.

3. **Research**
   Researching in the scientific sense, involves gathering and analysing other people's opinions or scientific findings in order to answer a question or to provide background information to help explain observed events. In the primary school, this might mean searching in non-fiction books, using the Internet and utilising experts in the community, for example, you could ask an electrician to come in to school to talk to the children about electricity.

4. Challenges

These sorts of investigations involve some kind of design task and/or a problem to solve. Challenges are most often suited to the study of materials and physical processes. In such situations children apply their scientific knowledge, skills and understanding to make (or design) something. Challenges can also be used as effective assessment tasks. In this unit, the children will be faced with the challenge of making their own electrical circuits, and designing and making a house with electric lighting and a door buzzer.

5. Fair testing

Fair testing finds relationships between factors (variables). A single variable is changed – this is the variable you are testing. All other variables are kept the same, which is why it is said to be fair. Any differences are said to be the result of the changed variable. So, if you wanted to test which material (iron, leather, wood, string or aluminium foil) is an electrical conductor, the variable you should change is the type of material. However, the way you carry out the test must be kept the same. Fair testing is particularly well suited to investigations that record measurements. The fair test planning board (see below) will be useful for this task.

6. Identifying and classifying

Identifying and classifying involves sorting objects or events into groups or categories, for example, magnetic/non-magnetic and conductor/insulator. Although you won't be explicitly teaching identification and classification in this unit, the children will be discovering which materials are conductors or insulators and will classify these materials using sorting hoops and Venn diagrams.

7. Observations

We can learn a great deal about the world around us from using our senses – through direct observation. In this unit, the children will be observing the effects of current electricity and how we use different types of electricity to provide light, movement and sound.

Fair Test Planning Board

I am investigating:

I will change:

I will keep the same:

I will measure or observe:

Science Learning Targets

Children will:

2.1 Be able to carry out simple investigations

- **Suggesting ways of collecting evidence**
- **Preparing a simple investigation which is fair with one changing factor**
- **Predicting the outcomes of investigations**
- **Using simple scientific equipment**
- **Testing ideas using evidence from observation and measurement**
- **Linking the evidence to broader scientific knowledge and understanding**
- **Using evidence to draw conclusions**
- **Recording and communicating their observations and findings in a variety of ways**
- **Explaining their observations and findings**

2.2 Be able to gather information from simple texts

2.3 Understand the importance of collecting scientific evidence

2.4 Understand some of the effects of what they learn on people's lives

2.25 Know that some materials conduct electricity

2.26 Know that some materials conduct heat more effectively than others

2.31 Be able to compare common materials and objects according to their properties

2.34 Understand that different materials are suited for different purposes

2.35 Know about the principles of magnets and magnetic and non-magnetic materials

2.36 Be able to construct electrical circuits to make devices work

2.37 Be able to change the type or number of components in a circuit to have a different effect

2.38 Know that forces have direction

2.39 Know that forces differ in size

2.40 Know about the effects of friction

2.41 Know that light travels from a source

Science Task 1 Challenges. Observations.

Learning Targets 1, 3, 4, 36, 37

Assessment for Learning Opportunity

2.1 Be able to carry out simple investigations

- **Suggesting ways of collecting evidence**
- **Preparing a simple investigation which is fair with one changing factor**
- **Predicting the outcomes of investigations**
- **Using simple scientific equipment**
- **Testing ideas using evidence from observation and measurement**
- **Linking the evidence to broader scientific knowledge and understanding**
- **Using evidence to draw conclusions**
- **Recording and communicating their observations and findings in a variety of ways**
- **Explaining their observations and findings**

Research activity

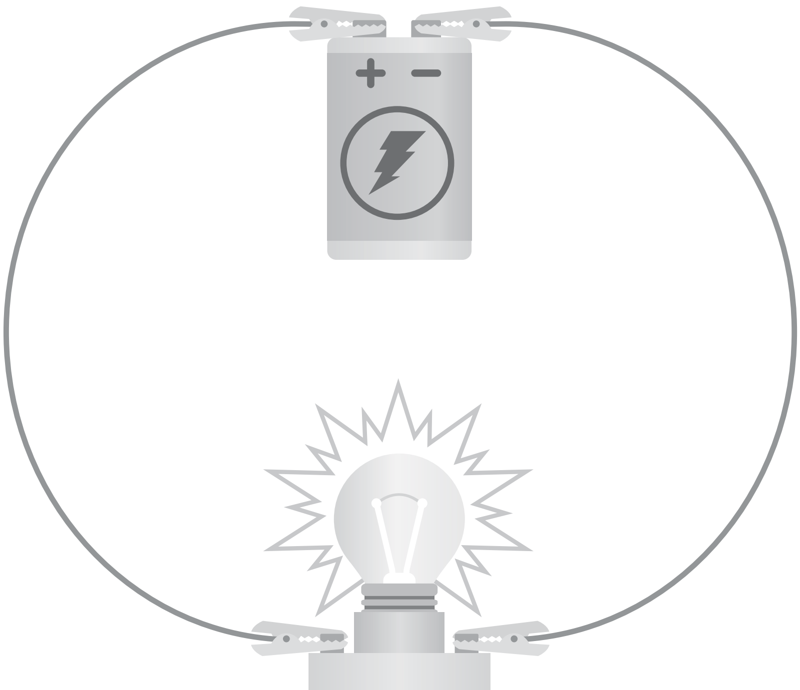
Refer back to the knowledge harvest and the 'true' and 'false' statements about electricity. Write the following statement on the board:

'Electricity flows through wires.'

Give the children, in groups, the basic components to make the simplest electrical circuit:

- Electrical wires with crocodile clips
- 2 small batteries (1.5 V) in holder
- Small bulb in holder

Ask the children to set up a circuit according to the diagram, see below:



Battery plus bulb

Educational and schools suppliers provide electrical kits that are ideal for this purpose. (See Resources section later in the unit.)

Add a switch to the circuit. What is the purpose of the switch in a circuit? Encourage the children to find out through practical investigation – what happens when we open up the circuit with the switch or when we close the circuit?

The children should learn that electricity flows like water in a circuit (a circle). If the flow is broken at any point in the circuit the flow of electricity stops and the bulb fails to illuminate.

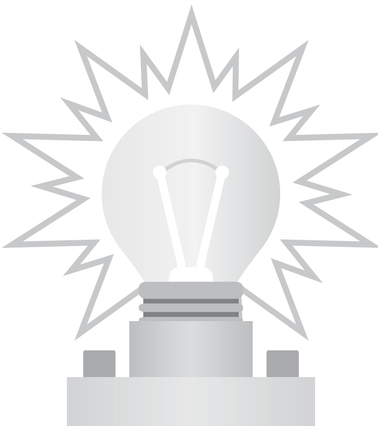
What if we didn't have a switch? Each time we wanted to stop the flow of electricity, we would have to disconnect the wires. While this is not dangerous in our investigation because we are using only a small battery (1.5 V), if you tried this at home with a device connected to mains electricity (240 V) you would get an electric shock and could die from it.

Recording activity

You could play a role-play game to revise what the children have learned about electrical circuits.

Draw the individual elements that make up electrical circuits on separate pieces of card, for example:

- A battery
- A light bulb (on)
- A light bulb (off)
- A wire
- An open switch (off)
- A closed switch (on)



Glowing light bulb

Three short lengths of wire

With younger age groups, add ribbon to the card so that the children can wear the symbols around their neck.

Make enough cards to create several circuits. Give out the cards at random, one to each child, and ask them to group together with other children to make an electrical circuit. Explain the basic rules, e.g. if they are a light bulb that is 'on' (illuminated) they will need to find a switch that is also 'on' (closed). The children could join hands to indicate that they are connected to each other and electricity is passing through them! When the children are more familiar with the rules, you can swap their roles.

Help and encourage the children to use the correct technical vocabulary in their role play – terminal, contact, electric current, flow, circuit, etc.

[Mathematical-Logical, Interpersonal, Bodily-Kinaesthetic Intelligences]

Science Task 2 Challenges. Fair testing.

Learning Targets 1, 25, 26, 31, 34, 36, 37

Assessment for Learning Opportunity

2.1 Be able to carry out simple investigations

- **Suggesting ways of collecting evidence**
- **Preparing a simple investigation which is fair with one changing factor**
- **Predicting the outcomes of investigations**
- **Using simple scientific equipment**
- **Testing ideas using evidence from observation and measurement**
- **Linking the evidence to broader scientific knowledge and understanding**
- **Using evidence to draw conclusions**
- **Recording and communicating their observations and findings in a variety of ways**
- **Explaining their observations and findings**

Research activity

Recall the previous task when the children made the simplest of circuits with a battery, a bulb and wires. Now tell the children they are going to find out if the electricity in this circuit will flow through different materials.

Ask them if they can think how they might test this. Ask for suggestions from the class. Conclude from their replies that they will need to pass an electric current through the material and to do this they will need to attach the material to the circuit.

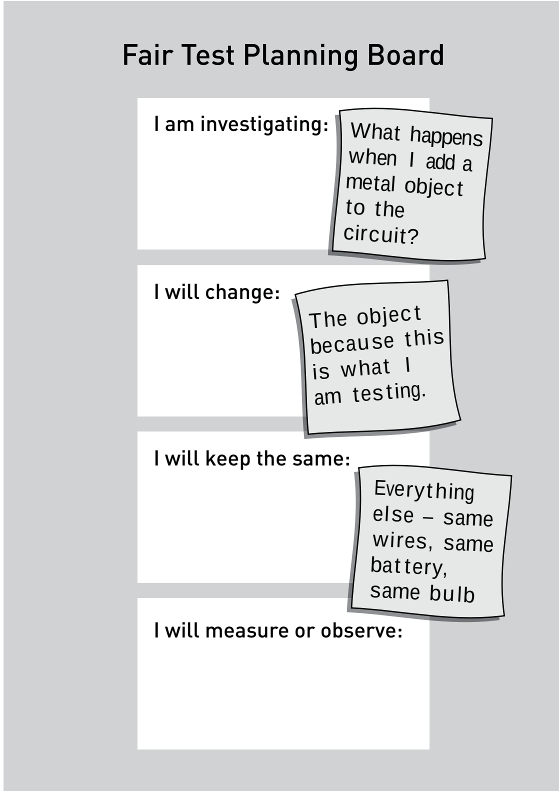
How will you know if the material allows electricity to pass through it? (The bulb will light up.)

For this investigation, the children, in groups, will need:

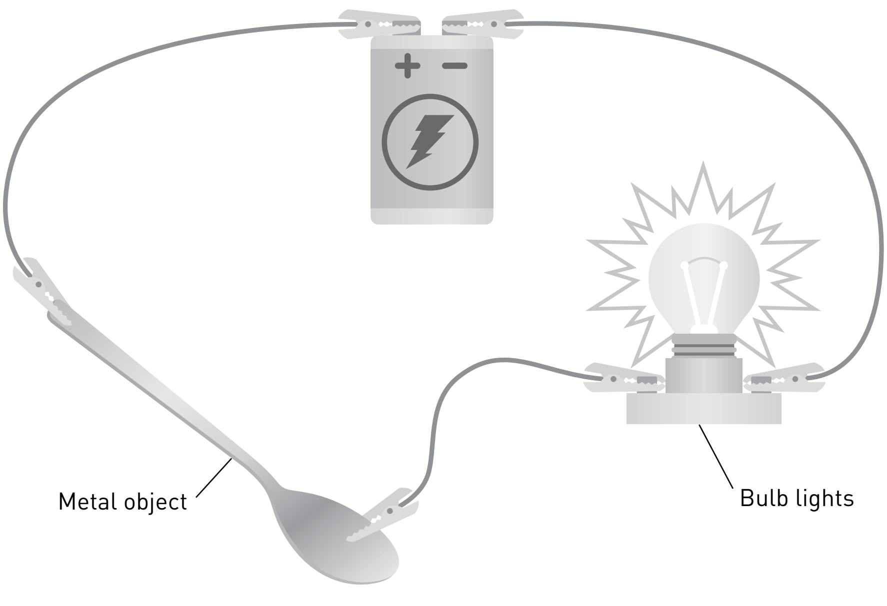
- 2 (1.5-V) batteries in battery holder
- Electrical wires with crocodile clips
- Bulb in bulb holder

- Materials to be tested: metal teaspoon (or key), plastic spoon (or comb), wet cotton wool (or string), dry cotton wool, coin, eraser, aluminium foil, fabric, etc.

Ask the children to devise a fair test that will investigate these different materials.



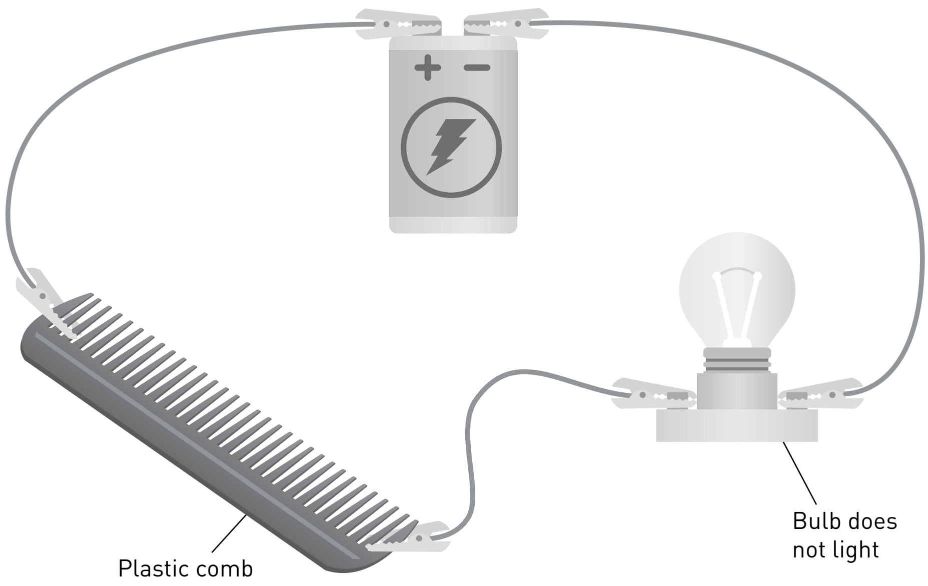
Recording activity



Conductor test

Tell the children that materials that allow electricity to pass through them are called 'conductors'. Materials that do not allow electricity to pass through them are called 'insulators'.

The children could draw a labelled diagram to show how they investigated the different materials within a circuit. For example:



They could also display their results in a table.

Electricity was able to pass through this object to light up the bulb	**Yes**	**No**
Metal spoon		
Plastic spoon		
Wooden lollypop stick		
Dry wool		
Wet wool		
Copper coin		

Ask the children to look at the results of their research above and use them to sort the different materials into two groups: conductors and insulators.

Apply what the children have learned to their everyday lives and experiences. For example, why is it dangerous to put a knife in the electric toaster? If you were caught in a thunderstorm why shouldn't you put up your umbrella? (Link to safety in Science Task 7.)

Peel back the plastic coating from a piece of electrical wire to reveal the thin copper wires inside. Why are the copper wires coated in plastic? (To stop the electricity from escaping and to protect us.)

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

Science Task 3 Challenges. Fair testing. Observations.

Learning Targets 1, 3, 4, 36, 37, 41

Assessment for Learning Opportunity

2.1 Be able to carry out simple investigations:

- **suggesting ways of collecting evidence**
- **preparing a simple investigation which is fair with one changing factor**
- **predicting the outcomes of investigations**
- **using simple scientific equipment**
- **testing ideas using evidence from observation and measurement**
- **linking the evidence to broader scientific knowledge and understanding**
- **using evidence to draw conclusions**
- **recording and communicating their observations and findings in a variety of ways**
- **explaining their observations and findings**

Research activity

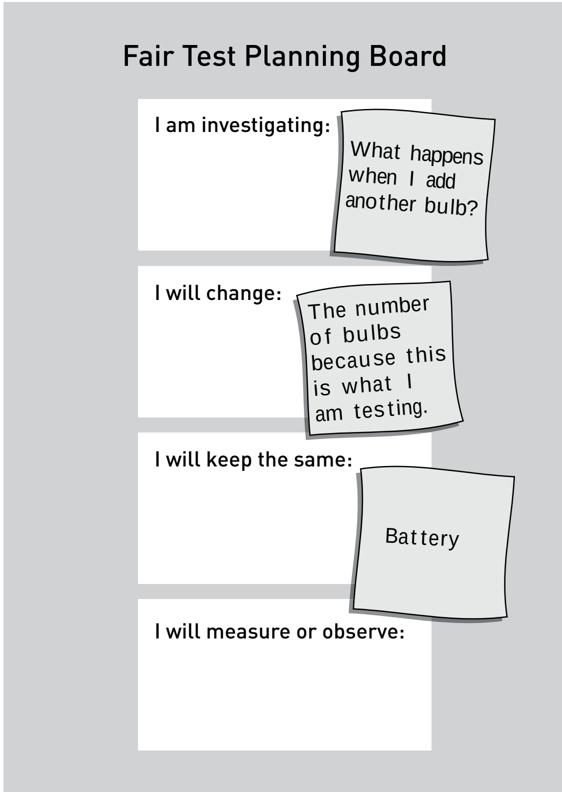
Start once again by asking the children to make a simple electrical circuit with a battery, a bulb and wires.

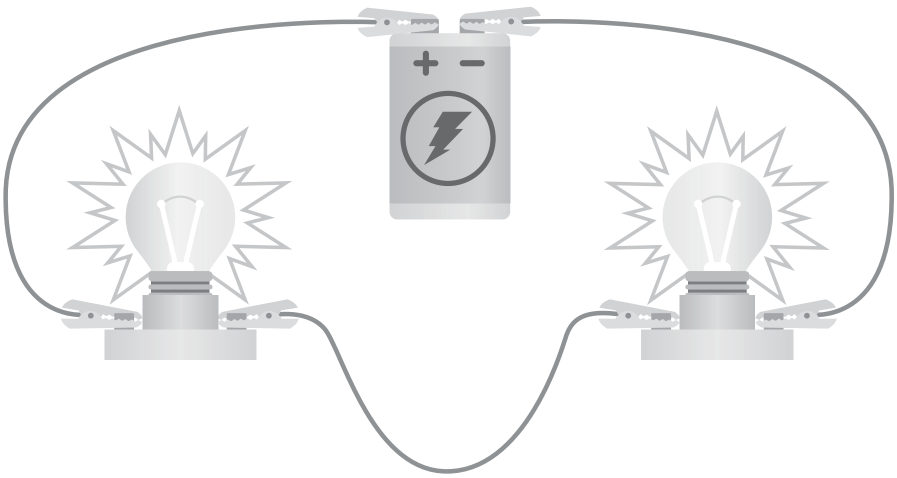
When they have done this, ask them to investigate the effects of changing one factor. For example, what happens to the brightness of the light when they...

- Add another bulb?
- Replace with a bigger bulb?
- Add another battery?
- Replace with a bigger or smaller battery?

Ask the children, if they are investigating the effects of adding another bulb, what should be kept the same to make this a 'fair test'. What effect does adding another bulb or battery have on the brightness of the original bulb? The children could use the fair test planning board to help them plan their investigation. See diagrams.

Teacher's note: to compare the brightness of the bulbs you might want to set up the original circuit (with one battery and one bulb) as a 'control' in the investigation against which comparisons can be more easily made.





Battery plus two bulbs
Series Circuit

Recording activity

The focus of this task is on observation, i.e. observing the brightness of the light produced by the bulbs. The children could record their observations in a variety of ways e.g. through drawing and writing, video and photographs.

The children could use the fair test planning board to structure their recording of this task, e.g. they could add their drawings, writing and photographs to it.

Invite the groups to share their findings with the rest of the class.

Teacher's note: the children should observe that when they add more bulbs or a larger bulb to a (series) circuit the light is dimmer. When they add more batteries or a larger battery the light is brighter.

You could extend this activity by investigating what happens to the brightness of the bulb if you use longer wires.

The following video might be useful for revision:

www.youtube.com/watch?v=E1ilRbWjpQs&feature=related
This YouTube video illustrates the effects that changing the direction and/or the number of batteries makes to the brightness of the bulb.

*(To watch a YouTube video in **safe mode**, scroll to the bottom of the page and click on 'Safety mode: **Off**', then select the '**On**' option)*

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

Science Task 4 Challenges. Fair testing. Observations.

Learning Targets 1, 3, 4, 36, 37

Assessment for Learning Opportunity

2.1 Be able to carry out simple investigations:

- **suggesting ways of collecting evidence**
- **preparing a simple investigation which is fair with one changing factor**
- **predicting the outcomes of investigations**
- **using simple scientific equipment**
- **testing ideas using evidence from observation and measurement**
- **linking the evidence to broader scientific knowledge and understanding**
- **using evidence to draw conclusions**
- **recording and communicating their observations and findings in a variety of ways**
- **explaining their observations and findings**

Research activity

Tell the children that you are going to set them a circuit-building challenge!

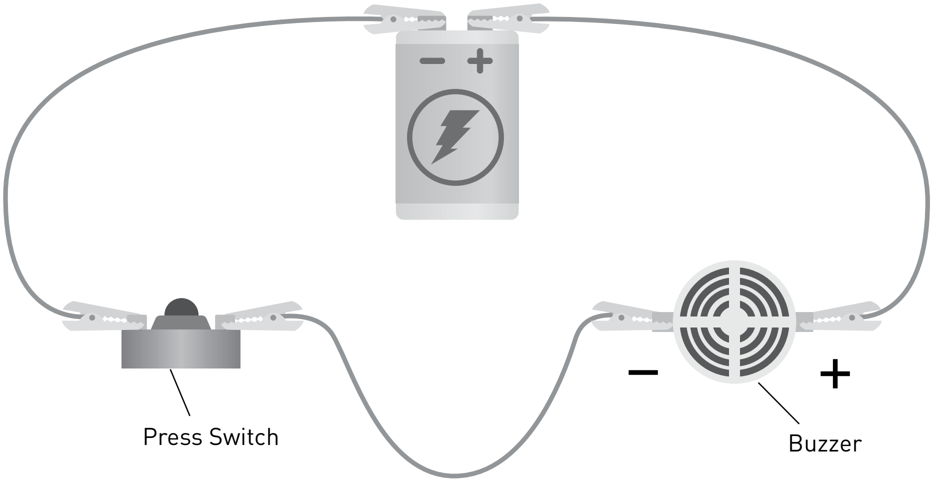
It will be easier for the younger children in the age group if you do this in three distinct steps (or parts):

- **Step 1 –** battery (9 V) and buzzer

Start the task by asking the children to make a simple circuit with a buzzer, a battery and two wires.

- **Step 2 –** battery, buzzer and switch

Now ask the children to add a switch to the circuit. How many more wires will they need? (They will need one more wire. Three wires in total.)



Buzzer plus switch

Tell the children that their challenge is to connect the wires between the components so that when the switch is 'on' the buzzer sounds.

- **Step 3 –** battery, buzzer, bulb and switch

Finally, ask the children to add a bulb to the circuit. How many more wires will they need now? (They might need to add another battery to increase the power.)

Their ultimate challenge is to connect the wires and components so that when the switch is on the buzzer sounds and the bulb lights up – both at the same time!

Teacher's note: If your circuit fails to work when you add more components, check each component separately and check the connections. If these are not the cause, then you will need to use a bigger battery or add another battery to the circuit.

Recording activity

Ask the children to draw a labelled diagram for each of the three steps above to explain how they made their three different circuits.

Discuss what the children have learned from this and how they can relate what they have discovered to their everyday lives. For example, where might they see a light and a buzzer working together? (A house alarm or car alarm.)

This activity will link directly to the Technology task when the children build a model house and add lighting and a door buzzer. (See later.)

ICT link: The following websites have useful simulation software to help with your investigation of electrical circuits. The children can change the number and type of components to observe the effects.

www.bbc.co.uk/schools/scienceclips/ages/6_7/electricity.shtml
BBC schools website has simulation software to help teach children about basic electrical circuits.

www.andythelwell.com/blobz/guide.html
The Blobz Guide to Circuits provides useful animated revision slides for children.

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

Science Task 5

Modelling. Challenges. Fair testing. Identifying and classifying. Observations.

Learning Targets 1, 3, 4, 35, 36

Assessment for Learning Opportunity

2.1 Be able to carry out simple investigations:

- **suggesting ways of collecting evidence**
- **preparing a simple investigation which is fair with one changing factor**
- **predicting the outcomes of investigations**
- **using simple scientific equipment**
- **testing ideas using evidence from observation and measurement**
- **linking the evidence to broader scientific knowledge and understanding**
- **using evidence to draw conclusions**
- **recording and communicating their observations and findings in a variety of ways**
- **explaining their observations and findings**

Research activity

Pose the question to the class: Are magnets anything to do with electricity?

What are magnets?

Invite responses from the children. They might tell you that magnets stick to metal or that they stick to each other. Invite the children to use simple bar magnets and a collection of magnetic and non-magnetic objects to demonstrate their ideas to the rest of the class. Sort the collection of objects into two groups: magnetic and non-magnetic using sorting hoops or trays. Ask the children, are all metals magnetic? (Iron, steel, nickel and cobalt are magnetic.) Which metals are not magnetic? (All other metals are not magnetic, as are all other materials.)

Magnets have two ends called a `north pole' and a `south pole'. Ask the children to identify, predict and then find out which two ends push each other away (repel) and which two ends stick together (attract).

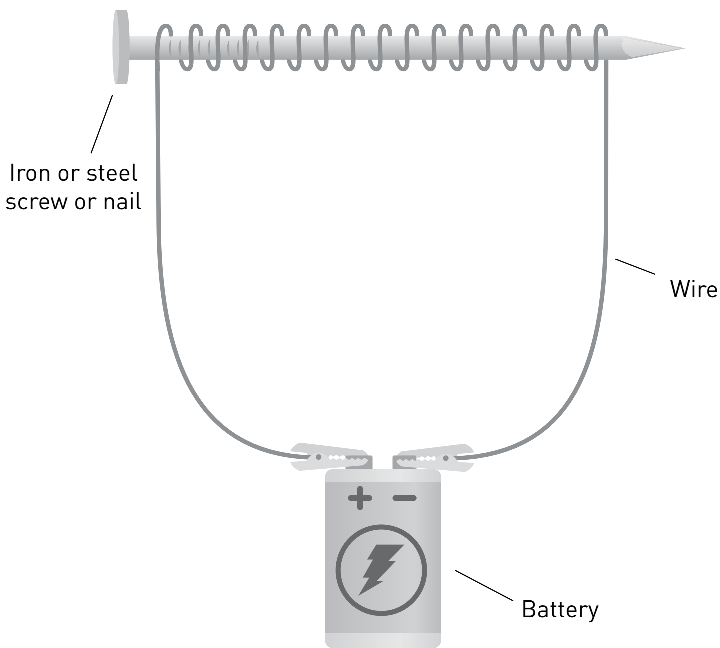
Through their research the children should observe that magnets can act at a distance - magnets can make steel paperclips jump up from the desk! Compare with other forces (such as friction) that need contact between objects.

Tell the children you are going to use a nail in the next investigation. Is a nail magnetic?

The children, in groups, will need:

- 9-V battery
- Large iron (or steel) nail / screw
- Electrical wire – about 40 cm (15 ins) long
- Small paper clips or pins

1. Coil the wire around the nail (or screw) many times fairly tightly, leaving both ends of the wire free.
2. Wrap the ends of the wire around the battery contacts. Make sure the electrical wire is touching the contact points.
3. You have made an electro-magnet! Wait about five minutes (be patient) for the electricity to fully charge the nail. The battery will feel warm.
4. Find out what your electro-magnet can pick up. Try to stick small (light in weight) pins, screws and paperclips to the pointed end of the nail.
5. What happens when...
    - You wind more coils of wire around the nail? Can you pick up more pins? If so, why? (The more coils the magnet has the stronger it is.)
    - You remove the nail. Is it still magnetic? (An iron nail will lose its magnetism but a steel nail will retain its magnetism.)



Electromagnet

Try out your magnet

Recording activity

The children could record the results from the sorting activity at the start of this task in the form of a table with two column headings: 'magnetic materials' and 'non-magnetic materials'. They should record their predictions and testing in appropriate ways, e.g. by drawing diagrams to show that 'like' poles repel and 'unlike' poles attract.

From the investigation task above, the children will have discovered that we can use electricity to make an electro-magnet.

Try to relate what the children have learnt to their own experiences. Discuss the industries that use electro-magnets. For example, scrap metal yards use electro-magnets to sort and move metals around the yard. Recycling factories use electro-magnets to sort steel cans from tin cans.

Mathematics link: count the number of coils in the wire and the objects your magnet can pick up. Is there a relationship? Draw a line graph to find out.

Technology: ask the children to find out what an alloy is and how it is made.

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

Science Task 6 Research. Pattern seeking. Observations.

Learning Targets 2, 3, 4, 25, 26, 34

Research activity

What's inside a light bulb to make it light up? Refer back to the previous Science tasks.

Pass some traditional (incandescent) light bulbs around the class for the children to examine. Tell them to look closely inside. What can they see? Tell them that the coiled wire inside the bulb is called a filament.

Why does a light bulb get hot when the light is switched on?

Teacher's note: The filament gets hot and glows brightly when the light bulb is switched on. Light bulbs get hot when they are switched on because electricity produces heat as well as light.

The children will have noticed that the bulbs in their previous investigations got warmer when they were lit. However, you can explain that the bulbs did not get dangerously hot because we used small bulbs and small batteries.

Safety note: tell the children they should never touch regular light bulbs in school or at home because the voltage running through them is about 85 times greater – these bulbs will burn their skin if touched. Remind the children that all electrical appliances get warmer when in use and care should be taken around them.

Bring an electric toaster into the classroom and make some toast for the children! Ask them if they can guess how the toaster works. Invite suggestions from the class. Tell them that the inside of the toaster has tightly coiled wires that get hot as electricity passes through them. (Link to the previous task when you made an electro-magnet – the coiled wires around the nail got slightly hot.)

Show the children a photograph of an electric bar fire – this works in exactly the same way as the toaster. Can the children find any other examples of electricity used as heat? Possible examples might be an electric kettle, an electric hot plate, a hair dryer, curling tongues, etc. Store/product catalogues would be a good source of reference for this research.

Recording activity

Make a class display of electrical items that use electricity as heat. Cut out pictures from product catalogues to use in the display.

From this research the children will learn that electrical copper wires are a good conductor of heat.

You could extend this activity, if you wish, by carrying out a further investigation to find out what other materials are good conductors of heat. Consider the materials used to make radiators, saucepans, cooking utensils, etc.

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

Science Task 7 Research. Observations. Pattern seeking.

Learning Targets 2, 4, 25, 26

Research activity

Electricity is useful to us in so many ways. We have explored how electricity can provide light, heat and sound but we do need to remember also that electricity can be dangerous. We must use electrical items with care.

Why is electricity dangerous? Ask for suggestions from the class. We have seen how electrical wires get hot and we've seen how metals can conduct electricity. What are the dangers of electricity? Invite the children, in pairs or groups, to make a 'Danger List'.

Some examples of dangerous scenarios might be:

- Sticking a knife in an electric toaster when it is switched on
- Putting a plug in a mains socket with wet hands
- Touching a bare wire
- Pulling out a plug using the wire
- Poking objects into electric sockets
- Falling over a trailing wire

Ask the children to think up some more dangerous scenarios.

The following website will provide a useful starting point:

www.switchedonkids.org.uk/house.html
Switched On Kids website has an interactive feature about the dangers of electricity around the home and in the garden.

Now ask the children to turn their attention to the classroom – tell them they are going to be 'Safety Inspectors' whose job is to check on the safe use of electrical devices found in school. They need to assess the dangers present in the classroom and other areas of the school. You could assign groups of children to different areas. Give the children digital cameras, paper and clipboards on which to record potential electrical safety hazards or 'Danger Zones'. For each danger they identify, the children should make their recommendations for reducing or eliminating the danger.

Teacher's note: you could join with Milepost 3 children for this activity if they are working on their electricity unit at the same time.

Recording activity

Give the children a plan of the internal layout of the school to show the classrooms and other areas. On this plan, the children could map the Danger Zones. They could print out photographs from their inspection to use as evidence and stick these down on the map.

The groups should then share their findings and recommendations with the rest of the class.

The teacher should challenge the children by asking questions, e.g. are your concerns real and are your recommendations appropriate and achievable?

When you are satisfied with their responses, your class could hold an assembly to tell the rest of the school about their findings and suggestions for improvement. Set a timeline for improvement and make follow-up inspections.

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

Science Extension Task

Learning Targets 1, 3, 4, 38, 39, 40

Modelling. Research. Observations.
Pattern seeking. Fair testing.
Identifying and Classifying.

Assessment for Learning Opportunity

2.1 Be able to carry out simple investigations:

- **suggesting ways of collecting evidence**
- **preparing a simple investigation which is fair with one changing factor**
- **predicting the outcomes of investigations**
- **using simple scientific equipment**
- **testing ideas using evidence from observation and measurement**
- **linking the evidence to broader scientific knowledge and understanding**
- **using evidence to draw conclusions**
- **recording and communicating their observations and findings in a variety of ways**
- **explaining their observations and findings**

Research activity

Recall the ways in which we can use electricity: for light, heat, sound – and movement. In this next task, you can extend the children's learning by investigating how electricity can be used to move a toy car.

When we look at how a toy car moves, we realise that other forces may also be at work – and one of these forces is friction.

For this investigation, you will need two or three battery-operated toy cars, i.e. one car for each group of children. (The children might be able to bring them in from home.) Ask the children to find out whether the ground surface affects the speed or performance of the car. (Recall any prior knowledge about friction. Link to the Milepost 2 science unit, *Feel the Force.*) The children could test different surfaces in the classroom and outside in the playground, e.g. carpet, wood, metal, plastic, ceramic tile, grass, gravel, tarmac, etc. They should make predictions first and then devise their own fair tests. Discuss what 'fair testing' means and how they can ensure their tests are fair.

Pose the following questions for testing:

- On which surface does the car travel fastest?
- Which surface provides the greatest amount of friction?
- How could you reduce friction on the surfaces?
- What happens if you put water, oil or soap on the tarmac?

And add any other questions the children would like to investigate!

Recording activity

The children could record their findings in tables and reports. They could draw arrow diagrams to show the direction of the forces acting on the car, i.e. they could draw the electrical force pushing the car forwards and friction pushing it back. The children should know that when the electrical force pushing forwards is greater than friction the car will move forwards. But when friction is the greater force then the car will stop.

The children should try to relate what they have learned to their everyday lives, for example, wet surfaces are slippery because they have low friction – this can be dangerous for cars when driving on wet roads.

[Mathematical-Logical, Interpersonal, Naturalist Intelligences]

Technology Learning Targets

Children will:

2.1 Know the way in which products in everyday use are designed and made affects their usefulness

2.2 Be able to design and make products to meet specific needs

2.3 Be able to make usable plans

2.4 Be able to make and use labelled sketches as designs

2.5 Be able to use simple tools and equipment with some accuracy

2.7 Be able to identify the ways in which products in everyday use meet specific needs

Technology Task

Learning Targets 1, 2, 3, 4, 5, 7

Assessment for Learning Opportunities

(NB: it is recommended that only one skill should be assessed at a time)

2.2 Be able to design and make products to meet specific needs

2.3 Be able to make usable plans

2.5 Be able to use simple tools and equipment with some accuracy

2.7 Be able to identify the ways in which products in everyday use meet specific needs

Research activity

The Technology task links directly to the Science tasks in this unit to provide context and meaning to what the children have learned about making electrical circuits.

The challenge is to design the interior of a house to include the following:

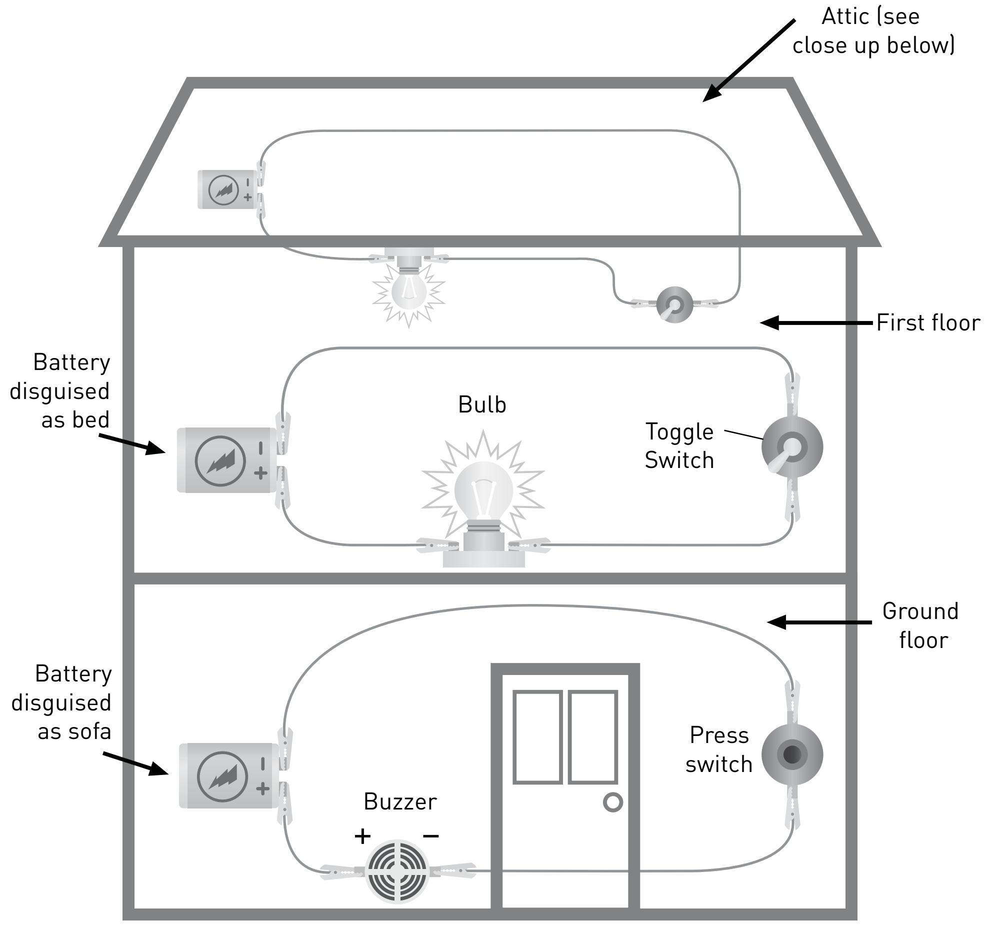
- A door buzzer with a press switch
- A light (or lights) with a toggle switch

The design criteria should be based on what the children now know about constructing their own electrical circuits.

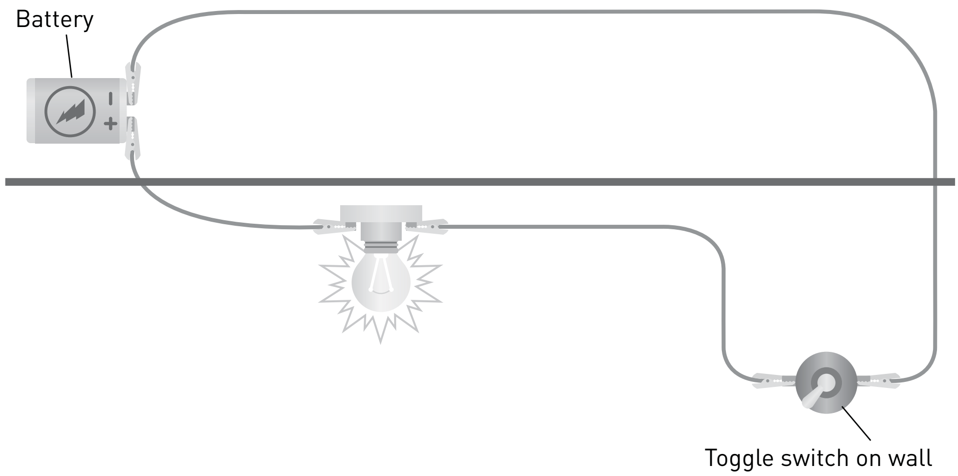
However, as an extra challenge for older or more able children, you could link to any prior learning in Technology and ask the children to include moving mechanisms such as levers so that the doors and windows can be opened and closed.

Start by building the two separate electrical circuits (refer back to the Science tasks): the first with a buzzer and the second with one or two bulbs in series (or separate). Each circuit should also have a simple toggle or press switch. When the children have made the circuits they can decide where they will place them inside the house and how they can turn them into working models.

Firstly, they will need to draw a plan or sketch of the interior to include these circuits. See the diagram below as a possible suggestion.



Ceiling light-wires (in attic)



Once they have decided on the internal layout they can select the materials, tools and equipment they are going to need to cut, shape, join and make their house. You could provide large and small cardboard boxes – large boxes for the outer walls and small boxes for the inner walls. The children might want to work in small groups for this task, with each group responsible for designing one floor of the house.

The children might want to create 'furniture' to disguise the components, e.g. the switch for the buzzer could be disguised as a door bell on the front of the house; the bare light bulb could be covered with a lamp shade in the form of a cone; the battery could be disguised as a sofa if covered in a piece of fabric.

Provide a variety of scrap materials – coloured card, wrapping paper, fabric, empty plastic containers, bottle tops, etc, for this purpose. To make a ceiling light the children will need to hide the wires in the 'attic' space and cut a hole in the ceiling big enough to fit the bulb.

Old magazines with photographs of house interiors would be useful for inspiration. Ask leading questions, e.g. how many different types of interior lights are there? (Uplighters, table lamps, ceiling lights, spotlights, wall lights, etc.) Does each type of light have a specific purpose or function? What type of light are you going to design for your house?

Recording activity

The children should evaluate their products against the design criteria agreed at the beginning of the task and consider the views of others when making improvements to their work. A house needs to be strong! Can the children think of ways of strengthening or reinforcing their house?

This activity provides a great opportunity to video the children as they discuss ideas and designs, make decisions, overcome problems and implement improvements to their products.

Display the children's plans and their finished houses in a prominent place in the classroom where you can invite visitors to test them out!

Extension 1: Ask the children to look around the classroom and at home for different types of switches on electrical appliances, e.g. toggle switches, turn switches, touch-sensitive switches, pull switches and push switches. Talk also about the reasons why some items have illuminated switches such as those found on a computer. The children could collect photographic examples from old magazines and catalogues and group these together by type. Ask the children why they think there are many different designs of switch. Are there different designs for different purposes? For example, why are pull switches often found in bathrooms? (Links to safety issues in Science Task 7.)

Extension 2: Can the children apply the use of control technology to make the lights in the house go on and off with a timer? There are electrical construction sets that have timing devices you could use but schools are advised to contact their ICT technician to ensure they are using the right tools and programs for their setting. Teachers may find the Milepost 3 unit Switched on a useful resource for supporting children with this extension activity. The information in the big picture and ICT tasks explores different types of control technologies and resources. The following is just one example of the type of resource that enables children to program and control switches:

- **http://www.tts-group.co.uk/shops/tts/Products/PD3650515/**
  The Learn and Go controller is a box that offers an easy first step into the world of control, without needing a computer

[Mathematical-Logical, Visual-Spatial, Interpersonal, Verbal-Linguistic Intelligences]

History Learning Targets

Children will:

2.4 Be able to give some reasons for particular events and changes

2.5 Be able to gather information from simple sources

2.6 Be able to use their knowledge and understanding to answer simple questions about the past and about changes

2.7 Understand that the past can be considered in terms of different time periods

History Task

Learning Targets 4, 5, 6, 7

Assessment for Learning Opportunities
(NB: it is recommended that only one skill should be assessed at a time)

2.4 Be able to give some reasons for particular events and changes

2.5 Be able to gather information from simple sources

Research activity

Help the children to trace the history of the electric light, starting with Humphry Davy's arc lamp.

Give pairs or small groups of children one inventor or one aspect of lighting to research, for example:

- Humphry Davy's arc lamp
- Joseph Swan's electric light
- Thomas Edison's power stations
- Nikola Tesla's discoveries

Provide reference books and website links to help with the children's research. The following websites provide a useful starting point:

http://kids.saveonenergy.ca/en/what-is-electricity/history_nikola_tesla.html
Kids' Corner features the scientists who gave us electricity.

http://inventors.about.com/od/timelines/a/electricity_timeline.htm
About.com website has a useful timeline of milestones in the history of electricity.

Recording activity

Create an illustrated timeline to record the history of the electric light. Include the children's own drawings and pictures printed from the Internet – check copyright first.

[Mathematical-Logical, Interpersonal, Verbal-Linguistic Intelligences]

International Learning Targets

Children will:

2.1 Know about some of the similarities and differences between the different home countries and between them and the host country

2.2 Know about ways in which these similarities and differences affect the lives of people

2.3 Be able to identify activities and cultures which are different from but equal to their own

International Task

Learning Targets 1, 2, 3

Assessment for Learning Opportunity

2.3 Be able to identify activities and cultures which are different from but equal to their own

Research activity

Where does the electricity in our homes come from? If we were to follow the wires back – where would they lead us?

Consider the following questions:

- How do we produce electricity in the host and home countries?
- What resources do we use to produce electricity?
- Does each country produce its own electricity?
- Do we all use electricity in the same way?

The children's research should focus on the similarities and differences between the host and the home countries and try to explain reasons for this. For example, countries with a long coastline might generate some of their electricity from wave and wind turbines.

The following website provides a useful starting point for research:

www.kids.esdb.bg/elproduction.html
Kids and Energy website has information about electricity generation and production.

Recording activity

The children could record their research in the form of a table or chart with a column for each country studied.

They should be able to explain their findings and give reasons for any similarities and differences they discovered.

The children could add maps, photographs and drawings to the chart to represent each country.

[Verbal-Linguistic, Interpersonal Intelligences]

The Exit Point

If your school is able to schedule the learning on the electricity-themed units for Mileposts 1, 2 and 3 at the same time, you could have a whole school 'Bright Sparks' day to showcase what you have all learned.

Decorate the hall or the classrooms where you plan to stage the event with coloured lights, plasma balls and disco balls. Each Milepost could make their own exciting display or presentation as part of the larger event to which you could invite the parents.

Have hands-on areas where visitors can try out the mini electrical circuits you created or have a go at building their own. Organise demonstrations, display the children's research, their videos and photographic evidence.

Milepost 1 children could have a 'magic show' to demonstrate static electricity – using static-charged balloons to pick up paper pieces or stick them on the walls and on their visitors! They could display the torches they made from plastic bottles in Technology.

Milepost 2 children could set up a 'fairground stall' with the electric wire-loop game they made in Science and explain how it works. They could display the model houses with their interior lights and door buzzers, created in Technology.

Milepost 3 children could perform a drama or role play to tell the story of electricity through the discoveries and inventions of famous scientists. They could display their model car electrics – the headlights, the horn and the air-conditioning systems.

End the event and this unit with an exciting electric sound and light show!

Assessment

Assessment is possible throughout the theme. The learning targets could be made into a class record sheet on which you can record evidence of success as and when you see it. You may decide to record by exception, i.e. assuming that the majority of the class attains the specified learning targets then you could just record evidence of those children who exceed or don't reach the target. This will allow you a more specific focus next time the class engages in new activities related to those targets.

Knowledge – the 'know about' learning targets – can be assessed at the end of each subject component.

Skills – the 'be able to' learning targets – can be observed and assessed whilst the children are doing them. The Rubrics in the IPC Assessment for Learning programme are an excellent resource for this.

Understanding – the 'understand' learning targets – can be evaluated by a judgement of observations carried out through the unit.

Ask the children to carry out their own assessment at the end of the unit. They should use the following headings to list/make notes on their newly acquired knowledge, skills and understanding – 'new things I **know** about communication', 'new things that I can **do**' and 'new things I am beginning to **understand**'.

Ask the children to evaluate their learning – what did they do well, what could they do better, what did they find most/least interesting?

How did they prefer to learn – as an individual/in pairs/small groups/large groups/as a whole class?

What was their preferred style of recording their findings – illustrating/writing/talking/making, etc?

This evaluation aspect will also support the development of the personal goals.

Resources

For this unit, you will need some, but not necessarily all, of the following:

Equipment

- Plasma ball
- Electronic construction set, e.g. available from **www.opitec.co.uk** (Product Number 105.015)
- Electrical wires with crocodile clips
- Batteries in battery holders (1.5V, 9V)
- Bulbs in bulb holders
- Switches – on/off and press switches
- Buzzers
- Motors (with propellers)
- Copper wire
- Duct tape
- Transparent tape
- Materials to be tested for conduction: metal teaspoon (or key), plastic spoon (or comb), wet cotton wool (or string), dry cotton wool, coin, eraser, aluminium foil, fabric, etc.
- Craft tools and scissors
- Cardboard boxes to make houses
- Collage materials
- Battery-operated toys
- Product catalogues
- Video camera
- Digital camera

Software:

- Presentation software, e.g. Microsoft PowerPoint
- Mind-mapping software such as Inspiration 9 (**www.inspiration.com/Kidspiration**) or 2connect (**www.2simple.com**).
- Graphing software
- Control resources such as Learn and Go controller (**http://www.tts-group.co.uk/shops/tts/Products/PD3650515/**)

Websites

www.amazon.com/Creative-Motion-10-Inch-Rotating-Disco/dp/B00005LZY5
Amazon website has a rotating disco ball.

www.adrianbruce.com/computers/mindmap/mindmap.htm
Adrian Bruce website allows you to download free mind-mapping software.

www.bbc.co.uk/schools/ks2bitesize/science/physical_processes/circuits_conductors/play.shtml
BBC Schools website has animation software that will help with the children's revision of electrical conductors.

www.bbc.co.uk/schools/scienceclips/ages/6_7/electricity.shtml
BBC schools website has simulation software to help teach children about basic electrical circuits.

www.andythelwell.com/blobz/guide.html
The Blobz Guide to Circuits provides useful animated revision slides for children.

www.switchedonkids.org.uk/house.html
Switched On Kids website has an interactive feature about the dangers of electricity around the home and in the garden.

http://inventors.about.com/od/timelines/a/electricity_timeline.htm
About.com website has a useful timeline of milestones in the history of electricity.

http://kids.saveonenergy.ca/en/what-is-electricity/history_nikola_tesla.html
Kids' Corner features the scientists who gave us electricity.

http://powerup.ukpowernetworks.co.uk/faqs.aspx
Power Up website has a list of frequently-asked questions and answers related to electricity.

www.woodlands-junior.kent.sch.uk/revision/Science/electricity.htm
Woodlands Junior website has links to many websites about electricity.

www.usborne-quicklinks.com
The Usborne website has links to websites about electricity. Type "YR electricity".

www.kids.esdb.bg/elproduction.html
Kids and Energy website has information about electricity generation and production.

www.opitec.co.uk
Opitec website sells electronics kits, buzzers and motors.

www.scientificsonline.com/science-kits/electric-kits.html
Scientifics Online website sells a wide range of electronics kits.

Videos

*(To watch a YouTube video in **safe mode**, scroll to the bottom of the page and click on 'Safety mode: **Off**', then select the '**On**' option)*

www.youtube.com/watch?v=aVso1rP52DQ&feature=related
YouTube has this video of a lightning strike.

www.youtube.com/watch?v=E1ilRbWjpQs&feature=related
This YouTube video illustrates the effects that changing the direction and/or the number of batteries makes to the brightness of the bulb.

Books

***Why It Works: Electricity,* by Anna Claybourne, QED Publishing, 2008**

***Horrible Science: Shocking Electricity,* by Nick Arnold and Tony De Saulles, Scholastic, 2000**

***Blackout!* by Anna Claybourne, Harcourt Education, 2006**

***The Power Cut,* by Mick Manning and Brita Granstrom, Franklin Watts, 2002**

***Eyewitness: Electricity,* by Steve Parker, Dorling Kindersley, 2005**

***Electric Mischief: Battery-Powered Gadgets Kids Can Build,* by Alan Bartholomew, Kids Can Press, 1998**

***Electricity: Make it Work,* by Alexandra Parsons, Two-Can, 2000**

Draft Letter To Parents

This letter is only for guidance. Please amend it to suit your own preferred style but, if you do, please include the same information.

Dear Parents,

Over the next _____ weeks those of us in Class _____ will be following a unit of work on a theme that focuses on 'Electricity'.

This unit of work is part of the International Primary Curriculum. This new curriculum sets out very clearly what children will learn – the learning goals – in three different areas:

1. The subjects of the curriculum. The learning goals for each of these subjects are at least as challenging as anything taught in the curriculum in your child's own country. In many cases, the learning goals are more challenging.
2. Personal development – the characteristics which will help children become more responsible, independent learners.
3. International understanding – which will help children develop both a sense of the independence of their own country and culture and the interdependence between countries and cultures.

Each unit of work is based around specific targets derived from the learning goals for one or more of the subjects.

During this unit we will be focusing on Science, Technology, History and International.

In Science, we'll be finding out:

- How to make an electrical circuit
- Which materials allow electricity to pass through them
- What happens when we change a circuit
- How to build bigger circuits
- About magnetism and electricity
- About using electricity as heat
- How to keep safe around electricity

In Technology, we'll be finding out:

- How to make a house with lighting and a door buzzer

In History, we'll be finding out:

- About the history of the electric light bulb

In International, we'll be finding out:

- How we produce electricity in our country

All of the work we are going to do has been specially written to help your child reach the learning goals. Children will be reading, researching, writing, illustrating, working on their own and working in groups. We will be checking to see how well your child has learned through particular activities and asking children to explain their work, perhaps to you.

We already know the interest you take in your child's work. If you can, please discuss with your child the work they have done as the term progresses and let them teach you.

Talk with your child about how you use electricity in your home. Make sure he/she knows how to keep safe from the dangers associated with electricity.

If your child has some work to research, please help them, but without actually doing the work. If you have the chance to further their interest in the ideas of this theme please take it, but your enthusiasm and interest is most important.

By the end of the unit, we hope your child has achieved all of the learning targets. We hope they have had an enjoyable time in the classroom. And we hope you have enjoyed seeing your child work with enthusiasm. If you have any comments about the work your child has done, please get in touch.