CurriculumVisions 2F Science@School

Using electricity

Teacher's Guide CD

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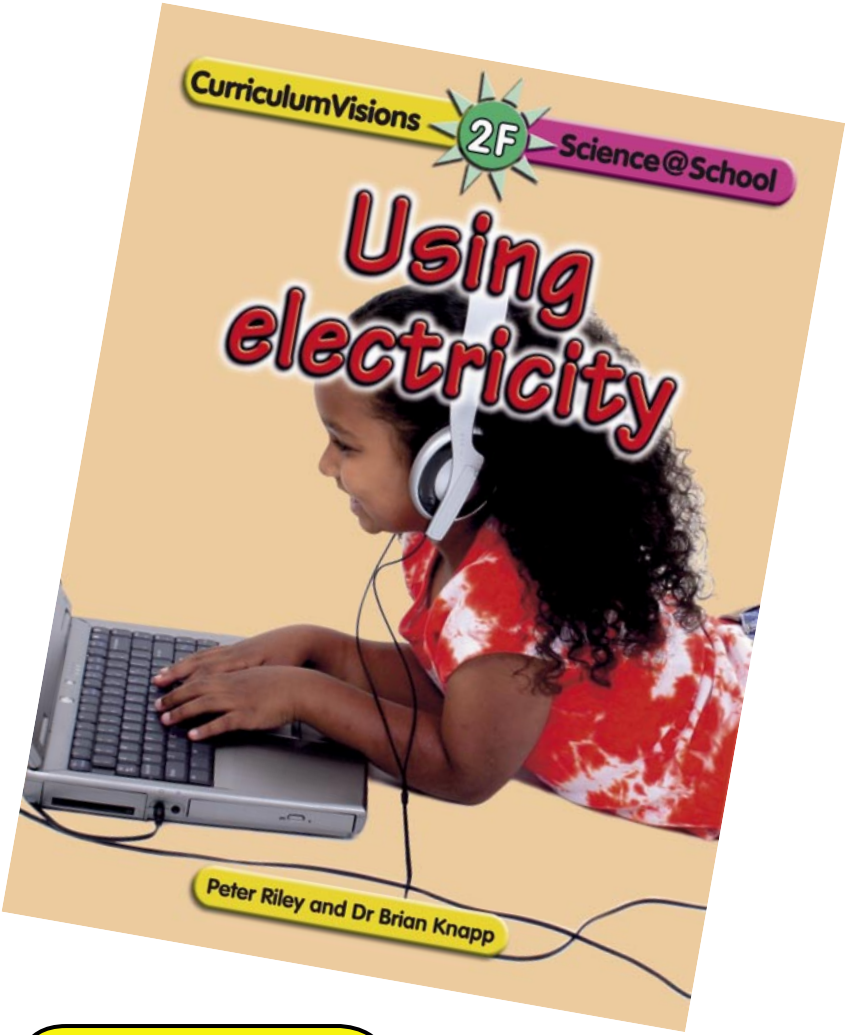

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Curriculum Visions

A CVP Teacher's Guide

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Introduction

The pupil's book

The Key stage 1 Science@School series is a series of twelve books. Each one addresses one of the QCA units in the Key Stage 1 science curriculum.

Each spread in the book addresses one or more objectives in a QCA unit by providing photographs, simple text and questions to stimulate discussion.

Each book has an illustrated glossary and a simple index for finding information.

The teacher's guide

It may be that you already have a scheme of work and wish to use the books to support it. Alternatively you could use the books, this CD ROM and the **CurriculumVisions.com** web site, which provides support material in the form of extra text (with audio option), pictures, captions, activities and demonstration videos to build a new scheme. Whichever way you choose, the notes in this teacher's guide have been set out as if you were using each page or spread as the basis for a lesson. You may follow each set of notes in their entirety to build up your lesson or take parts of the notes to fit into your scheme.

The teacher's notes contain information about practical work. You should check your school policies on practical science work and only select activities for which you are confident to take responsibility.

The book *Be Safe!* published by the ASE (ISBN 978–0–86357–324–8) provides useful guidance on carrying out science activities.

The structure of the notes

The notes for each page or spread follow the same structure, which is outlined here.

Objectives

These may be linked to the QCA objectives or build on them to enrich the topic.

Resources and preparation

Suggestions may be made for building on the visual display of the books with posters and models.

There are also pictures (aka flashcards) at the end of the notes to each lesson, which may be printed off and used as triggers to start the lesson or used in the plenary as revision. When the pictures have been used they could be displayed on a wall and others added as the subsequent lessons are completed. This will make a colourful summary of the work which could be used as a final revision resource when the book is completed.

If you are using the **CurriculumVisions.com** web site log in, go to Science, Year 2, Unit 2F Using electricity.

There may be some suggestions for building practical work into the use of the pages in the book and these include a list of requirements (simple, readily available materials) and advice on preparing the requirements for use in the lesson.

Introduction

Starting the lesson

Each lesson begins with a short activity, which helps settle the children and focus them on the work ahead.

Activities with the page

These may be reading activities, observing and discussing the pictures or answering a question. There may also be practical activities which are designed to develop a range of practical science skills from making observations to carrying out fair tests.

Differentiation

There are suggestions for providing help and activities for children of different abilities.

Assessment

There are suggestions for assessing the children's work. There are three assessments for you to print off at the end of this guide. These are for use with lesson 1 (page 55), lesson 4 (page 57) and lesson 8 (page 59), or you could use all three together as an end of unit test. Guidance for the answers is given in the assessment section of the lesson notes.

Plenary

The work done in the lesson is reviewed in this section and there may be a further activity to help secure the children's knowledge.

Outcomes

These may be linked to the QCA objectives or build on them to enrich the topic.

1 Teacher's sheet 2F

Do we need electricity?

Objectives

- To understand where electricity comes from.
- To know about the importance of electricity in our lives.
- To know that mains electricity can be dangerous.

Resources and preparation

A picture of a wind turbine on a turbine farm, a toy windmill (both from lesson 9 Science@School 2D Grouping and changing materials), a battery, three wires, a switch and a bulb to make a simple circuit.

Starting the lesson

If the children have done lesson 9 with Science@School 2D Grouping and changing materials they will have seen a picture of a wind turbine, blown a windmill and have a simple understanding that steam is used in many power stations to spin turbines and make electricity. You may like to remind them of this now.

Alternatively you may like to give the children some very tiny pieces of paper and ask them to rub their plastic pens on their sleeves and bring the pens near the paper. They should see the paper jump up to the pens and cling to them. Tell the children that they have just generated some electricity on their pens and it makes a force which pulls the paper to it. Tell the children that because the electricity stays on the pens it is called static electricity. Tell the children that there is another kind and hold up a battery. Tell the children that it is stored in the battery but you can get it out with wires, a bulb and a switch. Set up a circuit and switch it on and let the children see the bulb glowing. Tell the children that this kind of electricity is called current electricity and is running through the wires from one end of the battery to another. Switch the circuit on and off a few times to show when current flows and does not flow then tell the children that they are surrounded by bigger circuits than this running through the walls and ceiling. These circuits have much more electricity in them than has been generated in a power station a long way away and brought to the school on cables. This electricity can be very dangerous if it is not treated properly.

Activities with pages 4 and 5

- Read the opening sentence with the children and remind them of the electricity that you had flowing in the simple circuit.
- Read the paragraphs on the page slowly with the children to set the scene for the work.
- Read the caption and let the children look at the picture and identify the items in the kitchen. Point out

the black cooking stove and tell the children that every room had a fireplace to keep the home warm.

- Let the children tell you about people in other times before the Victorians that they may know about and point out that they did not have electricity either. You may tell the children that some old people living today may have grown up in houses where the houses had only electricity downstairs and they had grandparents who as children lived in houses without any electricity.
- Move on to page 5 and look at the picture of the birthday cake and read the caption. Tell the children that people still made cakes before electricity was used but they baked them in ovens next to fireplaces.
- Look at the picture of the pump and tell the children that in the days before electricity water had to be pumped out of the ground, and villages and neighbourhoods had their own pumps where people went to get their water. Read the caption and tell the children that electric pumps help deliver water to their taps. You may like to point out that it is very dangerous for water to come into contact with electric wires, plugs and switches and the electricity in the pumps is kept safely away from the water it moves.
- Look at the picture of the car and read the caption then move up to the wind surfer and read the caption. Ask the children about other outdoor sports and activities that people can do without electricity and look for answers about playing football, cricket, rounders, walking, horse riding and riding bicycles.

Differentiation

Ask the children to draw their classroom and feature all the items that are to do with the electricity such as switches, plugs, plug sockets, and leads, lights, computers, TV and whiteboard. Less confident learners may need help in identifying all the features and drawing them in place. More confident learners could count up the number of switches in the room – those on devices such as computers as well as light switches and switches on plug sockets.

Assessment

The children could be assessed on the accuracy and presentation of their pictures of the classroom. There is an assessment sheet for this lesson at the end of the guide (page 55).

Answer guidance

television, mobile phone, vacuum cleaner, torch, radio, washing machine. Note that some items of children's footwear do have lights in them! The children could select microwave oven, heater, fridge and table lamp as items using electricity. Pencil sharpener, coat and football are items which do not need electricity to be useful.

1 Teacher's sheet 2F

Plenary

Return to the Victorian kitchen and then ask the children to answer the question on page 5. Look for answers about kettle, toaster, microwave, oven, fridge, washing machine, dryer, food blender, food mixer, extractor fan.

Outcomes

The children:

- Understand where electricity comes from.
- Know about the importance of electricity in our lives.
- Know that mains electricity can be dangerous.

2 Teacher's sheet 2F

Electricity and light

Objectives

- To know that electricity can make lights work.
- To recognise sources of light in the surroundings.
- To know that light can be used to control traffic.

Resources and preparation

Note that after this lesson you may wish to move to lessons 8 (pages 18–19) and 9 (pages 20–21) and let the children develop skills in making circuits and getting bulbs to light.

For this lesson you will need a large filament bulb. Make a quick survey of all the staff to see if anyone uses energy-saving light bulbs. Make a tally of those that do and those that don't for the plenary.

Starting the lesson

Tell the children that the first people used the light from fires to see in their homes. Later candles were invented and then gas lighting was used. After ways of making electricity had been invented one of its first uses was to provide light. Ask the children to count the sources of light in the classroom. They should count the strip lights and desk lights and the light in the projector for the whiteboard.

Activities with pages 6 and 7

- Read the introductory sentence with the children and move on to the first line of the first paragraph. Ask them what was used before electricity to light homes and look for answers about fire, candles and gas.
- Read the second sentence of the paragraph and walk the children round the school looking at where there are lights. They could make a tally chart as they walk round.
- Read the second paragraph and then look across at the picture of the city and read the caption. Ask the children who might see the cities from space and look for an answer about astronauts but be prepared for someone saying aliens!
- Look at the traffic lights with the children and ask them if they know the sequence of lights starting with red. Let the children work on their own with coloured crayons to produce five pictures of traffic lights showing the correct sequence which is red, red and amber, green, amber, red.
- Read the first two sentences of the third paragraph and look at the picture of the traditional light bulbs and show them your bulb. Let them see the coiled wire filament and tell them that this is the part of the bulb that the electricity passes through. As it travels through the wire it heats it up so much that it glows. Tell the

children that if the wire was in air it would burn up very quickly so it is put in a glass bulb without air. Tell them that there is an air-like substance in the bulb but it stops the filament burning up. (This is a gas called argon but the children do not need to know about it.)

- Ask the children if they can see how the two bulbs are different and look for an answer about the bottoms of the bulbs. These are attached into the sockets and one has a screw thread (screw cap) while the other has two prongs (bayonet cap).
- Move on to the last sentence of the third paragraph and look at the energy-saving light bulbs. Ask the children how they can tell them from the traditional light bulbs and look for an answer about different shapes and having white glass. Tell the children that these bulbs do not have filaments and the electricity passes through an air-like substance (argon but with mercury vapour) and as it does so it makes the white sides of the bulbs glow (in a similar way to fluorescent lights).
- Tell the children that at many power stations the steam to turn the turbines is made by heating water by burning coal or oil. These two substances are called fuels and they contain energy, which is used to make electricity. With traditional light bulbs a lot of this energy is wasted making heat but in energy-saving bulbs there is much less waste. Tell the children that the world is running out of coal and oil so we need to save as much of them as possible. This can be done if we use energy-saving bulbs instead of traditional ones.
- Move on to the picture of the television and the caption on page 7 and tell the children that as electricity passes through a television it makes the screen light up. Ask the children if they can think of another item in the home or school which has a screen that lights up when it is switched on and look for an answer about computers.

Differentiation

Less confident learners may need help in observing all the lights as they go round the school and keeping their tally up to date. More confident learners could be allowed to make their own tally while being supervised and have it checked at the end with your tally. Less confident learners may need help with the sequence of colours at traffic lights. More confident learners can write down what each signal means – stop, prepare to move, go, prepare to stop, stop.

Assessment

The children can be assessed on the accuracy of their tallies and the presentation of their traffic light sequences.

2 Teacher's sheet 2F

Plenary

Look at the picture of the lights in the bedroom and ask the children how many lights they have in their bedroom. Be prepared for some children having flexible light tubes as decoration in addition to other light bulbs. Let the children answer the question on page 7 and make a tally of the results. Present them with the tallies for the staff. The children may conclude that more people, both in their own homes and the staff's homes, need to use energy-saving light bulbs to help save coal and oil.

Note you may like to move to lessons 8 (covering pages 18–19 of the student book) and 9 (covering pages 20–21 of the student book) now to build up the children's knowledge of circuits and develop their practical skills before preceding with the rest of the book.

Outcomes

The children:

- Know that electricity can make lights work.
- Can recognise sources of light in the surroundings.
- Know that light can be used to control traffic.

3 Teacher's sheet 2F

Electricity and heat

Objectives

- To know that electricity can be used to provide heat.
- To know that the heat produced by electricity can have a range of applications.

Resources and preparation

A piece of coal, an electric fire like the one on page 9, a convector heater. These do not need to be plugged in but just serve to help children to identify electric heaters they may have at home.

Starting the lesson

Remind the children that before ways of making electricity were invented people used to rely on fires, candles and gas to provide them with light. Tell the children that in the past fires and gas were used to provide heat too. Fires were used throughout human history but gas was only used for over the last hundred years or so and is still widely used today. Look at the Victorian kitchen on page 4 with the children and tell them that in Victorian times many homes had servants and one of the servant's jobs was to attend to the fire. Dealing with the fire may have followed this pattern. The servant rose early before the rest of the family got up and scraped out the ashes from the previous evening's fire. These would have to have been taken outside and a new stock of coal brought in. The fire would be laid with wood and paper and a little coal and once these were alight more coal would be added so that the fire was roaring away and providing heat by the time the family arrived in the room. At times the fire would need poking to help it burn and more coal would have to be put on it at regular intervals throughout the day. Show the children the piece of coal and ask them to imagine a shed outside the house full of coal and the servant having to shovel it into buckets and bring it into the home. Ask them to imagine what it was like if there were several fires in the home such as in the parlour, kitchen and bedroom. Tell the children that after Victorian times coal fires were used in most homes and by then most people did not have servants and had to tend to the fires themselves. Ask the children to ask their grandparents about coal fires and report back next lesson.

Activities with pages 8 and 9

- Read the opening sentences with the children and move straight on to the first paragraph and look up cable in the glossary.
- Read the first sentence of the second paragraph and continue into the second sentence up to warming rooms then move across to page 9 and look at the picture of the fire and read the caption about it.
- Show the children the heaters in your collection. Point out that the heater in the picture has a reflector behind

the hot metal wire, which reflects the heat back into the room. Tell the children that a convector heater has a hot metal wire inside it and holes at the top and bottom. As the wire gets hot, it heats the air and the warm air rises through the top holes and circulates round the room. Cooler air near the floor goes in through the bottom holes, becomes warm and rises out of the heater too.

- Move back to the second paragraph to read about ironing and then move back to page 9 to look at the picture of the iron and read the caption. Point out that there is a red light on the iron and ask the children about its purpose. Look for an answer about warning that the iron is switched on and is hot. Remind the children that electrical items which provide heat can get very hot and if touched will cause very painful burns.
- Move back to the paragraph on page 8 and read the last part of the sentence then look at the picture of the oven and read the caption. You may like to add that microwave ovens also use electricity. Move on to the kettle and read the caption and label. Tell the children that kettles also have red lights on them and ask them why they are important. Look for an answer about containing very hot water, which can scald the skin.
- Ask the children to answer the question and collate their responses on a tally chart. Let them make a bar chart of the results. When considering the heater say that central heating systems may use gas or oil but will have electricity to work the timers and thermostats. The children should just respond by saying that a radiator or convector is present or absent in their home and not give the numbers present.

Differentiation

Less confident learners may need help in making the chart. More confident learners should explain what the bar chart shows – that most homes have all or almost all the items in the survey.

Assessment

The children could be assessed on the presentation of their charts.

Plenary

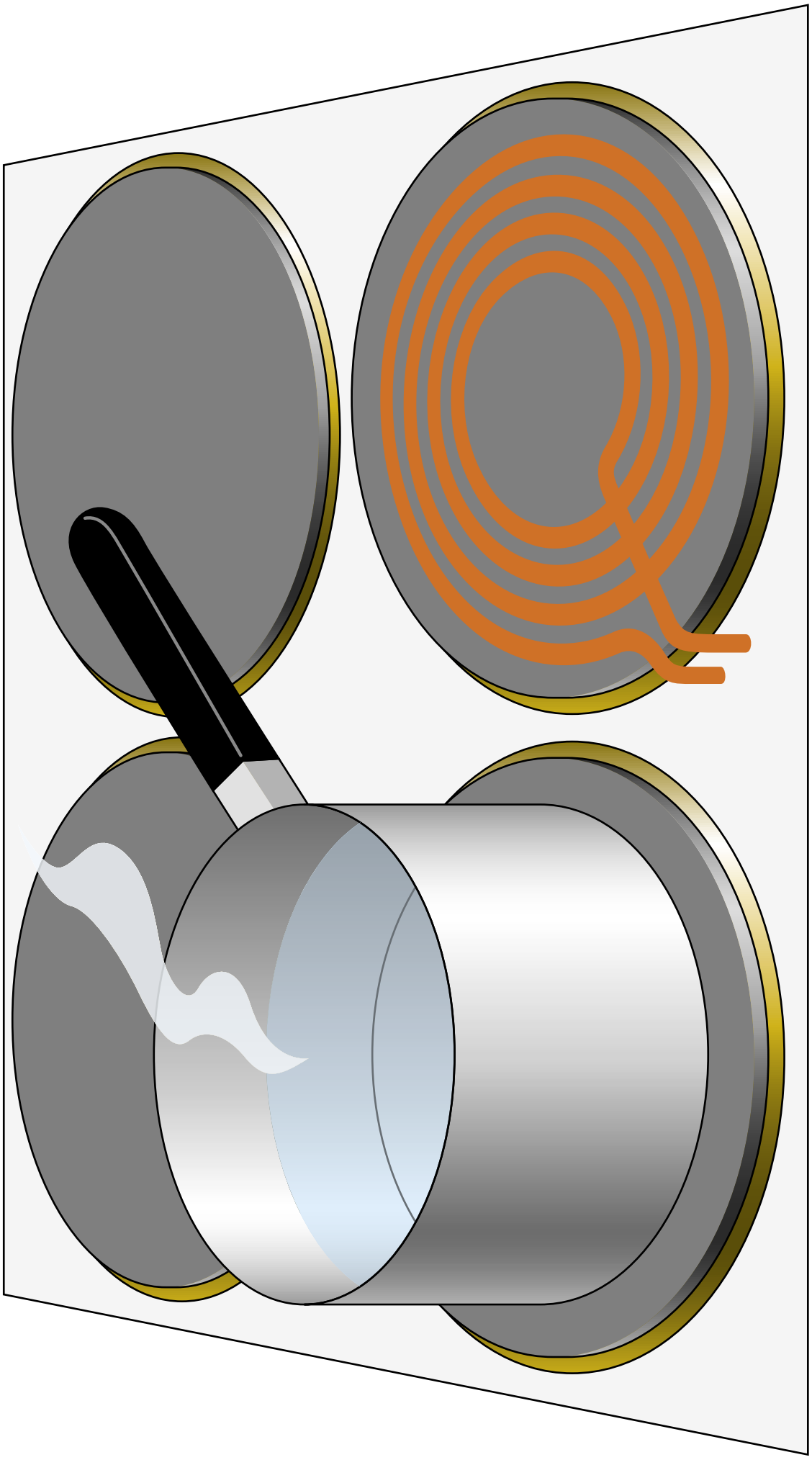
Ask the children to think about living in a house where they had coal fires and used candles. Remind them of the work involved with coal fires and discuss with them the need to always have some candles in stock to replace those that were used up. Tell the children that gas lighting needed a match to light it. Ask the children to think about how electricity provides heat and light and how people felt when it was brought into their home. Look for answers about it making life easier because there was less work and mess with the fires and no need to keep matches and candles handy. Conclude that electricity made life cleaner and heating and lighting became easier to control.

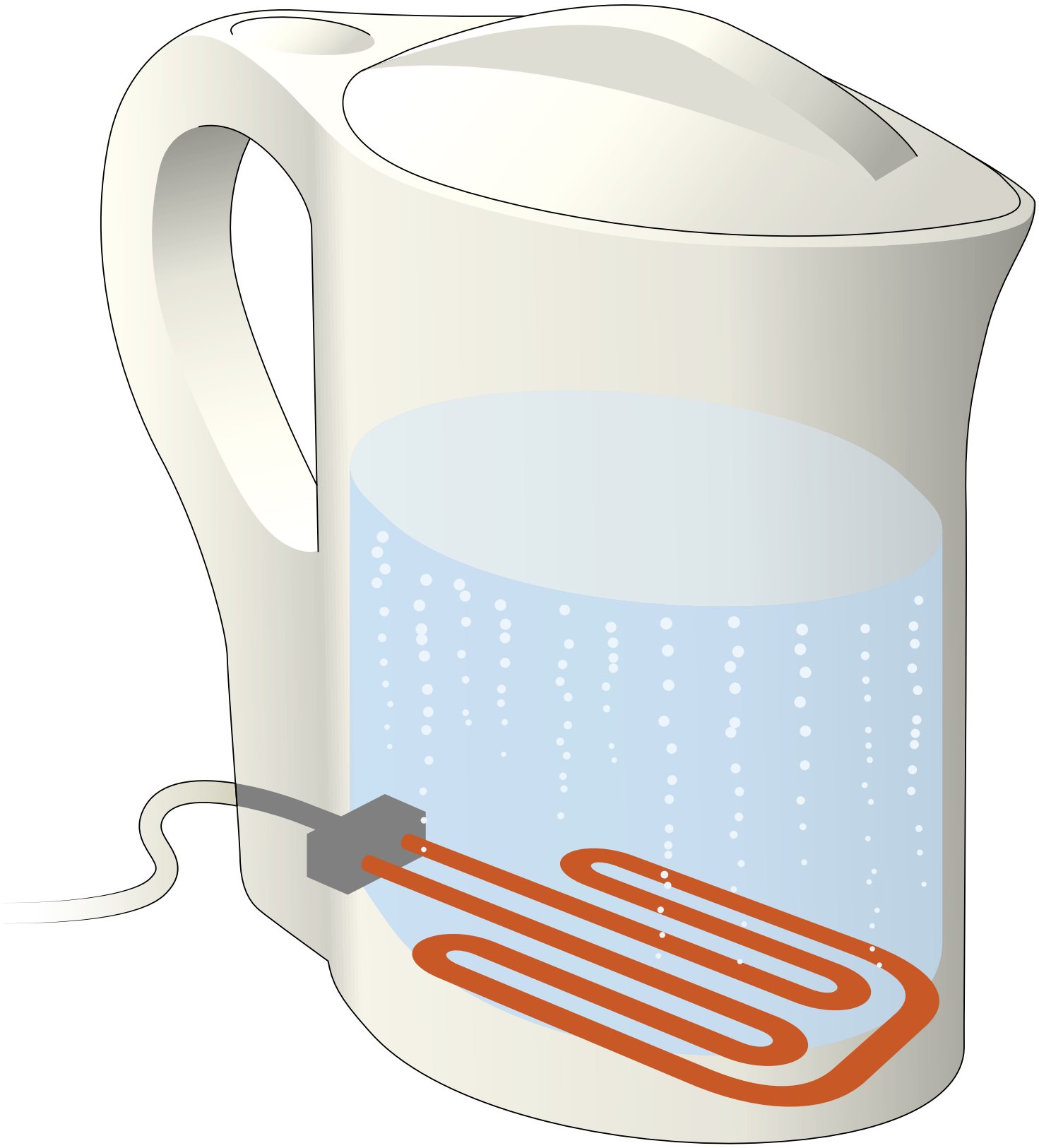
3 Teacher's sheet 2F

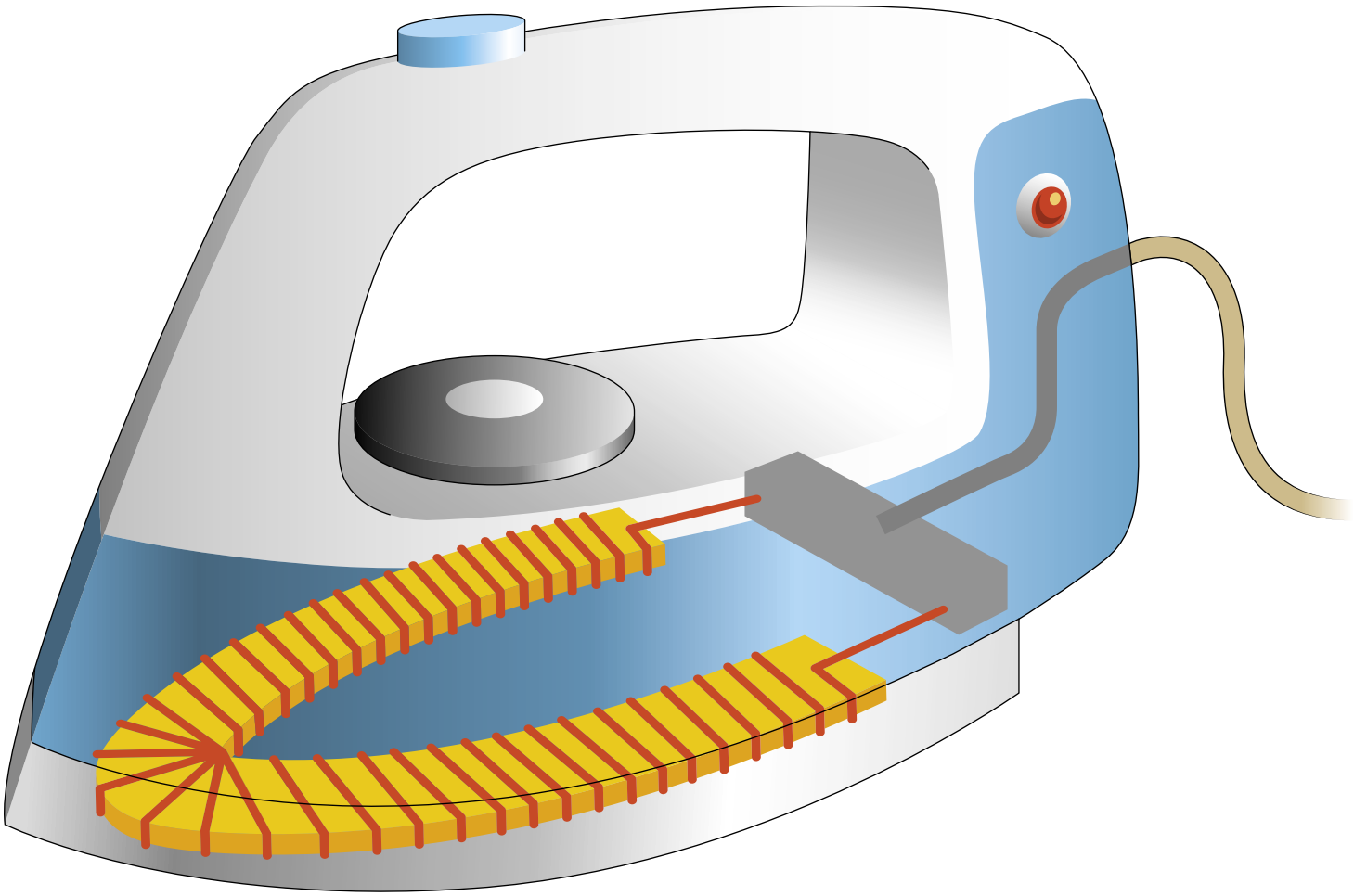
Outcomes

The children:

- Know that electricity can be used to provide heat.
- Know that the heat produced by electricity can have a range of applications.







Sound and movement

Objectives

- To know that electricity can be used to make sounds.
- To make a circuit containing a buzzer.
- To know that electricity can be used to produce movement.
- To make a circuit containing a motor.

Resources and preparation

The children will need to have done the work associated with pages 19–21, lessons 8 and 9 before attempting the practical work in this lesson. Each child or group will need a battery in a holder, a switch, three wires with crocodile clips, an electric motor with a piece of Plasticine to support it, a buzzer. Later they will also need another battery in a holder and a wire with crocodile clips. You will need a shatter resistant plastic ruler and a model electric car.

Starting the lesson

Ask the children about how sounds are made. Remind them of their work with Science@School 1F Using electricity and steer them towards vibrations. Ask them how you could make the ruler vibrate and set it twanging on the edge of a table. Tell the children that electricity can be used to make things vibrate. Show the children the electric car. Tell them that it has a motor inside it and when the electricity is switched on, the motor turns the wheels. Some children may wonder how a motor works. You could begin by showing the children two bar magnets and getting them to move towards each other and away from each other. Tell the children that electricity in a wire behaves as if it is a magnet and in a motor there is a coil of wire on a spindle. The coil is surrounded by a magnet and when electricity flows through the coil, it becomes a magnet and the other magnet pushes and pulls on it and makes it spin.

Activities with pages 10 and 11

- Read the two introductory sentences with the children and move on to the first two paragraphs.
- Look at the picture of the escalator and read the caption. Ask the children where they have ridden on an escalator.
- Move on to the drills and ask them if anyone in their homes uses one and what it is used for.
- Look at the picture of the hedgecutter and explain that the turning motion of the motor is made to move the teeth of the cutter from side to side. Put your hands together and spread your fingers a little and then move one hand over the other to mimic the action of the cutter.
- Ask the children to answer the question on page 11. Steer them from the hedgecutter to cutters used by hairdressers and the movement of an

electric toothbrush. Ask them to think of machines that have something that turns when you switch them on and look for answers about washing machines, tumbler dryers, microwave oven turntable, CD player, DVD player, and video recorder. Tell the children that an electric motor can be used to work a pump and suck in air and steer them towards the vacuum cleaner.

- Show the children an electric motor. Ask them how they could get the motor to work. Look for an answer about setting up a circuit with a battery, wires and switch. The children may need to be discouraged from putting a bulb in the circuit too as they should become aware that all circuits do not need bulbs in them.
- Issue the batteries, wires, switches, motors and Plasticine and let the children build their circuits and make their motor work.
- Ask the children to draw their circuit with the motor in it.
- Take in the motors and Plasticine and move back to page 10 and read the text and pictures about sound production. You may like to remind the children that headphones should not be turned up too loud as they will damage the ears.
- Issue the buzzers. Ask the children to make a circuit with the buzzer. Some may find that their buzzers work and others may find that they do not. Look at the two sets of circuits and compare them. The circuits with the buzzers that work will have the red wire leading towards the cap or positive terminal of the battery. Buzzers without a red wire will have their positive terminal (+) with a wire leading towards the positive terminal of the battery.
- Ask the children to draw their circuit with the buzzer in it.
- Challenge the children to think what might happen if they added a second battery. Look for a prediction about the buzzer making a louder noise because there is more electrical power. Issue the second batteries and let the children test their predictions.
- Ask the children to draw their circuit with the buzzer and two batteries in it.

Differentiation

Less confident learners may need help making all the connections secure in the circuit and help in making drawings of their circuit.

Assessment

The children can be assessed on the ease with which they make their circuits and the attention they give to making sure the connections are secure. They can be assessed on the accuracy of their diagrams.

Plenary

Let the children display their drawings, swap them and check them by making the circuits as they appear in the drawings.

Outcomes

The children:

- Know that electricity can be used to make sounds.
- Can make a circuit containing a buzzer.
- Know that electricity can be used to produce movement.
- Can make a circuit containing a motor.

5 Teacher's sheet 2F

Mains electricity

Objectives

- To know where mains electricity comes from.
- To know about the dangers involved with the transport of mains electricity to the home.
- To know about the dangers of mains electricity in the home.
- To know about the application of mains electricity in the home.

Resources and preparation

Model electric car. A motor, two wires with crocodile clips, a thread at least 20 cm long (assemble these items and try to light the bulb as explained in the 'Starting the lesson' section), a photograph of a wind turbine showing the generator behind the blades.

Starting the lesson

Remind the children of how a motor contains magnets and can be used to make electricity produce movement. You may like to illustrate this with the model electric car. Now tell them that the same arrangement inside a motor can be used to make electricity. Connect the bulb to the motor with the two wires. Press one end to the side of the motor and wrap the rest of the thread around the motor shaft at least thirty times. Take up the end that you have pressed against the motor and pull it quickly. The shaft should spin round so fast as the thread unwinds that it makes the bulb light up. Tell the children that you made the coil of wire spin round next to the magnet and this made electricity in the coil, which went round the circuit and lit up the bulb. Tell the children that you had made the motor behave as an electrical generator and in power stations there are huge electrical generators which have steam or water-driven turbines to make their coils spin. You could tell them that behind every wind turbine on its tower there is a generator that makes electricity, and show its position in the photograph.

Activities with pages 12 and 13

- Read the opening sentence with the children and ask them to look up mains electricity in the glossary.
- Move on to the first paragraph. Ask the children to look up power station in the glossary.
- Ask the children if they can remember the definition of a cable. Let them check their answer in the glossary.
- Look at the two pictures of the cables with the children and read the caption and labels.
- Return to the first paragraph and ask the children to look up pylon in the glossary.
- Read the second and third paragraphs with the children and look at the picture about delivering electricity to the home. Tell the children that they

must never climb on pylons as they could be electrocuted. Also they must never fly kites near cables in the air as the electricity could travel down the string and cause electrocution.

- Look at the green box at the foot of the pylon on page 13 and say that this represents a substation. If there is a substation close by you may wish to take the children to it or take a photograph of it and show it back in the classroom. Tell the children that at a substation the electricity is prepared to be sent to buildings in the town and is very dangerous. Children must not go through the railing surrounding a substation and must not go after footballs that may land on their roofs. There is the same danger of electrocution as with climbing pylons.
- Move on to the picture of the homes in the lower right hand corner and up to the large picture of the home. Tell the children that mains electricity is still dangerous when it is in the home and must be treated with great care. Switches and plug sockets must not be played with or have things poked into them. Adults should plug in electrical equipment. Electricity cables on machines in the home must not come into contact with water and all hands must be dried before handling switches because electricity can pass from the mains through the water to a person and give them a fatal electric shock.
- The children could devise posters to warn of the dangers of mains electricity.

Differentiation

Less confident learners may need the warnings repeated to them. More confident learners could write down the warning activity as a set of rues.

Assessment

The children could be assessed on their posters and rules and their contribution in the plenary.

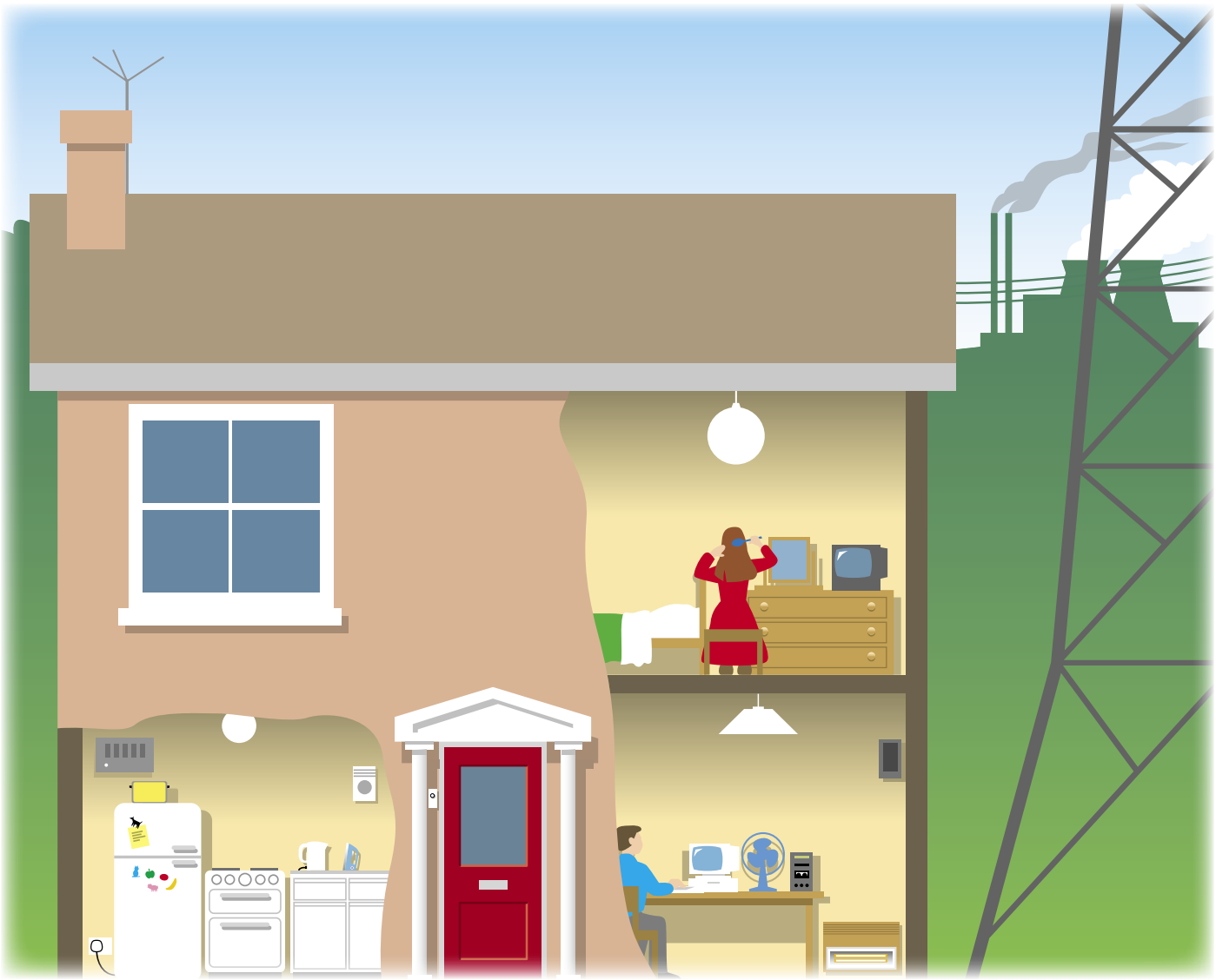
Plenary

Ask the children to answer the question on page 13. Go round the house from room to room – kitchen, living room, bedroom. Make sure the children distinguish between appliances that use mains electricity and those that use batteries.

Outcomes

The children:

- Know where mains electricity comes from.
- Know about the dangers involved with the transport of mains electricity to the home.
- Know about the dangers of mains electricity in the home.
- Know about the application of mains electricity in the home.



Batteries

Objectives

- To know that batteries are portable sources of electricity.
- To know that batteries have a wide range of uses.

Resources and preparation

You may wish the children to have some visual image of a current of electricity and one approach is featured in the start to the lesson. The image of a current of electricity is relatively easy to demonstrate but the direction of the flow of the current is more difficult because scientists originally thought it flowed from the positive to the negative terminals and this notion is still widely used today as the conventional current direction and shown on pages 18 and 19. In reality the electrons move in the other direction. You may like to consider if your children can cope with these ideas before performing the demonstration in the starter as someone is bound to ask "So which way round do they go?"
For the current demonstration – A jug of water, ramp and bowl, one half of a cardboard tube from a kitchen roll cut in half lengthways, a collection of marbles all the same size that can form a line down the inside of the 'gutter' made by the half tube. Some extra marbles. You may like to practise making the marbles move along the gutter as explained in starting the lesson before you show the children.
For other parts of the lesson – a mobile phone and its charger.

Starting the lesson

- Tell the children that when scientists discovered electricity that could flow through wires they wondered what it was. They thought it must be something like water that flowed. You may wish to pour a jug of water down a ramp into a bowl to show a current of water. Tell the children that later scientists discovered what the current of electricity really was. They discovered that in metals there are tiny particles, which can move about. These particles are called electrons. (There are electrons in every atom of every substance in the universe. They are generally held in position in atoms quite firmly. In metals some of the electrons are free to move about and these are the ones that produce the current of electricity.) Show the children the cardboard 'gutter' and say this represents a wire. Line up the marbles inside the 'wire' and say that they represent the electrons. Tell the children that when a circuit of electricity is switched on more electrons enter the wire and push some in one end and some out at the other end. You may like to throw each marble into the 'wire' so that it strikes one marble and all the others move causing a marble at the other end to fall out. You may need to pinch the sides of the 'wire' to keep the marbles

from going up them and not out at the other end.

- Tell the children that in a real wire there are millions of electrons and when a current is switched on millions more enter the wire and start the pushing to make a current of millions of electrons moving along the wire.
- Tell the children that at a power station the electrons are made in a generator and start moving the moment people switch on the mains. You may like to repeat the motor-as-a-generator demonstration from the start of the last lesson then tell the children that in a battery there is a store of electrons, which start to move the moment the circuit is switched on.
- If you do not wish to use the electron demonstration ask the children to think about anything that uses electricity that is not connected up to the mains. Ask the children how these devices work and look for an answer about batteries.

Activities with pages 14 and 15

- Read the opening sentence with the children and move on to the first paragraph. Read on down to the remote controls for TV and music centre, and then stop and look at the pictures of the remote. Tell the children that the ends of the batteries at the left hand side are connected together with a wire so electricity can flow from one to the other when buttons on the remote are pressed. The electricity then flows on wires connected to the right hand ends of the batteries to make the remote work.
- Read the rest of the paragraph and move on to the next paragraph. Make sure that none of the children will be upset by talking about heart conditions before looking at the pacemaker and its caption. Tell the children that our bodies make small currents of electricity but they do not move about on wires in our bodies but on long thread-like fibres called nerves. The nerves connect our brain to all parts of our body. One nerve sends currents from the brain to the heart to keep the heart beating but in some people the heart needs extra electricity and this is provided by a pacemaker. Look at the phrase electric shocks and tell the children that the shock is only very small. Tell the children that people can get electric shocks, particularly from mains electricity, if they do not use electrical equipment properly and ask the children to look up electric shocks in the glossary.
- Move on to page 15 and look at the torch battery. If the children have been making circuits already remind them that they used torch batteries in their investigations.
- Look at the rechargeable batteries and the mp3 player. Ask the children about another device that has rechargeable batteries and look for an answer about mobile phones. Tell the children that ordinary batteries are not rechargeable and no one must ever attempt to recharge them. Show

the children the mobile phone and charger and say that the charger is plugged into the mains and provides electricity to the batteries which they can store ready for use.

- Look at the pictures and captions on the rest of the page to discover that batteries can be different shapes and sizes.
- Ask the children to answer the question on page 15. Write down a list on the board. The list might include batteries in the remote control of their TVs, toy cars, dolls, toothbrush, watch, torch, etc.
- Get the children to make a table with two columns headed 'Item' and 'Use of electricity'. Ask the children to write down the names of the items on the board in the left hand column and the use of the electricity in the other. For example a torch uses electricity to make light. If a TV remote features in the list tell the children it makes a beam of light called infra red that we cannot see (but goldfish can) that makes things change inside the TV. They can simply write in beam of infra red light.

Differentiation

Less confident learners may need help making the table and need to make wide columns to accommodate the size of their letters. More confident learners could write down a story about someone using battery powered objects through a day – such as toothbrush, watch, TV remote control and torch.

Assessment

The children can be assessed on the presentation of their table and the ideas in their stories.

Plenary

The children could read out their answers about how the electricity was used and children who have written stories could read them out too.

Outcomes

The children:

- Know that batteries are portable sources of electricity.
- Know that batteries have a wide range of uses.

7 Teacher's sheet 2F

Looking inside a torch

Objectives

- To know about the components of a torch.
- To put batteries in a torch and make it light up.

Resources and preparation

Each child or group will need a torch. You will need a torch which can be taken to pieces and reassembled.

Starting the lesson

If you have read pages 18–21 and done lessons 8 and 9 with the children you can use this lesson for revision and move straight to the spread.

If you have been building up to making circuits tell the children that they are now going to look more closely at an electrical device and find out about its components and move straight to the spread.

Activities with pages 16 and 17

- Read the opening sentence with the children and then point out that there are two illustrations which are related. Look at the top photograph of all the components of a real torch and then at the picture which shows all the parts connected up inside the torch.
- Read the first paragraph with the children and look at the picture of the inside of the torch generally and say that the torch contains a circuit.
- Read the second paragraph with the children and then show how the front of the torch in the top photograph is related to the picture. Do the same with the case.
- Move on to point 1 and find the bulb in the photograph and the picture. Point out that in the picture the bulb is connected to a wire and a terminal of a battery.
- Move on to point 2 and look at the batteries in the photograph and the picture. Point out that the terminals both point in the same direction.
- Move on to point 3 and look at the springs in both the photograph and the picture and the bulb holders.
- Move on to point 4 and look at the switch in both the photograph and the picture. Point out that the switch is connected to a wire which connects to the spring and a wire that connects to the bulb.
- Tell the children that when the torch is switched on the electricity flows from the terminal to the bulb. Note that if you have discussed the flow of electrons thoroughly in lesson 7 you will need to say that the electricity flows from the battery into the spring. Ask the children to write down the path of electricity around the

circuit starting with the bulb. Using the conventional current direction the children should answer bulb, wire, switch, wire, spring, batteries. Using the electron flow direction the children should answer batteries, spring, wire, switch, wire, bulb.

Differentiation

Less confident learners may need help in writing a sequence. More confident learners can be challenged to think why the current does not flow when the torch is switched off. Look for an answer about the switch not pressing the two wires together and a gap forming which the electricity cannot cross.

Assessment

The children can be assessed on the ease with which they describe the movement of electricity around a circuit, their ability to take out the batteries from a torch and put them back in correctly and their ability to carefully take a torch to pieces and reassemble it.

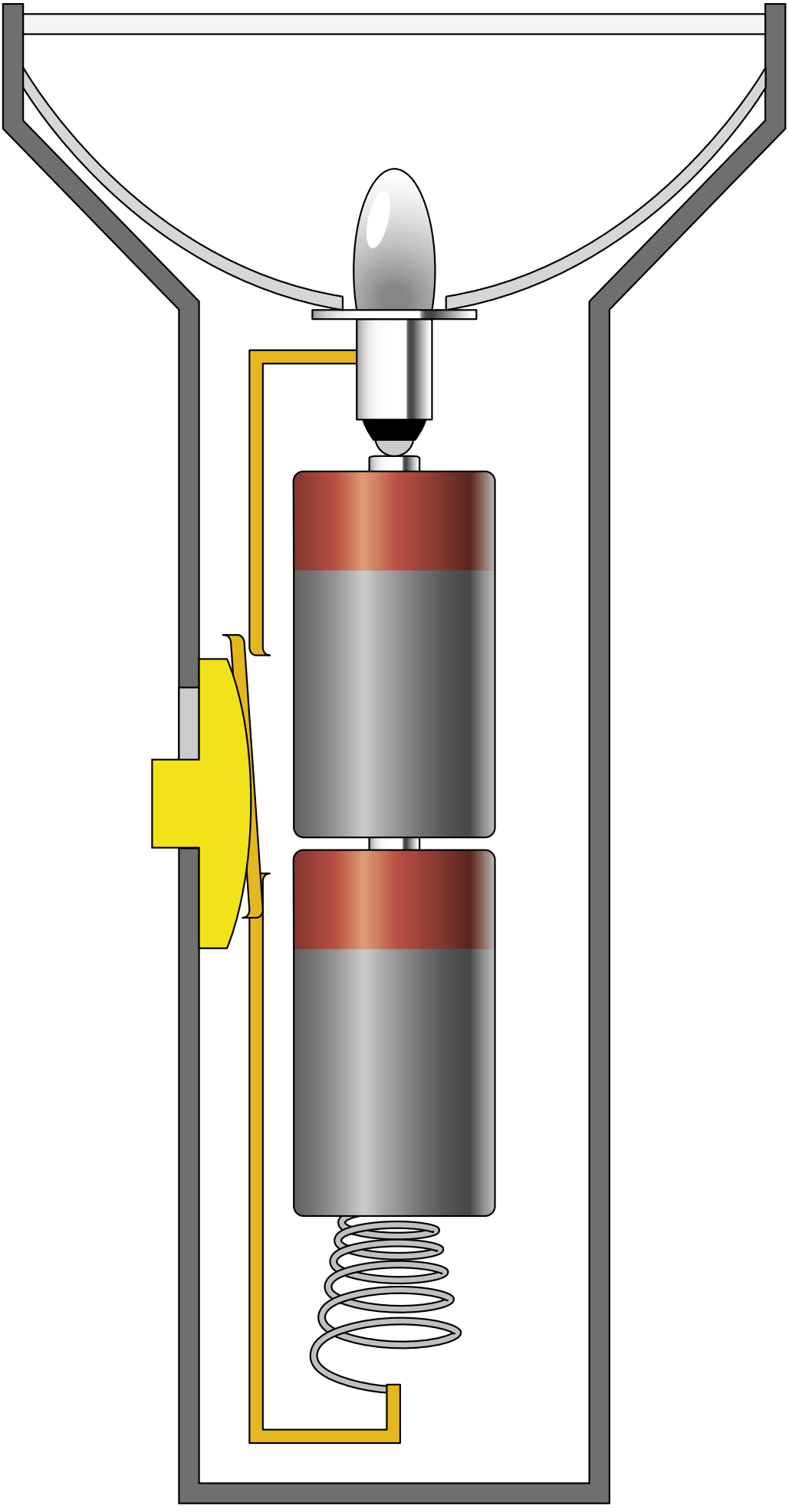
Plenary

Let the children compare the external parts of their torch with the photograph and picture. Let them compare how their switches work – some may be press switches and some sliding switches. The children should open their torches and take out their batteries. They should be able to see the spring and the strips of metal inside. Ask them to put in their batteries and light their torches. If you have a torch which can be taken to bits completely let each child or group take turns at answering the question on page 16.

Outcomes

The children:

- Know about the components of a torch.
- Can put batteries in a torch and make it light up.



8 Teacher's sheet 2F

Making a circuit work

Objectives

- To recognise the components of a simple circuit.
- To be able to assemble a simple circuit so that it conducts electricity.

Resources and preparation

At first each child or group will need one 1.5V battery in a holder, one 3V bulb in a holder, two wires with crocodile clips on their ends, a magnifying glass. After the circuit with one battery has been successfully built issue a second 1.5V battery in its holder and a wire with crocodile clips to join the batteries together.

Starting the lesson

Show the children a battery and tell them that it is a store of electricity. The electricity can only be released from the battery when it is connected into a loop of wires. Tell the children that the battery contains harmful chemicals and should not be broken open. When electricity flows through wires it cannot be seen so to check that electricity is flowing a bulb is placed in the circuit. Issue the bulbs and the magnifying glasses and ask the children to look inside the bulb and see the wire filament. Tell the children that the wire in the bulb is different from other wires in the circuit because when electricity passes through it the wire glows.

Activities with pages 18 and 19

- Read the opening sentences with the children and remind them that a loop has to be made for the electricity to flow and tell them that the path of the electricity is called a circuit.
- Look at the picture of the circuit and point out that the circuit has got two batteries in it. Tell the children that you are going to make a circuit with one battery in and add a second battery later.
- Issue the battery and wires and go through step one with the children and let them do it.
- Slowly go through steps 2 to 4 and let the children build up their circuits. If they have followed the steps correctly the bulb should light up.
- If the bulb does not light up move on to steps 5 and 6 and ask the children to check all the connections.
- Ask the children to answer the question and look for an answer about disconnecting one of the wires and breaking the loop. You may like them to disconnect each connection in turn to emphasise that the electricity will stop flowing if there is a break anywhere in the circuit.
- Look at the picture of the circuit again with the children and point out that one end of the battery is different to the other. This is very important because electricity flows from one

end of a battery, through the circuit to the other end. The end with the metal stud or cap is called the positive terminal of the battery and is marked with a plus (+). The other end of the battery is called the negative terminal. The symbol for this is the negative sign (-) but only the positive sign may appear on the case of a battery as this infers that the other end is the negative terminal. When scientists began studying the flow of electricity through circuits they described it as moving from the positive terminal to the negative terminal of the battery and this description (called the conventional current direction) is widely used today as it is here. Later, scientists discovered that the current of electricity is made up from tiny particles called electrons which flow from the negative terminal to the positive terminal. The children do not need to know this at this introductory stage to electricity, so you can use the conventional current direction.

- Point out that when a second battery is added to the circuit it must be set up so that its positive terminal is connected to the negative terminal of the other battery.
- Ask the children what they would expect to happen to the bulb when a second battery is added to the circuit and look for an answer about there being more electricity in the circuit and the bulb glowing brighter.
- Let the children add the second battery to the circuit by connecting a wire between its positive terminal and the negative terminal of the other battery. Ask the children to perform steps 5 and 6 again.

Differentiation

Less confident learners may need help in securing the connections and spotting gaps. More confident learners could disconnect one connection and just close it again by tapping the crocodile clip on the metal to make the light bulb flash. They could try this at each connection in the circuit to discover they could send messages by flashes from any part of the circuit. You could tell them about the Morse Code being a series of dots and dashes for each letter and number and tell them about SOS being a sign for help and being composed of three dots, three dashes and three dots. This can be turned into three short flashes, the three long ones and three short ones. Challenge the children to send the message with their circuit.

Assessment

The children can be assessed on their ability to construct circuits that work and their ability to handle the components carefully. There is an assessment sheet for this lesson at the end of the guide (page 57).

Answer guidance

1. One wire connects one contact of the bulb to the bottom of the battery and the other wire connects the other contact to the cap on the battery.

2. The second battery has its cap facing in the same direction as the battery in the picture. The wires are connected up in a similar way to those in the top picture.
3. battery–wire–bulb–wire
4. battery–battery–wire–bulb–wire

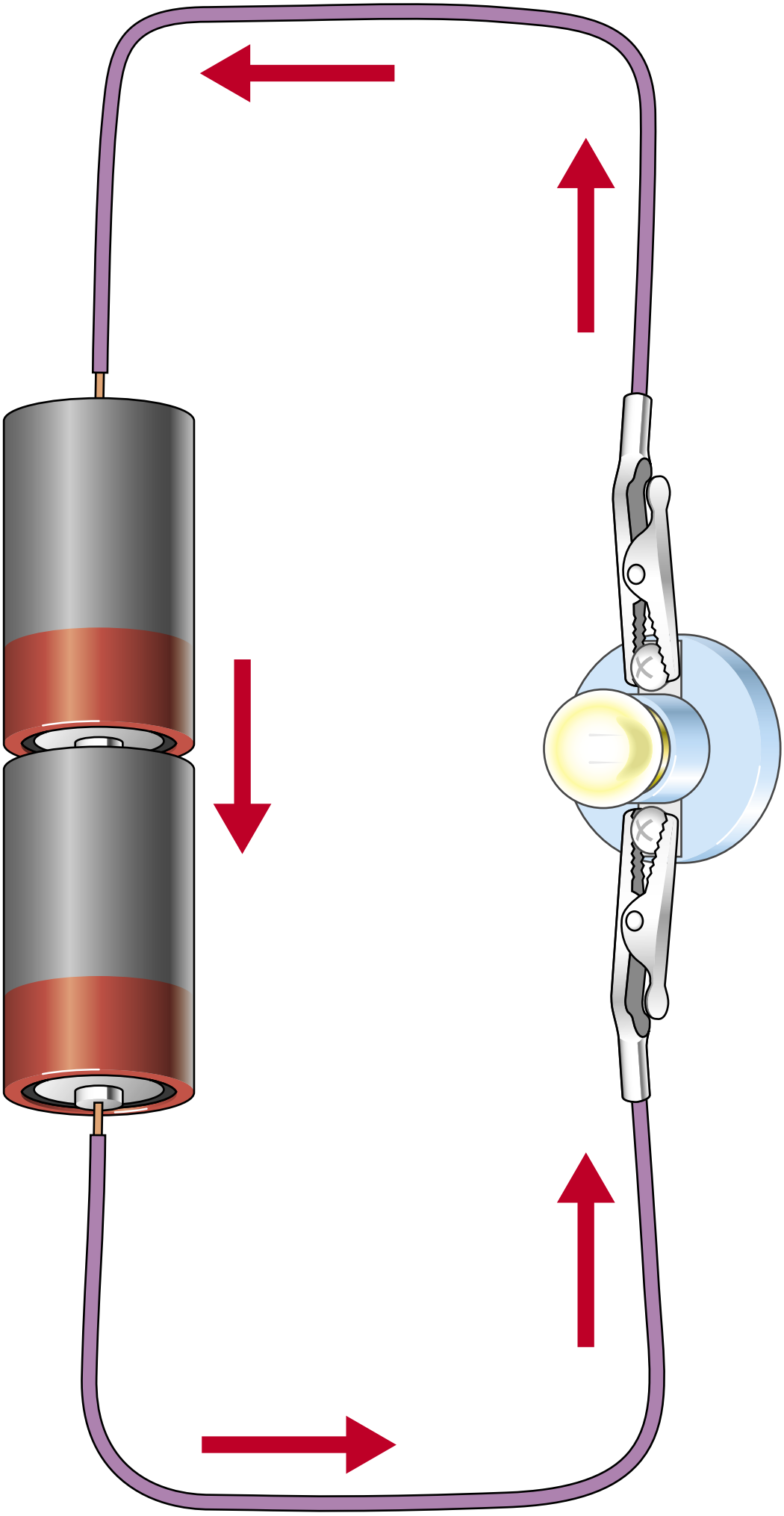
Plenary

Read the 'This is what happens' section on page 19 with the children. Tell the children that the power to make an electrical current is measured in volts which has the symbol V and is shown on the side of the battery. Tell the children that each battery has a power of 1.5 volts so that when they are placed together in a circuit their powers combine to make 3 volts. Other parts of the circuit must be able to cope with their power otherwise they would break. Point out the 3V symbol on the bulb which shows that the bulb can be used in circuits which have two 1.5 volt batteries. Tell the children that if more batteries were used the bulb would glow very brightly for a short time then the filament would break and the current would stop flowing. Emphasise that all the electrical components are used with great care.

Outcomes

The children:

- Can recognise the components of a simple circuit.
- Can assemble a simple circuit so that it conducts electricity.



Circuits that don't work

Objectives

- To know about the reasons why a circuit might not work.
- To construct a circuit from a picture.
- To make a new circuit and draw a picture of it.

Resources and preparation

At first each child or group will need two 1.5V batteries, three wires with crocodile clips and a 3V light bulb. Later they will need a switch and a wire with crocodile clips.

Starting the lesson

Ask the children what they learnt in lesson 8 and make points on the board such as a battery is a store of electricity, it has a positive terminal and a negative terminal, electricity cannot be seen moving along wires but when it flows through the wire in a bulb it makes the bulb glow, all parts of the loop need to be connected together to make a path for the electricity to flow.

Activities with pages 20 and 21

- Read the introductory sentence and the paragraph and look at the picture of the circuit. Get the children to trace the path of electricity round the circuit.
- Read the text below the picture and then issue the components for the circuits and let the children assemble them.
- Check that all the circuits are working and then ask the children to look at circuit 1 on page 21 and make their circuit like it. Ask them about the condition of the bulb and look for an answer about it not glowing.
- Ask the children to look at circuit 2 and tell you how it is different from the one on page 20. Look for an answer about the two batteries being connected by their negative terminals.
- Let the children make circuit 2 and report the condition of the bulb. It should not be glowing.
- Ask the children to answer the question on page 21. Look for an answer about there being a gap in circuit 1 so the electricity cannot flow across it. Look for an answer about the batteries pushing a current towards each other so that neither can flow. Demonstrate this by pushing two clenched fists together to show that they do not move.

Differentiation

Less confident learners may need help in constructing the circuits. More confident learners could be challenged to think what might happen if a second bulb was placed in the circuit in line with the

first. They may say that there will be two sharing the electricity and they may not glow as brightly as one on its own. Issue the extra bulb and wire and let the children test their prediction. They should find that the two bulbs are dimmer than the single bulb. If a child asks about the bulbs being arranged side by side issue a second wire so both bulbs can be set up with wires like the one in the picture on page 20. They should find that both bulbs shine brightly because they are both receiving the full power of the batteries and not 'sharing' the electricity along one wire. In reality the wire in a bulb offers a great deal of resistance to the current and when two bulbs are connected in line (in series) their two resistances add together to impede the flow. When the bulbs are connected side by side the resistances do not add together so they both shine brightly.

Assessment

The children could be assessed on their ability to construct a working circuit without assistance and to make circuits from the two pictures on page 21. There is an assessment sheet for this lesson at the end of the guide (page 59).

Answer guidance

1 and 5.

In 2 X is in the gap, in 3 X is by the wire that is not connected to the cap, in 4 X is by the two wires attached to the cap, in 6 X is in the gap by the motor.

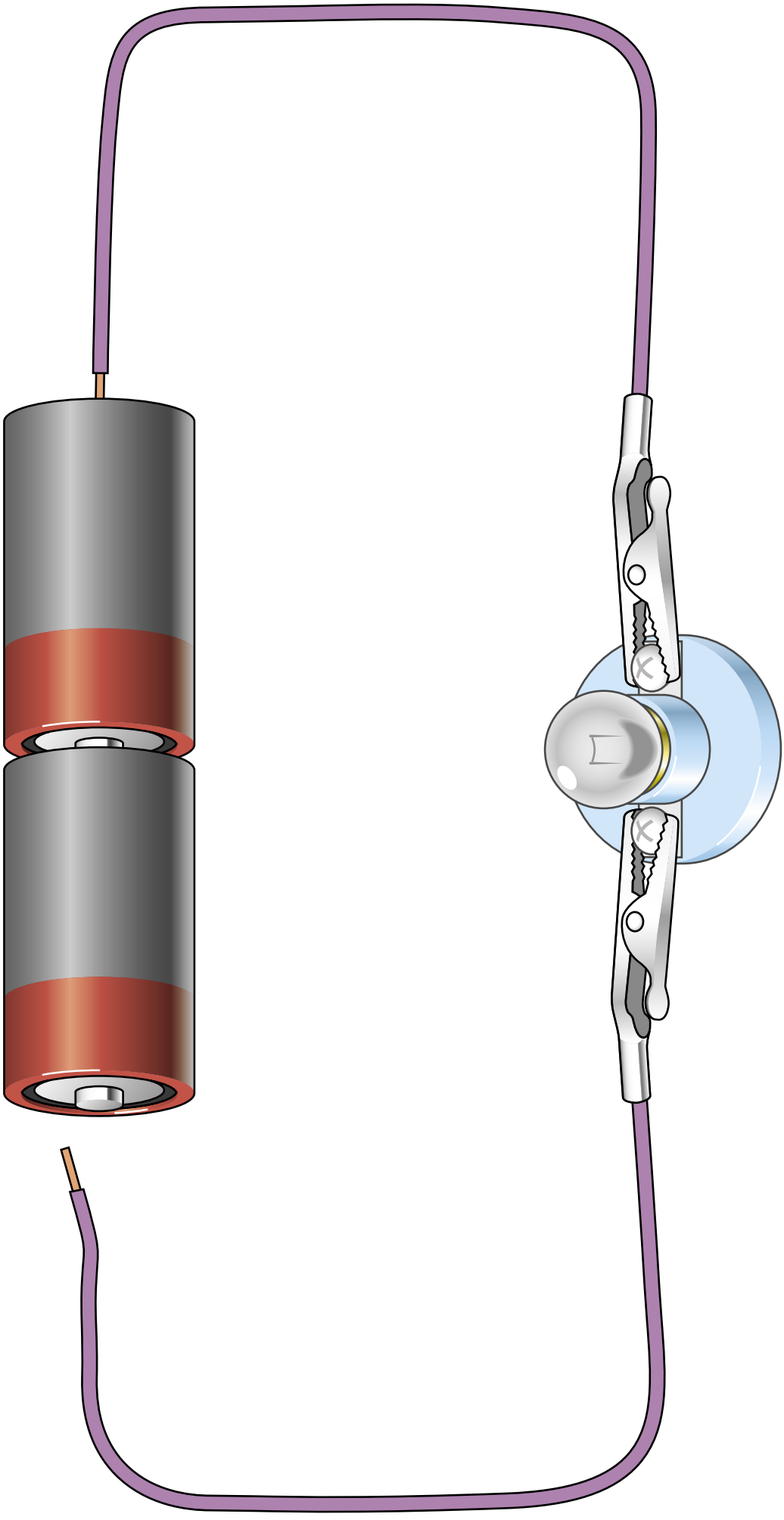
Plenary

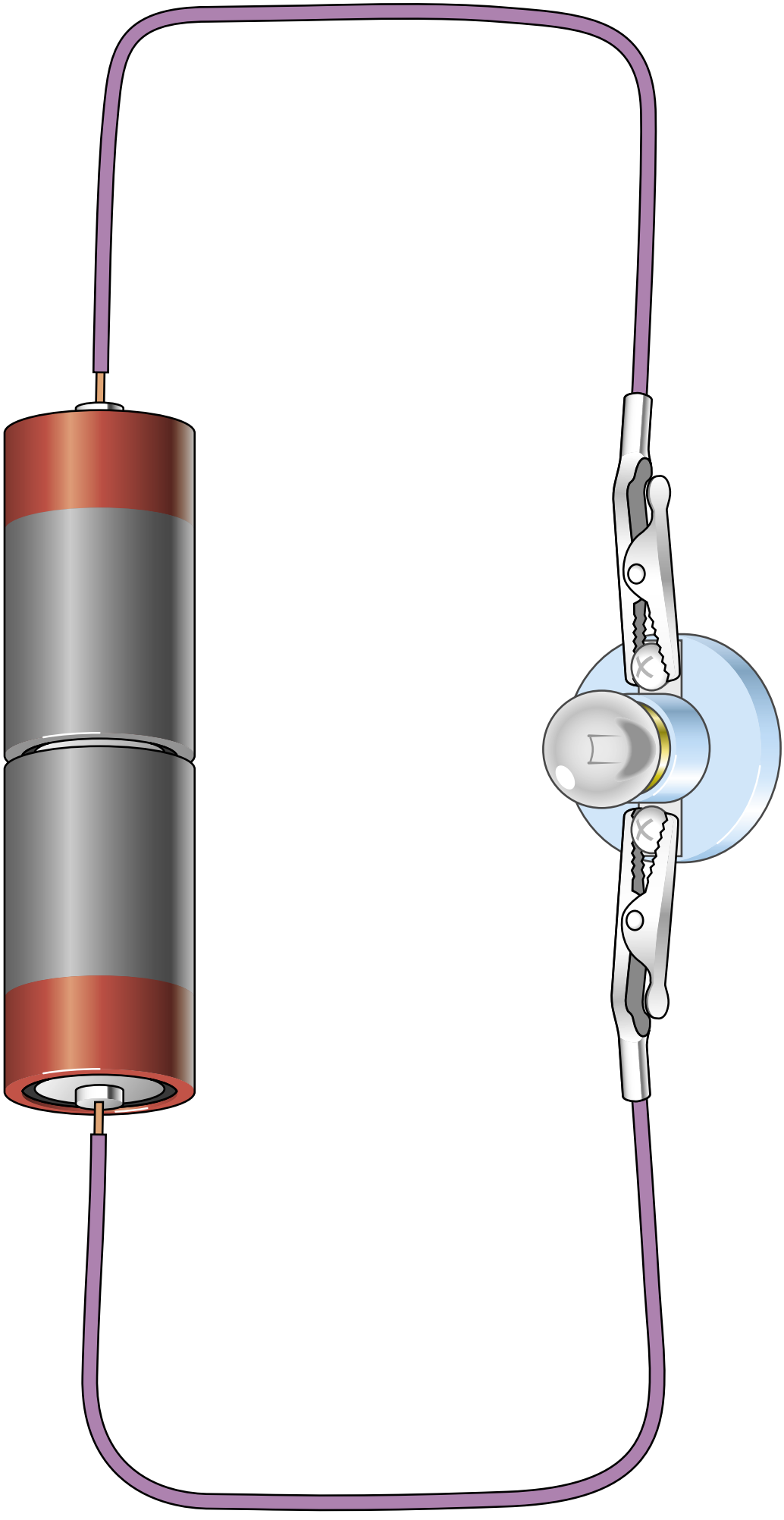
Ask the children how the flow of electricity to the lights is controlled in the classroom and look for an answer about switches. Show the children a switch and demonstrate how it can be placed in a circuit and used to turn the bulb on and off. Issue the switches and wires and let the children put the switch in their circuit and try it. Remind them of how they used the pictures on page 21 to make circuits and ask them to draw a picture of their circuit. Let the children display their drawings, swap them and try to make circuits from them.

Outcomes

The children:

- Know about the reasons why a circuit might not work.
- Can construct a circuit from a picture.
- Can make a new circuit and draw a picture of it.





Assessment

Name: .....

Do we need electricity?

Which of these items need electricity to make them work. Tick the boxes.

television	☐	comb	☐
skateboard	☐	rollerblades	☐
pencil	☐	torch	☐
mobile phone	☐	radio	☐
spoon	☐	spade	☐
vacuum cleaner	☐	washing machine	☐

Write down three other items that need electricity to make them work.

1. .....

2. .....

3. .....

Write down three other items that do not need electricity to make them work.

1. .....

2. .....

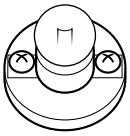
3. .....

Assessment

Name: .....

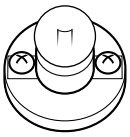
Making a circuit work

1.



Draw in the wires to make a circuit.

2.



Draw in a second battery and wires to make a circuit.

3. **Where does the electricity go as it goes round circuit 1?**

4. **Where does electricity go as it goes round circuit 2?**

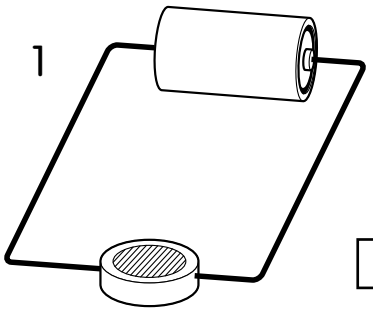
Assessment

Name: .....

Making a circuit work

1. Tick the boxes of the circuits which make the buzzer or the motor work.

1



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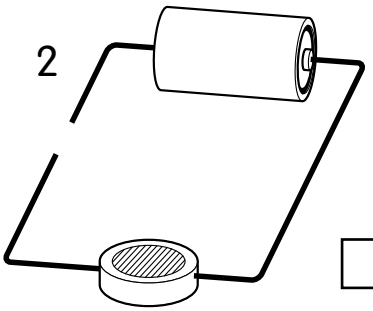

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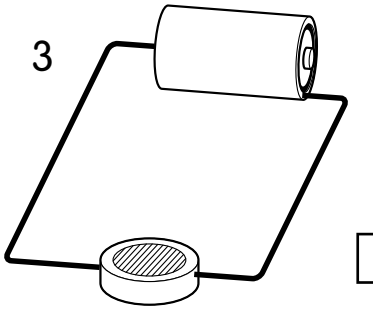

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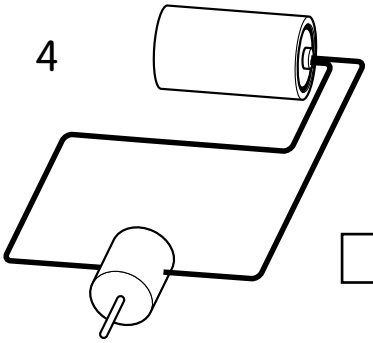

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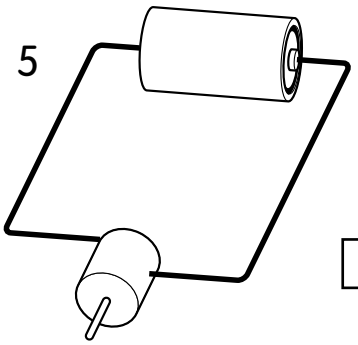

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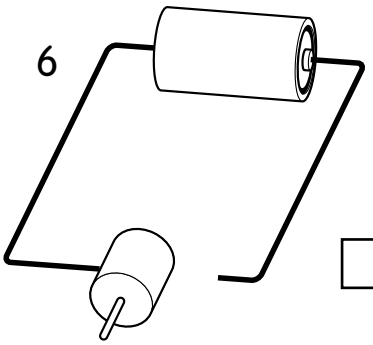

2. Where the circuits do not work, put a cross on the thing that is wrong.