Year 4 Science Spring 2 Plan - Electricity

Unit Rationale

This unit builds on children's learning and enquiry from Nursery. It allows children to apply their knowledge of their sense of electricity and to develop a deeper understanding of how objects run on electricity.
The children will learn about power sources and which appliances use different power sources. They will learn how to construct a simple circuit and name some of the components needed.

Common misconceptions:

Some children may think:

- electricity flows to bulbs, not through them
- electricity flows out of both ends of a battery
- electricity works by simply coming out of one end of a battery into the component.

National Curriculum Objectives

- Identify common appliances that run on electricity.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.
- Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.
- Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.
- Recognise some common conductors and insulators, and associate metals with being good conductors.

Cross Curricular Links:

PSHE - Climate change - Use of sustainable energy.
Geography - Climate change - How can we be greener?

Disciplinary Knowledge: Working Scientifically

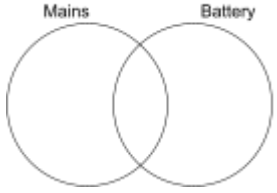
• **Methods used to answer questions** (use of models, classification, correlations and patterns, experimentation, fair testing)
• **Using apparatus and techniques** (accurate measurement, collecting and recording data, carrying out procedures safely and accurately)
• **Data analysis** (processing and presenting data, exploring relationships, communicating results in tables / graphs, identifying correlations)
• **Using evidence to develop explanations** (using evidence / scientific knowledge to draw conclusions, explain laws, models, concepts and findings)

Substantive knowledge:

- Able to group devices by their power source.
- Know how to complete a circuit and name some of the components needed.
- Identify whether a simple circuit is complete or not.
- Know that a switch breaks a circuit
- Explain how a switch works in a circuit.
- Know that some materials conduct electricity and can name some examples.

Trips and Visits	Modern Day Links: STEM
	Climate change - Greener leaving - https://teacher.lyfta.com/search/articles/preview/602
Prior learning:	**What next?**
• Explore how things work. (Nursery - Electricity) Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes. (Early Learning Goal)	• Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. (Y6 - Electricity) • Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. (Y6 - Electricity) • Use recognised symbols when representing a simple circuit in a diagram. (Y6 - Electricity)

Lesson	WALT	What should the children remember?	Lesson plan and outcome	Key Vocabulary	Key Questions
Lesson 1	**WALT:** classify devices according to their power source. Type of enquiry Classification Working scientifically Observing,sorting Using scientific vocabulary **Resources:** Pictures of devices - different energy source OR selection of devices for them to sort if you have enough. Wind-up torch, solar powered calculator, other solar-powered	Children can identify devices with different power sources Children can explain simply how electricity is made. Children sort devices according to whether they are mains, battery or rechargeable	**Organisation** For this lesson get the children to work in small groups. Each group will need pictures or objects that connect to the mains or are battery powered. They will need a mixed group of objects. They will also need sorting hoops or to be able to draw hoops. **Retrieval** (SLIDES 3 & 4) **Introduction** Explain to the children that today we are going to be looking at where power comes from. (SLIDE 5) Start a class discussion. Based on the question and image below. (SLIDE 6) Get the chn to think about What was it difficult to do without electricity? Which devices in your house wouldn't work? Which would work? How did you manage? What did you use instead to see or keep warm? Chn to feedback their ideas.  Teach the word and definition of electricity. MTYT, repetition, actions etc. (SLIDE 7)	**Key vocabulary:** electricity, battery, power, mains,	**WHAT MAKES IT WORK?** Assessment opportunities Assess children's prior knowledge using the diagram - record their second version that shows new learning. Can they sort according to power source? Record initial sorting and then sorting by power source or as with the GD the effect of electricity. What was it difficult to do without electricity?

	item (e.g. a light or a toy), sticky notes		(SLIDE 8) Cold task: Where does our electricity come from? Ask children to draw a diagram in their books to explain where they think electricity comes from, encourage the children to add labels to their diagram. Watch video about how electricity is made. This is a 10 minute video. Pause at key points in the video to ask questions and discuss. https://www.bbc.co.uk/teach/class-clips-video/primary-science-how-is-electricity-made/zfhfgwx (SLIDE 9) Return to the cold task diagram - can the children provide a more scientific response to which one they think is the odd one out? (SLIDE 9) They should write this in a different colour pen. Teach the words and definitions of power source, battery and mains. MTYT, repetition, actions etc. (SLIDE 10) **Main Part (**SLIDES 11-12) Provide children with object cards (RESOURCES) and get them to put into the Venn Diagram (Image is below). Get the children to think about: What differences are there between them? What criteria could we use to sort them? Which ones use electricity? Which ones need to be plugged in? Do they need to be plugged in all the time they are working? How are battery power and mains power different? Are there some rechargeable items?  		Which devices in your house wouldn't work? Which would work? How did you manage? What did you use instead to see or keep warm? Did it get worse the longer it went on? Was there anything good about it? Where does our electricity come from?

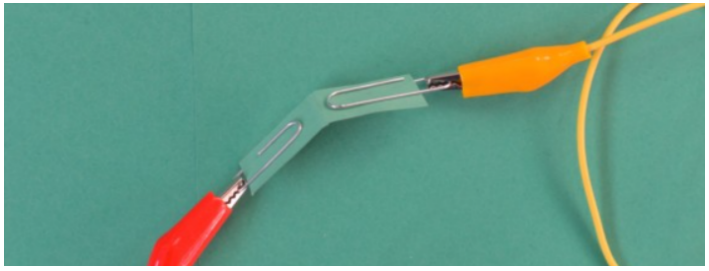
			Outcome Children can identify devices with different power sources Children can explain simply how electricity is made. Children sort devices according to whether they are mains, battery or rechargeable. **Quiz** (SLIDE 13) **Adaptation** All children should be able to identify some devices that use a power source and which Some children to focus on what is powered by electricity and sort objects into one hoop or children could have actual objects to sort. Some children could think about what happens to these devices when they are switched on and what effect electricity produces. Children discuss these ideas and add explanations to their venn diagram.		

Lesson 2	**WALT:** make a simple electrical circuit **Working scientifically links:** Recording findings using simple scientific language, drawings, labelled diagrams **Resources:** Enough cells (AA batteries), bulbs (1.5 volt), bulb holders, wires, buzzers and motors for children to work in pairs	Know the word components and give examples. That a circuit must be complete. identify circuits that will work and those that will not.	**Organisation** For this lesson children will be working in small groups. The children will need a set of 2 wires, one cell, one bulb, one bulb holder. **Retrieval** (SLIDES 2 & 3) **Introduction** Explain to the children that today we are going to be making an electrical circuit. Introduce the parts that they will have. Let the children experiment using the different components. Ensure that all of the children have been able to successfully light up the light. (SLIDE 5) Discuss with the children that in science, we call 'battery' a 'cell' and that a battery is when there is more than one cell. Teach the words and definition of component, current and circuit. MTYT, repetition, actions etc. (SLIDE 6) **Main Part** Demonstrate using children as a circuit. Children hold hands and pass the electricity around the circle Tell children that the bulb will only light if the electricity can go all the way round the circuit from one end of the cell, which supplies the power, through the wires which carry the electricity, through the bulb making it light up and back to the other end of the cell. The bulb will not light if there is a break in the circuit so the circuit is not complete. Explain that there are two ends to a cell (The + and -). One wire needs to be connected to each end. This is because each part of the circuit has a different job. The battery provides the power, the wires allow the electricity to pass through and the bulb lights up (SLIDE 7) what labels can you add to the drawing? (SLIDE 8) Depending on resources, get the chn to make a buzzer work or to make a motor work.Some buzzers need to be connected with the	**Key vocabulary:** cell wire bulb circuit component	**CAN YOU LIGHT THE BULB?** Assessment opportunities Use of cold task to elicit prior learning and misconception. Assess - can children make a circuit and name the components? Others will go further and explore different ways of adding in components and the effect this might have on the circuit. What is the least amount of components to make the bulb light? Do you know any other uses of the word circuit? What does it mean?

			current flow in a specific direction; they will not work if connected the wrong way round. Get the children to write underneath their diagram of what they needed to add or change when adding a motor or buzzer to their circuit. (SLIDE 9) Children to add a sentence about what they needed to add or change when adding the buzzer or motor to the circuit. (SLIDE 10) **Outcome** Children will know the components of a circuit. Children should know that if the circuit is not complete the circuit will not work. **Quiz** (Slides 11 & 12) **Adaptation** Some children could find different ways to make a bulb work. Children will connect a bulb without a bulb holder identifying where on the bulb the wires must contact. After connecting the bulb children will apply their understanding of a complete circuit to make a circuit using only one wire, a bulb and a cell. Some children could use visuals to help identify different components of a circuit.		
Lesson 3	**WALT:** investigate whether a circuit is complete or not	• Identify whether a simple circuit is complete or no	**Organisation** For this lesson children will be using the circuit materials in small groups. They will investigate complete and incomplete circuits **Retrieval** Match definitions to vocabulary taught so far. (SLIDES 2 & 3) **Introduction** Tell the children that today we are going to investigate whether circuits are complete or not. Remind them of the circuit they made	**Key vocabulary:** circuit	Assessment opportunities Can the children identify which circuits are complete and which are not?

			last week. What components did they use? How did they put them together? Why did the lightbulb light up. **Main Part** Show the children the pictures of the different complete and incomplete circuits. Ask them to predict if their will or will not light the bulb. Children make the circuits and then explain why they did or didn't light up. Use an enlarged version of the children's independent task to model how to complete the table. challenge question - if incomplete, what would you do to complete the circuit? You may not need to go through all the examples with the class. (SLIDES 6-10) **Outcome** Children complete the activity sheet. They predict if the bulb will or will not light up. They make the circuit. They explain what happened and why. (SLIDE 11) **Quiz** (SLIDES 12-13) **Adaptation** support - use widgets and adult support challenge - children describe what they would change to complete the circuit.		Can they say how to complete an incomplete circuit?
Lesson 4	**WALT:** add a switch into a circuit and explain how it works **Working scientifically links:** Recording findings using simple scientific	Know that a switch breaks the circuit. It controls the flow of electricity. They can explain how a switch works.	**Organisation** Children to work in small groups to add a switch to a circuit. Chn to use different materials to make a switch to add to their circuit and see if it works. Children to then explain why or why it doesn't work within their circuit. **Retrieval** (SLIDES 2 & 3) **Introduction**	**Key vocabulary:** break, open closed flow, switch	**WHAT DOES A SWITCH DO?**

	language, drawings, labelled diagrams. **<u>Resources:</u>** Enough cells, wires, bulbs and commercially available switches for paired work (at least one toggle switch needed for demonstration, ideally more), examples of handmade toggle and press (push to make) switches, materials for making switches (as listed on the resource sheets), scissors, wire cutters and strippers, hole punches or card drills and safety mats, rulers		Explain to the children that today we are going to be looking at switches. Get the children to think about : Why do we use switches? Children to write their ideas into their books. (SLIDE 5) Children can use the sentence stem to write their ideas. Use these questions to help generate ideas: What does a light switch do? How does it make the light go on and off? What is it doing to the circuit? https://www.nagwa.com/en/videos/727170573486/ (SLIDE 6) Watch the video that explains how a switch is used in the circuit. **Main Part** Children to work in small groups and have cells, wires, bulbs and commercially available switches. Children to work together. Tell them to make a circuit where the bulb can be switched on and off. Establish that the switch turns the light on and off by controlling the flow of electricity. Teach the word and definition of break. MTYT, repetition, actions etc. (SLIDE 7) Get the children to make a circuit where the light bulb can be switched on and off. (SLIDE 8) Children to explore what happens when they place the switch differently within the circuit. Can they still light the bulb? Does it always work? Why? (SLIDE 9)		

			Children to then have a go at making their own switch. See if they can get it to work within their circuit. (SLIDE 9)  Children make an annotated drawing of a switch in a circuit. Describe what it does and how it works. (SLIDES 10 & 11) Sentence stems to help with writing their ideas. **Outcome** Children make an annotated drawing of a switch in a circuit. Describe what it does and how it works. **Quiz** (SLIDES 12 & 13) **Adaptation** Some children could make their own switch and explain the type and how it works. Some children could use a switch in a circuit and know it makes or breaks the circuit. With help either from an adult or another pupil or they make a circuit with a switch.		
Lesson 5	**WALT:** sort materials into insulators and conductors. **Working scientifically links:** Using results to draw simple conclusions, make predictions	Know the terms electrical insulator and conductor. Name a good conductor and a good insulator GD explain why	**Organisation** For this lesson children will work in small groups to sort the materials into conductors and insulators. Children will think about what these words mean. Children will need circuit equipment in small groups and some insulator and conductor materials. **Retrieval** (SLIDES 2 & 3) **Introduction**	**Key vocabulary:** conductor insulator materials	**WHAT TYPES OF MATERIAL CONDUCT ELECTRICITY?**

	Type of Enquiry: Classification Research using secondary sources. **<u>Resources:</u>** A range of different materials including graphite (a pencil sharpened at both ends, but make sure it is graphite), labelled metal samples; other possibilities are rock, organic material such as a leaf, cork, ceramic.	metal is a good conductor of electricity through particle theory..	Teach the word and definition of conductor and insulator. MTYT, repetition, actions etc. (SLIDE 5) Introduce the children to the question. (SLIDE 6)  **Oracy-** Children to discuss in pairs what would happen. Some questions to help guide their discussions. What different metals are there? How do we keep safe from electricity in our everyday lives? (SLIDE 7) **Main Part** Explain to the children that today we are going to be testing different materials to find out which ones are best at conducting electricity in our circuits. (SLIDE 8) Show them a selection of objects (some must be conductors, some insulators) e.g. tin foil, magnets, paper clip, brass pins, copper wire, aluminium drink cans, (include a picture of a gold ring/necklace if you have one and are prepared to test it in front of the children.) nails, coins, pencil lead, plastic ruler, lolly stick, elastic band, water and salt water.. Ask them to sort them into two groups: those that conduct electricity and those that don't as a prediction.		

			Get the children to feedback what they think and any explanations they may have. (SLIDE 9) Explain that they are now going to test the different materials. (SLIDE 10) Recap with them a fair test and what they are going to keep the same and what they are going to change. (SLIDES 11 & 12) Children to test the different materials. Children record their findings on a table (Format provided teachers will need to add exactly which resources they have and are using) . Link the fact that the light turning on means it is a conductor and those that don't are insulators. (SLIDE 13) Discuss the results. Children to write what they have found out. What do they notice is the same about all of the conductors? Are they all the same? Do all metals conduct electricity? (SLIDE 14) Get the children to think about metals and how they might look under a powerful microscope. The particles (Atoms) are all lined up. This allows the electricity to flow through. (Electrons actually flow freely from one atom to another.) (SLIDE 15) **Outcome** Children complete table to show which materials are conductors and which are not. Children write up conclusion **Quiz** (SLIDES 17 & 18) **Adaptation** Some children could go on to explain why metals are good conductors and name a range of metals. They could also research why salt water is a conductor.		

			Some children could sort practical materials into insulators and conductors.		