**Science Autumn 2 Year 6 (LTP)** **Long Ago and Faraway**

| Domains |
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| ***Electricity*** |

| Electricity | |
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| **Prior Learning** | **Future Learning**<br>Children do not need to be taught this year |
| Year 4<br>• Identify common appliances that run on electricity.<br>• Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.<br>• 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.<br>• Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.<br>• Recognise some common conductors and insulators, and associate metals with being good conductors.<br>• Safety when using electricity. | KS3<br>• Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge<br>• Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current.<br>• Differences in resistance between conducting and insulating components (quantitative).<br>• Static electricity.<br>• Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects<br>• The idea of electric field, forces acting across the space between objects not in contact. |
| **In Year 6 NC Objectives** | |
| - associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit<br>- 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<br>- use recognised symbols when representing a simple circuit in a diagram. | |
| **Key Learning** | **Possible Evidence of Secure**<br>(Shows understanding of a concept using scientific vocabulary correctly) |
| • Adding more cells to a complete circuit will make a bulb brighter, a motor spin faster or a buzzer make a louder sound. If you use a battery with a higher voltage, the same thing happens. Adding more bulbs to a circuit will make each bulb less bright. Using more | • Can make electric circuits and demonstrate how variation in the working of particular components, such as the brightness of bulbs, can be changed by increasing or decreasing the number of cells or using cells of different voltages. |

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| motors or buzzers, each motor will spin more slowly and each buzzer will be quieter.<br>• Turning a switch off (open) breaks a circuit so the circuit is not complete and electricity cannot flow. Any bulbs, motors or buzzers will then turn off as well.<br>• You can use recognised circuit symbols to draw simple circuit diagrams. | • Can draw circuit diagrams of a range of simple series circuits using recognised symbols |

| **Common Misconceptions** | **Vocabulary** |
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| Some children may think:<br>• larger-sized batteries make bulbs brighter<br>• a complete circuit uses up electricity<br>• components in a circuit that are closer to the battery get more electricity. | **Circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, wire, bulb, buzzer, motor, switch, voltage, current, resistance, component,**<br><br>WS Vocabulary:<br>describe, group, record, evidence, data, patterns, diagram, chart, map, gather, record, classify, present, systematic, accurate measurements, quantitative measurements |

| **Sticky Knowledge** | **Key Questions** |
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| • Batteries are a store of energy. This energy pushes electricity round the circuit. When the battery's energy is gone it stops pushing. Voltage measures the 'push.'<br>• The greater the current flowing through a device the harder it works.<br>• Current is how much electricity is flowing round a circuit.<br>• When current flows through wires heat is released. The greater the current, the more heat is released. | - Do all batteries push as hard as each other?<br>- What is electricity?<br>- How does the voltage of a battery affect how much current is pushed?<br>- How does the length of time I leave the current flowing for affect the brightness of the bulb?<br>- How does number of bulbs affect the brightness of a bulb?<br>- Are all types of wires as good as conducting electricity?<br>- Why are wires insulated in plastic? Does type of material make a difference?<br>- Does length of wire make a difference?<br>- Does the type of circuit affect how the components work/long the battery lasts?<br>- What renewable ways can we generate electricity?<br>- How does current affect heat?<br>- What are the dangers of a short circuit? |

**Pre-Topic Assessment Resources**

**Explorify** – filter for y5-6 Electricity - *Odd one Out, What's Going on?*
**Explore, Engage, Extend** (EEE) by PSTT:
– Copy of activity instructions
-Cards downloaded from website https://www.pstt.org.uk/eee-resources
-Copy of Challenging Misconceptions
-Children's Questions

| **Working Scientifically**<br>(Apply knowledge in familiar related contexts, including a range of enquiries) | **Possible Evidence of Secure** |
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| 1. Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary<br>2. Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate<br>3. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs<br>4. Using test results to make predictions to set up further comparative and fair tests<br>5. Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations<br>6. Identifying scientific evidence that has been used to support or refute ideas or arguments.<br>Highlighted yellow = main focus during this topic | • Can incorporate a switch into a circuit to turn it on and off<br>• Can change cells and components in a circuit to achieve a specific effect<br>• Can communicate structures of circuits using circuit diagrams with recognised symbols<br>• Can devise ways to measure brightness of bulbs, speed of motors, volume of a buzzer during a fair test<br>• Can predict results and answer questions by drawing on evidence gathered |
| **Pupils could work scientifically by:**<br>• Explain how a circuit operates to achieve particular operations, such as to control the light from a torch with different brightnesses or make a motor go faster or slower.<br>• Make circuits to solve particular problems, such as a quiet and a loud burglar alarm.<br>• Carry out fair tests exploring changes in circuits.<br>• Make circuits that can be controlled as part of a DT project. | |

| **Fair/Comparative testing-** | **Identify & Classify** | **Observation over time** | **Pattern Seeking** | **Research** |
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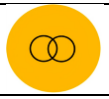
|  |  |  |  |  |
| Which make of battery lasts the longest?<br>Which type of fruit makes the best fruity battery? | How would you group electrical components and appliances based on what electricity makes them do? | Does the temperature of a light bulb go up the longer it is on? | Does the temperature of a light bulb go up the longer it is on? | How has our understanding of electricity changed over time? |

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| How does the voltage of the batteries in a circuit affect the brightness of the lamp?<br>How does the voltage of the batteries in a circuit affect the volume of the buzzer? | | | | What renewable ways are there to make electricity? |

**Big Question**
Can we vary the effects of electricity?

| **Assessments** | **Key Scientists** |
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| **<u>TAPS</u>**<br>Conductive dough<br>Bulb brightness<br>**<u>Concept Cartoons</u>**<br>Twisted wires | **SOTSOG**<br>Michael Faraday - created a method to generate electricity.<br>Alessandro Volta - electrical battery<br>Nicola Tesla - alternating currents<br>Edith Clark – electrical engineer<br>Hertha Ayrton – electric arc for improved lights |

| **Linked Texts** | **Science Capital** | **Maths** |
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| Horrible Science: Shocking Electricity – Nick Arnold<br><br>Women in Science – 50 Fearless Pioneers Who Changed the World – Rachel Ignotofsky<br>• Hertha Ayrton (page 21)<br>• Edith Clark (page 41) | Lesson linked to the school and making a recommendation to the head regarding electricity use and ways of being more sustainable<br><br>Links to electricity all around them in everyday items – make these links clear<br><br>Early on in teaching, discuss whether anyone's families work with electricity e.g. electrician. Ask children what they know about how electricity impacts their lives. | Measurements, adding (voltages), drawing tables, drawing graphs |

**Planning Resources**

PSTT
ASE
Standing on the shoulders of giants SOTSOG (PSTT)
Hamilton Trust

Ogden Trust
Explorify

| Session 1 - WALT: investigate components and their functions within a circuit | |
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| Retrieval activity | 1) States of matter quiz (Y4)<br>2) Electricity year 4 vocab game |
| Lesson | Possible safety talk first?<br>Give chn resources to build a circuit and let them investigate for 5 minutes to see what they can make (assessment opportunity - teacher to ask lots of questions and listen to conversation)<br>Once most chn have created a working circuit, introduce vocab for what they've used so far: wire, bulb, battery/cell, circuit voltage, current, etc.<br>Then display some 'can you statements' and get chn to investigate. Go round and ask chn what investigation type they're using<br>- Can you make the bulb brighter? (add battery)<br>- Can you find a different way to make the bulb brighter? (high voltage battery)<br>- Can you make the bulb dimmer? (lower voltage battery or adding more bulbs)<br>- Can you find a way to turn the light off? (remove battery)<br>- Can you find a different way to turn the light off? (switch)<br><br>Then, use these results to predict what would happen to a buzzer and motor if batteries/voltage was changed. |
| Key vocabulary | Component, battery, cell, wire, bulb, motor, buzzer |
| Differentiation | Chn to work in mixed ability pairs<br><br>Widgit vocab mat supplied to support SEN/EAL with language |
| Assessment | Initial assessment of prior learning - can chn independently set up circuit and name components<br><br>Assessing working scientifically skill 'use test results to make predictions' - can they apply knowledge and skills from today to a buzzer or motor? |

| Session 2 - WALT: interpret circuit symbols and diagrams | |
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| Retrieval activity | 1) Cops and robbers retrieval game for space topic (Y5)<br>2) Challenge grid (to do after this lesson) |
| Lesson | Start with a vocab game to go over last lesson's key words.<br><br>Demonstrate how circuits work using human circuit stick – really focus on what happens if the circuit is broken and what a complete circuit looks like. Set up both a simple and parallel circuit. |

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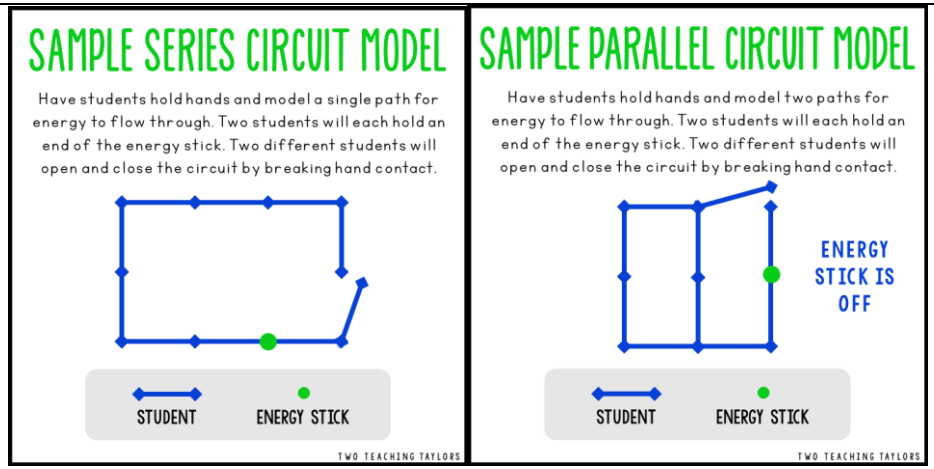
| |  <br><br>Then give chn, in pairs, a match up activity to do with key words, definitions and circuit symbols. See if they know any already or can work out what each might be. Go through answers and show examples of circuit diagrams. Can chn identify the different parts?<br>Chn to then use circuit diagrams, make predictions on whether each will make the bulb light up first. If they don't think it will light up, they need to write why. Then they can test them by using the circuit diagram to build the circuits and see if their prediction was correct. |
| Key vocabulary | Circuit, circuit symbol, circuit diagram, bulb, battery, cell, wire, motor, buzzer, complete circuit, incomplete circuit, switch, open, closed |
| Differentiation | Extension – parallel circuits diagrams to look at. Can chn identify which bulbs will light and explain why some will and some won't based on their understanding of complete circuits<br>Symbols on working wall to support<br>Chn working in mixed ability groupings<br>Widgit vocab mats to support language<br>Adults to scribe what chn say for any individuals who would benefit |
| Assessment | Formative assessment – teacher discussion and observations + challenge quiz after lesson<br>• Can chn recognise and name circuit symbols?<br>• Do chn understand what a complete circuit is – can they identify these? Can they explain why a bulb won't light in some incomplete circuits? |

| Session 3 - WALT: plan and carry out an investigation | |
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| Retrieval activity | 1) Digestive system match up and definition (Y4)<br>2) 5 words, 5 grand style vocab game (send 1 kid out, give another kid 5 words linked to a topic, they say a word associated. Bring the second kid in, if they match, they get a dojo). |

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| Lesson | Introduce the chn to the definitions of current and voltage using Widget word mat to support visually. Current is the amount of electricity flowing through the circuit (basically a flow of electrons moving in a loop in the circuit). Voltage is the difference in electrical energy between two parts of a circuit. Voltage is the pressure from an electrical circuit's power source that pushes charged electrons (current).<br>Give chn a variety of cells and batteries and see if they can locate where the voltage is on it. Then ask them to calculate the voltage if we put multiple cells together. As a quick retrieval, ask the kids what will happen to the bulb if the voltage is increased?<br>Finally discuss how different components (e.g. light bulbs) will have a voltage listed on them and ask what they think might happen if a battery with a voltage that is too high it used to power a light bulb? (the bulb will blow as the filament will get too hot).<br><br>Discuss resistance (the opposition to current flow in an electrical circuit) and demonstrate this by pushing a toy car or something through an empty tray and then a tray with sand. The electrical resistance of an electrical conductor is a measure of the difficulty of passing an electric current through a substance. Explain that everything we connect to a circuit will have resistance, even wires that conduct electricity will offer some resistance (although it will be low).<br><br>Explain to chn that we are going to do an investigation looking at what happens when we increase the number of components and thus the resistance of a circuit. Ask what type of enquiry this would be and show chn the symbol to reinforce. Since it is a fair test, ask what our dependent variables (brightness of bulbs) and independent variable (number of bulbs) would be and what we need to keep the same (distance of data logger from bulb, voltage of cells, number of cells, etc.) Plan and discuss the fair test as a class (post it planning could be used).<br>Chn to set up a simple circuit to ensure all their equipment is working. Draw this as a circuit diagram in their books. They should then use a data logger or data logger on the ipad to measure the brightness of the bulb and record this next to their circuit diagram. Then begin to systematically add more bulbs, drawing the circuit diagram each time and recording the measurements. |
| Key vocabulary | Circuit, battery, cell, voltage, resistance, current, bulb, wire, fair test, variables, measure, circuit diagram, circuit symbol |
| Differentiation | Extension: ask chn to use their results from this investigation to ask another question and work out how they would test it and then attempt to carry it out<br><br>Support: working wall and vocab mats to support chn with drawing circuits and using the correct language. Some learners don't need to draw the circuit diagram every time and may be better to draw just one and then focus on result collection. |
| Assessment | Planned assessment – working scientifically skills – assessing WS skills 1 + 3 + 4 |

| Session 4 - Exploration – series and parallel circuits | |
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| Retrieval activity | 3) Digestive system match up and definition (Y4)<br>4) 5 words, 5 grand style vocab game (send 1 kid out, give another kid 5 words linked to a topic, they say a word associated. Bring the second kid in, if they match, they get a dojo). |

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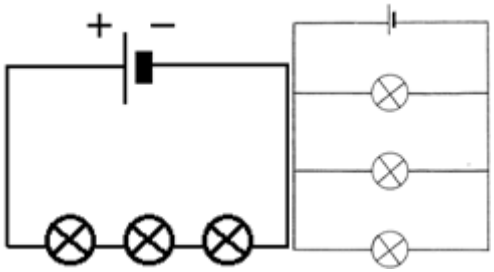
| Lesson | Starter: read page 20-21 of Women in Science – 50 Fearless Pioneers Who Changed the World and discuss.<br><br>Show chn a diagram of a series and a parallel circuit and introduce these two terms to them. Without giving any details away, explain that they will be creating both of these circuits and looking to see what happens if a bulb is removed from each one.<br><br>Send round a piece of sugar paper with a series and parallel circuit draw and ask chn in pairs/groups to write down their predictions. Then get them to build these circuits and test what happens. Chn to then record on sugar paper what they noticed. Put this sugar paper on the working wall at the end of the lesson.<br><br>  |
| Key vocabulary | Circuit, series, parallel, complete, incomplete, current, flow, bulb |
| Differentiation | To be completed as a class with lots of discussion – words mats to support vocab use and adults to facilitate conversation and target questions |
| Assessment | Teacher to read the predictions and discuss the thinking behind each prediction with the chn. Teacher to also assess the results writing and verbally feedback to class about misconceptions.<br><br>Green sticker in a day following the lesson to assess chn's understanding of what they saw: 'Would it be better to have the lights on a Christmas tree in series or parallel? Why?' |

| Session 6 - WALT: plan and carry out an investigation | |
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| Retrieval activity | 1) Parts of flowering plant (Y5)<br>2) Concept cartoon space (Y5) |
| Lesson | Which fruit makes the best battery investigation? Present this question to the chn and get a discussion going on how they would investigate this. Which investigation type would we use? (fair test) What resources would we need? How would we carry out the investigation?<br><br>https://www.livescience.com/62570-potato-battery-conduct-electricity.html + https://www.upsbatterycenter.com/blog/making-fruit-batteries-which-one-works-best/ - has the science background. Chn don't need to know all the background as this lesson is more a working |

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| | scientifically lesson and planning and carrying out an investigation but this is there in case the kids are curious. Citrus fruits should be good because of the citric acid as well as potatoes because they contain phosphoric acid.<br><u>Resources:</u><br>• 2 room temp fruits per group (lemons, potato, oranges, limes, apple, carrot, etc.)<br>• Paper towels<br>• 1 penny (pre-1982 if possible) or 4" length of copper wire<br>• 1 galvanized nail or 3" zinc strip<br>• Voltmeter or data logger<br>• Alligator wires<br>• Bulb<br><br>Whole class investigation – take pictures, record as class and pupil voice recorded for conclusions |
| Key vocabulary | Battery, cell, voltage, volts, data logger, wire, bulb, acidic, conductivity |
| Differentiation | Splat map given to support vocab<br>Mixed ability groups |
| Assessment | Odd one out and concept cartoon retrieval activities<br>Working scientifically skills |

| Session 7 - WALT: research using secondary source<br>WALT: evaluate different sources of energy | |
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| Retrieval activity | 1) Insect life cycles (Y5)<br>2) Retrieval grid – this week, last week, last term, last year |
| Lesson | Renewable energy research lesson. Discuss the issues with using electricity and how we can reduce the amount we use e.g. turning things off that we're not using and why this is important. Suggest Mrs Harrison wants to look at ways the school could do better and wants Y6 to investigate and recommend a renewable source to use.<br><br>Tell chn we are going to look into renewable ways to make electricity and they are going to be researching in groups to present back to the class (could make a poster?) They need to include what the renewable source is, how it makes electricity, what it's pros and cons are, etc.<br><br>Possibly done in the next lesson, chn to present (film these) and then, after the presentations, chn to evaluate which renewable energy source would be best for the school to invest in and which would be worst and why.<br><br>Provide print outs, books and possibly one laptop per group. Adults to move around the room using questions to get chn thinking e.g.<br>• Is this a type of renewable energy the school would be able to put into place?<br>• What would the neighbours think of it?<br>• What is its biggest drawback? |

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| | • What is its biggest strength?<br><br>Solar, wind, hydro, tidal, biomass, geothermal |
| Key vocabulary | Renewable, non-renewable, electricity, solar, wind, hydroelectric, tidal, biomass, geothermal |
| Differentiation | Mixed ability groups set up by teacher – each child could take on a different role e.g. scribe, presenter, reader, etc. to play to their strengths and make sure all can engage<br><br>For evaluation, some chn to use clicker to type, others to have adults scribe ideas, some to try videoing their thoughts<br><br>Extension – chn to begin thinking about |
| Assessment | Odd one out activity and reasoning for it<br>Assessment of reasoning chn put into books |