	Science	Year 4
	Term 2	Topic Title: Electricity

Key Question: What is electricity and how can we use it?

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.

Vocabulary: Electricity, electrical appliance/device, mains, plug, electrical circuit, complete circuit, component, cell, battery, positive, negative, connect/connections, loose connection, short circuit, crocodile clip, bulb, switch, buzzer, motor, conductor, insulator, metal, non-metal, symbol

N.B. Children in Year 4 do not need to use standard symbols for electrical components, as taught in Year 6.

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

Prior Learning:

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)

Common misconceptions:

- 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.

Knowledge: Many household devices and appliances run on electricity. Some plug in to the mains and others run on batteries. An electrical circuit consists of a cell or battery connected to a component using wires. If there is a break in the circuit, a loose connection or short circuit, the component won't work. A switch can be added to the circuit to turn a component on/ off. Metals are good conductors so they can be used as wires in a circuit. Non-metallic solids are insulators except for graphite (pencil lead). Water, if not completely pure, also conducts electricity.

Investigative skills

Fair/comparative testing	Identifying and classifying	Observations (over time)	Pattern seeking	Research
How does the thickness of a conducting material affect how bright the lamp is? How does the voltage of batteries in a circuit affect the brightness of a lamp? (Y6 Electricity) *Which metal is the best conductor of electricity?* Set up simple, practical enquiries, comparative and fair tests. Select and use a range of scientific equipment. Communicate findings both orally and in writing, using appropriate scientific vocabulary. Record data using scientific diagrams, tables and graphs.	*How would you group these electrical devices based on where the electricity comes from?* (Mains/solar/battery) How would you group electrical components and appliances based on what electricity makes them do? (Y6 Electrcity) Talk about criteria for grouping, sorting and classifying. Identify differences and similarities relating to scientific ideas and processes. Report and present findings in oral and written forms such as displays and scientific diagrams.	*What makes a successful circuit?* How does the brightness of a bulb change as the battery runs out? How can we measure how quickly a battery is used up? (Y6 Electricity) Make systematic and careful observations. Select from a range of practical resources to gather evidence to answer questions. Record findings using simple scientific language, labelled drawings/diagrams. Use results to draw simple conclusions, make predictions for new values, suggest improvements & raise further questions.	*Which room has the most electrical sockets in a house?* Does the temperature of a light bulb go up the longer it is on? (Y6 Electricity) Gather, record and present data in a variety of ways to help in answering questions.	*How has electricity changed the way we live?* How has our understanding of electricity changed over time? Research different ways of producing energy. (Y6 Electricity) Research Benjamin Franklin, Thomas Edison and Michael Faraday's contribution to our understanding of electricity. Research questions generated by chn themselves across the unit- plan different types of scientific enquiries to answer questions including recognising and controlling variables where necessary.

Significant Scientists: **Thomas Edison- (First Working Lightbulb)** **Benjamin Franklin- (Electricity research/lightning rod)** **Michael Faraday- (electromagnetism)**	**End point:** Can construct a range of circuits Can communicate structures of circuits using drawings that show how the components are connected Use classification evidence to identify that metals are good conductors and non-metals are insulators Can incorporate a switch into a circuit to turn it on and off Can connect a range of different switches identifying the parts that are insulators and conductors Can add a circuit with a switch to a DT project and can demonstrate how it works Can give reasons for choice of materials for making different parts of a switch Can describe how their switch works
Science stories: **Until I Met Dudley-** Roger McGough **Charging about: the story of electricity (Science Works)** Jacqui Bailey	
Cross Curricular Links: **English:** create mini poems to embed key vocabulary. Record findings in written explanations using scientific language. Write a fact file/biography about key scientists. **Maths:** construct and interpret data from tables, charts and graphs. **DT:** Select and use a range of materials according to their functionality. **ICT:** Use search engines to research scientific ideas or figures. Use Purple Mash to create biographies.	**Oracy:** • Mime it game and discussion • p101-109 Concept cartoons 10.1-10.9 discussion. • Vocabulary alphabet game
Wider Reading and resources	**Enrichment/ Science capital**
Jumpstart Science – Rosemary Feasey A creative approach to teaching Science- Nicky Waller STEM organisation	Relate electricity to items in their own homes and toys. Relate experiences to careers- electrician. Do they know anybody with this profession? (friends/family) Make a human circuit using circuit sticks. Explore static electricity in everyday situations.

Sequence of Learning		
Lesson	Key Question	Key learning/notes
1	What is electricity?	• Complete the pre-unit quick quiz and a KWL grid. What do children know and want to learn about electricity? Display wonders on a flipchart/"wonder wall." • What is electricity? Use the BBC bitesize link to explore the different types of electricity and introduce ideas about safety. • Learn that batteries and mains electricity are the most widely used sources of electricity. Can children sort given appliances into these two categories? How else could they be sorted?- encourage chn to work scientifically by creating their own criteria- note any misconceptions to be addressed. • Which rooms have the most electrical sockets in the house? Why? Which rooms do not have any or have a different type of socket? (e.g. bathrooms-shavers) • Enforce that electricity can be dangerous so care needs to be taken. • Use ppt in resource folder, Electro Mouse safety clip from www.bbc.co.uk or Interactive game identifying electrical safety issues from www.switchedonkids.org.uk to identify electricity hazards and dangers. • Create detailed information posters to highlight potential dangers of electrical appliances at home/school.
2	What is a circuit?	• Mime it! Ask chn to perform a mime which show them using an electrical appliance. Rest of the class try to identify the item. Listen out for misconceptions e.g. "it's not electrical because it runs on batteries." Facilitate the game so that discussions can take place about whether items run on mains, batteries or both in order to address misconceptions and explain that both are acceptable examples of electricity. • Teach the key components of an electrical circuit. Identify and name the basic parts and relate this to everyday examples of circuits in households, toys, equipment etc. (refer back to any that may have been discussed in the game)

		• Chn make a simple circuit with support and recognise when/why a circuit will not work. (This can be done creatively by using sweets before using real components.) • They understand that a circuit needs a source of power and a device that uses that power to make it work. • Children create a poem to revise and embed key vocabulary. Give them key nouns and ask them to add a word to describe what it does ending in "-ing" They must use a word that explains the function e.g. battery-charging, wires-conducting, filament- glowing, bulb-lighting, circuit-working. They may use more than one -ing word for each if they wish to show their full understanding of components.
3	What makes a successful circuit? Observations	• Explain that chn are going to train to become an electrician's apprentice now. Is anybody in their family/anybody they know an electrician? (Assign challenges and "sign off" skills as pupils achieve to work towards a certificate/qualification.) • **Challenge 1:** Empty an "electrician's toolbox" of various components: bulbs, batteries, buzzers, wires, motors, switches, holders etc Give children an equipment list and place real examples next to corresponding name. (Take photos for individual books or WS floor book) Offer second attempt to chn with errors. • **Challenge 2:** Use the components to independently build simple circuits. Give a checklist: Can you build a circuit to: light a bulb/buzz a buzzer/spin a motor. **Extension challenges:** Can you light a bulb without using a holder? What happens if you swap the wires over when connecting a buzzer in a circuit? What happens if you connect wires to the same end of a battery when lighting a bulb? Can you make a motor spin both clockwise and anticlockwise? What else can you find out? • Take photos or videos of successful circuit construction as each challenge is completed. Chn to draw pictures of their circuits, labelling the components required. (conventional circuit symbols not required until Y6). • Award 'certificates' or stickers for those who have completed their electrician training level 1. For those who haven't, offer certificates/stickers for effort and set a target telling them how to complete their training.
4	What affects the brightness of a bulb? **Investigation**	• Make a "human circuit" to recap how simple circuits work. (Give chn labels to be each component and challenge them to consider how they need to connect.) Ask "what happens to the bulb when all of the 'wires (hands)' in the circuit are connected? Give 'bulb' child something yellow to hold/yellow cap to show the lit-up bulb. Ask two children to let go. What will happen to the bulb now? Why? Remove yellow item from bulb. (**wow factor: use a circuit stick to demonstrate with**) • Children move on to level 2 of their electrician training by inspecting circuits. Can chn identify the reason these circuits do not work? Children to write/tick explanations of failed circuits next to images. Provide cloze procedure/word banks where needed. Check on chn who had misconceptions from lesson 3. Have they achieved their level 1 now they have had a chance to discuss and explore circuit images? • Introduce key question and set up an enquiry to find out how changing the number of components in a series circuit can make a bulb brighter or dimmer. (Use LKS2 investigation template to plan and record the investigation.) • Children to make predictions in groups and then individually in their books. They state how they will keep the test fair then decide how they would like to present their observation results through drawings and tables followed by the subheadings **I notice** and **I wonder** to make notes as they carry out investigation. • Swap the bulbs for motors or buzzers and make further enquiries. • Discuss findings and share wonders. Can we test out any of the wonders?
5.	How do cables and plugs help us to use electricity safely? Starter demo:  **Investigation:** Which material is the best conductor of electricity?	• **Wow factor:** Present children with a piece of foil, a single cell (battery) no holder and a bulb. Can they make a circuit with these materials? Do a vote to see who thinks yes/no. Post- it predictions- chn to write their initial thoughts on a post-it to add to class flipchart. (Place in WS floor book later with photo of start(Challenge chn to suggest how it will work. Chn have a go. Bulbs light. How/why? Note resposnes (TA scribe in WS floor book) • Relate the electrical conductivity of materials to their uses in wires and plugs. Show the inside of a plug or related video clips. • Chn carry out an enquiry to find out which materials are good electrical conductors and which are good electrical insulators. • Discuss outcomes. Where might these materials be used in everyday life? Chn should begin to understand that electrical dangers are increased with materials

		that are good conductors. Relate to real life health and safety e.g. electric shocks. Discuss purpose of plastic covering on wires & plug casings for protection (insulating materials.) Show Bitesize clip to reinforce vocab and examples. • Complete a conductors quiz to consolidate learning/key knowledge.
6	What is the purpose of a switch?	• Discover that switches are used to break an electrical circuit and that switches are used to stop and start an electrical appliance or to change how it works. • There are various forms of switches- show several examples and discuss reasons for their differences/similarities. Show Bitesize clip on using switches to create circuits and games. • Chn design, make and test their own switch and use it to control components in circuits they have made using it to control a buzzer, motor or bulb. • Once completed, chn should demonstrate their switch designs to each other. • Children can mount their switches on cardboards and photographs taken. • Show concept cartoon 10.6 *unusual switch*. Chn stick in books and explore/explain.
7	How has electricity changed the way we live?	• Study the phenomenon of static electricity and explain that one scientist in particular began to investigate this in relation to storms. • Discuss Benjamin Franklin, Thomas Edison and Michael Faraday's contribution to our understanding of electricity. • Children carry out research and write a fact file/biography about key scientists using Purple Mash or Microsoft Office software to present and publish. • Allow chn time outside of Science lessons to decorate/make fit for display.
8	What is electricity and how can we use it?	• Play the alphabet game (unit vocabulary warm up/revision.). e.g The S I am thinking about is used make/break an electrical circuit. (switch.) Also link to enquiry vocabulary e.g. The V I am thinking about are things you can change in an investigation. (variables.) This P is what we look for in data. (pattern.) • Children to complete the end of unit quiz. • Can they go back and answer any of their original wonders from the wonder wall? • Allow chn to play a game e.g. Operation, buzz wire games, or their own games that they have made e.g a circuit clown and award electrician apprentice certificates.