GOLDSBOROUGH SICKLINGHALL FEDERATION

INSPIRE NURTURE BELIEVE ACHIEVE

*Working **together** to be the **best** that we can be.*

Happiness | Perserverance | Resilience | Kindness | Friendship | Respect

Science: Electricity Progression of Skills and Milestones Document

Year 4
Electricity

- **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**

Notes:

Pupils should construct simple series circuits, trying different components, for example, bulbs, buzzers and motors, and including switches, and use their circuits to create simple devices. Pupils should draw the circuit as a pictorial representation, not necessarily using conventional circuit symbols at this stage; these will be introduced in year 6.

Note: pupils might use the terms current and voltage, but these should not be introduced or defined formally at this stage. Pupils should be taught about precautions for working safely with electricity.

Pupils might work scientifically by: observing patterns, for example, that bulbs get brighter if more cells are added, that metals tend to be conductors of electricity, and that some materials can and some cannot be used to connect across a gap in a circuit.

Key Vocabulary	Common Misconceptions
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 this is taught in Year 6	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.
Activities	**Possible Evidence**
• Construct a range of circuits. • Explore which materials can be used instead of wires to make a circuit. • Classify the materials that were suitable/not suitable for wires. • Explore how to connect a range of different switches and investigate how they function in different ways. • Choose switches to add to circuits to solve particular problems, such as a pressure switch for a burglar alarm. • Apply their knowledge of conductors and insulators to design and make different types of switch. • Make circuits that can be controlled as part of a DT project.	• Can communicate structures of circuits using drawings which 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

N.B. Children should be given one component at a time to add to circuits. TAPS practical assessments to be used at the end of each unit.	• Can give reasons for choice of materials for making different parts of a switch • Can describe how their switch works Concept Cartoons' and 'Exit Cards' to be used at the end of lessons to assess understanding.

Y4 Proof of Progress - Working Towards (Basic), Age Related (Advancing) and Greater Depth Expectations (Deep)

Identify common appliances that run on electricity.

Basic

Identify and **name** common appliances that run on electricity.

Label appliances that run on high and low voltage electricity.

Identify and **describe** sources of electricity for appliances, including mains, battery, solar and others.

Advancing

Explain the **similarities** and **differences** between a 240 volt, 40 watt halogen light bulb and a 12 volt, 6 watt LED light bulb.

Explain the **similarities** and **differences** between a 240 volt mains-powered vacuum cleaner and a 12 volt battery-powered vacuum cleaner.

Deep

Investigate battery-powered road cars and draw some **conclusions** about their benefits and problems.

Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.

Basic

Follow instructions to create a series circuit.

Label the components of the circuit.

Advancing

Make a number of series circuits containing different components. **Explain** the **similarities** between the circuits despite the different components.

Deep

Explain the concept of a series circuit and **recommend** some **general** rules.

See an example on page 156

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.

Basic

Complete incomplete circuits by adding the correct components.

Answer questions about the completeness of various circuits.

Advancing

Predict the effect of changing the arrangement of the components of a circuit (some of which maintain a circuit and others that do not).

Experiment with the effect of placing more than one bulb in a series circuit and **summarise** your findings.

Deep

Find and rectify faults (**solve non-routine problems**) for a range of incomplete circuits.

Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.

Basic

Observe and **describe** the effect of using switches in a circuit.

Complete circuit diagrams, showing and **labelling** switches.

Advancing

Explain why opening and closing switches affects a series circuit.

Deep

True or false? If there are five switches in a row in a series circuit, only one needs to be 'on' for the circuit to be complete.

Relate the idea of switches to the creation and sending of Morse code.

See an example on page 197

Recognise some common conductors and insulators, and associate metals with being good conductors.

Basic

Observe and **record** how different materials act as conductors or insulators of electricity.

Observe the effect of some poor and good conductors and **label** materials as poor or good conductors.

Advancing

Categorise materials on the basis of their conductivity.

Experiment with materials that conduct but also resist the flow of electricity. **Summarise** your findings.

Deep

True or false? Everything on Earth either conducts or doesn't conduct electricity, including humans.

End of Lower Key Stage 2 Age Related Expectations

Milestone indicator	Basic	Advancing	Deep
Identify common appliances that run on electricity.	**Identify** and **name** common appliances that run on electricity. **Label** appliances that run on high and low voltage electricity. **Identify** and **describe** sources of electricity for appliances, including mains, battery, solar and others.	**Explain** the **similarities** and **differences** between a 240 volt 40 watt halogen light bulb and a 12 volt, 6 watt L.E.D light bulb. **Explain** the **similarities** and **differences** between a 240 volt mains powered vacuum cleaner and a 12 volt battery vacuum cleaner.	**Investigate** battery powered road cars and draw some **conclusions** about their benefits and problems.
Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.	**Follow instructions** to create a series circuit. **Label** the components of the circuit.	Make a number of series circuits containing different components. **Explain** the **similarities** between the circuits despite the different components.	**Explain the concept** of a series circuit and **recommend** some **general** rules.
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.	**Complete** incomplete circuits by adding the correct components. **Answer questions** about the completeness of various circuits.	**Predict** the effect of changing the arrangement of the components of a circuit (some of which maintain a circuit and other that do not). **Experiment** with the effect of placing more than one bulb in a series circuit and **summarise** your findings.	Find and rectify faults (**solve non-routine problems**) for a range of incomplete circuits.
Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.	**Observe** and **describe** the effect of using switches in a circuit. **Complete** circuit diagrams showing and **labelling** switches.	**Explain** why opening and closing switches affects a series circuit.	**True or false:** If there are five switches in a row in a series circuit, only one needs to be 'on' for the circuit to be complete? **Relate** the idea of switches to the creation and sending of 'morse code'.
Recognise some common conductors and insulators, and associate metals with being good conductors.	**Observe** and **record** how different materials act as conductors or insulators of electricity. **Observe** the effect of some poor and good conductors and **label** materials as poor or good conductors.	**Categorise** materials on the basis of their conductivity. **Experiment** with materials that conduct but also resit the flow of electricity. **Summarise** your findings.	**True or false:** Everything on Earth either conducts or doesn't conduct electricity, including humans?

Year 6
Electricity

- **associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit**
- **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**
- **use recognised symbols when representing a simple circuit in a diagram**

Notes:

Building on their work in year 4, pupils should construct simple series circuits, to help them to answer questions about what happens when they try different components, for example, switches, bulbs, buzzers and motors. They should learn how to represent a simple circuit in a diagram using recognised symbols.

Note: pupils are expected to learn only about series circuits, not parallel circuits. Pupils should be taught to take the necessary precautions for working safely with electricity.

Pupils might work scientifically by: systematically identifying the effect of changing one component at a time in a circuit; designing and making a set of traffic lights, a burglar alarm or some other useful circuit.

Key Vocabulary	Common Misconceptions
Circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, bulb, buzzer, motor, switch, voltage N.B. Children do not need to understand what voltage is, but will use volts and voltage to describe different batteries. The words “cells” and “batteries” are now used interchangeably.	Some children may think: • larger-sized batteries make bulbs brighter • a complete circuit uses up electricity • components in a circuit that are closer to the battery get more electricity.
Activities	**Possible Evidence**
• 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. • Make circuits to solve particular problems, such as a quiet and a loud burglar alarm. • Carry out fair tests exploring changes in circuits. • Make circuits that can be controlled as part of a DT project. TAPS practical assessments to be used at the end of each unit.	• 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 • Can draw circuit diagrams of a range of simple series circuits using recognised symbols • Can incorporate a switch into a circuit to turn it on and off • Can change cells and components in a circuit to achieve a specific effect • Can communicate structures of circuits using circuit diagrams with recognised symbols • Can devise ways to measure brightness of bulbs, speed of motors, volume of a buzzer during a fair test • Can predict results and answer questions by drawing on evidence gathered Concept Cartoons’ and ‘Exit Cards’ to be used at the end of lessons to assess understanding.

Y6 Proof of Progress - Working Towards (Basic), Age Related (Advancing) and Greater Depth Expectations (Deep)

Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.

Basic	Advancing	Deep
Observe and **describe** the effect of changing the number and voltage of cells used in a series circuit.	**Experiment** with, **explain** and **demonstrate** the **pattern** between the voltage of cells and the brightness of a bulb.*	**Suggest** why a bulb or buzzer may stop working when the voltage is increased.

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.

Basic	Advancing	Deep
Observe and **describe** the effect of placing extra bulbs (or buzzers) into a circuit and how this can be overcome by increasing the number and voltage of cells.	**Predict** the outcome of placing various components into an electrical circuit. **Explain** the patterns.*	**Investigate** the concept of resistance and **prove** or **disprove** that components, including wire, are resistors. Is it possible to make your own resistor? **(suggest, prove)**

*Emphasise continuous variables where the comparative degrees end in **er**.

Use recognised symbols when representing a simple circuit in a diagram.

Basic	Advancing	Deep
Label and **learn** the recognised symbols for representing components in a circuit diagram.	Make circuits then represent them in circuit diagrams, **applying** component symbols appropriately.	How do the images of recognised symbols **relate** to their function?

End of Lower Key Stage 2 Age Related Expectations

Milestone indicator	Basic	Advancing	Deep
Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.	**Observe** and **describe** the effect of changing the number and voltage of cells used in a series circuit.	**Experiment** with, **explain** and **demonstrate** the **pattern** between the voltage of cells and the brightness of a bulb. (emphasising continuous variables noted by the use of comparative degrees ending in **er**)	**Suggest** why a bulb or buzzer may stop working when the voltage is increased.
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.	**Observe** and **describe** the effect of placing extra bulbs (or buzzers) into a circuit and how this can be overcome by increasing the number and voltage of cells.	**Predict** for the outcome of placing various components into an electrical circuit and explain why this happens. **Explain** the patterns. (emphasising continuous variables noted by the use of comparative degrees ending in **er**)	**Investigate** the concept of resistance and prove or disprove that components, including wire provide are resistors. Is it possible (**suggest, prove**) to make your own resistor?
Use recognised symbols when representing a simple circuit in a diagram.	**label** and **learn** the recognised symbols for representing components in a circuit diagram.	Make circuits then represent them in circuit diagrams and **applying** component symbols appropriately.	How do the images of recognised symbols **relate** to their function?