The Sutton Academy

# Knowledge Rich Curriculum Plan

SCIENCE- Physics Year 10

## Electrical Circuits

| Lesson/Learning Sequence | Intended Knowledge:<br>*Students will know that…* | Prior Knowledge:<br>*In order to know this, students need to already know that…* | Working Scientifically | Tiered Vocabulary and Reading Activity |
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| **Lesson: Circuit Basics** | • Students will know the symbols for: a switch (open and closed), cell, battery, diode, resistor, variable resistor, LED, lamp, fuse, voltmeter, ammeter, thermistor and LDR<br>Students will know how to draw and interpret circuit diagrams | • ***Students need to already know how to represent circuits***<br>***Students need to already know the importance of complete circuits*** | *Making simple circuits* | *Tier 2*<br><br>*Tier 3*<br><br>*parallel - components connected in a circuit so that the potential difference is the same across each one. These components are connected as "branches".*<br><br>*Series - components connected in a circuit in such a way that the same current passes through them. These components are connected one after each other.* |
| **Lesson: Electrical Charge and current** | • Students will know the current is the rate of flow of charge<br>• Students will know that for current to flow through a closed circuit there must be a source of potential difference<br>• Students will know that charge flow can be calculated using the equation:<br>Charge flow = current x time<br>Q = I x t<br>Students will know that the unit of charge flow is coulombs, C | • ***Students need to already know that the unit of current is amperes, A***<br>***Students need to already know that the unit of time is seconds, s*** | Using formula from equation sheets | *Tier 2*<br><br>*Tier 3*<br>**Current:** A measurement of the rate of flow of electrical charge |
| **Lesson: Series and Parallel Circuits (2 lessons)** | • Students will know that a series circuit is made of one continuous loop<br>• Students will know that in a series circuit the current through each component is the same<br>• Students will know that in a series circuit the total potential difference of the power supply is shared between the components<br>• Students will know that in a series circuit the total resistance of two components is the sum of the resistance of each component<br>• Students will know that parallel circuits are made up of more than one loop (i.e. a circuit that contains branches)<br>• Students will know that the potential difference across each branch of a parallel circuit is the same | • ***Students need to already know how to identify series and parallel circuits*** | . | *Tier 2*<br><br>*Tier 3*<br>Current – the flow of charge, measured in amps<br><br>Potential Difference - a measure of the work done or energy transferred to a component by each coulomb of charge that passes through it. The unit of potential difference is the volt (V)<br><br>Parallel - components connected in a circuit so that the potential difference is the same across each one. These components are connected as "branches".<br><br>Series - components connected in a circuit in such a way that the same current passes through them. These components are connected one after each other |

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| | • Students will know that in a parallel circuit the current through the whole circuit Is the sum of the currents of each branch<br>• Students will know that in a parallel circuit the total resistance is less than the resistance of the smallest individual resistor<br>• Students will know how to use circuits to investigate series and parallel circuits<br>• Students will know how the describe the differences between series and parallel circuits<br>• Students will know how to determine the current, potential difference and resistance measurements at different parts of the circuit | | | |
| **Lesson: Current, Resistance and Potential Difference** | • Students will know that the current flowing through a component depends on the resistance of the component and the potential difference across the component<br>• Students will know the greater the resistance across a component the smaller the current<br>• Students will know that the equation that links potential difference, current and resistance is:<br>Potential difference = current x resistance<br>V = I x R<br>• Students will know that resistance is measured in ohms<br>• Students will know that the above equation is also referred to as "Ohm's law"<br>• Students will know that ammeters are connected in series with the component, and voltmeters are connected in parallel with the component<br>Students will know how to use the equation to calculate current, potential difference and resistance | ***Students need to already know that resistance is a measure of how difficult it is for current to flow*** | Using formula from the equation sheet | *Tier 2*<br><br>*Tier 3*<br>**Potential difference** (pd) is a measurement of the amount of **work done** or **energy transferred** to the component by each coulomb of charge that passes<br><br>**The voltmeter** measures the **potential difference** (pd) across a component. The voltmeter is connected in **parallel** |
| **Lesson: Required Practical - Resistance in a wire** | 1. Students will know how to set up a circuit to investigate how length of a wire affects the resistance | ***Students need to know the correct circuit symbols for an ammeter, a voltmeter and a battery*** | Measuring potential difference and current<br>Identifying and controlling variables<br>Recording results<br>Representing results graphically | *Tier 2*<br><br>*Tier 3*<br>**Electrical resistance** of an object is a measure of its opposition to the flow of electric current |

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| Lesson:<br>Resistors | • Students will know that Ohm's law says that for a component with a fixed resistance current and potential difference are directly proportional (at constant temperature)<br>• Students will know that any component that follows Ohm's law is referred to as an ohmic conductor<br>• Students will know that some components don't follow Ohm's law, and these are referred to as "Non-ohmic conductors"<br>• Students will know that as the current flowing through a filament lamp increases, the temperature of the filament increases<br>• Students will know that as the temperature of the filament increases, the resistance increases too.<br>• Students will know that the current through a diode flows in one direction only.<br>• Students will know that a diode has a very high resistance in the reverse direction<br>• Students will know how to represent the IV Characteristics of different components using graphs<br>• Students will know that the resistance of a thermistor decreases as the temperature increases<br>• Students will know that thermistors are used in thermostats for central heating<br>• Students will know that the resistance of an LDR decreases as the light intensity increases<br>• Students will know that LDRs are used in automatic street lights and car headlights<br>Students will know how to explain the design of a circuit used to measure resistance | | . | *Tier 2*<br>***Intensity*** *– A measurable amount of a property*<br><br>***Dependent*** *– Determined by*<br><br>*Tier 3*<br>***Ohmic Conductor –*** *A resistor that follows Ohm's law* |
| Lesson:<br>Required Practical – IV Characteristics | Students will know how to practically measure the current and potential difference varies in a filament lamp, a diode and a fixed resistor | ***Students need to already know how to represent circuit diagrams*** | Recording results<br>Representing results graphically | *Tier 2*<br><br>*Tier 3*<br>***Ohmic Conductor –*** *A resistor that follows Ohm's law and an IV graph shows a directedly proportional relationship between the current and potential difference.* |

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| | | | | **non-Ohmic conductor** if the graph of voltage versus current is not a straight line and the relationship is not directly proportional. |
| **Lesson: Static Electricity (TRIPLE ONLY)** | • Students will know that insulating materials can be electrically charged by rubbing them against other insulating materials.<br>• Students will know that electrons are rubbed off one material and on to the other.<br>• Students will know that a material that loses electrons will become positively charged<br>• Students will know that a material that gains electrons will become negatively charged<br>• Students will know that two like charges repel each other.<br>• Students will know that two opposite charges attract each other.<br>• Students will know that attraction and repulsion are examples of non-contact force<br>• Students will know how to explain the production of charged objects.<br>Students will know that sparking is caused by electrons returning to ground through a conductor | ***Students need to already know that electrons are negatively charged subatomic particles*** | | *Tier 2*<br><br>*Tier 3*<br>**Ground:** A direct electrical connection to earth or a connection to a particular point in an electrical circuit |
| **Lesson: Electric Fields (TRIPLE ONLY)** | • Students will know that a charged object creates an electric field around itself.<br>• Students will know that the electric field is strongest close to the charged object.<br>• Students will know that the further away from the charged object, the weaker the field<br>• Students will know that if a second charged object is placed in an electric field it experiences a force.<br>Students will know that an electric field can be represented by a diagram. Straight lines are used to represent the field, with arrows showing the direction of the field (pointing towards a negative charge, away from a positive charge) | ***Students need to already know that charged objects experience repulsion or attraction*** | | *Tier 2*<br><br>*Tier 3*<br>**Force field:** An area where an object would feel a non-contact force<br>**Field lines**: lines that are drawn to demonstrate a force field |