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**Knowledge Rich Curriculum Plan**

SCIENCE- Physics Year 10

| **Lesson/Learning Sequence** | **Intended Knowledge:**  *Students will know that…* | **Prior Knowledge:**  *In order to know this, students need to already know that…* | **Working Scientifically** | **Tiered Vocabulary and Reading Activity** |
| --- | --- | --- | --- | --- |
| **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   Students will know how to draw and interpret circuit diagrams | * ***Students need to already know how to represent circuits***   ***Students need to already know the importance of complete circuits*** | *Making simple circuits* | *Tier 2*  *Tier 3  parallel - components connected in a circuit so that the potential difference is the same across each one. These components are connected as “branches”.  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 * Students will know that for current to flow through a closed circuit there must be a source of potential difference * Students will know that charge flow can be calculated using the equation:   Charge flow = current x time  Q = I x t  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***   ***Students need to already know that the unit of time is seconds, s*** |  | *Tier 2*  *Tier 3*  A measurement of the rate of flow of electrical charge |
| **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 * Students will know the greater the resistance across a component the smaller the current * Students will know that the equation that links potential difference, current and resistance is:   Potential difference = current x resistance  V = I x R   * Students will know that resistance is measured in ohms * Students will know that the above equation is also referred to as "Ohm's law" * Students will know that ammeters are connected in series with the component, and voltmeters are connected in parallel with the component   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*** |  | *Tier 2*  *Tier 3*  **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  **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  Identifying and controlling variables  Recording results  Representing results graphically | *Tier 2*  *Tier 3*  **Electrical resistance** of an object is a measure of its opposition to the flow of electric current |

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| --- | --- | --- | --- | --- |
| **Lesson: 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) * Students will know that any component that follows Ohm's law is referred to as an ohmic conductor * Students will know that some components don't follow Ohm's law, and these are referred to as "Non-ohmic conductors" * Students will know that as the current flowing through a filament lamp increases, the temperature of the filament increases * Students will know that as the temperature of the filament increases, the resistance increases too. * Students will know that the current through a diode flows in one direction only. * Students will know that a diode has a very high resistance in the reverse direction * Students will know how to represent the IV Characteristics of different components using graphs * Students will know that the resistance of a thermistor decreases as the temperature increases * Students will know that thermistors are used in thermostats for central heating * Students will know that the resistance of an LDR decreases as the light intensity increases * Students will know that LDRs are used in automatic street lights and car headlights   Students will know how to explain the design of a circuit used to measure resistance |  | . | *Tier 2*  ***Intensity*** *– A measurable amount of a property*  ***Dependent*** *– Determined by*  *Tier 3*  ***Ohmic Conductor –*** *A resistor that follows Ohm’s law* |
| **Lesson:**  **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  Representing results graphically | *Tier 2*  *Tier 3*  ***Ohmic Conductor –*** *A resistor that follows Ohm’s law and an IV graph shows a directedly proportional relationship between the current and potential difference.*  **non-Ohmic conductor** if the graph of voltage versus current is not a straight line and the relationship is not directly proportional. |
| **Lesson:**  **Series and Parallel Circuits** | * Students will know that a series circuit is made of one continuous loop * Students will know that in a series circuit the current through each component is the same * Students will know that in a series circuit the total potential difference of the power supply is shared between the components * Students will know that in a series circuit the total resistance of two components is the sum of the resistance of each component * Students will know that parallel circuits are made up of more than one loop (i.e. a circuit that contains branches) * Students will know that the potential difference across each branch of a parallel circuit is the same * Students will know that in a parallel circuit the current through the whole circuit Is the sum of the currents of each branch * Students will know that in a parallel circuit the total resistance is less than the resistance of the smallest individual resistor * Students will know how to use circuits to investigate series and parallel circuits * Students will know how the describe the differences between series and parallel circuits   Students will know how to determine the current, potential difference and resistance measurements at different parts of the circuit | ***Students need to already know how to identify series and parallel circuits*** | . | *Tier 2*  *Tier 3*  Current – the flow of charge, measured in amps  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)  Parallel - components connected in a circuit so that the potential difference is the same across each one. These components are connected as “branches”.  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:**  **Domestic Uses and Safety** | * Students will know that mains electricity is an ac supply. * Students will know that in the UK, domestic electricity supply has a frequency of 50 Hz and is about 230 V * Students will know that direct potential difference produces a current that travels in one direction (direct current) * Students will know that alternating potential difference produces a current that constantly changes direction (alternating current) * Students will know that most appliances are connected to mains through a three-core cable * Students will know that the live wire is brown, the neutral wire is blue and the earth wire is green and yellow * Students will know that the live wire carries the potential difference from the supply * Students will know that the neutral wire completes the circuit * Students will know that the earth wire is a safety wire that stops the appliance becoming live. * Students will know that the potential difference between the live wire and earth is about 230 V. Students will know that the neutral wire and the earth wire have a potential of 0 V. * Students will know how to explain why a live wire is dangerous even when a switch in the circuit is open   Students will know how to explain the dangers of providing any connection between the live wire and earth | ***Students need to already know that current is the flow of charge.*** |  | *Tier 2*  *Appliance – A piece of equipment designed for a particular task*  *Tier 3*  *Alternating current – current that flows in constantly changing direction*  *Direct current – current that flows in one direction*  *Earth – A direct physical contact for current to flow to the Earth* |
| **Lesson:**  **Power** | * Students will know that the power that is transferred in a device is related to the potential difference across it and the current through it * Students will know the equation for calculating power as:   power = potential difference x current  Power = current squared x resistance   * Students will know that power is measured in Watts   Students will know how to use the equations to calculate power, current, resistance and potential difference | ***Students need to already know that the unit of potential difference is V, the unit of current is A and the unit of resistance is ohms*** |  | *Tier 2*  *Tier 3*  **Electric power** is the rate, per unit time, at which energy is transferred by an electric circuit.  **Watt**: The SI unit of power is the watt, one joule per second. |
| **Lesson:**  **Energy transfers** | * Students will know that everyday electrical appliances bring about energy transfers * Students will know that the amount of energy transferred depends on how long the appliance is switched on for and the power of the appliance. * Students will know how to describe energy transfers within appliances. * Students will know that work is done when charge flows in a circuit * Students will know that the energy transferred in a circuit can be calculated by:   energy transferred = power x time  Energy transferred = charge flow x potential difference  Students will know how to use the equations to calculate energy, power, time, charge and potential difference. | ***Students need to already know that the unit of energy is J, the unit of power is W, the unit of time is s, the unit of charge is C and the unit of potential difference is V*** |  | *Tier 2*  *Tier 3* |
| **Lesson:**  **The National Grid** | * Students will know that the National Grid is a system of cables and transformers linking power stations to consumers. * Students will know that step-up transformers are used to increase the potential difference from the power station to the transmission cables * Students will know that step-down transformers are used to decrease, to a much lower value, the potential difference for domestic use. * Students will know that the National Grid is used as an efficient way to transfer energy   Students will know that the National Grid is used to reduce the amount of energy lost through dissipation. | ***Students need to already know that electrical power is generated in power stations.*** |  | *Tier 2*  *Tier 3*  **Dissipation**: Energy that is transferred to the surroundings  **Transformer**: device used to change the potential difference of an electrical supply |
| **Lesson:**  **Static Electricity (TRIPLE ONLY)** | * Students will know that insulating materials can be electrically charged by rubbing them against other insulating materials. * Students will know that electrons are rubbed off one material and on to the other. * Students will know that a material that loses electrons will become positively charged * Students will know that a material that gains electrons will become negatively charged * Students will know that two like charges repel each other. * Students will know that two opposite charges attract each other. * Students will know that attraction and repulsion are examples of non-contact force * Students will know how to explain the production of charged objects.   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*  *Tier 3*  **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. * Students will know that the electric field is strongest close to the charged object. * Students will know that the further away from the charged object, the weaker the field * Students will know that if a second charged object is placed in an electric field it experiences a force.   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*  *Tier 3*  **Force field:** An area where an object would feel a non-contact force  **Field lines**: lines that are drawn to demonstrate a force field |