YEAR 2022-2023 First TERM

'An ambitious curriculum that meets the needs of all'

Medium Term Planning - Topic: Electricity

Curriculum Intent

In addition to working further on objectives from GCSE Physics, pupils will be taught, following National Curriculum guidelines, the following this term:

Skills/Assessment Objective Links

3.5.1 Current electricity

3.5.1.1 Basics of electricity

Content	Opportunities for skills development
Electric current as the rate of flow of charge; potential difference as work done per unit charge. $I = \frac{\Delta Q}{\Delta t}$, $V = \frac{W}{Q}$ Resistance defined as $R = \frac{V}{I}$	**AT b, f** Students can construct circuits from the range of components.

3.5.1.2 Current–voltage characteristics

Content	Opportunities for skills development
For an ohmic conductor, semiconductor diode, and filament lamp. Ohm's law as a special case where $I \propto V$ under constant physical conditions. Unless specifically stated in questions, ammeters and voltmeters should be treated as ideal (having zero and infinite resistance respectively). Questions can be set where either I or V is on the horizontal axis of the characteristic graph.	

3.5.1.3 Resistivity

Content	Opportunities for skills development
Resistivity, $\rho = \frac{RA}{L}$ Description of the qualitative effect of temperature on the resistance of metal conductors and thermistors. Only negative temperature coefficient (ntc) thermistors will be considered. Applications of thermistors to include temperature sensors and resistance–temperature graphs. Superconductivity as a property of certain materials which have zero resistivity at and below a critical temperature which depends on the material. Applications of superconductors to include the production of strong magnetic fields and the reduction of energy loss in transmission of electric power. Critical field will not be assessed.	**MS 3.2, 4.3 / PS 1.2 / AT a, b, f, g** Investigation of the variation of resistance of a thermistor with temperature.
Required practical 5: Determination of resistivity of a wire using a micrometer, ammeter and voltmeter.	

3.5.1.4 Circuits

Content	Opportunities for skills development
Resistors: *in series*, $R_T = R_1 + R_2 + R_3 + \ldots$ *in parallel*, $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$ *Energy and power equations*: $E = IVt$; $P = IV = I^2R = \frac{V^2}{R}$ The relationships between currents, voltages and resistances in series and parallel circuits, including cells in series and identical cells in parallel. Conservation of charge and conservation of energy in dc circuits.	**MS 0.3 / PS 4.1 / AT a, b, f, g** Students can construct circuits with various component configurations and measure currents and potential differences.

3.5.1.5 Potential divider

Content	Opportunities for skills development
The potential divider used to supply constant or variable potential difference from a power supply. The use of the potentiometer as a measuring instrument is not required. Examples should include the use of variable resistors, thermistors, and light dependent resistors (LDR) in the potential divider.	**MS 3.2 / PS 4.1 / AT f** Students can investigate the behaviour of a potential divider circuit. **MS 3.2 / AT g** Students should design and construct potential divider circuits to achieve various outcomes.

3.5.1.6 Electromotive force and internal resistance

Content	Opportunities for skills development
$\varepsilon = \frac{E}{Q}$, $\varepsilon = I(R + r)$ Terminal pd; emf Students will be expected to understand and perform calculations for circuits in which the internal resistance of the supply is not negligible.	
Required practical 6: Investigation of the emf and internal resistance of electric cells and batteries by measuring the variation of the terminal pd of the cell with current in it.	**MS 3.1, 3.3 / PS 2.2, 3.1 / AT f**

Spiritual, moral, social, and cultural development	**SMSC:** Listening to each other and valuing each person's contributions in discussions, working together in lessons to problem solve and achieve a shared goal. Learning about different scientists and learning how their understanding of the world evolved. **PSHE/British Values:** Working together in practical and problem-solving work. The practical work in this section requires two people to work together to take the measurements whilst holding the equipment in place. **Skills Builder:** development of practical skills through the numerous practical activities.
Numeracy	Constant numerical development in every lesson. Measuring skills, graph skills, problem solving. Exam questions build on topics with mechanics components frequently brought in.
Literacy	**Vocabulary Tier 2: wires, power supply, batteries, power, efficiency, kilowatt-hour, insulator, fuse, series and parallel, sensor.** **Vocabulary Tier 3: ionized, conduction, electrostatic, ampere, Kirchoffs first law, electromotive force, potential difference, ohmic conductors, diode, resistivity, conductivity, internal resistance, semiconductors, thermistors, absolute zero, critical temperature, superconductor, potential divider,** **Reading:** Reading of the booklet and questions. Students need to be able to read the methods for practical lessons and ensure they complete them in the right order, using the right equipment. **Writing:** Students are exposed to a number of questions, both numerical and short and long written answers. Students need to be able to write in a concise way whilst using the key words. **Oracy:** Class discussions are incredibly important in physics where students regularly participate in class discussion to discuss abstract concepts. Students need to be able to express their understanding of concepts and theories.
Becoming future ready	**Careers/Employability:** Students learn about the skills needed for electrical engineering, being an electrician.
Adaptation **QFT/SEND Provision**	Throughout this topic, quality first teaching will provide differentiation: **By product:** different learners are asked different questions, different level of detailed responses are expected and the level of scaffolding for the problem solving questions are varied. **By resource:** All booklets are the same, however, extra scaffolding and extension may be provided from the new Kerboodle resources. **By Intervention**: by providing different levels of supervision and support **By Progressive Questioning:** exploring pupils' understanding through interactive dialogue. **By Grouping:** according to prior attainment, gender, social preference, preferred learning style. **By Task:** Pupils should be involved in the identification of targets which are meaningful to them and in the selection of an appropriate task from the given range. **By Offering Optional Activities:** In class or as homework, to extend learning. This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work.
Implementation Curriculum Delivery	• To be able to: ***Lesson Objectives***

Learning Outcomes (Knowledge)	1. To know and understand the letters and symbols for charge, current, pd and resistance. 2. To understand and define charge, current, pd and resistance. 3. To set up simple circuits to determine the current and pd in a circuit. 1. To be able to apply the formulas Q=It, V= IR and V=W/Q 2. To understand conventional current. 3. To know and explain the resistances of an ammeter and voltmeter. 1. To understand the causes of static electricity. 2. To investigate static electricity and use a coulombmeter to find the charge. 1. Know and explain resistivity, including derivation of the units. 2. Apply the resistivity formula to the exam questions 3. To know and understand superconductors and critical temperature. 1. To follow the instructions and carry out the resistivity of a wire 2. To complete the lab write up 1. To know and explain the rules for series circuits 2. To know and explain the rules for parallel circuits. 3. To explain the differences in the power of bulbs in series and parallel 1. To set up and test the resistance of resistors in series. 2. To set up and test the resistance of resistors in parallel. 3. To apply the knowledge to the exam questions. 1. To complete the practical on the resistance of a thermistor. 2. To understand how a thermistor works 3. To explain the differences in resistance between an ohmic resistor and a thermistor 1. To understand series circuits. 2. To set up a potential divider circuit with a variable resistor and take readings. 3. To explain how a potential divider works and apply the knowledge to exam questions. 1. To understand that all batteries have an internal resistance. 2. To understand emf, delivered pd and lost volts. 3. To apply the EMF and IR formula to exam questions 1. To follow the instructions and find the EMF and IR of a battery 2. To complete the lab write up •
Current learning to be developed in the future within:	• Red denotes interleaving; aspects of knowledge covered previously. Electricity topics are covered in parts of Capacitors, Magnetism and Induction in Year 13.
Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.