Electricity and Magnetism

	Working towards Mastery (W)	**Meeting Mastery (M)**	**Beyond Mastery (B)**
Electromag-netism	- An electromagnet uses the principle that a current through a wire causes a magnetic field. Its strength depends on the current, the core and the number of coils in the solenoid. - The magnetic field of an electromagnet decreases in strength with distance.	- Use a diagram to explain how an electromagnet can be made and how to change its strength. - Explain the choice of electromagnets or permanent magnets for a device in terms of their properties.	- Critique the design of a device using an electromagnet and suggest improvements. - Suggest how bells, circuit breakers and loudspeakers work, from diagrams.
Magnetism	- Magnetic materials, electromagnets and the Earth create magnetic fields which can be described by drawing field lines to show the strength and direction. - The stronger the magnet, and the smaller the distance from it, the greater the force a magnetic object in the field experiences. - Two ‘like’ magnetic poles repel and two ‘unlike’ magnetic poles attract. - Field lines flow from the north-seeking pole to the south-seeking pole.	- Use the idea of field lines to show how the direction or strength of the field around a magnet varies. -Explain observations about navigation using Earth’s magnetic field.	- Predict the pattern of field lines and the force around two magnets placed near each other. - Predict how an object made of a magnetic material will behave if placed in or rolled through a magnetic field.

Current	- Current is a movement of electrons and is the same everywhere in a series circuit. - Current divides between loops in a parallel circuit, combines when loops meet, lights up bulbs and makes components work. - Around a charged object, the electric field affects other charged objects, causing them to be attracted or repelled. - The field strength decreases with distance. - Similarly charged objects repel, two differently charged objects attract.	- Describe how current changes in series and parallel circuits when components are changed. - Turn circuit diagrams into real series and parallel circuits, and vice versa. - Describe what happens when charged objects are placed near to each other or touching. - Use a sketch to describe how an object charged positively or negatively became charged up.	- Compare the advantages of series and parallel circuits for particular uses. - Evaluate a model of current as electrons moving from the negative to the positive terminal of a battery, through the circuit. - Suggest ways to reduce the risk of getting electrostatic shocks.
Voltage and resistance	- In a series circuit, voltage is shared between each component. - In a parallel circuit, voltage is the same across each loop. Components with resistance reduce the current flowing and shift energy to the surroundings. - Calculate resistance using the formula: resistance (Ω) = potential difference (V) ÷ current (A).	- Draw a circuit diagram to show how voltage can be measured in a simple circuit. - Use the idea of energy to explain how voltage and resistance affect the way components work. - Given a table of voltage against current, use the ratio of voltage to current to determine the resistance. - Use an analogy like water in pipes to explain why part of a circuit has higher resistance.	- Predict the effect of changing the rating of a battery or a bulb on other components in a series or parallel circuit. - Justify the sizes of voltages in a circuit, using arguments based on energy. - Draw conclusions about safety risks, from data on voltage, resistance and current.